Reforming Japanese Rice Policies: Importance of Product Differentiation

By

Praveen M. Dixit

and

Vernon O. Roningen[1]

[1]Paper to be presented at the American Agricultural Economics Association selected paper sessions, Manhattan, Kansas, Aug 4-8, 1991. Authors are economists at the Economic Research Service, U.S. Department of agriculture. Views expressed in this paper are those of the authors' and not necessarily those of the U.S. Department of Agriculture.

Reforming Japanese Rice Policies: Importance of Product Differentiation

Abstract

Recognition of product differentiation in the rice market could alter the economic implications of Japanese policy reform. Rice imports into Japan range from 3.6 million metric tons (mmt) to 5.1 mmt, depending upon the degree of substitution assumed. China and Thailand would benefit the most if the market is assumed to be homogenous. If product varieties are considered, the United States and Australia would be the major beneficiaries.

Keywords: Rice, japonica, indica, Japan, policy reform, SWOPSIM, PSE.

#20187

Reforming Japanese Rice Policies: Importance of Product Differentiation

Past studies that have examined the economic implications of agricultural policy reform have often been faulted for failing to recognize the substantial product differentiation that exists among agricultural commodities. Studies such as those of Roningen and Dixit (1990), Tyers and Anderson (1986), and the OECD (1987), it is argued, naively assume product homogeneity in agricultural markets and consequently provide an improper representation of the likely implications of policy reform.

The criticisms on product differentiation have been especially severe on studies that look at the rice market. Childs (1990), in his study of government intervention in the world rice market, indicates that most studies, including those by Roningen and Dixit (1991) and Tyers and Anderson (1986), do not recognize an important and rather crucial element of the market—that Japonica rice produced and consumed in Japan is far different in quality to indica rice traded in the world market. Consequently, post-reform implications on the rice market, especially those concerning Japanese imports, may be grossly overestimated.

More specifically, the argument goes, Japanese consumers have such a strong preference for Japonica rice that availability of indica rice even at much lower prices (following liberalization) would not generate large increases in Japanese indica imports (Wailes, Ito, and Cramer, 1991). In addition, it is pointed out, there is also a supply problem. Japonica-type rice variety is only grown in a few select areas in the world (California, South and North

Korea, and Australia), and even if Japan were to completely eliminate all import barriers, these areas could not, in the short to medium term, substitute into japonica rice and fulfill Japanese import requirements.

Our primary objective in this paper is to examine the importance of product differentiation in the world rice market in the context of Japanese rice policy reform. We do this by building a world rice net trade model that disaggregates rice types into the japonica and indica varieties. Product differentiation is examined in the context of substitution in both consumption and production.

We begin the paper with a brief description of the Japanese and world rice markets. We then present the world net trade model that is used to address the product differentiation issue. A comparison of the economic implications of policy reform in the Japanese rice markets are examined under four separate assumptions: i) rice is a homogenous product, ii) indica and japonica rice are heterogenous products with no substitution possibilities, iii) some substitution possibilities exists in Japanese consumption of rice, and iv) some substitution/expansion possibilities exist in production of japonica rice in exporting countries. We conclude the paper by pointing out the limitations of our approach and conditions under which the assessments could alter.

The Japanese and World Rice Markets

The economic importance of rice to Japanese agriculture has been well documented (ABARE, 1988). Rice accounts for roughly a third of the gross

value of agricultural production, and rice farmers are the largest farming group in Japanese agriculture. Three out of every four farmers in Japan cultivates rice, and for them, its cultural value transcends that of being a mere crop.

The role of rice in consumption is no less important. In the early 1930's, it accounted for as much as 30 percent of the food expenditure of urban workers and this share did not drop below 10 percent until after 1960. Even now, it accounts for nearly 8 percent of food expenditures, compared to less than 1 percent in most other industrialized countries.

