

## The Foreign Trade Linkages

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Historically, most efforts to model the U.S. agricultural sector or its individual subcomponents have assumed a closed economy. Exports or imports were either ignored, treated as exogenous and added to demand or supply through identities, or explained with very simple, naive models.

During the 1950s and 1960s, such approaches in most cases did little violence to reality. With a few exceptions, trade was in fact relatively unimportant. Exports were important for only a few commodities, and such imports as we had did not compete directly with domestic products since they consisted largely of tropical products. Moreover, such competition as there might have been was excluded by trade barriers designed to protect domestic commodity policies.

Ignoring the trade sector is no longer realistic, however. During the 1970s, U.S. agriculture effectively became part of a world agricultural economy. Agricultural exports burgeoned, with the result that today approximately 30 percent of cash marketings are attributed to export sales, and the output of slightly more than one out of every three acres of cropland is sold abroad. For individual commodities, these percentages are even greater. We export roughly 60 percent of our production of wheat and cotton, 40-50 percent of our soybeans, and some 30 percent of our corn and tobacco. These are important commodities in the agricultural sector. Moreover, many of the shocks to these sectors come from the trade sector. To ignore trade is to ignore an important set of factors affecting the agricultural sector.

This situation is further complicated by the fact that exports of some commodities that are important to U.S. agriculture dominate

the international trade in those commodities. For example, the U.S. exports 70 percent of all the corn, 70-80 percent of all the soybeans, and 40 percent of all the wheat that move in world trade. The small-country assumption is hardly appropriate under these circumstances, so one cannot take international prices as exogenous in these cases.

Treating international prices as endogenous greatly complicates modeling efforts. One has to understand import demand and export supply from other countries, and this requires that one understand the agriculture and market conditions in those countries. Moreover, trade flows are complex, with a great deal of product differentiation and multiple flows among countries. In addition, government policy becomes a major factor affecting trade flows and if we ultimately want to push back to the identification of underlying casual factors, we must understand why governments do what they do.

Finally, commodity markets can no longer be understood in isolation of capital markets, either domestically or internationally. Although rather badly neglected until recently, shifts in real exchange rates can be a major factor influencing trade flows. Changes in real exchange rates took place even when nominal exchange rates were fixed. What has complicated this picture is that international capital markets have become increasingly important and increasingly well integrated over the last decade. In the context of a flexible exchange rate regime, these well integrated capital markets cause monetary policies to impact on agriculture in very different ways than with a fixed exchange rate system in which capital markets are either highly segmented or atrophied. Moreover, under the post-Bretton Woods system, monetary policy and conditions in capital markets can exert important influences on commodity markets.

The remainder of my paper is divided into three parts. The first part is a brief review of the alternative approaches that have been taken to modeling agricultural trade. Here I draw on an excellent paper by Robert Thompson.<sup>1</sup> The second part discusses the monetary aspects of agricultural trade and briefly reviews the state of knowledge of these phenomena. The third part makes some suggestions for directions that trade modeling efforts might take if we are

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1. "A Survey of Recent U S Developments in International Agricultural Trade Models." *bibliography and literature, Agriculture #21*, ERS. USDA. September 1981.

to develop realistic models of agricultural trade.

### **Approaches to Agricultural Trade Modeling**

There was a large increase in agricultural trade modeling in the 1970s, a reflection of the growing importance of trade to U.S. agriculture. The models which have evolved can be classified into basically two groups. In one group are the two-region models which involved essentially econometrically estimated export demand equations. The second group consists of multiple-region models and includes (1) nonspatial price equilibrium models, (2) spatial price equilibrium models, and (3) trade flow and market share models.

Let me attempt to characterize such models and make a brief assessment of their value for policy purposes.

#### ***Two-Region Models***

In two-region models all countries of the world are divided into two groups: the one of interest (e.g., the United States) and all others. Two-region models are basically agricultural sector models that are open to international trade. They contain explicit import demand or export supply relations and linkages between the domestic and world market prices to reflect the simultaneous determination of domestic supply, utilization, and price with those in the rest of the world.

Such open-economy models constitute a significant part of the agricultural trade research to date and have been used extensively for U.S. trade policy analysis. However, as Thompson notes, such models are not trade models in the strictest sense since they do not account for source-to-destination trade flows.

An import-demand or export-supply equation is nothing more than an excess demand or excess supply equation. Hence, it is the domestic demand curve minus the domestic supply curve, or vice versa, whichever the case may be. For the export-supply equation, the domestic-demand and supply curves are relevant. For the import-demand equation, it is the demand and supply conditions in the foreign country that are relevant. In the case of import demand, there would be one such equation for each country. This suggests how complex a structural model might be if it were to reflect any degree of country detail.

Two approaches can be used to obtain estimates of the parameters of such equations. The first is to estimate them directly. The second

is to calculate them by means of Yntema's formula,<sup>2</sup> which provides estimates of import-demand and export-supply elasticities as a weighted sum of the domestic demand and supply elasticities. The weights are relative shares of imports and exports in relation to domestic consumption and production.

Thompson surveys the various studies that have attempted to estimate these parameters. Quite a number of attempts have been made, both with single-commodity and multicommodity models. However, these studies have reached little consensus on the underlying or "true" elasticities, and considerable controversy still prevails, for example, over whether the foreign import demand for U.S. agricultural exports is price-elastic or price-inelastic. From a policy standpoint, this is an important issue, of course.

The reasons for the lack of consensus on the basic parameters are fairly obvious once one remembers how an "ideal" model might be specified and compares it with equations whose parameters are actually estimated. Thompson summarizes the points very well. First, an equation representing the excess demand of the rest of the world represents in effect the net effect of all supply and demand adjustments in all other trading countries. If the countries participating in trade change and their respective import demand elasticities are different, then the elasticity obtained would be quite sensitive to the time period used for the study.

Second, exchange rates, tariffs, subsidies, and transportation costs should be taken into account. The effect of changes in these factors is to **either shift** or rotate the excess demand schedule faced by an individual country. These factors do change from time to time. But when an aggregate relationship is used for purposes of estimation, there is no way to take account of such shifts. Hence, aggregation problems are quite serious.

Third, most models treat only one commodity at a time and ignore important linkages and interrelationships. They also tend to use OLS estimation procedures. Hence, the parameter estimates are subject to both specification and simultaneous equations bias. Moreover, most variables are probably measured with substantial error, and this introduces additional bias.

