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## Potential Impact Of Tpp Trade Agreement On U.S. Bilateral Agricultural Trade: Trade Creation Or Trade Diversion?

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Potential Impact of TPP Trade Agreement on U.S. Bilateral Agricultural Trade: Trade Creation  
or Trade Diversion?

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North Carolina A&T State University

A Thesis submitted to the graduate faculty  
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

Department: Agribusiness, Applied Economics and Agriscience Education  
Major: Agricultural and Environmental Systems (Agribusiness and Food Industry Management)

Major Professor: Dr. Osei Agyeman Yeboah

Greensboro, North Carolina

2015

The Graduate School  
North Carolina Agricultural and Technical State University

This is to certify that the Master's Thesis of

Afia Fosua Agyekum

has met the thesis requirements of  
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Greensboro, North Carolina  
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2015

## Biographical Sketch

Afia Fosua Agyekum earned her Bachelor of Agriculture (agricultural economics) degree from University of Ghana in 2010 and also received her Master of Philosophy degree in agricultural economics in 2013 from the same university. In 2013, she joined the Master of Science program in Agribusiness and Food Industry Management at North Carolina Agricultural and Technical State University (NCATSU) at North Carolina, U.S.

While pursuing her M.S. degree at NCATSU, Ms. Agyekum worked as a graduate research assistant at the Department of Agribusiness, Applied Economics and Agriscience Education from 2013 to 2015, conducting several research work including data collection, analysis and report writing. In addition, she also worked as an intern with USAID FEWS NET, conducting research work in the field of global food security.

Ms. Agyekum has presented papers at three academic conferences; Appalachian Energy Summit Mid-Year Meeting, 2014, Southern Association of Agricultural Scientists Conference, 2014 and Southern Association of Agricultural Scientists Conference, 2015. In addition, she has published her research paper in the Journal of Business and Economics.

Ms. Agyekum's field of interest is in the area of international trade which is why her M.S. thesis evaluated the potential impact of TPP trade agreement on U.S. bilateral agricultural trade. After graduation, Ms. Agyekum intends to pursue her PhD Agricultural Economics (concentration in international trade) where she hopes to carry her research study further by assessing the role free trade agreements play in eradicating global poverty.

## Dedication

This work is dedicated to Almighty God for how far he has brought me.

## Acknowledgments

My sincere gratitude goes first to the Almighty God for his protection and guidance all through life and for how far he has brought me. My appreciation again goes to my advisor, Dr Osei Agyeman Yeboah for critically examining my scripts and for his constructive suggestions and corrections. Next, I want to express my sincere thanks to my committee members, Drs. Saleem Shaik and Paula E. Faulkner, for their insightful contributions and support during the process.

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May the good Lord richly bless you all and replenish you in thousand fold.

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## Abstract

The Trans-Pacific Partnership (TPP) trade agreement is a trade agreement the U.S. is negotiating with 11 other countries in the Asia-Pacific region—namely Australia, Brunei Darussalam, Canada, Chile, Japan, Malaysia, Mexico, New Zealand, Peru, Singapore, and Vietnam—to reduce or eliminate tariffs on U.S. products exported to the TPP countries. With TPP, the U.S. expects to expand its trade with members of the TPP partnership; resulting in growth in gross domestic product (GDP). However, there are enormous concerns related to the potential negative impact TPP will have on U.S. agricultural trade. This research study therefore examined the potential effect of the TPP agreement on U.S. agricultural trade using panel vector autoregressive model (VAR) and impulse response function (IRF). A system of three VAR equations was developed for the three endogenous variables: agricultural trade, real exchange rate, and price ratio of imports to exports. In addition, the future pattern of trade was determined using the IRF. Results from the data analysis showed that U.S. is a net exporter of agricultural products to all TPP member countries with Japan, Mexico and Canada as U.S. main agricultural trading partners. The coefficients of the lagged agricultural trade volumes were significant in all three models, implying that current trade patterns are influenced by past volumes of trade. Also, the coefficient of the two year lagged price ratios was found to negatively influence current agricultural trade volumes as expected. Overall, the study found that a unit shock in price ratios as a result of the TPP trade agreement leads to a trade creation for U.S. in the shortrun but in the longrun leads to more trade diversion than trade creation.

## **CHAPTER 1**

### **Introduction**

#### **1.1 Background**

The globalization of the world economy has been rapid since World War II ended and which most of the occurrence was due to the drastic change in regionalism and trade agreements (Schott, 2003). Collectively, regionalism and trade agreement have linked many developing countries to developed countries and caused trade to spread beyond local neighbors to involve partners across the continents (Schott, 2003). One of the earliest developments of trade agreements was the regionalism in Western Europe; which manifested in the creation of the European Economic Community (EEC) in 1958 with similar moves occurring in Central and South America (Urata, 2002). According to Urata (2002), one factor that played a central role in the move towards regionalism is free trade agreements (FTAs). This makes FTA major factors of growth for the world economy.

The United States of America (U.S.) is party to many FTAs worldwide. According to Cooper (2014), FTAs can contribute to the growth of U.S. and world economies by helping to: 1 secure open markets for U.S. exports, 2 protect U.S. domestic producers from foreign unfair trade practices and from rapid surges in fairly traded imports, 3 for foreign policy and national security reasons and 4 to help foster global trade to promote world economic growth. Currently, the U.S. has 14 FTAs in force with 20 countries in the world (Cooper, 2014), notably among them are the North American Free Trade Agreement (NAFTA) and the Dominican Republic-Central America-United States Free Trade Agreement (DR-CAFTA), with several more FTAs under negotiations for consideration. One of the largest trade agreements under negotiations is the Trans-Pacific Partnership (TPP) trade agreement.

The Trans-Pacific Partnership (TPP) trade agreement is a 21<sup>st</sup> century trade agreement that U.S. is negotiating with 11 other countries throughout the Asia-Pacific region (Australia, Brunei Darussalam, Canada, Chile, Japan, Malaysia, Mexico, New Zealand, Peru, Singapore, and Vietnam). The TPP trade agreement is expected to be the largest U.S. FTA by trade value (Williams, 2013). The main purpose of the U.S. joining the TPP agreement is to eliminate tariffs and commercially-meaningful market access for U.S. products exported to TPP countries, and to make a provision to address long-standing non-tariff barriers, including import licensing requirements and other restrictions (Williams, 2013). By achieving these objectives, the U.S. expects to expand in volume and value its trade with members of the partnership; resulting in growth in its gross domestic product (GDP). The expected growth in GDP is mainly due to the fact that the U.S. is the largest TPP market in terms of both GDP and population. In 2012, TPP partners, excluding the U.S., collectively had a GDP of \$11.9 trillion, just over 75% of the U.S. level, and a population of 478 million, which is approximately 50% larger than the U.S. population. Japan's (population of 128 million and GDP of \$6 trillion), inclusion in the TPP agreement increases the significance of the agreement on both GDP and Population metrics (Williams, 2013). In addition, the Asia-Pacific region is home to 40% of the world's population, producing nearly 60% of global GDP, and is one of the fastest growing economies in the world. Including Canada, Mexico and Japan, TPP negotiating partners made up 40% of U.S. goods trade in 2012, and the Asia-Pacific economies as a whole made up over 62% (Williams, 2013).

While some of the TPP partners (Australia, Canada, Chile, Mexico, Peru, and Singapore) already have FTA with U.S. which collectively accounts for over 80% of U.S. goods traded, Japan, Brunei, Malaysia, New Zealand, and Vietnam do not have an existing free trade agreement with the U.S., although Japan is the U.S.'s fourth-largest agricultural export market.

However, with TPP, the U.S. plans to expand its market access for goods, services, and agriculture with countries it currently does not have FTAs. Though Japan protects its sensitive commodities (dairy, pork and beef) with very high tariffs and restrictive quotas, the U.S. expects to increase its agricultural exports (particularly dairy products) to Japan after the implementation of TPP due to reduced or eliminated tariff. According to Fergusson, Cooper, Jurenas and Williams (2013), Japan is viewed by U.S. as the most promising market for the U.S. agricultural exports. In addition, Malaysia and Vietnam, due to their expanding populations and growing incomes, are expected to fuel demand for consumer-ready U.S. food products. U.S. cotton is also expected to experience higher demand from Vietnam for its textile sector (Fergusson et al., 2013). Additionally, with Canada and Mexico's participation in TPP agreement, the U.S. plans to improve the access of its dairy and poultry products to the restricted Canadian market and address ongoing non-tariff barriers that arise when shipping agricultural commodities to Mexico.

## **1.2 Problem Statement**

The U.S. is a member of several FTAs which have been successful in achieving its intended effects although some have not been as successful as expected, especially in the U.S. agricultural sector. In the mid-1990s, the U.S. agreed to the North American Free Trade Agreement (NAFTA) because U.S. farmers and ranchers were promised a new path to economic success through increased exports. However, after over a decade of trade under NAFTA, the total volume of U.S. food exports in 2013 was approximately 0.5% higher than in 1995, the year that the World Trade Organization (WTO) took effect (Foreign Agricultural Service (FAS), 2014). In contrast, food imports for U.S. in 2013 towered 115 percent above the 1995 level (FAS, 2014). Despite an increase in trade flows under NAFTA, food imports into the U.S. outpaced U.S. exports. This accounts for U.S. becoming a net food imported with a food trade

deficit of nearly \$370 million in 2005 (FAS, 2014). Also, high international prices due to inflation cause U.S. food value to increase although U.S. food volumes exported fairly remained stable. For example, in 2013, the international food price index of FAO was 86% above the median price level in 2004 (Food and Agricultural Organization (FAO), 2014). While this high price pushed the value of U.S. food exports 98% above the 2004 level, the volume of U.S. food exports remained at 8% above the 2004 level (FAS, 2014). Similarly, U.S. meat exports (beef, pork and poultry) declined by \$215 million, representing 9% under U.S.-Korea FTA, against the expected “booming” impact prior to the signing of the agreement with U.S. pork exports declining by 39% (\$171 million) in the first two years of U.S.-Korea FTA implementation, compared to the year before the FTA started (FAS, 2014).

