Noncompetitive Pricing and Exchange Rate Pass-Through in Selected U.S. and Thai Rice Markets

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Abstract

A "pricing to market" international trade model is applied to U.S. and Thai rice exports to high and middle income countries that are continuous rice importers. These markets are characterized by strong quality preferences and highly inelastic demand, and thus exporters may exercise market power. Evidence of noncompetitive pricing either through price discrimination across destinations or through imperfect exchange rate pass-through is found in this small but growing segment of the international rice trade.

Keywords: exchange rates, imperfect competition, international trade, rice

Evidence regarding the degree of competition in the international rice trade is mixed. Mitchel and Duncan show that rice and coarse grain markets conform closely to an oligopolistic model, with the U.S. as the price leader. More recently, Karp and Perloff also provide evidence of an oligopoly market in international rice trade. In contrast, both Petzel and Monke, and Uri find a high degree of integration among international rice prices. Petzel and Monke report that prices in the dominant long grain trade move closely together after a short lag. In comparing rice prices across grades and markets, Uri concludes that there is a single world market for rice.

To further investigate pricing behavior in the international rice trade, this paper uses the "pricing to market" model developed by Krugman, and Knetter. This model allows an examination of a new dimension of noncompetitive behavior--the ability of export firms to exercise market power in response to exchange rate changes. In a competitive market with constant marginal cost, exchange rate changes should be fully reflected in import prices. If exporters have market power, they can adjust mark-ups in particular markets as exchange rates change. Thus, imperfect exchange rate pass-through provides evidence of noncompetitive pricing.

The paper focuses on market behavior in a small but growing segment of the international trade-- high and middle income countries that are continuous importers of rice. Rice demand in high income markets is expected to increase dramatically as a result of the recently concluded GATT agreement (USDA). Consistent purchase in these markets allows application of the pricing to market model. For these importers, loyalty to specific types of rice, from specific export origins, is similar to brand loyalty for manufactured products. Strong loyalty for particular types of rice can cause demand within market segments to be inelastic. In this context, the dominant exporters, the U.S. and Thailand, may view the rice market not as "one market" but as a number

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of market niches with unique demand elasticities for their products.

The paper first reviews the characteristics of the markets selected for study. Then the theoretical model of export pricing is presented, which allows us to derive an empirical model and testable hypotheses. The results of estimates for the Thai and U.S. long grain rice markets and for the U.S. parboiled rice market are presented, and their implications for market behavior explored.

Export and Import Markets Selected

The structure of the world rice market changed in the 1980s. On the supply side, Thailand and the U.S. increased their combined share of exports (table 1). In the 1970s, the combined market share of the two countries was 40-45 percent, but increased to over 50 percent during the 1980s, with Thailand accounting for over 30 percent. The increasing dominance of these two exporters leads to concern that they may be able to exercise market power. The behavior of U.S. and Thai rice export prices in the 1980s is the focus of this study.

Whether these exporters are able to price discriminate also depends on the nature of demand in the world rice market. In the 1980s, import demand shifted away from Asia, with rice imports growing in the Middle East, Africa, and Latin America. Many south and southeast Asian importers reduced their import demand due to increased production following the green revolution. For example, Indonesia was the world's largest importer of rice in the 1970s, but did not import rice during several years in the late 1980s. This change in structure means that a larger share of import demand comes from higher income countries that are not traditional producers.[1]

The selection of import markets is based on both the magnitude of total exports to the country and the frequency of purchase (i.e., the occurrence of continuous rice shipments from Thailand or the U.S. throughout the 1980s). The model presented below requires continuous observations on prices. Many rice importers trade only infrequently in the international market, due to trade policies that seek to stabilize domestic prices (Falcon and Monke). The selection criteria therefore identified a particular segment of the rice trade-- import markets in high income countries with limited or no production capacity.