Finally, all shifters of the domestic supply and demand schedules

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2. Yntema, T.O.. *A Mathematical Reformatron of the General Theory of International Trade*. Chicago. University of Chicago Press, 1932.

in all other trading nations would be variables in a correctly specified import demand equation for U.S. exports. These shifters are typically omitted from the estimated equation, with specification bias again the likely result. Moreover, it simply may be asking too much to expect that a single import demand equation could adequately reflect the myriad forces which sift it from year to year. Put somewhat differently, one is faced with a rather serious identification problem, and the models used to date have had very weak identification power.

In conclusion, popular as the two-region models have been, they have really contributed little to our understanding of the interrelationships between the U.S. and world markets. Perhaps a more important point is that even if acceptable parameters estimates were available, their only value would be in analyzing domestic farm policies and U.S. trade policy. This is because it is impossible to tell how to change the import demand function in response to a policy change in any individual foreign country. Yet such changes in policy are the coin of the realm. Moreover, since policies in one country may tend to respond to changes in another, policy models for the U.S. really need the additional detail.

### ***Nonspatial Price Equilibrium Models***

Nonspatial price equilibrium models are the simplest multiple-region models one can have. They explicitly treat the interrelations among trading regions by assuming that the world market price is determined simultaneously by the supply-demand balance in all trading regions in such a way that the global market clears. The models are comprised of systems of equations which may be solved by various techniques. The model solution gives the world market clearing **price(s)** and net trade of each region trading in the world market. However, it provides no information on source-destination trade flows.

There are three classes of nonspatial price equilibrium models, with each class differing in the nature of the price linkages among the trading region. One class assumes the existence of one global market-clearing price (often the U.S. domestic or export price) at which all international transactions occur. In the second class the commodity prices in all but one region in the model are linked through transportation costs to the price in the *n*th region, which is often the United States. The third class is made up of models which

link prices through transport costs pairwise along the principal historical trade flows. This produces a web of price linkage equations. Although this class of models introduces a spatial pattern of prices, it differentiates itself from spatial equilibrium models in that it generates only the net trade position of each trading region, while the latter generates source-destination trade flows.

Nonspatial price equilibrium models can and often do include considerable detail on domestic markets. In addition, such models can also easily reflect tariff policies, although as Thompson notes, in practice they tend to have a free-trade bias.

The focus of these models is on the interrelationships among the trading regions. To be useful for this purpose, the models must reflect the structure of the markets of the regions linked through trade. This includes not only the structure of internal demand and supply, but also government policy behavior and the competitive structure of the industry.

Most models of this kind have contained internal supply and demand schedules of the trading regions. However, some have contained only an export-supply or import-demand schedule for each region.

Thompson observes that past research using such models has put much more emphasis on model specification and solution technique than on the empirical content. He finds that few validation statistics are reported, and that little attempt has been made to assess whether parameter estimates are realistic in light of the phenomena being modeled.

A major difficulty in doing research on such models is the availability of data. Obtaining data that are consistent across countries is a major challenge. No single organization now has the responsibility for doing this. Obtaining information on country policies is equally difficult, especially when most such information is in a foreign language. It may be that awareness of these data problems is one of the reasons why so little attention has been given to the empirical content of these models.

Thompson notes that researchers developing such models have tended to neglect the relatively large number of agricultural sector models that are available and that could be used as building blocks. The IIASA world model of agriculture is the only case in which considerable effort has been invested in developing satisfactory country models as elements of the nonspatial price equilibrium

models.

Another deficiency of such models is that they have failed to take account of trade interventions in a realistic way. Tariff barriers in particular can be easily introduced into a simultaneous equations model by means of the price linkage equations. But many nontariff barriers can also be introduced. Given the extent of such trade interventions, the failure to take account of them can only result in models that are of little value for policy purposes.

Government policy decisions are another element that have been neglected in such models. Considerable evidence has now accumulated that such decisions are not exogenous to the commodity markets.<sup>3</sup> It is not difficult to endogenize policy variables by including policy reaction functions or price transmission equations. Given the importance of government in most countries and the instability of government policies, the failure to endogenize this sector must be considered a serious deficiency of such models.

Two other variables that are usually treated as exogenous and which may need to be treated endogenously are freight rates and currency exchange rates. In years of unusually large volumes of trade, freight rates are clearly not determined exogenously. Little work has been done, however, to understand this important sector of the trade economy.

Similarly, Cheng and Chambers and Just have shown that the U.S. dollar exchange rate has been sensitive to changes in the value of agricultural exports.<sup>4</sup> This suggests that the exchange rate should also be made endogenous to the agricultural trade sector. This issue will be taken up below.

A final comment on such models has to do with the homogeneity assumption that is usually made. Grennes, Johnson and Thursby<sup>5</sup> found that in the case of wheat there was little correlation among

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3 For a survey and analysis of the literature on endogenizing government behavior, see Gordon C. Rausser, Erik Lichtenberg, and Ralph Lattimore, "Developments in Theory and Empirical Applications of Endogenous Government Behavior," in Gordon C. Rausser, ed., *New Directions in Econometric Modeling and Forecasting in U.S. Agriculture*, Amsterdam, North-Holland Publishers, forthcoming.

4 G. D. C. Cheng, "A Study of the Impact of U. S. Grain Exports on the Exchange Rate and the Domestic Price Level." Ph. D. Thesis, University of Notre Dame, South Bend, Indiana, 1976, and R. G. Chambers and R. E. Just, "An Investigation of the Effects of Monetary Factors on Agriculture," forthcoming in *Journal of Monetary Economics*.

5 T. Grennes, P. J. Johnson, and M. Thursby, "Some Evidence on the Nebulous Law of One Price," paper presented at the annual meetings of the Southern Economics Association, Washington, D. C., November 1978.

prices of the same commodity in different countries. Only as they narrowed the specification of the product did the correlations increase until the prices of the export goods for two different countries become almost perfectly correlated. This suggests that even quite narrowly defined agricultural products are in fact aggregates of different goods.

In conclusion, nonspatial price equilibrium models have made several contributions to understanding the interrelations among trading regions. In particular, they have helped us understand the extent to which world market shocks get transmitted through policy reaction functions or price transmission equations. The failure to give more attention to the empirical content of the models has limited their value for policy purposes, however. In particular, the failure to give more attention to trade distortions is somewhat paradoxical given the importance and significance of such distortions and the relative ease with which they can be introduced in the models.

