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Determinants of the U.S. Trade Balance in Consumer-Oriented Agricultural Products

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Highlights

The U.S. agricultural trade surplus has declined significantly from $26.9 billion in 1996 to just $3.9 billion in 2005. Much of the decline is due to the rapid increase in the U.S. trade deficit for consumer-oriented products. Prior to 1995, U.S. exports of consumer-oriented products were increasing at a significant pace, from $8.5 billion in 1989 to $19.1 billion in 1995, an average annual increase of 12.4%, and U.S. imports were increasing at a relatively slower pace, from $12.6 billion to $16.7 billion during the same period, an average annual increase of 6.9%. As a result, the U.S. trade balance for consumer-oriented products improved from a deficit of $4.1 billion in 1989 to a surplus of $2.4 billion in 1995. After 1995, however, imports grew at a faster rate than exports. From 1995 to 2005, U.S. imports increased from $16.7 billion to $40.1 billion, an average annual increase of 9.2%. Exports, meanwhile, increased from $19.1 billion in 1995 to $27.4 billion in 2005, an average annual increase of 3.7%. Consequently, the U.S. trade surplus became a deficit again in 1998, and this deficit grew to $13.6 billion in 2004. In ten years, the U.S. trade balance for consumer-oriented products deteriorated by $15.9 billion. This deficit improved slightly to $12.7 billion in 2005.

Canada and Mexico are the most important sources for U.S. imports of consumer-oriented agricultural and food products. Due partly to the North American Free Trade Agreement (NAFTA), U.S. imports from these two countries increased from $2.9 billion in 1989 (accounting for 22.7% of U.S. total imports) to $15.8 billion in 2005 (accounting for 39.5% of U.S. total imports). U.S. imports have also increased rapidly from other important trading partners, including Australia, China, some of the European Union (EU) member countries (e.g., Belgium, France, Italy, the Netherlands, and the United Kingdom), and some Latin American countries (e.g., Chile, Colombia, Costa Rica, and Ecuador). U.S. imports from Australia (the third most important country after Canada and Mexico) increased from $0.77 billion in 1989 to $2.25 billion in 2005, an average annual increase of 6.9%. Imports from China jumped from $0.16 billion in 1989 to $1.19 billion in 2005, an average annual increase of 13.26%.

U.S. exports to Canada and Mexico combined increased from $2.0 billion in 1989 (accounting for 23.7% of U.S. total exports) to $12.3 billion in 2005 (accounting for 45.1% of U.S. total exports). Japan was the single largest market for U.S. exports of consumer-oriented products in 1989. U.S. exports to Japan in 1989 accounted for 35.1% of total exports, but this share dropped to 12.1% in 2005. Exports to Japan grew at a significant pace from $3.0 billion in 1989 to $5.4 billion in 1995, but after 1995, exports declined to $4.5 billion in 1998 (partly due to the Asian financial crisis in 1997-1998) and to $3.3 billion in 2005. The rapid decrease in U.S. exports to Japan in recent years is mainly because of the trade restrictions imposed after the reported occurrence of mad cow disease in the state of Washington in December 2003. Red meats had been the leading U.S. export to Japan, but the country banned imports of U.S. beef soon after the mad cow discovery. Other important markets for U.S. exports include South Korea, China, Philippines, and the EU member countries, including Belgium, France, Germany, Spain, the Netherlands, and the United Kingdom.

So far, few studies have looked at this critical issue for U.S. agricultural trade. In this study, we investigate the reasons behind the growing U.S. trade deficit in consumer-oriented

products, using a panel data set covering 28 countries and a time period of 16 years, from 1989 to 2005. An empirical trade model is derived based on international trade theory. The generalized least squares estimator is used to estimate the parameters of the model. The potential endogeneity problems associated with the bilateral trade volume and foreign direct investment are tackled through an instrumental variables estimation approach. The study estimates the effects of bilateral trade volume, real exchange rate, U.S. per capita income, foreign per capita income, foreign market openness, foreign direct investment, U.S. demographic change, the development status of foreign trading partners, NAFTA, and the Asian financial crisis on U.S. exports share, which is defined as the ratio of U.S. exports to total U.S. trade (an export share below 0.5 indicates a trade deficit).

Per capita income in the United States appears to be the most important determinant of U.S. trade balance in consumer-oriented products. A 1% increase of U.S. consumer income, all other things being equal, would decrease U.S. export share by 1.151%. This indicates that as per capita income increases in the United States, U.S. imports of consumer-oriented goods increase faster than U.S. exports. The estimated parameter for per capita income in foreign countries shows that a 1% increase of foreign per capita income, all other things being equal, would lead to an increase of 0.409% of export share held by the United States. In other words, as per capita income increases in foreign countries, their imports of consumer-oriented products from the United States will grow faster than their exports. It is worth to note that U.S. export share is much more sensitive to U.S. income than foreign income.

The results indicate that a 1% appreciation of the U.S. dollar would lead to a decrease of 0.098% in export share held by the United States. Appreciating the U.S. dollar would result in an increase in imports and a decrease in exports, resulting in a decrease in export share.

A 1% increase of U.S. foreign direct investment (FDI) in the foreign countries is found to decrease U.S. export share by 0.139%, suggesting that FDI and exports of consumer-oriented products have a substitute relationship. U.S. multinationals in the processed food industry tend to move capital investment into foreign countries to produce consumer-oriented final goods and market them in the countries rather than shipping from the United States.