Five major markets were identified for U.S. Long Grain white rice (code 0422130): the European Community (EC), Canada, Iraq, Ivory Coast, and Saudi Arabia. For U.S. exports of Long Grain Parboil (code 0422120) the major markets were: the EC, Canada, Ivory Coast, and Saudi Arabia. Taken together, U.S. exports in these categories to these markets accounted for about one-third of U.S. rice exports. Four countries were identified as major and consistent destinations for Thai long grain rice: Hong Kong, Malaysia, Saudi Arabia, and Singapore. These markets accounted for only 19 percent of Thailand's long grain rice exports of rice during the 1980s. Thailand traditionally supplied the Asian markets, and it is these traditional rice producing countries that tend to participate in the market infrequently (Falcon and Monke).

All of the eight markets selected are high or middle income countries (as classified by the World Bank). Four of the eight, Singapore, Hong Kong, Canada, and Saudi Arabia, have virtually no domestic production of rice. In the other four countries, production does not meet demand for various reasons. In the EC, most consumers prefer long grain rice. Italy, the major European producer, grows mostly short grain *arborio* rice for its own consumption (McNitt; Kaosa-ard Juliano). The Ivory Coast and Malaysia both produce rice, but food crop production has not expanded as rapidly as tree crop exports in these middle income countries. Iraq's production has been limited by its climate and possibly by the disruptions of war.

Whether these regular purchasers of rice face a more or less competitive market than infrequent rice buyers is an empirical question. Previous studies (e.g., Siamwalla and Haykin) have emphasized the role of high search costs in creating imperfections in the international trade. Such costs are lower for regular purchasers.

Table 1. Market Shares of Leading Rice Exporters, 1970-1990

Year	Burma	China	Pakistan	Thailand	U.S.	U.S.+ Thailand
			(Percent)			
1970	7.3	11.1	1.5	12.1	19.8	31.8
1971	8.7	9.8	2.1	16.9	16.0	32.9
1972	5.8	9.5	3.3	23.3	22.5	45.8
1973	1.6	21.2	9.1	9.1	17.4	26.5
1974	2.4	21.3	7.1	11.7	19.6	31.4
1975	3.8	25 0	6.4	12.3	27.6	39.8
1976	7.0	15.9	9.8	21.9	23.4	45.4
1977	6.2	10.9	8.2	27.2	21.6	48.8
1978	3.6	17.3	8.0	16.6	24.2	40.8
1979	5.0	12.4	11.6	23.7	19.7	43.5
1980	5.0	10.1	7.4	21.5	23.5	44.9
1981	5.1	5.2	8.6	23.2	24.4	47.6
1982	5.8	6.6	6.5	31.5	21.2	52.7
1983	7.4	0.0	7.8	30.0	20.6	50.6
1984	5.8	9.3	10.1	36.9	17.1	54.0
1985	3.9	8.8	8 4	34.8	16.6	51.5
1986	5.0	7.4	9.0	34.0	18.8	52.8
1987	3.7	7.9	9.6	34.2	19.2	53.4
1988	0.3	6.6	9.9	43.3	18.6	61.8
1989	1.1	2.5	5.6	41.6	20.2	61.7
1990	1.8	3.3	6.1	33.0	20.3	53 3

Source: FAO Trade Year Book, various issues.

However, regular purchasers may have inelastic demand for imports due to relatively high income and strong quality preferences.

One indicator of the potential for exercise of market power is the dominance of an exporter in a particular market. Table 2 presents the exporters' shares of rice imports in the selected markets. The U.S. is the principal exporter to Iraq and Canada, and supplies substantial shares in Saudi Arabia and the EC. Thailand supplies most of the rice for Singapore and Malaysia, and a large portion in Hong Kong, Saudi Arabia, the EC, and the Ivory Coast. The U.S. and Thailand compete directly in Saudi Arabia and the EC; Thailand also competes directly with China for the Hong Kong market.[2]

