Regional trade agreements in the Americas: impacts on rice trade

Eric Wailes, Frank Fuller, Harjanto Djunaidi and Alvaro Durand
Department of Agricultural Economics and Agribusiness,
Fayetteville, AR 72701.

Free Trade of the Americas, the WTO, and New Farm Legislation
San Antonio, Texas
May 23-24, 2002

Regional trade agreements in the Americas: impacts on rice trade

Abstract: The U.S. rice industry is losing competitiveness in foreign markets. Regional trade agreements such as NAFTA have helped to sustain exports. The broader Free Trade of the Americas Agreement (FTAA) proposal would subject the U.S. to growing competition from the MERCOSUR nations for rice trade in the Western Hemisphere. This study evaluates the effect of regional trade agreements on rice trade, with a particular focus on the proposed FTAA.

Keywords: Rice, trade, regional trade agreements.

Efforts to unite the Western Hemisphere economies into a single free trade agreement began at the Summit of the Americas held in Miami, Florida in December 1994. An agreement was forged to construct a Free Trade Area of the Americas (FTAA), in which barriers to trade and investment will be progressively eliminated and to complete negotiations for the agreement by 2005. This paper examines the impact upon regional rice trade and prices of an elimination of existing trade barriers on rice in the Western Hemisphere.

Rice is one of leading agricultural exports from the southern region of the United States. Approximately 50% of U.S. rice exports are shipped to Western Hemisphere nations. Yet competition for these markets is intensifying as production expands in Argentina, Uruguay, Brazil, and Guyana. The U.S. is also facing fierce competition from Asian rice exporters, Thailand, Vietnam, India and China. The U.S. has remained competitive in the Western Hemisphere in part because, unlike competitors, the U.S. is willing to export rough rice as well as milled rice. Many Western Hemisphere countries have preferential tariffs that favor rough rice imports relative to milled rice. The specific objective of this paper is to evaluate the potential of U.S. rice exports under the proposed the FTAA Agreement against the existing trade regimes of the region. It is anticipated that this agreement will provide preferences for U.S. rice relative to Asian competitors but competitors within the Americas will challenge the U.S. as the dominant export supplier.

Most previous international trade studies assume that rice is a homogeneous product. This ignores the distinct supply and demand characteristics of each rice product and models based on homogenous quality assumptions will be biased. Although traded rice is considered a relatively thin market; it becomes much thinner when disaggregated into its component products.

In spite of the difficulties, several studies have disaggregated the international rice market into several sub-markets. In estimating the effects of trade liberalization on world rice markets Cramer et al. (1993, 1991) divided rice into three categories: high quality Indica, low quality Indica, and Japonica. They estimated that global liberalization increased the volume of trade from 5.4 to 11.1 percent and increased consumer welfare by $5.03 billion. Song and Carter (1996) developed a US demand and supply model which treated Indica and Japonica separately. They concluded that trade liberalization will increase the demand for US Japonica more than for US Indica rice.

This study updates and extends the Cramer et al. study by adding more rice trading participants and disaggregates the international rice market into three categories different from the earlier study. Japonica rice is not an important type of rice traded in the Western Hemisphere but paddy rice is. Therefore instead of disaggregation into Indica high and low quality and Japonica, this study disaggregates by degree of milling -- milled rice, brown rice, and paddy rice where each category includes Indica and Japonica types. These refinements will more precisely reflect issues that are relevant to Western Hemisphere rice trade because a major dimension of rice trade barriers in this region is differential import tariffs by degree of milling. Milled rice tariffs are typically higher than brown and paddy in order to provide implicit subsidies to domestic rice milling industries.

The following two sections review world rice production, consumption, and trade; and world rice trade by categories. The fourth section discusses the estimation of a multi-product quadratic programming which is the primary analytical tool. The fifth section reviews the methodology followed by the data and model parameters section. Empirical results are reported in the seventh section. Concluding comments are made in the final section.