Results also show that U.S. export shares for consumer-oriented products have tended to be lower in the developed countries than in the developing countries and NAFTA has a significant negative impact on U.S. trade balance of consumer-oriented products. Foreign market openness is also found to have a positive impact on the U.S. trade balance, though the magnitude of the effect is small.

The estimated results suggest that an increase in per capita income and trade liberalization in foreign countries would improve U.S. trade balance. U.S. FDI abroad in food processing has increased in recent years, and this is found to have a negative effect on U.S. trade balance. The results also suggest that a strong U.S. dollar and NAFTA deteriorate U.S. trade balance.

Abstract

This study investigates the factors behind the growing U.S. trade deficit in consumer-oriented agricultural and food products by using reliable panel data and an empirical trade model derived from international trade theory. The results indicate that per capita income in the United States appears to be the most important determinant for the growing U.S. trade deficit. Increases in per capita income and trade liberalization in foreign countries improve the U.S. trade balance. U.S. foreign direct investment abroad in food processing, a strong U.S. dollar, and NAFTA are found to have negative effects on the U.S. trade balance.

Keywords: Consumer-oriented products, trade balance, trade deficit, exchange rate

Determinants of the U.S. Trade Balance in Consumer-Oriented Agricultural Products

Introduction

According to the U.S. Department of Agriculture (USDA), U.S. agricultural trade has increased steadily over time, jumping from $61.91 billion in 1989 to $122.50 billion in 2005, an average annual increase of 4.36%. However, U.S. agricultural exports have fluctuated and increased slowly over the past decade, while its imports have increased rapidly. As a result, the U.S. agricultural trade surplus has declined from $26.91 billion in 1996 to just $3.86 billion in 2005. The decline in U.S. agricultural trade surplus is mainly due to the increase in the trade deficit for consumer-oriented agricultural and food products.

USDA classifies traded agricultural products into consumer-oriented, bulk, and intermediate products. The importance of consumer-oriented products in U.S. agricultural trade has increased over time. The share of consumer-oriented products in U.S. agricultural trade increased from 34% in 1989 to 55% in 2005 (Figure 1). By contrast, the share of bulk goods has decreased from 46% in 1989 to 25% in 2005. The share of intermediate goods in U.S. agricultural trade has been around 20% over the entire period. Figure 2 shows the changes in trade balances for consumer-oriented, bulk, and intermediate products. The U.S. trade surplus for the bulk products has fluctuated around $15.08 billion with a standard deviation of $2.68 billion. The U.S. trade surplus for the intermediate products was around $4.60 billion prior to 2002 and decreased to $1.21 billion in 2005. By contrast, the U.S. trade balance for consumer-oriented products has declined sharply from a trade surplus of $2.38 billion in 1995 to a trade deficit of $12.73 billion in 2005.

The question that needs to be asked is what are the reasons behind the rapid increase in the U.S. trade deficit for consumer-oriented agricultural and food products? So far, few studies have looked at this critical issue. The objective of this study is to identify the determinants for U.S. trade of consumer-oriented products, using an empirical trade model derived from international trade theory. The paper is organized as follows. Section 2 provides an overview of the changes in exports and imports of consumer-oriented agricultural and food products since 1989.[1] The empirical model used for this study is derived in section 3. Section 4 discusses data and estimation method. The estimation results and a discussion of the findings are presented in section 5, and the final section presents the conclusions of the paper.

[1] Data prior to 1989 are not available.