Susanto, Rosson and Adcock, (2007) argued that generally, FTAs result in some amount of both trade creation and trade diversion; with the net effect as the overall effect of the FTA. Whether, the FTA leads to either creating more trade or diverting more trade depends on the characteristics of the partner countries, the goods to be traded, the nature of the agreement and the terms of trade from the rest of the world. Therefore, it is essential to evaluate carefully, the possible impact of a FTA before it is signed. According to Miljkovic and Rodney (2003), agriculture is one of the sectors in which there is considerable concern about the potential effects of FTAs on domestic producers and consumers.

Although the TPP may reduce tariffs for U.S. agricultural exports and expand U.S. market share, there are still enormous concerns with regards to the potential TPP’s negative impact on U.S. agricultural exports. For instance, there are concerns about the competition that New Zealand’s dairy sector will pose in the U.S. market as well as other TPP country’s markets; affecting both U.S. domestic and international dairy trade. Also, the U.S. sugar production sector



is threatened by possible imports of sugar from other TPP countries, particularly Australia. One key issue under negotiation is Australia's objective, supported by New Zealand, to secure disciplines on other TPP countries' use of export subsidies, official export credits, and food aid in support of their agricultural sectors. According to Inside U.S. Trade (2012), the acceptance of this objective will provide a competitive edge to agricultural exporters in Australia and New Zealand against U.S. agricultural market. These issues raise concerns about the possible impact of TPP on U.S. agricultural exports and the need for quantitative analyses to predict the possible impact of TPP on U.S. agricultural exports.

### **1.3 Objectives**

The main objective of this study is to examine the effects of impending TPP trade agreement on U.S. bilateral agricultural trade with TPP member countries employing panel vector autoregressive model (VAR) and the impulse response function. The specific objectives are:

1. To describe the trends in U.S. agricultural trade, export and import volumes with each TPP member country from 1980 -2013.
2. To econometrically determine the extent of trade creation and trade diversion associated with TPP using VAR model and IRF.

### **1.4 Justification**

This study provides information on the potential welfare effects of TPP trade agreement on U.S bilateral agricultural trade with all TPP member countries. This information is relevant because it provides a clear and exact representation of the potential effects of TPP agreement before the implementation of the agreement, which is necessary in deciding the overall negotiation positions of the countries involved. It also allows for a pre-implementation cost-

benefit analysis to justify the need to be in the trade agreement. Also, this information is helpful in identifying what each country can and cannot provide to other countries in the TPP agreement especially during the negotiations stage. With this information, the U.S. government and policy makers will be able to make informed decisions on the terms of trade to negotiate with the TPP member countries so that U.S. can obtain its maximum benefit from the trade agreement. Also, information generated from the trend analysis of U.S. agricultural trade after TPP will guide U.S. producers; importers and exporters; retailers; and the final consumer in their production, business, and consumption decisions, respectfully, when TPP takes full effect so that they can maximize their gains. Lastly, information from the trend analysis of U.S. trade volumes before the implementation of TPP and the trend after TPP implementation will be beneficial to all TPP member countries as they negotiate for the TPP agreement, especially, countries that do not currently have FTAs with U.S.

### **1.5 Organization of Study**

This study is organized into Five Chapters. Chapter Two presents a detailed review of the TPP agreement, U.S. agricultural trade and empirical studies on trade agreements. The theoretical framework, method of analysis for each objective and a description of the data are presented in Chapter Three. The results of the analysis and its discussion are presented in Chapter Four while Chapter Five presents the summary, conclusions and policy recommendations of the study.

## CHAPTER 2

### Literature Review

#### 2.1 Introduction

This chapter discusses reviewed literature on key concepts related to the study. It begins with a discussion on preferential trade agreements, reviews of U.S. FTAs, and detailed discussion on U.S.-TPP trade agreement. Next, U.S. agricultural trade commodities as well as the trend in U.S. agricultural trade volumes over the last five years are discussed and the main trading countries identified. This is followed by a discussion on methodologies employed to evaluate the impact of FTAs with more emphasis on vector autoregressive (VAR) model and impulse response functions (IRFs). Literature is also reviewed on empirical studies on FTAs. This chapter ends with the conclusion section which is a summary of the literature reviewed.

#### 2.2 Background to Preferential Trade Agreements

Preferential trade arrangements are trade arrangements under which member countries grant one another preferential treatment in trade and may include (a) free trade agreements (FTAs), which allow individual countries to maintain their own tariff against outside countries (like NAFTA), (b) customs unions where member countries adopt a common external tariff, (c) common markets which expands on customs union to include elimination of barriers to labor and capital flows across national borders within the market and (d) economic unions where members merge their economies by establishing a common currency (Cooper 2014; Jad and Alban,2004 ). Cooper (2014) defines FTAs as arrangements among two or more countries to reduce or eliminate tariffs and nontariff barriers on trade in goods among themselves while each member country maintains its own policies, including tariffs, on trade outside the agreement region. Broadly, there are two types of FTAs; bilateral trade agreement, between two parties, and

multilateral trade agreement, among more than two parties. The process of forming FTAs begins with discussions between trading partners to determine the feasibility of forming the FTA. Once the countries agree, negotiations on what the terms of trade will be are undertaken. Generally, these negotiations cover areas such as tariff elimination, rules of origin, procedures to settle disputes that may arise among member countries, rules on implementation of border controls, sanctions and the duration of the agreement. A FTA may not cover all these areas but at the minimum, it will cover tariff elimination and the duration of the agreement.

According to Whalley (1998), the main reason why countries form FTAs is the idea that through reciprocal exchanges of concessions on trade barriers there will be improvements in market access from which all parties to the negotiation will benefit. In reality however, research has shown that gains may not always accrue to countries forming FTAs since trade may also be diverted to higher-cost suppliers within the integrating partners (Viner 1950); that is, trade-diversion losses may outweigh trade-creating gains. Despite this, a country may enter into a FTA based on some other economic factors such as strengthening domestic policy reform, increased multilateral bargaining power, guarantees of market access especially in the case of large-small nation trade, and strategic linkage for security purposes ( Whalley,1998).

### **2.3 Review of U.S. Free Trade Agreements**

FTAs became a major trade policy issue in U.S. after World War II. This was mainly due to U.S. desire to secure open markets for U.S. exports, to protect domestic producers from foreign unfair trade practices and from rapid surges in fairly traded imports, to control trade for foreign policy and national security reasons and lastly, to help foster global trade to promote world economic growth (Cooper 2014). The U.S. was a major player in the development and signing of the General Agreement on Tariffs and Trade (GATT) in 1947 (Cooper 2014). In

addition, U.S. was a leader in nine rounds of negotiations that expanded the coverage of GATT and led to the establishment of the World Trade Organization (WTO) in 1995, the body that administers the GATT and other multilateral trade agreements (Cooper 2014).

Currently, the U.S. has free trade agreements in force with 20 countries namely, Australia, Bahrain, Canada, Chile, Colombia, Costa Rica, Dominican Republic, El Salvador, Guatemala, Honduras, Israel, Jordan, Korea, Mexico, Nicaragua, Oman, Panama, Peru, and Singapore. Of these, U.S. has two multilateral trade agreements; one with Mexico and Canada in the North American Free Trade Agreement (NAFTA), which entered into force in January 1994, and the U.S.-Dominican Republic-Central American Free Trade Agreement (DR-CAFTA) among El Salvador, Honduras, Nicaragua, Guatemala, Dominican Republic, and Costa Rica. In addition to these, the U.S. is in negotiations of a regional, Asia-Pacific trade agreement, known as the Trans-Pacific Partnership (TPP) Agreement and the Transatlantic Trade and Investment Partnership (TTIP).

#### **2.4 U.S.-TPP Trade Agreement**

The Trans-Pacific Partnership (TPP) is an ambitious 21<sup>st</sup> century trade and investment agreement that the U.S. is negotiating with 11 other countries throughout the Asia-Pacific region. These countries are Australia, Brunei Darussalam, Canada, Chile, Japan, Malaysia, Mexico, New Zealand, Peru, Singapore and Vietnam. The TPP originally began as an agreement between four small states: Brunei, Chile, New Zealand and Singapore in 2006 and was referred to as the Trans-Pacific Strategic Economic Partnership (P4), but received little attention until 2008 when the U.S. announced its interest in joining the agreement (Elms, 2013). Immediately after the expression of interest by U.S., Australia, Peru and Vietnam also joined. Then the name was changed to trans-pacific partnership and the first TPP negotiation held in Australia in March

2010. Malaysia joined later in 2010. In 2012, Canada and Mexico entered the partnership and in July 2013, Japan also joined the TPP negotiations becoming the 12 participant (Elms, 2013). The leaders of TPP member countries aspire to achieve a high-quality, “21st century” agreement that serves as a model for addressing both traditional and emerging trade issues (Burfisher et al., 2014). This goal has been translated into five defining features of the agreement (U.S. Trade Representative (USTR), 2011); 1 TPP is intended to be a living agreement that can be updated as appropriate to address emerging trade issues or to include new members, 2 TPP’s provision for a comprehensive market-access reform is expected to eliminate or reduce tariffs and other barriers to trade and investment, 3 TPP is expected to support the development of integrated production and supply chains among its members, 4 TPP is expected to address cross-cutting issues, including regulatory coherence, competitiveness and business facilitation, support for small- and medium-sized enterprises, and the strengthening of institutions important to economic development and governance, and 5 to promote trade and investment in innovative products and services.

Broadly, the objective of U.S. for participating in TPP is to eliminate tariffs and commercially-meaningful market access for U.S. products exported to TPP countries; and to address longstanding non-tariff barriers, including import licensing requirements and other restrictions (Burfisher et al., 2014). Agriculture is addressed in multiple chapters of the agreement. The reduction or elimination of tariffs and nontariff barriers among the TPP members, including barriers to agricultural trade are discussed under the market-access chapter. In addition, the TPP agreement addresses issues of food security, agricultural export competition, customs regulations, the environment, and intellectual property rights, rules of origin, sanitary and phyto-sanitary (SPS) standards, and technical barriers to trade (Burfisher et al., 2014).

