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Potential Impact of TPP Trade Agreement on US Bilateral Agricultural Trade: Trade Creation or Trade Diversion?

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Selected Paper prepared for presentation at the Southern Agricultural Economics Association's 2015 Annual Meeting, Atlanta, Georgia, January 31-February 3, 2015

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Abstract

Trans-Pacific Partnership (TPP) trade agreement is a trade agreement U.S is negotiating with 11 other countries in the Asia-Pacific region (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, U.S expects to expand its trade with members of the partnership; resulting in GDP growth. However, there exist large concerns about the potential negative impact TPP will have on U.S. agricultural trade. Therefore, this paper examines the potential effect of TPP agreement on U.S agricultural trade using panel VAR and IRF models. A system of three VAR equations is developed for the three endogenous variables agricultural trade, real exchange rate, and the price ratio of imports to exports. In addition, the future pattern of trade is determined using the IRF curves. The lagged coefficients of agricultural trade volumes were significant in all three models implying current trade patterns are influenced by past volumes of trade. Also, the lagged price ratios have negative effect on current agricultural trade volumes as expected. Overall, the study found that a unit shock in price ratios as a result of the TPP agreement leads to a trade creation for U.S in the short run but in the long run, leads to more trade diversion than trade creation.

Key words: Trans-Pacific Partnership Agreement, Vector Autocorrelation, Impulse Response Function

1. Introduction

The globalization of the world economy has been rapid after World War II and much of this has been due to the drastic change in regionalism and trade agreements (Schott, 2003). These two factors collectively, have linked many developing countries to developed countries and cause trade to spread beyond local neighbors to involve partners across the continent (Schott, 2003). 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 driver of growth for the world economy. The United States of America (USA) is party to many FTAs worldwide. According to Cooper (2014), FTAs can contribute to the growth of U.S economy and the world economy by helping it to (1) secure open markets for U.S. exports, (2) protect its 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, United States has 14 FTAs in force with 20 countries in the world (Cooper, 2014); with several more FTAs under negotiations. 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 21st century trade agreement that the United States 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 is expected to be the largest U.S. FTA by trade value (Williams, 2013). The main purpose of TPP is to eliminate tariffs and commercially-meaningful market access for U.S. products exported to TPP countries; and to make provision to address longstanding 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 GDP growth. This is because the United States is the largest TPP market in terms of both GDP and population. In 2012, TPP partners, excluding U.S, collectively had a GDP of $11.9 trillion, just over 75% of the U.S. level, and a population of 478 million, about 50% larger than the U.S. population. Japan's (pop. 128 million and GDP $6 trillion), inclusion increases the significance of the agreement on both 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 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 partners in the TPP (Australia, Canada, Chile, Mexico, Peru, and Singapore) already have FTA with United States and collectively accounts for over 80% of U.S. goods trade, Japan, Brunei, Malaysia, New Zealand, and Vietnam do not have any existing free trade agreement with the U.S., although Japan is U.S fourth-largest agricultural export market. However, with TPP, the United States hopes to expand its market access for goods, services, and agriculture with countries it does not currently have FTAs. Though Japan protects producers of its sensitive commodities with very high tariffs and restrictive quotas, with TPP, the U.S expects to increase its agricultural exports (particularly dairy products) to Japan due to reduced or eliminated tariff. According to Fergusson et al. (2013), Japan is viewed as the most promising market for 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). Also, with Canada and Mexico's participation, the U.S intends to improve its dairy and poultry products access to the restricted Canadian market and also address ongoing non-tariff barriers that arise when shipping agricultural commodities to Mexico. Although the TPP may reduce tariffs for U.S. agricultural exports and expand U.S market share, there is still a large concern about the TPP's potential 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 potential impact of TPP on U.S agricultural trade; which has not been evaluated by any study.

The main objective of the paper is to examine the effects of impending Trans-Pacific Partnership (TPP) trade agreement on U.S agricultural trade using panel Vector Autoregressive (VAR) and the Impulse Response Function (IRF) dynamic. The specific objectives are: (1) to describe the trend in U.S agricultural trade with each TPP member country over the period 1980 to 2013 and (2) to econometrically determine the extent of trade creation and trade diversion associated with TPP using VAR and IRF models. This will serve as a guide to the U.S government on the terms of trade to be negotiated. It will also help U.S agricultural producers and consumers in their production and consumption decisions when TPP takes full effect to enable them maximize their gains. Information on the trends in U.S exports and factors affecting U.S exports will also be beneficial to all TPP countries as they negotiate for the TPP agreement.

The paper is organized into five sections. Section 2 is a brief review of literature on FTAs, the TPP agreement and empirical studies on trade agreements. Section 3 presents the methodology employed in the analysis. Results of the analysis and its discussions are presented in Section 4 while Section 5 presents the conclusions.

2. Literature Review

2.1 Overview of U.S Free Trade Agreements

FTAs became a major trade policy issue in USA after World War II. This was mainly due to US 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. Currently, the United States has free trade agreements in force with 20 countries namely, Australia, Bahrain, Canada, Chile, Colombia, Costa Rica, Dominican Republic, El Salvador, Guatemala, Honduras, Israel, Jordon, 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 January1994, 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 United States 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).

