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Tariff Escalation: Impacts on U.S. and Global Rice Trade

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Selected Paper prepared for presentation at the American Agricultural Economics Association Annual Meeting, Denver Colorado, August 1-4, 2004

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Abstract

Tariff escalation is an important aspect of protection for domestic milling industries, particularly in Central America. The United States exports over 40 percent of its rice as paddy. This study uses a spatial equilibrium trade model to evaluate the impacts of tariff escalation on U.S. and global long grain paddy and milled rice trade. Tariffs are harmonized for paddy and milled rice at two levels: milled tariff rates and zero. The results indicate that tariff escalation distorts US rice trade in favor of paddy exports, reducing the demand for rice milling and associated value-added activities in the US.

Key words: tariff escalation, rice, trade, milling.

Tariff Escalation: Impacts on U.S. and Global Rice Trade

Introduction

Rice is one of the most important food crops in the world, accounting for more than 20 percent of total calories consumed by humans and an even higher share of calories in developing countries. Yet, despite its importance as a basic food staple, rice trade is only 6.5 percent of consumption. Such limited trade is due partly to preferences for specific local types and grades of rice, but also to protectionist import policies based on food security objectives and price and income support to producers and processors.

Trade liberalization is having an impact on the international rice market because rice trade has been highly protected in both industrialized and developing nations (Wailes, 2002; Sumner and Lee, 2000). The relatively modest terms of agreement in the Uruguay Round Agreement on Agriculture along with regional trade agreements and national policy reforms have contributed to an increase in global rice trade growth experienced in the latter half of the 1990s (Figure 1). Compared to the 1970s and 1980s, post-Uruguay Round rice trade has essentially doubled in both volume and as a share of consumption. Nevertheless, rice remains with sugar and dairy products, as one of the most protected food commodities in world trade.

One important trade policy in rice is protection for the domestic rice milling industry. This form of protection is expressed in tariff escalation and is especially prevalent in Central and South American nations. Tariffs on milled rice are higher than for paddy (rough) rice (table 1). The objective of this paper is to analyze the effects of tariff escalation on U.S. and global rice trade and prices. The U.S. is one of only a few of the major rice exporting countries where export of paddy rice is legal or at least not

discouraged. In recent years the share of U.S. rice exports as paddy has increased to over 40 percent (Figure 2). Tariff escalation increases the import prices on milled rice relative to paddy rice, skewing the location of processing in favor of the importing countries as the demand for milling services and associated value-added activities in the exporting nation decline. While total rice trade may or may not increase, there are welfare losses to the milling sector and value added sectors in the exporting nation and welfare gains to the milling sector and value added sectors in the importing nation. If the distortion in tariffs moves the milling of rice from a more efficient rice milling country into a higher cost, less efficient milling country then global losses may be negative.

Table 1. Schedule of rice tariffs by degree of milling for selected countries, 2002.

	Long Grain Non-Aromatic Rice	
	White	Paddy
Bolivia	10%	10%
Brazil	18%	14%
Canada	0%	0%
CARICOM	25%	25%
Chile	7%	7%
Costa Rica	35%	35%
El Salvador	40%	0%
Guatemala	35%	0%
Haiti	0%	0%
Honduras	45%	0%
Mexico	20%	10%
Nicaragua	62%	45%
Peru Ad valorem	25%	12%
plus levy (USD/MT)	122	122
Rest of the World	11%	0%

Source: USDA, FAS. *Attache Reports*.

Measurement of the effects of tariff escalation

The literature on measuring the effects of tariff escalation recognizes that the net effects depend upon what changes in the tariff structure are compared to the existing regime. First, Yeats (1984) has shown that moving to a uniform tariff does not

necessarily remove the bias in location of processing if the demand elasticity for the processed good is rather higher than for the raw product. Second, a move to no tariffs, which is commonly assumed in much of the tariff escalation literature, would have two effects; one, increasing the import demand across all processing stages and two, increasing the demand for the processed relative to the raw product demand. A third alternative would be to define a “neutral” tariff regime that is defined as one that would hold the relative shares of the raw and processed exports in the same proportion under the free trade (no tariffs) regime but would maintain constant the total combined value of exports of the raw and processed products (Hecht, 1997). Comparison between the escalating tariff regime and the “neutral” tariff regime would provide a measure of the pure effect of the tariff escalation. Comparison to a free trade regime or a uniform tariff regime would only be approximations to the measure of the pure effect.