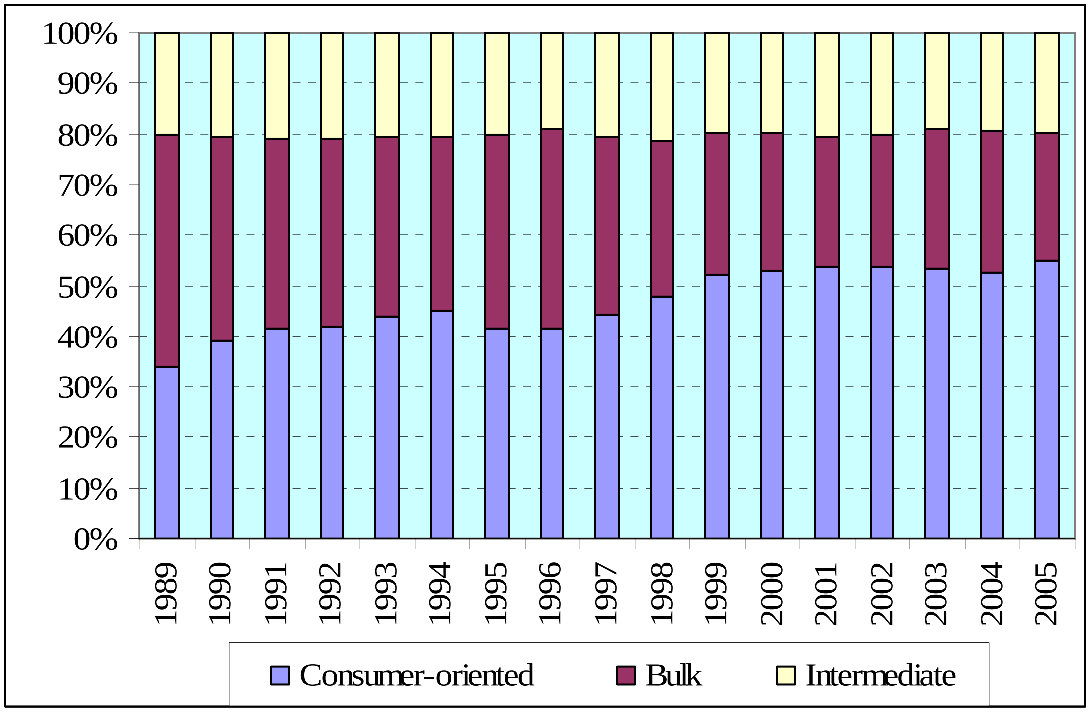

Figure 1. Share of Each Product Group in U.S. Agricultural Trade, 1989-2005

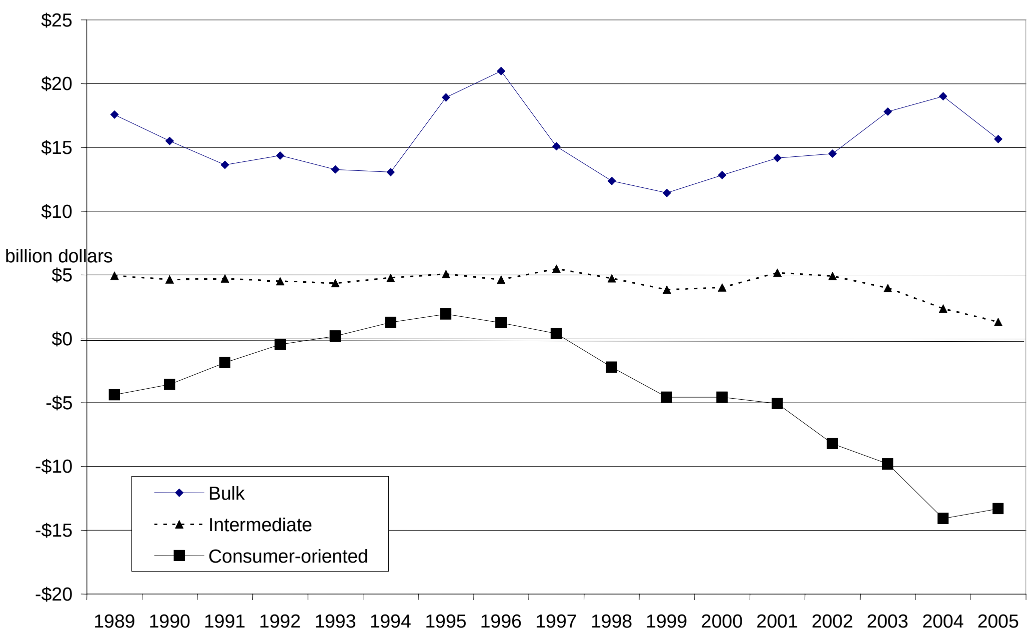

Figure 2. U.S. Agricultural Trade Balance by Group, 1989-2005

An Overview of U.S. Trade for Consumer-Oriented Products

USDA classifies traded agricultural products into bulk, intermediate, and consumer-oriented products. Bulk agricultural products include commodities that have received little or no processing such as wheat, corn, soybeans, and cotton. Intermediate products are those that have received some processing but are generally not ready for final consumption. These include products such as wheat flour, soybean meal, live animals, and hides and skins. Consumer-oriented products are those that are generally ready for final consumption, such as snack foods, meat and dairy products, processed or fresh fruits and vegetables, beverages, and other processed or ready-to-eat foods.

U.S. trade for consumer-oriented products increased from $21.14 billion in 1989 to $67.42 billion in 2005, an average annual increase of 7.52%. The rate of growth in trade has increased since 2002. While U.S. exports of consumer-oriented products were increasing at a significant pace prior to 1995, from $8.54 billion in 1989 to $19.06 billion in 1995, an average annual increase of 12.40%, U.S. imports of consumer-oriented products prior to 1995 were increasing at a relatively slower pace, from $12.61 billion to $16.68 billion during the same period, an average annual increase of 6.94% (Figure 3). As a result, the U.S. trade balance for consumer-oriented products improved from a deficit of $4.07 billion in 1989 to a surplus of $2.38 billion in 1995. After 1995, however, imports grew at a faster rate than exports. From 1995 to 2005, U.S. imports of consumer-oriented products increased from $16.68 billion to $40.07 billion, an average annual increase of 9.16%. Exports, meanwhile, increased from $19.06 billion in 1995 to $27.35 billion in 2005, an average annual increase of 3.68%. Consequently, the U.S. trade surplus became a deficit again in 1998, and this deficit grew to $13.55 billion in 2004. In ten years, the U.S. trade balance deteriorated by $15.93 billion. This deficit improved slightly to $12.73 billion in 2005.