Negotiations on these issues and agricultural tariff reduction schedules are currently underway with no decisive conclusions yet.

## **2.5 U.S. Agricultural trade**

Over the last decade, U.S. agricultural exports and imports have experience periods of expansion and periods of contraction with changes in the mix of agricultural commodities traded as well as the trading countries. U.S agricultural exports have exceeded U.S. agricultural imports since 1960, generating a surplus in U.S. agricultural trade (U.S. Department of Agriculture Economic Research Service (USDA-ERS), 2015). In 2014, U.S. agricultural exports were valued at \$14 billion, agricultural imports at \$10 billion with a trade balance of \$4 billion (USDA-ERS, 2015).

### **2.5.1 Exports**

The total volume of U.S. agricultural exports in 2014 was about 237 million metric tons. U.S. agricultural export volumes increased by 12.5% in 2010 from about 191 million metric tons in 2009 and declined steadily until 2014 (USDA-ERS, 2015). Table 1 presents U.S agricultural export volumes from 2009 to 2014. U.S agricultural exports are categorized into twelve food groups namely grains and feeds, oilseeds products, forest products, horticultural products, livestock and meat products, poultry products, sugar and tropical products, dairy products, cotton, lintens and waste, fishery products, planting seeds, and tobacco products. Of these, the top five commodity groups exported are grains and feeds (include commodities such as wheat, rice, baileys, oats, sorghum and corn) , oilseeds products (include peanuts, soybeans, cottonseed, coconut oil, palm oil, cotton seed cake and meal, peanut butter), forest products (such as softwood logs, hardwood logs, poles, plywood, lumber, railroad ties), horticultural products (examples: fruits, vegetables, tree nuts, wine and wine products, cut flowers, essential oils) and

livestock and meat products (including beef and beef products, pork and pork products, lamb/mutton products, wool, leather, cattle hide).

Table 1

*U.S. Agricultural Export Volumes from 2009 to 2014*

Product	2009	2010	2011	2012	2013	2014
	(Million Mt)					
Grains and Feeds	93.4	107.4	105.2	82.1	84.3	113.8
Oilseeds Products	56.1	59.3	48.9	59.7	56.5	66.9
Forest Products	16.2	20.0	23.0	21.9	25.0	24.6
Horticultural Products	10.4	11.1	11.6	12.1	12.4	12.6
Livestock Meats	4.9	5.4	5.9	5.5	5.3	5.3
Poultry Products	3.9	3.7	4.0	4.2	4.2	4.2
Sugar and Tropical Products	2.1	3.3	3.6	3.7	3.4	3.4
Dairy Products	1.2	1.6	1.7	1.8	2.1	2.2
Cotton, Linters and Waste	1.4	1.9	2.1	1.8	1.9	1.9
Fishery Products	1.2	1.3	1.5	1.5	1.5	1.5
Planting Seeds	0.4	0.4	0.5	0.5	0.6	0.6
Tobacco Products	0.1	0.2	0.2	0.2	0.2	0.2
Total	191.5	215.5	208.2	194.9	197.4	237.2

Source: U.S. Census Bureau Trade Data, 2015.

The top five destination countries for U.S. agricultural exports are China, Mexico, Japan, Canada and South Korea; collectively accounting for 27.4% of total volume of U.S. agricultural exports from 2009 to 2014 (USDA-ERS, 2015). Among these, U.S. has no trade agreements with



Japan and China, and a free trade agreement involving one or both countries will be very promising to U.S. agricultural exports and economic growth.

### **2.5.2 Import**

U.S. agricultural imports increased gradually from 2009 to a maximum of 112,587,796.40 Mt in 2014 increasing by 42.7 % over the period. U.S. agricultural imports are categorized into five commodity groups namely forest products ( includes logs and chips, hardwood lumber, softwood and treated lumber), consumer oriented products (such as snack food, red meat, cheese, fresh, processed fruits and vegetable, wine, beer, spices), bulk total (wheat, rice, coarse grain, cocoa beans, tea, cane sugar), intermediate total (tropical oils, vegetable oil, animal hides and skin, sweetener, cocoa butter) and seafood products (tuna, lobster, fillets, salmon). Table 2 presents U.S. import volumes for each commodity group from 2009 to 2014. Forest and consumer oriented products formed the bulk of U.S. agricultural imports from 2009 to 2014.

Canada, Mexico, Guatemala, Costa Rica and Brazil are U.S. top five countries for agricultural imports in terms of import volumes although U.S. has no trade agreements with Guatemala, Costa Rica and Brazil. With FTA, tariffs on U.S. imports from these countries will be minimized, resulting in cheaper imports.

Table 2

*U.S. Agricultural Import Volumes from 2009 to 2014*

Product	2009	2010	2011	2012	2013	2014
	Million Mt					
Forest Products	30.8	33.1	35.9	36.4	41.4	48.1
Consumer-Oriented	23.9	25.5	26.2	27.0	28.8	30.0
Bulk Total	11.9	11.9	12.6	14.2	16.6	16.3
Intermediate Total	10.1	10.6	13.3	14.0	15.0	15.7
Seafood Products	2.3	2.4	2.4	2.4	2.4	2.5
Grand Total	78.9	83.5	90.4	94.3	104.2	112.6

Source: U.S. Census Bureau Trade Data, 2015

## 2.6 FTA-Impact Assessment

Plummer, Cheong and Hamanaka (2010) defined impact as the positives, negatives, primary and secondary long-term effects of an intervention, policy or project either directly, indirectly, intended or unintended. In FTA, impact is viewed as the consequence of a trade agreement on the status of selected indicators such as domestic and international prices, trade volumes, consumption, production, GDP, exchange rates, terms of trade, etc. According to Plummer et al. (2010), there is increasing recognition that policies such as FTAs result in a complex, multiple effects. Similarly, Lipsey (1970); Panagariya (2000) and Viner (1950), also stated that in theory, the net welfare effect of a FTA is ambiguous, thus assessing the impact of FTAs requires broad range of methods for effective evaluation. Generally the impact of FTAs can be conducted ex-ante and ex-post.

### **2.6.1 Ex ante evaluation**

According to U.S. International Trade Commission (USTC) (2003), ex ante evaluations are conducted prior to an agreement, as an attempt to contribute to the debate about whether to enter into an agreement and how to formulate the agreement. They involve both qualitative and quantitative analysis. While qualitative analysis often seeks to describe the expected trend in key variables, quantitative analysis typically produce estimates of the change in economic welfare expected from the agreement. Common models used for ex-ante FTA evaluations are the Software for Market Analysis and Restrictions on Trade model (SMART) and the Global Trade Analysis Project (GTAP) model (Plummer at al., 2010; USTC, 2003). The SMART model is a partial equilibrium model used in assessing the trade, tariff revenue, and welfare effects of a FTA by focusing on the changes in imports of a particular sector (Plummer at al., 2010). This model assumes that commodities are differentiated by their country of origin, thus, for a particular commodity; imports from one country are imperfect substitute for imports from another country (Plummer at al., 2010). The SMART model uses panel data on several trade variables such as imports, exports and tariff rates. Advantages of the SMART model include its simplicity in use as well as its ability to allow the analysis to be performed at the most disaggregated level of data. However, the main limitation of the SMART model is that the SMART model is a partial equilibrium model, which means the results of the model are limited to the direct effects of a trade policy change only in one market (Plummer at al., 2010). Based on this, some studies prefer to use the GTAP model. The GTAP model is a computable general equilibrium model (CGE) which analyses the impact of FTAs on several sectors of an economy at the same time.

Broadly, the GTAP analysis is conducted in three steps. First, a benchmark period analysis is conducted to determine the equilibrium values of all variables in the model that

equates demand and supply in all markets. Afterwards, the values of all exogenous variables are changed to simulate policy changes in the correctly specified CGE-GTAP model, as expected by the FTA, thus yielding new equilibrium values. This new equilibrium is known as the counterfactual equilibrium. Lastly, the model compares the simulated changes between the benchmark and counterfactual equilibriums to make inferences about the potential effects and desirability of the FTA (Plummer et al., 2010). Although the GTAP model is preferable as it covers all sectors and variables affected by the FTA, it may become difficult to use when faced with lack of data as this may severely compromise the scope and relevance of the research (Plummer et al., 2010). In addition, the GTAP involves many parameters, which may be difficult to estimate and validate.

Aside these models, other indicators that can be used for ex-ante analysis include: intraregional trade share, which shows the relative importance of trade within the region compared to the total trade of all regional members and Intraregional trade intensity, defined as the intraregional trade share divided by the share of the region's total trade in world trade. Also, most ex ante research on impact of FTAs that aims at forecasting future trends employ forecasting models such as vector autoregressive model (VAR), vector error correction model (VEC) and Impulse response functions (IRF).

### **2.6.2 Vector autoregressive models (VAR)**

VAR models are suitable for describing the data generation process of a set of time series variables, thus a very powerful tool for data description and forecasting (Luetkepohl, Kraetzig and Phillips, 2004). VAR models solve the problem of endogeneity that exist among macro variables, and determine the relationship among multiple time series variables. All variables in VAR models are treated as endogenous. There are three types of VAR models namely: reduced

form VAR, recursive VAR and Structural VAR models (Stock and Watson, 2001). Reduced form VARs express each variables as a linear function of its own past values, the past values of all other variables under consideration and a serially uncorrelated error term (Stock and Watson, 2001). If the different variables in a reduced form VAR are correlated, then the errors will also be correlated across equations. According to Stock and Watson (2001), recursive VAR model construct the error terms in each regression equation to be uncorrelated with the error term in the proceeding equations by including contemporaneous values as regressors in the model. Structural VAR models use econometric theory to sort out the contemporaneous links between variables in the model. Structural VAR modeling begins with an explicit statement of the longrun relationship between the variables of the model based on theory. The longrun relationships are approximated by equations with disturbances that characterize the deviations of the longrun relations from the realized shortrun relations. These deviations are referred to as longrun structural shocks (Garratt, Lee, Pesaran and Shin, 1998). One advantage of structural VAR models is that it provides an explicit relationship between the estimated model residuals and the structural shocks of the underlying economic model (Garratt et al., 1998). This explicit relationship indicates the restrictions that are required for identification of the effects of specific innovations using the structural VAR model. However, according to Garratt et al. (1998), such restrictions are not available hence the need to rely on methods which does not depend on the use of identifying restrictions. One such common method is the impulse response analysis.