The Japanese Government intervenes rather extensively in the production and marketing of rice. Policy instruments include direct price and income support to producers, border measures such as state controls and quotas, and subsidies on inputs used in rice production.[1]

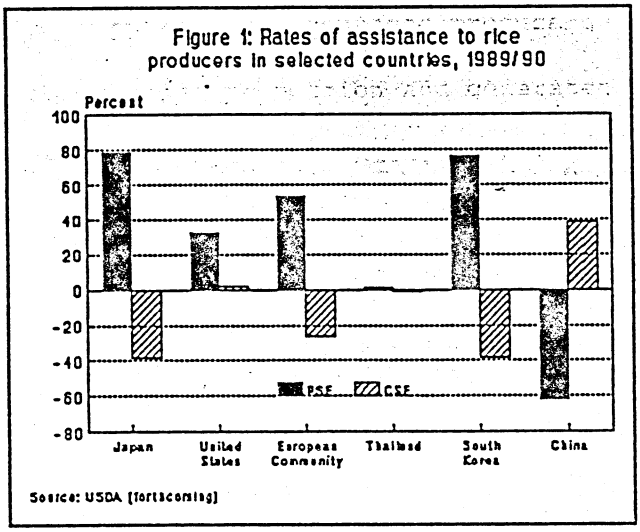
The prices received by rice producers are based on production costs and some notion of parity. Producer prices in the last decade have been at least 8 times the world price (Childs, 1990). Rates of assistance to Japanese rice producers, as measured by the producer subsidy equivalent[2], are also much higher than in other industrial market economies (figure 1). The high levels

---

[1]ABARE (1988), Childs (1990), and Wailes, Ito, and Cramer (1991) provide further details on Japanese rice policies and market structure.

[2]The producer subsidy equivalent (PSE) represents the value of government support to producers and includes both budgetary and non-budgetary assistance. Percent PSE is conventionally expressed as the ratio of total support to the market value of production adjusted for direct payments. Details on the measure and its counterpart, the consumer subsidy equivalent (CSE), are provided in USDA (1987).

of support has encouraged producers to increase production and generated serious surpluses. Riceland diversion schemes, such as the current Paddy-Field Reorientation Programs, have been introduced to deal with the problem.



Domestic price support programs are maintained through external trade barriers. Imports of rice are strictly controlled by the Japanese Food Agency, the same body which controls the domestic marketing of rice. The Agency gives permission to traders to import and export rice. But, importers are obliged to sell rice to the Agency. This control over imports enables the Agency to insulate the domestic market from world market forces. Imports accounted for less than half of 1 percent of domestic consumption during the eighties.

Japan produces and consumes almost exclusively the Japonica variety of rice, a medium-grain rice grown in temperate regions that is semi-sticky and moist when cooked. Some non-glutinous varieties—less than 5 percent of all rice production—are grown and used for industrial purposes. There is, though, very little substitution in consumption between indica and Japonica rice.

Nearly 30 percent of the world's Japonica rice is produced in Japan. Japonica rice itself accounted for roughly 10 percent of world rice production and

almost 16 percent of world trade during the early and mid-1980's. Japan, China, North Korea, and South Korea are the primary producers and consumers of Japonica rice. Together, these four countries account for about three-fourths of total consumption and production of japonica rice.

Indica rice, a long-grain variety grown typically in tropical regions, accounts for most of the remaining rice produced and consumed. Indica rice normally sells at a premium on the world market. Enough substitution appears to occur in areas outside of Japan to cause indica and japonica prices to generally move together (Childs, 1990).

The Modeling Framework

The analysis of the economic implications of rice policy reform in Japan is done with the Static World Policy Simulation (SWOPSIM) modeling framework (Roningen, 1986). A SWOPSIM model is characterized by three basic features: i) it is a nonspatial price equilibrium model; ii) it is an intermediate-run static model that represents world agriculture in a given year; and iii) it is a multiregion partial equilibrium model. In order to use this static, nonspatial price equilibrium model to describe world rice trade, we assume that world markets are competitive, that domestic and traded goods are perfect substitutes in consumption, and that a geographic "region", possibly containing many countries, is one market place.

The economic structure of SWOPSIM models includes constant elasticity domestic supply and demand equations. Trade is the difference between domestic supply

and total demand. The policy structure is embedded in equations linking domestic and world prices. Policies (PSEs and CSEs) are inserted as subsidy equivalents at the producer, consumer, export, or import levels. In addition, price transmission elasticities which characterize the degree of connection between domestic and world prices are also included. Details on the economic and policy structures, and the use of summary support measures in the modeling framework are presented in Roningen and Dixit (1989).

