THE IMPACT OF MULTILATERAL TRADE ASSOCIATION MEMBERSHIP ON AGRICULTURAL AND FOOD TRADE

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ABSTRACT

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This thesis models trade flows between countries as a function of several variables, including those representing membership in multilateral trade agreements (MTAs). The objective of this research is to evaluate the impact of trade policies, trading costs, trade agreements and other demographic characteristics on exports of food and agriculture products. More specifically, the paper uses a gravity model augmented with three sets of dummy variables to estimate the impact of 13 trade arrangements on intra-bloc and extra-bloc trade. Results indicate that several MTAs enhance intra-bloc trading at the expense of non-members while others have been successful at increasing both intra-bloc trade and trade with the rest of the world. Findings further suggest that several arrangements had no significant effect on member trading and that a few have effectively reduced trade for members.

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CHAPTER 1

INTRODUCTION

In recent years, international trade has increased as a result of reduced trade barriers and the global diffusion of production technologies. For small economies, changes in international markets pose numerous challenges and opportunities. Richard Bernal, in his paper presented at a World Bank Conference in July 2001, outlined the characteristics of small developing economies as follows: high degree of openness, limited diversity in economic activity, export concentration on one to three products, small size of firms and significant dependency on trade taxes. For example, in some countries of the Organization of Eastern Caribbean States, international trade taxes account for 60 percent of government revenues (Ocampo 2002). These characteristics increase a small country's vulnerability to exogenous shocks, constrain their ability to compete and limit their adjustment capacity (Bernal 2001). Without trade, small economies do not enjoy economies of scale or scope, limiting needed technological advancement that will improve their competitiveness. This is exasperated by their restricted access to financial capital and external resources since investments in these small economies are considered risky by many financial institutions and private investment firms. On the other hand, the sizes of these small economies may potentially allow them to achieve greater social cohesion, which may promote economic growth and improve the investment climate within that economy (Ocampo 2002). In addition, a smaller population may promote better access to essential information needed to foster cooperation in development activities.

Trade liberalization has forced many small economies to engage in unilateral reforms. Many of their fiscal policies are now geared towards reducing reliance on trade taxes and developing domestic financial markets that will create access to resources for export companies. There have also been moves to develop strategic alliances among small economies with the aim of improving competitiveness and technological linkages. Small economies can no longer stand alone and hope to wade through trade liberalization as individual nations. Many decision makers in these small countries are cognizant of the need for regional and sub-regional integration to promote joint marketing ventures, common financial services and improved cooperation in research and development (Ocampo 2002). The success of the smaller economies will hinge on their ability to adjust and take advantage of the opportunities offered by their small size. The task ahead will be difficult but many small country decision makers have recognized their plight and have made provisions via "special and differential treatment."

In addition to these initiatives by many small countries, the Doha Round of the WTO was initiated in November 2001 to correct and prevent restrictions and distortions in world agricultural markets, with the specific purpose of improving welfare in the developing world. In this current round, trade ministers and/or trade representatives agreed to 50 provisions that clarified the obligations of developing countries with respect to issues relating to agriculture, clothing and textile, subsidies, rules of origin, technical barriers to trade and trade–related investment measures. Issues of particular importance were those highlighted in the Agreement on Agriculture reached at the end of the Uruguay round in 1994. Under the Doha round, member governments pledged commitments relating to market access, export subsidies and domestic supports for the agriculture sector. The following sentence from the declaration signed at the Doha Ministerial indicates the commitment of member governments:

> "Building on the work carried out to date and without prejudging the outcome of the negotiations we commit ourselves to comprehensive negotiations aimed at: substantial improvements in market access; reductions of, with a view of phasing out, all forms of export subsidies; and substantial reductions in trade-distorting domestic supports." (WTO Ministerial Declaration November 2001)

Negotiations during the Doha round focused on setting phase-out periods and other deadlines for the removal of trade barriers. It highlighted actions to be taken by all parties, i.e., developed, developing and least developed countries in order to reduce Amber box[1] programs and accomplish welfare gains. Developed countries agreed to cut amber box spending by 20 percent in total spending over six years while developing countries committed to cut amber box spending by 13.3 percent over ten years (Beierle 2001). Under the special and differential treatment clause, developing countries are allowed longer phase-out periods to minimize potential negative shocks from reduction in supports to their agricultural sector. This affords small countries time to develop production efficiencies and to determine areas in which they may have comparative advantage.

Liberalizing trade on all commodities and eliminating agricultural subsidies are estimated to lead to welfare improvements of $300 billion a year by 2015 (Anderson and Martin 2005). Welfare improvements would be shared disproportionately between

[1] All domestic support measures considered to distort production and trade (with a few exceptions) fall into the WTO Amber box. These include measures to support prices or subsidies directly related to production quantities. Other boxes include the blue box and the green box. The blue box also includes support measures that may distort production and trade but have a production limiting component. The green box includes those measures that are not trade distorting.

developing and developed countries. Developing countries may enjoy 45 percent of the global gains, a disproportionate gain given their current 20 percent share of global Gross Domestic Product. Developing countries' welfare (through efficiency gains) would increase by 1.2 percent as compared to a 0.6 percent increase for developed countries. The welfare gains from liberalization would be shared by both consumers and producers. Consumers will have access to a wider array of goods at lower prices and producers will have access to imported inputs and foreign markets. Increased competition promotes greater efficiency and productivity resulting in lower cost production and lower prices for consumers. The potential gains to developing countries from complete trade liberalization would be attributed to domestic reforms and the reduction of high tariffs faced by their exporters/producers when entering developed country markets. Unilateral reforms would involve the development of domestic economic policies that encourage the allocation of resources to more productive activities. The special and differential treatment clause affords developing countries different timetables, different target reduction rates and different exemptions, to promote their economic well-being and food security. Although this is intended to negate negative consequences of liberalization, Anderson and Martin (2005) cited that developing and least developed countries would realize more gains if they relinquish some of their claims to special and differential treatment.

Need for Study

Agricultural trade policies supporting trade liberalization have far reaching impacts on developing countries since agricultural earnings are important contributors to current welfare and economic development. This is of course true for all sectors if trade policies restrict market access by diverting income to larger nations. In particular, those developing countries that are not members of major trading blocks do not enjoy the associated benefits and are therefore disadvantaged by trade restrictions that may impede their ability to expand exports to larger markets, effectively reducing foreign exchange earnings, current account surplus and GDP. The impediments to export expansion must be analyzed to determine losses experienced by small countries that have traditionally received most of their foreign exchange from agricultural commodities. Market access has been restricted by tariffs and non-tariff measures including export subsidies, domestic supports and other protective farm policies in developed nations. Exporters from developing countries face an average tariff of 16 percent for agriculture and food, 9 percent for clothing and textiles and 2.5 percent for other manufactured goods (Anderson and Martin 2005). The average tariff on agricultural goods is high both in high-income countries and developing countries.

Although strides have been made to reduce subsidies under the WTO, some developed countries still find ways to circumvent amber box regulations. The problem of market access is further compounded where trade agreements offer advantages to member countries by reducing or eliminating tariffs and other barriers for them, while restricting access to non-members. Exports of those regions or countries excluded from Free Trade Agreements are usually diverted to the countries that are parties to the agreement. Central American and Caribbean countries experienced such trade diversion when NAFTA came into effect in 1994 since Mexican products were granted duty free access to the US market. The imposition of Rules of Origin under NAFTA further encourages trade diversion. Although Lederman, Maloney and Serven (2005) did not find significant effects of

NAFTA on the trade flows of non-member countries, they did assert that the gradual reduction of tariffs envisioned by the treaty and the short amount of time that had elapsed since NAFTA's inception posed difficulties in their assessment. It is clear that welfare gains from liberalization for developing nations will only be realized if all market distortions are eliminated.

Objectives

There are many trade policies and practices that have limited access to world markets by restricting trade. Trade agreements have also impacted trade flows between countries. The objective of this research is to evaluate the impact of trade policies, trading costs, trade agreements and other economic and demographic characteristics on exports of food and agriculture products. An additional objective is to determine the regional effects of trade barriers and trade agreements on regions such as Central America. Individual countries and/or regions excluded from preferential agreements may experience limited market access reducing their exports of agricultural and food products, leading to a reduction in export earnings and consequently a reduction in income.

Organization

Chapter 2 discusses previous studies related to trade models used to evaluate the determinants of bilateral trade flows, highlighting previous studies done in the areas of agriculture and food trade. The theoretical foundation, model development, and data sources are reported in Chapter 3. The Empirical Results of trade models for 183 countries are presented in Chapter 4. Chapter 5 provides the conclusions and a summary of the study.

CHAPTER 2

LITERATURE REVIEW

Introduction

In recent years the world has seen a continuous increase in the level of trade amongst nations. Much research has evaluated trade flows between countries. Researchers have used the gravity model or its variations to estimate relationships between trade and distance, market size, border effects and other explanatory variables. Past findings indicate that distance is a major determinant of bilateral trade since countries are more likely to trade with others in near geographic proximity instead of those further away. Other factors, such as market size, trade policies, and per capita incomes, have been found to either promote or distort trade. Furthermore, the significance of variables may vary depending on the sector under analysis. Both resource-based factors and gravity model variables are known to impact trade amongst countries.

Trade Models

Jan Tinbergen (1962) applied the gravity model to international trade flows citing that exchanges between countries would follow the same functional form as other gravity models. The gravity model of trade specifies the value of trade between two countries as a positive function of their incomes and a negative function of the distance between them (Thursby and Thursby 1987). Since the early 1900s, the gravity model has had empirical success in explaining many different types of flows. The gravity model specifies that flow from origin i to destination j can be explained by economic forces at the origin, at the destination, and economic forces that either aid or inhibit movement from origin to destination. (Bergstrand 1985). The simplest gravity-type model stems from a rearrangement of the Cobb Douglas expenditure function, using the assumption that each country specializes in producing its own good (there is one good for each country in the simple model) and that there are no transport costs or tariffs (Anderson 1979). Standard forms of the gravity model have been criticized for their lack of theoretical foundation and many attempts have been made to expand the simple form to give it more empirical and theoretical weight. Anderson (1979) sought to provide a theoretical explanation for the gravity equation by applying a trade-share expenditure system model. He derived the gravity equation from the properties of expenditure systems using the non-income dependent expenditure shares as the most relevant variables. This system provides legitimacy to the gravity model and increases its efficiency properties in estimation.

In addition to distance and wealth, Ciuriak and Kinjo (2005) hypothesized that this level of trade is also impacted by commonalities between the countries trading. However, they cited a criticism of the gravity model as not taking into account the theory of comparative advantage, particularly when the model is used to address policy applications. Although the standard gravity model provides useful inferences about international trade flows, variations of this model exist to take into account other variables of significance. Ciuriak and Kinjo used the Trade Specialization Index which accounts for a country's net exports in a specific sector, to account for comparative advantage between trading partners.

Bergstrand (1985) attempted to derive a generalized gravity equation from a general equilibrium world trade model, while evaluating whether the typical gravity equation was misspecified. Results of this study indicated that the typical gravity equation that excludes price and exchange rate variables can not be explicitly derived from the theoretical model. In cases where aggregate trade flows are differentiated by national origin, omitting certain price variables leads to misspecification of the model. Harris and Matyas (1998) conducted a comparison of the common fixed effect gravity model and the less common random effect counterpart. They refined the estimation by accounting for simultaneity, and by clearly specifying the source, target and business cycles involved. Harris and Matyas believed that using panel data would account for heterogeneity in the model and would capture time effects which significantly affect bilateral trade flows. They contended that ignoring these effects would lead to a misspecified econometric model.

The use of gravity-type models remains popular. Although the theoretical underpinning for this model has been questioned, the model itself continues to see empirical success as researchers create variations to address changes in world trade. Bergstrand (1989) tied the gravity equation with models of inter-industry and intra-industry trade. This study expanded upon Bergstrand's 1985 paper by applying differences in factor endowment to the generalized gravity model. This study along with others has incorporated features that will account for comparative advantage and other variables not accounted for by the typical gravity equation. Feenstra et al. (2001) stated that the theoretical foundations for the gravity equation are quite general, but the empirical performance is quite specific. They derived gravity equations for both differentiated and homogenous goods using Rauch's measure of homogenous versus differentiated goods to separate their samples. The authors contended that gravity equations can be used to distinguish amongst different theoretical models. Through their study they proved that this argument is valid and that the theories determined varying home market effects. The gravity model has been used in conjunction with other trade models and this flexibility has increased its acceptance in empirical work.

One important variable in all gravity-type models is distance. This variable has always been included as a factor that affects trade between origin and destination countries since it has been theorized that transport cost are increasing in distance. The amount of trade taking place between two countries that are 5,000 miles apart will be 20 percent of the amount of trade predicted to take place if those countries were 1,000 miles apart (Ghemawat 2001). Ghemawat also expanded the definition of distance to include four dimensions: administrative, cultural, economic and geographic. Administrative distance refers to political and historical associations such as colonial relationships. Cultural distance relates to the cultural attributes of a country's population and affects consumer's preference which in turn will determine what is demanded in the destination country. Geographic distance affects transportation and communication costs that are incurred when trading. This becomes very significant when markets are not proximate. Economic distance refers to the disparity in wealth or income among consumers in trading countries. This determines both the level of trade and the type of trade partners. Although other variables have been added to trade models over time, distance still remains an important variable in explaining international trade. Berthelon and Freund (2004) concluded that distance has become more significant in trade models since 1980 due to increasing distance sensitivity in 25 percent of industries included in their study. The results of their study further suggest that while distance related trade costs remain unchanged for most industries, there have been shifts in support of contiguous markets for some industries. In a study comparing homogenous and differentiated goods, Rauch (1999) looked at the effects of proximity and common language/colonial ties on trade between international buyers and sellers. He concluded that other trade costs relating to accessing information about international markets and finding trade partners are also likely to reduce distant trade.

Agricultural Trade

Agricultural trade liberalization has significant implications for developing countries. Both the Uruguay Round and the Doha Round of WTO trade negotiations have focused on agriculture and potential welfare losses and gains to smaller countries. Many researchers have addressed the trade disparities that exist and the resulting implications to poorer nations. However, Hertel et al. (2001) describe analytical procedures assessing such impacts as rudimentary since when dealing with multi-country analysis, researchers are compelled to use per capita effects instead of detailed household data. Nevertheless, impacts of domestic supports, tariffs and other protectionist measures have been assessed from different angles. Hoekman, Ng and Olarreaga (2002) evaluated effects of granting duty free access to Least Developed Countries (LDCs) for tariff peaks items in four markets (Canada, the European Union, Japan and the United States). Simulation results showed that duty free access increases exports of LDCs by approximately $2.5 billion, an 11 percent increase. In this study, gains for LDCs translate into losses for other developing countries. This accentuates that for every action taken, the outcomes may differ for each stakeholder. The ripple effect from all trade decisions may lead to either trade creation or trade diversion. The outcome is determined by many factors including but not limited to the demand and supply of the commodity being traded, the level of domestic support for this commodity in developed countries and the level of other non-tariff barriers erected.