Canada and Mexico are the most important countries for U.S. imports of consumer-oriented agricultural and food products. Due partly to the North American Free Trade Agreement (NAFTA), U.S. imports from these two countries increased from $2.86 billion in 1989 (accounting for 22.7% of U.S. total imports) to $15.82 billion in 2005 (accounting for 39.5% of U.S. total imports). U.S. imports have also increased rapidly from other important trading partners, including Australia, China, some of the European Union (EU) member countries (e.g., Belgium, France, Italy, the Netherlands, and the United Kingdom), and some Latin American countries (e.g., Chile, Colombia, Costa Rica, and Ecuador). U.S. imports from Australia (the third most important country after Canada and Mexico) increased from $0.77 billion in 1989 to $2.25 billion in 2005, an average annual increase of 6.89%. Imports from China jumped from $0.16 billion in 1989 to $1.19 billion in 2005, an average annual increase of 13.26%.

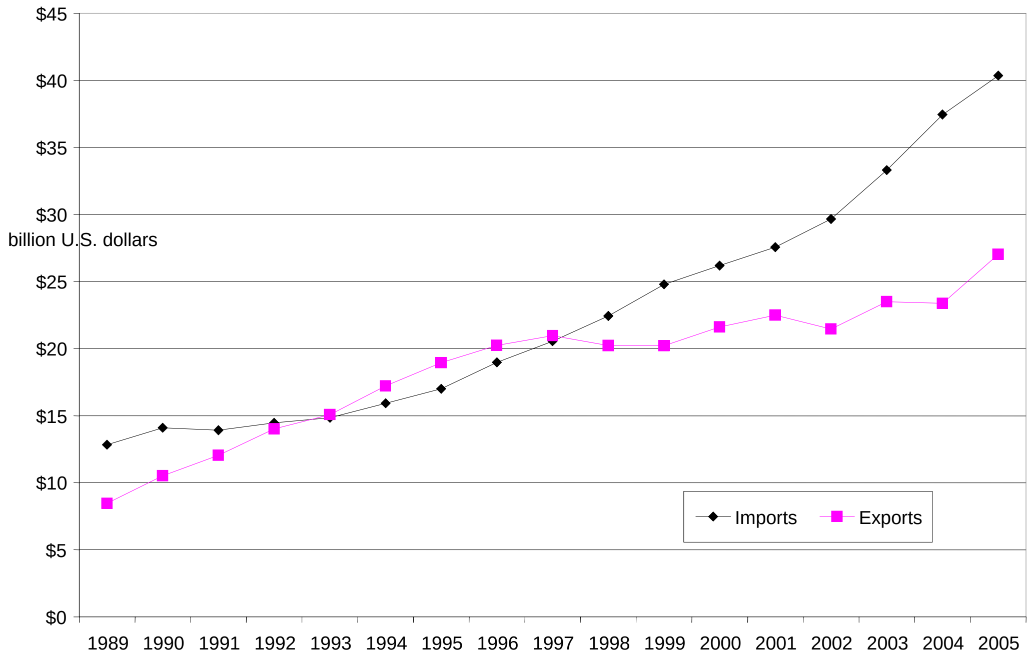

Figure 3. U.S. Trade in Consumer-Oriented Products, 1989-2005

U.S. exports to Canada and Mexico combined increased from $2.02 billion in 1989 (accounting for 23.7% of U.S. total exports) to $12.33 billion in 2005 (accounting for 45.09% of U.S. total exports). Japan was the single largest market for U.S. exports of consumer-oriented products in 1989. U.S. exports to Japan in 1989 accounted for 35.08% of total export, but this share dropped to 12.11% in 2005. Exports to Japan grew at a significant pace from $2.99 billion in 1989 to $5.36 billion in 1995. However, exports to Japan have declined since 1995, from $4.50 billion in 1998 (partly due to the Asian financial crisis in 1997-1998) to $3.31 billion in 2005. The rapid decrease in U.S. exports to Japan in recent years is mainly because of the trade restrictions imposed after the reported occurrence of bovine spongiform encephalopathy (BSE) in the state of Washington in December 2003. Red meats had been the leading U.S. export to Japan, but the country banned imports of U.S. beef soon after the BSE discovery. Other important markets for U.S. exports include South Korea, China, Philippines, and the EU member countries, including Belgium, France, Germany, Spain, the Netherlands, and the United Kingdom.

The primary types of consumer-oriented agricultural and food products imported and exported by the United States differ across the countries. For instance, while leading U.S. imports from the EU member countries are wine and beer, its leading imports from Canada are snack foods and red meats, and those from Mexico are fresh vegetables. By contrast, leading U.S. exports to the EU member countries are nuts, those to Canada are fresh or processed fruits and vegetables and snack foods, and those to Mexico and Japan are red meats.

Empirical Model

According to international trade theory, bilateral trade of a good is mainly influenced by the difference in prices of the good and bilateral exchange rate (Dixit and Norman 1980, Gandolfo 2001). Based on this notion, we specified a bilateral trade model of consumer-oriented products between the United States and its trading partners as a function of differences in the average prices of consumer-oriented products between the United States and its trading partners, bilateral exchange rate, and a vector of other variables as follows:

$$Q_t^{ex} = \alpha_0 + \alpha\,(P_t^f - P_t^{us}) + \beta\, RE_t^{us,f} + \sum_k \lambda_k \mathbf{Z_t} + \varepsilon_t \qquad (1)$$

where Q_t^{ex} is U.S. exports to a foreign country in time t, P_t^f and P_t^{us} are average prices of consumer-oriented agricultural and food products in the foreign country and the United States, respectively; $RE_t^{us,f}$ is the real exchange rate between the United States and the foreign country (foreign currency per U.S. dollar); $\mathbf{Z_t}$ is a vector of other independent variables that may affect bilateral trade between the United States and the foreign country; and ε_t is a random error term.

