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# Exchange Rate Impacts on the Composition of Agricultural Trade

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## **EXCHANGE RATE IMPACTS ON THE COMPOSITION OF AGRICULTURAL TRADE**

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### **Summary**

This paper analyzes the impact of real exchange rate movements on the composition of trade in value-added and intermediate goods. It is shown that following a depreciation of the exporting country's currency, the cost of importing value-added products declines relative to the cost of adding value to imported intermediate inputs. In equilibrium the composition of the resulting trade vector depends upon the relative magnitudes of price changes and import demand elasticities. Via simulation, the theoretical results are applied to U.S. trade in meat and feed grains. The papers conclusions have relevance for the development of integrated exchange rate, trade, and industrialization policies.

### **1. Introduction**

There is an intuitive relationship between trade in value-added products and trade in the bulk commodities used to create value-added products. One way to view this relationship is to consider the value-added process as a means of repackaging bulk products. Another way to view the connection is to consider the location of the value-adding industry as being mobile between countries, while the location of bulk commodity production is often dependant on immobile primary resources, such as land or mineral deposits. In both cases, whenever countries export (or import) both bulk and value-added products at the same time, the export volume of one will be related to the volume of the other. There appears to be many more bulk/value-added pairs in agriculture than in other industries. For example, agricultural pairs include meat and

feed grains, lumber and furniture, tobacco and cigarettes, wheat and flour, and sugar, fruits and vegetables versus canned or further-processed foods. Non-agricultural pairs include steel and cars, and bulk chemicals versus refined chemicals.

As the value-added goods contain inputs used in other sectors (i.e., labor and capital), there is no reason to expect the competitiveness of the value-added and bulk export industries to respond in the same way to exchange rate movements. This will happen only if prices of all inputs in the importing countries adjust in the same way and at the same time to the exchange rate movements.

We have chosen to use U.S. meat and feed grain exports as the focus of this study for three reasons. First, it can be assumed that these industries may be modeled as perfectly competitive markets. Second, data can be defined and obtained for both the bulk commodity (feed grains) and the value-added products (beef, pork, and poultry meat). Third, the desired results can only be isolated if the ceterus paribus assumption is valid. Thus, we wanted to avoid industries that were characterized by technological change occurring at varying speeds in different countries.