Agricultural trade studies have historically focused on poorer countries that are agriculture-driven and other countries where agriculture constitutes a substantial portion of their export earnings. These include Sub-Saharan Africa, Latin America, China, India and other developing countries and LDCs that are highly dependent on exports or imports of agricultural commodities. Countries less dependent on agriculture have not received much attention in agricultural trade research. This paper will look specifically at regional effects and welfare implications stemming from liberalized agricultural trade and multilateral trade associations (MTAs). The share of world trade taking place under MTAs has increased significantly. Mexican exports to the United States rose from 78.8 percent of total exports in 1990 to 85.4 percent in 1997. Intra-PTA trade among MERCOSUR members grew from 8.9 percent of total exports in 1990 to 24.4 percent in 1997 (WTO 1998). With the increase in the number of MTAs, economists have questioned whether they are trade-liberalizing or protectionist and there have been many attempts to quantify MTA effects on both members and non-members. Lederman, Maloney and Serven (2005) used a gravity approach in an attempt to examine the effects of NAFTA on trade flows of non-member countries, particularly Caribbean and Central American countries. This task proved difficult since there are many non-constant exogenous trade factors that may have influenced changes during the time period they analyzed. Although Caribbean and Central American countries are concerned about potential welfare losses from trade diversion to Mexico, the data implies that NAFTA had no adverse effects on non-member trading. However, the overall findings were inconsistent, citing no significant changes on trade flows from non-member countries, while indicating that there may be trade diversion at the sectoral level. Given the time that has elapsed since NAFTA's inception in 1994 and the volatility of trade determinants since then, findings from studies on NAFTA's trade impacts must be evaluated with discretion. Krueger (1999) also echoed this sentiment, citing that most of the Preferential Trade Agreements studied only have data for a few years and those years are often within the transitional period where new regulations are being phased in.

Although most of the studies on NAFTA have found evidence of trade creation and none of trade diversion, there are other agreements where trade diversion is a huge possibility. There is no strong evidence to support the claim that a MTA will be trade creating or that all members will benefit (World Bank 2005). The World Bank in their Global Economic Prospects 2005 cited that while many developing countries have reduced tariffs, they remain high in many regions so potential trade diversion is still significant. Yeats (1998) concluded that most of the intra-MERCOSUR trade between 1988 to 1994 resulted from trade diversion from low cost members to higher cost MERCOSUR sources. Yeats found that many domestic producers in MERCOSUR redirected exports to local markets reducing potential exports of third countries. Soloaga and Winters (2000) applied a gravity model to annual non-fuel imports data for 58 countries using dummies that reflected intra-bloc trade and members' total exports and imports separately. While they found no significant boost in intra-bloc trade for any of the PTAs in their estimation, they did notice a positive trend on the coefficients on overall imports for CACM and MERCOSUR. Their results also indicated evidence of trade diversion within the European

Union. Using a gravity model, Clarete, Edmonds and Wallack (2002) outlined the major PTAs in Asia and other regions and reviewed trends in trade flows within the various arrangements. They found that the ANDEAN Pact, MERCOSUR and SPARTECA tend to expand trade among members at the expense of imports from the rest of the world. The EU was found to expand member trade without negatively affecting external trade while NAFTA has not changed intra-bloc trade but reduced trade with the world. There have also been studies that evaluate whether PTAs increase protectionism. Krueger (1999) stated that all PTAs are not created equal, citing the differences between EU's trade liberalization and MERCOSUR's trade diversion. Foroutan (1998) explored the nature of the relationship that existed between a country's participation in a PTA and the restrictiveness of that country's trade. This study found that Latin American countries that are members of a PTA are also those that have liberalized the most. In concluding, however, Foroutan noted that the acceptance of a liberal trade policy supersedes membership in a PTA and that belonging to a regional bloc constitutes neither a necessary nor sufficient condition for an open and liberal trade regime.

Trade agreements that support comprehensive trade liberalization across all key sectors and nonrestrictive rules of origin are more likely to realize success (World Bank GEP 2005). Many researchers recognize that PTA's can either be trade creating or trade diverting and individual assessment must be conducted to determine effects on trade flows. In reassessing the implications of NAFTA and other trading arrangements on regions including Central American nations, this study will allow for a mechanism to control for exogenous factors in the model and will deal specifically with the agriculture and food sectors. It is expected that sector level evaluation will yield more conclusive results.

Methodologies of Previous Research

Different versions of general and partial equilibrium models, as well as other formulations, have been used to quantify the effect of liberalization on agriculture-dependent nations. Martin and Brandao (1993) used various types of partial liberalization to assess the impacts from liberalization by developed countries only, by developing countries only and by both developing and developed countries using a general equilibrium framework (RUNS Model). The paper focused on agricultural trade liberalization as opposed to liberalization of agricultural policies. Assessing the impact of each partial liberalization highlighted the effects of each scenario on developing nations and consequently on welfare. Messerlin (2005) cited that the priority of the Doha round should be substantial tariff reduction and used the Swiss formula as a tool to reduce dispersion of tariff rates creating a uniform tariff. The Swiss formula incorporated three maximum tariffs, a low tariff for developed countries, a higher tariff for LDCs and an intermediate one for other countries. Messerlin views high tariffs as the main instrument of protection imposed by developing countries on imports and reduction thereof will lead to gains from trade between developing countries. Van der Mensbrugge and Beghin (2004) also used a general equilibrium model to quantify potential gains from agricultural trade reform. The global LINKAGE model was used to assess impacts of agricultural trade and support policies on global trade, income and output patterns, using baseline simulation and a reform simulation. The simulations identify the share of total gains derived from both industrial countries' and developing countries' reform. They also determine the share of gains driven by reform to border protection measures and those driven by reform relating to domestic supports.

Hertel, Dimaranan and Keeney (2003) look specifically at the effects of OECD domestic supports on developing countries. They use a restructured GTAP database and model, using four classifications of domestic supports, i.e. input subsidies, output subsidies, land-based payments and capital based payments. Five simulations were used to assess the impacts of changes in OECD domestic support on developing countries. This is done by systematically adjusting domestic supports by various percentages and by sectors and then measuring the outcomes. Hertel et al. (2001) attempted to quantify the impacts of multilateral trade liberalization on poverty by using a cross-section consumption analysis and earnings data from household surveys in seven countries. This approach went beyond country per capita effects and assessed trade policies on households by computing the change in household income.

Previous Findings

Martin and Bradoa (1993) measured welfare effects by terms of trade impacts, efficiency gains from liberalization and second-best effects manifested in induced changes in tariff revenues. They found that if only the OECD countries liberalize, some developing countries experience losses. As a group, however, a small gain of US$629 million is realized. Under global liberalization, gains for developing countries increase considerably in relation to gains realized by OECD countries. The net gain of developing countries in this scenario is US$59 billion. Overall results indicate that most gains to developing countries come from domestic reforms, the net gain being US$56 billion. This is highlighted by the results of the scenario that considers only the liberalization of developing countries. Even those developing countries that experience losses under global liberalization would experience gain under this scenario. Messerlin (2005) cited similar results, indicating that a country's welfare gains will come mainly from unilateral liberalization. This proved true for both developing and OECD countries. They added that developing countries would gain considerably from OECD agricultural liberalization as well. According to Francois, Meijl, and Tongeren (2003), agricultural liberalization offers mixed results citing that domestic support liberalization in OECD is positive for the OECD countries but produces negative consequences for some other countries, particularly for Sub-Saharan Africa. They found that gains are usually related to relaxation of domestic supports while elimination of border measures yields mixed results.

Van der Mensbrugghe and Beghin (2004) estimated that agriculture and food trade reforms provide 70 percent of total gains from trade reform, or $265 billion of the estimated $385 billion in welfare improvements. While the gains were found to be distributed equally between industrial and developing countries, developing countries gained more as a share of initial income. They also found that developing countries gain more from unilateral reforms than from increased market access in developed countries. Industrial countries also gain more from national reforms. Van der Mensbrugghe and Beghin established that the main determinants in the overall level of welfare gains are trade elasticities. Anderson (2000) made a similar but somewhat distinct conclusion as it related to agriculture liberalization in OECD countries. Data collected in this study suggest that about 48 percent of global welfare gains would result from agriculture and food reform in OECD countries, even though such commodities only account for 4 percent of global GDP.

This represents almost half of the global gains. Anderson concluded that export subsidies should be banned completely to bring agriculture in line with other products under the GATT, considering that other authors only mentioned successive reduction of export subsidies without alluding to export subsidy elimination.

Concluding Remarks on Agricultural Trade

Agricultural trade liberalization has been given much attention, mainly due to potential welfare gains for developing and underdeveloped nations. Many studies have extracted data relating to specific economies and have used various versions of partial and general equilibrium models along with other analytical formulas to quantify effects. Employing an approach that combined national household surveys, the ICP database on per capita consumption, the Deninger and Squire Income distribution data set and the GTAP database, Hertel et al. (2001) used measures of compensating and equivalent variation to evaluate welfare gains. They found that marginal households in the agriculture sector gain in all but one of the regions they were evaluating as a result of increased world food prices and the consequent increased returns to agriculture. This, again, highlights the dependency of marginalized economies on agricultural trade. In reviewing related literature, the consensus appears to be that multilateral trade liberalization will cause substantial gains for impoverished and developing countries. More important though are the increased gains resulting from unilateral reforms. Hoekman, Olarreaga and Ng (2002) cited that domestic distortions and other institutional weaknesses act as major constricting factors to LDC's export expansion. It is, therefore, important that countries recognize those factors that impede trade expansion so that they can implement reform measures. The assessment of the Central American countries in this study will possibly disclose potential distortions within national boundaries to mitigate their influence before addressing the welfare implications of global agricultural trade liberalization. Given the literature on this topic, one thing appears certain: whatever the implications, partial liberalization will lead to greater welfare gains than no liberalization (Somwaru and Skully 2005). Without liberalization, many countries will validate their protectionist policies and erect additional barriers to trade. In such a scenario, the survival of the fittest nation may drive poorer countries further into poverty.

Food Trade

Over the years, there have been major changes in global food trade stemming from changes in the production and consumption of food worldwide. The adoption of production technology in the food industry has been influenced by research and development, the supply of raw materials, disposable income and other economic factors, food habits, health and nutrition, and other market conditions (Edelman and Fewell 1985). Trade in food is affected by supply side factors such as relative growth in factors of production and demand-driven factors such as growth in disposable income and change in consumer preferences (Regmi 2001). These changes have shifted the composition of world agricultural trade in terms of both food and non-food commodities in either raw or processed form. Gehlhar and Coyle (2001) categorized agricultural trade into four components: bulk commodities, processed intermediate products, fresh horticulture products and processed consumer goods. In the past, bulk commodities including grains accounted for a large percentage of total agricultural trade. With improvements in shipping technology, the world has seen trade expansion in fresh produce. In winter Americans can now purchase fresh grapes from Chile, oranges from Australia, snow peas from Guatemala and almost any other produce all year long (Regmi 2001). However, many of the fastest growing categories in trade are packaged products (Gehlhar and Coyle 2001). Pastry, chocolates and other prepared foods accounted for $15 billion in world trade[2] in 2001, while wine accounted for $7.4 billion, exhibiting a growth rate of 6 percent per annum. Gehlar and Coyle broke down the determinants of food trade into factor growth on the supply side, income growth on the demand side, and barriers to trade.

Demand-Driven Factors

Food in general is considered to be a normal good with a positive income elasticity of demand. However, according to Engel's law, food's share of total expenditure declines as income increases. This is more evident in higher income economies. According to Cranfield et al. (1998), countries with low per capita income are expected to see relatively larger growth in their food expenditure than countries with high per capita expenditure since quantities demanded in low income countries increase proportionately more with income growth than in developed, higher income countries. In Cranfield's study, Ethiopia had the most responsive food demand while the United States had the least responsive demand. A ten percent increase in per capita expenditure in Ethiopia resulted in a 9.7 percent increase in food demand, while the same ten percent increase in per capita expenditure in the United States resulted in a 1.5 percent increase in food demand. For those economies where food supply is of great concern, food consumption will be primarily

[2] World Trade in this context does not include trade among members of the European Union.

affected by income. In such instances, changes in income may be the primary factor contributing to changes in food consumption. For higher income economies, consumption patterns may also be affected by other lifestyle changes and changes in consumer preferences. Import demand will therefore be influenced by the consumer's requirement for palatable, safe and nutritious foods that are convenient, readily available and provide value for money (Edelman and Fewell 1985).

Shifts in the consumption of food types may drastically impact food trade. With increased disposable income, countries may demand foreign brands of food items, changing the composition of total domestic consumption. This will lead to an increase in imports of food. However, in certain instances the demand for foreign varieties encourages intra-industry trade since there is simultaneous exporting and importing of similar products between trading partners (Gehlhar and Coyle 2001).

Supply Driven Factors

Supply side factors also have significant impact on the changing trade patterns in the international food industry. Changes in the relative abundance of primary factors such as land, labor and capital determine changes in production costs, which in turn affect the level of trade (Gehlhar and Coyle 2001). This follows from the Hecksher-Ohlin model which states that countries will export products that utilizes their abundant factor(s) of production and will import products that utilizes their scarce factor(s). By extension, technological growth also influences trade in food. Many food processing facilities must invest in capital upgrades and engage in capital intensive operations. The abundance and intensity of factors therefore determine specialization in either primary or processed products and indicate whether countries are net exporters or net importers of the products in question. However, Gehlar and Coyle (2001) have concluded that supply-side effects have had more to do with shifts in economy-wide structure rather than compositional changes in trade.

