The Growing U.S. Trade Deficit in Consumer-Oriented Agricultural Products

Renan Zhuang
Research Assistant Professor
Center for Agricultural Policy and Trade Studies
Department of Agribusiness and Applied Economics
North Dakota State University
207B Morrill Hall, Fargo, ND 58105
Email: renan.zhuang@ndsu.edu
Tel.: (701)231-8993, Fax: (701)231-7400

Won W. Koo
Chamber of Commerce Distinguished Professor and Director
Center for Agricultural Policy and Trade Studies
Department of Agribusiness and Applied Economics,
North Dakota State University
209B Morrill Hall, Fargo, ND 58105
Email: won.koo@ndsu.edu
Tel.: (701)231-7448, Fax: (701)231-7400

Jeremy W. Mattson
Research Associate
Center for Agricultural Policy and Trade Studies
Department of Agribusiness and Applied Economics,
North Dakota State University
207A Morrill Hall, Fargo, ND 58105
Email: jeremy.w.mattson@ndsu.edu
Tel.: (701)231-8945, Fax: (701)231-7400

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Abstract

We investigate the factors behind the growing U.S. trade deficit in consumer-oriented agricultural 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. An increase in per capita income and trade liberalization in foreign countries would improve U.S. trade balance. U.S. foreign direct investment abroad in food manufactures, a strong U.S. dollar and NAFTA are found to have negative effects on U.S. trade balance.

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

JEL Classification: F14, Q17

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1. Introduction

According to the U.S. Department of Agriculture (USDA), U.S. agricultural trade has increased steadily over time, jumping from $61.91 billion (U.S. dollars) 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, U.S. trade surplus has declined from $26.91 billion in 1996 to just $3.86 billion in 2005.

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, etc. Intermediate agricultural 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, etc. Consumer-oriented agricultural 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 (See Appendix 1 for details).

Comparisons between U.S. trade situations by group provide us the following two insights. First, the importance of consumer-oriented agricultural products in U.S. total agricultural trade has increased over time. Specifically, the share of consumer-oriented agricultural products in U.S. total agricultural trade has increased from 34% in 1989 to 55% in 2005 (Figure 1). By contrast, the share of bulk agricultural products has decreased from 46% in 1989 to 25% in 2005. The share of intermediate agricultural products has been around 20% over the entire period from 1989 to 2005. Second, the decline in U.S. total agricultural trade surplus is mainly due to the increase in the trade deficit for consumer-oriented agricultural products. Figure 2 shows the changes of trade balances for consumer-oriented, bulk, and intermediate agricultural products. U.S. trade surplus for the bulk agricultural products has fluctuated around $15.08 billion with a standard deviation of $2.68 billion. U.S. trade surplus for the intermediate agricultural products was around $4.60 billion prior to 2002 and decreased to $1.21 billion in 2005. By contrast, U.S. trade balance for consumer-oriented agricultural products has declined sharply from a trade surplus of $2.38 billion (a record high in history) in 1995 to a trade deficit of $12.73 billion in 2005.

What are the reasons behind the rapid increase in U.S. trade deficit for consumer-oriented agricultural products? So far, there are essentially no studies in the existing literature that have looked at this critical issue. The objective of this study is to identify the determinants for U.S. trade of consumer-oriented agricultural products, using an empirical trade model derived from international trade theory. Note that most economists do not believe that trade deficits are inherently good or bad, but must be judged based on the circumstances in which they arose. One thing is clear that trade deficit in consumer-oriented agricultural products leads to higher consumption for the current generations. This is in contrast to a trade deficit in supporting domestic investment, which leads to higher consumption in the future. It is not our attempt in this study to argue whether a trade deficit is good or bad. Rather, we attempt to explain why the U.S. trade competitiveness in consumer-oriented agricultural products has decreased over the past decade.

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]. Section 3 derives an empirical model used for this study. Section 4 discusses data and estimation method. Section 5 presents estimation results and discusses our findings. The final section presents conclusions of the paper.