The version of SWOPSIM that we use for this study (RI89) is based on 1989/90 marketing year data. The world is divided in eight regions—Japan, the United States, Australia, the European Community (EC), the People's Republic of China, Thailand, South Korea, and an aggregated Rest-of-World. Two rice varieties, Japonica and Indica—representing all other types of rice—, are included in the model.

Various types of data for both rice varieties in each country were required to construct RI89: supply, demand, and trade data for 1989-90; own- and cross-price elasticities of demand and supply; price transmission elasticities; technical coefficients, such as feed conversion ratios; PSE and CSE data; and macro-economic data, such as exchange rates.

Supply, demand and trade data were obtained from the U.S. Department of Agriculture's Foreign Agricultural Service (FAS). FAS, however, does not disaggregate supply and use data by product types. Consequently, we generated disaggregated rice data in the following manner: using Bateman's (1988) "typical " japonica production, use, and trade data for marketing years 1980-

86, we calculated shares of japonica rice in total rice for the period; then, we used these shares on 1989/90 FAS marketing year rice data to obtain the split between japonica and indica varieties; finally, several rice analysts were asked to review the data for appropriateness and consistency. The supply, demand, and trade data used in the modeling framework are presented in appendix table 1.

The own- and cross-price elasticity estimates for demand and supply were based on a number of empirical studies. Details on the estimates and the technical coefficient used in the model are presented in Gardiner, Liu, and Roningen (1989). If a country produced and/or consumed both varieties of rice, the same supply and demand elasticities were used for both varieties. Information on price transmission elasticities can be found in Sullivan (1990), while data on PSEs and CSEs are given in OECD (1991) and USDA (forthcoming).

This paper presents the results of experiments using the RI89 model in which new equilibrium solutions are obtained by removing PSEs and CSEs. The new solution represents an approximation of the resulting adjustments in production, consumption, trade, and prices of agricultural commodities expected after 5 years, with the important proviso that all other conditions remain the same as in the base year, 1989/90. This permits the analysis to isolate and identify the differences between the new solution and the initial or reference solution and to attribute them to the removal of distortionary agricultural policies.

Eliminating Policy Intervention in Japanese Rice Market

We used the model and the aggregate measures of government intervention (PSEs and CSEs) to simulate conditions that would exist if Japan unilaterally eliminated all rice support as they existed in 1989/90. From this we deduced the distortions in world prices and trade and the annual economic welfare costs of such policies. Simulations were carried out to represent four different characterizations of the world rice market: rice varieties are perfect substitutes, rice varieties are separate products with no substitution possibilities, some substitution exists in Japanese consumption of rice, and moderate substitution/expansion possibilities exist in foreign (non-Japanese) japonica production.

Rice Varieties as Perfect Substitutes

If we assume that rice is a homogenous product, then elimination of support to Japanese rice producers in our model would raise the world rice price by 7.5 percent and Japanese rice imports would increase by 5.1 million metric tons (mmt) annually (table 1). In other words, nearly half (46 percent) of total rice consumption in Japan would be fulfilled through imports in a liberalized (post-reform) situation.

Thailand and China would be the major beneficiaries from a relaxation of Japanese rice import restrictions. Rice production in these countries would increase slightly (around 1 percent), compared to a fall of 41 percent in

Table 1: Changes in indicators of agricultural performance from Japanese rice policy reform—the perfect substitution case, 1989/90

Indicators	Japan	United States	European Community	Australia	Thailand	China
Producer price (percent)	-76.6	5.1	3.5	7.4	3.7	2.4
Net Trade (000 mt)	-5072	125	29	32	183	628
Production (percent)	-41.3	2.0	1.2	4.4	1.2	0.4
Consumption (percent)	12.4	-0.9	-0.9	-1.6	-0.2	-0.2
Producer income ($ million)	-14030	85	19	5	68	466