Concluding Remarks on Food Trade

Many factors have contributed to the changing structure of global food consumption and trade. Coyle et al. (1998) found that demand, driven by changes in per capita income and income elasticities is the most significant factor affecting food consumption patterns. Others like Gehlhar and Coyle (2001) attributed the changes to demand side factors, supply-side factors and trade barriers. Regmi et al. (2001) found that both food budget share and income elasticity of food decline as income increases and that lower income countries spend a larger share of their budget on food and are more responsive to income and food price changes than middle and high-income countries. Regmi (2001) cited that even though income increases improved food purchasing power, overall improvements in trade and transportation have enhanced selection and availability of food products. Given past research findings, it is evident that there are combinations of factors that affect food trade. Although changing preferences and availability of food has affected food consumption, the underlying factor is the consumer's ability to purchase food which is determined by income.

CHAPTER 3

THEORETICAL FOUNDATION AND MODEL DEVELOPMENT

This chapter presents the methods and data used to analyze determinants of agriculture and food trade. The review of literature outlines several factors proven to affect trade between countries. Variables representing income, market size, distance, historical relationships and cultural affinity are often used in trade models. A combination of these factors determines the level of production and consumption domestically and by extension the expansion of markets beyond national borders.

While international trade deals with trade between countries instead of trade within an economy, the underlying factors remain the same. Consumers will demand products subject to prices and personal income. Producers will supply products subject to revenues and costs. Production decisions are also guided by availability of resources. In agriculture, for example, the amount of arable land, labor, and other inputs can all be varied to produce different amounts of a specialized crop.

Specialization is the basis of international trade (Vachal 1992). Trade allows countries to focus on the production of certain products while maintaining a variety of products for consumption (Koo and Kennedy 2005). A nation's ability to specialize is associated with its resource endowment and production cost. To maximize export earnings, countries will specialize in those goods that they can produce efficiently. The availability of resources and income will determine consumption and production levels on the consumption possibilities frontier and the production possibilities frontier, respectively. Hence, import and export trade will be determined by a nation's consumers maximizing utility and producers maximizing profits, subject to incomes and resource cost, respectively.

The Model

We develop a model that combines consumer food demand, food production and an agricultural sector producing raw agricultural products used in food manufacturing. Consumption occurs in every country. Production of primary and processed food may occur in any country depending on production technologies. Both food and agricultural intermediate goods may be traded. We hypothesize that final demand, local characteristics of food manufacturing, trade costs, resource endowments and relative prices in the agricultural producing countries will be determinants of the location of food and agricultural production and underlie observed trade flows.

Consumer Demand

Food manufacturers are faced with the following inverse demand function in country *i* (Feinberg and Keane 2003):

(1) $P_i = P_{i0} Q_i^{-g}$,

where P_i and Q_i represent prices and quantities of an aggregate food good. The demand intercepts, P_{i0} , differ by country. Exponent g_i is the negative of the inverse price elasticity of food demand in country *i*.

Demand for food products will be derived from consumers maximizing utility subject to a budget constraint. The Marshallian demand function expresses the quantities of food products demanded by the consumer in terms of food prices and income. Assuming that the consumer is representative of the population, total demand will be the summation of individual demands in country i. The effects of income and population will be captured in the inverse demand function as arguments in the demand intercept, where $P_{i0} = P_{i0}$ (m, n), where m is income and n is population.

Food Manufacturing

Food production may occur in any country S_j. Food production combines purchased inputs, L_j, assumed to be non-traded, and intermediate agricultural inputs, A_j:

(2) $S_j \le f_j^F (A_j, L_j)$.

The agricultural inputs used in food manufacturing A_j are either produced domestically, X_{jj}, or are imported from country *l*, X_{lj}. Supplies of the intermediate agricultural inputs used in food manufacturing in country *j* cannot exceed local production and imports:

(3) $A_j \le \sum_l X_{lj}$.

Food price in country *i* is dependent on total sales, Q_i, which in turn is determined by those shipments from manufacturing country *j* to final markets in country *i*:

(4) $Q_i \le \sum_j Q_{ji}$.

Food shipped from country of manufacturer *j* cannot exceed production in *j*,

(5) $S_j \ge \sum_i Q_{ji}$.

Food manufacturing in country j can be represented by an industry profit function, where food manufacturers in country j seek to maximize profits from food sales in all markets *i*.

(6) $\prod^F_j = \sum_i (P_{i0}\, Q_i^{-g_i}) Q_{ji} - w_j A_j - w_{jL} L_j - \sum_i \tau_{ji} Q_{ji} - \sum_l v_{lj} X_{lj}$

Total production costs are incurred in each of the countries in which food is produced. These costs are dependent on local prices of raw agricultural inputs w_j and the cost of purchased inputs w_{jL}. Costs τ_{ji} represents any transportation or trading costs of shipments of final product from country j to markets in i, while v_{lj} represents any transportation or trading costs of shipment of raw agricultural inputs used in production imported from country l to country j.

Agricultural Production

The raw agricultural input X_l may be produced in any country l and is a function of locally available fixed resources, D_l, and a purchased input, M_l

(7) $X_l \leq f_l^{\,A} (D_l, M_l)$

Domestic use of agricultural inputs and shipments of agricultural inputs to food manufacturing plants in country j cannot exceed production

(8) $X_l \geq \sum_j X_{lj}$

The agriculture sector is assumed to be perfectly competitive, represented by the following profit maximization objective:

(9) $\prod_l^A = w_l X_l - r_{Dl} D_l - r_{Ml} M_l$

The agricultural product carries the farm gate value in country l. All transportation cost is borne by the food manufacturer, whether used domestically or in overseas markets. Each agricultural industry is constrained by land availability.

(10) $D_l \leq D^{max}{}_l$

Partial Equilibrium Model of the Food and Agricultural Sectors

To determine market clearing prices and quantities, level of trade, and resource use, the partial equilibrium model of consumer demand and the food and agricultural production sectors below is used:

(11) *Maximize* $■ = \sum_i P_{i0}\, Q_i^{\,1-g_i} - \sum_j w_{jL} L_j - \sum_i \sum_j \tau_{ji} Q_{ji} - \sum_j \sum_l v_{lj} X_{lj} - \sum_l w_{lm} M_l$
$+ \sum_j \lambda_j^1 (f^F_j(A_j, L_j) - S_j) + \sum_j \lambda_j^2 (\sum_l X_{lj} - A_j) + \sum_l \lambda_j^3 (\sum_j Q_{ji} - Q_i) + \sum_j \lambda_j^4 (S_j - \sum_i Q_{ji})$
$+ \sum_l \lambda_l^5 (f_l^A(D_l, M_l) - X_l) + \sum_l \lambda_l^6 (X_l - \sum_j X_{lj}) + \sum_l \lambda_l^7 (D_l - D_l).$

The first order conditions characterizing optimality of the above equation are listed below.

(12) $\partial ■ / \partial Q_i = (1-g_i)\, P_{i0}\, Q_i^{\,-gi} - \lambda_i^3 \leq 0$

The marginal revenue of food quantity supplied in market i is less than or equal to the marginal cost of supplying food to the market. Assuming an interior solution, food consumption in country i occurs when marginal revenue equals marginal cost.

(13) $\partial ■ / \partial Q_{ji} = - \tau_{ji} + \lambda_i^3 - \lambda_j^4 \leq 0$

If $Q_{ji} > 0$ (i.e. food is produced in country j and shipped to market i), the marginal value of the food to the importer in i is equal to the marginal cost of procuring the food in country j plus the cost of transportation from j to i.

(14) $\partial ■ / \partial S_j = - \lambda_j^1 + \lambda_j^4 \leq 0$

The marginal value of food in country j, λ_j^4, is less than or equal to the marginal cost of supply λ_j^1.

(15) $\partial ■ / \partial A_j = \lambda_j^1 \dfrac{\partial f_j^F(A_j, L_j)}{\partial A_j} - \lambda_j^2 \leq 0$

The marginal value product of the agricultural intermediate good in country *j* is less than or equal to the marginal cost of supplying the agricultural input to country *j*.

$$(16) \quad \partial \mathcal{L} / \partial X_{lj} = -v_{lj} + \lambda_j^2 - \lambda_l^6 \leq 0$$

The marginal value of the agricultural input at *j*, λ_j^2, is less than or equal to the marginal cost of producing the input in country *l* plus the cost of transportation of agricultural inputs from *l* to *j*.

$$(17) \quad \partial \mathcal{L} / \partial X_l = - \lambda_l^5 + \lambda_l^6 \leq 0$$

The marginal value of the agricultural input produced in *l* is less than or equal to the marginal cost of producing X_l.

$$(18) \quad \partial \mathcal{L} / \partial L_j = - w_{jL} + \lambda_j^1 \frac{\partial f_j^F(A_j, L_j)}{\partial L_j} \leq 0$$

If variable inputs are used in food production in country j, the marginal value product of the input will be equal to the exogenous prices of those purchased inputs.

$$(19) \quad \partial \mathcal{L} / \partial M_l = - w_{lM} + \lambda_l^5 \frac{f_l^A(D_l, M_l)}{\partial M_l} \leq 0$$

If variable inputs are used in agricultural production in country *l*, the marginal value product of the variable input will equal its exogenously determined price.

$$(20) \quad \partial \mathcal{L} / \partial D_l = \lambda_l^5 \frac{\partial f_l^A(D_l, M_l)}{\partial D_l} - \lambda_l^7 \leq 0$$

The marginal value product of the fixed resource used in agricultural production in country *l* will be less than or equal to the marginal cost of an additional unit of the fixed resource, or λ_l^7.

The objective of this research is to evaluate the impact trade costs, trade agreements and other economic and demographic characteristics on exports of food and agricultural products. Establishing these effects requires estimation of the underlying parameters in the conceptual model outlined in the preceding section. Factors characterizing consumer demand for food, production functions for food manufacturing and agricultural sectors, resource endowments and input prices, and other transportation and trade costs are essential in this estimation.

Food Trade

Marginal revenue in the food manufacturing sector will be a function of demand function parameters. The marginal cost of supplying food to destination market i will equal the marginal cost of producing food in countries supplying food to i, in addition to all transportation and/or trade costs associated with moving food from origin j to destination i. The cost of procurement in j will be less than or equal to the marginal cost of producing food. The food production costs in j will be a function of production technology and input costs of intermediate agricultural inputs and other non-traded purchased inputs. The cost of the intermediate agricultural input A_j will depend on the supply of this input in country j, which can either be produced locally or imported from country l.

Agriculture Trade

Agricultural trade occurs if the difference between the value of the agricultural input in the destination and origin countries, $(\lambda_j^2 - \lambda_l^6)$, is equal to the cost of transporting the input from l to j. The marginal value product of the agricultural intermediate input in country j is equal to the marginal value of the agricultural input, A_j. The agricultural production function $f_l^A(D_l, M_l)$, the exogenous price of the variables inputs w_{lm}, and the shadow price of fixed resources used in agricultural production will jointly determine the marginal cost of producing the agricultural intermediate input in country l.

Transportation and Trading Cost

In the case of both food and agricultural products, no trade will occur if transportation and trading cost exceeds the difference between procurement cost in the origin country and marginal revenue in the destination country.

Equations for Agricultural and Food Trade

Trade in raw agricultural commodities X_{lj} and in food products for final demand Q_{ji} will be estimated. Food trade will be determined by trade costs and by marginal revenues being equal to marginal costs for each producing and supply country. Marginal revenues depend on factors affecting consumer demand including population, income, food prices and other prices in the destination market. The marginal cost of food production will depend on the cost of the agricultural input and other variable inputs and food production technology in country j. The marginal cost of the agricultural input depends on domestic production and trade X_{lj}. Agricultural production will depend on resource endowments in producing countries, variable input costs and agricultural production technology in country l.

Agricultural Trade

Combining the structural model presented above results in the following conceptualization of the estimating equations for the model:

(21) X_{lj} = *g(agricultural production technology in country l, agricultural input costs in l, transportation and trade costs, resource endowments)*

Agricultural trade will be estimated using three distinct models. The models include variables representing income, market size, factor endowment, historical relationship and transportation cost. Model 1 incorporates membership in trade agreements or associations by accounting for individual participation of origin and destination countries in each Multilateral Trade Agreement (MTA) included in the sample. Model 2 makes use of the same MTAs but instead accounts for joint participation by both origin and destination countries in an association. Model 3 combines the MTA variables of Models 1 and 2 (i.e. variables representing individual participation of origin and destination countries as well as a variable for joint participation). Model 3 allows statistical measurement of trade within the MTAs as well as indicators of trade diversion or creation associated with each MTA (Clarette et al. 2002).

Model 1

The equation for estimating exports of agricultural products from origin l to destination j under model 1 takes the following form:

(21.1) $X_{lj} = \beta 0 + \beta 1\ contig + \beta 2 comlang\_off + \beta 3\ Col45 + \beta 4\ D + \beta 5\ GDP_l + \beta 6\ Pop_l + \beta 7 GDPRatio_l + \beta 8\ Factor_l + \beta 9\ GDP_j + \beta 10\ Pop_j + \beta 11 GDPRatio_l + \beta 12 Factor_j + \beta 13\ WTO_l + \beta 14\ NAFTA_l + \beta 15\ EU_l + \beta 16\ MERCOSUR_l + \beta 17\ CARICOM_l + \beta 18\ CACM_l + \beta 19\ ANDEAN_l + \beta 20\ ASEAN_l + \beta 21\ SPARTECA_l + \beta 22\ PATCRA_l + \beta 23\ COMESA_l + \beta 24\ SAFTA_l + \beta 25\ GAFTA_l + \beta 26\ WTO_j + \beta 27\ NAFTA_j + \beta 28\ EU_j + \beta 29 MERCOSUR_j + \beta 30\ CARICOM_j + \beta 31\ CACM_j + \beta 32 ANDEAN_j + \beta 33\ ASEAN_j + \beta 34\ SPARTECA_j + \beta 35\ PATCRA_j + \beta 36\ COMESA_j + \beta 37\ SAFTA_j + \beta 38\ GAFTA_j + \varepsilon_{lj}$.

Model 2

The equation for estimating exports of agricultural products from origin l to destination j under model 2 takes the following form:

(21.2) $X_{lj} = \beta 0 + \beta 1\ contig + \beta 2 comlang\_off + \beta 3\ Col45 + \beta 4\ D + \beta 5\ GDP_l + \beta 6\ Pop_l + \beta 7 GDPRatio_l + \beta 8\ Factor_l + \beta 9\ GDP_j + \beta 10\ Pop_j + \beta 11 GDPRatio_l + \beta 12 Factor_j + \beta 13\ WTO\_O*D + \beta 14\ NAFTA\_O*D + \beta 15\ EU\_O*D + \beta 16\ MERCOSUR\_O*D + \beta 17\ CARICOM\_O*D + \beta 18\ CACM\_O*D + \beta 19\ ANDEAN\_O*D + \beta 20\ ASEAN\_O*D + \beta 21\ SPARTECA\_O*D + \beta 22\ PATCRA\_O*D + \beta 23\ COMESA\_O*D + \beta 24\ SAFTA\_O*D + \beta 25\ GAFTA\_O*D + \varepsilon_{lj}$

Variables are defined as above in Model 1, with the exception of those introduced in this equation that measure joint membership in the specified MTAs. The description of variables are listed in Table 1.