### **2.6.3 Impulse Response Function (IRF)**

The impulse response function introduced by Koup, Pesaran and Potter (1996) and developed by Pesaran and Shin (1998) describes the effect of a shock to a variable on all other variables in the system without giving economic interpretation to the shock. IRFs thus, describe

the time profile of the effect of a unit shock to a particular equation on all endogenous variables in the model. The dynamics that result from the shock includes the contemporaneous interactions of all the endogenous variables in the system. Once the structural VAR model is estimated, the shortrun and longrun dynamic properties of the endogenous variables can be predicted using IRFs. To ensure that the shocks traced by the IRFs are uncorrected, Ronayne (2011) emphasized orthogonalizing the VAR's shocks. The IRF dynamics helps to answer questions on the extent to which policy changes may affect outcome variables. Therefore, this study uses the VAR model and IRF to analyse the possible response of U.S. bilateral agricultural trade to the TPP trade agreement.

#### **2.6.4 Ex post evaluation**

Ex post evaluation of FTAs seeks to determine whether or not an implemented agreement has achieved its expected economic impact by utilizing data from the post-agreement period (USTC, 2003). Such studies are important in drawing up further necessary adjustment policies for the affected sectors and exploiting the benefits that are yet to fully materialize. According to USTC (2003), this kind of impact assessment is important when the negative effects of the FTA seem to be larger than the positive effects. Ex post studies rely on a variety of econometric techniques and the use of historical data. One major econometric model for ex-post evaluation of FTAs is the gravity model (Plummer et al., 2010). The basic gravity model relates the imports of a country positively to GDP but negatively to the geographical distance between the trading countries. According to Plummer et al. (2010), the main benefit of the gravity model in evaluating FTAs is that it controls for the effect of many trade determinants besides the FTA itself, therefore isolating the effects of the FTA on trade and other welfare variables. Aside the gravity model, other quantitative indicators for ex-post FTA evaluation include the change in

terms of trade indicator and the change in trade volumes indicator. Each model reviewed has its own advantages and disadvantages, thus, the choice of model to use depends on the ability of the model to explain explicitly, and predict more accurately, the values of the variables of interest while minimizing the error potential to very minimal levels.

## **2.7 Review of Empirical Studies**

Literature shows that much empirical work has been devoted toward evaluating trade and welfare effects of FTAs. Such Studies include works by Casario (1996), Gauto (2012), Kandogan (2005), Kawasaki (2003), Kimberly (2001), Korinek and Melatos (2009), Kwentua (2006), Susanto et al. (2007), Zhu (2013) and Zhuang et al. (2007). Evidence of the economic effects of free trade agreements fall into two broad categories; (1) those that examine trade agreements explicitly and are normally categorized into ex-ante studies Casario (1996) and Kawasaki (2003) and ex-post studies (Kandogan, 2005; Kimberly, 2001; Kwentua, 2006; Susanto et al., 2007; Zhuang et al., 2007), (2) studies that examine the economic effects of increasing exposure to trade or increasingly liberalized trade policies, on one or more economic variables without reference to a particular agreement (Kandogan, 2005; Zhu, 2013). All studies on trade agreements used panel data although the variables considered vary based on the model. While most studies employed yearly data, (Kimberly 2001; Zhu 2013; Zhuang et al. 2007), a few studies used quarterly data Casario (1996). The common models used to assess the impact of FTAs are the gravity models and the general equilibrium models. These are often used in ex-post studies to determine, whether or not a FTA has had an economic impact after the signing of the agreement. Zhu (2013) measures the effect of free trade agreements on bilateral flows under different tariff scenarios using the gravity model. Similarly, Gauto (2012), Kandogan (2005) and Korinek and Melatos (2009) employed the gravity model to analysis the effect of different trade

agreements on different economic factors. Some studies that used the general equilibrium models to assess the implications of different trade agreements on different economic variables are Kwasaki (2003), (the impact of FTAs in Asia) and Zhuang et al. (2007), (impact of U.S.-Korea FTA on various sectors of the economies of the two countries). Kimberly (2001) and Susanto et al. (2007) employed a demand and supply framework model and import demand model, respectively, to identify the growth in trade after NAFTA with member and non-member countries. Kimberly's (2001) work focused on U.S.-Canada bilateral FTA while Susanto et al. (2007) considered U.S.-Mexico bilateral FTA. Few studies (Casario, 1996) also used the VAR model to predict potential trade patterns. Casario (1996) analyzed the potential impact of NAFTA on U.S.-Canada and U.S.-Mexico bilateral trade volumes. According to Casario (1996), the VAR model was used because of its ability to forecast future trends in trade under different tariff scenarios. Despite this, only few studies which forecast potential impact of a FTAs on trade uses the VAR/VEC model.

Findings from these studies suggest that most FTAs lead to substantial trade creation with no significant evidence of trade diversion among member countries (Gauto, 2012; Kimberly, 2001; Korinek and Melatos, 2009; Susanto et al., 2007; Zhu, 2013). Although most studies showed overall trade creation, it was obvious not all sectors in an economy gained from FTAs as Zhuang et al. (2007) found some sectors in both U.S. and Korea to have suffered great trade losses under the U.S.-Korea FTA. Casario (1996) also found an overall trade creation effect of NAFTA although a few sectors suffered trade diversion in each of the three countries. Kwentua (2006) showed participation in FTA induces huge trade volumes amongst both member and non-member countries, which was contrary to the findings of Korinek and Melatos (2009); which



showed that participation in FTAs did not result in any strong trade creation among non-member countries.

## **2.8 Conclusion**

A review of literature suggest that each FTA has different impact on the economy of the trading partners based on the type of goods being traded, the countries involved in the agreement and the terms of trade. While a country may experience an overall trade creation effect, some sectors of the country may suffer a great loss as a result of a FTA. This justifies the need to evaluate and forecast the potential impact of a FTA on each sector of the economy. This provides information needed to make better negotiations to protect the sectors that might suffer losses as a result of the trade agreement. With the agricultural sector being one of the key sectors in U.S. economy, this study seeks to predict the potential impact of U.S.-TPP trade agreement on U.S. agricultural trade using the VAR model as used by Casario (1996).

## **CHAPTER 3**

### **Methodology**

#### **3.1 Introduction**

The theoretical framework underpinning this study, empirical framework and the method of analysis for each objective are presented in this chapter. The main models discussed are the vector autoregressive model (VAR) and the impulse response function (IRF). In addition, the type of data employed in the study as well as the sources of the data is also presented in this chapter.

#### **3.2 Theoretical Framework**

International trade applies microeconomic models to help understand the international economy. Its purpose is to understand the effects of international trade, trade policies and other economic conditions on individuals, businesses and governments. This is achieved using supply and demand analysis of international markets, firm and consumer behavior analysis. Trade between two countries is generated by the interaction of consumers acquiring the taste for diversity of goods. A country's volume of trade is the sum of the country's imports and exports. Imports occur when there is excess demand while exports occur when there is excess supply. Excess demand refers to a situation where the domestic market demand for a commodity is greater than the domestic market supply of the commodity while excess supply is where the domestic market supply of a commodity exceeds the domestic market demand. To derive the excess demand and excess supply functions, the domestic demand and domestic supply functions must first be determined. Employing the consumer utility and firm's profit maximization theories, the domestic demand and supply of a commodity in a country are derived, respectively. This study assumes a bilateral trade between U.S. and the rest of TPP member countries to derive

the import demand and export supply functions. We assume two factors of production labor (L) and capital (K), each perfectly mobile within each country but immobile across countries.

### 3.2.1 Consumers

Assume U.S. produces agricultural good (A) using L and K and each country differ in terms of its relative factor abundance, tastes for variety and trade barriers (transportation costs and /or tariffs); the utility U.S. consumers derive from the consumption of good A in a given year (t) is given as:

$$\sum_{t=1}^T U_t = U\left(\sum_{t=1}^T A_t\right) \quad (1)$$

With the assumption that consumers spend all their income on good A, the budget constraint is given as

$$\sum_{t=1}^T B_t = \sum_{t=1}^T (P_t^A A_t) \quad (2)$$

Where

$B_t$  is the total budget U.S. consumers spend on good A in year t

$P_t^A$  is the price of good A in period t

T is the total number of years under consideration

From (1) and (2), the consumer optimization problem is given as

$$L = U\left(\sum_{t=1}^T A_t\right) + \lambda \left[ \sum_{t=1}^T B_t - \sum_{t=1}^T (P_t^A A_t) \right] \quad (3)$$

Taking derivative of L with respect to  $Y_i$  gives:

$$\frac{dL}{dA_t} = \frac{dU}{dA_t} - \lambda P_t^A \quad (4)$$

$$\frac{dL}{d\lambda} = \sum_{t=1}^T B_t - \sum_{t=1}^T (P_t^A A_t) \quad (5)$$

Solving equations (4) and (5) simultaneously gives the U.S. domestic demand for good A as

$$A_t = f(P_t^A, B_t) \quad (6)$$

Thus, the U.S. demand for agricultural good (A) is a function of the price of A and the budget of the U.S. consumers given by the U.S. GDP per capita.

### 3.2.2 Producers

Generally, producers and firms seek to maximize profits from their production activity.