Much of the previous literature on tariff escalation focuses on developed country tariff escalation impacts on value added processing in developing countries. Golub and Finger (1979) examined the effects of deescalating export duties in developing countries and escalating import duties in developed countries. They found that eliminating both sets of duties benefits developing countries substantially but not as much if only the developed countries eliminated their escalating import duties. Laird and Yeats (1987) looked at tariff escalation on trade among developing countries and found that developing countries for the 19 commodity processing chains analyzed had much greater tariff escalation than developed countries. They then assessed a south-south preferential elimination of tariff escalation and estimated relatively large increases in trade of textiles, rubber and leather but little for food products. Clark (1985) examined tariff escalation in

vegetable oils in developed countries and included the effects of GSP relative to MFN tariffs for developing nations. He found that removal of tariff escalation and GSP had offsetting effects on developing country exports of vegetable oils.

The Uruguay Round reduced for a number of commodity chains the so-called “tariff wedge” i.e. the difference in the nominal tariffs between raw and processed goods (WTO, 1995). Lindland (1997) assessed the impact of the Uruguay Round Agreement on Agriculture (URAA) on tariff escalation in Japan, the European Union and the United States. The study found that positive tariff wedges (escalating tariffs) existed for half of the commodity chains, 10 percent had no tariff wedges and the remainder had negative tariff wedges. As a result of the URAA over 80 percent of the tariff wedges have decreased. The average tariff wedge decreased from 23 percent to 17 percent, with Japan having the highest tariff wedges and the United States the lowest. The tariff wedge for paddy to brown in the EU was reduced by 45.1 percent but the brown to milled tariff wedge remained one of the highest of the commodity chains post-URAA at 49.4 percent.

In this study, we utilize RICEFLOW, a spatial equilibrium model to evaluate the effects of tariff escalation between paddy and processed rice trade (Durand-Morat and Wailes, 2003). The base year for the data on trade flows and tariffs is 2002 (USDA, FAS and AMAD).

Methodology

Modeling Framework

A spatial price equilibrium model is used for the analysis according to Takayama and Judge (p 250). Since the matrix of parameters of the demand equations is not symmetric, the model is constructed to maximize the net social monetary gain, defined as

the total social revenue minus the total social production cost, transportation cost, as well as cost of domestic and trade policies. A generalized spatial rice market model is presented below.

The structure of the optimization problem is to

$$\begin{aligned} \max \quad & \sum_i QMD_i^k \cdot PM_i^k + \sum_j QMD_j^k \cdot PM_j^k - \sum_i QPS_i^k \cdot PP_i^k - \sum_j QPS_j^k \cdot PP_j^k - \\ & \sum_i MC_i^k \cdot QMS_i^k / MR_i^k - \sum_j MC_j^k \cdot QMS_j^k / MR_j^k - \sum_{ij} FL_{ji}^{km} \cdot TC_{ji} - \sum_{ij} FL_{ji}^{kp} \cdot TC_{ji} - \\ & \sum_{ij} FIMPT_{ij}^{km} \cdot FL_{ji}^{km} - \sum_{ij} FIMPT_{ij}^{kp} \cdot FL_{ji}^{kp} - \sum_{ij} VAVIMPT_{ij}^{km} - \sum_{ij} VAVIMPT_{ij}^{kp} + \\ & \sum_{ij} FEXPS_{ji}^{km} \cdot FL_{ji}^{km} + \sum_{ij} FEXPS_{ji}^{kp} \cdot FL_{ji}^{kp} + \sum_{ij} VAVEXPS_{ji}^{km} + \sum_{ij} VAVEXPS_{ji}^{kp} \end{aligned}$$

subject to :

Material balance equations :

$$\begin{aligned} (1) \quad & QMD_i^k - QMS_i^k - \sum_j FL_{ji}^{km} \leq 0 \\ (2) \quad & QPD_i^k - QPS_i^k - \sum_j FL_{ji}^{kp} \leq 0 \\ (3) \quad & QMD_j^k - QMS_j^k + \sum_i FL_{ji}^{km} \leq 0 \\ (4) \quad & QPD_j^k - QPS_j^k + \sum_i FL_{ji}^{kp} + \sum_i FL_{ji}^{km} / MR_j^k \leq 0 \end{aligned}$$