Table 1. Description of Model Variables

Variable	Description
X_{lj}	amount of agriculture trade (exports) between country l and country j.
Q_{ji}	amount of food trade between country j and i.
Contig	Indicates whether the two countries are contiguous. If they are then one, otherwise the variables takes on a zero value
Comlang_off	Common language (when the countries share an official common language, then one, otherwise the variable takes the value zero)
Col45	If the countries have had a colonial relationship after 1945, then one, zero otherwise.
D_{lj}	The weighted average[3] distance from country l to country j in kilometers.
GDPCapita	GDP at Purchasing Power Parity per capita
Pop	The population of the country
GDPRatio	Agriculture GDP as a percentage of total GDP.
Factor	The ratio of arable land (in thousand of hectares) to agriculture labor force (in thousands).
WTO	If country is a member of the World Trade Organization, then the variable equals one, otherwise it equals zero.
NAFTA	If country is a member of the North American Free Trade Agreement, then the variable equals one, otherwise it equals zero.
EU	If country is a member of the European Union, then the variable equals one, otherwise it equals zero.
MERCOSUR	If country is a member of Mercado Comun del Cono Sur, then the variable equals one, otherwise it equals zero.
CARICOM	If country is a member of the Caribbean Community, then the variable equals one, otherwise it equals zero.
CACM	If country is a member of the Central American Common Market , then the variable equals one, otherwise it equals zero.
ADEAN	If country is a member of the Andean Community, then the variable equals one, otherwise it equals zero.
ASEAN	If country is a member of the Association of Southeast Asian Nations, then the variable equals one, otherwise it equals zero.

[3] The weighted distance measure uses city-level data to assess geographic distribution of the population inside each country. The distance between two countries is calculated based on bilateral distances between the largest cities of those two countries, those inter-city distances being weighted by the share of the city in the country's overall population (CEPII).

Table 1. (continued)

Variable	Description
SPARTECA	If country is a member of the South Pacific Regional Trade and Economic Cooperation Agreement , then the variable equals one, otherwise it equals zero.
PATCRA	If country is a member of the Papua New Guinea-Australia Trade and Commercial Relations Agreement, then the variable equals one, otherwise it equals zero.
COMESA	If country is a member of the Common Market for Eastern and Southern Africa , then the variable equals one, otherwise it equals zero.
SAFTA	If country is a member of the South Asian Free Trade Area, then the variable equals one, otherwise it equals zero.
GAFTA	If country is a member of the Greater Arab Free Trade Agreement, then the variable equals one, otherwise it equals zero.
*WTO_O*D*	*If* both origin and destination countries are members of WTO, then one, otherwise zero.
*NAFTA_O*D*	*If* both origin and destination countries are members of NAFTA, then one, otherwise zero.
*EU_O*D*	*If* both origin and destination countries are members of EU, then one, otherwise zero.
*MERCOSUR_O*D*	*If* both origin and destination countries are members of MERCOSUR, then one, otherwise zero.
*CARICOM_O*D*	*If* both origin and destination countries are members of CARICOM, then one, otherwise zero.
*CACM_O*D*	*If* both origin and destination countries are members of CACM, then one, otherwise zero.
*ANDEAN_O*D*	*If* both origin and destination countries are members of the ANDEAN Community, then one, otherwise zero
*ASEAN_O*D*	*If* both origin and destination countries are members of ASEAN, then one, otherwise zero.
*SPARTECA_O*D*	*: If* both origin and destination countries are members of SPARTECA, then one, otherwise zero.
*PATCRA_O*D*	*If* both origin and destination countries are members of PATCRA, then one, otherwise zero.
*COMESA_O*D*	*If* both origin and destination countries are members of COMESA, then one, otherwise zero.
*SAFTA_O*D*	*If* both origin and destination countries are members of SAFTA, then one, otherwise zero.
*GAFTA_O*D*	*If* both origin and destination countries are members of GAFTA, then one, otherwise zero.

Model 3

In order to capture the decomposition of total trade among MTA members, a third model was added for both agricultural trade and food trade. This model combined Models 1 and 2 by including all MTA variables in the estimation. The overall effects of the various trade agreements are, therefore, best explained by Model 3. The equation for Model 3 takes the following form:

$$(21.3) \quad X_{lj} = \beta 0 + \beta 1\ contig + \beta 2 comlang\_off + \beta 3\ Col45 + \beta 4\ D + \beta 5\ GDP_l + \beta 6\ Pop_l + \beta 7 GDPRatio_l + \beta 8\ Factor_l + \beta 9\ GDP_j + \beta 10\ Pop_j + \beta 11 GDPRatio_l + \beta 12 Factor_j + \beta 13\ WTO_l + \beta 14\ NAFTA_l + \beta 15\ EU_l + \beta 16\ MERCOSUR_l + \beta 17\ CARICOM_l + \beta 18\ CACM_l + \beta 19\ ANDEAN_l + \beta 20\ ASEAN_l + \beta 21\ SPARTECA_l + \beta 22\ PATCRA_l + \beta 23\ COMESA_l + \beta 24\ SAFTA_l + \beta 25\ GAFTA_l + \beta 26\ WTO_j + \beta 27\ NAFTA_j + \beta 28\ EU_j + \beta 29 MERCOSUR_j + \beta 30\ CARICOM_j + \beta 31\ CACM_j + \beta 32 ANDEAN_j + \beta 33\ ASEAN_j + \beta 34\ SPARTECA_j + \beta 35\ PATCRA_j + \beta 36\ COMESA_j + \beta 37\ SAFTA_j + \beta 38\ GAFTA_j + \beta 39\ WTO\_O{*}D + \beta 40\ NAFTA\_O{*}D + \beta 41\ EU\_O{*}D + \beta 42\ MERCOSUR\_O{*}D + \beta 43\ CARICOM\_O{*}D + \beta 44\ CACM\_O{*}D + \beta 45\ ANDEAN\_O{*}D + \beta 46\ ASEAN\_O{*}D + \beta 47\ SPARTECA\_O{*}D + \beta 48\ PATCRA\_O{*}D + \beta 49\ COMESA\_O{*}D + \beta 50\ SAFTA\_O{*}D + \beta 51\ GAFTA\_O{*}D + \varepsilon_{lj}$$

The variables in Model 3 are defined as above in Models 1 and 2. Model 3 includes dummy variables on joint membership, O*D $ASSN_k$; dummy variables indicating the origin's membership in the agreement, O_ASSN_k; and dummy variables representing the destination's membership in the agreement, D_ASSN_k. This approach mimics that of Soloaga and Winters (2001) and Clarete, Edmonds and Wallack (2002). The coefficient on O_Assn_k represents the origin country's exports to non-members of the bloc, or the general liberalization effect on exports. Likewise, the coefficient on D_Assn_k represents the additional imports to the destination country from non-members, or the general liberalization effect on imports (Clarete, Edmonds and Wallack 2002). $O*D\ Assn_k$ is an interaction term on origin and destination membership (i.e., joint membership) in the agreement. The coefficient on this variable represents intra-bloc trading or the additional exports from origin to destination when both countries are members of the association. A combination of the coefficients on the three MTA related variables represents the total effect of the arrangement on member trade.

Combining the three dummy variables in one model allows us to evaluate the contribution of the agreement to intra-bloc trade and to trade with the rest of the world (ROW). In instances of trade diversion, the coefficient on joint membership will be positive while the sum of the coefficients on origin membership and destination membership will be negative indicating that the arrangement reduces imports from the global market more than it increases exports to the global market. In cases where the arrangement enhances intra-bloc trade as well as trade with non-members, both the coefficient on joint membership and the sum of the coefficients on origin membership and destination membership will be positive (Clarete, Edmonds and Wallack 2002).

The equations for agricultural trade contain variables that will represent demand and supply of agricultural products. Overall consumer demand will be influenced by GDP per capita and the total population within the country. Supply of agriculture products will be influenced by factors of production including agricultural labor and arable land. The level of trading will be affected by combinations of factors including the transportation costs, trading relationships and other commonalities between countries.

GDP per capita and the GDP ratio (which includes agricultural GDP) will act as proxies for agricultural production technology since technological advances in the agricultural sector will depend on the level of income and investment in the economy. In many countries, particularly developing countries, the agricultural sector is labor intensive. Agricultural input costs therefore predominantly reflect agricultural labor cost. Resource endowment is represented by arable land since land is the main resource used in agricultural production. The ratio of the two provides a productivity estimate for the sector. Distance data acts as a proxy for transportation cost while trade costs are represented by the other factors in the system that affect communication and the level of tariff and non-tariff barriers. These include language and colonial relationships as well as membership in trading agreements.

Food Trade

Estimation for food trade also included three models. Similar to the agricultural trade models, model 1 accounts for individual participation of origin and destination countries in each Multilateral Trade Agreements (MTA) included in the estimation. Model 2 accounts for joint participation of both origin and destination country in an agreement. Model 3 combines all MTA variables from Models 1 and 2.

Model 1

(22) Q_{ji} = *g(food demand, food production technology, food input cost, transportation and trade costs, participation in MTAs)*

Specifically, the equation to estimate food trade using Model 1 is as follows:

(22.1) $Q_{ji} = \beta 0 + \beta 1\ contig + \beta 2 comlang\_off + \beta 3\ Col45 + \beta 4\ D + \beta 5\ GDP_i + \beta 6\ Pop_i + \beta 7 GDPRatio_i + \beta 8\ Factor_i + \beta 9\ GDP_j + \beta 10\ Pop_j + \beta 11 GDPRatio_i + \beta 12 Factor_j + \beta 13\ WTO_i + \beta 14\ NAFTA_i + \beta 15\ EU_i + \beta 16\ MERCOSUR_i + \beta 17\ CARICOM_i + \beta 18\ CACM_i + \beta 19\ ANDEAN_i + \beta 20\ ASEAN_i + \beta 21\ SPARTECA_i + \beta 22\ PATCRA_i + \beta 23\ COMESA_i + \beta 24\ SAFTA_i + \beta 25\ GAFTA_i + \beta 26\ WTO_j + \beta 27\ NAFTA_j + \beta 28\ EU_j + \beta 29 MERCOSUR_j + \beta 30\ CARICOM_j + \beta 31\ CACM_j + \beta 32 ANDEAN_j + \beta 33\ ASEAN_j + \beta 34\ SPARTECA_j + \beta 35\ PATCRA_j + \beta 36\ COMESA_j + \beta 37\ SAFTA_j + \beta 38\ GAFTA_j + \varepsilon_{ij}$

Variables are defined as above in the agricultural trade equation, with the exception of those introduced in this equation:

Q_{ji}: amount of food exports from origin *j* to destination *i* using the BEC classification. Food exports are defined as food and beverage trade for household consumption (i.e., the food product) and combines BEC Classification 112 (Food and Beverage (Primary) for Household Consumption) and BEC Classification 122 (Food and Beverage (Processed) for Household Consumption).

Model 2

(22.2) $Qji = \beta 0 + \beta 1\ contig + \beta 2 comlang\_off + \beta 3\ Col45 + \beta 4\ D + \beta 5\ GDP_I + \beta 6\ Pop_I + \beta 7 GDPRatio_I + \beta 8\ Factor_I + \beta 9\ GDP_j + \beta 10\ Pop_j + \beta 11 GDPRatio_I + \beta 12\ Factor_j + \beta 13\ WTO\_O{*}D + \beta 14\ NAFTA\_O{*}D + \beta 15\ EU\_O{*}D + \beta 16\ MERCOSUR\_O{*}D + \beta 17\ CARICOM\_O{*}D + \beta 18\ CACM\_O{*}D + \beta 19\ ANDEAN\_O{*}D + \beta 20\ ASEAN\_O{*}D + \beta 21\ SPARTECA\_O{*}D + \beta 22\ PATCRA\_O{*}D + \beta 23\ COMESA\_O{*}D + \beta 24\ SAFTA\_O{*}D + \beta 25\ GAFTA\_O{*}D + \varepsilon_{Ij}$

Model 3

Model 3 under food trade is identical to that introduced under agricultural trade. It combines the MTA variables from models 1 and 2. The equation for model 3 takes the following form:

(22.3) $Q_{Ij} = \beta 0 + \beta 1\ contig + \beta 2 comlang\_off + \beta 3\ Col45 + \beta 4\ D + \beta 5\ GDP_I + \beta 6\ Pop_I + \beta 7 GDPRatio_I + \beta 8\ Factor_I + \beta 9\ GDP_j + \beta 10\ Pop_j + \beta 11 GDPRatio_I + \beta 12 \mathrm{Factor}_j + \beta 13\ WTO_I + \beta 14\ NAFTA_I + \beta 15\ EU_I + \beta 16\ MERCOSUR_I + \beta 17\ CARICOM_I + \beta 18\ CACM_I + \beta 19\ ANDEAN_I + \beta 20\ ASEAN_I + \beta 21\ SPARTECA_I + \beta 22\ PATCRA_I + \beta 23\ COMESA_I + \beta 24\ SAFTA_I + \beta 25\ GAFTA_I + \beta 26\ WTO_j + \beta 27\ NAFTA_j + \beta 28\ EU_j + \beta 29 MERCOSUR_j + \beta 30\ CARICOM_j + \beta 31\ CACM_j + \beta 32 ANDEAN_j + \beta 33\ ASEAN_j + \beta 34\ SPARTECA_j + \beta 35\ PATCRA_j + \beta 36\ COMESA_j + \beta 37\ SAFTA_j + \beta 38\ GAFTA_j + \beta 39\ WTO\_O{*}D + \beta 40\ NAFTA\_O{*}D + \beta 41\ EU\_O{*}D + \beta 42\ MERCOSUR\_O{*}D + \beta 43\ CARICOM\_O{*}D + \beta 44\ CACM\_O{*}D + \beta 45\ ANDEAN\_O{*}D + \beta 46\ ASEAN\_O{*}D + \beta 47\ SPARTECA\_O{*}D + \beta 48\ PATCRA\_O{*}D + \beta 49\ COMESA\_O{*}D + \beta 50\ SAFTA\_O{*}D + \beta 51\ GAFTA\_O{*}D + \varepsilon_{Ij}$

The equation for food trade comprises variables that represent food demand and supply. The demand for food is determined by individual consumers maximizing utility subject to a budget constraint. Underlying factors influencing consumer choices (i.e. food demand) include income, food prices and other prices faced by the consumer. Total food demand will be influenced by the population of country *i*. Variables such as GDP per capita and population will therefore be used to model food demand in the equations.