Other independent variables ($\mathbf{Z_t}$) may include consumer income, market openness, foreign direct investment (FDI), and a demographic variable that reflects the change of consumer tastes and preferences. As consumer income increases, demand for imports of high-value food products increases. Devadoss (1998) remarked that the food processing sector was growing due to increased consumer demand for differentiated products, and that U.S. demand for variety and differentiated products was the result of high per capita income and other factors. Market openness is another factor that potentially affects U.S. trade for consumer-oriented products. In particular, tariff and non-tariff trade barriers for consumer-oriented products are significant in most countries (Regmi et al. 2005). It is hypothesized that a more open foreign market would improve the U.S. trade balance for consumer-oriented products.

The relationship between foreign direct investment (FDI) and trade is subject to much debate. While many have argued that FDI and trade are complements (e.g., Koo and Uhm 2001; Bolling et al. 1998; Banerjee 1997), implying that an increase of U.S. FDI in a foreign country would result in an increase of U.S exports to that country, others have argued that FDI and trade are substitutes (e.g., Gopinath et al. 1999), implying that an increase of U.S. FDI in a foreign country would result in a decrease of U.S exports to that country. Some economists (e.g., Overend et al. 1997; Munirathinam et al. 1998; Melanoski et al. 1997; Somwaru and Bolling 1999) have argued that FDI-export relationship can be either a complement or substitute relationship depending on factors such as the state of economic development of the host country and the nature of the industry to which the FDI is directed.

An increase in foreign born population would increase U.S. import demand for consumer-oriented goods since these consumers have preferences to the food products from their home countries. According to the U.S. Census Bureau, the share of foreign born population in the United States has increased from 7.95% in 1990 to 12.04% in 2005. Three dummy variables are also added to Z_t^k to account for the effect of NAFTA, the impact of Asian financial crisis in 1997-1999, and the difference between developed and developing countries.

Annual time series data on average prices of consumer-oriented products are not available in most foreign countries. Thus, we use the bilateral trade volume of consumer-oriented products (TV_t), measured in dollars, between the United States and the foreign country as a proxy for the difference in prices. An increase in price difference between the United States and its trading partners would raise trade volume between them. Thus, equation (1) is rewritten as follows:

$$Q_t^{ex} = \alpha_0 + \alpha\ TV_t + \beta\ RE_t^{us,f} + \sum_k \gamma_k\ \mathbf{Z_t} + \varepsilon_t \qquad (2)$$

Since we are interested in modeling U.S. trade balance rather than exports only, we may use either an export to import ratio or U.S. export share (Q_t^{ex}/TV_t) as a dependent variable. In this study, we use export share instead of an export to import ratio based on the following reasons: (1) the export share ranges between zero and one and can be transformed into a logarithm form without being concerned about possible negative values for the actual trade balance; and (2) the export share variable is less susceptible to extreme observations and is defined even if there is only one-way trade between the United States and a trading partner. Note that the ratio of exports to imports (a traditional indirect measure of trade balance) is not defined in this case.

$\mathbf{Z_t}$ is replaced with per capita income in the United States (Y^{us}); per capita income in the foreign country (Y^f); market openness in the foreign country (OP), which is measured as the ratio of total trade volume to GDP; U.S. FDI in the foreign country (FDI_f^{us}); demographic change in the United States (*DEMO*), which is measured as the percentage of the U.S. population that is foreign born; and three dummy variables as discussed earlier. Assuming the model to be a log-linear equation, the empirical model (equation 2) becomes as follows:

$$ln(Q_t^{ex}/TV_t) = \alpha_0 + \alpha\ ln(TV_t) + \beta\ ln(RE_t^{us,f}) + \gamma_1\ ln(Y^{us}) + \gamma_2\ ln(Y^f) + \gamma_3 ln(OP) + \gamma_4\ ln(FDI_f^{us}) + \gamma_5 DEMO + \gamma_6\ D^{NAFTA} + \gamma_7\ D^{afc} + \gamma_8\ D^{dev} + \varepsilon_t \qquad (3)$$

The sign for α can be either positive or negative. If α >0, the U.S. trade balance improves with increased trade volume; and if α < 0, the U.S. trade balance deteriorate with increased trade volume. The sign for β is expected to be negative. The real exchange rate ($RE_t^{us,f}$) represents local currency per U.S. dollar. An increase in the real exchange rate means the depreciation of foreign currency relative to the U.S. dollar and thus disfavors U.S. exports to the foreign country.