Assuming that firms in U.S. produce good A at a fixed technological level, the production equation is given as

$$\sum_{t=1}^T A_t = f(K_t, L_t) \quad (7)$$

And the aggregate profit for U.S. producers ( $\pi^*$ ) given as

$$\sum_{t=1}^T \pi^* = \sum_{t=1}^T \{ [P_t^A A_t] - TC(A_t) \} \quad (8)$$

Applying envelope theorem and differentiating  $\pi^*$  with respect to  $P_t^A$  gives

$$\frac{d\pi^*}{dP_t^A} = A_t = f(P_t^A) \quad (9)$$

Where  $A_t$  is U.S. aggregate supply of agricultural goods at a fixed technological level and it is a function of the domestic price of agricultural goods.

Given that U.S. import demand for good A is given by the excess demand for good A in the U.S., the excess demand function for A is given as

Excess Demand = Domestic Demand – Domestic Supply

$$= A_t (P_t^A, B_t) - A_t (P_t^A)$$

$$ED(A_t) = A_t (P_t^A, B_t) \quad (10)$$

Where the excess demand (ED) function is the demand for U.S. imports

Similarly, U.S. supply of good A is given by the excess supply function as

Excess Supply = Domestic Supply – Domestic Demand

$$= A_t (P_t^A) - A_t (P_t^A, B_t)$$

$$ES(A_t) = A_t (P_t^A, B_t) \quad (11)$$

Where the excess supply (ES) function is U.S. export function

Thus, at a given technological level, the volume of U.S. agricultural trade which is the sum of U.S. export volume and import volume is given as

U.S. agricultural trade volume = U.S. agricultural export volume + U.S. agricultural import volume

$$= A_t (P_t^A, B_t) + A_t (P_t^A, B_t)$$

$$\text{Volume of agricultural trade } (A_t) = f(P_t^A, B_t) \quad (12)$$

If U.S. imposes a tariff ( $ta$ ) on its agricultural imports from other countries, then the volume of U.S. agricultural trade is given as

$$\text{Volume of Trade} = f(P_t^A, B_t, ta) \quad (13)$$

### 3.3 Empirical Model

This section discusses the Vector Auto-Regression model (VAR) and Impulse Response Functions (IRF) and how they are applied in this study.

#### 3.3.1 VAR model

Vector Auto-Regression (VAR) introduced by Chris Sims (1980), provides a flexible and tractable framework for analyzing economic time series data. In international trade, VAR models are used to examine the interaction of many international trade variables among trade agreement partners. They generalize the univariate auto-regression (AR) models by allowing for more than one evolving variable. The model uses prior information to guide the selection of variables to be used while theoretical restrictions such as exogeneity, are not imposed a priori (Casario, 1996). In addition, VAR models also allow complete flexibility in specifying the correlations between past, present and future realizations of the system variables, thus, facilitate flexible and dynamic analysis of trade flows.

VAR modeling does not require as much knowledge about the forces influencing a variable as do structural models with simultaneous equations (Garratt et al., 1998). The only prior knowledge required is a list of variables which can be hypothesized to affect each other inter-temporally (Garratt et al., 1998). The structural VAR model is used because it is derived from the theory of international trade, thus, has a theoretical basis. All variables in structural VAR models are treated symmetrically in a structural sense; each variable has an equation

explaining its evolution based on its own lags and the lags of other model variables. Empirically, a VAR model is given as

$$Z_t = \alpha + \beta Z_{t-i} + \gamma K_{t-i} + \varepsilon_t \quad (14)$$

Where Z= endogenous dependent variable,  $Z_{t-1}$  = lagged dependent variables, K= exogenous variables and their lags,  $\varepsilon_t$  = error term.

According to Bussière, Chudik, and Sestieri, (2009), the estimated VAR model can be used for different purposes such as the analysis of impulse responses for forecasting of variables.

### 3.3.2 IRF model

Impulse response functions (IRF) trace out the response of current and future values of a variable to a one-unit or one-standard deviation shock (increase or decrease) in the current value of the VAR errors. A problematic assumption with this type of impulse response analysis is that a shock occurs only in one variable at a time. According to Rossi (n.d), this assumption holds only if the shocks in different variables are independent otherwise the error terms will consist of influences and variables not directly included in the set of variables in the model. If in addition to this, the error terms are correlated, then it is possible that a shock in one variable is likely to be accompanied by a shock in another variable; in which case setting all other errors to zero may provide a misleading picture of the actual dynamic relationships between the variables (Rossi, .d).

To deal with this problem, Rossi (n.d) proposed using the Cholesky decomposition of the IRF model. This is because the Cholesky decomposition of the IRF assumes that a change in one variable has no effect on the other variables because the variables are orthogonal (uncorrelated) (Rossi, n.d). This way, the problem of assuming that the error terms return to zero is eliminated and the response of a variable to a unit shock or one standard deviation shock (forecast error) in

another variable can be estimated and depicted graphically to get a visual idea of the dynamic interrelationships within the system (Rossi, n.d).

### 3.4 Method of Analysis

Objective 1: Trend in U.S. agricultural trade, export and import volumes with each TPP member country from 1980 -2013.

The mean, minimum and maximum import, export and trade volumes with all TPP member countries over the period 1980-2013 are estimated. In addition, the trend in U.S. agricultural trade, export and import volumes with each TPP member country from 1980 to 2013 is described using a line graph and the main U.S. agricultural trading, exporting and importing partner countries among the TPP member countries identified.

Objective 2: To econometrically determine the extent of trade creation and trade diversion associated with TPP using VAR and IRF.

The structural VAR model is used to estimate the response of each endogenous variable to a one percentage change in its lags, the lags of other endogenous variables in the model and the lags of the exogenous variables in the model. Considering that trade between the U.S. and TPP countries involves different currencies aside the U.S. dollar, exchange rates are included in the basic model (equation 13) to cater for variation in currencies. Also, the relative price of U.S. agricultural imports to U.S. agricultural exports is used as a proxy for U.S. agricultural tariff on its imports. Therefore, equation (13) becomes

$$A = f(RP, B, Ex, Trend) \quad (15)$$

Where

A is U.S. agricultural trade volumes

RP is the relative price of U.S. agricultural imports to U.S. agricultural exports



B is the real GDP per capita

Ex is the real exchange rate between each TPP country and the U.S. dollar

With volume of U.S. agricultural trade, real exchange rate between each TPP country and U.S.

and relative price of U.S. imports to U.S export as endogenous variables and real GDP per capita

and time trend as exogenous variables, the VAR model is given as:

$$\begin{aligned}
 &Ln\left(\sum_{t=1}^T \sum_{j=1}^J A_t\right) = \\
 &\alpha_A + \beta_{1A}Ln\left(\sum_{t=1}^T \sum_{j=1}^J A_{t-1}\right) + \beta_{2A}Ln\left(\sum_{t=1}^T \sum_{j=1}^J A_{t-2}\right) + \beta_{1RP}Ln\left(\sum_{t=1}^T \sum_{j=1}^J RP_{t-1}\right) + \\
 &\beta_{2RP}Ln\left(\sum_{t=1}^T \sum_{j=1}^J RP_{t-2}\right) + \beta_{1Ex}Ln\left(\sum_{t=1}^T \sum_{j=1}^J Ex_{t-1}\right) + \beta_{2Ex}Ln\left(\sum_{t=1}^T \sum_{j=1}^J Ex_{t-2}\right) + \\
 &\beta_{GDP}Ln\left(\sum_{t=1}^T \sum_{j=1}^J B_{t-1}\right) + \beta_{Trend}Ln\left(\sum_{t=1}^T \sum_{j=1}^J Trend_{t-1}\right) + \sum_{t=1}^T \sum_{j=1}^J \varepsilon_t \quad (16)
 \end{aligned}$$

$$\begin{aligned}
 &Ln\left(\sum_{t=1}^T \sum_{j=1}^J RP_t\right) = \\
 &\alpha_A + \beta_{1A}Ln\left(\sum_{t=1}^T \sum_{j=1}^J A_{t-1}\right) + \beta_{2A}Ln\left(\sum_{t=1}^T \sum_{j=1}^J A_{t-2}\right) + \beta_{1RP}Ln\left(\sum_{t=1}^T \sum_{j=1}^J RP_{t-1}\right) + \\
 &\beta_{2RP}Ln\left(\sum_{t=1}^T \sum_{j=1}^J RP_{t-2}\right) + \beta_{1Ex}Ln\left(\sum_{t=1}^T \sum_{j=1}^J Ex_{t-1}\right) + \beta_{2Ex}Ln\left(\sum_{t=1}^T \sum_{j=1}^J Ex_{t-2}\right) + \\
 &\beta_{GDP}Ln\left(\sum_{t=1}^T \sum_{j=1}^J B_{t-1}\right) + \beta_{Trend}Ln\left(\sum_{t=1}^T \sum_{j=1}^J Trend_{t-1}\right) + \sum_{t=1}^T \sum_{j=1}^J \varepsilon_t \quad (17)
 \end{aligned}$$

$$\begin{aligned}
 &Ln\left(\sum_{t=1}^T \sum_{j=1}^J Ex_t\right) = \\
 &\alpha_A + \beta_{1A}Ln\left(\sum_{t=1}^T \sum_{j=1}^J A_{t-1}\right) + \beta_{2A}Ln\left(\sum_{t=1}^T \sum_{j=1}^J A_{t-2}\right) + \beta_{1RP}Ln\left(\sum_{t=1}^T \sum_{j=1}^J RP_{t-1}\right) + \\
 &\beta_{2RP}Ln\left(\sum_{t=1}^T \sum_{j=1}^J RP_{t-2}\right) + \beta_{1Ex}Ln\left(\sum_{t=1}^T \sum_{j=1}^J Ex_{t-1}\right) + \beta_{2Ex}Ln\left(\sum_{t=1}^T \sum_{j=1}^J Ex_{t-2}\right) + \\
 &\beta_{GDP}Ln\left(\sum_{t=1}^T \sum_{j=1}^J B_{t-1}\right) + \beta_{Trend}Ln\left(\sum_{t=1}^T \sum_{j=1}^J Trend_{t-1}\right) + \sum_{t=1}^T \sum_{j=1}^J \varepsilon_t \quad (18)
 \end{aligned}$$

Where  $\alpha$  and  $\beta$ 's are the estimated coefficients, which are elasticities,  $t$  is time and  $j$  is country.