Food production technology will be represented by income (i.e., GDP per capita). Since food production combines purchased inputs and intermediate agricultural inputs, those costs associated with agricultural inputs will also affect food input cost. Therefore, estimated agricultural exports in primary form may also affect food input costs. As with agriculture, distance data for food trade act as proxies for transportation cost. Trade costs are represented by variables such as language and colonial relationships as well as membership in trading agreements. These contribute to information costs, communication costs and the cost of policy barriers (tariff and non-tariff barriers).

Data

The estimating equations resemble the basic gravity model and include variables representing economic size, historical and cultural relationships, geographic characteristics and trading relations. All factors impact agriculture and food trade, either on the demand side or the supply side. However, unlike the gravity model, exports from *j* to *i* and exports from *i* to *j* are viewed as separate observations. Other changes include consideration of procurement of supplies from country *l* used in food production. There are variables for both agriculture trade and food trade. Common variables include population, gross domestic product per capita, distance, foreign direct investment and trade agreements. The equation for agriculture trade also included Agriculture GDP per capita, agricultural labor and arable land.

Export data were collected from the United Nations Commodity Trade Statistics Database and include classification by Broad Economic Categories (BEC) defined in terms of the Standard International trade Classification (SITC), Revision 3. Exports under BEC are classified as BEC 111 (Food and Beverage (Primary) for Industry), BEC 121 (Food and Beverage (Processed) for Industry), BEC 112 (Food and Beverage (Primary) for Household Consumption) and BEC 122 (Food and Beverage (Processed) for Household Consumption). Population figures were collected from the Penn World Tables. Gross Domestic Product based on purchasing-power parity per capita in US dollars is from the World Economic Outlook Database (April 2005) of the International Monetary Fund and the Central Intelligence Agency World Fact-Book for 2004. Data on agricultural GDP per capita, agriculture labor force and arable land are from the Food and Agriculture Organization of the United Nations (FAO Statistical Yearbook 2005-2006). Data for countries not reported here in the FAO dataset were collected from the CIA World Fact-Book. Membership in major trading agreements was determined from the World Trade Organization's list of trade agreements in force. Distance data along with those variables marking commonality in colonial relationships and language were collected from the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII) bilateral trade files.

Within every data set there were a few missing observations. Data for the missing observations were collected from other sources to ensure that most countries had observations for each variable. Hence, estimation procedures across sources may vary slightly. In most cases, the CIA World Fact-Book was used as the secondary source to fill in missing observations. For the variable GDP per capita (PPP), 40 observations used years between 1991-2003 and 2005 as proxies for 2004 as the 2004 figures were not available.

CHAPTER 4

EMPIRICAL RESULTS

This chapter presents ordinary least squares estimates of the coefficients of the models for agricultural intermediate goods trade and food trade for a 2004 cross section of 183 countries. Models were estimated using the PROC Model procedures in SAS. Observations were available for 7,492 agricultural intermediate good trade flows and for 10,957 food trade flows. Continuous variables were converted to logarithms to enable interpretation of the coefficients as elasticities.

All models estimated indicated the presence of heteroskedasticity. The Heteroskedasticity Consistent Covariance Matrix Estimator was thus used to provide consistent estimates of the coefficient standard errors. In addition to heteroskedasticity, the correlation matrix of independent variables showed high correlations among various independent variables. Collinearity testing in SAS confirmed the presence of multi-collinearity in the models. The effect of each individual variable was then evaluated by expanding the model one variable at a time. With each variable added, the model was re-evaluated and examined for major changes in individual coefficients which would imply that multi-collinearity existed. Particular attention was paid to changes in the signs of the estimated coefficients.

The Foreign Direct Investment (FDI) variable was highly correlated with Gross Domestic Product (GDP) per capita and was consequently removed from the estimation. Other high correlations existed between income variables, population and agricultural resource variables. The ratio of arable land and agricultural labor were used to create a new variable, factor, to reduce potential collinearity issues. Arable land and agricultural labor are used as proxies for technology level in agricultural producing countries.

Trade Flows of Agricultural Intermediate Goods

Table 2 presents ordinary least square (OLS) estimates of the coefficients of the agricultural intermediate goods trade model with cross sectional data for the year 2004. The columns show independent variables, regression coefficients, and t-statistics derived from heteroskedasticity consistent standard errors. The empirical models perform adequately in explaining bilateral trade flows of agricultural intermediate good among countries. The adjusted R^2 for the three models are .35, .29 and .36, respectively.

Model Specification Tests

Likelihood ratio tests (LRTs) were used to compare models 1 and 2 against model 3. Both models 1 and models 2 are nested in model 3. Hence, model 3 is the unrestricted model and models 1 and 2 are restricted. Asymptotically, the LR test statistic is distributed as a chi-squared random variable, with degrees of freedom equal to the exclusion restriction i.e. the number of parameters excluded from the restricted model.

$LR = 2(L_{ur} - L_r)$

The first test included models 1 and 3. We test the null hypothesis that the restrictions are equal to zero or that there is no difference in the two models. The log-likelihood values were extracted from the proc model regressions performed in SAS and used to calculate the likelihood ratio statistics.

Table 2. Estimated Coefficients of the Models for Agricultural Intermediate Goods (t-statistics in bold)

	Model 1		Model 2		Model 3	
Constant	-1.1589	*	-4.23052	***	-0.8387	
	-1.76		**-6.72**		**-1.17**	
Contig	1.2582	***	1.5755	***	1.3218	***
	9.27		**11.55**		**9.61**	
comlang_off	0.6353	***	0.5348	***	0.5410	***
	7.37		**6.06**		**6.13**	
col45	1.5224	***	1.4859	***	1.6004	***
	8.19		**7.82**		**8.4**	
Distwces	-0.9959	***	-0.5749	***	-0.8942	***
	-24.72		**-14.07**		**-19.44**	
O_GDPCapita	0.3262	***	0.4817	***	0.3123	***
	6.92		**12.97**		**6.62**	
O_Pop	0.6940	***	0.6432	***	0.6927	***
	31.44		**29.84**		**31.33**	
O_GDPRatio	0.8633	***	0.3106	***	0.9238	***
	6.75		**2.69**		**7.16**	
O_Factor	0.0129	***	0.0128	***	0.0131	***
	4.49		**8.29**		**4.58**	
D_GDPCapita	0.5359	***	0.5281	***	0.5371	***
	14.28		**15.72**		**14.38**	
D_Pop	0.6255	***	0.5914	***	0.6229	***
	31.17		**32.10**		**31.06**	
D_GDPRatio	0.1318		0.2890	***	0.1369	
	1.49		**3.45**		**1.55**	
D_Factor	-0.0048	*	-0.0046	**	-0.0045	
	-1.73		**-2.55**		**-1.61**	
O_WTO	0.3010	**			-0.7726	***
	2.15				**-2.71**	
O_NAFTA	1.0960	***			1.0507	***
	4.81				**4.54**	
O_EU	**0.7613**	***			**0.7037**	***
	8.05				**6.86**	
O_MERCOSUR	2.7295	***			2.6300	***
	16.16				**15.14**	
O_CARICOM	0.8325	***			0.0747	
	3.08				**0.23**	

Table 2. (continued)

	Model 1		Model 2		Model 3	
O_CACM	2.3246	***			2.2446	***
	13.84				**12.6**	
O_ANDEAN	1.6191	***			1.5834	***
	9.23				**8.8**	
O_ASEAN	1.8453	***			1.8037	***
	14.17				**13.1**	
O_SPARTECA	3.2470	***			3.1038	***
	16.20				**14.58**	
O_PATCRA	-2.4793	***			-2.4704	***
	-6.01				**-5.99**	
O_COMESA	0.8556	***			0.8127	***
	5.51				**4.96**	
O_SAFTA	-0.3603	*			-0.4057	*
	-1.73				**-1.91**	
O_GAFTA	-0.5968	***			-0.6966	***
	-3.77				**-3.96**	
D_WTO	0.0889				-1.1233	***
	0.97				**-3.7**	
D_NAFTA	0.3436				0.2998	
	1.42				**1.23**	
D_EU	0.1718	*			0.1004	
	1.75				**0.9**	
D_MERCOSUR	-0.7653	***			-0.9235	***
	-4.42				**-5.16**	
D_CARICOM	0.3361	**			-0.0848	
	2.04				**-0.51**	
D_CACM	-0.5424	***			-0.6006	***
	-2.85				**-2.89**	
D_ANDEAN	-0.9089	***			-0.9426	***
	-4.40				**-4.38**	
D_ASEAN	0.4355	***			0.4037	**
	2.96				**2.57**	
D_SPARTECA	0.4795	**			0.2939	
	2.18				**1.22**	
D_PATCRA	-0.1152				-0.0562	
	-0.29				**-0.14**	
D_COMESA	-0.0464				-0.0920	
	-0.33				**-0.61**	

Table 2. (continued)

	Model 1		Model 2		Model 3	
D_SAFTA	-0.3086				-0.3482	*
	-1.51				**-1.67**	
D_GAFTA	0.4990	***			0.4351	***
	4.36				**3.63**	
WTO O*D			0.3163	***	1.3233	***
			3.84		**4.24**	
NAFTA O*D			1.9502	***	1.0837	**
			4.94		**2.55**	
EU O*D			0.7124	***	0.3292	**
			5.87		**2.26**	
MERCOSUR O*D			2.3252	***	1.0509	*
			4.11		**1.71**	
CARICOM O*D			2.3750	***	2.7657	***
			6.44		**5.65**	
CACM O*D			2.2936	***	0.7103	**
			10.36		**2.08**	
ANDEAN O*D			0.1893		0.0296	
			0.28		**0.04**	
ASEAN O*D			1.7080	***	-0.2205	
			4.88		**-0.53**	
SPARTECA O*D			2.8715	***	0.7864	*
			7.99		**1.90**	
PATCRA O*D			-2.0260	***	-0.4191	
			-5.04		**-0.77**	
COMESA O*D			0.8823	**	0.4377	
			2.52		**1.08**	
SAFTA O*D			-0.7541		0.2435	
			-0.74		**0.23**	
GAFTA O*D			0.4047		0.6206	*
			1.49		**1.91**	
Number of Obs.	**7492**		**7492**		**7492**	
Adjusted R^2	**0.3535**		**0.2946**		**0.3593**	

***, ** and * denote significance at the 1, 5 and 10 percent levels.

In the LR Test of models 1 and 3 for agricultural trade, the LR statistic is –1010. Since this calculated value in absolute term is greater than the chi-square value at 13 degrees of freedom, we reject the null hypothesis in favor of the alternative. Model 3 is superior to model 1. An identical test was conducted to compare models 2 and 3 of agricultural trade. The computed LR statistic is –9746. The calculated value exceeds the chi-square value at 26 degrees of freedom so we reject the null hypothesis that the restrictions are equal to zero, proving that Model 3 is also superior to model 2.

Determinants of Trade Flows

The estimated coefficient on contiguity is statistically significant and positive. Adjoining countries do trade more than those separated by land or sea. All models are consistent indicating that contiguity increases agricultural good trade by 1.32 percent. The coefficient on comlang_off indicates that countries sharing a common official language will trade more than those not sharing a common official language. Historical relationships between countries also positively impact trade. The col45 variable has a positive sign and is statistically significant, indicating that there will be more trade between those countries that were in a colonial relationship after 1945 regardless of current official relationships. Similar to other trade studies, the distance variable is negatively related to trade between countries. Since distance serves as a proxy for transportation/transaction costs, this indicates that increased transportation costs act as a trade deterrent. The farther apart two countries are, the more costly it is to trade. Increased trading cost will erode potential gains from trade. For model 3, each additional (log of) kilometer distance reduces trade values by .89 percent.

The estimated coefficients of GDP per capita for both origin and destination are statistically significant and have positive signs. Per capita GDP is a measure of a country's personal wealth or income. Countries with higher income will produce and export more intermediate agricultural goods. The income of the destination country or importer signifies purchasing power. Destination countries with higher income are seen to import more. The estimated coefficients on population for both origin and destination countries are also statistically significant and positive. Since population represents market size, the increase in market size will increase both exports and imports. A large population in the exporting country may indicate greater availability of labor resources which will improve production capacity. A large population in the importing country signifies a large consumer base that will demand more imports.

While the ratio of agricultural GDP to total GDP is positive for both origin and destination countries, it is only statistically significant for the exporting country. As agricultural GDP as a percentage of GDP increases by one percent, agricultural exports increase 0.92 percent for origin countries and 0.14 percent for destination countries. The estimated coefficient on the ratio of arable land to agricultural labor (or Factor) for the exporting country is statistically significant and has a positive sign. Interpreting a higher land to labor ratio as an indicator of increasing productivity, increased agricultural productivity in the exporting country translates to more efficient production and more exports. For importing countries, the Factor variable is statistically significant at the 10 percent level and carries a negative signs indicating that as the agricultural productivity of the importing country increases, they will import fewer intermediate agricultural goods.

Effects of Individual Trading Blocs

The estimated coefficient for the WTO variable for exporting countries is statistically significant with a negative sign indicating that the origin's membership in

WTO decreases export volume to non-members. The coefficient on the WTO variable for importing countries is also statistically significant and negative indicating that imports from the rest of the world is also reduced.

The dummy variable representing joint membership in WTO is statically significant and positive indicating that WTO membership has enhanced trade among member countries. The overall effect of the World Trade organization is trade enhancing for members. These results reflect the wide embrace of WTO membership. One hundred fifty one of the countries in the sample were members of WTO in 2004.

The estimated coefficient for NAFTA membership is statistically significant and positive for the exporting country but is not statistically significant for the importing country. The estimated coefficient on joint NAFTA membership is also statistically significant and positive indicating that NAFTA has enhanced trade among its members. Since the coefficient on importers was not statistically significant, it appears that NAFTA has positively influenced exports, yet has not affected imports into the three NAFTA countries from non-member nations.