The World Rice Market

Rice is an important staple food for over half of the world's population—accounting for 22% of global caloric intake—and is produced in significant quantities in every continent except Antarctica. Asia, however, accounts for about 90% of the world's production and consumption.[1] China, India, Indonesia, and Bangladesh alone, account for 70% of world production. The Asian countries of Thailand, Vietnam, Burma, and Japan account for another 14% of world production. The two largest producing countries outside of Asia, Brazil and the United States, only account for 2.3% and 1.3%, respectively, of world production. National production shares have been fairly stable over the last ten years.

Because the largest consuming nations in Asia are generally self-sufficient, world trade is relatively unimportant. Typically, about 4% of world production is traded. That relatively small producing countries—Thailand, Vietnam, Burma, the United States, and Australia—are typically among the leading exporters emphasizes this point. Trade, however, has increased to 5% of world production in recent years. Since the 1961/62 marketing year, trade has increased at an annual rate of 3.7% while production has only increased at a 2.7% annual rate.

Traditional leading rice exporters, such as Thailand and the United States, have gradually lost market shares to newly emerging exporters—primarily Vietnam and India. The United States lost second position to India in 1995 and was the fourth leading exporter in 1996. With unexpected reductions in exports by India, the United States moved up to third place in 1997 and 1998. Other top exporters include Pakistan, Argentina, and Uruguay. For the last ten years Pakistan has maintained a market share of about 8% while Argentina and Uruguay increased their market shares from 0.3% to 3% and 2.5% to 3.5%, respectively. During the 1990s Vietnam has had an average market share of 7.6%, but has had market shares as high as 20% and 18.2%

[1]The percentages are the ten year averages from the 1988/89 through the 1997/98 market years.

in 1995 and 1996. China and India are the two most volatile exporters—moving from net importers in one year to net exporters in the next.

Due to internal domestic rice dynamics, export market shares are volatile. A leading cause of this volatility is the fact that 45% of Asian production is upland and relies completely on the Asian monsoons. Over the last 32 years the standard deviation of the percent change in production was only 0.03, while that for trade was 0.11. Resulting variability in production contributes to substantial instability in world rice prices. Thin, volatile, and trade distorted world markets are further exacerbated by the heterogeneous nature of rice. Product differentiation is considered a critical factor in understanding world rice trade flows (Cramer et al., 1991; Siamwalla and Haykin, 1983).

Rice Categories and World Trade

One difficulty faced in trying to differentiate among rice products is that there is no standard classification in use. Strong preferences for particular rice types are based primarily on cooking and taste characteristics. Several international organizations such as the WTO and the UN's Food and Agricultural Organization (FAO) have attempted to classify rice into various categories. Rice is typically grouped into four major types: Indica, Japonica, glutinous, and fragrant or aromatic.[2] The first two, Indica and Japonica, are the most important. In general, Indica corresponds to long grain and Japonica to medium and short grain.[3] Indica usually elongates into large, fluffy, easily separable kernels when cooked; japonica becomes sticky and

[2]Another type of rice, Javonica or bulu rice is only produced in some parts of Indonesia and the Philippines (Rastegari-Henneberry, 1985) is not included in the analysis. Jayne (1993) lists another variety called glaberimma, which is found in West Africa.

[3]Song and Carter (1996) argue that California long grain is closer to Japonica than to Indica and also consider southern U.S. medium grain as Indica.

moist when cooked. Under this grouping, fragrant rices are Indica and glutinous Japonica. These four rice types can be further classified into quality and degree of milling classifications.

Quality is typically measured in percentage of broken kernels. To reduce the percentage of brokens requires a higher degree of milling and sorting, thus higher quality rice commands a higher price. High-income consumers in both developed and developing countries typically consume high quality rices. High quality rice typically has less than 10% brokens, medium quality between 10 and 20%, and low quality rice more than 20% brokens. Other characteristics that influence quality are conditioning, heat damage, odor, color and degree of foreign material.