2.2 The TPP Agreement

The Trans-Pacific Partnership (TPP) is an ambitious, 21st century trade and investment agreement that the United States 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 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 United States announced its interest in joining the agreement (Elms, 2013). Immediately after the expression of interest by US, 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 formally joined TPP negotiations becoming the 12 participant (Elms, 2013). The leaders of TPP member countries aspire to achieve a high-quality, “21st century” agreement that will serve 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 (USTR, 2011). First, the TPP is intended to be a living agreement that can be updated as appropriate to address emerging trade issues or to include new members. Second, the TPP’s provisions for comprehensive market-access reforms will eliminate or reduce tariffs and other barriers to trade and investment. Third, the TPP will support the development of integrated production and supply chains among its members. Fourth, the TPP will 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. Fifth, the TPP aims to promote trade and investment in innovative products and services.

Broadly, the objective of U.S for participating in TPP is the elimination of 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. 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). Currently, most negotiations on agricultural tariff are still under discussion but the agreements hopes to develop a tariff reduction policy that completely removes all agricultural tariff by member countries by the end of the agreement in 2025.

2.3 Review of Empirical Studies on FTAs

Literature shows that much empirical work has been devoted toward evaluating trade and welfare effects of FTAs. Such Studies include works by Zhu (2013), Gauto (2012), Korinek and Melatos (2009), Zhuang et al. (2007), Susanto et al. (2007), Kwentua (2006), Kandogan (2005), Kawasaki (2003), Kimberly (2001), and Casario (1996). 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 Kawasaki (2003), and Casario (1996) and ex-post studies (Zhuang et al., 2007; Susanto et al., 2007; Kwentua, 2006; Kandogan, 2005; Kimberly, 2001), (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), Korinek and Melatos (2009), and Kandogan (2005) 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 Zhuang et al. (2007), (impact of US-Korea FTA on various sectors of the economies of the two countries) and Kwasaki (2003), (the impact of FTAs in Asia). 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 US-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 leads to substantial trade creation with no significant evidence of trade diversion among member countries (Gauto, 2012; Susanto et al., 2007; Kimberly, 2001; Zhu, 2013; and Korinek and Melatos, 2009). 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 US-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) study which showed that participation in FTAs did not result in any strong trade creation among non-member countries.

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).

3. Methodology

3.1 Theoretical Framework

International economics provides understanding on the effects of international trade, trade policies and other economic conditions on individuals, businesses and the government. This is achieved using supply-and-demand analysis of international markets, firm and consumer behavior analyses. International trade between two countries is generated by the interaction of consumers having taste for diversity of goods. Volume of trade of a country is the sum of country's imports and exports. Imports are derived from the consumer utility function while exports are derived from firms profit maximization problem. Assume two factors of production Labor (L) and Capital (K), each perfectly mobile within each country but immobile internationally. Assume good Y is produced using these two factors and each country is endowed with different levels of K and L. The two countries also differ in terms of relative factor intensities, tastes for variety and trade barriers (transportation costs and /or tariffs).

Utility Maximization

Consumers in each country derive utility from the consumption of the good produced. The utility function is given as

$$Ui = u(Y_{Hi,}Y_{Fi}) \tag{1}$$

Where
Y_{Hi} = Quantity of good Y produced in home country and demanded by individual (i) in home country.
Y_{Fi} = Quantity of good Y produced in foreign country and demanded by individual (i) in home country.

However, each individual spends a fixed budget on the consumption of these goods. Assuming that an individual spends all his income on only these goods, the budget constraint of each individual is given as

$$B = P_Y^H Y_H + P_Y^F Y_F \tag{2}$$

Where
P_Y^H = the price of good Y produced in the home country;
P_Y^F = the prices of good Y imported from foreign country into the home country. The import price include the tariff (T) charged by the home country on all imported goods. i.e. $P_Y^F = P_Y + T$
Thus, (2) becomes

$$B = P_Y^H Y_H + (P_Y + T)Y_F \quad (3)$$

With this budget constraint, each individual is faced with a Utility maximization problem given as

$$\text{Max } Ui = u(Y_{Hi}, Y_{Fi}) \text{ subject to } B = P_Y^H Y_H + (P_Y + T)Y_F \quad (4)$$

Setting up the Lagrangian gives

$$L = u(Y_{Hi}, Y_{Fi}) + \lambda(B - P_Y^H Y_H - (P_Y + T)Y_F \quad (5)$$

Differentiating (5) gives

$$\frac{dL}{dY_{Hi}} = \frac{du}{dY_{Hi}} - \lambda P_Y^H = 0$$

$$\frac{dL}{dY_{Fi}} = \frac{du}{dY_{Fi}} - \lambda(P_Y + T) = 0 \quad (6)$$

$$\frac{dL}{d\lambda} = B - P_Y^H Y_H - (P_Y + T)Y_F = 0$$

Solving equation (6) simultaneously gives:

$$Y_{Hi}^* = Y_{Fi}^* = f(P_Y^H, P_{Y,} T, B) \quad (7)$$

Where
Y_{Hi}^* = demand for good Y produced by the home country
Y_{Fi}^* = demand for good Y produced in a foreign country, the import demand for Y