Dominance of a particular exporter arises in part from strong quality preferences. Not all quality differences can be discerned from the standard grades used by the two exporters, because these describe only physical characteristics. The U.S. is recognized as a reliable supplier of both high quality parboiled rice and high quality long grain white rice. U.S. white rice tends to have higher amylose (firmer cooked texture) than Thai rice, and this texture characteristic is preferred by Middle Eastern consumers and consumers of northern European origin (Kaosa-ard and Juliano). Thailand exports both very high and very low quality white rice. Thai rice tends to have a softer texture which is preferred by Asian consumers. Thai fragrant rice which has a soft texture commands a premium in Hong Kong and Singapore markets (Kaosa-ard and Juliano). These differences explain in part the patterns observed in table 2.[3]

In addition to quality preferences, government interventions in the rice trade also play a role in determining market shares. Some

Table 2. Import Shares of U.S. and Thailand in Markets with Continuous Rice Imports, 1980-88 Average

	Percent Import Share From		
	U.S.	Thailand	Other
Canada	77.0	5 8	17.2
Iraq	73.2	0.0	26.8
Saudi Arabia	56.0	26.3	17.7
EC[a]	41.1	21.8	37.1
Ivory Coast	2.3	22.7	75.0[b]
Singapore	1.1	97.5	1.4
Hong Kong	0.7	44.3	55.0[c]
Malaysia	0.0	87.3	12.7

Sources: Total imports for each importer are from the FAO Trade Yearbook. U.S. exports by destination are from USDA/FAS. Thai exports by destination are from Bank of Thailand Monthly Bulletin.

[a] Due to the difficulty of correcting for intra-EC trade in the above sources, these data are from the FAO Intergovernmental Group on Rice and represent the 1986-88 average.

[b] Other exporters to the Ivory Coast include Pakistan, Burma, and Vietnam.

[c] China provides 42 percent of Hong Kong imports.

of these import markets (Ivory Coast, Malaysia, Saudi Arabia, Iraq) have government monopolies on rice imports, and purchasing decisions may be politically motivated. The U.S. government also has promoted rice exports aggressively, especially after 1985. The provision of export credits to Iraq and Saudi Arabia has tied sales to U.S. suppliers, and so have concessional sales to the Ivory Coast.

In summary, three factors suggest that noncompetitive pricing may occur. First, two exporters dominate the international rice trade. Second, markets for continuous imports in high and middle income countries are characterized by strong quality preferences. The relatively high incomes of consumers in these markets could make demand inelastic for rice from a particular source. Finally, U.S. sales promotions may serve to tie certain markets to U.S. suppliers. Next, we develop a model that allows us to test directly for the noncompetitive pricing.

A Theoretical and Empirical Model of Price Discrimination

An exporter with market power can use exchange rate changes in order to "price to market" (Krugman; Knetter). Assume that an exporter maximizes profit by selling to N foreign destinations, each with a unique demand function, and that the exporter can behave as a monopolist, segmenting markets and adjusting export prices to bilateral exchange rate changes. Demand in each market is represented as,

$$q_{it} = F(e_{it}p_{it})v_{it} \quad i = 1, ...,N \quad t = 1, ...,T \qquad (1)$$

where p_{it} is price in terms of the exporter's currency, e_{it} is the exchange rate (importer's currency per unit of the exporter's currency), and v_{it} is a random variable that may shift demand in market i in period t. The exporter's cost is given by

$$C_t = C(\Sigma q_{it})\delta_t \quad t = 1, ...,T \tag{2}$$

where C_t measures costs in the exporter's domestic currency units, which are summed over all destination markets, and δ_t is a random variable that may shift the cost function (e.g., changes in input prices) in period t. Substituting equation (1) for q_{it}, the maximization problem becomes

$$\max \Pi = \Sigma[p_{it}F(e_{it}p_{it})v_{it}] - C\{\Sigma[F(e_{it}p_{it})v_{it}]\}\delta_t. \tag{3}$$

Differentiating equation (3) with respect to p_{it} and expressing in terms of elasticities, the first order conditions are

$$p_{it} = c_t\,(\varepsilon'_t/(\varepsilon'_t-1)) \quad i = 1, ...,N \quad t = 1, ...,T \tag{4}$$

where c_t equals the marginal cost of production in period t ($C'\delta_t$), and ε'_t is the demand elasticity for imports in importing country i in period t. Equation (4) states that the price discriminating monopolist will equate marginal cost to marginal revenue in each market.