The sign for γ_1 is expected to be negative. An increase in U.S. per capita income would increase demand for imports, and thus deteriorate the U.S. trade balance. The sign for γ_2 is expected to be positive. An increase in per capita income in a foreign country would lead the country to import more U.S. products and thus improve the U.S. trade balance. The sign for γ_3 is expected to be positive since the openness of foreign market is conducive to U.S. exports. The sign for γ_4 could be either positive or negative since the relationship between FDI and trade is ambiguous as we discussed earlier. The sign for γ_5 is expected to be negative since an increase of foreign born population would lead the United States to import more and thus deteriorate the U.S. trade balance. The sign for γ_6 is expected to be negative. While both U.S. exports and imports have increased under NAFTA, imports have grown at a faster pace than exports. The sign for γ_7 is expected to be negative since the Asian financial crisis decreased U.S. exports to Asian countries. The sign for γ_8 is expected to be negative since U.S. exports to the developed countries have increased slower than exports to the developing countries.

Data and Estimation Method

We use panel data covering a 16-year period from 1989 to 2005 and 28 countries, which include Argentina, Australia, Belgium, Brazil, Canada, Chile, China (mainland), Colombia, Costa Rica, Dominican Republic, Ecuador, France, Germany, India, Indonesia, Ireland, Italy, Japan, Korea, Mexico, Netherlands, Panama, Peru, Philippines, Spain, Thailand, United Kingdom, and Venezuela. These countries are the major U.S. trading partners, accounting for 81.4% of U.S total trade volume in consumer-oriented products during the period from 1989 to 2005.

Annual time series data for U.S. exports to and imports from foreign countries for consumer-oriented products are obtained from the USDA Foreign Agricultural Service (FAS) online database. These data are expressed in dollar terms instead of quantity terms because they measure the trade in an aggregate group of commodities. Annual time series data for FDI for the food industry are obtained from the U.S. Department of Commerce's Bureau of Economic Analysis (BEA). The BEA data measures FDI as sales by affiliates and as the investment position on a historical cost basis. Note that the industry classifications were based on Standard Industrial Classification (SIC) codes prior to 1999, while they have changed to the North American Industry Classification System (NAICS) beginning in 1999. This change of industry classification may have reduced slightly the magnitudes of FDI in the food industry after 1999. The annual time series data for real exchange rate (in terms of foreign currency per U.S. dollar) are obtained from the USDA's Economic Research Service (ERS) online database. Annual time series data for real per capita income (purchasing power parity adjusted real per capita GDP), consumer price index (CPI), population, total trade, total GDP are obtained from the World Bank's World Development Indicators (WDI) online database. The summary statistics of the panel data set are presented in Appendix.

Several potential econometric problems were addressed before estimation. First, U.S. trade balance might be affected by the lagged bilateral exchange rates. Previous studies on the hypothesized J-curve effect for agricultural products have mixed results. Carter and Pick (1989) and Doroodian et al (1999) found evidence supporting J-curve effects, while Baek et al (2006) argued there was no J-curve effect for U.S. agricultural trade. We used a Polynomial Distributed Lag (PDL) or the Almon model (Almon 1965) to determine whether or not lags of the exchange rate variable in equation 3 should be taken into consideration. We started with a lag of 6 years and chose 3 as the order of the polynomial, and found that all the coefficients for the lagged exchange rate variables are not statistically different from zero. For this reason, lagged exchange rate variables are not included in the model to capture the J-curve effect.

Second, non-stationarity of the data may lead to spurious estimation results (Entorf 1997). We evaluated the stationarity properties of the variables using both Pesaran (2003) and Levin, Lin and Chu (2002) panel unit root test methods. The test results are summarized in Table 1. All the variables under test were found to be stationary using both test methods.

Third, the bilateral trade volume variable, TV_t, in equation 3 is potentially correlated with the error term since it is a component of the dependent variable. The variable, FDI_f^{us}, in the equation may be endogenous as well. A firm's decision to invest in another country may be influenced by many factors such as the host country market size and economic stability in the host country. To test the exogeneity of the above two variables, we have used the Davidson-MacKinnon (1993) test.[2] The null hypotheses, which states that an OLS fixed effect model would result in consistent estimates, are rejected at a 1% level for both cases (Table 1), indicating that TV_t and FDI_f^{us} are endogenous variables.

[2] Davidson and MacKinnon show that this test, which is similar to the (Durbin-Wu-) Hausman test, will always yield a computable test statistic, whereas the Hausman test, depending on the difference of estimated covariance matrices being a positive definite matrix, often cannot be computed by standard matrix inverse methods.

Table 1 – Results of Panel Unit Root Tests and Other Tests

Variable	Levin-Lin-Chu Method	Pesaran Method
U.S. Exports Share, *ln*(Share)	-4.684***	-2.119**
	(0.000)	(0.025)
Bilateral Trade Volume, $ln(TV_t)$	-2.525***	-2.066**
	(0.006)	(0.045)
Real Exchange Rate, $ln(RE_t^{us,f})$	-6.889***	-2.738***
	(0.000)	(0.000)
U.S. Per Capita Income, $ln(Y^{us})$	na	na
Foreign Per Capita Income, $ln(Y^{f})$	-2.853***	-2.598***
	(0.002)	(0.000)
Foreign Market Openness, $ln(OP)$	-20.89***	-3.898***
	(0.000)	(0.000)
Foreign Direct Investment, $ln(FDI_f^{us})$	-7.261***	-2.378***
	(0.000)	(0.000)
U.S. Demographic Change, *DEMO*	na	na

Davidson-MacKinnon test of exogeneity for $ln(FDI_f^{us})$:
F(1, 440) = 69.14 (0.000)

Davidson-MacKinnon test of exogeneity for $ln(TV_t)$:
F(1, 440) = 69.14 (0.000)

Wooldridge test for serial correlation: F(1, 27) = 39.02 (0.000)

Likelihood-ratio test for heteroscedasticity: LR χ^2 (27) = 468.5 (0.000)

Note: Reported values include the t-bar statistic and the probability of the null hypothesis that the variable has unit root (in parenthesis). Panel unit root tests are irrelevant for U.S. per capita income and demographic change since there are no variations across the panels for these two variables. Asterisks *** and ** represent significance level at 1% and 5%, respectively. Tests are conducted in the presence of a constant only. The cases with a constant and a time trend are irrelevant for our study since no trend variables are included in our model.