Source: SWOPSIM RI89 simulations

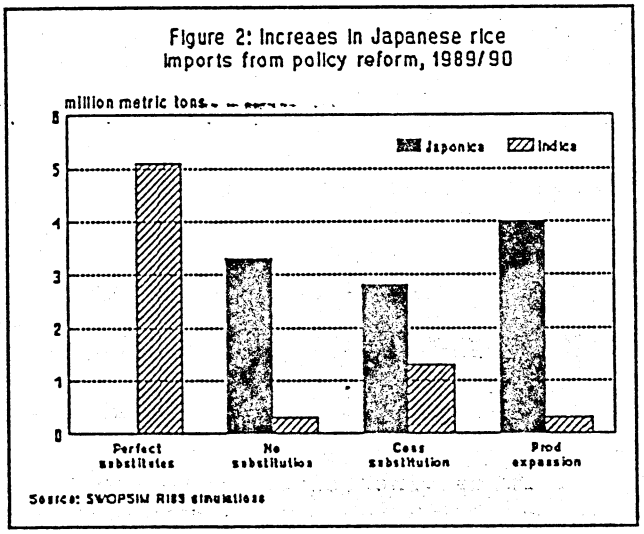
Japan. The U.S. and Australia would gain very little, and account for only a small share of the expansion in world rice trade.

Opponents of trade reform often point to the losses in producer incomes as an argument against liberalization. Indeed, our results indicate that Japanese producer surplus losses from unilateral rice reform would be about $14 billion or about half of the total net agricultural incomes in 1989/90. While these losses may appear large, consider the following. In 1986, agricultural income provided only about 2 percent of Japanese household income for the 40 percent of farm households with 0.5 hectare or less of cultivated land, and less than 8 percent of household income for 28 percent of farm households with 0.5-1.0 hectare of cultivated land (ABARE, 1988). Therefore, for nearly 70 percent of Japanese farm households, even a considerable drop in farm income as implied

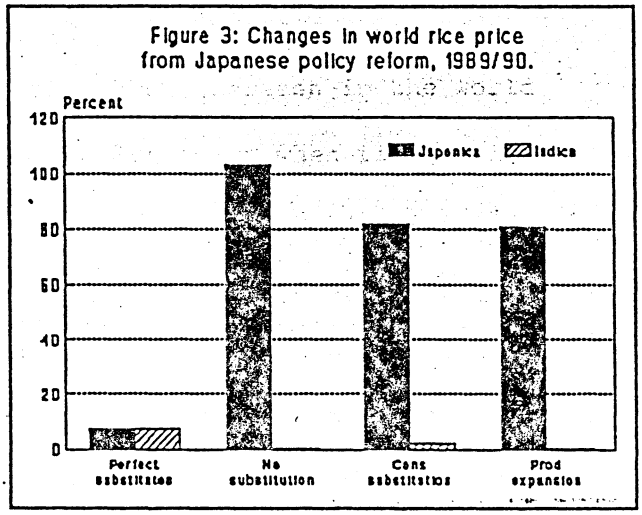
by our results would have very little effect on their living standards. This is especially true given that average income of farm households in 1986 was nearly 30 percent higher than average income of non-farm households.

No Substitution Possibilities between Rice Varieties

Model results indicate that if japonica and indica rice are treated as separate commodities with no substitution possibilities, then elimination of support to Japanese producers would increase total rice imports by 3.6 mmt annually (figure 2). In other words, only about a third of Japanese consumption would be imported. Compare this to the earlier situation where rice varieties were considered perfect substitutes and more than 5.0 mmt of rice—or 50 percent of consumption—would be imported.



Why are there such differences in Japanese imports? Mostly because elimination of support to rice producers in Japan more than doubles the (103 percent) world japonica price (figure 3). Consequently, the price received by Japanese japonica producers falls by only 56 percent, compared to the 77 percent decline earlier when perfect substitution was assumed. As a result, Japanese rice production decreases by only 20 percent. Production decline was much larger (41 percent) when rice was treated as a homogenous product.



The large increase in the world japonica price when rice varieties are modeled as imperfect substitutes occurs because of high levels of Japanese protection for that variety of rice and the importance of Japan in global production and consumption of japonica rice. Japan accounts for 33 percent of world Japonica production but only 4 percent of all rice production. Little wonder then that disaggregating the market by rice types and attributing most of the Japanese support to the japonica variety makes such a difference in world price and trade changes.