In its natural state rice has an outer husk. Inside the husk is the kernel that is covered with a brown colored germ. Rice oil can be extracted from the germ. The germ itself also has uses once it is stabilized. Unhusked rice is referred to as rough or paddy rice. Brown rice is rice that has had the hull removed, but which retains the bran. Brown rice can be further classified according to the length of the kernel such as long, medium, short, and mixed brown rice. Husked rice which has also had the germ removed is referred to as milled or "white" rice.

Only the United States and Thailand disaggregate rice trade data by categories. Most countries do not report disaggregated rice trade data. According to Schnepf and Just (1995) almost 40% of the rice traded during the 1991 through 1993 period was high-quality long grain, 23% was intermediate-quality long grain rice, 22% was low-quality long grain, 13% medium grain, and 2% was glutinous.[4] Trade in 1999 by degree of milling was reported to be 80% milled, 14% brown and 6% paddy (FAOSTAT).

In this study the rice traded on world markets is divided into the three degree of milling categories.

Data and Methods

---

[4]Schnepf and Just categorize aromatics as long grain. High quality is defined as less than or equal to 10% broken grains, intermediate quality as more than 10% but not beyond 20% broken grains and low quality as greater than 20% broken grains.

A spatial equilibrium model is used to assess the rice trade flows of members and non-members of the FTAA. One of the most commonly used spatial trade frameworks is Takayama and Judge's quadratic programming model. In this model, a quadratic net quasi-welfare function is maximized subject to a set of linear constraints. To achieve global market equilibrium, the model's optimal solution is based on an assumption of perfect competition in both domestic and world market. This assumption may appear extreme for rice, because there are few exporters and significant government controls over exports in most major exporting countries. Karp and Perloff, however, found the world rice market was closer to a price-taking market than a collusive one. Hence, we maintain the perfect competition assumption.

Assuming a competitive market and linear demand and supply functions, a multi-product quadratic programming model is formulated to analyze trade flows and prices under current trade agreements and distortions and under the proposed FTAA.

The quasi-welfare function is defined as the sum of all importers' and exporters' surpluses over all markets and products. The optimal solution can be obtained by maximizing this function subject to a linear arbitrage condition and spatial equilibrium conditions.

The model is expressed as:

$$\max_{pd,ps,q} \sum_i \sum_q \left(\mathbf{a}_q^i PD_q^i - \frac{1}{2} \sum_k \mathbf{b}_{qk}^i PD_k^i PD_q^i \right) - \sum_e \sum_q \left(\mathbf{t}_q^e PS_q^e + \frac{1}{2} \sum_k \mathbf{d}_{qk}^e PS_k^e PS_q^e \right), \text{ Subject}$$

to (1) $PD_q^i - PS_q^e \leq TC_q^{ie}$, for all q

(2) $\sum e\left(Q_q^e\right) = \sum_i \left(\mathbf{a}_q^i + \sum_k \mathbf{b}_{qk}^i PD_k^i\right)$, for all q

(3) $\sum^i \left(Q_q^i\right) = \sum_e \left(\mathbf{t}_q^i + \sum_k \mathbf{d}_{qk}^e PS_k^e\right)$, for all q

(4) and PD, PS, Q $\geq$ 0

where PD = c.i.f. price per ton; PS = f.o.b. price per ton; Q = quantity of rice traded; TC = transportation cost; α,β = parameters in excess demand function; τ, δ = parameters in excess supply function; I = importing country; e = exporting country; q, k = index of rice types. The integrability condition requires symmetry to hold: $b^{i}_{qk} = b^{i}_{kq}$ and $d^{e}_{qk} = d^{e}_{kq}$ (Takayama and Judge 1964).

Current transportation costs will be base on data from Chartering Annual (Maritime Research Inc.). Elasticities of excess demand and supply will be derived from observed average values of 1998-2000 rice production, consumption, and trade (USDA), and domestic supply, demand, stock elasticities among the three types of rice. These estimates will be in turn used to generate linear excess supply and demand functions. Relaxation of trade barriers is applied to the baseline tariffs and subsidies.