### *Spatial Price Equilibrium Models*

Spatial equilibrium models are the most common class of agricultural trade models, particularly for comparative statistical analysis of the effects of a change in policy. These models are distinguished from the previous two classes in that they endogenize trade flows and market shares. They are structured in a manner consistent with spatial equilibrium theory, with the result that prices are directly linked only between those pairs of countries which actually trade with each other.

The data requirements for a spatial price equilibrium model are identical to those for a nonspatial price equilibrium model. Both require internal supply and demand schedules or an export-supply or import-demand schedule for each trading region, documentation on the levels of all policy variables, exchange rates, and a matrix of transportation costs.

The fundamental difference between spatial and nonspatial price equilibrium models is in the solution technique used. Most spatial models have been linear and solved by quadratic programming.<sup>6</sup> However, the disadvantage of linear equations has been overcome

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6. Other techniques include specifying the problem as a classical transportation problem and the use of linear and reactive programming; models with nonlinear demand equations have also been used.

by separable programming, Bender's decomposition, and nonlinear solvers.

An advantage in using quadratic programming is the facility with which policies can be introduced. Tariff barriers can be introduced in these models in basically the same way as in nonspatial price equilibrium models. Moreover, quantitative restrictions to trade can be introduced directly as linear inequality constraints in the constraint set of the QP problem. This is easier than using "if" statements in iterative solution techniques for systems of nonlinear equations.

One of the principal arguments for use of spatial over nonspatial models is that the former generate trade flows and market shares, variables which are of interest to some users of the models. In practice, however, this advantage has been illusory, in large part because the spatial models have not explained real world trade flows very well. This in turn is probably due to the fact that inadequate attention has been given to the empirical realism of the models.

As an example, the spatial equilibrium model assumes perfect certainty, yet the real world is characterized by risk and uncertainty. Risk behavior could be reflected in trade models in the same way that **Hazell** and Scandizzo<sup>7</sup> have introduced it into agricultural sector models. Yet Thompson could not find any attempt to use such a procedure.

Some users of trade policy analyses need information on the time path of adjustment of supply, disappearance, and price. Modeling work so far has done little along this line, although a number of different approaches might be used to generate such information. Moreover, if storage costs were included as the cost of carrying wheat from one year to the next, insight could be provided into the issue of optimum reserve stocks.

Another deficiency of spatial equilibrium trade models is their assumption that all trading countries behave perfectly competitively. The objective function could be altered to make every region trade on its marginal import cost or marginal export revenue schedule. However, such an approach would probably reflect inadequately the differences in market structure among trading regions.

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7. P. B. R. Hazell and P. L. Scandizzo, "Competitive Demand Structures Under Risk in Agricultural Linear Programming Models," *American Journal of Agricultural Economics* 56(1974), pp. 235-244.

Other aspects of the empirical deficiencies of such models includes simultaneous equations and specification bias in the structural elements of the models. The empirical results from the model can be no better than the empirical input to the model. Until more attention is given to these details, and to the detail of policy interventions, these models will provide poor replicas of real world phenomena.

### ***Trade Flows and Market Share Models***

The motivation for developing trade flow and market share models was the failure of spatial price equilibrium models to adequately account for trade flows and the lack of empirical support for the law of one price in world agricultural markets. As noted earlier, commodities are not perfectly homogenous. Moreover, both importers and exporters may want to diversify their sources and markets, respectively, due to market uncertainty or for historical and political reasons.

The trade flow and market share models are a response to these problems, and focus on explaining the elements of the trade flow matrix. The various approaches used include mechanical procedures which transform the trade flow matrices from one year to the next without regard for price, econometric models designed to explain one or more elements of the trade flow matrix, and modifications of the spatial equilibrium models in which the elasticity of substitution among sources of supply is less than infinite in each importing region. The latter includes the so-called Armington approach to trade modeling.

The mechanical techniques, of course, lack normative content and can offer little guidance for policy formulation. Typical of these are the use of derived transition matrices. A second technique is the constant market share approach, which assumes that each exporter's market share is constant through time unless something happens which alters that exporter's competitiveness. A given country's export growth is then decomposed into various components, much as time series data are decomposed by mechanical procedures.

A related approach to studying trade flows is through probabilistic trade models. Still another approach is to use Markov models to predict market shares. This technique follows Telser's approach<sup>8</sup> to

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8. L. G. Telser, "The Demand for Branded Goods as Estimated from Consumer Panel Data," *Review of Economics and Statistics* 44(1962), pp. 300-24.

analyzing domestic demand for branded goods and does bring prices into the explanation.

The second class of trade flow and market share models implicitly or explicitly assumes that the U.S. exports of the respective commodities of interest are not perfect substitutes for exports from other countries in each importing country. Perhaps the most common application has been to estimate equations which explain the shipments from a given exporter to each foreign destination. These are usually represented as regional import demand equations for the given country's exports. Another approach has been to estimate a total import demand equation for each importing region and separate market share equations for the U.S. and other exporters.

The assumption that importers differentiate among goods by country of origin implies that the elasticity of substitution between countries of origin is less than infinite. Armington<sup>9</sup> has developed the theory for a class of trade models in which goods are differentiated by country of origin. In this approach it is assumed that the utility function is weakly separable so that the consumer's decision process may be viewed as occurring in two stages. The total quantity of a commodity to be imported is first determined, and then this quantity is allocated among the competing suppliers. The model is simplified by assuming that the total quantity of the product imported is a constant elasticity of substitution (CES) index of the quantities imported from the respective countries of origin. Given these assumptions, the cross-price elasticities between all pairs of countries of origin can be calculated from estimates of only the overall price elasticity of import demand and the (assumed constant) import elasticity of substitution and data on import shares. The cross elasticities, therefore, need not be estimated directly. The constant and identical assumptions for the elasticity of substitution can be relaxed, of course. This requires a multistage decision process instead of Armington's two-stage process.

By way of evaluation, the Markov approach is the only one of the mechanical approaches to analyzing trade flows which has explicit theoretical foundations. The models which seek to explain individual elements of the trade flow matrix suffer from the same specification and estimation problems as the import demand equations in

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9. P. S. Armington, "A Theory of Demand for Products Distinguished by Place of Production," *IMF Staff Papers*, 16(1969), pp. 159-178.

two-region models, since they tend to be specified as import demand equations.

The Armington approach to trade modeling, by explicitly introducing elasticities of substitution, can generate trade flows between **all** pairs of trading countries in solution. This represents a significant generalization of the spatial equilibrium model.