Similar to the effects of NAFTA, the coefficient for EU membership is statistically significant and positive for exporting countries but is not statistically significant for importers, implying that the EU has been effective in improving export trade for its member countries. The EU dummy variable for joint membership is statistically significant and positive indicating enhanced trade among EU members, one of the primary objectives underlying the formation of the EU.

The estimated coefficient on the variable MERCOSUR is statistically significant and has a positive sign for exporters. The coefficient on MERCOSUR membership for imports from non-members is statistically significant and negative. Although this MTA encourages trade within the group, it does so at the expense of trade with non-members, effectively limiting member countries' access to imports from outside sources. The coefficient on joint membership in MERCOSUR is statistically significant at the 10 percent level and positive. MERCOSUR has benefitted trade among members, and has increased exports to non-members. While there have been significant tariff reduction for MERCOSUR members, the introduction of the common external tariff actually raised the average tariff rate for some member countries. (Yeats 1998)

The coefficients on the CARICOM variables are not statistically significant for exports to and imports from non-member countries. The dummy variable for joint membership in CARICOM is statistically significant and positive. This indicates that CARICOM has improved trade activities among member countries but has not contributed to enhanced trade with the rest of the world.

The estimated coefficients on the CACM variables are statistically significant for exports and imports with non-member countries. The positive sign on CACM membership for the exporting country indicates that there is a positive relationship between the exporting country's CACM membership and trade to non-members. There is a significant and negative correlation between CACM membership and imports from non-members. The estimated coefficient on CACM joint membership is statistically significant and positive. The significance of the coefficient on joint CACM membership is associated with improvement in trade among members.

The estimated coefficient on ANDEAN membership is statistically significant and has a positive sign for exporters. On the contrary, the coefficient on ANDEAN membership for imports from non-members is statistically significant and negative. While the ANDEAN pact has a significant positive effect on exporters, the negative effects this agreement has on importers seem to be more pronounced. The estimated coefficient on joint membership in the ANDEAN community is not statistically significant, indicating little to no effect on trade among members.

The coefficients for ASEAN membership are statistically significant and positive for both exporting and importing countries, implying that ASEAN has been effective in improving import and export trade to non-members. The dummy variable for joint membership in ASEAN is not statistically significant, indicating that while ASEAN has enhanced trade with the rest of the world, it has not contributed to improvement of intra-bloc trade.

Similarly, membership in SPARTECA is positive and statistically significant for origin countries but is not statistically significant for destination countries, indicating that this agreement has enhanced export trade to non-members without having much effect on import trade from non-members. The estimated coefficient on the dummy variables for joint membership in SPARTECA is statistically significant at the 10 percent level and positive. SPARTECA has enhanced intra-bloc trade for its members.

The dummy variable representing PATCRA membership for exporting countries is statistically significant and has a negative sign indicating that exporters' membership in PATCRA will reduce their trade volume to non-members. The coefficient on PATCRA membership for importing countries also carries a negative sign but is not statistically significant. The dummy variable on joint PATCRA membership is not statistically significant indicating that PATCRA membership has not improved intra-bloc trade for members.

The estimated coefficient on the COMESA variable for exporting countries is statistically significant and has a positive sign indicating a positive impact on exports to non-members. The coefficient for importers' membership in COMESA is negative but not statistically significant. COMESA membership is associated with trade enhancement to their exporters. The coefficient on the COMESA variable for joint membership is not significant indicating that this trade agreement has not contributed to enhanced trade amongst members.

The dummy variables on SAFTA membership indicates that this agreement has not been effective in enhancing trade among its members. Both coefficients for exports and imports carry negative signs and are significant at the 10 percent level. The coefficient on joint membership is not statistically significant. Even controlling for income, agricultural production, and other factors considered, members of SAFTA are not major exporters or importers of agricultural goods.

The estimated coefficient on GAFTA membership for exporters is statistically significant and has a negative sign indicating a negative correlation between exporters' membership in GAFTA and trade volume to non-members. Imports from non-member countries, on the other hand, is statistically significant and positive indicating that membership in this agreement is associated with increased agricultural imports. Estimated coefficients representing joint membership in GAFTA is statistically significant at the 10 percent level and positive indicating that GAFTA has also led to increased intra-bloc trade.

Trade Creation and Trade Diversion

Under Model 3, emphasis was placed on analyzing the nature of trade resulting from the 13 trade agreements included in the sample. Hypothesis testing was conducted to determine if an arrangement led to trade creation or trade diversion. The test involved calculating the sum of the coefficients on exports from and imports to non-member countries. According to Clarete, Edmonds and Wallack (2002), trade-diverting behavior is evident when coefficients on joint membership are positive and the sum of the coefficients on origin and destination membership in the agreement are negative. A positive coefficient on joint membership along with a positive sum of the coefficients on exporter and importer membership will indicate that the agreement has expanded intra-bloc trade as well as trade with the rest of the world.

We test the null hypothesis that the coefficients on $O\_ASSN_K + D\_ASSN_K = 0$ for the trade agreements in the study. Specifically, the null hypothesis assumes no effect on agricultural trade between members and non-members of trade associations. Results of the hypothesis tests for agricultural trade are reported in Table 3.

The results for agricultural trade indicate that 11 of the 13 trade agreements have significant effects on trade between members and non-members: WTO, NAFTA, EU, MERCOSUR, CACM, ANDEAN Pact, ASEAN, SPARTECA, PATCRA, COMESA and SAFTA. The coefficients on CARICOM and GAFTA are not statistically significant, so we fail to reject the null of no effect. Of the agreements included in the study, three are found to have trade-diverting effects since the summation of the coefficients on imports and exports with non-members is negative: WTO, PATCRA and SAFTA. This means that these three agreements have diverted agricultural trade from the rest of the world to member countries. The majority of the MTAs have positively and significantly affected agricultural trade with countries outside of the specific MTAs.

Table 3. Hypothesis Tests of Trade Creation/Diversion Effects of Membership in an MTA for Agricultural Trade

Equation	Coefficient	T-Stat	Wald
O_WTO + D_WTO	-1.8958	-3.37	11.36
O_NAFTA + D_NAFTA	1.3505	3.94	15.49
O_EU + D_EU	0.8041	4.78	22.81
O_MERCOSUR + D_MERCOSUR	1.7065	6.61	43.71
O_CARICOM + D_CARICOM	-0.0101	-0.03	0
O_CACM + D_CACM	1.6441	5.94	35.29
O_ANDEAN + D_ANDEAN	0.6408	2.27	5.17
O_ASEAN + D_ASEAN	2.2074	10.14	102.86
O_SPARTECA + D_SPARTECA	3.3977	10.14	102.82
O_PATCRA + D_PATCRA	-2.5266	-4.31	18.55
O_COMESA + D_COMESA	0.7207	3.14	9.89
O_SAFTA + D_SAFTA	-0.7538	-2.51	6.32
O_GAFTA + D_GAFTA	-0.2615	-1.20	1.43

While WTO has increased intra-bloc trading amongst members by 1.32 percent, it has done so at the expense of trade with non-members. Both the coefficient on O_Assn_k and D_Assn_k are negative indicating that this agreement has reduced exports to and imports from outside sources. In addition the coefficient on the summation of extra-bloc trade is statistically significant at the 1 percent level and negative indicating that WTO has diverted trade from non-members to member countries. WTO members are more likely to trade with each other instead of trading with other non-WTO countries. The overall effects of the MTAs on agricultural trade are listed in Table 4.

Table 4. Overall Effect of Individual MTA on Agricultural Trade

	O_Assn		D_Assn		O*D Assn		O_Assn + D_Assn	
WTO	-	***	-	***	+	***	-	***
NAFTA	+	***	+		+	***	+	***
EU	+	***	+		+	**	+	***
MERCOSUR	+	***	-	***	+	*	+	***
CARICOM	+		-		+	***	-	
CACM	+	***	-	***	+	**	+	***
ANDEAN	+	***	-	***	+		+	**
ASEAN	+	***	+	**	-		+	***
SPARTECA	+	***	+		+	*	+	***
PATCRA	-	***	-		-		-	***
COMESA	+	***	-		+		+	***
SAFTA	-	*	-	*	+		-	***
GAFTA	-	***	+	***	+	*	-	

***, ** and * denote significance at the 1, 5 and 10 percent levels.
+ denotes a positive sign on the coefficient and – denotes a negative sign on the coefficient.

The results of this study found NAFTA to be entirely trade creating. NAFTA exporters have expanded exports 1.05 percent as a result of NAFTA membership while imports from non-NAFTA members increased by .3 percent. In addition, NAFTA has expanded trade amongst its members by 1.08 percent. The coefficient on O_ASSN_K + D_ASSN_K for NAFTA is positive, further indicating the trade creating effects of this arrangement. There was significant trade among NAFTA members prior to the agreement, which may be one reason why trade diversion was not evident in this association.

The EU and SPARTECA have similar results to those of NAFTA. Both have expanded trade for exporters and importers to and from non-member countries. The EU has increased exports of agricultural goods to world markets by 0.7 percent. EU and SPARTECA have also expanded intra- bloc trade by 0.33 and 0.79 percent, respectively.

The coefficients on the calculated values representing extra-bloc trade indicate that EU and SPARTECA are both trade creating.

MERCOSUR has expanded trade for its exporters by 2.6 percent but market openness to imports has been restricted. While this arrangement has increased intra-bloc trading amongst members and has not shown significant signs of trade diversion, importers from the rest of the world have restricted access to the MERCOSUR market. The nature of trade created by MERCOSUR to non-members is attributed to export expansion.

CARICOM membership is characterized by increased intra-bloc trading and increased exports to the rest of the world. However, there is clear evidence of trade diversion within this grouping. The coefficient on destination membership indicates that CARICOM had no effect on imports from the rest of the world.

CACM, the ANDEAN Community and COMESA are characterized by export expansion and increased intra-bloc trade but membership in these markets has not increased imports from the rest of the world. They have reduced imports from non-members by 0.6, 0.94 and 0.09 percent respectively. The coefficients on O_ASSN_K + D_ASSN_K for the three arrangements are statistically significant and positive, indicating trade creation. The effects of export expansion have overshadowed any negative effect on imports.

While ASEAN has opened its market to global trade, i.e. trade with the rest of the world, it has done so at the expense of intra-bloc trade. While exports to and imports from the rest of the world have increased by 1.8 and 0.4 percent, respectively, intra-bloc trade was reduced by 0.22 percent. The enhanced trade with non-members has led to trade creation for members and there is no evidence of trade diversion under this arrangement.

The coefficients on all MTA variables in the estimation for PATCRA membership are negative or not statistically different from zero. This implies that PATCRA provides no influence on agricultural trade for members.

Both SAFTA and GAFTA were shown to reduce exports to outside countries. While SAFTA has reduced imports from the rest of the world, GAFTA has opened its market to imports. SAFTA and GAFTA have both led to increased intra-bloc trade but both also show signs of trade diversion.

Trade Flows of Food Products

The results of the food trade models are presented in Table 5. The columns show independent variables, regression coefficients, and t-statistics derived from White's heteroskedasticity consistent standard errors. The adjusted R^2 for models 1, 2 and 3 are 0.46. 0.43 and 0.47, respectively.

Model Specification Tests

Likelihood ratio tests were conducted to compare models 1 and 2 against model 3. Model 3 is the unrestricted model and models 1 and 2 impose parameter restrictions. The first test included models 1 and 3. We test the null hypothesis that the restrictions are equal to zero. In the LR test of models 1 and 3 for food trade, the LR statistic is –1532. Since this calculated value in absolute terms is greater than the chi-square value at 13 degrees of freedom, we reject the null hypothesis in favor of the alternative. Another test was conducted to compare models 2 and 3 for food trade. The computed LR statistic is – 9104,

Table 5. Estimated Coefficients of the Models for Household Food Products (t-statistics in bold)

	Model 1		Model 2		Model 3	
Constant	-7.3625		-8.6578	***	-7.5936	***
	-14.19		**-17.79**		**-13.59**	
Contig	1.1175	***	1.3384	***	1.1679	***
	10.18		**12.35**		**10.61**	
comlang_off	0.9019	***	0.7993	***	0.7951	***
	13.03		**11.52**		**11.05**	
col45	1.7188	***	1.6737	***	1.8210	***
	10.74		**10.66**		**11.33**	
Distwces	-1.2062	***	-0.8869	***	-1.0845	***
	-38.73		**-29.07**		**-31.92**	
O_GDPCapita	1.0399	***	1.0564	***	1.0311	***
	27.87		**36.30**		**27.64**	
O_Pop	0.7909	***	0.7889	***	0.7877	***
	46.84		**50.45**		**46.76**	
O_GDPRatio	0.4568	***	0.2935	***	0.4690	***
	5.09		**3.54**		**5.21**	
O_Factor	-0.0026		-0.0015		-0.0022	
	-1.36		**-1.31**		**-1.17**	
D_GDPCapita	0.7710	***	0.7536	***	0.7722	***
	28.06		**30.45**		**28.19**	
D_Pop	0.5555	***	0.5135	***	0.5531	***
	38.3		**40.41**		**38.18**	
D_GDPRatio	0.2938	***	0.3857	***	0.2954	***
	4.46		**6.00**		**4.49**	
D_Factor	0.0004		0.0058	***	0.0006	
	0.16		**3.97**		**0.26**	
O_WTO	0.9435				0.2908	
	10.01				**1.32**	
O_NAFTA	0.2831	*			0.2228	
	1.87				**1.45**	
O_EU	0.2176	***			0.1549	**
	2.94				**1.96**	
O_MERCOSUR	2.0055	***			1.9392	***
	19.72				**18.8**	
O_CARICOM	0.1086				-0.5364	**
	0.57				**-2.46**	
O_CACM	0.6153	***			0.4353	**
	3.7				**2.51**	
O_ANDEAN	1.0477	***			0.9682	***
	9.22				**8.37**	
O_ASEAN	0.9920	***			0.9266	***
	10.14				**9.31**	
O_SPARTECA	2.9243	***			2.7788	***
	16.39				**14.64**	

Table 5. (continued)