The mix of countries that gain from Japanese import liberalization is also somewhat different when the market is segregated by product varieties. Whereas China and Thailand were the major beneficiaries under the homogenous market assumption, the United States and Australia do most of the supplying in the disaggregated market. Japonica rice, which forms the bulk of Japanese imports, is not grown in Thailand.

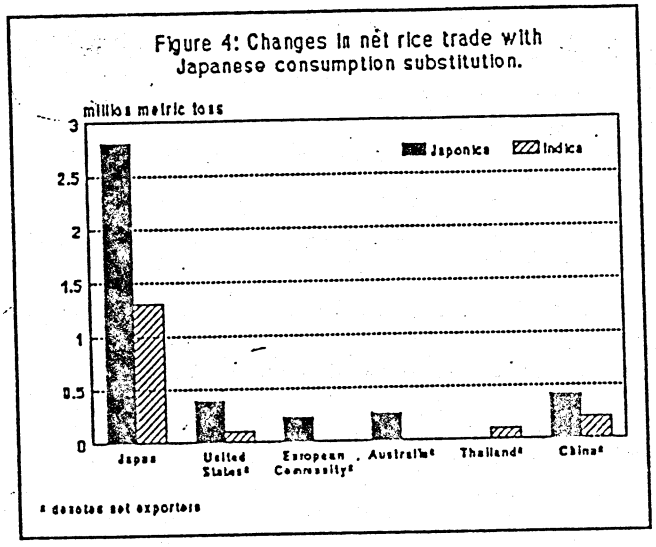
The effects on the world indica market from reforms in Japanese rice policy are not very consequential in this scenario. This is principally because consumption and production substitution possibilities between indica and japonica varieties are not modelled. What minor effects that exist in the

indica market come from the limited role that non-glutinous rice plays in the Japanese economy.

Moderate Substitution Possibilities in Japanese Consumption

Some may argue that the lack of substitution possibilities in consumption between japonica and indica rice is rather unrealistic. In a third set of experiments, we allowed for moderate substitution in Japanese consumption of different rice types by assuming an elasticity of substitution of 3 between the japonica and indica varieties. Because our objective is to isolate the effects that changes in the Japanese rice market have on world trade, we continued to assume that substitution between the two varieties were nonexistent in other markets.

Model results indicate that imports of rice into Japan increases by 4.1 mmt when Japanese consumers are allowed to substitute japonica and indica varieties (figure 4). This is slightly greater (15 percent) than the 3.6 mmt that Japan imports when rice varieties were considered separate products. Note, however, that the mix of imports changes considerably. Just over 30 percent of the imports is now indica compared to the 7 percent in a completely differentiated market.



As was the case earlier, most of the increase in Japanese indica imports appear to come from China, while the United States and Australia continue to account for a large share of japonica imports. Despite this, total U.S. exports of japonica rice falls by 18 percent, indicating that any substitution into indica rice by the Japanese would adversely affect U.S. japonica producers the most.

The world price implications are also rather different when substitution possibilities are permitted. World japonica price rises by only 82 percent compared to the 103 percent increase without substitution possibilities. In other words, part of the increase in world japonica price has been absorbed through greater consumption of indica rice in Japan. Consequently, world indica price increases—but not by much (2.0 percent), suggesting that the Japanese rice policy reform is not all that consequential for the indica market when only moderate substitution possibilities exist. But whether in fact the world Japonica rice price can diverge so dramatically from the indica price could be an issue of contention: historically, the two prices have moved closely together. Note, however, that part of this divergence reflects the absence in our model of any substitution possibilities between the two varieties in countries other than Japan. If appropriate substitution possibilities were allowed in other countries, then the price movements would more likely resemble the historical patterns that have been observed in the world rice market.

Moderate Production Expansion Possibilities for Exporters

There are those who argue that imports of rice into Japan following trade reform are not likely to be very large because of the limited opportunities for expansion in japonica production among exporters. Part of this belief is based on the consideration that substitution into japonica rice from other varieties of rice may not be easy because of technological constraints. Others, on the other hand, contend that, over any given period of time, continued profitability in japonica production would induce greater supply response among exporters. Supply response could be forthcoming either from expanded japonica acreage or substitution away from indica rice.