With GDP per capita (GDPP) as the income of each consumer and exchange rates (Ex), the demand function for Y_F is given as

$$Y_F = f(P_Y^H, P_{Y,} T, GDPP, Ex) \quad (8)$$

Profit Maximization

Each firm in the goods market is assumed to produce output subject to the technology (Te) as

$$Y = Y(K, L, Te) \quad (9)$$

Firms in each country maximizes profit subject to the technology as

$$Max\ \pi = P_Y Y(K, L, Te) - R_Y Y - FC = 0 \quad (10)$$

Where R_Y = Unit cost of producing good Y and FC = Fixed cost
Differentiating with respect to P_Y gives

$$\frac{d\pi}{dP_Y} = Y^*(P_Y, Te) \quad (11)$$

Where Y^* is the export supply of good Y.

With Volume of trade = Exports volume + Imports volume

$$=[Y = f(P_Y, Te)] + \left[Y_F = f(P_Y^H, P_{Y,} T, GDPP, Ex)\right]$$

$$= f\left(, P_Y^H, P_{Y,} T, Ex, GDPP, Te\right) \quad (12)$$

However, with a trade bloc, all barriers to trade including tariffs are drastically reduced or eliminated. This study defines a trade bloc as an agreement between countries to eliminate trade policy barriers on goods among participating countries. If two countries negotiate for a trade bloc, then the tariff component of all import prices is taken off. This makes imports cheaper in the importing country, stimulating demand in the importing country and production in the exporting/ foreign country. However, Viner (1950) demonstrated that trade blocs are not always welfare improving and may sometimes create or divert trade. Trade blocs create trade when they result in welfare gain by replacing domestic production with lower cost cheaper imports from foreign markets and divert trade when they lead to the replacement of lower cost cheaper imports from the world market by more expensive imports from agreement partners, thus creating welfare losses (Snorrason, 2012). According to Viner (1950), the relative strength of these two effects determines whether or not a trade bloc is welfare enhancing or not. Thus, this study uses the VAR and IRF models to predict the expected level of trade creation or trade diversion of US-TPP agreement on U.S agricultural trade.

3.2 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 trade variables over time. They generalize the univariate autoregression (AR) models by allowing for more than one evolving variable. All variables in a VAR are treated symmetrically in a structural sense; each variable has an equation explaining its evolution based on its own lags and the lags of the other model variables. VAR modeling does not require as much knowledge about the forces influencing a variable as do structural models with simultaneous equations: The only prior knowledge required is a list of variables which can be hypothesized to affect each other inter-temporally.

Given three endogenous variables and two exogenous variables, a system of three panel VAR equations are developed to explain the impact of US-TPP trade agreement on U.S agricultural trade. This paper considers a bilateral trade between U.S and all other TPP member countries and the system of equations are

$$AgT = f(AgT_{t-i}, Ex_{t-i}, RP_{t-1,} RGDP_{t-i}, \text{T}) \quad (3)$$
$$Ex = f(AgT_{t-i}, Ex_{t-i}, RP_{t-1,} RGDP_{t-i}, \text{T}) \quad (4)$$
$$RP = f(AgT_{t-i}, Ex_{t-i}, RP_{t-1,} RGDP_{t-i}, \text{T}) \quad (5)$$

To linearize the system of VAR models, we take the natural log to give

$$In(AgT) = \alpha_1 + \beta_i\, In\,(AgT_{t-i}) + \gamma_i\, In\,(Ex_{t-i}) + \delta_i\, In(RP_{t-1}) + \theta_i\, In\,(RGDP_{t-i}) + \varphi \text{T} + \varepsilon \text{i}) \quad (6)$$
$$In(Ex) = \alpha_1 + \beta_i\, In\,(AgT_{t-i}) + \gamma_i\, In\,(Ex_{t-i}) + \delta_i\, In(RP_{t-1}) + \theta_i\, In\,(RGDP_{t-i}) + \varphi \text{T} + \varepsilon \text{i}) \quad (7)$$
$$In(RP) = \alpha_1 + \beta_i\, In\,(AgT_{t-i}) + \gamma_i\, In\,(Ex_{t-i}) + \delta_i\, In(RP_{t-1}) + \theta_i\, In\,(RGDP_{t-i}) + \varphi \text{T} + \varepsilon \text{i}) \quad (8)$$

Where
AgT = Contemporaneous volume of agricultural trade (export volume + import volume)
Ex = Contemporaneous exchange rate
RP = Contemporaneous relative import prices to export prices (indicator for tariff)
RGDP = Real GDP per capita
T = time trend, i= number of lags
α, β, γ, δ, θ, φ are the estimated coefficients which are elasticities.
This equation is estimated using OLS. According to Bussière et al. (2009), this estimated model can be used for different purposes such as the analysis of impulse responses and forecasting of variable.

