The International Demand for Thailand's Rice Exports

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Abstract

The familiar 'small country' assumption is tested empirically in this paper, focussing upon the long-run international demand for Thailand's rice exports and drawing upon recent developments in the statistical analysis of economic time series. A relatively robust long-run price elasticity of export demand is obtained, at just under 2. The literature on the export demand for manufactured goods has shown the central importance of the 'normalisation' used during estimation. Our results suggest that this issue may not be as important in the case of primary commodity exports, at least not where the exporting country possesses a degree of monopoly power.

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Introduction

Economic analyses of development issues commonly assume that the international demand for a country's exports is infinitely elastic, and therefore that export prices may be taken as given. It is widely recognised that, in principle, some commodities may depart from these assumptions, in the case of large exporters of those commodities, but the empirical research on this subject has been thin and largely inconclusive. This paper explores this issue for Thailand, focussing upon the Thai export commodity for which international demand has seemingly the greatest chance of departing from the 'small country' assumption - rice.

The analysis draws upon recent developments in the statistical analysis of economic time series. The results have implications for the desirability of taxes applied to Thailand's rice exports and also for the evaluation of investment proposals, such as irrigation projects, which would have the effect of increasing the country's rice exports.

For over a century, taxation of rice exports was a major source of revenue for the Thai government (Ingram 1971). The rice export tax was in part an attempt to exercise monopoly power in the international market for this commodity. The existence of these taxes was therefore at least partly based upon the assumption that such market power existed and could be exploited. The rates of these taxes were gradually reduced through the 1970s and early 1980s. They were suspended in 1986, at a time of low international

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rice prices (Siamwalla *et al.* 1993) and have not been reinstated. The reasons for the abandonment of rice export taxes included doubts as to whether Thailand really possessed monopoly power in the international rice market, concern for the possible adverse effects the taxes may have on the incomes of farmers (Pinthong 1984), and the expanding availability of alternative sources of tax revenues as the country industrialised.

More recently, in the early 1990s, proposals were made for the *subsidisation* of rice exports as an instrument of income redistribution towards poor rice farmers, but the possible adverse effects on Thailand's terms of trade remained controversial. If Thailand possessed monopoly power in the world rice market, it was argued, then on efficiency grounds - and leaving aside the possible retaliation of trading partners or the possible violation of international agreements that could be involved[1] - the optimal policy would be a tax on rice exports, and certainly not a subsidy (Corden 1974).[2]

Thailand is a large exporter of rice, accounting for an average of around one third of total world exports. Rice has traditionally been the major export commodity for Thailand but during the 1980s the rapid growth of Thailand's manufactured exports caused rice to decline as a share of total merchandise exports. Rice nevertheless remains a significant export commodity for Thailand and dominates agricultural production within that country (Warr 1993). Clearly, there is *a priori* reason to suspect that Thailand may possess market power in the world rice market.

The elasticity of export demand for rice has been a central issue in discussions of many economic policy issues within that country. These issues have included the economic effects of a rice export tax or subsidy, as summarised above, but also the welfare effects of technical change in Thai rice production and investment in infrastructure facilities such as irrigation, and the effects of government interventions

[1]Violation of Thailand's GATT commitments is more likely to arise in the case of an export subsidy than a tax.
[2]See especially Chapter 7.

aimed at affecting domestic rice prices (Siamwalla and Setboonsarng 1989, 1991). Nevertheless, the empirical question of whether the 'small country' assumption applies to Thailand's rice exports remains unresolved to this day. This issue is investigated in this paper by estimating the international demand function for Thai rice exports.

Quantitative analysis of the international rice market is made difficult by the thinness of that market - only around 5 per cent of world production is traded - and by the prevalence of managed trade within the market. Barker and Herdt point out that the rice market responds as much to political as to economic forces, and the political variables are hard to quantify (Barker and Herdt 1985, p. 193).