Thompson notes that the model also gives much smoother changes in trade flows in response to shocks than does the spatial equilibrium approach. He also points out that there is a logical inconsistency between assuming a commodity is differentiated by country of origin and then assuming that the same constant elasticity of substitution applies between all pairs of exporters in all import markets. Recent work has been directed to relaxing this assumption.

In conclusion, work on the trade flow and market share models has been the frontier of agricultural trade modeling in the past decade. Many of the approaches appear to account for the observed variation in trade flows more adequately than do spatial equilibrium models. Nevertheless, the theoretical foundation for several of the approaches is weak and few of the models include much policy or institutional content. Finally, the empirical content of the models also tends to be weak due to inadequate and incomplete data, specification errors, and choice of an inappropriate estimation.

### **The Monetary Aspects of Agricultural Trade**

The growing internationalization of agricultural commodity markets in the 1970s was a major factor influencing the modeling of the agricultural sector for policy purposes. Perhaps of equal importance was the shift from a system of fixed exchange rates to a system of flexible exchange rates and the growth and increased integration of the international capital **markets**.<sup>10</sup> In this section I want to briefly review this last set of developments and discuss the implications for modeling agricultural trade.

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10. The Bretton-Woods system of **fixed** exchange rates began to break down in 1968 when the world for all practical purposes went off the last semblance of gold standard. The **culmination** of the change occurred in 1973 when the U.S. floated the dollar. For a more **comprehensive** treatment of the monetary aspects, see G. Edward Schuh, Chris Hodges, and Dave Orden, "Monetary Aspects of International **Agricultural** Trade," Department of Agricultural and Applied Economics, **University** of Minnesota, December 1980 (mimeographed).

### Flexible Exchange Rates and Agricultural Trade

The shift from a system of fixed exchange rates to what is essentially a system of flexible exchange rates had two important consequences for agriculture. First, it permitted underlying comparative advantages to reveal themselves to a greater extent than they had under the fixed exchange rate system." In the case of the U.S., this accounted for an important part of the expansion of agricultural exports during the 1970s, since the value of the dollar experienced a significant decline with the shift to floating exchange rates.

An important aspect of the realignment of exchange rates was the large change that took place in the value of gold.<sup>12</sup> This change had at least two important effects. First, countries that held gold as part of their reserves experienced both an increase in the value of their international reserves for transactions purposes and a rather sizeable wealth effect, with both effects determined by how much gold they held. Second, the Soviet Union is a major producer of gold and sells it as the means of paying for its agricultural imports. The rise in the value of gold, coincidental with the decline in the value of the dollar, constituted a favorable shift in the terms of trade for the Soviet Union that undoubtedly contributed to its dramatic shift to external sources of supply for grain. A comprehensive modeling of this development would need to take into account the monetary phenomenon, per se, the change in terms of trade, and the response of policymakers in the Soviet Union to external economic conditions.

The second effect of the shift from fixed to flexible exchange rates was that, in the presence of well-integrated international capital markets, it altered significantly the way that monetary policy affected agriculture.<sup>13</sup> With a fixed exchange rate regime and seg-

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11. For a discussion of this phenomenon in the case of U.S. agriculture, see G. Edward Schuh, "The Exchange Rate and U.S. Agriculture," *American Journal of Agricultural Economics*, February 1974, 56(1), pp. 1-13.

12. The value of gold in dollar terms increased from \$35 an ounce to almost \$800 an ounce before declining to its present range of approximately \$400.

13. For more details on this set of issues, see G. Edward Schuh, "Income and Stability Implications of Monetary, Fiscal, Trade, and Economic Control Policies," *Farm and Food Policy Symposium*, South Dakota State University, 1977, and G. Edward Schuh, "Floating Exchange Rates, International Interdependence, and Agricultural Policy," presented at the 17th International Conference of the International Association of Agricultural Economists, in Banff, Alberta, September 3-12, 1979.

mented or poorly developed commodity markets, monetary policy affected U.S. agriculture largely through its impact on the intersectoral labor market. The secular outmigration of labor from agriculture, an integral component of economic development, has been quite sensitive to the level of unemployment in the general economy. With monetary policy reflected in differing levels of cyclical unemployment, the welfare of farm people and of course the level of farm output were influenced by monetary policy through its influence on the labor market. In terms of the secular adjustment of resources out of agriculture, this phenomenon was quite important and has been well recognized in the literature. In terms of short-term fluctuations in commodity markets, it was relatively unimportant, especially in light of the large stocks in government hands during most of the period in which these conditions prevailed.

The shift to floating exchange rates, in the presence of well-integrated international capital markets, significantly changed the impact of changes in monetary policy on U.S. agriculture. These changes were compounded by the decline in stocks in government hands, which had they continued might have attenuated at least some of the consequences.

The change in how monetary policy affects agriculture comes about because changes in monetary policy are reflected in changes in the value of the dollar. A tight monetary policy, other things being equal, leads to a rise in the value of the dollar and a decline in the competitiveness of the export sector in international markets. An easy monetary policy, on the other hand, leads to a decline in the value of the dollar and increased competitiveness. To put it simply, the trade sectors bear the adjustment of changes in monetary policy, and trade is now important to agriculture.<sup>14</sup>

Two points are worth noting in this context. First, the prices of both paper and real commodities can take place without actual changes in capital or commodity flows. In fact, one would generally expect the prices to change in the short run and then flows of capital and/or commodities to take place as time permitted adjustments to take place. In terms of model specification, we generally are concerned about both the changes in relative prices and in commodity flows.

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<sup>14</sup> It should be noted that the adjustments are borne by both the export sectors and the import-competing sectors. Our interest here, of course, is with the export-competing sectors.

The second point to note is that a number of developments converged to significantly change the conditions of commodity markets during the 1970s. It was this convergence of factors that made for such dramatic changes in these markets. For example, the shift to a floating exchange rate regime meant that foreign demand became more unstable than under the fixed exchange rate regime that prevailed earlier. This instability occurred at the same time that trade became relatively more important to U.S. agriculture. Similarly, international capital markets were growing rapidly and becoming increasingly well integrated at about the same time that we shifted from a fixed to a flexible exchange rate regime.

Finally, my discussant, Gale Johnson, has called our attention to the role of trade impediments as a factor causing instability in international commodity markets. With those impediments to market adjustment, it is no wonder that the monetary instability of the 1970s has led to such instability in commodity markets. This instability has been compounded by the virtual elimination of large government stocks which, whatever their liabilities and negative consequences, might have contributed some stability to the markets were they to be managed in an appropriate way.