IRF Model

Impulse response functions (IRF) trace out the response of current and future values of each of variable to a one-unit or one-standard deviation shock (increase or decrease) in the current value of one of the VAR errors, assuming that this error returns to zero in subsequent periods and that all other errors are equal to zero. However, a problematic assumption in this type of impulse response analysis is that a shock occurs only in one variable at a time. Such an assumption may be reasonable if the shocks in different variables are independent. If they are not independent, then the error terms may consist of influences/ variables which are not directly included in the model. In addition, if the error terms are correlated, it may indicate that a shock in one variable is likely to be accompanied by a shock in another variable. Under these circumstances, setting all other errors to zero provide a misleading picture of the actual dynamic relationships between the variables. To deal with this problem, Rossi (2004) proposed using the Cholesky decomposition of the IRF model. This is because the Cholesky decomposition of the IRF assume that a change in one variable has no effect on the other variables because the variables are orthogonal (uncorrelated) (Rossi, 2004). This way, the problem of assuming that the error terms return to zero is eliminated.

Given that agricultural tariffs under TPP will be reduced gradually to zero by the end of the agreement, (probably 2025), the relative price variable (proxy for tariff) is shocked (reduction in tariff) by one standard deviation to forecast the changes in U.S agricultural trade after the signing of the TPP agreement. The IRF is suitable to this analysis because the TPP agreement is still under negotiations with most agricultural tariff reduction schedules yet to be decided. This makes it difficult to forecast trade volume after TPP using specific tariff cuts. By shocking the tariff trend by one standard deviation, the IRF predicts future trade patterns under continuous tariff reduction. Therefore the trend in U.S trade after TPP (reduction in tariff) is shown by the Cholesky decomposition of the IRF model. Using the trend, the extent of trade creation and trade diversion is reviewed with the overall net welfare effect determined.

3.3 Data

The study uses panel data consisting of US agricultural trade with TPP member countries (import and export volumes) measured in metric tons, exchange rate of foreign country to the U.S dollar, relative price of imports to price of exports and real GDP per capita of each country. The panel data for all the TPP member countries is 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.

4. Results and Discussion

4.1 Trend in US agricultural export, import and trade volumes (1980-2013)

The descriptive statistics are presented in table 4.1. The mean, minimum and maximum U.S agricultural export, import and trade volumes with all TPP countries over the period 1980 to 2013 is presented in Table 4.1. 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 is 6,560,553.78 Mt. the trend in U.S agricultural exports, imports and trade volumes with each TPP member country, respectively is presented in Figure 4.1a, b, c. Japan, Mexico and Canada are the main U.S agricultural trading partner. Japan was U.S main agricultural export destination country until 2004 when U.S agricultural exports begun to decline and Mexico took over. Although U.S agricultural exports to both Mexico and Japan are currently declining, Mexico leads in terms of U.S agricultural export volumes. Aside these two, Canada is the third destination country for U.S agricultural export. In terms of imports, Canada is U.S main importing country with the volume of imports rising steadily over the time period. Next to Canada is Mexico, also exhibiting a gradual increase in U.S agricultural import volumes. Overall, U.S agricultural trade with Canada and Mexico rose steadily over the period while U.S trade with japan remained fairly stable over the period until the 2000's when it gradually declined.

4.2 Potential impact of TPP on U.S agricultural trade

The vector autocorrelation model is used to examine the dynamics of U.S bilateral agricultural trade with all TPP member countries from 1980 to 2013. The estimated coefficients from the VAR model are presented in Table 4.2. The overall model is significant with the selected variables explaining over 80% of the variation in the dependent variables. Similarly, one

year lagged and two year lagged values of U.S agricultural trade volumes significantly affect contemporaneous trade volumes, price ratios and exchange rates.

The estimates of the trade model shows that one year lagged and two year lagged volumes of trade positively affect contemporaneous U.S agricultural trade volumes with TPP member countries. The impact is higher for one year lagged (0.79) than two year lagged volumes (0.22), indicating that previous year's trade volumes account more for current trade volumes. Similarly, the lag of price ratios has negative influence on contemporaneous trade volume. A 1% increase in price ratios will cause a decrease in future U.S agricultural trade volume only by 0.1%. However, lags of exchange rate and real GDP per capita do not impact U.S agricultural trade with TPP member countries. Trend being significant and positive implies that current trade volumes are positively influenced by the duration of trade.

The estimates of the price ratio model shows that one year lagged and two year lagged trade volume significantly influence contemporaneous agricultural price ratios. While one year lagged trade volumes decreases price ratio by 0.2246%, two year lagged trade volumes increases price ratio by 0.2527%. Also, one year lagged of price ratio has a positive influence on contemporaneous price ratios. This is because a higher tariff rate raises the price ratio which makes U.S imports expensive and exports cheap. However, because U.S exports more agricultural products than it imports, cutting down on imports and increasing exports lead to an overall net effect of more exports. The excess supply of U.S exports with demand unchanged causes U.S export prices to fall so that eventually, the price ratios increase.