Price equations :

$$\begin{aligned} (5) \quad & PM_i^k \leq (PP_i^k + MC_i^k) / MR_i^k \\ (6) \quad & PM_j^k \leq (PP_j^k + MC_j^k) / MR_j^k \\ (7) \quad & PM_i^k \leq (PM_j^k * (1 - AXS_{ji}^{km}) + TC_{ji} - FEXPS_{ji}^{km}) * (1 + AVT_{ij}^{km}) + FIMPT_{ij}^{km} \\ (8) \quad & PP_i^k \leq (PP_j^k * (1 - AXS_{ji}^{kp}) + TC_{ji} - FEXPS_{ji}^{kp}) * (1 + AVT_{ij}^{kp}) + FIMPT_{ij}^{kp} \end{aligned}$$

where:

i: importing regions	QMD: quantity of milled rice domestically demanded
j: exporting regions	QMS: quantity of milled rice domestically supplied
k: rice types	QPD: quantity of paddy demanded for domestic consumption
m: milled rice	QPS: quantity of domestic paddy supplied

p: paddy rice	VAVEXPS: value of the ad-valorem export subsidy
MC: milling cost	VAVIMPT: value of the ad-valorem import tariff
MR: milling rate	FIMPT: fixed import tariff (USD)
FL: trade flow	FEXPS: fixed export subsidy (USD)
PM: price of milled rice	EXS: ad-valorem export subsidy
PP: producer paddy price	AVT: ad-valorem import tariff

Estimation of the Domestic Demand Equations

An important assumption of this model is that all rice is finally consumed as milled rice. This assumption is consistent with the actual market situation except for very small amounts that are consumed as brown rice. The estimation of demand equations for milled rice is based on the formulas developed by Armington. For each region r , φ_r denotes the overall rice domestic demand elasticity and $\theta_r^{kk^*}$ and $\theta_r^{kk^{**}}$ the elasticity of substitution between rice types k and k^* and k and k^{**} , respectively. v_r^k represents the market share of type k during the baseline period. According to Armington, the direct price elasticity for rice type k is defined as

$$\epsilon_r^k = \sum_{k^* \neq k} \left[- (1 - v_r^k) \cdot \theta_r^{kk^*} \right] + v_r^k \cdot \varphi_r$$

and the cross-price elasticity with respect to type k^* and k^{**} as

$$\begin{aligned} \epsilon_r^{kk^*} &= v_r^k \cdot \left(\varphi_r + \theta_r^{kk^*} \right) \\ \epsilon_r^{kk^{**}} &= v_r^k \cdot \left(\varphi_r + \theta_r^{kk^{**}} \right) \end{aligned}$$

The relative magnitudes of the overall price elasticity φ_r and the elasticity of substitution $\theta_r^{kk^*}$ and $\theta_r^{kk^{**}}$ determine the sign of the cross price effect. For the different types to be substitutes, the absolute value of the substitution elasticity must be greater than the

overall demand elasticity. In this study, the substitution elasticities were set to be twice the overall elasticity in absolute value.

Using the direct price and cross-price elasticities estimated above, the linear demand function for milled rice of type k , QMD_r^k , is estimated as follows:

$$\begin{aligned} b_r^k &= \epsilon_r^k \cdot \text{CONS}_r^k / \text{PM}_r^k & c_r^k &= \epsilon_r^{kk^*} \cdot \text{CONS}_r^k / \text{PM}_r^{k^*} \\ d_r^k &= \epsilon_r^{k^{**}} \cdot \text{CONS}_r^k / \text{PM}_r^{k^{**}} & a_r^k &= QMD_r^k - b_r^k \cdot \text{PM}_r^k - c_r^k \cdot \text{PM}_r^{k^*} - d_r^k \cdot \text{PM}_r^{k^{**}} \\ QMD_r^k &= a_r^k + b_r^k \cdot \text{PM}_r^k + c_r^k \cdot \text{PM}_r^{k^*} + d_r^k \cdot \text{PM}_r^{k^{**}} \end{aligned}$$

CONS defined as the quantities of milled rice consumed by type, as well as the prices for milled rice by type, PM, are set at the baseline level for the parameter estimation.

The domestic demand function for type k paddy rice in region r , QPD_r^k , is derived from the milled demand function estimated above. In importing regions i , QPD_i^k is derived through the following transformation:

$$QPD_i^k = \frac{1}{MR_i^k} \cdot \left(QMD_i^k - \sum_j FL_{ji}^{km} \right)$$

Thus, the domestic demand for type k paddy rice in an importing region equals the paddy equivalent of the demand for type k milled rice minus the paddy equivalent of any inflow of type k milled rice.

In exporting regions j , the demand for type k paddy rice is defined as

$$QPD_j^k = \frac{1}{MR_j^k} \cdot QMD_j^k$$

Thus, in exporting regions j , the demand for type k paddy rice is completely derived as the paddy equivalent of the quantity of type k milled rice demanded.