The endogeneity problems for the above two variables are addressed through an instrumental variables estimation approach. For the bilateral trade volume variable, TV_t, the instrumental variables include the exogenous variables in equation 3 and three other variables. The first instrumental variable is the natural logarithm of the sum of real gross domestic products of the United States and the foreign country (*lnTGDP*). According to studies using gravity type models (e.g., Glick and Rose 2001; Rose and Wincoop 2001), the sum of income between two trading countries is strongly correlated with trade volume between the countries, but has no effects on the export share of a specific country. The second and the third instrumental variables are the natural logarithm of U.S. consumer price index (*lnUScpi*) and the natural logarithm of foreign consumer price index (*lnFcpi*). Consumer price indices in the home and foreign countries are strongly correlated with the bilateral trade volume while their correlations with export share of a specific country are very small. For U.S. FDI abroad, the instrumental variables include per capita GDP, real exchange rate volatility,[3] foreign consumer price index, and foreign market openness. While per capita GDP is a proxy for market size, real exchange rate volatility and foreign consumer price index reflect the economic stability of a country.

Finally, there are potential problems of heteroskedasticity and serial correlation, which are common symptoms for a panel data set. A likelihood-ratio test is performed for heteroskedasticity, and the null hypothesis is rejected at a 1% level, indicating the symptom of heteroskedasticity (Table 1). We also test for serial correlation using the test for panel data derived by Wooldridge (2002). Drukker (2003) has demonstrated that this test is attractive because it can be applied under general conditions and is easy to implement. The null hypothesis of no serial correlation is rejected at a 1% level, indicating the symptom of serial correlation. To tackle these problems in our estimation, we use the generalized least squares (GLS) estimation method to estimate our model. It is assumed that the error structure across the panels is heteroskedastic and that serial correlation across time is a panel-specific autoregressive process of order one.

Results and Discussion

The estimation results are summarized in Table 2. All the estimated parameters have the expected signs and most estimated coefficients are statistically significant at a 1% level. Specifically, the estimated coefficient for the bilateral trade volume variable, $ln(TV_t)$, is 0.499 and statistically significant at a 1% level. This implies that a 1% increase in TV_t (proxy for price difference between a foreign country and the United States), ceteris paribus, would increase U.S. export share by 0.499%. This indicates that the U.S. trade balance for consumer-oriented products would improve if trade volume increases.

[3] Exchange rate volatility is measured as the deviation from the three-year mean in absolute percentage terms.

Table 2 – Generalized Least Squares (GLS) Estimation Results

Parameters	Independent Variables	Estimates
α	Bilateral trade volume, $ln(TV_t)$	0.499*** (0.114)
β	Real exchange rate, $ln(RE_t^{us,f})$	-0.098*** (0.038)
γ_1	U.S. per capita income, $ln(Y^{us})$	-1.151*** (0.349)
γ_2	Foreign per capita income, $ln(Y^f)$	0.409*** (0.155)
γ_3	Foreign market openness, $ln(OP)$	0.037*** (0.008)
γ_4	Foreign direct investment, $ln(FDI_f^{us})$	-0.139*** (0.035)
γ_5	U.S. demographic change (*DEMO*)	-0.024 (0.022)
γ_6	Dummy for developed countries	-0.634*** (0.227)
γ_7	Dummy for NAFTA	-0.615** (0.305)
γ_8	Dummy for Asian financial crisis	-0.027 (0.021)
α_0	Intercept	5.188 (3.281)
	Number of Observations	476

Note: Dependent variable is U.S. export share. Standard errors are in parentheses. Asterisks *** and ** represent significance level at 1% and 5%, respectively.

The estimated coefficient for the bilateral exchange rate, $ln(RE_t^{us,f})$, is -0.098 and statistically significant at a 1% level. It means that a 1% increase of the exchange rate (i.e., U.S. dollar appreciates by 1% against foreign currencies), all other things being equal, would lead to a decrease of 0.098% in export share held by the United States. Appreciating the U.S. dollar would result in an increase in imports and a decrease in exports, resulting in a decrease in export share.

The estimated parameter for U.S. per capita income is -1.151 and is statistically significant at a 1% level, implying that a 1% increase of U.S. per capita income, ceteris paribus, would decrease U.S. export share by 1.151%. This reflects that as per capita income increases in the United States, U.S. imports of consumer-oriented goods increase faster than U.S. exports. The estimated parameter for per capita income in foreign countries is 0.409 and is statistically significant at a 1% level, indicating that a 1% increase of foreign per capita income, all other things being equal, would lead to an increase of 0.409% of export share held by the United States. In other words, as per capita income increases in foreign countries, their imports of consumer-oriented products from the United States will grow faster than their exports. Furthermore, it is worth to note that U.S. export share is much more sensitive to U.S. income than foreign income.