Results from the exchange rate model indicates that one year lagged and two year lagged of trade volumes, price ratio and exchange rate all influence contemporaneous exchange rate between any TPP member country currency and the U.S dollar. While one year lagged of trade volumes, exchange rate and two year lagged of price ratio cause U.S dollars to depreciate against the another TPP member country's currency, two year lagged of trade volume, exchange rate and one year lagged of price ratio cause U.S dollars to appreciate.

4.2.1 Forecasting the impact of TPP on US agricultural trade

The short run and long run effect of changes in price ratio, due to the implementation of TPP, on U.S agricultural trade volume with TPP member countries is presented in Figure 4.2. The IRF curve shows that when price ratios are shocked up by one standard deviation, i.e. when import price increases, U.S agricultural trade volumes with TPP members will decline gradually overtime. This is attributed to the fact that U.S import volumes are lesser than U.S export volumes. However, if price ratios are shocked down one standard deviation, i.e. when import prices decline, U.S agricultural trade volumes with TPP countries increase in the short run and falls in the long run. This is because, overtime, consumers adjust to the change in prices 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 short period for U.S but in the long run, leads to more trade diversion than trade creation.

5. Conclusion

Findings from the study indicate that current trade volumes are influenced by past volumes of trade and lagged of price ratio therefore, using current trade volumes and prices, the future patterns of trade can be predicted. The initial years of signing the TPP agreement are promising to the U.S agricultural sector as U.S agricultural trade with TPP member countries will increase. Also, U.S agricultural trade volumes peak in the early periods after implementation of TPP and declines 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 creates agricultural trade for U.S in the short run, in the long run, it leads to more U.S agricultural trade diversion than trade creation.

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List of Tables

Table 4.1: Descriptive Statistics: US Exports, Imports and Trade with All TPP Countries

Country		Exports	Imports	Trade
US-All TPP Countries	Mean	4977881.9259	1582671.8535	6560553.7794
	Minimum	0.00	0.00	0.00
	Maximum	31230943.20	20579118.70	39547415.20

Table 4.2: Results of VAR Model

Variables	LTRADE	LPRICERATIO	LEXCHANGERATE
LTRADE (Log 1)	**0.788158*****	**-0.224585****	**0.070789****
	(-0.05874)	(-0.09158)	(-0.02975)
LTRADE (Log 2)	**0.216943*****	**0.252657*****	**-0.06955****
	(-0.05903)	(-0.09204)	(-0.0299)
LPRICERATIO (Log 1)	0.029995	**0.853648*****	**-0.034251***
	(-0.03688)	(-0.0575)	(-0.01868)
LPRICERATIOMX (Log 2)	**-0.099135*****	-0.007302	**0.034411***
	(-0.03709)	(-0.05783)	(-0.01879)
LEXCHANGERATE (Log 1)	-0.016645	-0.142472	**1.32591*****
	(-0.11132)	(-0.17356)	(-0.05639)
LEXCHANGERATE (log 2)	0.031193	0.16978	**-0.324315*****
	(-0.11222)	(-0.17497)	(-0.05685)
LRPGDP_OTHER	-0.010369	0.025867	0.000802
	(-0.01369)	(-0.02135)	(-0.00694)
TREND	**0.002176***	-0.002361	-0.00044
	(-0.00132)	(-0.00206)	(-0.00067)
Constant	-0.085287	-0.150769	-0.014689
	(-0.14415)	(-0.22474)	(-0.07302)
R-squared	0.984633	0.838766	0.998533
Adj. R-squared	0.984219	0.834423	0.998493
Sum sq. resids	12.59993	30.62815	3.232884
S.E. equation	0.205971	0.321131	0.104332
F-statistic	2378.819	193.13	25264.04
Log likelihood	53.85862	-82.04036	261.987
Akaike AIC	-0.293194	0.595035	-1.65351
Schwarz SC	-0.183676	0.704552	-1.543993
Mean dependent	14.59061	1.076859	2.3735
S.D. dependent	1.639624	0.78919	2.687708

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Figure 4.1a: US Agricultural Export Volumes to TPP Member Countries (Metric Tons)