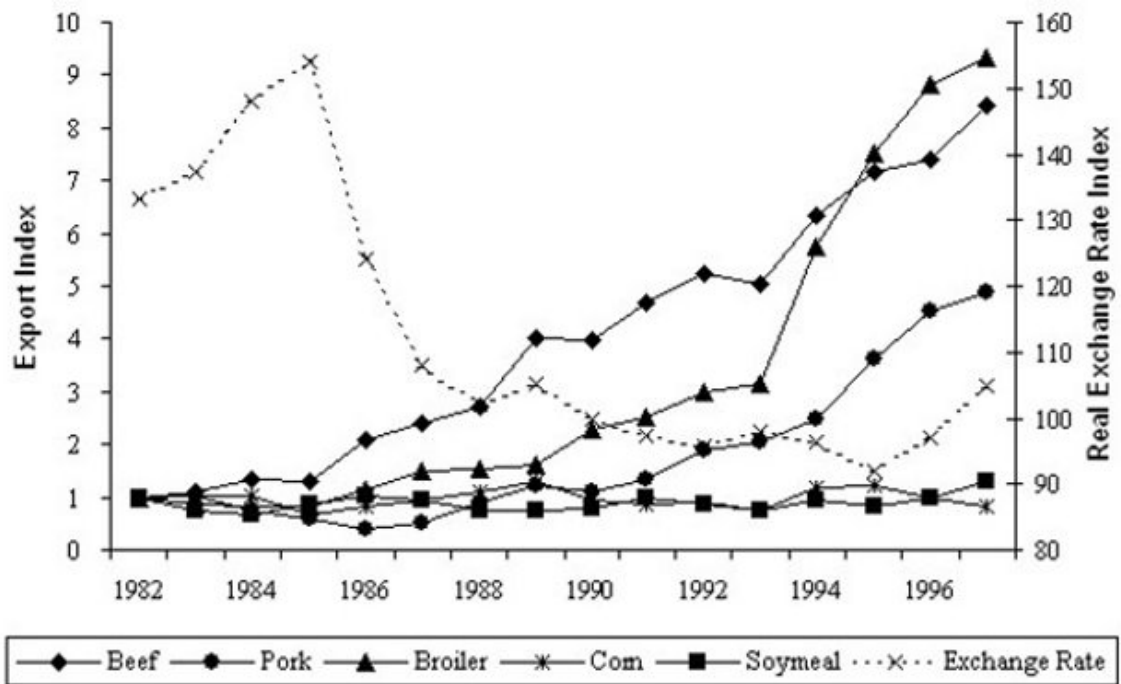


Figure 1. U.S. meat and feed exports and the real effective dollar exchange rate

Figure 1 shows that the substantial appreciation of the dollar against many world currencies that began in 1978 peaked in 1985. From 1985 to 1995, the real effective dollar exchange rate depreciated on average 4.7 percent a year for a total depreciation of more than 40 percent. Over this same time period, U.S. agricultural exports also fluctuated; however, net exports of beef, pork, and broiler meat increased dramatically. Figure 1 also displays U.S. exports of beef, pork, broiler meat, corn, and soybean meal normalized by export levels in 1982. The graph indicates that exports of all three meats increased at an average rate of more than 20% percent per year, totaling a 447, 503, and

802 percent increase from 1985 to 1995 for beef, pork, and broilers. During this same period, beef imports were fairly stable, while pork imports fell more than 40 percent. The total export value of all three meats was \$5.4 billion in 1997. Unlike meat trade, shipments of corn and soybean meal do not show a clear trend over the last decade. Figure 1 shows that exports of both feed grains have experienced significant declines over the period of sustained exchange rate depreciation, particularly during the early 1990s. U.S. exports of corn in 1995 were 87 percent higher than in 1985, but soybean meal exports were virtually unchanged. The value of corn and soybean meal exports totaled \$7.0 billion in 1997.

The purpose of this paper is to examine the impact of currency changes on relative trade in value-added and bulk commodities. The intuition behind the results presented here is relatively simple, and can be explained using the meat-feed grain pair displayed in Figure 1. Suppose Japanese food importers must choose between importing meat and feed grains. In equilibrium, they will import quantities of the two goods that equate the marginal cost of producing meat with imported grain to the marginal cost of importing meat. Now assume that the value of the U.S. dollar falls relative to the yen. This exchange rate change reduces the yen value of imported corn, reducing the Japanese cost of producing meat. Japanese production costs only fall in proportion to the share of imported grain in the total cost of production because Japanese wages and rental rates are initially unaffected by the currency depreciation. The yen value of imported meat also declines, but since meat imports contain U.S. labor and capital as well as the grain used to produce the meat, the marginal cost of importing the meat declines relative to the cost of production in Japan. This change in the relative cost of adding value could cause a significant shift in animal feeding from Japan to the U.S.

The importance of this study is that it shows how exchange rate impacts can influence the prosperity of a particular sector. Moreover, in countries where manufacturing export growth causes a strong currency, there may be a feedback loop whereby a strong currency eventually reduces manufactured exports. Our investigation of this issue begins with the derivation of some general results that demonstrate the potential impact of exchange rate changes on the commodity composition of trade. This analysis employs a three-factor, three-good general equilibrium model of trade with value-added and intermediate goods. A simplified version of the model is then utilized to assess the relevance of the theoretical results for the special case of U.S. meat and feed grain trade. The simulation results are compared to actual meat and feed grain trade patterns.

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### **Biographical Sketches**

**Frank Fuller** is an Assistant Professor in the Department of Agricultural Economics and Agribusiness at the University of Arkansas. His research interests are in the areas of international agricultural trade, trade policy, agricultural marketing, and vertical linkages in agricultural markets. Prior to accepting a position at the University of Arkansas, Frank was the Technical Director for the Food and Agricultural Policy Research Institute (FAPRI) at Iowa State University. While with FAPRI, Dr. Fuller was a lead investigator for marketing and trade policy research projects focusing on agricultural sectors in the People's Republic of China, the Republic of Turkey, and the European Union. Frank received a B.A. in economics in 1990 from the University of Wisconsin-Eau Claire. From August 1990 to July 1991, he was a Fulbright Scholar at Christian-Albrechts University in Kiel, Germany, and from January 1993 to January 1996, he was a USDA National Needs Fellow in Agricultural Marketing at Iowa State University. Dr. Fuller received his PhD. in economics in 1996 from Iowa State University.

**Dermot Hayes** is the Pioneer Hi-Bred international chair in Agribusiness, a Professor in the Department of Economics, and a Professor in the Department of Finance at Iowa State University. He is also assistant director of the Meat Export Research Center at Iowa State University. Dermot is a native of the Republic of Ireland. He obtained a Bachelor of Agriculture Science degree from University College in Dublin in 1981. He entered the Ph.D. program in the Department of Agricultural Economics at Berkeley in the fall of 1981, where he majored in International Trade. Dr. Hayes joined the Department of Economics at Iowa State University in March 1986. His research interests include food safety, livestock modeling, demand analysis, commodity markets, and agricultural and trade policy.