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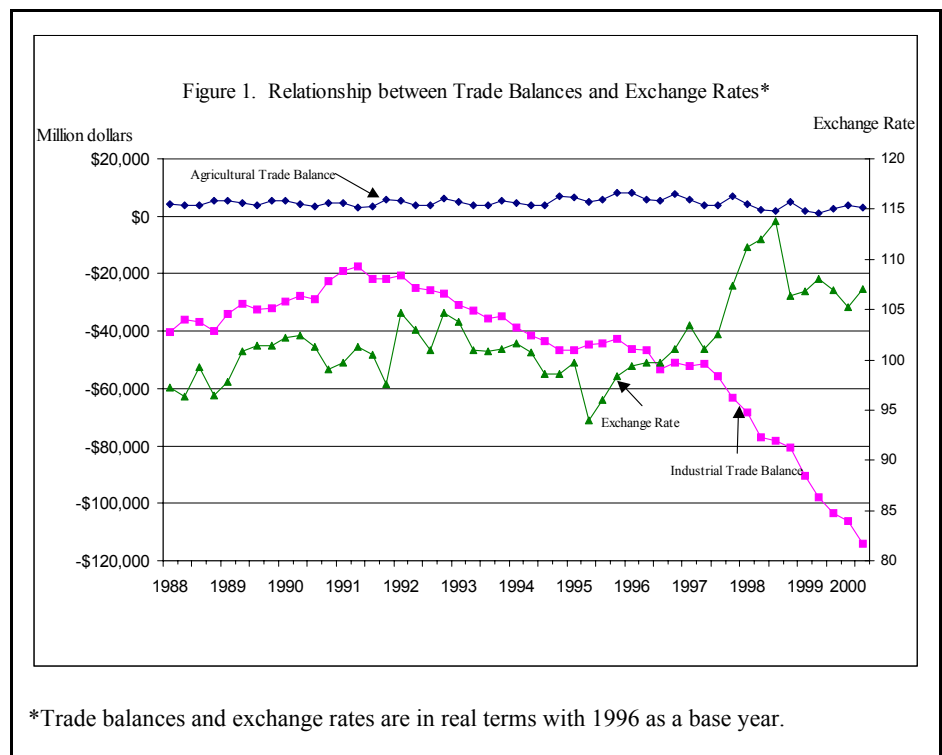
The U.S. dollar has been strong relative to the major world currencies since 1995. This newsletter focuses on the issue of exchange rate effects on U.S. agricultural trade. The first two sections were largely contributed by Mina Kim, and the other two sections by Hyun Jin and Edwin Sun, respectively. All of the contributors are research assistant professors in the Center.
-Won W. Koo, Director

THE ROLE OF THE EXCHANGE RATE IN THE U.S. ECONOMY

Changes in U.S. dollar value are generally believed to be one of the main determinants of U.S. international trade. Between 1987 and 2000, the U.S. real trade-weighted exchange rates appreciated by more than 6%. Appreciation of the U.S. dollar relative to other currencies makes U.S. products more expensive in foreign markets, leading to a decrease in demand for U.S. products in foreign markets, while U.S. import demand for foreign goods increases. The U.S. agricultural trade surplus declined by 16.4%, while the industrial trade deficit rose by 143.8% during the same period (Figure 1). In order to analyze the impact of changes in exchange rates on the U.S. agricultural and industrial sectors, both the vector error correction and the vector moving average representation models are utilized.

Quarterly aggregated measurements of five variables from 1987 to 2000 are used: U.S. dollar values relative to foreign currencies, U.S. trade balance, U.S. domestic income, domestic price, and interest rates for both the agricultural and industrial sectors.

The exchange rate is found to have a pervasive effect on trade and the economy in both U.S. sectors. However, the effect of an exchange rate shock on the agricultural sector is larger than that on the industrial sector. For example, the agricultural trade surplus declines by 2.00% in the long-run when the U.S. dollar appreciates by 1%, whereas the industrial trade deficit increases by 1.23%. Agricultural prices fall by 0.93%, while industrial prices decrease by only 0.47%. U.S. industry, in general, trades both consumer goods and raw materials. When the U.S. dollar appreciates relative to foreign currencies, imported raw materials become cheaper and production costs of output produced from these raw materials decrease. As a result, the industrial sector can recover from the decrease in exports. In contrast, imported agricultural inputs are processed for domestic consumption rather than for export. This implies that, unlike



the industrial sector, importing an increased volume of raw material does not nullify the initial effects of exchange rate appreciation in the agricultural sector.