### *The New Exchange Rate System*

Based on the above considerations, a proper modeling of international commodity markets now requires that exchange rates be taken into account. Some background on that system is therefore essential for proper modeling. What we now have is very much of a mixed system, with a considerable — although declining — degree of government management of the float. Both of these factors complicate the modeling of the exchange markets.

The mixed nature of the system is reflected in the tendency to bloc floating. Individual countries tie their currency to certain key currencies such as the U.S. dollar, the French franc, or the British pound sterling. To the extent that these key currencies float against each other and against other currencies, the currencies tied to them also float. Hence, in 1978 some 80 percent of trade took place across markets in which floating exchange rates prevailed, even though only 38 of the 133 member countries of the IMF, plus Switzerland as a nonmember country, had freely floating exchange rates. The important point, of course, is that such bloc floating gives rise to important third-country exchange rate effects that

generally do not receive the attention they deserve in either the modeling or the analysis of commodity markets.

### *An Increasingly Well-Integrated International Capital Market*

The third significant development affecting agricultural commodity markets is the growth and increased integration of the international capital markets. This development has been little noted by agricultural economists. But as noted above, its implications for modeling commodity markets is quite great. The international capital markets have become important links among individual economies and a means of transmitting the effects of government policies from one country to another. They have also become an important source of shocks to individual commodity markets.

In the immediate post-World War II period, international capital markets were almost nonexistent. Such capital flows as there were were either on a government-to-government basis, often on **concessional** terms, or they were surreptitious shifts of funds to circumvent regulations or to flee oppressive governments.

As confidence grew in the international system that emerged in the aftermath of World War II, and as trade grew at a rate requiring increased amounts of liquidity, an international credit system gradually evolved, with an ever larger participation of the private and public banking systems. Perhaps the most significant institutional innovation was the emergence of a Eurodollar market. This latter transformed itself into a more broadly based Eurocurrency market. An Asian currency market has emerged more recently. The volume of credit and capital that flows in these markets is now huge — the volume of credit outstanding in the Eurocurrency market now approaching **\$1 trillion** alone. Less-developed countries and centrally planned economies alike make use of it, and capital flows on concessional terms have dwindled to insignificance in a relative sense.

Perhaps the most significant aspect of this market is the lack of government regulation and distortion. The Eurocurrency market, for example, is almost completely beyond the pale of government regulation, despite the tight control exercised by governments whose currencies are represented in these markets over both their domestic capital and credit markets and over their respective commodity markets. The lack of government regulation suggests that these markets may be relatively efficient. **Harberger's** imaginative

attempt to look at the efficiency of this market<sup>15</sup> suggests that it may, in fact, be relatively efficient. This has obvious importance for commodity markets, for the modeling of commodity markets, and for government commodity policy. We will return to these factors below.

### Modeling Exchange Rate *Effects*<sup>16</sup>

Perhaps the first published discussion of how to model exchange rate effects on U.S. agriculture appeared with the exchange between Vellianitis-Fidas and myself.<sup>17</sup> This discussion focused on whether it was the domestic demand and supply elasticities that were relevant or the import demand and export supply elasticities. V-F emphasized the former; I stressed the latter. The appropriateness of the econometric procedures used by V-F to test for the effects of changes in the exchange rate also came under review.

A year after this exchange, Kost<sup>18</sup> also took exception to the view that "the exchange rate is an important structural variable" and suggested that such conclusions were "at their worst, wrong, or at their best, quite misleading as to the magnitude of the effects we can expect in agriculture when the exchange rate changes." To support his contention, Kost introduced a two-country, one-commodity, free-trade equilibrium model. Using graphical analysis to "derive" excess supply and import demand curves for a "trade sector" from the underlying supply and demand curves in each country, Kost introduced devaluation by the exporting country as a rescaling of the price axis of the importing country. Subsequent supply and demand adjustments in the importing country were then assumed to be reflected in the trade sector in a rightward shift in import demand along an unchanged excess supply curve.

Kost concluded from his graphs that "the apparent shift in the supply and demand curves in the importing country, and the result-

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15. A. C. Harberger, "Perspectives in Capital and Technology in Less Developed Countries," M. J. Artis and A. R. Nobay, ed., *Contemporary Economic Analysis*, London, 1978.

16 This section draws on Schuh, Hodges, and Orden

17 Vellianitis-Fidas, "The Exchange Rate and U.S. Agriculture. Comment," *American Journal of Agricultural Economics* 57(November 1975). pp. 691-95, and G. Edward Schuh, "The Exchange Rate and Agriculture Reply," *American Journal of Agricultural Economics* 57(November 1975). pp. 696-700.

18 William Kost, "Effects of an Exchange Rate Change on Agricultural Trade," *American Economics Research* 28(3) (July 1975), pp. 99-106.

ing shift in the import demand curve, each equal the percentage change in the exchange rate," which he argued was an upper ceiling on the price change (assuming excess supply is perfectly inelastic) or the quantity change (assuming excess supply is perfectly elastic) that can occur in response to devaluation.

In an appendix, Kost derived expressions for elasticity of excess supply in the exporting country,  $E_{ES} = \frac{e_S Q_S - e_D Q_D}{Q_S - Q_D}$ , and of im-

port demand,  $E_{ID} = \frac{e_D Q_D - e_S Q_S}{Q_D - Q_S}$ , where RHS elasticities and

quantities in each expression refer to the exporting and importing country's economy. Then, observing that the elasticity of both supply and demand is low for agricultural products in the U.S., Kost allowed that within the narrow limits suggested by his model one would expect that devaluation would have a greater price impact than quantity impact on agricultural goods. But, to reemphasize the point, Kost's principal conclusion was that the proportional increase in price or quantity of traded goods in response to a devaluation was restricted to being less than or equal to the percent of devaluation. Further, Kost argued that trade restrictions such as the EEC variable levy would insulate importers' domestic markets from changes in world prices and hence reduce the shift of the import demand curve, further lessening possible trade impacts of devaluation. Kost concluded, "In summary, we can only expect a small impact on agricultural trade as a result of a change in exchange rate."