Estimation of the Domestic Supply Equations

The linear domestic supply equation for type k in region r, QPS_r^k , is estimated from the baseline production quantity by type ($PROD_r^k$) and producer price (PP_r^k), and the domestic supply elasticity, γ_r^k . The parameters for QPS_r^k are estimated as follows:

$$e_r^k = PROD_r^k - f_r^k \cdot PP_r^k \quad f_r^k = \gamma_r^k \cdot PROD_r^k / PP_r^k$$

$$QPS_r^k = e_r^k + f_r^k \cdot PP_r^k$$

The domestic supply function for type k milled rice, QMS_r^k , is derived from QPS_r^k . In importing region i, QMS_i^k is defined as

$$QMS_i^k = MR_i^k \cdot \left(QPS_i^k + \sum_j FL_{ji}^{kp} \right)$$

Thus, the domestic supply of type k milled rice in importing region i equals the milled equivalent of the domestic supply of type k paddy rice plus the sum of the inflows of type k paddy rice over all exporters.

In exporting region j, QMS_j^k is defined as

$$QMS_j^k = MR_j^k \cdot \left(QPS_j^k - \sum_i FL_{ji}^{kp} \right)$$

In exporting region j, the domestic supply of type k milled rice equals the milled equivalent of the difference between the domestic production of type k paddy rice minus the sum of type k paddy outflows over all importing regions.

Definition of the Value of the Ad-valorem Import Tariff and Export Subsidy

The value of the ad-valorem import tariff on type k milled rice is estimated as follows:

$$VAVIMPT_{ij}^{km} = AVT_{ij}^{km} \cdot (PM_j^k + TC_{ji}) \cdot FL_{ji}^{km}$$

All variables remain as defined previously. The same formula is used to estimate the value of the ad-valorem import tariff on type k paddy rice.

Furthermore, the value of the export subsidy is estimated as:

$$VAVEXPS_{ji}^{km} = EXS_{ji}^{km} \cdot PM_j^k \cdot FL_{ji}^{km}$$

All variables remain as defined previously. The same formula is used to estimate the value of the ad-valorem export subsidy on type k paddy rice.

Definition of the regions for this study

Most tariff escalation schedules occur across the Western Hemisphere, mainly in Central American countries. Therefore for the analysis presented in this paper, we limit the framework to only long-grain non-aromatic rice, which is the dominant rice type trade in the Western Hemisphere. We also limit the export suppliers to Western Hemisphere exporting nations. This is justified because over 90 percent of total world paddy trade occurs among Western Hemisphere nations. The United States is the most important supplier in the Central American market with marginal flows also coming from Argentina, Uruguay, and Guyana. It is therefore expected that an elimination of the escalation effect may have a significant impact on the welfare of the rice industry in the exporting countries, mainly the United States.

To assess the import tariff escalation effect on the rice markets in the Western Hemisphere, the model was disaggregated in four exporting and fourteen importing regions as shown in table 2.

Table 2. Exporting and importing regions defined in this study.

Importing Regions		
	Bolivia	Guatemala
	Brazil	Haiti
	Canada	Honduras
	CARICOM	Mexico
	Chile	Nicaragua
	Costa Rica	Peru
	El Salvador	Rest of the World
Exporting Regions		
	Argentina	Uruguay
	Guyana	US

Results

The baseline results of the validation of the simulated model are shown in table 3. As can be seen, the model closely simulates the baseline scenario, yielding low percentage errors for each of the variables analyzed.

Table 3. Comparison of actual 2002-baseline data and simulated output on total volume of rice production, consumption, and trade, as well as prices of paddy and milled rice.

Variables	Importers	Exporters
Actual consumption (mt milled basis)	367,589,006	3,748,366
Baseline consumption (mt milled basis)	364,564,784	3,811,016
Difference (percentage)	-0.82%	1.67%
Actual rice production (mt paddy basis)	558,014,397	11,822,770
Baseline rice production (mt paddy basis)	553,960,958	11,492,485
Difference (percentage)	-0.73%	-2.79%
Actual volume of trade (mt)	4,953,743	4,953,743
Baseline volume of trade (mt)	4,940,391	4,940,391
Difference (percentage)	-0.27%	-0.27%
Actual weighted paddy price (usd/mt)	140	121
Baseline weighted paddy price (usd/mt)	133	111
Difference (percentage)	-4.62%	-8.69%
Actual trade-weighted milled price (usd/mt)	283	254
Baseline trade-weighted milled price (usd/mt)	291	239
Difference (percentage)	2.93%	-5.91%

In the baseline, the US ships approximately 37.5 percent (1.3 mmt) of the total volume of exports as paddy rice, eighty seven percent of which goes to the Central American market and Mexico. The rest of the total US rice production, estimated at 9.27 mmt paddy, gets milled domestically, yielding a milled supply of 5.56 mmt. From this volume, approximately 60 percent is consumed domestically whereas the remaining 40 percent is exported.