> 'National governments have controlled, either indirectly or directly, the volume of rice to be traded (either imported or exported) on the basis of the adequacy of domestic production and supplies and have tended to be unresponsive to changes in world price. As a consequence a major portion of price instability has been shifted to the world market.' (Barker and Herdt 1985, p.11)

Thus, the estimation of the *short-run* export demand relationships for Thai rice would appear difficult, given that the Thai government and the governments of its trading partners actively intervene in their domestic and export markets. However, no consensus can be drawn from previous analyses of the underlying *long run* export demand relationships for rice. For example, Meenaphant (1981) estimates the export price elasticity of demand for Thai rice to be -1.07, Wong (1978) estimates it at -4, Roumasset and Setboonsarng (1988) assume the same elasticity to lie between -5 and -8, and Mitchell (1985) assumes that Thailand is a 'small country' with infinitely elastic export demand. The literature provides inadequate guidance to Thai policy makers requiring information on this key economic relationship.

The following section of this paper reviews the methodological issues relating to the estimation of export demand relationships in light of a recent debate concerning manufactured exports from the newly industrialising economies.[3] This debate raised econometric issues which are also relevant for the analysis of international markets for primary commodities and in particular, for evaluation of the potential market power of exporters. We then describe the characteristics of data used in the estimation procedure adopted to estimate an export demand function for Thai rice. The estimation methodology utilised is the Phillips-Hansen 'fully modified' OLS estimation procedure. The results, presented in the following section, lead us to conclude that the 'small country' hypothesis must be rejected in this case..

Estimating Export Demand Relationships: Methodological Issues

The traditional framework for analysing the demand for commodity exports is set out by Goldstein and Khan (1978). Although the specification of this model differs between studies, particularly with respect to dynamics and supply structure, the core of the underlying (long-run) framework is usually a demand equation for a particular country's exports of a given commodity, or group of commodities, defined as,

$$\ln X_d^t = a_0 + a_1 \ln(P_X^t / P_{Xw}^t) + a_2 \ln Y_w^t \qquad (1)$$

where X_d^t is the quantity of exports demanded at time *t*; P_X^t is the price of exports; P_{Xw}^t is the export price of competing commodities, and Y_w^t is a weighted average of real incomes of the country's trading partners. The parameters a_1 and a_2 are directly estimated price and income elasticities of export demand respectively.[4]

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[3]Riedel (1988), Athukorala and Riedel (1991), and Muscatelli, Srinivasan and Vines (1992).

[4] In the case of manufactured goods, the absence of a variable to capture product quality improvements (or product diversification) will tend to bias the estimated income elasticity of demand upwards (see, for example, Krugman (1989)). Because this problem does not arise to a comparable extent with primary commodities, the analysis of export demand for these commodities would appear less statistically problematical than for manufactured goods.

The supply of exports from the country concerned is usually specified as a function of the export price relative to the domestic price and some domestic production capacity variable, and expressed re-normalised in the export price - that is, with prices as the dependent variable. The resulting inverse supply equation is then estimated simultaneously with (1) to obtain the long-run demand and supply relationships. Often, however, the demand equation is actually estimated in isolation using OLS under the assumption of an infinitely elastic export supply function or a stable demand function (see Goldstein and Khan (1985) for a survey).

According to Riedel, and Athukorala and Riedel, it is more appropriate to test whether a country is a 'small' player in the market for a particular commodity by estimating (1) re-normalised in the price of exports, such that,

$$\ln P_X^t = c_0 + c_1 \ln X_d^t + c_2 \ln P_{Xw}^t + c_3 \ln Y_w^t \qquad (2)$$

Athukorala and Riedel comment that: in the small country case:

> `[I]f the country were truly a price-taker, [P_X^t and P_{Xw}^t in (1)] would be perfectly, or at least very highly collinear. In this case, the relative price variable [P_X^t / P_{Xw}^t] would exhibit very little, if any, variability. Therefore, for a true small country, the coefficient on the relative price variable cannot be precisely estimated, and may turn out relatively low (and statistically insignificant) even though its true value is extremely high.' (Athukorala and Riedel, 1991, p. 144).