A total of 82 countries and regions are included in the model. Of this total 35 are Western Hemisphere countries. They include: Argentina, Aruba, Bahamas, Barbados, Bermuda, Belize, Bolivia, Brazil, Canada, Chile, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, El Salvador, Equador, Granada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, St. Kitts, St. Lucia, St. Vincent, Trinidad-Tobago, United States, Uruguay, and Venezuela.

Model Parameters for the FTAA Scenario

The parameters of the excess supply and demand functions are derived from structural equations in the Arkansas Global Rice Model and from Sullivan. These parameters are the base scenario parameters, which reflect actual world trade in the 1994 and 1995 period with all trade distortions present. Both excess demand and supply functions for simulation the impacts of the FTAA agreement on international rice trade in the year 1999 are obtained by adjusting the corresponding parameters in the base scenario. Adjustments are made based upon removal of existing tariffs by rice type (table 1).

Results

The base and FTAA global quantities traded are reported in table 2. Milled and brown rice trade each increase by 1 percent. Paddy rice trade increases by 16%. Total rice trade (milled basis) increases by 379 tmt. Milled rice accounts for 51 percent of the increase, brown 11 percent and paddy 38 percent. The impact on prices is reported in table 3. Milled rice price increases by $1.41 per mt, less than one percent, brown rice price increases by $3.54 per mt, a one percent increase and paddy rice price increases by $15.45 per mt or 9.7 percent. The model results were generated under an assumption of no substitution by degree of milling in trade and therefore we argue that the paddy trade and price impacts are the upper range of what is expected.

The effect of an elimination of tariffs on Western Hemisphere rice is presented in table 4[5]. Imports of milled rice increase by 14 percent, brown rice by 32 percent and paddy by 23 percent. Total rice imports increase by 568 tmt of which 54 percent are milled, 19 percent are brown and 27 percent are paddy. Exports of rice from Western Hemisphere countries (Argentina, Equador, Guyana, United States, Uruguay, and Venezuela) increase in total by only 247 tmt. An increase in exports from Western Hemisphere exporters to Western Hemisphere importers of 862 tmt is offset by a loss in exports to non-members of 615 tmt. The major increase is paddy with 140 tmt or a 17 percent increase. Brown rice exports increase by 70 tmt, 8 percent. Milled rice exports increase slightly by 2 percent, 37 tmt.

The trade creation and diversion effects of the FTAA are presented in table 5. The results indicate that trade creation exceeds losses from diversion. Trade creation of milled rice is 550 tmt, which is offset by a diversion of 142 tmt from non-members. Brown rice trade creation is 155 tmt offset by a diversion of 47 tmt. Paddy trade creation is 157 tmt with diversion of 5 tmt.

[5] Only aggregate results are presented in this paper. Detailed country results are available from the authors.

Conclusions

The FTAA agreement will have limited impact on the global rice market because the Western Hemisphere consumes and produces less than 10 percent of the world's rice. It accounts for nearly 15 percent of the trade. The agreement increases trade of all types of rice by degree of milling with the largest increase in paddy rice. Prices increase marginally for milled and brown rice but by nearly 10 percent for paddy. A limitation of this study is the assumption of no substitution across rice types. This assumption will be relaxed in future studies. Trade creation exceeds trade diversion by 568 tmt, nearly three percent of world rice trade.

References

Bierlen, Ralph, Eric J. Wailes, and Gail L. Cramer. (1997). *The Mercosur Rice Economy.* Bulletin 954, Arkansas Agricultural Experiment Station, University of Agriculture.

Childs, Nathan and Linwood Hoffman. (1999). "Upcoming World Trade Organization Negotiations: Issues for the U.S. Rice Sector." In *Rice Situation and Outlook Yearbook*, USDA, ERS, RCS-1999.

Cramer, Gail L., Eric J. Wailes, and Shangnan Shui. (1993). "Impacts of Liberalizing Trade in the World Rice Market." *American Journal of Agricultural Economics* 75:219-226.