Based on estimations of the US marketing margin from milling to wholesale, the gross revenue from milling is estimated at around USD 699 million. The marketing margin encompasses the milling cost as well as other costs related with rice processing and handling through to the wholesale level.

Scenario with harmonized tariffs at milled tariff levels

This scenario equalized the import tariff rates across rice milling degrees to the milled tariff rates. This is cited as one method of approximating the measurement of the pure effect of tariff escalation as discussed above. Table 4 shows the total volume of production, consumption, trade, and trade-weighted prices after harmonization of tariff rates with a comparison to the baseline.

As can be seen, the aggregate change in the variables under analysis is marginal with the tariffs harmonized at milled rice tariff levels. However, when analyzing the domestic effects for most Central American countries, significant changes in trade flows are observed. Table 5 shows the main trade flow changes as a result of the import tariff harmonization across milling degrees.

El Salvador and Honduras, which respectively imported approximately 109,000 and 145,000 mt of paddy rice from the US during the baseline period, completely

substitute paddy imports with milled rice imports from the US in this scenario (table 5).

As a consequence of this substitution, the gross revenue from milling in both El Salvador and Honduras would decrease by 79 percent and 93 percent, or USD 9.5 million and USD 10.4 million, respectively.

Table 4. The effect of tariff harmonization compared to the baseline on total volume of rice production, consumption, and trade, as well as prices of paddy and milled rice.

Variables	Importers	Exporters
Baseline consumption (mt milled basis)	364,564,784	3,811,016
Simulated consumption (mt milled basis)	364,564,366	3,811,649
Difference (percentage)	0.00%	0.02%
Baseline rice production (mt paddy basis)	553,960,958	11,492,485
Simulated rice production (mt paddy basis)	553,966,345	11,489,221
Difference (percentage)	0.00%	-0.03%
Baseline volume of trade (mt)	4,940,391	4,940,391
Simulated volume of trade (mt)	4,842,103	4,842,103
Difference (percentage)	-1.99%	-1.99%
Baseline trade-weighted paddy price (usd/mt)	133	112
Simulated trade-weighted paddy price (usd/mt)	137	112
Difference (percentage)	3.53%	0.00%
Baseline trade-weighted milled price (usd/mt)	281	239
Simulated trade-weighted milled price (usd/mt)	289	239
Difference (percentage)	2.58%	0.00%

Table 5. Percentage changes in total trade volume by degree of milling and change in domestic consumption for selected countries for tariffs harmonized at milled rice tariff levels.

	% Change in volume of trade from the baseline			% Change in domestic consumption
	Total volume	Paddy imports	Milled imports	
El Salvador	-38.5%	-100%	*	-2.7%
Guatemala	-15.2%	-15.2%	0%	-6.1%
Honduras	-39.5%	-100%	*	-3.4%
Nicaragua	-21.6%	-21.6%	0%	-3.3%

* No percentage change is provided, since the volume of milled import during the baseline was zero and 100 percent milled after tariff harmonization.

No substitution between milling degrees was observed for Nicaragua and Guatemala. The reduction in volume of imports translates completely into to a decrease in domestic consumption.

The composition of imports by Costa Rica and Mexico are estimated to remain unchanged after the harmonization. Costa Rica applied a flat import tariff rate across milling degrees in 2002, and therefore there is no escalation effect. Mexico used a slightly higher import tariff on milled rice compared to paddy rice from the US, but harmonizing tariffs does not have any impact on the composition of rice imports by milling degree.

On the export side, the US milling sector receives all of the gains from the harmonization of import tariffs across milling degrees. The percentage share of paddy rice exports over total rice exports decreases from 37.5 percent to 29.4 percent. As a result of this substitution, the US milling activity and the gross revenue from milling are expected to increase by 4 percent above the baseline, but the volume of trade on a milled equivalent basis declines very slightly by –0.1 percent.