Despite the apparent weaknesses in these arguments, Kost's paper captures much of the essence of later discussions on modeling the effects of the exchange rate. One of the first to respond to Kost was **Bredahl**.<sup>19</sup> In particular, Bredahl argued that within the two-country, one-good model, there was no basis for concluding that the proportional change in quantity traded was constrained by the percentage devaluation. Again using linear supply and demand curves, Bredahl developed expressions for the elasticity of exporters price and quantity traded with respect to exchange rate:

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19. Maury E. Bredahl, "Effects of Currency Adjustments Given Free Trade, Trade Restrictions, and Cross-Commodity Effects," Department of Agricultural and Applied Economics, Staff Paper p. 76-35, University of Minnesota, November 1976.

$$E_{p,r} = - \frac{1}{1 - E_{ES}} \frac{1}{E_{ED}}$$

$$E_{Q,r} = (E_{p,r}) (E_{ES})$$

Clearly, in his model,  $-1 \leq E_{p,r} \leq 0$ , constraining change in price in response to devaluation, as Kost suggested. But  $E_{Q,r}$  has no a priori lower bound. Noting that  $E_{ES}$  may be greater than one even if exporters' domestic supply and demand are inelastic, **Bredahl** rejected Kost's earlier result.

An obvious empirical issue in modeling exchange rate effects is the size of the foreign import demand for U.S. agricultural exports. **Tweeten**<sup>20</sup> had derived an expression for this foreign excess demand as follows:

$$E_{ED} = \sum_i \left[ e_{Di} e_{pi} \frac{Q_{Di}}{Q_x} - e_{Si} e_{pi} \frac{Q_{Si}}{Q_x} \right]$$

where  $i = 1 \dots n$  is a country index,  $e_{Di}$ ,  $e_{Si}$ ,  $Q_{Di}$  and  $Q_{Si}$  are elasticities of demand and supply and quantities demanded and supplied in the  $i$ th country, and  $Q_x$  is the quantity of U.S. exports. The term  $e_{pi}$  (referred to as the "elasticity of price transmission") measures the responsiveness of price in country  $i$  to changes in the U.S. price. Based on this expression and assuming free world trade, **Tweeten** initially estimated  $E_{ED} = 15.9$ , but he reasoned that trade restrictions reduced this value significantly to something on the order of  $E_{ED} = 6.3$ . This estimate has been widely used by those who argue that changes in the exchange rate have had a significant effect on the agricultural sector.

**Johnson**<sup>21</sup> disagreed with **Tweeten's** algebraic expression for  $E_{ED}$  but arrived at a similar estimate by his own techniques. This exchange points up an important problem that has arisen in the empirical work. Estimates of the export supply elasticity and the import demand elasticity that are built up from direct estimates of the more

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20. Luther G. **Tweeten**, "The Demand for U.S. Farm Output," *Food Research Institute Studies*, 7(1967), pp. 343-59.

21. Paul R. **Johnson**, "The Elasticity of Foreign Demand for U.S. Agricultural Products," *American Journal of Agricultural Economics* 59(1977), pp. 735-36.

basic elasticities suggest rather large excess demand and supply elasticities. However, direct estimates of the responsiveness of trade to changes in prices generally find a very low response.<sup>22</sup> At least part of this disparity is due to the identification problem in dealing with the trade sector. For the most part, models which make direct estimates of the elasticities are quite simple and probably not capable of identifying the underlying parameters.

Bredahl, Meyers, and Collins<sup>21</sup> returned to the controversy to assert that this discrepancy between derived and directly estimated elasticities is explained by restrictions on trade that insulate important agricultural markets so that the  $e_{pi}$  approaches zero in many cases. With  $e_{pi} = 0$ , a change in world price or a currency devaluation by an exporter would have no effect on domestic markets in the  $i$ -th country, and no effect on  $E_{ED}$ . After reviewing government policies of major importers of U.S. corn, sorghum, wheat, soybeans, and cotton', Bredahl, Meyers, and Collins assign an implied  $e_{pi}$  in each case. Elasticities of excess demand calculated on the basis of these  $e_{pi}$  ranged from  $-.47$  for soybeans to  $-2.36$  for sorghum, compared to  $-1.12$  for soybeans to  $-5.50$  for wheat under the assumption that  $e_{pi} = 1$  for all countries and all goods. The authors concluded that the estimates of the elasticity of excess demand put forth by **Tweeten** and Johnson are simply not "in line with what is known about a world with insulated agricultural markets."

Applied to the argument over the expected consequence of a change in exchange rates, the results of Bredahl, Meyers, and Collins underscore the variety of effects among countries and commodities that might be expected in response to a specific change in the exchange rate.

For all its utility in clarifying the relationships among countries, the two-country, one-commodity model examined by Kost and **Bredahl**, and often utilized implicitly in empirical work, is still a rather simple and perhaps excessively abstract representation of the real world. Chamber and Just<sup>24</sup> suggest a more complete two-country

22. For example, see Robert N. Stern, *Price Elasticities in International Trade: A Compilation and Annotated Bibliography*, London: MacMillan Press, 1978.

23. Maury E. Bredahl, William H. Meyers, and Keith J. Collins, "The Elasticity of Foreign Demand for U.S. Agricultural Products: The Importance of the Price Transmission Elasticity," *American Journal of Agricultural Economics* 61(1), February 1979, pp. 58-63.

24. Robert G. Chambers and Richard E. Just, "A Critique of Exchange Rate Treatment in Agricultural Trade Models," *American Journal of Agricultural Economics* 61(2) (May 1979), pp. 249-257.

model in which excess demand for goods in the importing country is a function of a commodity price and income expressed in the importer's currency, while excess supply of goods from the exporting country is a function of the same  $n$  goods expressed in exporter's currency. Following **Bredahl's** approach (totally differentiating demand and supply equations at equilibrium), Chambers and Just derive an expression for the proportional change in exporter currency price of the  $i$ -th good ( $p_i$ ) resulting from a given percentage change in the exchange rate:

$$\tilde{E}_{p_i,r} = E_{p_i,r} - \frac{\sum_{\substack{j=1 \\ j \neq i}}^n E_{p_j,r} \left[ e_{D_j} - e_{S_j} \right] - \left[ w_i + e_{D_i} \right]}{e_{D_i} + \sum_{\substack{j=1 \\ j \neq i}}^n e_{S_j}}$$

where  $E_{p_i,r}$  = the elasticity of price  $p_i$  with respect to the exchange rate (now interpreted as a partial elasticity)

$E_{p_j,r}$  = the elasticity of the  $j$ -th cross price (in exporter's currency) with respect to the exchange rate

$e_{D_j}$  = elasticity of excess demand (importer's for the  $j$ -th good

$e_{S_j}$  = elasticity of excess supply (exporter's for the  $j$ -th good

$w_i$  = income elasticity of excess demand for good  $i$ .