If the elasticity of demand in the importing country is not constant, then changes in the bilateral exchange rate between the exporter and the importer will cause the optimal markup to change. When demand schedules are less (more) convex than a constant elasticity schedule, elasticity of demand increases (decreases) with increase in price (Knetter). Markups of price over cost fall (rise) when the exporter's currency appreciates.

To test whether exporters can vary prices across destinations or with changes in exchanges rates, we define an empirical model,

$$\ln P_{it} = \alpha + \Sigma\,\Theta_t x_t + \Sigma\,\lambda_r x_r + \Sigma\,\beta_t \ln e_{it} + u_{it}$$
$$i = 1, ...,N \text{ and } t = 1, ...,T \tag{5}$$

where P_{it} is the export unit value to market destination i in period t; α is a regression constant; Θ_t measure the time effect corresponding to the t periods; λ_r measure the country effect corresponding to the individual i destination markets; the x_t and x_r are sets of dummy variables used to specify the time and country effects, respectively; and u_{it} is the error term.[4] The e_{it} reflects the market-specific exchange rate in period t, where the observations corresponding to the prices in country i are the market-specific exchange rates, and zero otherwise. The β_t measure the exchange rate pass-through for the individual i countries. The export unit values and the exchange rates, as indicated in equation (5), are expressed in natural logs.

The formulation in equation (5) allows statistical tests for three hypotheses.

Null Hypothesis. $H_0 : \beta_t = 0 \quad \lambda_r = 0$

In a competitive market, export prices will be the same for all destinations. There will be no country effects ($\lambda_r = 0$), and changes in the bilateral exchange rates will not affect bilateral export prices ($\beta_t = 0$). Note that the destination-specific variables may affect the export unit values, but if markets are integrated these effects will be transmitted across destinations and are thus accounted for by the time effects, Θ_t, in the model. Hence, in a competitive market, $\lambda_r = \beta_t = 0$, and the time effects, Θ_t, measure factors affecting price for all destinations.

Noncompetitive pricing can take one of two forms.

Alternative Hypothesis 1. $H_A : \beta_t \neq 0$

If demand elasticities vary with exchange rate changes, then optimal markup over marginal cost for a monopolistic exporter will vary with exchange rates. Export price will depend on exchange rates and this implies that $\beta_t \neq 0$. The signs of the β_t coefficients reveal the way markups vary with changes in the exchange rate. A negative (positive) β indicates that import demand is less (more) convex than the constant

elasticity demand curve, and that exchange rate changes are not (more than) fully reflected in import prices.

Alternative Hypothesis 2. $H_A : \lambda_i \neq 0$

The country effect, λ_i, measures the component of the markup factor that differs across destinations when a monopolistic exporter can segment markets. Such price discrimination will not vary in response to exchange rate changes if there is constant elasticity of demand in the importing country (Knetter). In this case β_i are not significantly different from zero, but the country effects (λ_i) show that prices differ across destinations.[5]

Equation (5) is estimated for three different sets of export prices: U.S. Long Grain Rice, U.S. Parboil Rice, and Thai Long Grain Rice. The export prices are unit f.a.s. values of shipments to various destinations. All data are quarterly from 1980 through 1987. Since the short-run pricing decision is the focus of this study, nominal exchange rates were used for all regressions. As suggested by Knetter, the exchanges rates are "normalized" by dividing each observation by the value for the first observation. This allows comparison of the β coefficients across destinations. The dummy variables for first quarter of 1980 and for Saudi Arabia are dropped, so that time effects are measured relative to 1980:1 and country effects show how high or low export prices are relative to Saudi Arabia. Data sources include: U.S. Bureau of the Census: U.S. Exports Schedule E, Commodity by Destination; Bank of Thailand Quarterly Bulletin; the International Monetary Fund: International Financial Statistics; and Eurostatistic: Data for Short-Term Economic Analysis.