The tariff-harmonized scenario at milled tariff levels has no impact on the composition of rice exports from Argentina, Uruguay, and Guyana. One of the reasons is that Argentina and Uruguay ship most of their rice to Brazil, where they already enjoy zero import duty as a result of Mercosur preferences. All of Guyana's rice shipments to the Western Hemisphere go to the Caricom bloc, in which Guyana, as a member, already enjoys zero import preferential duty.

Tariff Harmonization at Zero Tariffs: Free Trade Scenario

As previously cited, the impact of the removal of all barriers to trade on the composition of trade flows is another method to approximate the tariff escalation effect. This scenario overstates the impact as a result of the price effect of removing all tariff barriers. Table 6 shows the impact of rice trade liberalization on the levels of the main variables under analysis.

Trade liberalization and elimination of the tariff wedge increases the volume of exports from Argentina, Guyana, Uruguay, and the US by 2.7 percent in the aggregate and export prices increase by 17.5 percent and 11.3 percent for paddy and milled rice, respectively.

Table 6. The effect of complete trade liberalization compared to the baseline on total volume of rice production, consumption, and trade, as well as prices of paddy and milled rice.

Variables	Importers	Exporters
Baseline consumption (mt milled basis)	364,564,784	3,811,016
Simulated consumption (mt milled basis)	364,763,574	3,710,130
Difference (percentage)	0.05%	-2.65%
Baseline rice production (mt paddy basis)	553,960,958	11,492,485
Simulated rice production (mt paddy basis)	553,428,593	12,069,157
Difference (percentage)	-0.10%	5.02%
Baseline volume of trade (mt)	4,940,391	4940393
Simulated volume of trade (mt)	5,071,778	5,071,778
Difference (percentage)	2.66%	2.66%
Baseline trade weighted paddy price (usd/mt)	133	112
Simulated trade-weighted paddy price (usd/mt)	138	131
Difference (percentage)	3.68%	17.56%
Baseline trade-weighted milled price (usd/mt)	281	239
Simulated trade-weighted milled price (usd/mt)	288	266
Difference (percentage)	2.53%	11.39%

The aggregate trade-weighted import price for paddy and milled rice is estimated to increase by 3.7 percent and 2.5 percent, respectively. The trade-weighted price margin

between import and export price narrows from USD 42/mt to USD 22/mt. While one would expect the import price to decline with trade liberalization, weighting of the import price by trade increases the price slightly. The reason is that during the baseline the most important rice flows across the region occurred at a very low or even zero import duty due to previously established trade agreements, namely, NAFTA, Mercosur, and Caricom.

The import paddy price in Brazil, Mexico, and Guatemala would increase by 12.6 percent, 14.4 percent, and 9.6 percent, respectively. At the same time, the import paddy price in Honduras, Costa Rica, Nicaragua, and El Salvador would decrease by 14.6 percent, 15.0 percent, 23.7 percent and 23.0 percent, respectively.

Changes in import paddy price translate domestically into changes in the volume of production. Although in the aggregate the production volume across importers decreases by 0.1 percent, the absolute impact is particularly important in Brazil, where the domestic rice production is expected to increase by 2.5 percent (from a baseline production of over 10 mmt), and substitute an important part of Brazilian imports.

The import price for milled rice in Brazil and Mexico also would increase by 10.4 percent and 11.2 percent, respectively because of higher exporter prices. However, these two importers continue to import paddy rice at the same share to total imports as in the baseline, which suggests that their tariff escalation effect is marginal given the baseline tariff schedule and origin of trade flows.

The import price for milled rice in Honduras, Costa Rica, Nicaragua, and El Salvador is expected to decrease by 9.6 percent, 13.0 percent, 14.3 percent, and 19.7 percent, respectively, whereas in Guatemala it is expected to increase by 4.5 percent. As a

result of the change in the relative import prices, Honduras, Nicaragua, El Salvador and Guatemala completely substitute imports of paddy rice with milled rice. Costa Rica continues to import all rice as paddy, which is consistent with the fact that no tariff wedge exists for Costa Rica.

Changes in milled rice prices translate domestically into changes in consumption volumes. Although consumption volumes across importers increase in aggregate by only 0.05 percent, large domestic changes are seen in Brazil and Peru, where, as a result of trade liberalization and higher import prices, consumption of rice in Brazil decreases by 4.5 percent and in Peru as a result of elimination of high tariffs, consumption increases by 17.7 percent from the baseline. Across Central American countries, the most important changes occur in Costa Rica, El Salvador, and Nicaragua; their consumption increases by 2.8 percent, 4.9 percent, and 6.8 percent, respectively.