The estimated parameter for foreign market openness is 0.037 and is statistically significant at a 1% level. Market openness of U.S. trading partners has a positive impact on the U.S. trade balance for consumer-oriented products. The estimated coefficient for the U.S. FDI variable is -0.139 and is statistically significant at a 1% level. This implies that a 1% increase of U.S. foreign direct investment in the foreign countries would lead to a decrease of 0.139% in U.S. export share of consumer-oriented products. The result suggests that FDI and exports of consumer-oriented products have a substitute relationship. U.S. multinationals in the processed food industry tend to move capital investment into foreign countries to produce consumer-oriented final goods and market them in the countries rather than shipping from the United States. The estimated coefficient for the U.S. demographic variable is -0.024, but it is not statistically significant.

The estimated coefficient for the dummy variable of developed countries is -0.634 and is statistically significant at a 1% level. This indicates that U.S. export share of consumer-oriented products have tended to be lower in the developed countries than in the developing countries. The estimated parameter for the dummy variable of NAFTA is -0.615 and is statistically significant at a 5% level. This suggests that NAFTA has a significant negative impact on U.S. trade balance of consumer-oriented products. This is because U.S. imports from Canada and Mexico have increased much faster than its exports to the two countries under NAFTA. The estimated coefficient for the dummy variable of Asian financial crisis is -0.027, but it is not statistically significant.

Summary and Conclusions

U.S. agricultural trade surplus has declined significantly from $26.91 billion in 1996 to just $3.86 billion in 2005. Much of the decline is due to the rapid increase in U.S. trade deficit for consumer-oriented products. So far, few studies have looked at this critical issue for U.S. agricultural trade. In this study, we investigate the reasons behind the growing U.S. trade deficit in consumer-oriented products, using a panel data set covering 28 countries and a time period of 16 years, from 1989 to 2005. An empirical trade model is derived based on international trade theory. The generalized least squares estimator is used to estimate the parameters of the model. The potential endogeneity problems associated with the bilateral trade volume and foreign direct investment are tackled through an instrumental variables estimation approach.

The estimated parameters have expected signs for all variables and most are statistically significant at a 1% level. Per capita income in the United States appears to be the most important determinant of U.S. trade balance in consumer-oriented products. A 1% increase of U.S. consumer income, ceteris paribus, would decrease U.S. export share by 1.151%. The estimated results suggest that an increase in per capita income and trade liberalization in foreign countries would improve U.S. trade balance. U.S. FDI abroad in food processing has increased in recent years, and this is found to have a negative effect on U.S. trade balance. The results also suggest that a strong U.S. dollar and NAFTA deteriorate U.S. trade balance.

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Appendix: Summary Statistics of the Panel Data Set

Variable		Mean	Standard Deviation	Minimum	Maximun	Observations	
U.S. export share	overall	0.326	0.262	0.008	0.963	N =	476
	between		0.256	0.035	0.945	n =	28
	within		0.075	0.024	0.630	T =	17
Bilateral trade volume	overall	1198.5	2149.7	14.9	16805.5	N =	476
	between		1966.4	91.0	9187.7	n =	28
	within		940.5	-5120.4	8816.3	T =	17
Real exchange rate	overall	1047.0	3505.7	0.55	25566	N =	476
	between		3501.7	0.62	17723	n =	28
	within		664.4	-1697	8890	T =	17
U.S. per capita income	overall	31935	2971	27990	37437	N =	476
	between		0	31935	31935	n =	28
	within		2971	27990	37437	T =	17
Foreign per capita income	overall	13346	9405	1565	36621	N =	476
	between		9308	2207	26186	n =	28
	within		2176	3290	25397	T =	17
Foreign market openness	overall	65.6	38.9	13.2	198.8	N =	476
	between		37.7	19.4	158.7	n =	28
	within		11.9	28.1	113.5	T =	17
U.S. FDI abroad	overall	806.3	1181.7	0.01	9011	N =	476
	between		990.5	17.7	3677	n =	28
	within		669.7	-970.9	7478	T =	17
Share of foreign born population in USA	overall	9.81	1.43	7.95	12.04	N =	476
	between		0	9.81	9.81	n =	28
	within		1.43	7.95	12.04	T =	17
U.S. consumer price index	overall	92.9	11.9	72.0	113.4	N =	476
	between		0	92.9	92.9	n =	28
	within		11.9	72.0	113.4	T =	17
Foreign consumer price index	overall	86.5	35.1	0.0001	274.5	N =	476
	between		10.2	64.0	97.7	n =	28
	within		33.6	-9.4	282.6	T =	17
Foreign gross demostic products	overall	836.4	1051.5	10.3	7667.9	N =	476
	between		1000.3	16.0	4137.1	n =	28
	within		372.5	-1550.6	4367.2	T =	17

Note: Bilateral trade volume is in million U.S. dollars. Per capita income is in the form of PPP (purchasing power parity) adjusted per capita GDP on the base year 2000. Real exchange rate is in local currency per U.S. dollar. Share of foreign born population is in percentage.