It is expected that the lagged values of each endogenous variable positively influence its contemporaneous value. Each equation in the structural VAR is estimated using panel VAR.

The estimated errors of the structural VAR model are used for the IRF curve. Given that agricultural tariffs under TPP will be reduced gradually to zero, the relative price variable (proxy for tariff) is shocked by one standard deviation (34.18% of the mean) to forecast the changes in trade volumes after TPP using the Cholesky decomposition of the IRF model (Sims, 1950) In addition, the future trend in the exchange rate and price ratio variables are also predicted and the forecasted trends presented graphically using the Cholesky curve.

### **3.5 Data**

The study uses panel data for all the TPP member countries from 1980 to 2013. Data on U.S. imports and exports with TPP members as well as import and export prices were obtained from the USDA FAS, exchange rate data from International Financial Statistics of the International Monetary Fund and data on real GDP per capita from USDA-ERS International Macroeconomic Data Set.

## CHAPTER 4

### Results

#### 4.1 Introduction

This chapter presents the results of the data analyses and a discussion of the results. It begins with the descriptive statistics of U.S. agricultural import, export and trade volumes. Next, the trend in U.S. agricultural import, export and trade volumes from 1980 to 2013 are presented and discussed and ends with the results and discussion of the VAR and IRF models.

#### 4.2 Descriptive Statistics of U.S. Agricultural Export, Import and Trade volumes

Table 3 presents the mean, minimum and maximum U.S. agricultural export, import and trade volumes with all TPP countries over the period 1980 to 2013. The mean export volume per year of 4,977,881.93 Mt is about 60% more than the mean import volume (1,582,671.85 Mt). Overall, the mean U.S. agricultural trade with TPP member countries over the period was 6,560,553.78 Mt. The maximum export, import and trade volumes were 31,230,943, 20,579,119 and 39,547,415, respectively.

Table 3

*Descriptive Statistics of U.S. Export, Import and Trade Volumes with all TPP Countries*

Country		Exports (Mt)	Imports (Mt)	Trade (Mt)
U.S.-All TPP Countries	Mean	4,977,882	1,582,672	6,560,554
	Minimum	0	0	0
	Maximum	31,230,943	20,579,119	39,547,415

### 4.3 Trend in U.S. Agricultural Export, Import and Trade volumes (1980-2013)

The trend in the U.S. agricultural exports, imports and trade volumes with each TPP member country, respectively is presented in Figure 1, 2 and 3 respectively. The three leading destination countries for the U.S. agricultural exports are Japan, Mexico and Canada. The U.S. exports to Canada increased gradually over the study period while the U.S. exports to Japan and Canada increased steadily till 2006 and declined afterwards till 2013. Although the U.S. agricultural exports to both Mexico and Japan are currently declining, Mexico leads in terms of the U.S. agricultural export volumes followed by Japan and then Canada.

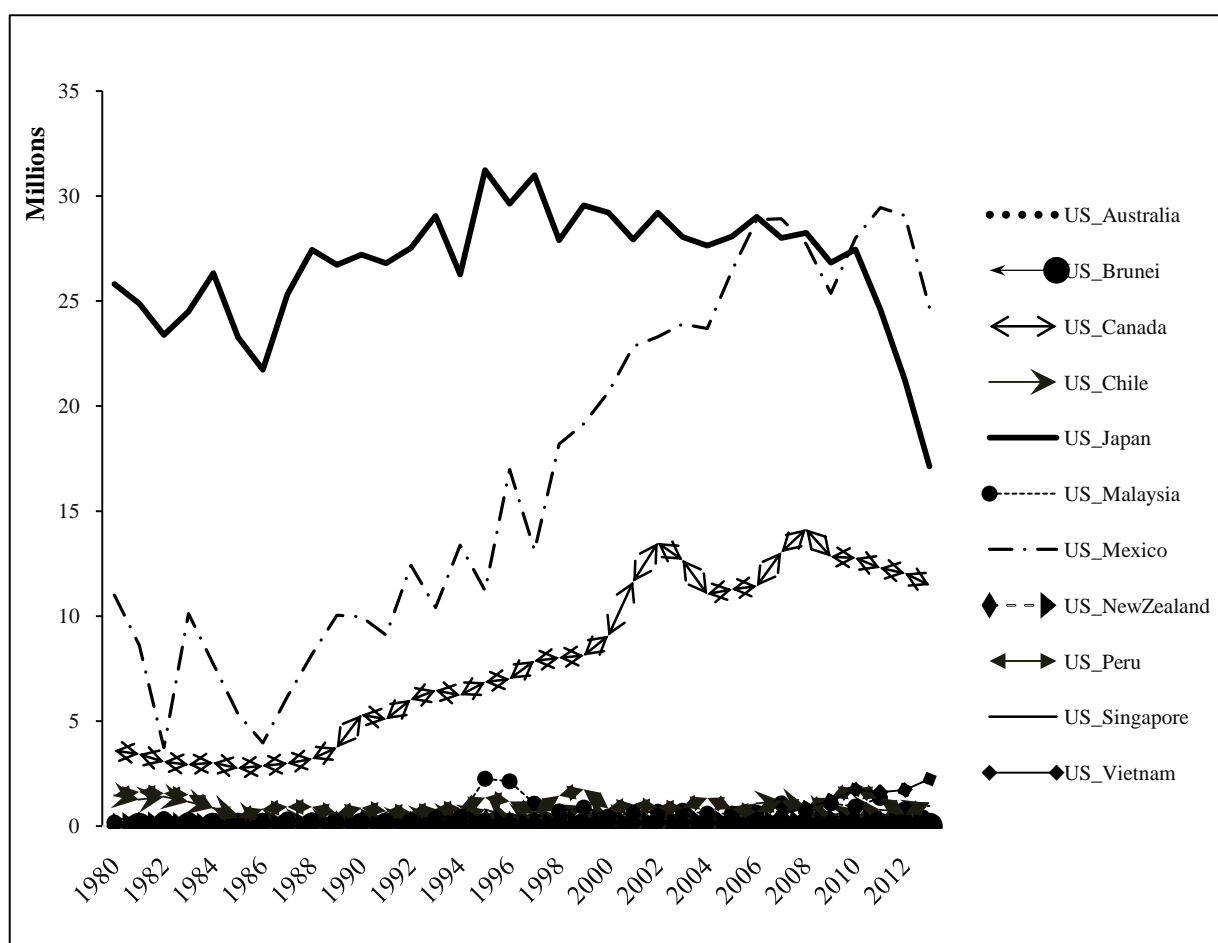


Figure 1. U.S. Agricultural Export Volumes to TPP Member Countries (Mt) from 1980-2013

Among the TPP member countries, the U.S. agricultural imports are mainly from Canada and Mexico. The U.S. imports from these countries increased gradually from 1980 to 2013.

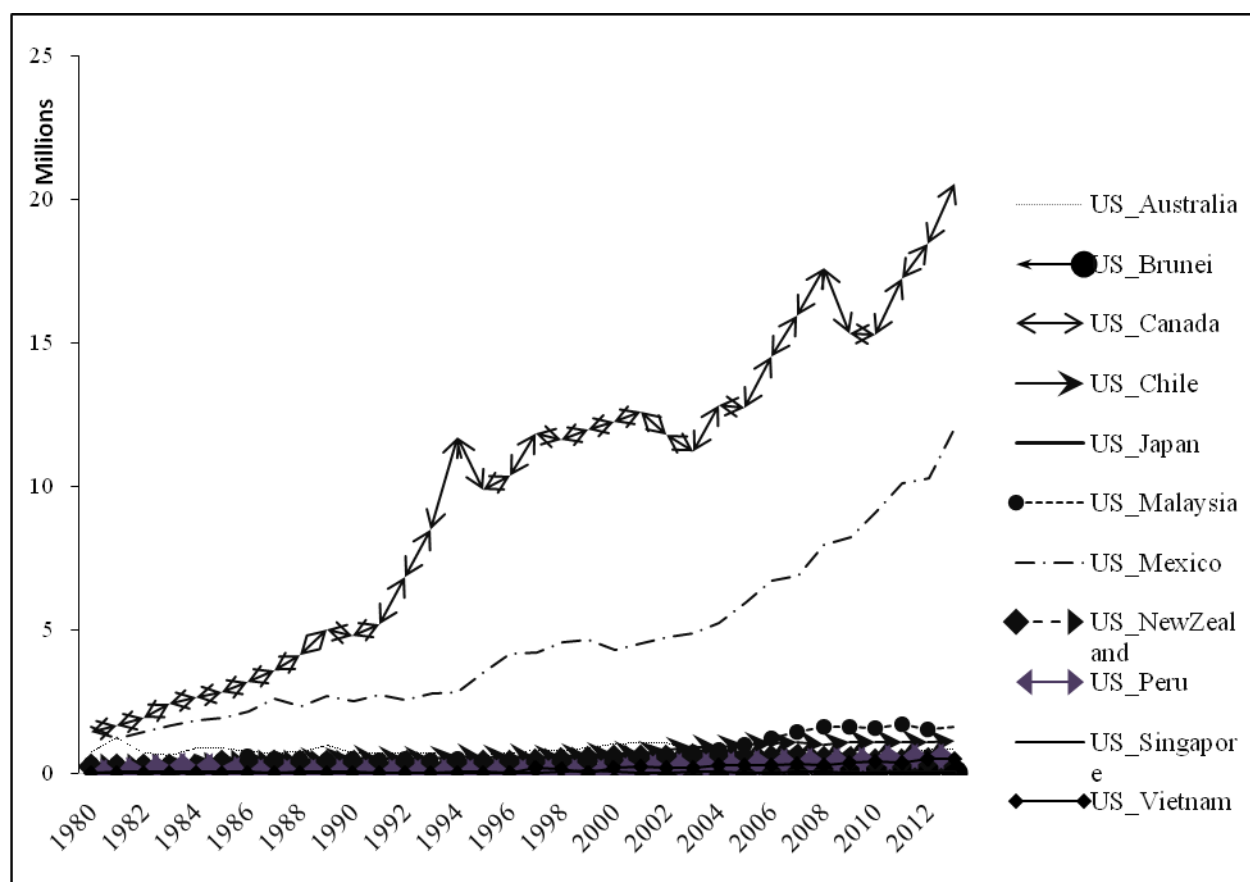


Figure 2. U.S. Agricultural Import Volumes from TPP Member Countries (Mt) from 1980-2013

Japan, Mexico and Canada are the main U.S. agricultural trading partners. Japan was U.S. main agricultural trading country until 2006 when U.S. agricultural trade with Japan began to decline and Mexico took over. Canada is U.S. third agricultural trading country.