Cramer, Gail L., James M. Hansen, and Eric J. Wailes. (1999). "Impact of Rice Tariffication on Japan and the World Rice Market." *American Journal Agricultural Economics* 81:1149-1156.

Lee, Dae-Seob, Eric Wailes, and James Hansen. (1998). "From Minimum Access to Tariffication of Rice Imports in Japan and South Korea." Paper presented at the American Association of Agricultural Economics Annual Meeting. Salt Lake City, Utah.

Song, Joo Ho and Colin A. Carter. (1996). "Rice Trade Liberalization and Implications for U.S. Policy." *American Journal of Agricultural Economics* 78:891-905.

Sumner, Daniel A. and Hyunok 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* 80:709-17.

Wailes, Eric J. (1996). "Rice" In *Quality of U.S. Agricultural Products,* ed. L. Hill, Council for Agricultural Science and Technology (CAST) Task Force Report No. 126.

Wailes, Eric, Gail Cramer and James Hansen. (1999). "Tariffication of Rice Imports in Japan." In *Proceedings*, Conference on World Japonica Rice Marketing and Production Potential: Trade under the Tariffication. Fukuoka, Japan.

Wailes, Eric. (1999). "Trade Liberalization in Rice." Paper presented at the International Agricultural Trade Research Consortium Annual Meeting. New Orleans, Louisiana.

Wailes, Eric, Gail Cramer, Eddie Chavez, and James Hansen. (2000). *Arkansas Global Rice Model: International Baseline Projections for 2000-2010*. Arkansas Agricultural Experiment Station, University of Arkansas, Special Report 200.

Table 1. Import tariffs for rice by degree of milling for Western Hemisphere countries, 1999.

	Ad Valorem Import Tariffs (in percent)		
Countries	**Milled**	**Brown**	**Paddy**
Brazil	15	13	13
Argentina	13	13	13
Chile	10	10	10
Canada	0	0	0
Bahamas	0	0	0
Colombia	20	20	15
Costa Rica	35	35	20
Equador	20	20	15
Guatemala	20	20	20
Honduras	0	0	0
Mexico	20	20	10
Jamaica	25	25	25
Nicaragua	45	45	35
Panama	130	130	130
Peru	68	68	68
Trinidad & Tobogo	25	25	25
Uruguay	15	13	13
Venezuela	20	20	15
Regional average	27	26	24
Source: Free Trade Area of the Americas at http://www.ftaa-alca.org			

Table 2. FTAA Impacts on global rice trade.

Rice type	Base	FTAA	Difference
Milled (tmt)	20,366	20,560	194
Percent change (%)			1
Brown (tmt)	3,574	3,615	41
Percent change (%)			1
Paddy (tmt)	890	1,034	144
Percent change (%)			16

Table 3. FTAA Impacts on global rice prices.

Rice type	Base	FTAA	Difference
Milled ($/mt)	$235.50	$236.91	$1.41
Percent change (%)			1
Brown ($/mt)	348.70	352.44	3.54
Percent change (%)			1
Paddy ($/mt)	159.99	175.44	15.45
Percent change (%)			10

Table 4. FTAA Impacts on Western Hemisphere rice imports.

Rice type	Base	FTAA	Difference
Milled (tmt)	2,126	2,434	308
Percent change (%)			14
Brown (tmt)	341	449	108
Percent change (%)			32
Paddy (tmt)	667	819	152
Percent change (%)			23

Table 5. FTAA Impacts on Western Hemisphere rice exports.

Rice type	Base	FTAA	Difference
Milled (tmt)	1,812	1,850	37
Percent change (%)			2
Brown (tmt)	885	955	70
Percent change (%)			8
Paddy (tmt)	833	974	140
Percent change (%)			17

Table 6. Trade creation and diversion under FTAA.

Rice type	Quantity (tmt)	Percent change
Milled trade creation	550	26
Milled trade diversion	-142	-7
Brown trade creation	155	45
Brown trade diversion	-47	14
Paddy trade creation	157	24
Paddy trade diversion	-5	1