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

As shown in Figure 3, U.S. trade for consumer-oriented agricultural products has increased from $21.14 billion in 1989 to $67.42 billion in 2005, an average annual increase of 7.52%. The trade has increased at an even faster pace since 2002. While U.S. exports of consumer-oriented agricultural 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 agricultural products prior to 1995 were increasing at a relatively slower pace, from $12.61 billion to $16.68 billion for the same period, an average annual increase of 6.94%. As a result, U.S. trade balance for consumer-oriented agricultural products improved from a deficit of $4.07 billion in 1989 to a surplus of $2.38 billion in 1995. After 1995, imports grew at a faster rate than exports. From 1995 to 2005, U.S. imports of consumer-oriented agricultural products increased from $16.68 billion to $40.07 billion, an average annual increase of 9.16%. Exports, however, increased from $19.06 billion in 1995 to $27.35 billion in 2005, an average annual increase of 3.68%. Consequently, U.S. trade surplus became a deficit again in 1998, and this deficit grew to $13.55 billion in 2004. In ten years, 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 products. Partly thanks to the North American Free Trade Agreement (NAFTA), U.S. imports from these two countries increased from $2.86 billion in 1989 (accounted for 22.7% of U.S. total imports) to $15.82 billion in 2005 (accounted 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 Untied 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, and 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%.

U.S. exports to Canada and Mexico combined increased from $2.02 billion 1989 (accounted for 23.7% of U.S. total exports) to $12.33 billion in 2005 (accounted for 45.09% of U.S. total exports). Japan was the single largest market for U.S. exports of consumer-oriented agricultural products in 1989. U.S. exports to Japan in 1989 accounted for 35.08% of its 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, a record high in history. 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 reported occurrence of mad cow disease in the state of Washington, USA, in December 2003. Red meats have been U.S. leading export products to its trading partners, particularly Japan. Soon after the reported occurrence of mad cow disease, Japan banned imports of U.S. beef. 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 products imported and exported by the United States differ across the countries. For instance, while U.S. leading 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, U.S. leading 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.

3. 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 foreign country in time t, P_t^f and P_t^{us} are average prices of consumer-oriented agricultural and food products in foreign country and the United States, respectively; $RE_t^{us,f}$ is real exchange rate between the United States and 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 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 U.S. trade balance for consumer-oriented products. The relationship between FDI and trade is subject to much debate. While many argued 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 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; Malanoski et al, 1997; Somwaru and Bolling, 1999) 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. 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. 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. In addition, three dummy variables are 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. Following Koo and Zhuang (2007), we use the bilateral trade value of consumer-oriented products (TV_t) between the United States and 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 value between them and vice versa. 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 its 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 from the United States to its trading partners. Note that the ratio of exports to imports (a traditional indirect measure of trade balance) is not defined in this case.

Replacing $\mathbf{Z_t}$ with per capita income in the United States (Y^{us}), per capita income in foreign country (Y^f), market openness in the foreign country (OP) [2], U.S. FDI in foreign country (FDI_f^{us}), demographic change in the United States (*DEMO*), and three dummy variables as we discussed earlier, and 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 bilateral trade value. If α < 0, the U.S. trade balance deteriorate with increased bilateral trade value. 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 foreign country would lead the country to import more of U.S. products and thus improve 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 is inconclusive 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.

4. Data and Estimation Method

We use a panel data covering 16-year period from 1989 to 2005 and 28 countries, based on data availability. The 28 countries 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 U.S. major trading partners, accounting for 81.4% of U.S total trade volume in consumer-oriented products on the average 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 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 2.

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. Cater and Pick (1989) and Doroodian et al (1999) found evidences 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[3]. For this reason, lagged exchange rate variables are not included in the model to capture the J-curve effect.

Second, non-staitonarity 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 [4]. The null hypotheses which state 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.

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 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*). Koo and Zhuang (2007) found that the natural logarithm of the consumer price indices in the home and foreign countries are strongly correlated with the natural logarithm of 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 [5], 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 panel data set. We have performed a likelihood-ratio test for heteroskedasticity. The null hypothesis is rejected at a 1% level, indicating the symptom of heteroskedasticity (Table 1). We have also tested 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 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.