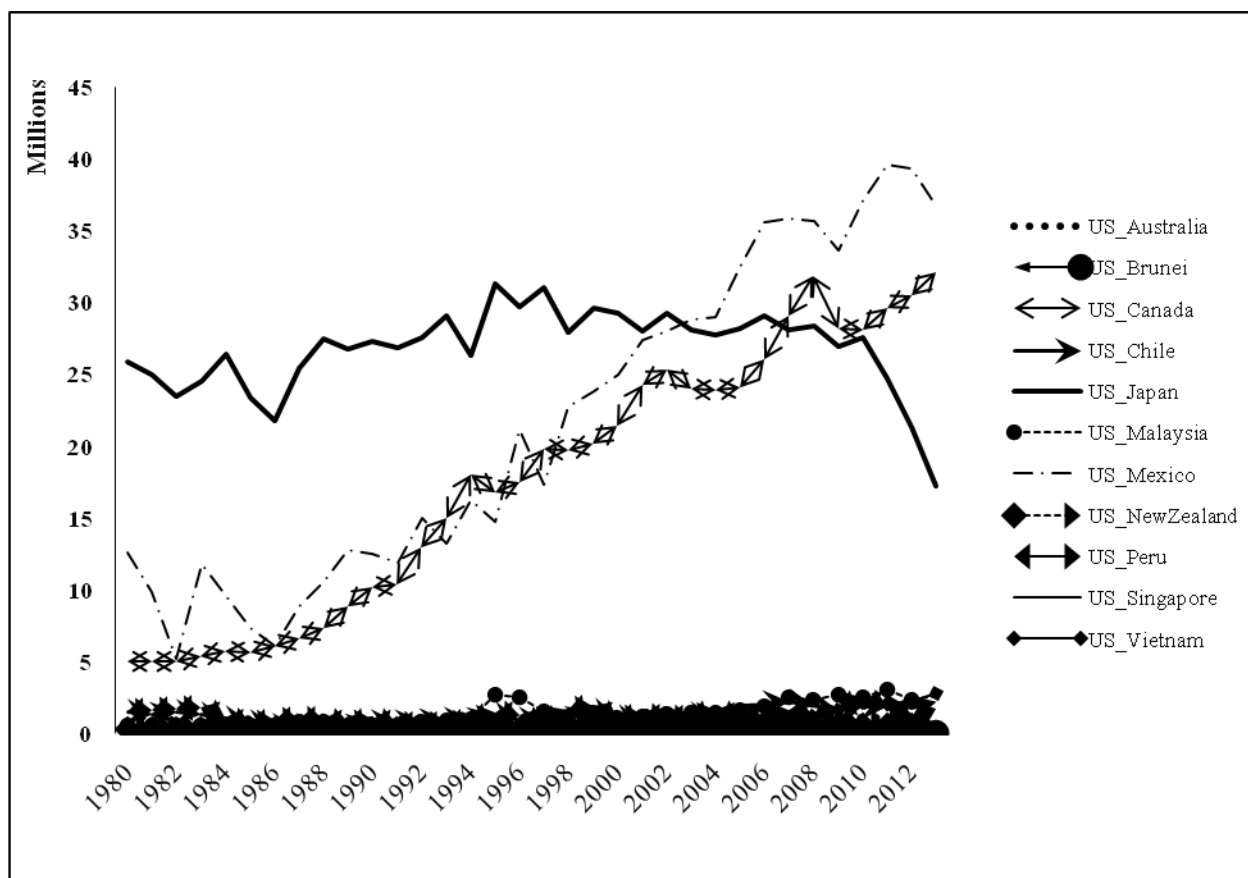


Figure 3. U.S. Agricultural Trade Volumes from TPP Member Countries (Mt) from 1980-2013

#### 4.4 Potential Impact of TPP on U.S. Agricultural Trade

The results of the VAR model are presented in Table 4. Variables in each model are statistically significant at 1% with Adjusted R-Squared values of 0.98, 0.83 and 0.99 for the trade, price ratios and exchange rate models, respectively. This means that the explanatory variables explain over 80% of the variation in each dependent variable. The factors identified to influence the U.S. contemporaneous agricultural trade volumes are one-year lagged trade volume, two-year lagged trade volumes and two-year lagged price ratios, all significant at 1% and trend, significant at 10%. The coefficients for one-year and two-year lagged trade volumes being significant indicate that lagged volumes of trade significantly influence contemporaneous trade volumes.

Table 4

*Results of VAR Model*

<b>Variable</b>	<b>Trade</b>	<b>Price Ratio</b>	<b>Exchange Rate</b>
LA (Lag 1)	<b>0.7882***</b>	<b>-0.2246**</b>	<b>0.0708**</b>
LA (Lag 2)	<b>0.2169***</b>	<b>0.2527***</b>	<b>-0.0696**</b>
LRP (Lag 1)	0.0300	<b>0.8536***</b>	<b>-0.0343*</b>
LRP (Lag 2)	<b>-0.0991***</b>	-0.0073	<b>0.0344*</b>
LEx (Lag 1)	-0.0166	-0.1425	<b>1.3259***</b>
LEx (Lag 2)	0.0312	0.1698	<b>-0.3243***</b>
LB	-0.0104	0.0259	0.0008
Trend	<b>0.0022*</b>	-0.0024	-0.0004
Constant	-0.0853	-0.1508	-0.0147
Adj. R-sq.	0.98	0.83	0.99
F-stat. (9, 22)	2378.82	193.13	25264.04
Sample (adj.)	1982-2013	Included Obs.	306

\*\*\*, \*\* and \* implies significant at 1%, 5% and 10%, respectively.

The coefficient of one-year lagged trade volume of 0.79 implies a 1% increase in one-year lagged trade volumes increases U.S. contemporaneous trade volumes by 0.79%. Similarly, the coefficient of two-year lagged trade volume of 0.22 implies a 1% increase in two-year lagged trade volume increase contemporaneous trade volumes by 0.22%. The effect of one-year lagged trade volumes (0.79) is greater in magnitude than the effect of two-year lagged trade volumes (0.22) implying that previous year's trade volumes account more for current trade volumes. Also,

the coefficient of price ratio in the trade model which is -0.10 implies a 1% decrease in price ratios as a result of a reduction in tariff rate (which makes U.S. agricultural imports cheaper) results in an increase in U.S. agricultural trade volume only by 0.1%. The coefficient of Trend of 0.002 implies that *ceteris peribus*, the U.S. agricultural trade volumes increase by 0.002% each year.

From the price ratio model, the variables identified to significantly influence contemporaneous price ratios are one-year lagged trade volumes, two-year lagged trade volumes and one-year lagged price ratios, significant at 5%, 1% and 1%, respectively. While one-year lagged trade volumes influence contemporaneous price ratios negatively, two-year lagged trade volumes influence contemporaneous price ratios positively. The coefficient of one-year lagged trade volume which is -0.22 implies a 1% increase in trade volumes decreases price ratios by 0.22%. Again, the coefficient of two-year lagged trade volumes of 0.25 implies a 1% increase in trade volumes increases price ratios by 0.25%. In addition, the coefficient of one-year lagged price ratio of 0.85 implies a 1% increase in one-year lagged price ratio increases contemporaneous price ratios by 0.85%. Thus, one-year lagged price ratio has a positive influence on contemporaneous price ratios. The influence is based on the fact that a higher tariff rate raises the price ratio which makes U.S. imports expensive and exports cheap. However, since the U.S. exports more agricultural products than are imported, reducing imports and increasing exports can lead to an overall net effect of more exports. The excess supply of U.S. exports with demand unchanged causes U.S. export price to fall so that eventually, the price ratios increase.

Similarly, results from the exchange rate model indicate that one-year lagged trade volumes, two-year lagged trade volumes, one-year lagged price ratios, two-year lagged price



ratios, one-year lagged exchange rate and two-year lagged exchange rate all influence contemporaneous exchange rate between any TPP member country and the U.S. The coefficient of one-year lagged and two-year lagged trade volumes in the exchange rate model are both statistically significant at 5%. Again, the coefficients of one-year and two-year lagged price ratios are both statistically significant at 10% while the coefficients of one and two-year lagged exchange are significant at 1%. Thus, lagged values of exchange rates significantly influence contemporaneous exchange rates. While one-year lagged trade volumes, one-year lagged exchange rate and two-year lagged price ratio cause U.S. dollar to depreciate against any other TPP member country's currency, two-year lagged trade volumes, one-year lagged price ratios and two-year lagged exchange rates cause the U.S. dollar to appreciate. The coefficient of the one-year lagged exchange rate of 1.33 implies a 1% increase in one-year lagged exchange rate cause the U.S. dollar to depreciate relative to the foreign country currency by 1.33%. Similarly, the coefficient of the two-year lagged exchange rate of -0.32 implies a 1% increase in two-year lagged exchange rate makes the U.S. dollar to appreciate relative to the foreign country currency by 0.32%.