	Model 1		Model 2		Model 3	
O_PATCRA	-1.6089	***			-1.6113	***
	-5.21				**-5.17**	
O_COMESA	0.3399	***			0.1701	
	2.65				**1.28**	
O_SAFTA	0.6965	***			0.6383	***
	4.83				**4.39**	
O_GAFTA	0.1111				0.0556	
	1.19				**0.56**	
D_WTO	0.2083	***			-0.5188	**
	3.18				**-2.29**	
D_NAFTA	0.5443	**			0.5076	**
	2.49				**2.3**	
D_EU	0.1444	*			0.0693	
	1.93				**0.82**	
D_MERCOSUR	-1.2017	***			-1.2402	***
	-7.88				**-7.89**	
D_CARICOM	0.2792	***			-0.0192	
	2.77				**-0.19**	
D_CACM	-0.4195	***			-0.6026	***
	-2.86				**-3.99**	
D_ANDEAN	-0.8922	***			-0.9886	***
	-5.74				**-6.16**	
D_ASEAN	-0.1517				-0.2154	*
	-1.27				**-1.75**	
D_SPARTECA	0.4426	***			0.3014	*
	2.79				**1.80**	
D_PATCRA	0.3276				0.3487	
	1.05				**1.11**	
D_COMESA	-0.2457	**			-0.4076	***
	-2.23				**-3.55**	
D_SAFTA	-0.3404	**			-0.3905	**
	-2.26				**-2.56**	
D_GAFTA	0.2408	***			0.1831	*
	2.65				**1.90**	
WTO O*D			0.4660	***	0.7811	***
			8.19		**3.35**	
NAFTA O*D			1.3970	***	1.0539	***
			3.33		**2.70**	
EU O*D			0.6168	***	0.4023	***
			6.98		**3.75**	

Table 5. (continued)

	Model 1		Model 2		Model 3	
MERCOSUR O*D			0.4966		-0.1559	
			1.21		-0.33	
CARICOM O*D			2.2715	***	2.7896	***
			9.45		8.68	
CACM O*D			2.5252	***	2.5235	***
			10.51		7.84	
ANDEAN O*D			1.2033	***	1.3071	***
			4.53		4.13	
ASEAN O*D			0.8407	*	0.0476	
			1.87		0.10	
SPARTECA O*D			3.1985	***	0.7118	**
			10.43		2.09	
PATCRA O*D			-1.5776	***	-0.8729	**
			-4.68		-1.97	
COMESA O*D			1.4845	***	1.7332	***
			4.61		4.92	
SAFTA O*D			0.7783		0.4741	
			0.93		0.55	
GAFTA O*D			0.6665	***	0.5759	**
			3.31		2.48	
Number of Obs.	10957		10957		10957	
Adjusted R^2	0.4644		0.4297		0.4709	

***, ** and * denote significance at the 1, 5 and 10 percent levels.

which exceeds the chi-square value at 26 degrees of freedom. We reject the null hypothesis that the restrictions are equal to zero, indicating that model 3 is superior to both models 1 and 2 for food trade.

Determinants of Trade Flows

Many of the impacts affecting trade in agricultural intermediate goods have similar effects on food trade. The estimated coefficient on contiguity is statistically significant and has a positive sign, indicating that countries sharing a border will trade more with each other. Contiguity increases food trade by 1.17 percent. Countries sharing a common official language will trade up to .80 percent more than those not sharing a common official language. The Col45 variable has a positive sign and is statistically significant, indicating that there will be more trade between countries that were in a colonial relationship after 1945. As expected, the coefficient on distance is statistically significant and has a negative sign indicating that as the distance between two countries increase, trade volume decreases since increased distance implies increased transportation costs.

The estimated coefficients of GDP per capita for both exporting and importing countries are statistically significant and have positive signs, indicating that an origin or exporting country with a higher income exports more. Importing countries with higher incomes will have more purchasing power and will consume and import more. The estimated coefficients on population for exporters and importers are statistically significant and carry positive signs, indicating a positive relationship between population and trade.

Effects of Individual Trading Blocs

Similar to results from intermediate agricultural goods trade, many of the trade agreements included in the food trade model are trade enhancing for members. The estimated coefficient for the WTO variable for exporting countries is not statistically significant indicating that the origin's membership in WTO does not significantly impact export trade in this sector. The coefficient on the WTO variable for importing countries is statistically significant and has a negative sign. While WTO has not impacted export trade to non-members, it has reduced food imports from the rest of the world. The dummy variable representing joint membership in WTO is statically significant and positive indicating that WTO membership has enhanced intra-bloc food trade. Those countries in WTO experience increased trade volume of food products within the arrangement.

The estimated coefficient on the variable NAFTA for origin countries is not statistically significant. The NAFTA variable for destination countries has a coefficient that is statistically significant at the five percent level and has a positive sign. While membership in NAFTA has increased food imports from the rest of the world, membership has no significant effect on exports to non-members. The estimated coefficient on joint NAFTA membership is statistically significant and positive indicating that NAFTA has enhanced trade among its members in the food sector.

The dummy variable representing EU membership for the food exporting country has a statistically significant coefficient that carries a positive sign indicating that EU membership has increased food trade for its exporting members. The estimated coefficient on the EU variable for destination countries is not statistically significant indicating that EU has not significant affected import trade from non-members. The coefficient on the EU dummy variable is statistically significant and positive indicating enhanced food trade among EU members.

The estimated coefficient on the variable MERCOSUR for origin countries is statistically significant and positive indicating that membership in MERCOSUR has increased food exports to the rest of the world. In contrast, the coefficient on the variable MERCOSUR for destination countries is statistically significant and has a negative sign indicating that food imports have been impeded by MERCOSUR membership. Yeats (1998) cites that MERCOSUR's discriminatory tariffs against non-members have lead to substantial trade diversion in the arrangement. The high tariffs imposed on food goods from non-members will substantially reduce imports from these countries and hence membership in MERCOSUR will have a negative correlation with imports from non-members. The coefficient on joint membership in MERCOSUR is not statistically significant, implying that MERCOSUR has not affected intra-bloc trading in the food sector.

In the case of CARICOM membership, the estimated coefficient on the variable for exporters is statistically significant and negative while the coefficient for importers is not statistically significant. This indicates that membership in CARICOM reduces exports to the rest of the world but has not affected imports from the rest of the world. The coefficient on the dummy variable for joint membership in CARICOM is statistically significant at the 1 percent level and has a positive sign. This indicates that CARICOM has improved trade activities among member countries in the food sector.

The estimated coefficient on membership in CACM is statistically significant and positive for exporters and statistically significant and negative for importers indicating that while exporters in CACM have seen increased food trade to the outside world, importers did not. The dummy variable for joint membership in CACM is statistically significant and has a positive sign indicating that CACM have improved intra-bloc trade for in the food industry.

The ANDEAN community has a statistically significant and positive coefficient for exporters but the coefficient for importers is statistically significant and negative. This indicates that membership in the ANDEAN community has reduced food imports for members. The estimated coefficient on joint membership in the ANDEAN community is statistically significant and positive indicating that this trade agreement has enhanced food trade amongst member nations.

The coefficient on the dummy variable representing membership in ASEAN is statistically significant and positive for exporting countries. The coefficient for importing countries is negative and statistically significant at the 10 percent level. This signifies improvement in extra-export trade but deterioration in imports from non-members. While ASEAN has improved export trade with the rest of the world, it had no impact on intra-bloc food trade.

The coefficient on the dummy variables representing SPARTECA membership is statistically significant and positive for exporters and importers. The coefficient for SPARTECA membership is much higher for exporters indicating that even though both importers and exporters benefit from SPARTECA membership, membership has had a greater impact on food exports. The estimated coefficient on joint membership in SPARTECA is statistically significant at the 5 percent level and positive indicating that this trade agreement has also enhanced food trade among members.

The estimated coefficient on PATCRA membership for origin countries is statistically significant and has a negative sign indicating food exporters in PATCRA export less to the rest of the world. The estimated coefficient for importers in PATCRA is not statistically significant. The estimated coefficient on joint PATCRA membership is statistically significant at the 5 percent level and negative indicating that PATCRA membership impedes intra-bloc food trade.

The coefficients of dummy variables representing COMESA membership is not statistically significant for exporters but is statistically significant and negative for importers indicating that COMESA has not affected exports outside of the region but has reduced imports from non-members. The estimated coefficient on the COMESA variable for joint membership is statistically significant and positive indicating that COMESA membership enhances food trade within the bloc.

Memberships in SAFTA have similar results to that of MERCOSUR. The coefficient of dummy variables representing membership is statistically significant and positive for exporters and statistically significant and negative for importers. This indicates that while food exporters trade more with non-members, food importers trade less with the rest of the world. While the coefficient on the SAFTA variable for joint inclusion is positive, it is not statistically significant indicating that SAFTA has not affected intra-bloc food trade.

While the estimated coefficient on GAFTA membership for exporters is positive, it is not statistically significant. However, the coefficient for importers is positive and statistically significant at the 10 percent level indicating that membership in GAFTA has enhanced food imports from the rest of the world for its member countries. The estimated coefficient on joint membership in GAFTA is statistically significant at the 5 percent level and positive indicating that GAFTA has enhanced food trade amongst members.

Trade Creation and Trade Diversion

Similar hypothesis testing conducted in the agricultural trade model was used to determine if an arrangement lead to trade creation or trade diversion in the food sector. The test involved calculating the sum of the coefficients on exports to and imports from non-members. We test the null hypothesis that the sum of coefficients is not statistically different from zero., i.e. the null hypothesis assumes no effect on food trade. Results of the hypothesis test for food trade are reported in Table 6.

Table 6. Hypothesis test of Trade Creation/Diversion Effects of Membership in an MTA for Food Trade

Equation	Coefficient	T-Stat	Wald
O_WTO + D_WTO	-0.2279	-0.53	0.28
O_NAFTA + D_NAFTA	0.7304	2.67	7.11
O_EU + D_EU	0.2242	1.80	3.24
O_MERCOSUR + D_MERCOSUR	0.6990	3.61	13.03
O_CARICOM + D_CARICOM	-0.5556	-2.29	5.25
O_CACM + D_CACM	-0.1673	-0.73	0.53
O_ANDEAN + D_ANDEAN	-0.0204	-0.10	0.01
O_ASEAN + D_ASEAN	0.7112	4.36	18.98
O_SPARTECA + D_SPARTECA	3.0802	11.75	138.18
O_PATCRA + D_PATCRA	-1.2626	-2.82	7.92
O_COMESA + D_COMESA	-0.2374	-1.31	1.72
O_SAFTA + D_SAFTA	0.2478	1.16	1.35
O_GAFTA + D_GAFTA	0.2387	1.67	2.73

The results of the hypothesis test for food trade vary from the agricultural trade results in certain instances. Eight of the thirteen agreements are found to have statistically significant effects on food trade creation or diversion.

The coefficients on WTO, CACM, ANDEAN Pact, COMESA and SAFTA are not statistically significant, so we fail to reject the null hypothesis that these arrangements had no effect on food trade creation or diversion with non-member countries. Results indicate that CARICOM and PATCRA were trade diverting. We reject the hypothesis that membership in NAFTA; MERCOSUR; ASEAN; SPARTECA and, to a lesser extent, the

EU and GAFTA had no effect on trade with non-members, but rather tended to create additional food trade with countries outside the MTAs. These arrangements have opened their markets to global imports and have expanded exports to the rest of the world. Results of the overall effect of the MTA's on food trade are listed in Table 7.

Table 7. Overall Effect of Individual MTA on Food Trade

	O_Assn		**D_Assn**		**O*D Assn**		**O_Assn + D_Assn**	
WTO	+		-	**	+	***	-	
NAFTA	+		+	**	+	***	+	***
EU	+	**	+		+	***	+	*
MERCOSUR	+	***	-	***	-		+	***
CARICOM	-	**	-		+	***	-	**
CACM	+	**	-	***	+	***	-	
ANDEAN	+	***	-	***	+	***	-	
ASEAN	+	***	-	*	+		+	***
SPARTECA	+	***	+	*	+	**	+	***
PATCRA	-	***	+		-	**	-	***
COMESA	+		-	***	+	**	-	
SAFTA	+	***	-	**	+		+	
GAFTA	+		+	*	+	**	+	*

***, ** and * denote significance at the 1, 5 and 10 percent levels.
+ denotes a positive sign on the coefficient and – denotes a negative sign on the coefficient.

CHAPTER 5

SUMMARY AND CONCLUSIONS

Summary

Trade liberalization is a major issue for many countries throughout the world. The expansion of global markets presents remarkable challenges for many nations. It is thus imperative that studies evaluate factors that enhance and distort trade between countries. In this study, we estimated several models of trade involving 183 countries and 13 trading blocs, using data for 2004 or appropriate proxies. Variables representing income, market size, distance, colonial relationship, cultural affinity, contiguity and membership in an economic trade arrangement were all included in the estimation.

The main objective of the study was to evaluate the impact of trade policies, trading costs, trade agreements and other economic and demographic characteristics on exports of food and agriculture products. Specifically, the paper examined the effects of trade agreements on countries and/or regions. The 13 trading blocs included in this study are located in different regions of the world. These are WTO, NAFTA, EU, MERCOSUR, CARICOM, CACM, the ANDEAN Pact, ASEAN, SPARTECA, PATCRA, COMESA, SAFTA and GAFTA.

A modified gravity-type model is used in this study. In the typical gravity model of trade, the dependent variable, bilateral trade between country pairs, is explained by variables representing income and market size in both origin and destination countries. Other dummy variables represent contiguity, common language and colonial relationship.

The model in this study included several dummy variables representing trade association membership. There were dummy variables representing exports from members of MTAs to non-members and imports to MTA members from non-members. An additional set of dummy variables indicated if both parties to the trade were members of the same MTA. This definition of trade relationships allowed us to capture the effects of the MTAs on intra-bloc trade and trade with the rest of the world.

The estimated coefficients of variables such as contiguity, common official language, colonial link, GDP per capita, population, the ratio of agricultural GDP per capita to GDP per capita, and the ratio of arable land to agricultural labor effectively explain agricultural and food trade flows. The coefficients on these variables are as expected and are in line with results of previous studies.

Estimates on the effect of the 13 trade agreements varied considerably across blocs. Membership in several MTAs was found to enhance intra-bloc trading at the expense of non-members, while membership in others has successfully increased both intra-bloc and trade with the rest of the world. There are also arrangements that had no significant effect on trading among members and those that have effectively reduced trade for members with the rest of the world.

Conclusions

WTO has increased intra-bloc trade in agriculture and food but has diverted trade in the agricultural sector. CARICOM significantly enhanced agricultural and food trade amongst members but diverted food trade. NAFTA, EU and SPARTECA have consistently been found to increase intra-bloc agricultural and food trade and were all found to be trade creating in both sectors. CACM and the ANDEAN community have been trade creating in the agricultural sector but have had no significant trade creating or diverting effect in the food sector. MERCOSUR and ASEAN have been trade creating in both agricultural and food trade. SAFTA has diverted trade in the agricultural sector while COMESA created trade in this sector. GAFTA has been trade creating in the food sector. PATCRA showed signs of trade diversion in both agricultural and food trade.