5. 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 value variable, $ln(TV_t)$, is 0.499 and statistically significant at a 1% level. This implies that a 1% increase in U.S. bilateral trade value with its trading partners (TV_t), ceteris paribus, would increase U.S. export share by 0.499%. In other word, the U.S. trade balance for consumer-oriented agricultural products would improve if U.S. bilateral trade value with other countries increases. While U.S. export share has decreased with the increase of bilateral trade in the cases for Canada and Mexico as discussed earlier, U.S. export share has increased with the increase of bilateral trade in the cases for China, India, and most other countries. Since each U.S. trading partner is equally weighted in our regression, an increase in U.S. bilateral trade with its trading partners would, on the average, lead to an increase in U.S. export share in consumer-oriented agricultural products.

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 against foreign currencies would make the U.S. products more expensive relative to the corresponding foreign products. Thus, it would lead to an increase in U.S. imports and a decrease in U.S. exports, resulting in a decrease in U.S. 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 agricultural products 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 agricultural 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 its income than foreign income.

The estimated parameter for foreign market openness is 0.037 and is statistically significant at a 1% level. This indicates that an open market of U.S. trading partners would have a positive impact on U.S. trade balance for consumer-oriented agricultural products. The estimated coefficient for U.S. FDI variable is -01.39 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 agricultural products. The result suggests that FDI and exports of consumer-oriented agricultural products have a substitute relationship, which is consistent with the findings by Gopinath et al (1999). 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 (*DEMO*) is -0.024, which has expected negative sign but 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 agricultural products in the developed countries have tended to be lower than in the developing countries. Therefore, the United States should promote its trade with developing countries to improve its trade deficit in consumer-oriented agricultural products. 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 agricultural 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, which has expected negative sign but is not statistically significant.

6. 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 agricultural products. So far, there are essentially no studies in the existing literature that have looked at this critical issue for U.S. agricultural trade.

In this study, we have investigated the determinants behind the growing U.S. trade deficit in consumer-oriented agricultural products, using a panel data set covering 28 countries and a time period of 25 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 in consumer-oriented agricultural products. U.S. FDI abroad in food manufactures has increased in recent years, and this is found to have a negative effect on U.S. trade balance in consumer-oriented agricultural products. The results also suggest that a strong U.S. dollar and NAFTA deteriorate U.S. trade balance in consumer-oriented agricultural products.

Endnotes:

[1] Data is not available prior to 1989.

[2] Market openness is defined as the ratio of total trade volume to GDP.

[3] The regression and test results are not reported here to conserve space. These are available form the authors on request.

[4] Davision 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.

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

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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.

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.