Generalized least squares estimates of coefficients are generated by using a cross-sectionally heteroskedastic and timewise autoregressive model (Judge et al; Kmenta, pp. 618-622). A two-stage transformation first corrects for heteroskedasticity across markets and then for autocorrelation over time in each market. Separate estimates of ρ_i are used to transform the observations within cross-sections. An iterative procedure is used to produce maximum likelihood estimates for the ρ_i.

Results

The regression analysis identified market segments where price behavior is consistent with market imperfections. Regression results are reported in tables 3 and 4.[6] Significant positive and negative country effects indicate that prices in the import market are higher or lower, respectively, than the omitted country dummy. Significant exchange rate coefficients indicate pricing to market, and the positive sign for the significant β reported here indicates the exporter's effort to capture greater monopoly rent in the destination market.[7] The F1 and F2 tests reported in tables 3 and 4 reject the null hypotheses of competitive pricing. Thus all three equations showed evidence of noncompetitive pricing, through imperfect exchange rate pass-through and price discrimination across markets. In the discussion that follows, the regression results are associated with market characteristics.

U.S. Parboiled Rice Exports

The product differentiation of U.S. parboil rice arising from the special packaging and brand name recognition (e.g., Uncle Ben's) undoubtedly contributes to U.S. market power in this segment of the rice trade. There is evidence of price discrimination across markets for U.S. parboil exports, as the EC and Saudi Arabia consistently received lower export prices than Canada and the Ivory Coast during the 1980s.

Lower prices could reflect relatively elastic demand compared to the other two destinations, the exercise of monopsony power by the importer, or an effort by the exporter to gain market share. Exports to the EC may have been priced lower in a bid to gain market share. In the mid to late 1980s, effective sales promotion has contributed to an increase in U.S. exports to EC (Rastegari-Henneberry). Price discrimination for Saudi Arabia parboiled rice purchases could be attributed to monopsony in that it is the largest buyer of U.S. parboiled rice, accounting for over one-third of total U.S. parboil exports from 1980 to 1986 (Childs).

The U.S. parboiled rice results also show monopolistic pricing in the form of imperfect exchange rate pass-through for exports

Table 3. Generalized Least Squares Results for U.S. Export Price Regressions[a]

Parboil Rice

	EC	Canada	Ivory Coast	Saudi Arabia
Country Effect λ	-0.3039 (-4.2945*)	0.3025 (3.7071*)	0.4437 (4.9798*)	.....
Exchange Rate β	-0.2976 (-1.4380)	1.8083 (2.2020*)	-0.3168 (1.8343)	0.7840 (1.0605)

R-square = .8183
Durbin-Watson = 2.01
Breusch-Pagan = 52.52 (39 df)
F1 = 2.90* (4,92 df)
F2 = 20.28* (3,92 df)

Long Grain Rice

	EC	Canada	Ivory Coast	Iraq	Saudi Arabia
Country Effect λ	-0.3377 (-3.1635*)	-0.2035 (-1.4914)	-0.0999 (-0.9489)	-0.2397 (-2.4188*)	.....
Exchange Rate β	0.22126 (1.0337)	2.0093 (1.8224)	0.37634 (2.2975*)	0.5120 (0.2941)	3.4096 (2.6327*)

R-square = .6859
Durbin-Watson = 1.97
Breusch-Pagan = 45.75 (41 df)
F1 = 2.7651* (5,123 df)
F2 = 3.0600* (4, 123 df)

[a] The numbers in parentheses are t statistics. The asterisks (*) indicate t statistics and F statistics significant at the 0.05 level. F1 is the F statistic for H_0: $\beta_i = 0$; F2 is the F statistic for H_0: $\lambda_i = 0$. θ coefficients are not reported due to space limitations.

to Canada. The positive β coefficient reveals that markups are adjusted upward by 18.1 percent for a 10 percent appreciation in the U.S. dollar. Such pricing behavior indicates very inelastic demand in Canada for parboiled rice of U.S. origin.