The Cholesky IRF predicts graphically, the future trend in U.S. agricultural trade volumes, price ratios and exchange rates after the implementation of the TPP agreement. The result of the Cholesky IRF is presented in Figure 4. The shortrun effects of the one standard deviation shock (34.18% of mean) covers the first two periods after the shock while periods after two reflect the longrun effects. From the IRF curve, it is observed that when price ratios are shocked up by one standard deviation, that is, when import prices increase due to a 34.18% increase in tariffs, U.S. agricultural trade volumes with all TPP member countries will decline gradually in both the shortrun and the longrun. The observed trend is attributed to the fact that

U.S. is a net exporter thus when imports become expensive, U.S. cut down on its imports leading to a decrease in U.S. agricultural trade.

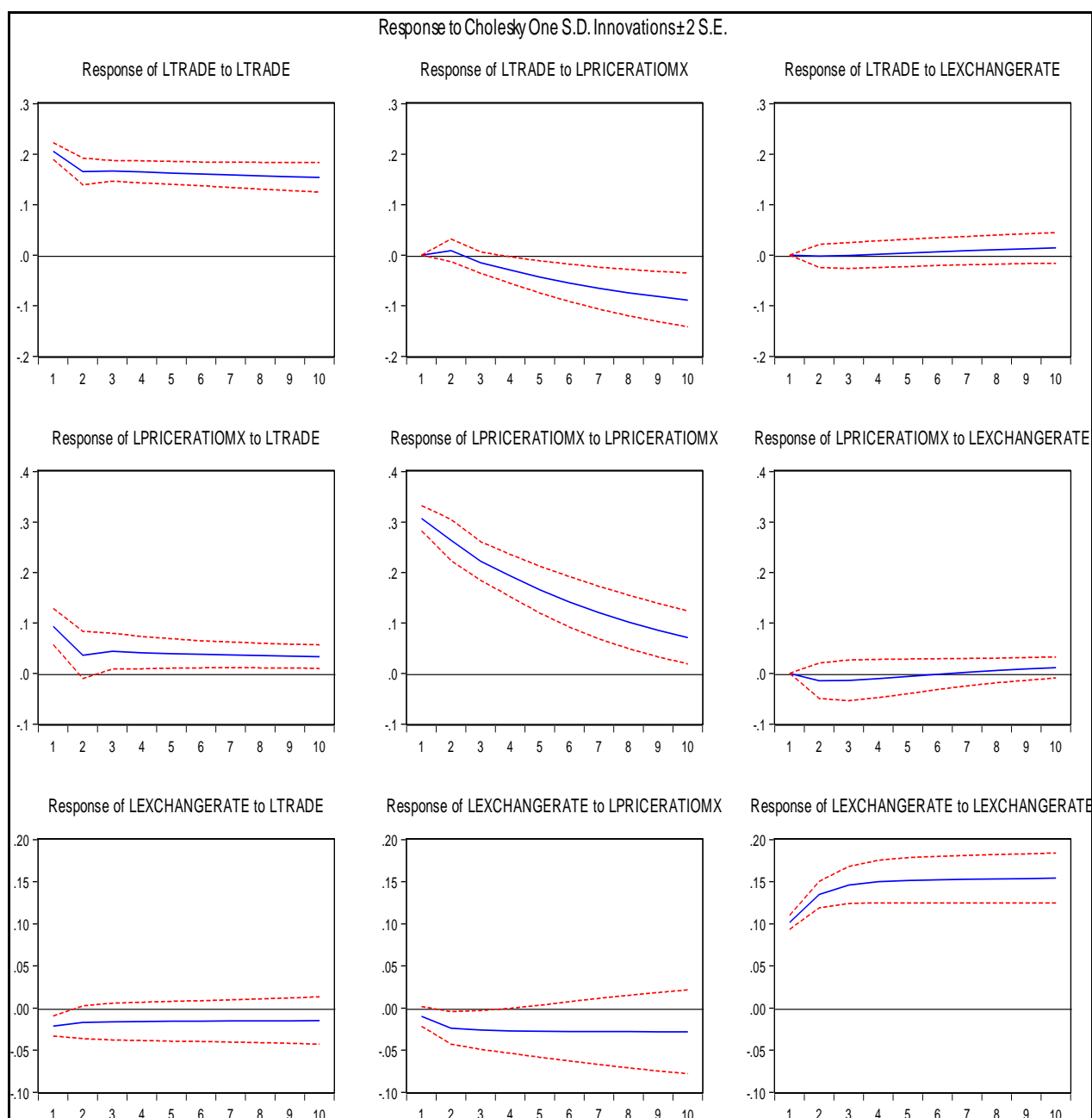


Figure 4. Results of Cholesky IRF model

However, if price ratios are shocked down by one standard deviation, i.e. when import prices decline by 34.18%, U.S. agricultural trade volumes with TPP countries will increase in the shortrun and decrease in the longrun. The observed trend is attributed to the fact that overtime; consumers in those countries adjust and return to their normal consumption patterns, with demand for U.S. imports falling. Overall, a unit shock in price ratio as a result of the implementation of the TPP agreement creates trade in the shortrun for the U.S. but in the longrun, leads to more trade diversion than trade creation.

Again, a one standard deviation shock (up or down) in trade volumes will cause U.S. agricultural trade volumes and price ratios to decline in the short run. However, a one standard deviation shock up (increase by 34.18%) in trade volumes will cause exchange rate of any TPP country currency to the U.S. dollar to decline in the shortrun implying the U.S. dollar has appreciated against the foreign country currency although in the longrun, the response of the exchange rate to a one standard deviation shock in trade volumes is fairly stable. A one standard deviation shock up/ down in price ratio will cause the exchange rate of any TPP country currency to the U.S. dollar to decrease in the short run implying an appreciation of the U.S dollar. However, in the longrun, a one standard deviation shock down in price ratios will result in a decrease in the exchange rate of any TPP country currency to the U.S. dollar, implying an appreciation of the U.S. dollar while a one standard deviation shock up in price ratios will lead to a decrease in the exchange rate, implying a depreciation of the U.S. dollar.

Similarly, in the shortrun, a one standard deviation shock up in exchange rate (U.S. dollar depreciates) will result in a decrease in U.S. agricultural trade volumes although in the longrun, both trade volumes and price ratios will increase gradually.

## CHAPTER 5

### Summary, Conclusions and Recommendations

#### 5.1 Introduction

This chapter begins with a brief summary of the study including the research objectives; main models employed for the data analyses; data type used and key findings. Next, the main conclusions derived from the results of the data analyses are presented with the chapter ending with the policy recommendations of the study.

#### 5.2 Summary

The Trans-Pacific Partnership trade agreement is a trade agreement currently under negotiations between the U.S. and eleven other member countries namely Australia, Brunei Darussalam, Canada, Chile, Japan, Malaysia, Mexico, New Zealand, Peru, Singapore, and Vietnam. The main objective of this agreement is to eliminate all traditional trade barriers between member countries and promote trade. Although TPP is expected to reduce tariffs and promote trade, there are major concerns about the potential competition that U.S. agricultural sector will face and its impact on the U.S. agricultural trade. Therefore, this study aimed mainly to examine the effects of the impending TPP trade agreement on U.S. bilateral agricultural trade with TPP member countries. To achieve this objective, the study described the trend in U.S. agricultural trade, export and import volumes with each TPP member country from 1980 -2013 and econometrically determined the extent of trade creation and trade diversion associated with TPP using VAR and IRF models.

Objective one, which described the trend in U.S. agricultural trade volumes from 1980 to 2013, was achieved using line graphs while objective two was obtained using the structural vector auto-regressive model (VAR) and impulse response function (IRF). The structural VAR is

used to estimate the responses of three endogenous variable to a one percentage change in their lags, the lags of other endogenous variables and other exogenous variables while the IRF is used to forecast the changes in trade volumes after TPP when the relative prices (proxy for tariff) are shocked by one standard deviation (34.18% of the mean). The key assumption is that agricultural tariffs under TPP will be reduced gradually to zero. Panel data from 1980-2013 was employed. Overall, the mean U.S. agricultural trade with all TPP countries is 6,560,553.78 Mt. The mean export volume is approximately 60% more than the mean import volume of 1,582,672 Mt. Japan, Mexico and Canada are the major U.S. agricultural trading partners. Results from the trade model showed that lagged volumes of trade significantly influenced contemporaneous trade volumes, exchange rate and price ratios as expected. The IRF curve showed that when price ratios are shocked down by one standard deviation, i.e. when import prices decline, U.S. agricultural trade volumes with TPP countries will increase in the shortrun and decrease in the longrun.

### **5.3 Conclusions**

From the results, it is concluded that the U.S. is a net exporter of agricultural products to TPP countries. With regards to the countries participating in the TPP trade agreement, Japan, Mexico and Canada are U.S. major agricultural trading partners. The future volumes of U.S. agricultural trade with TPP countries can be predicted using lagged trade volumes and price ratios since they were identified to influence U.S. agricultural trade volumes.

The initial years of signing the TPP agreement are promising to the U.S. as the agricultural trade with TPP member countries will increase. Also, U.S. agricultural trade volumes peak in the early periods after implementation of TPP and decline afterwards. Although, trade volumes increase with the onset of TPP, the increase in volumes is not sufficient to offset the decline in trade

volumes that occurs over time. Therefore, although the reduction in tariff after implementing the TPP agreement will create agricultural trade for U.S. in the shortrun, in the longrun, it will cause more U.S. agricultural trade diversion than trade creation.

#### **5.4 Recommendations**

The U.S. government and U.S. department of agriculture (USDA) are encouraged to maintain and enhance U.S. agricultural production policies such as input subsidies, and trade policies to ensure the U.S. continues to be a net exporter of agricultural commodities. Furthermore, Japan is one of U.S. major agricultural trading partners, particularly in terms of U.S. exports, although U.S. does not currently have a FTA with Japan. Therefore, establishing a FTA with Japan will help increase U.S. agricultural exports to Japan, creating more revenue for the U.S. government while expanding the market base of U.S. agricultural producers such as producer in the beef, dairy, feed and grain sectors. Lastly, since the TPP trade agreement is promising to the U.S. agricultural sector in the short term only, negotiators of the agreement for U.S. economy are advised to seek for short term agreements particularly for the agricultural sector to maximize U.S. gains from the TPP trade agreement.

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