Under an assumption of homogeneity,  $e_{D_i} \div \sum e_{S_j} = e_{D_i} \cdot e_{S_i} < 0$ , so the numerator in the expression  $\tilde{E}_{p_i,r}$  is negative. While lacking the elegance of ease of interpretation, in case of the denominator being negative,  $\tilde{E}_{p_i,r}$  is larger (in absolute value) than  $E_{p_i,r}$ . In particular, Chambers and Just concluded that there is no basis to claim a priori that  $-1 \leq \tilde{E}_{p_i,r} \leq 0$ . By implication, earlier empirical studies specifying demand or supply as a function of own good price are thus in their view not capable of measuring the true effects of changes in the exchange rate on commodity prices. In contrast, Chambers and Just suggest that if a simple model is to be used the exchange rate should be included as a separate regressor. They cite

studies of wheat exports by Fletcher, Just, and Schmitz<sup>25</sup> and of corn exports by Meelke and de Gorter<sup>26</sup> in which exchange rates were found to be significant variables explaining U.S. exports.

Chambers' and Just's results imply that exchange rate effects can only be measured in a general equilibrium context. This point was underscored in an exchange between Grennes, Johnson, and Thursby (GJT)<sup>27</sup> and Chambers and Just<sup>28</sup> in the AJAE. An earlier study by GJT (AJAE, 1977)<sup>29</sup> had distinguished wheat by country of origin, and demand equations had included all wheat prices, and, exogenously, prices of other grains. Chambers and Just had criticized the GJT model as equivalent to the simpler one-good model developed by Bredahl. GJT responded that "failure to incorporate price of related products" was not a shortcoming of their approach. Chambers' and Just's reply was to emphasize that "the exchange rate must be given greater flexibility in a trade model than can be allowed by tying its effects to those of wheat and possibly corn prices, or indeed, to any small group of commodities."

An important strength of the 1977 paper by Grennes, Johnson, and Thursby was that they did use a model which permitted cross-elasticity effects among countries. However, rather than to attempt estimates of these cross-elasticities, they assumed them to be a rather low 0.3. Unfortunately, they then concluded that the effect of a change in the exchange rate would be quite low, apparently not aware that they had assumed a low effect by the assumption they had made. At a minimum, sensitivity analysis would have been appropriate.

In reviewing this literature, it appears in hindsight that the re-

25. Stanley M. Fletcher, Richard E. Just, and Andrew Schmitz, "The Impact of Exchange Rates and Other Factors on North American Wheat Export Demand," *World Food Crisis: Issues and Policy Alternatives*, Gordon C. Rausser, ed., Amsterdam: North Holland Publishing Co.

26. Karl D. Meelke and Hendry de Gorter, "A Quarterly Econometric Model of the North American Feed Grain Industry," paper presented to Economics Branch, Agriculture Canada, Ottawa, April 27, 1977.

27. Thomas Grennes, Paul R. Johnson, and Marie Thursby, "A Critique of Exchange Rate Treatment in Agricultural Trade Models: Comment," *American Journal of Agricultural Economics* (May 1980), pp. 249-51.

28. Robert G. Chambers and Richard E. Just, "A Critique of Exchange Rate Treatment in Agricultural Trade Models: Reply," *American Journal of Agricultural Economics* (May 1980), pp. 255-59.

29. Thomas Grennes, Paul R. Johnson, and Marie Thursby, "Devaluation, Foreign Controls, and Domestic Wheat Prices," *American Journal of Agricultural Economics* 59 (1977), pp. 619-27.

search has perhaps been cast in too narrow a context. This narrowness is probably due to the focus upon changes in the quantity demanded that are expected to result from changes in the exchange rate. As Kost showed, the change in exchange rate is a shift phenomenon whereby the excess demand curve moves along the excess supply curve in response to exporter changes in exchange rates. Therefore, it is not enough to say that prices change along a curve (FJT, BMC); rather, one must say that prices change in response to shifts in excess demand and excess supply curves. Furthermore, these shifts in excess demand and excess supply reflect a number of important and often subtle variables which are affected by changes in the exchange rate.

Bredahl's 1976 paper reveals the importance of including excess supply in the analysis. Chambers and Just (CJ) directed the discussion away from own-price relationships and included cross-price effects in their excess supply and excess demand functions. However, the models still remain incomplete. While Chambers and Just included the cross-price effects, they neglected to focus upon input prices as important shifters of domestic supply and the effect changes in the exchange rate would have on these prices. Finally, it is important to consider the cross-country effects of exchange rate changes. The excess demand for U.S. agricultural products is composed of demand and supply in both importing and exporting countries. Therefore, substitution among exporters can occur and should be considered in a multi-country model. Greenshields considered this factor in determining Japanese demand for U.S. grain and soybean exports where a U.S. devaluation caused Japan to substitute U.S. wheat for Australian wheat. Considering these factors, the following specification for a trade model equilibrium would be necessary:

Rest-of-World Excess Demand = Country j Excess Supply

$$\sum_{i=1}^n \left[ D_i(eP_j, P_i, M) - S_i(eP_j, P_i) \right] = S_j(P_j r_j) - D_j(P_j M)$$

$D_i$  = Foreign demand in country  $i$

$S_i$  = Foreign supply in country  $i$

$P_j$  = Price vector of related goods in demand and supply which are traded

$P_i$  = Price vector of non-traded related goods in demand and supply in country  $i$

$r_j$  = Intermediate good and input prices in country  $j$ 's supply function

$M$  = Income

$e$  = Exchange rate

The large number of shift variables discussed above presents econometric problems, but their inclusion prevents biases resulting from incorrect specification. The justification for their inclusion lies in the fact that the exchange rate is pervasive and directly affects all traded goods.

By now, the suitability of a general equilibrium treatment of this question should be apparent. The inclusion of input prices, intermediate goods, substitute goods and competitive goods in the excess supply function suggests the need for a multi-sector general equilibrium treatment. A more fundamental rationale for employing a general equilibrium approach is its usefulness in measuring changes in the terms of trade. The discussion to this date has centered upon the impact of exchange rate changes on absolute agricultural prices. This by itself is a poor measure of agriculture's gain or loss from exchange rate changes when changes in other sector prices, non-traded agricultural good prices or the general price level may actually turn the domestic terms of trade against agriculture.

A simple four-sector matrix suggests how different sectoral prices can be compared.