U.S. Long Grain Exports

The U.S. long grain rice trade shows evidence of monopolistic pricing in the form of price discrimination across destinations. Prices are consistently lower for the EC and Iraq than for Canada, Ivory Coast, and Saudi Arabia. Further evidence of monopolistic pricing is found in the significant β coefficients for U.S. shipments of long grain rice to Saudi Arabia and the Ivory Coast. Markups increase by 34.1 percent and 3.8 percent in Saudi Arabia and Ivory Coast, respectively, for a 10 percent appreciation in the U.S. dollar.[8]

U.S. market power in these two destinations can be explained in part by special credit arrangements with Saudi Arabia and concessional sales to Ivory Coast. These credit arrangements essentially become an agreement to buy rice from only U.S. suppliers since the credits can only be applied to rice from the U.S. In the

Table 4. Generalized Least Squares Results for Thai Export Price Regressions[a]

Long Grain Rice

	Hong Kong	Singapore	Malaysia	Saudi Arabia
Country Effect	0.0001	0.0123	-0.1989	.. ..
λ	(0 0036)	(0.2366)	(-3.8356*)	
Exchange Rate	0.3249	0.2173	-0.3041	1.048
β	(1.7713)	(0.9948)	(-0.6870)	(2.5841*)
R-square = .850				
Durbin-Watson = 1.97				
Breusch-Pagan = 55.81 (39 df)				
F1 = 3.72* (4,92 df)				
F2 = 9.56* (3,92 df)				

[a] See table 3 for an explanation of the table.

Saudi market, the U.S. supplies about half of the imports, due to both the credit arrangements, and its reliability as a regular supplier of high quality rice. One company is the main U.S. supplier of imported rice to this market, and industry experts claim that a strong clientele base has been developed over several years because of consistent and regular supply of high-quality rice. U.S. commercial exports to Ivory Coast are relatively small and very recent. However, the significant β could be attributed to the influence of concessional sales, which account for over half of U.S. exports to Ivory Coast.

Thai Long Grain Rice Exports

The results show price discrimination for Thai long grain rice exports. Malaysia received lower export prices than other Thai markets during the 1980s. This may be induced by Malaysian government policy which has sought to diversify its sources of rice imports. Baharumsha observed that in order to reduce the risk of over-dependence on Thailand for all of its imports, Malaysia has recently diversified its source of imports to include Pakistan, Burma, and China. Charging lower prices in Malaysia could be an attempt by Thai exporters to avoid Malaysian government import restrictions and to hold on to market share.

Another interesting finding is that both the U.S. and Thailand seem to be able to extract rent in the Saudi Arabian market for long grain rice when exchange rates change, as the β coefficients are significant in both equations. Interviews with industry experts revealed that the Saudi Arabian market is segmented. There is strong preference for Basmati rice in the Eastern part of the country and strong preference for U.S. rice in the Western half. Others suggest that further segmentation arises due to the large populations of Pakistani, Indian, Bangladeshi, and Philippine immigrant workers in Saudi Arabia. This Asian population along with some Saudi nationals is the main consuming block of the rice imports from Asian countries, such as Thailand, Pakistan, and India. Hence, since the U.S. and Thailand exporters operate within somewhat separate high income markets, with inelastic demands, it is possible for them to price discriminate without concern for loss of market share.

Conclusions

The evidence from this study identifies noncompetitive pricing in one segment of the international rice market, high and middle income markets with continuous demand for imports. Price discrimination across destinations is found

for U.S. and Thai long grain exports and U.S. parboil exports. While quality differences could account for some of the price variation across destinations, structural characteristics in some markets (i.e., tied sales) also provide opportunities for noncompetitive pricing. Stronger evidence of noncompetitive pricing is found in imperfect exchange rate pass-through observed in three out of the eight importing countries (Saudi Arabia, for both U.S. and Thai long grain exports, Ivory Coast for U.S. long grain rice, and Canada for U.S. parboil rice).