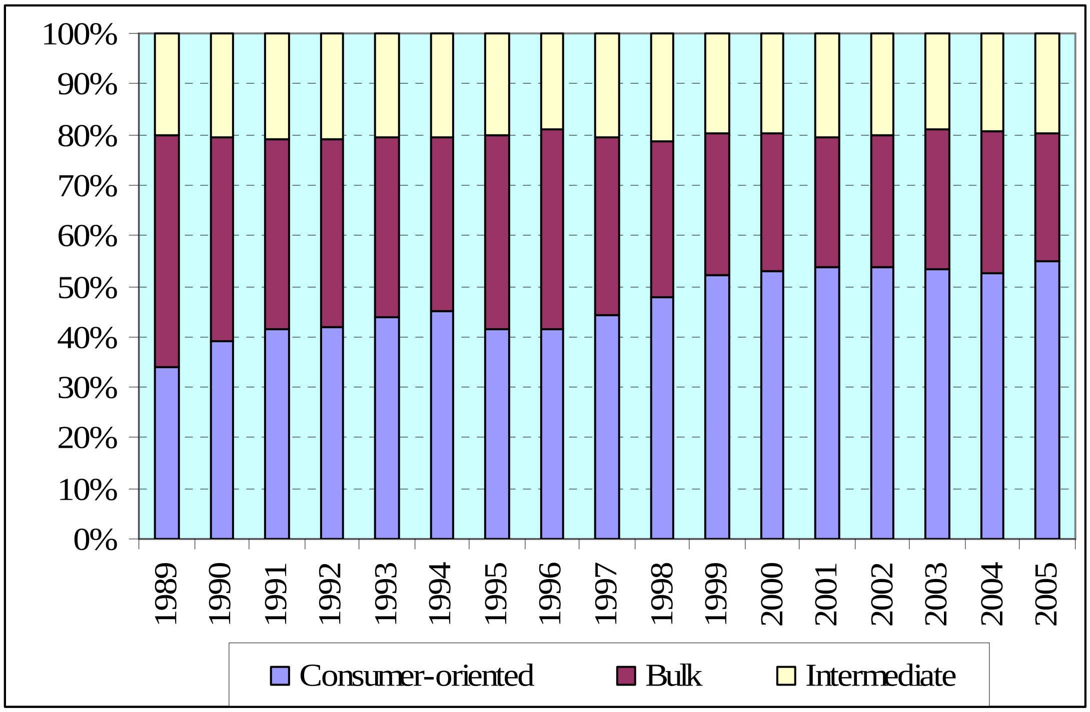

Figure 1 – Share of Each Group Products in U.S. Agricultural Trade in 1989-2005

Note: 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, etc. 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, etc. 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.

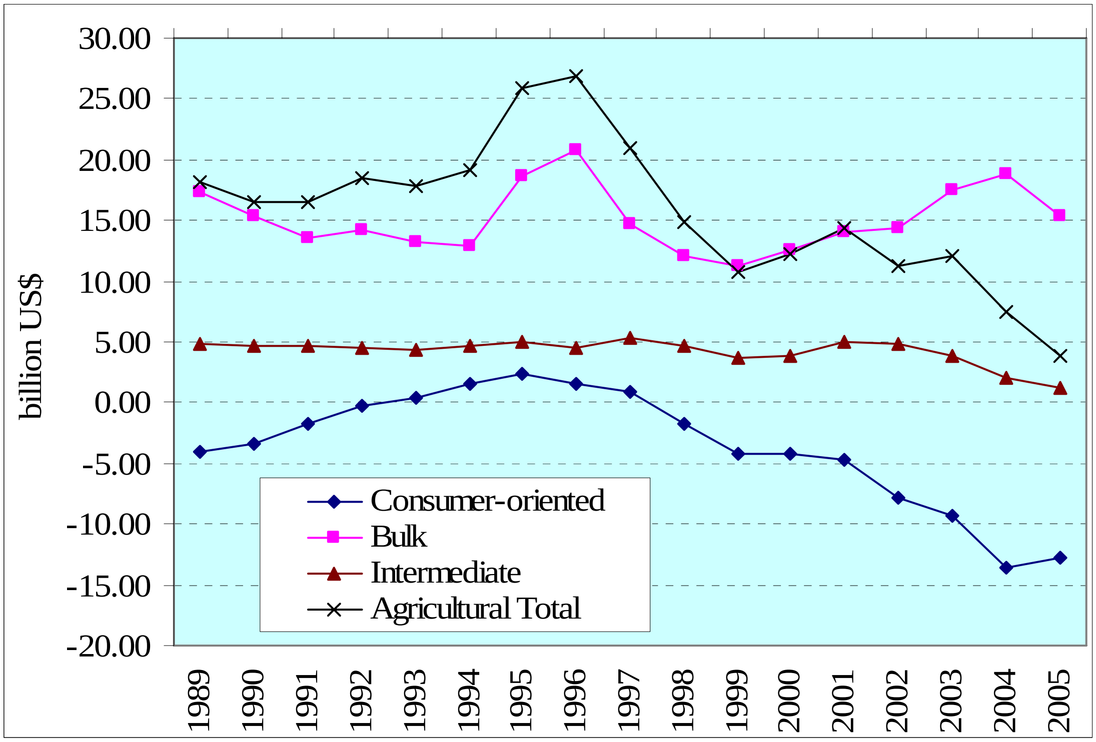

Figure 2 – U.S. Trade Balance by Group in 1989 – 2005

Note: 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, etc. 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, etc. 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.