To study the economic implications of greater supply response on Japanese rice imports, we doubled the own-price elasticity of supply for japonica rice for all exporters. This larger supply response is designed to represent not only the expansionary effects in production but also the long-run substitution away from indica rice. To isolate the effects of production expansion, we assumed no substitution in consumption between the two varieties in Japan.

Our results indicate that the implied long-run increase in world japonica price (81 percent) from Japanese liberalization is smaller than the 91 percent rise obtained for the short-to-intermediate run (figure 3). As a result, the decline in Japanese japonica production is greater (24 percent), and Japanese imports of japonica rice (4.0 mmt) are larger than earlier (figure 4). Total rice imports (4.3 mmt) is, in fact, somewhat close to the 5.1 mmt imported when rice was considered a homogenous product.

How are exporters affected by this? Australia (90 percent increase in net exports vis-a-vis no-substitution case) benefits the most, followed by the United States (58 percent) and China (42 percent). What this suggests is that if Japan were to open its rice market, and if Japanese consumers were to show a strong preference for japonica rice, then Australia and the United States can be expected to benefit substantially in the long run. If, on the other hand, Japanese consumers were to substitute into indica rice, China and Thailand could be expected to be the major beneficiaries.

Limitation of Analysis

The economic implications of trade liberalization are likely to differ depending upon the period under analysis. In comparing the results of this study with another that used 1986/87 marketing year as base (Roningen and Dixit, 1991), we found out that liberalization of rice policies by Japan would have increased world agricultural prices much less under 1989/90 conditions than under 1986/87 conditions. As a result, imports of Japanese rice under 1986/87 conditions would be almost half those under 1989/90 conditions. Such large differences in import estimates in a matter of a few years suggests that care should be taken in any analysis of policy reform.

Our model uses synthetic elasticity estimates. While this methodology has recently gained considerable recognition in the profession as a means of policy analysis, the approach itself still has to be viewed with caution—especially when sufficient empirical estimates of the elasticities are not

available. This, for instance, is the case with parameters that describe the substitution in consumption between japonica and indica varieties in Japan and the supply response of japonica rice in countries other than Japan. Japanese import restrictions, in no small way, may have contributed to this dearth of information.

We focused on complete trade liberalization in our study. In many respects, this may seem rather unrealistic. If liberalization were to be partial—as is most likely the case—, our rather naive interpretation of the world market in which institutional rigidities are not taken into account could be a source of some concern.

Cross-commodity effects are also not included in our analysis. Typically, this would be viewed as a problem. In the case of rice, however, we believe that such an approach is justified. Empirical estimates of the cross-price effects between rice and other crops in both production and consumption have been found to be very small (Gardiner, Liu, and Roningen, 1989).

Our model results are based on the assumption that other countries do not change their policies as a result of higher world prices. If policies change, the implication could change. This is especially true for China which accounts for more than a third of global rice production.

Finally, there is also the Lucas critique. Lucas (1976) argued that models estimated using data under past policy regime may not be relevant to current or future conditions. This issue is of special concern when large shocks like

trade liberalization occur. Should policy regimes change drastically, as would be the case with trade liberalization, a model based on historical parameters may not give the correct story.

Conclusion

This paper was undertaken largely in response to criticism that past studies on agricultural trade liberalization did not recognize the substantial product differentiation that exists in the world rice market. Our general conclusion appear to be that recognition of the difference could alter the economic implications of agricultural trade reform.

In particular, there appears to be some merit in the argument that Japanese imports of rice are not likely to be as high as has been surmised in studies that assume that rice varieties are perfect substitutes. The strong preference of Japanese consumers for japonica rice, and the limited immediate opportunities for foreign supply response in japonica rice, would ensure that increases in world price would be substantial. Consequently, declines in Japanese domestic production would be smaller than suggested in most past studies.

Our analysis also seems to indicate that a proper representation of Japanese imports following liberalization would be somewhere between the 3.6 mmt obtained assuming no substitution and the 5.1 mmt derived under perfect substitution. In reality, there is likely to be some substitution in consumption between the two varieties. Moreover, farmers in other countries

are likely to produce japonica rice after an adjustment period if profitability continues to exist.