If the small country hypothesis is maintained for a particular country's exports, then world income should have no impact on that country's exports even if the global income elasticity of demand is high. However, as Athukorala and Riedel note, the high income elasticities of demand combined with low price elasticities obtained in previous studies could point to the 'false' notion that LDC exports of manufactures are

sensitive to the level of income of developed countries. Indeed, using two-stage least squares and specifying a partial adjustment mechanism for the demand and supply equations, Athukorala and Riedel find that, for the case of Korean exports of machinery and transport equipment, an inverse export demand equation (*i.e.* price-normalised) supports the small-country hypothesis whilst the usual (quantity-normalised) demand equation points to a low price and a high income elasticity of demand for these commodities - both equations fitting the data similarly well.

An alternative methodology for estimating export elasticities has recently been implemented by Muscatelli, Srinivasan and Vines (1992). These authors use the estimation procedure of Phillips and Hansen (1990) to obtain long-run export demand and supply elasticities of manufactured goods from Hong Kong. Essentially, the Phillips-Hansen methodology is 'fully modified' OLS, which results in an optimal single-equation technique (Phillips and Loretan 1991, p. 419) for estimating with I(1) variables. When traditional OLS is implemented with non-stationary variables, test statistics cannot be interpreted in the usual way and spurious regressions may result. The Phillips-Hansen methodology corrects these test statistics using a semi-parametric procedure and also corrects regression coefficients and associated test statistics for statistical endogeneity of right-hand side regressors and for serial correlation.

Phillips and Loretan suggest a two-step estimation methodology that utilises the fully modified (FM) approach to estimate long-run economic relationships, the results of which can then be employed within an error-correction model (ECM) to estimate short-run relationships. This is essentially the procedure which Muscatelli *et al*. (1992) adopt: they obtain FM long-run export demand and supply elasticities by estimating demand and supply equations separately, finding that the Phillips-Hansen procedure 'alleviated the problem' of normalisation in the case of Hong Kong exports of manufactures by taking 'proper account of the short-run properties of the data'

(Muscatelli *et al*. 1992, pp. 1472-1473). That is, similar long-run export elasticities were obtained. Muscatelli *et al*. estimate jointly the export demand and supply equations, specified as an ECM, with the long-run relationships imposed. In this paper we follow the first step of Muscatelli *et al.* and estimate the long run export demand equation for Thai rice under different normalizations using the Philipps-Hansen FM approach.

Data

Quarterly data from 1976(i)-1990(iv) were used to estimate equation (1) and its normalised versions.[5] In this equation X_d^t is the volume of Thai rice exports; P_X^t is the unit value of Thai rice exports in US. Dollars; and P_{Xw}^t is the price of wheat at US Gulf ports in US Dollars per Bushel[6]. Ideally, Y_w^t would be specified as a trade weighted income index of Thai rice importing countries, however, quarterly GNP (or GDP) data are not available for the key importers. Instead, the total value of imports of these countries were used[7], and deflated by a world import price index[8]. Weights used in the construction of the Y_w^t index are the average annual share of Thai rice exports of the major importers: for some of these countries (Iran, Nigeria, Senegal and China) import data were unavailable for the full period, data on world exports to these countries were used instead; other countries included in the analysis - for which import data were available - are Hong Kong, Indonesia, Malaysia, Singapore, India, EEC-12 and Brazil. Together, these countries accounted for 57 per cent of the Thai rice export market over the estimation period.

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[5] All of the data series were de-seasonalized in conducting the subsequent empirical analysis.
[6] Sources of X_d^t, P_X^t and P_{Xw}^t are International Monetary Fund, *International Financial Statistics*, various issues.
[7]Source: International Monetary Fund, *Direction of Trade Statistics*, various issues
[8]Source: International Monetary Fund, *International Financial Statistics*, various issues.