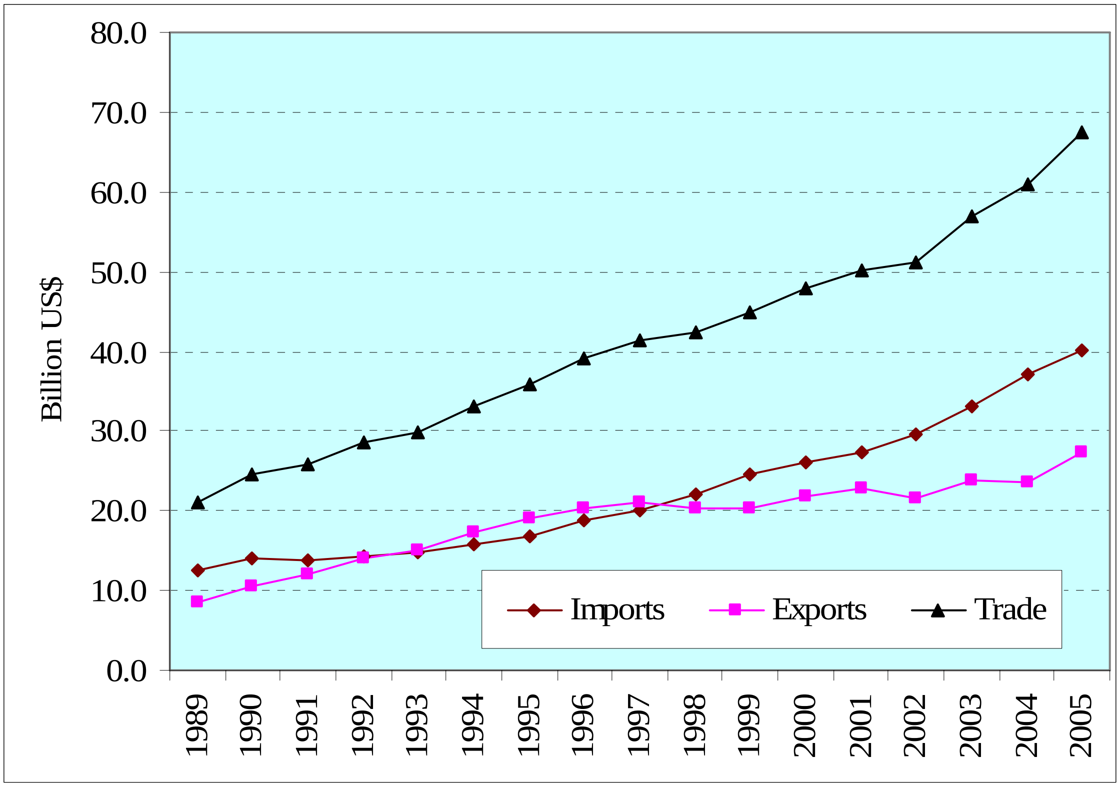

Figure 3 – U.S. Trade for Consumer-Oriented Agricultural Products in 1989 – 2005

Appendix 1: U.S. Bulk, Intermediate, and Consumer-Oriented Commodity Aggregations

Bulk Agricultural Products	
Wheat	Coarse Grains
Rice	Tobacco
Rubber & Allied Products	Coffee, Unroasted
Cocoa Beans	Tea and Herb
Raw Beet and Cane Sugar	Other Bulk Commodities
Intermediate Agricultural Products	
Tropical Oils	Other Vegetable Oils
Feed and Fodders	Live Animals
Hide and Skins	Planting Seeds
Sugar and Sweeteners	Essential Oils
Cocoa Paste and Cocoa Butter	Other Intermediate Products
Consumer-Oriented Agricultural Products	
Snack Foods	Red Meats, (Fresh, Chilled, and Frozen)
Red Meats (Preparations)	Cheese
Other Dairy Products	Bananas and Plantains
Other Fresh Fruit	Fresh Vegetables
Processed Fruit and Vegetables	Fruit and Vegetable Juices
Tree Nuts	Wind and Beer
Nursery Products	Roasted and Instant Coffee
Spices	Other Consumer-Oriented

Source: U.S. Department of Agriculture/Foreign Agricultural Service.
http://www.fas.usda.gov/USTrade/ustlists/ImBICOGrp.asp?QI=
Note: The commodity codes are derived from the Harmonized Tariff System (HTS) to the 6-digit level for generalized categories. The U.S. defines products using 10-digit HTS codes. While exports codes are administered by the U.S. Census Bureau, imports codes are administered by the U.S. International Trade Commission.

Appendix 1: 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.