In summary, profits or gains from trade will be dependent on the revenues and costs associated with the exchange. We have found that income, market size, cultural relationship and geographical proximity all significantly affect bilateral trade between countries. Both geographic and cultural distances are important considerations when nations choose trade partners. In addition, we have found that MTAs have contributed significantly to trade amongst nations.

Need for Further Study

Although this study includes several variables representing economic integration, there are other variables not included that are important factors affecting bilateral trade. Tariff rates, foreign direct investment and the impact of multinational corporations may affect the choice of trade partners and the level of trade occurring between two countries. An expanded model including these variables, along with other variables such as exchange rates, can be developed to determine the effects of taxation, international capital movements and foreign exchange on trade flows.

Further studies can also assess the nature of multilateral and bilateral trade agreements with the aim to identifying policies that are protectionist instead of trade liberalizing. Although trade agreements can be trade creating or trade diverting, there are policies that can reduce the potential for trade diversion. Further studies can analyze policy instruments in place that may encourage trade diversion and attempt to develop solutions that will promote policies also geared at improving trade with the rest of the world.

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APPENDIX A

SAS PROCEDURE INPUT FILES

```
proc import out=work.trade1
datafile = "C:\Documents and Settings\Student\My Documents\HH_Data(2).xls"
DBMS=Excel Replace;
Run;

proc import out=work.trade2
datafile = "C:\Documents and Settings\Student\My Documents\IND_Data(2).xls"
DBMS=Excel Replace;
Run;
Proc Model data=trade1;
Parms B0 B1 B2 B3 B4 B5 B6 B7 B8 B9 B10 B11 B12 B13 B14 B15 B16 B17 B18 B19
B20 B21 B22 B23 B24 B25 B26 B27 B28 B29 B30 B31 B32 B33 B34 B35 B36 B37 B38
B39 B40 B41 B42 B43 B44 B45 B46 B47 B48 B49 B50 B51;
LNHHTRADE = B0 + B1*contig + B2*comlang_off + B3*col45 + B4*distwces +
B5*O_GDPCapita + B6*O_POP + B7*O_GDPRatio + B8*O_Factor +
B9*D_GDPCapita + B10*D_POP + B11*D_GDPRatio + B12* D_Factor +
B13*O_WTO + B14*O_NAFTA + B15*O_EU + B16*O_MERCOSUR +
B17*O_CARICOM + B18*O_CACM + B19*O_ANDEAN + B20*O_ASEAN +
B21*O_SPARTECA + B22*O_PATCRA + B23*O_COMESA +B24*O_SAFTA +
B25*O_GAFTA + B26*D_WTO + B27*D_NAFTA + B28*D_EU +
B29*D_MERCOSUR + B30*D_CARICOM + B31*D_CACM + B32*D_ANDEAN +
B33*D_ASEAN +B34*D_SPARTECA + B35*D_PATCRA + B36*D_COMESA +
B37*D_SAFTA + B38*D_GAFTA +B39*WTO_O_D + B40*NAFTA_O_D +
B41*EU_O_D + B42*MERCOSUR_O_D + B43*CARICOM_O_D +
B44*CACM_O_D + B45*ANDEAN_O_D + B46*ASEAN_O_D +
B47*SPARTECA_O_D + B48*PATCRA_O_D + B49*COMESA_O_D
+B50*SAFTA_O_D + B51*GAFTA_O_D;
fit LnHHTrade/HCCME=1;
Test B13+B26;
tEST B14+B27;
TEST B15+B28;
TEST B16+B29;
TEST B17+B30;
TEST B18+B31;
TEST B19+B32;
TEST B20+B33;
TEST B21+B34;
TEST B22+B35;
TEST B23+B36;
TEST B24+B37;
TEST B25+B38;
```

```
Run;

Proc Model data=trade2;
Parms B0 B1 B2 B3 B4 B5 B6 B7 B8 B9 B10 B11 B12 B13 B14 B15 B16 B17 B18 B19
B20 B21 B22 B23 B24 B25 B26 B27 B28 B29 B30 B31 B32 B33 B34 B35 B36 B37 B38
B39 B40 B41 B42 B43 B44 B45 B46 B47 B48 B49 B50 B51;
LNINDTRADE = B0 + B1*contig + B2*comlang_off + B3*col45 + B4*distwces +
B5*O_GDPCapita + B6*O_POP + B7*O_GDPRatio + B8*O_Factor +
B9*D_GDPCapita + B10*D_POP + B11*D_GDPRatio + B12* D_Factor +
B13*O_WTO + B14*O_NAFTA + B15*O_EU + B16*O_MERCOSUR +
B17*O_CARICOM + B18*O_CACM + B19*O_ANDEAN + B20*O_ASEAN +
B21*O_SPARTECA + B22*O_PATCRA + B23*O_COMESA +B24*O_SAFTA +
B25*O_GAFTA + B26*D_WTO + B27*D_NAFTA + B28*D_EU +
B29*D_MERCOSUR + B30*D_CARICOM + B31*D_CACM + B32*D_ANDEAN +
B33*D_ASEAN +B34*D_SPARTECA + B35*D_PATCRA + B36*D_COMESA +
B37*D_SAFTA + B38*D_GAFTA +B39*WTO_O_D + B40*NAFTA_O_D +
B41*EU_O_D + B42*MERCOSUR_O_D + B43*CARICOM_O_D +
B44*CACM_O_D + B45*ANDEAN_O_D + B46*ASEAN_O_D +
B47*SPARTECA_O_D + B48*PATCRA_O_D + B49*COMESA_O_D
+B50*SAFTA_O_D + B51*GAFTA_O_D;
fit LnINDTrade/HCCME=1;
Test B13+B26;
tEST B14+B27;
TEST B15+B28;
TEST B16+B29;
TEST B17+B30;
TEST B18+B31;
TEST B19+B32;
TEST B20+B33;
TEST B21+B34;
TEST B22+B35;
TEST B23+B36;
TEST B24+B37;
TEST B25+B38;
Run;

Proc Model data=trade2;
Parms B0 B1 B2 B3 B4 B5 B6 B7 B8 B9 B10 B11 B12 B13 B14 B15 B16 B17 B18 B19
B20 B21 B22 B23 B24 B25 B26 B27 B28 B29 B30 B31 B32 B33 B34 B35 B36 B37 B38
B39 B40 B41 B42 B43 B44 B45 B46 B47 B48 B49 B50 B51;
LNINDTRADE = B0 + B1*contig + B2*comlang_off + B3*col45 + B4*distwces +
B5*O_GDPCapita + B6*O_POP + B7*O_GDPRatio + B8*O_Factor +
B9*D_GDPCapita + B10*D_POP + B11*D_GDPRatio + B12* D_Factor +
B13*O_WTO + B14*O_NAFTA + B15*O_EU + B16*O_MERCOSUR +
B17*O_CARICOM + B18*O_CACM + B19*O_ANDEAN + B20*O_ASEAN +
B21*O_SPARTECA + B22*O_PATCRA + B23*O_COMESA +B24*O_SAFTA +
```

```
B25*O_GAFTA + B26*D_WTO + B27*D_NAFTA + B28*D_EU +
B29*D_MERCOSUR + B30*D_CARICOM + B31*D_CACM + B32*D_ANDEAN +
B33*D_ASEAN +B34*D_SPARTECA + B35*D_PATCRA + B36*D_COMESA +
B37*D_SAFTA + B38*D_GAFTA +B39*WTO_O_D + B40*NAFTA_O_D +
B41*EU_O_D + B42*MERCOSUR_O_D + B43*CARICOM_O_D +
B44*CACM_O_D + B45*ANDEAN_O_D + B46*ASEAN_O_D +
B47*SPARTECA_O_D + B48*PATCRA_O_D + B49*COMESA_O_D
+B50*SAFTA_O_D + B51*GAFTA_O_D;
fit LnINDTrade/HCCME=1;
Restrict B13+B26;
Run;
```

APPENDIX B

SAS INPUT FILES FOR COLLINEARITY TESTING

```
Proc Import Out=work.trade2
Datafile="C:\Documents and Settings\Student\My Documents\IND_data(2).xls"
DBMS=Excel Replace;
Run;

Proc Means;

Proc Corr;

Proc model data=trade2;
Parms B0 B1 B2;
LNINDTRADE=B0 + B1*O_GDPCapita + B2*D_GDPCapita;
fit LnINDTrade/HCCME=0;
Run;

Proc model data=trade2;
Parms B0 B1 B2 B3 B4;
LNINDTRADE=B0 + B1*O_GDPCapita + B2*D_GDPCapita + B3*O_Factor +
B4*D_Factor;
fit LnINDTrade/HCCME=0;
Run;

Proc model data=trade2;
Parms B0 B1 B2 B3 B4 B5 B6;
LNINDTRADE=B0 + B1*O_GDPCapita + B2*D_GDPCapita + B3*O_Factor +
B4*D_Factor +B5*O_FDI + B6*D_FDI;
fit LnINDTrade/HCCME=0;
Run;

Proc model data=trade2;
Parms B0 B1 B2 B3 B4 B5 B6;
LNINDTRADE=B0 + B1*O_GDPCapita + B2*D_GDPCapita + B3*O_Factor +
B4*D_Factor + B5*O_POP + B6*D_POP;
fit LnINDTrade/HCCME=0;

Proc model data=trade2;
Parms B0 B1 B2;
LNINDTRADE=B0 + B1*O_TOTGDP + B2*D_TOTGDP;
fit LnINDTrade/HCCME=0;
Run;
```

```
Proc model data=trade2;
Parms B0 B1 B2 B3 B4;
LNINDTRADE=B0 + B1*O_TOTGDP + B2*D_TOTGDP + B3*O_Factor +
B4*D_Factor;
fit LnINDTrade/HCCME=0;
Run;

Proc model data=trade2;
Parms B0 B1 B2 B3 B4 B5 B6;
LNINDTRADE=B0 + B1*O_TOTGDP + B2*D_TOTGDP + B3*O_Factor +
B4*D_Factor + B5*O_FDI + B6*D_FDI;
fit LnINDTrade/HCCME=0;
Run;

Proc model data=trade2;
Parms B0 B1 B2;
LNINDTRADE=B0 + B1*O_TOTGDP + B2*D_TOTGDP;
fit LnINDTrade/HCCME=0;
Run;

Proc model data=trade2;
Parms B0 B1 B2 B3 B4;
LNINDTRADE=B0 + B1*O_TOTGDP + B2*D_TOTGDP + B3*O_POP +
B4*D_POP;
fit LnINDTrade/HCCME=0;
Run;

Proc model data=trade2;
Parms B0 B1 B2 B3 B4 B5 B6;
LNINDTRADE=B0 + B1*O_TOTGDP + B2*D_TOTGDP + B3*O_POP +
B4*D_POP + B5*O_FACTOR + B6*D_Factor;
fit LnINDTrade/HCCME=0;
Run;

Proc model data=trade2;
Parms B0 B1 B2 B3 B4 B5 B6 B7 B8;
LNINDTRADE=B0 + B1*O_TOTGDP + B2*D_TOTGDP + B3*O_POP +
B4*D_POP + B5*O_FACTOR + B6*D_Factor + B7*O_FDI + B8*D_FDI;
fit LnINDTrade/HCCME=0;
Run;

Proc model data=trade2;
Parms B0 B1 B2;
LNINDTRADE=B0 + B1*O_GDPCapita + B2*D_GDPCapita;
fit LnINDTrade/HCCME=0;
```

```
Run;

Proc model data=trade2;
Parms B0 B1 B2 B3 B4;
LNINDTRADE=B0 + B1*O_GDPCapita + B2*D_GDPCapita + B3*O_POP +
B4*D_POP;
fit LnINDTrade/HCCME=0;
Run;

Proc model data=trade2;
Parms B0 B1 B2 B3 B4 B5 B6;
LNINDTRADE=B0 + B1*O_GDPCapita + B2*D_GDPCapita + B3*O_POP +
B4*D_POP + B5*O_Factor + B6*D_Factor;
fit LnINDTrade/HCCME=0;
Run;

Proc model data=trade2;
Parms B0 B1 B2 B3 B4 B5 B6 B7 B8;
LNINDTRADE=B0 + B1*O_GDPCapita + B2*D_GDPCapita + B3*O_POP +
B4*D_POP + B5*O_Factor + B6*D_Factor + B7*O_FDI + B8*D_FDI;
fit LnINDTrade/HCCME=0;
Run;

Proc model data=trade2;
Parms B0 B1 B2;
LNINDTRADE=B0 + B1*O_GDPCapita + B2*D_GDPCapita;
fit LnINDTrade/HCCME=0;
Run;

Proc model data=trade2;
Parms B0 B1 B2 B3 B4;
LNINDTRADE=B0 + B1*O_GDPCapita + B2*D_GDPCapita + B3*O_POP +
B4*D_POP;
fit LnINDTrade/HCCME=0;
Run;

Proc model data=trade2;
Parms B0 B1 B2 B3 B4 B5 B6;
LNINDTRADE=B0 + B1*O_GDPCapita + B2*D_GDPCapita + B3*O_POP +
B4*D_POP + B5*O_land + B6*D_Land;
fit LnINDTrade/HCCME=0;
Run;

Proc model data=trade2;
Parms B0 B1 B2 B3 B4 B5 B6 B7 B8 B9 B10;
```

```
LNINDTRADE=B0 + B1*O_GDPCapita + B2*D_GDPCapita + B3*O_POP +
B4*D_POP + B5*O_land + B6*D_Land + B7*O_AgLabor + B8*D_AgLabor +
B9*O_FDI + B10*D_FDI;
fit LnINDTrade/HCCME=0;
Run;

Proc model data=trade2;
Parms B0 B1 B2 B3 B4 B5 B6;
LNINDTRADE=B0 + B1*O_GDPCapita + B2*D_GDPCapita + B3*O_POP +
B4*D_POP + B5*O_Factor + B6*D_Factor/ tol vif collin;
Run;
fit LnINDTrade/HCCME=0;
Run;

Proc reg data=trade2;
Model LNINDTRADE = O_GDPCapita D_GDPCapita O_POP D_POP O_Factor
D_Factor/tol vif collin;
Run;

Proc reg data=trade2;
Model LNINDTRADE = O_GDPCapita D_GDPCapita O_POP D_POP O_Factor
D_Factor O_FDI D_FDI/tol vif collin;
Run;
```