The substitution of imports is likely to greatly affect the welfare of the milling industry and other industries related to it in most Central American countries, since most of the milling activity would shift to the exporting regions. On the export side, the US gains most of the benefits from the removal of tariff escalation. The share of paddy exports with respect to total exports is expected to decrease from 37.5 percent during the baseline to 22.0 percent under free trade. The US milling industry is expected to increase both the volume of processing and gross revenue by 12.2 percent above the baseline. The impact of trade liberalization on the milled equivalent of total rice exports from the US is an increase of 13.7 percent.

Uruguay is also found to substitute paddy exports to Brazil with milled rice exports to the rest of the world. Thus, the Uruguayan rice-processing sector would benefit

to some extent after the elimination of tariff escalation to zero tariffs in the rice market. The composition of exports by milling degree from Argentina and Guyana is expected to remain unchanged.

Summary and Conclusions

Tariff escalation in rice importing countries particularly in the Western Hemisphere provides protection to the domestic milling industry but has resulted in a significant shift over the past decade in US rice exports from milled to paddy rice. This study attempts to estimate the effect of removing the tariff wedge between milled and paddy rice. A spatial equilibrium model that allows for substitution across rice by milling degree is presented and validated for long grain rice trade. Tariff wedges were removed in two alternative scenarios; first by harmonizing tariff rates at the rates associated with milled rice and second by elimination all tariffs, thus harmonizing at a zero tariff level.

The results suggest that US rice trade is distorted in favor of paddy exports, reducing the demand for rice milling and associated value-added activities in the US. The share of paddy to total rice exports would decline from 37.5 percent in the baseline to 29.4 percent in the milled tariff harmonizing scenario and to only 22 percent if tariff rates for milled and paddy rice were eliminated. Total trade would decline slightly if tariff rates for paddy were increased to the milled rice tariff levels. Total trade expands 3 percent and for the US exports increase by 12 percent if tariff rates are harmonized at a zero rate.

Extensions to this study are needed to more fully understand the consequences. The model framework can be expanded to include other types of rice, especially medium

grain. Considerable tariff escalation also exists between brown and milled rice. Brown rice trade flows and associated tariff schedules also need to be added to the model framework to more fully evaluate the effects of tariff escalation on global rice trade. Finally greater attention must be given to determining the input-output relationships associated with rice milling in order to evaluate the employment and total economic effects.

Figure 1. World rice trade and percent of total use, 1973/74 to 2003/04.