The agricultural sector has a longer length of deviation from the long-run equilibrium when a certain shock is given, indicating that the agricultural sector might suffer more than the industrial sector when trade distortion occurs. It takes 3.58 quarters for the agricultural trade balance to eliminate the shock, whereas it takes 2.54 quarters for the industrial trade balance. The agricultural price adjusts to the long-run equilibrium slower (4 to 6 quarters) than industrial price (3 to 5 quarters) does.

Exchange rates only function exogenously in the agricultural sector, meaning they compel the agricultural sector to deviate from the long-run equilibrium but are not influenced by the sector in return. By contrast, exchange rates act both endogenously and exogenously in the industrial sector. The exchange rate is the greatest contributing factor which forces the industrial sector to deviate from the long-run equilibrium, as well as the most responsive variable to shocks within the industrial sector. Both the agricultural and industrial trade balances immediately decline 2.0% and 1.23%, respectively, due to a 1% appreciation of the U.S. dollar value. However, the exchange rate reacts by less than 1% to a 1% change in industrial trade balance.

EXCHANGE RATE EFFECTS ON U.S.-CANADA AGRICULTURAL TRADE

The U.S. agricultural trade deficit with Canada has increased rapidly within the last two decades. In the first quarter of 1981, the United States had a \$227 million surplus in its agricultural trade with Canada, but it fell into a trade deficit by the third quarter of 1982. This deficit increased to \$817 million by the fourth quarter of 2000. Five quarterly measurements from 1983 to 2000 are used in this analysis: U.S.-Canada exchange rate, U.S. exports to Canada, U.S. imports from Canada, U.S. agricultural price, and U.S. agricultural income. It is confirmed that the U.S.-Canada exchange rate functions exogenously, implying that it affects the U.S. agricultural sector but is not affected by other variables in the sector.

The exchange rate is found to have significant short- and long-run influences, although the magnitude of the impact is minimal. Both U.S. exports and imports respond in the short-run by less than 0.2% to a 1% shock in the U.S.-Canada exchange rate, while U.S. income decreases by 0.011%. However, in the long-run, the effects of the exchange rate on U.S. imports from Canada and U.S. agricultural income are larger. U.S. imports from Canada rise by 0.54% and U.S. agricultural income decreases by 1.55%. Because of the interdependency among major economies, changes in the U.S. dollar value against the Canadian dollar may affect other currencies in the same direction, resulting in significant changes in U.S. agricultural income. This result indicates that the exchange rate affects U.S. imports from Canada more than U.S. exports. There might exist some factors other than the exchange rate which affect U.S. exports, so that the effect of the exchange rate is nullified in the long-run.

Furthermore, U.S. agricultural income has a long-run impact on U.S.-Canada bilateral trade. U.S. exports decrease by 0.082%, and U.S. imports increase by 0.084%, when the income grows by 1%.

When a certain shock is given to agricultural bilateral trade, it takes more than a year for both U.S. exports and imports to recover their long-run equilibrium positions (3 to 5 quarters are needed for U.S. exports, and about 7 quarters for U.S. imports). Meanwhile, U.S. prices adjust very slowly (only 9.8% in one quarter) to the long-run equilibrium.

EFFECTS OF EXCHANGE RATE RISK ON U.S. MARKET SHARE IN ASIA

U.S. wheat market shares in Asia have decreased from 63% in 1980 to 38% in the current year. The drop in the U.S. market share is associated with displaced sales by competing suppliers, such as Canada and Australia. The market shares of all three exporting countries in East and South-East Asian countries are, on average, more than 90% of the total market shares for the sample years 1973 to 2000. Canadian and Australian wheat exports have increased

dramatically at the expense of the United States. When compared to trade statistics from the early 1970s, Canada's wheat exports have increased by 40% and Australia's exports by 100%. To analyze the impact of the two competitors on U.S. wheat exports to Asian countries, a third country effect model is developed and applied to the data on U.S. market shares in this region.