Do our results indicate that the whole international rice market is noncompetitive? It is important to note that this study only covered high quality rice exports by U.S. and Thailand in selected markets with regular trade. The markets considered accounted for 34 percent of U.S. exports, and thus much of the U.S. trade can be characterized as noncompetitive. However, the total volume of imports considered here (i.e., the combined imports of U.S. long grain and parboil rice and Thai long grain rice in the selected destinations) ranged from 1.1 million metric tons in 1980 to 1.4 million metric tons in 1987, or 7.4 percent to 11.1 percent of total world imports. Hence, while evidence of market power is provided in certain market segments for high quality rice, one cannot conclude that the entire international rice market is noncompetitive. Thus our findings qualify, rather than refute, those of Petzel and Monke or Uri.

Our findings may have implications for the rapidly changing market for high quality medium grain rice. The recently concluded GATT agreement will significantly increase demand for this type of rice, principally in Japan and Korea. The U.S. is expected to be the major supplier of this increased demand, and the ability of other competitors to respond is limited (USDA). Although our results pertain to the long grain and parboiled markets, they are suggestive of how pricing behavior might evolve in these new high income import markets. It may be possible for U.S. exporters to exert market power in the medium grain market niche.

Finally, it is interesting to compare these results with those of Pick and Park. They found little evidence of noncompetitive pricing in markets for U.S. exports of corn and soybeans, even though the U.S. provides a much larger share of world trade in those two products than in rice. Pick and Park did find imperfect exchange rate pass-through for certain wheat markets, as we did for certain rice markets. Wheat and rice are food staples. In contrast to feed stuffs, food grain trade may have more potential for noncompetitive pricing due to the inelastic nature of demand for food grains in high income countries and government intervention to assure food security. However, since most high income importers utilize grain imports for feed, these food import markets are limited in scope.

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Endnotes

1. Falcon and Monke identified countries with average rice imports of more than 200,000 metric tons per year from 1961 to 1977, and all were in Asia, with the exception of USSR and Cuba. Countries averaging imports of more than 200,000 metric tons per year between 1970 and 1987 include seven new entrants, all outside of Asia: EC, Nigeria, Iran, Saudi Arabia, Ivory Coast, Senegal, and Iraq (Yumkella).

2. The Ivory Coast varies its sources of rice supply substantially from year to year. Thailand supplied no exports to the Ivory Coast in 4 of the 9 years examined. Other suppliers include Pakistan, Burma, and Vietnam. In 1990, the U.S. provided nearly half of rice imports to Ivory Coast, probably as a result of concessional sales. Unlike the other selected markets, the Ivory Coast is not tied to a particular source for reliable quality.

3. Some importing countries, such as the EC, Saudi Arabia, and Canada, import from different sources because there are populations of different ethnic origins. In fact, the U.S. has been importing growing quantities of Thai rice for consumers of Asian heritage.

4. Singularity is avoided by dropping the first quarter of 1980 for the time dummies and one country dummy for each regression. The intercept term, α, captures the first quarter of 1980 for the omitted country. The time effects, Θ_t, capture variables that would have a common impact in each time period on all destination markets. Such variables include marginal cost of exporters, general inflationary trends in world markets and omitted variables.

5. Such price differences could reflect unmeasured differences in cost across destinations, due for example, to systematic differences in quality. Thus significant country effects do not necessarily indicate noncompetitive pricing.

6. The Durbin-Watson statistics indicate no first-order serial correlation in the corrected residuals. The Breusch-Pagan-Godfrey test accepts homoskedasticity at the 1 and 5 percent levels for the U.S. regressions. For the Thai regression, homoskedasticity is accepted at the 1 percent level, but marginally rejected at the 5 percent level.

7. A negative β would be consistent with exporter pricing to market to defend market share. In such cases the exporter attempts to maintain stable prices by reducing the effect of importers' currency devaluation in markets where there are other competing suppliers.

8. The β coefficient for Iraq also might be expected to be significant since the U.S. is so dominant in that market. However, the exchange rate between the Iraqi currency and the U.S. dollar did not vary much during the study period, and hence there was little opportunity for pricing to market through incomplete exchange rate pass-through.