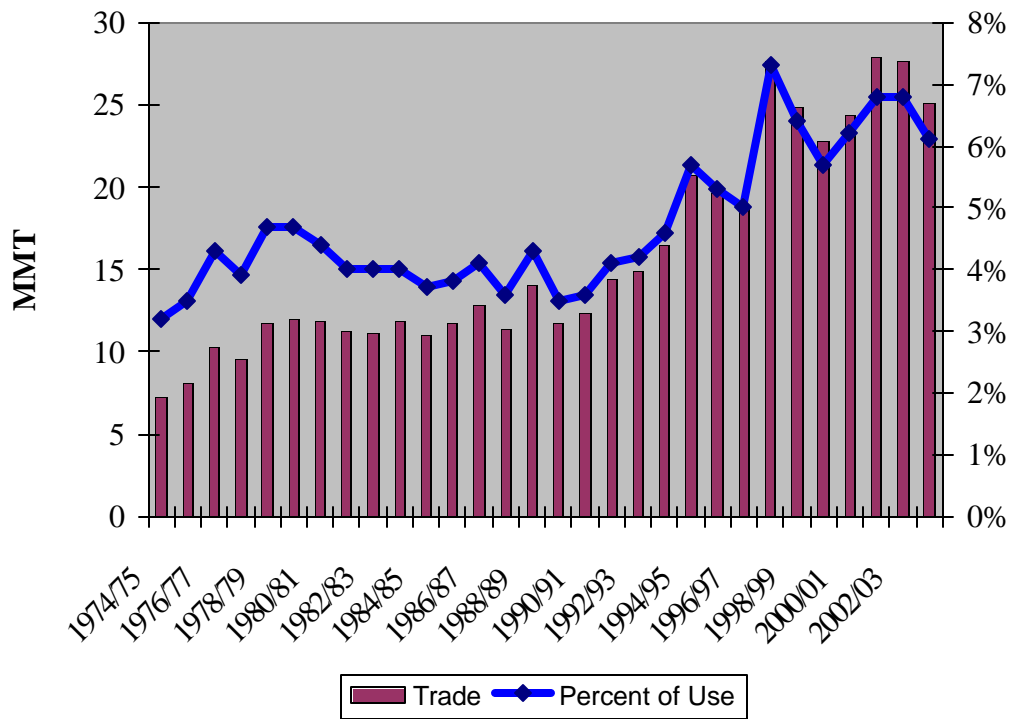
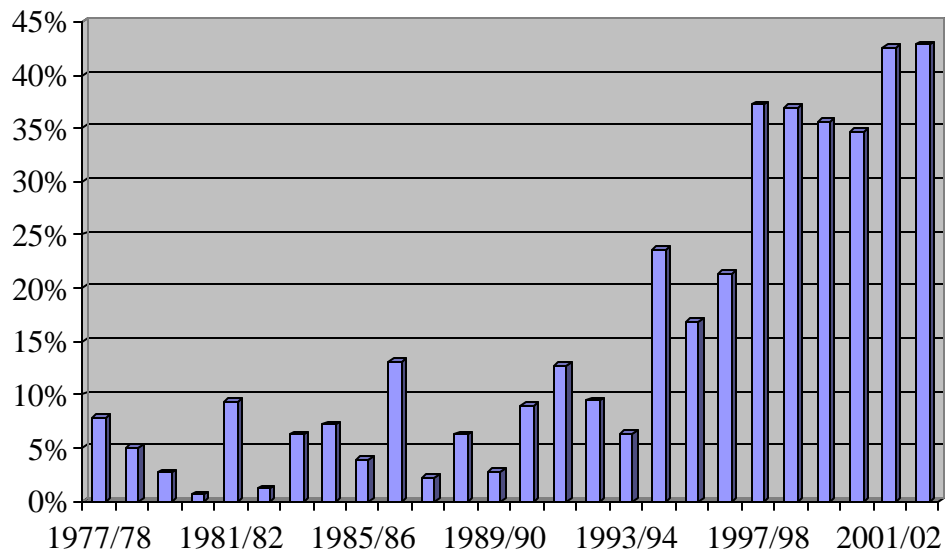


Figure 2. Growth in U.S. rough rice exports as a share of total U.S. rice exports.



Source: Foreign Agriculture Service, USDA

References

- AMAD. 2004. Agricultural Market Access Database. At <http://www.amad.org/>
- Clark, D.P. 1985. "Protection and developing country exports: The case of vegetable oils." *Journal of Economic Studies* 12(5): 3-18.
- Durand-Morat, A. and E.J. Wailes. 2003. RICEFLOW®: A spatial equilibrium model of world rice trade. Staff Paper SP 02 2003. Dept. of Agr. Econ. and Agribus. Div. of Agr. Univ. of Arkansas.
- Golub, S. and J.M. Finger. 1979. The processing of primary commodities: Effects of developed country tariff escalation and developing country export taxes. *Journal of Political Economy* 83(3): 559-577
- Hecht, J.E. 1997. "Impacts of tariff escalation on the environment: Literature review and synthesis." *World Development* 25(10): 1701-1716.
- Fukuda, H., J. Dyck, and J. Stout. 2003. Rice sector policies in Japan. U.S. Department of Agriculture, Economic Research Service. RCS-0303-01.
- Laird, S. and A. Yeats. 1987. Empirical evidence concerning the magnitude and effects of developing country tariff escalation." *The Developing Economies* 25(2): 99-120.
- Lindland, J. 1997. "The impact of the Uruguay Round on tariff escalation in agricultural products." *Food Policy* 22(6):487-500.
- Sumner, D.A. and H. Lee. 2000. "Assessing the effects of the WTO agreement on rice markets: What can we learn from the first five years?" *American Journal of Agricultural Economics* 82(3): 709-717.
- Takayama, T. and G.G. Judge. 1971. *Spatial and Temporal Price and Allocation Models*. Amsterdam: North-Holland Publishing Company.
- USDA, FAS. Production, Supply and Distribution online database. At <http://www.fas.usda.gov/psd/>
- Wailes, Eric. "Trade liberalization in rice." In *Agricultural Trade Policies in the New Millennium*, ed. P. Lynn Kennedy. Haworth Press, 2002.
- WTO. 1995. *The results of the Uruguay Round of Multilateral Trade Negotiations. The Legal Texts*. Geneva.
- Yeats, A.J. 1984. "On the analysis of tariff escalation: Is there a methodological bias against the interest of developing countries?" *Journal of Development Economics*: 15: 77-88.