	<u>Traded</u>	<u>Non-traded</u>
Agriculture	$P_{at}$	$P_{an}$
Manufactured	$P_{mt}$	$P_{mn}$

A devaluation will increase  $P_{at}$  and  $P_{mt}$ , but the net impact upon agriculture remains ambiguous due to impacts upon  $P_{an}$  and  $P_{mn}$  and the secondary effects transmitted through input prices, intermediate goods, incomes, and demand shifts.

The literature contains many treatments of inter-sectoral linkages such as Dornbusch (1973), Mundell (1961), and McKinnon (1963).<sup>30</sup> Dornbusch applied a monetary approach to the theory of

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30 R. Dornbusch, "Devaluation Money and Non-traded Goods." *American Economic Review* 63 (December 1973), pp. 871-80. R. A. Mundell, "A Theory of Optimum Currency Areas," *American Economic Review* 51 (September 1961), pp. 657-65, and R. I. McKinnon, "Optimum Currency Areas." *American Economic Review* 52 (September 1963), pp. 717-725.

devaluation and concluded that non-traded goods in the devaluing country will suffer a price fall. This is largely due to the shift in the hoarding schedule caused by the devaluation.

### *The Money Supply and Commodity Prices*

Shei<sup>31</sup> made an attempt to estimate the effects of the 1971 and 1973 devaluations of the dollar in a general equilibrium framework. He specified a general equilibrium econometric model of the U.S. economy and estimated the parameters for this model. The model treated both the real and monetary sectors, with sufficient disaggregation that the important simultaneities of the agricultural sector with the rest of the economy could be reflected.

The estimates of the structural equations were used to simulate the effects of a unilateral devaluation of the U.S. dollar, a once-and-for-all increase in the stock supply of the domestic component of the monetary base, and an exogenous shock to the system such as a crop failure in the rest of the world which shifts the export demand for U.S. crops upward. The simulations were based on observed levels of each of these changes in 1973.

These experiments suggested that dollar devaluations had a significant effect on U.S. crop exports and domestic and export prices in the early 1970s. However, the observed monetary expansion explained a larger part of the price changes than the dollar devaluation. Simulations of the shifting export demand for U.S. crops as a result of the 1972 crop failure in the rest of the world explained a relatively small amount of the observed changes in the early 1970s.

Barnett<sup>32</sup> followed up on Shei's work by examining the effects of both domestic and international liquidity on agricultural prices. His interests were in particular to determine whether international liquidity had a significant effect on the prices of commodities traded internationally, and whether these monetary variables have had an effect on the ratio of agricultural prices to prices in the rest of the economy.

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31. Shun-YI Shei, "The Exchange Rate and U.S. Agricultural Product Markets: A General Equilibrium Approach." unpublished Ph.D. thesis, Purdue University, 1978

32. Richard C. Barnett, "The Relationship Between Domestic and International Liquidity and Nominal Agricultural Prices: A Time Series Analysis," unpublished master's thesis, Purdue University, December 1980.

The empirical evidence suggested that both domestic and international monetary expansion had a significant effect on domestic agricultural and food prices in the United States and in the world in general during the 1970s. Monetary expansion also appears to have had an influence on the observed change in the ratio of U.S. agricultural prices to nonagricultural prices during this period. His empirical evidence also suggested that money is causal to agricultural prices, with little or no feedback.

### **Some Suggestions for Future Modeling Efforts**

This review of the monetary aspects of agricultural trade suggests that future modeling efforts have to deal with models that are a great deal more comprehensive than those used in the past. Treating the trade sector as a simple extension of the domestic agricultural sector as a general approach is not likely to have a very high payoff.

Instead, commodity markets need to be linked directly to monetary aggregates, both domestic and international. This is a tall order, especially in light of the more general effects of monetary policy and capital markets. One need only recognize that with privately held stocks, changes in the money markets have significant effects on the holding of stocks and in turn on commodity prices. The growing deregulation of the U.S. credit and banking system makes the entire agricultural sector much more sensitive to changes in monetary and fiscal policy. The failure to take account of this in our modeling efforts can only lead to a lack of realism in the models and poor prediction and forecasting models.

Two implications immediately follow from this. The first is that models of the agricultural sector really have to be components of general equilibrium models of the economy. There seems no other route to go, despite our desire for simplicity and for models that can be used in a low cost way.

The second implication is that viewing commodity markets in the traditional context of flows is unsatisfactory. Once one introduces monetary phenomena, one has to view commodity stocks as assets on a par with monetary assets and other capital instruments. The observed shifting of funds back and forth between commodity and capital markets is just too great to be ignored any longer.

In modeling exchange rate phenomena, greater attention needs to be given to both cross-country effects among exporters and to the supply response in import-demanding countries. The importance of

cross-country effects was referred to above. The supply response in import-demanding countries was discussed only implicitly. The point, of course, is that exchange rate realignments that are passed on to domestic economies affect the quantity supplied as well as the quantity demanded.

To understand the U.S. agricultural trade sector a great deal more effort needs to be devoted to understanding the agricultural sector of other countries. Models designed to do this will have to be structured as comprehensively and in as sophisticated a way as those for the U.S. agricultural sector. That means that available sector models for the most part will only be starting points. They need to be cast in general equilibrium models of their respective economics.

Much more attention also needs to be given to trade distortions and government interventions. As Thompson notes, many of the trade models have had an exaggerated free market bias to them. Government intervention in trade is significant and pervasive. It needs to be taken into account in developing sound models for policy analysis.

Greater attention also needs to be given to the role of governments in commodity markets. The evidence we have on the responsiveness of policy to changing economic conditions also suggests that government can no longer be treated as exogenous, but must be treated as endogenous to the economy. Moreover, it isn't just the **U.S.** government that needs to be understood; the behavior of governments in other countries is equally as important.

Finally, a great deal more effort needs to be directed to developing appropriate data series and information on government policy and interventions. Moreover, this information needs to be organized and pooled in such a way that it can be made available to modelers and trade researchers.

### **Concluding Comments**

Most models of the U.S. agricultural sector have been specified in a partial equilibrium context and have had fairly weak and inadequately specified linkages to the rest of the economy. The internationalization of **U.S.** agriculture, together with the shift to a floating exchange rate regime and the emergence of a well-integrated international capital market, cause the continued use of such an approach to be of dubious value. U.S. agriculture can only be understood in the context of the world agricultural economy of

which it is a part. Moreover, world agriculture can only be understood in the context of a general equilibrium model that takes account of monetary and fiscal phenomena. It would be nice if the world were simpler. But it really isn't.