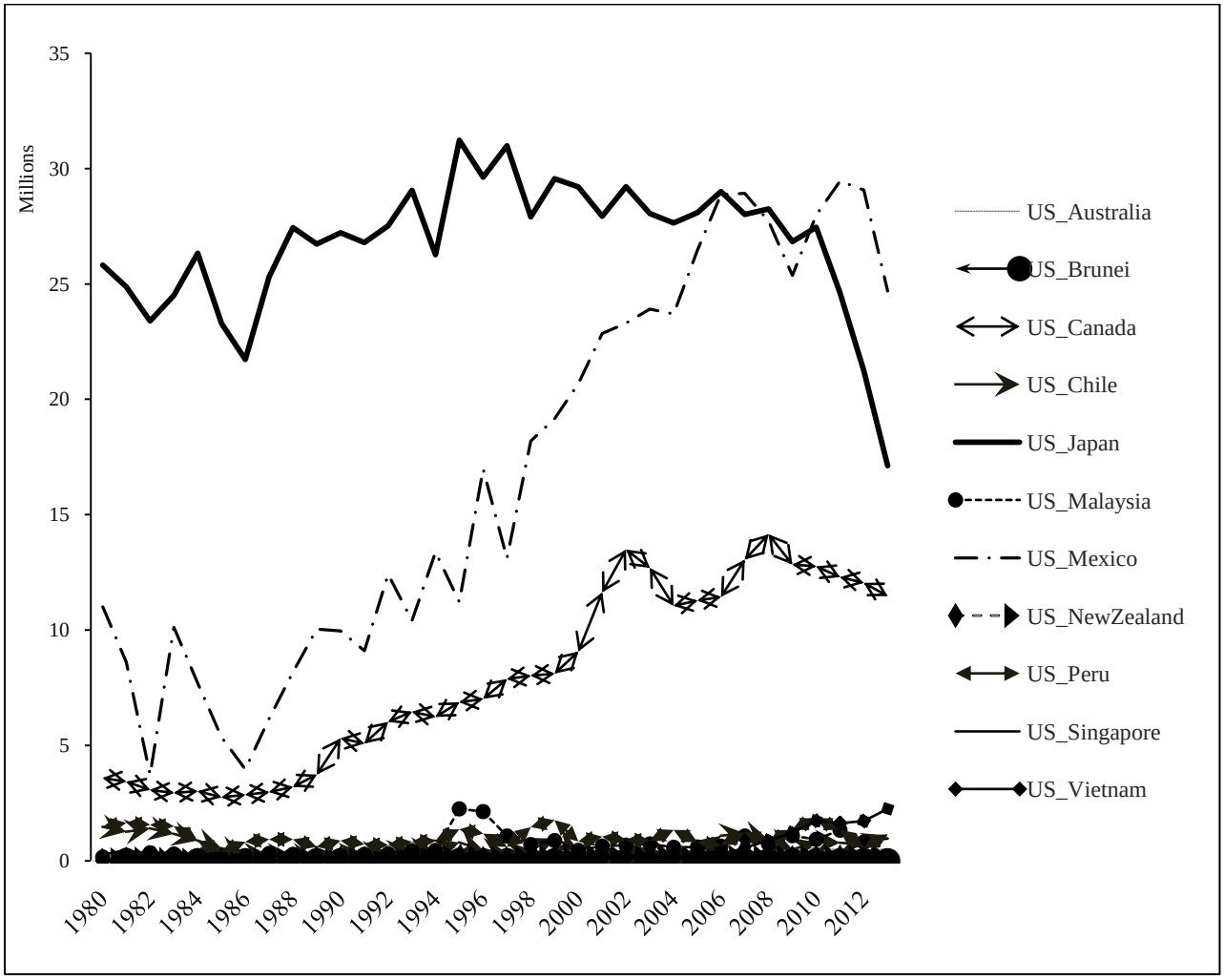

Figure 4.1b: US Agricultural Import Volumes from TPP Member Countries (Metric Tons)