The decision maker's objective in an import market is to maximize the *mean-variance utility* with respect to purchasing costs; the objective function is a minimization of purchasing costs subject to the risk associated with those costs. Market share demand functions are obtained from the objective function.

The model is expanded by considering three exporting countries: the United States, Canada, and Australia. Wheat is priced in the exporters' currencies so that importers face two risk components: wheat price and exchange rate variations. If a representative importer minimizes real purchasing costs, the remaining variables of interest are the future values and volatilities of wheat prices and of exchange rates toward the three exporting countries.

The dependent variable is U.S. market shares of the wheat trade in ten Asian countries. Explanatory variables include a relative measure of competitiveness among the United States, Canada, and Australia, exchange rates between the importing and exporting countries, and volatility in the exchange rates. The data consists of U.S. market shares in the Asian countries (China, Hong Kong, Indonesia, Thailand, Taiwan, Singapore, Philippines, Malaysia, S. Korea, and Japan), average wheat export prices of the three exporting countries, and real exchange rates between the importing countries and exporting countries. The data ranges from 1973 to 2000 by fiscal year.

The overall empirical results show that relative wheat export prices between the United States and its competitors and exchange rates between the Asian and the exporting countries are not statistically significant. However, the volatilities in the exchange rates are found to be significant. This result suggests that U.S. wheat exports to Asian countries are influenced by volatilities in the U.S. dollar value against the importing and the other exporting countries' currencies.

Importers pay a specific price in the exporters' currencies at the time of delivery, and so face currency risk in the time between the contract and delivery. This suggests that importers are sensitive to exchange rate variations. Importers may reduce the risk associated with the currency variations by participating in currency futures markets.

EXCHANGE RATE VOLATILITY IN WORLD WHEAT TRADE

International wheat trade has exhibited several striking features during last two decades. Although the total volume of wheat traded worldwide has remained relatively stable, around 100 million tons, the market has been quite dynamic from the perspectives of both individual exporters and importers. Among the major exporters, Argentina and Australia have been rapidly expanding their market shares, while the United States, the largest exporter, has lost its market share. More importantly, importer loyalty has been shifting among the major exporters. Consequently, a natural question is what are the driving forces behind the changing world matrix of wheat trade?

Uncertainty in exchange rates has generally been perceived as one of the main determinants of international trade, which is also true for wheat trade. In this study, the effect of exchange rate uncertainty on wheat trade worldwide is evaluated using a modified gravity-type model, which contains variables such as the population in both exporting and importing countries, the per capita wheat production in the countries, the per capita gross domestic product in the countries, the ocean freight rate as a proxy of the transportation costs in the countries, and the real exchange rate volatility of the U.S. dollar against importing countries' currencies. In addition, to capture any effect from the regional trade agreement, a dummy variable for the Asian Pacific Economic Cooperative (APEC) is added.

The trade between five exporters (United States, Canada, European Union, Australia, and Argentina) and thirteen major importers during last two decades is analyzed. Short-term and long-term measures of exchange rate volatility are constructed and compared. Special attention is also given to the econometric properties of the gravity model within the panel framework.

All the variables have their expected effects. The population variables, as the indication of market size, show that bigger countries tend to trade more (a 10% increase in population would increase trade by around 11 to 15%). Income growth in both exporting and importing countries have insignificant effects. These results are not a surprise considering that wheat is food and a necessity. Wheat production capacity has highly significant effects, indicating that international wheat trade is closely related to resource endowment for wheat production in each country. In addition, the trade agreement dummy for APEC has a strong positive effect, but the ocean freight rate has an insignificant effect in explaining wheat exports.

Measures of both short-term and long-term exchange rate volatility show a negative effect on world wheat trade, and the long-term effect is quite large. A 10% increase of volatility would result in a 1.4% reduction in wheat trade worldwide in the short-term, or 3.4% in the long-term. This result implies that exchange rate volatility is an important factor in explaining worldwide wheat trade patterns and cannot be neglected.

For more information on this research, please contact Beth Ambrosio, Center for Agricultural Policy and Trade Studies, NDSU at (701) 231-7334 or download upcoming publications from this website:
<http://www.ag.ndsu.nodak.edu/capts/publication.htm>

North Dakota State University
Dept. of Agribusiness & Applied Economics
P.O. Box 5636
Fargo, ND 58105-5636

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