Analyzing the economic implications of agricultural trade liberalization is a not an easy task. Our objective in this exercise was merely to point out the ranges of possible outcomes if Japan were to liberalize its rice market. What we conclude from our analysis is that Japan would import substantial amounts of rice following agricultural policy reform, but the actual magnitude could be expected to vary as Japanese tastes and foreign production patterns change.

References

Bateman, Merrill J. "Economic Effects of Japan's Rice Policy on the U.S. and World Rice Economies." Commodity Information Ins., Orem, Utah, Sept. 1988.

Australian Bureau of Agricultural and Resource Economics (ABARE). Japanese Agricultural Policies: A Time of Change. Canberra, Australia: Australian Government Publishing Service, Oct. 1988.

Childs, Nathan W. The World Rice Market—Government Intervention and Multilateral Policy Reform. Staff Report AGES9060, U.S. Dept. Agr., Econ. Res. Serv., Sept. 1990.

Gardiner, Walter H., Karen Liu, and Vernon O. Roningen. Elasticities in the Trade Liberalization Database. Staff Report AGES 89-20, U.S. Dept. Agr., Econ. Res. serv., May 1989.

Lucas, Robert E. "Econometric Policy Evaluation: A Critique," The Phillips Curve and Labor Market, eds. K. Bruener and A.H. Meltzer, Amsterdam: North Holland Publishing Co., 1976.

Organisation for Economic Cooperation and Development (OECD). Agricultural Policies, Markets, and Trade: Monitoring and Outlook Report 1991, Paris, France, 1991.

Roningen, Vernon O. A Static World Policy Simulation (SWOPSIM) Modeling Framework. Staff Report AGES860625, U.S. Dept. Agr., Econ. Res. Serv., July 1986.

Roningen, Vernon O., and Praveen M. Dixit. "Reforming Agricultural Policies: The Case of Japan." Journal of Asian Economics, Vol. 2, No. 1, Spring 1991.

Roningen, Vernon O., and Dixit, Praveen M. Economic Implications of Agricultural Policy Reforms in Industrial Market Economies. Staff Report AGES 89-36, U.S. Dept. Agr., Econ. Res. Serv., Aug. 1989.

Sullivan, John Price Transmission Elasticities in the Trade Liberalization (TLIB) Database. Staff report AGES 9034, U.S. Dept. Agr., Econ. Res. Serv., Washington, DC, Apr. 1990.

Tyers, Rod, and Kym Anderson. "Distortion in World Food markets: A Quantitative Assessment." Background paper for the World Bank's World Development Report. Washington, DC, July 1986.

U.S. Department of Agriculture (USDA), Economic Research Service. Estimates of Producer and Consumer Subsidy Equivalents: Government Intervention in Agriculture, 1982-89. Staff Report, U.S. Dept. Agr., Econ. Res. Serv., forthcoming.

U.S. Department of Agriculture (USDA), Economic Research Service. Government Intervention in Agriculture: Measurement, Evaluation, and Implications for Trade Negotiations. FAER-229, 1987.

Wailes, Eric J., Shoichi Ito, and Gail L. Cramer Japan's Rice Market: Policies and Prospects for Trade Liberalization. Report Series 319, Arkansas Agricultural Experiment Station, University of Arkansas, Fayetteville, Arkansas, Feb. 1991.

Appendix-1: Supply, Demand, and Trade Data for Japonica And Indica Varieties, of rice 1989/90

	Supply	Demand	Trade
	—Japonica thousand metric tons—		
Japan	9077	9077	0
United States	1042	816	226
European Community	1324	723	601
Australia	554	103	451
Thailand	0	0	0
South Korea	4971	4971	0
China (PRC)	10087	9969	118
Rest-of-World	7215	8611	-1396
	—Indica (all others) thousand metric tons—		
Japan	339	356	-17
United States	3968	1859	2109
European Community	0	783	-783
Australia	102	102	0
Thailand	13860	9860	4000
South Korea	926	926	0
China (PRC)	126091	126191	-100
Rest-of-World	178384	184871	-6487

Source: Foreign Agricultural Service (USDA), Bateman, (1986), and authors' calculation.