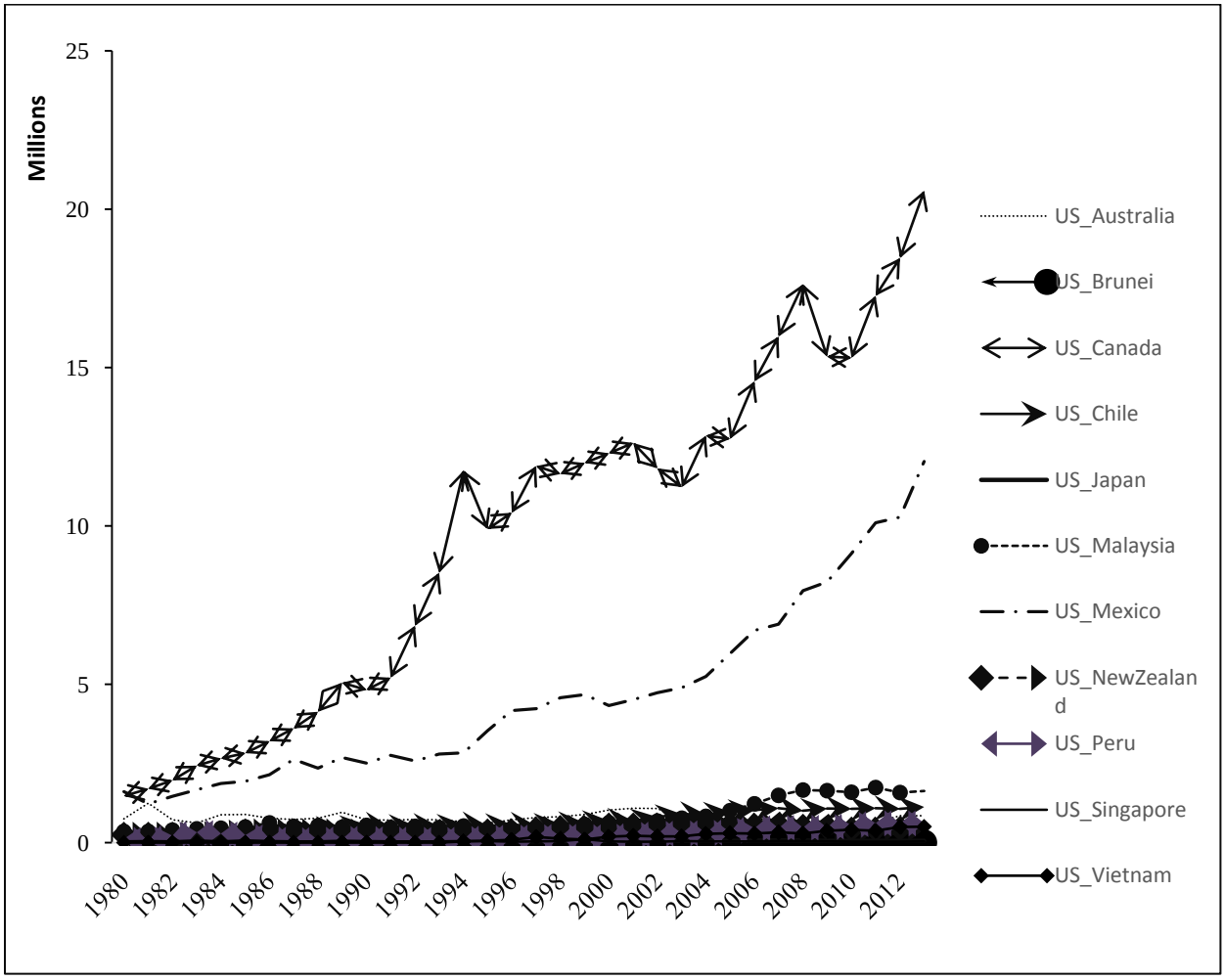

Figure 4.1c: US Agricultural Trade Volumes with TPP Member Countries (Metric Tons)

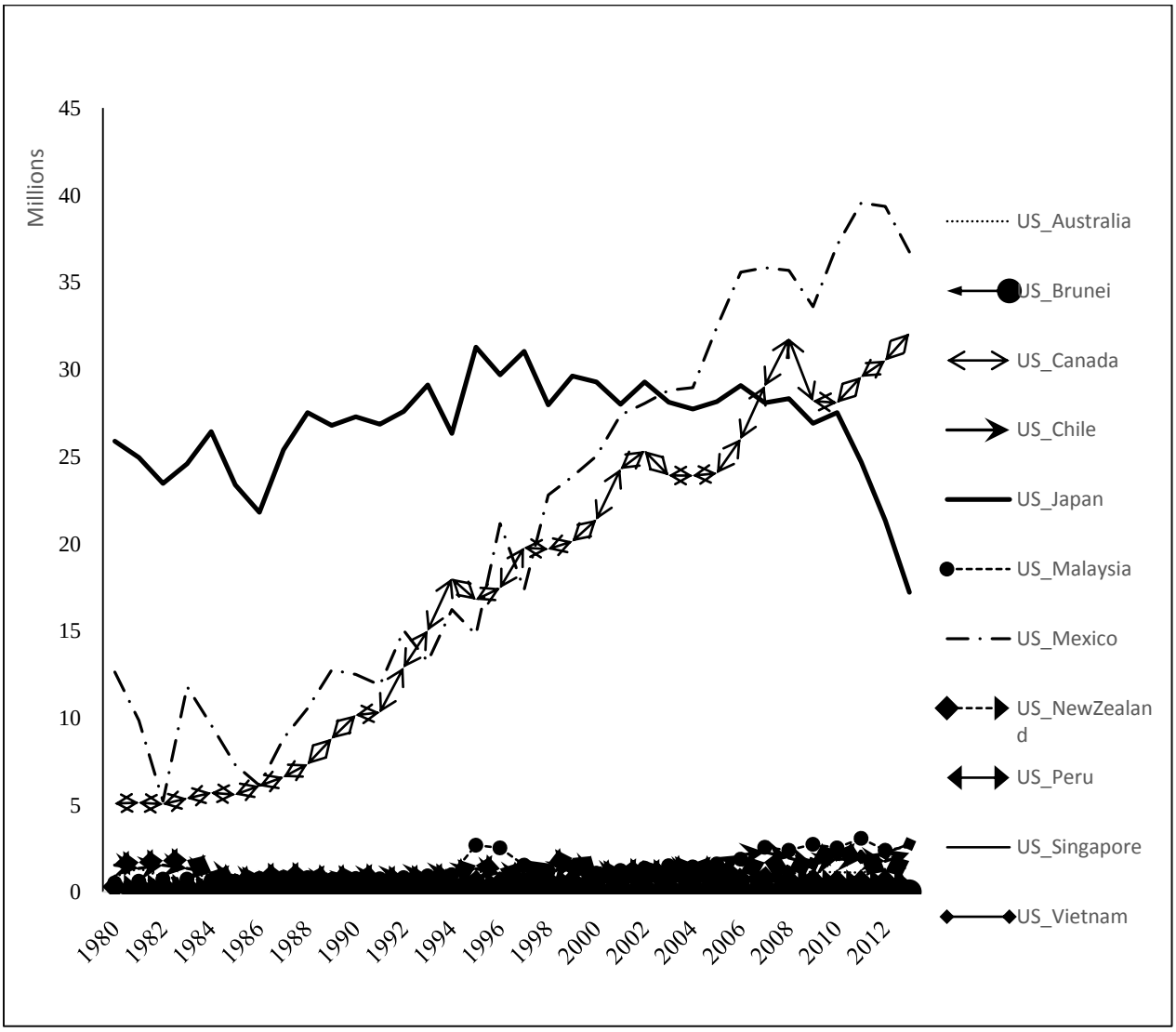
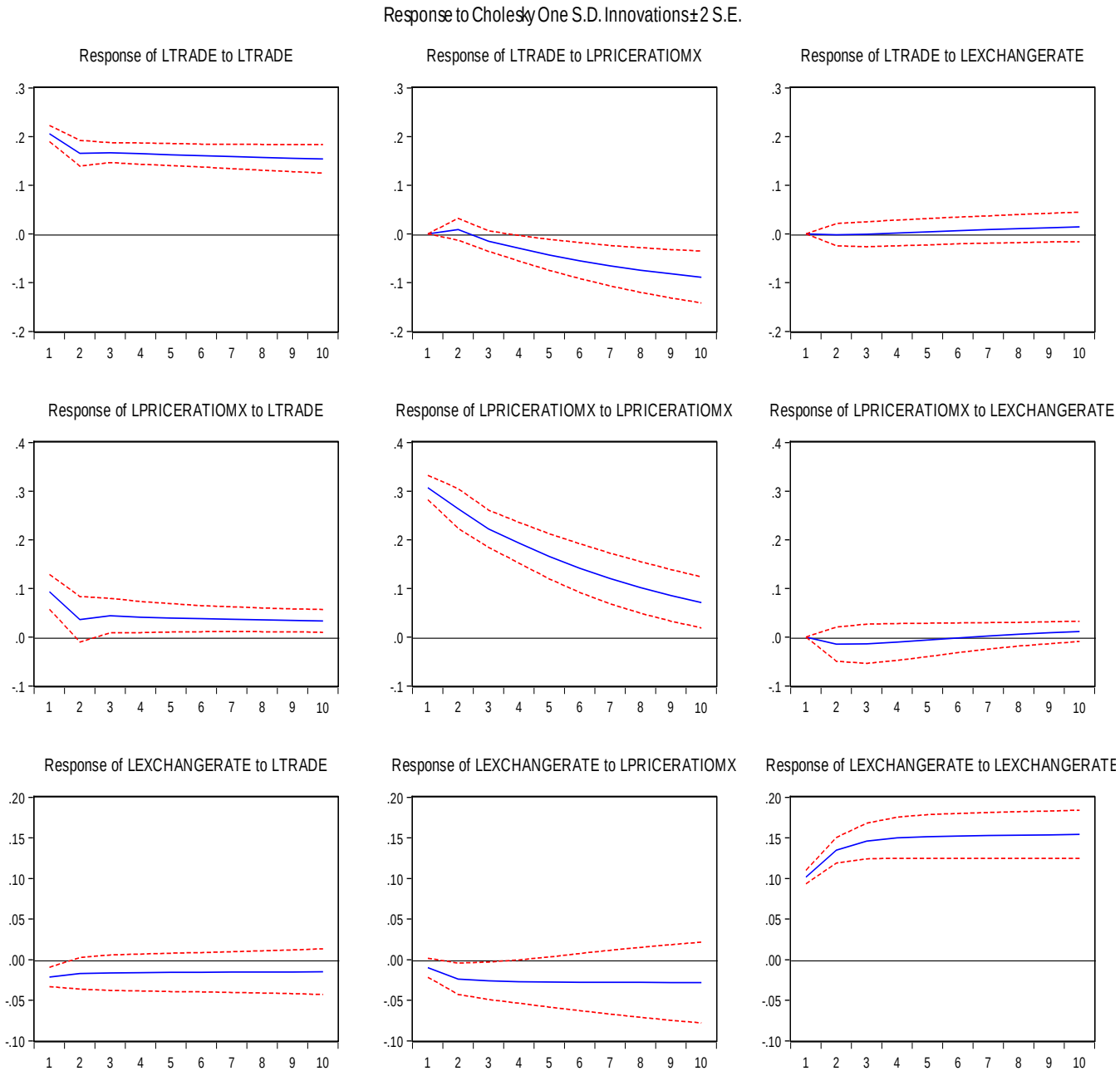
Figure 4.2: Results of Cholesky IRF Curves