In order to interpret the estimated coefficients in equation (1) as long-run elasticities, the Phillips-Hansen procedure requires that all variables are I(1), thus before estimating it was first necessary to test all variables for unit-root non-stationarity. The null hypothesis is the presence of a unit root and is tested using the $Z(t_{\alpha}^{*})$ statistic of Phillips and Perron (1988), which tests for unit root non-stationarity *versus* stationarity around a deterministic trend.[9]

Table 1 reports the estimated $Z(t_{\alpha}^{*})$ statistics for each series and corresponding estimates of the autoregressive coefficient α^{*}. The null hypothesis of unit-root non-stationarity for all series, except exports of rice (not rejected at the 5 per cent significance level), could not be rejected at the 10 per cent significance level. First-differencing each series, the null hypothesis of non-stationarity was rejected at high levels of significance. Thus, the evidence suggests that the series are likely to be I(1) and it is reasonable to include all series in the estimating equation.

Estimation Results

Results from estimating the export demand equation under different normalisation specifications are presented in Table 2.[10] When the standard demand equation (normalised in quantities) is estimated with the restriction of homogeneity in prices imposed (equation (*i*)), a low price elasticity of demand of -1.247 is obtained. The estimated income elasticity of demand is significant and somewhat higher than expected (1.238). Using the $\hat{Z}_{\alpha}$ and $\hat{Z}_{t}$ tests of Phillips and Ouliaris (1990), a test of the null hypothesis of no cointegration was rejected at the 1 per cent significance level, supporting the interpretation of the parameter estimates as long-run elasticities.

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9 The COINT procedure of SHAZAM was used to conduct unit root and cointegration tests. See Perron (1988) for a summary and discussion of alternative tests for unit roots.

10 An algorithm in GAUSS was used to compute the Phillips-Hansen `fully-modified' least squares estimates (see COINT procedure version 1.5, due to Ouliaris).

When the demand equation is re-normalised in prices (equation (*ii*)) a larger implied long-run elasticity of demand of a larger magnitude is obtained (-1.928), although the 95 per cent confidence intervals of this parameter estimate clearly overlaps that of the quantity normalised demand equation. The estimated income elasticity of demand is virtually unchanged. With homogeneity in prices imposed (equation (*iii*)) very similar results to equation (i) are obtained.

The (re-normalised in price) demand elasticity estimated here of roughly -1.9 is substantially lower than that assumed in some studies of Thai rice exports. As mentioned above, Roumasset and Setboonsarng suggest a range for the elasticity of demand for Thai rice of -5 to -8. The upper bound of this range (-8) is based on a previous estimate of the elasticity of demand for *world* exports of rice of -2, divided by the share of Thai rice in total world trade of 0.25. As Roumasset and Setboonsarng recognise, this calculation rests on the improbable assumption that Thai rice is a perfect substitute for rice from other exporting countries. If, as seems more likely, Thai rice is an imperfect substitute for rice from other exporting sources, then the demand for Thai rice will be less elastic than this calculation would imply. But since the basis for the lower bound estimate (-5) is unstated, it is unclear whether it takes proper account of this point. However, the value estimated here falls within the range found in the empirical studies of Meenaphant (-1.07) and Wong (-4).

Athukorala and Riedel argue convincingly that when the 'small country' assumption applies, the normalisation used to estimate the demand equation is critical - whether export prices or quantities demanded are treated as the dependent variable. Quantity-normalised demand equations will produce price elasticity estimates that are biased downwards. Our quantity and price normalised demand equations do not produce significantly different price elasticity estimates. These results for Thai rice exports suggest that the methodological issue of normalisation may not be as important in the case of primary commodity exports as for manufactured goods, at

least not where the exporting country possesses a degree of monopoly power. Based on the Athukorala-Riedel argument, if the small country assumption had applied the normalisation would presumably have made a greater difference.

Concluding Remarks

The long-run demand relationship for Thai exports of rice is examined in this paper, drawing upon recent developments in the statistical analysis of economic time series and the insights arising from a recent debate on the elasticity of demand for manufactured exports from LDCs. A relatively robust long-run price elasticity of demand for rice is obtained, at between -1.2 and -1.9. The 'small country' hypothesis is rejected using the specification of a price normalised demand equation.

These results are relevant for current agricultural policy debate in Thailand. For example, analysis of the welfare effects of policies that would increase rice exports from Thailand should clearly take into account their potential adverse effects on the terms of trade. Such policies include not only the recent proposals for a rice export subsidy, but also include infrastructure development projects which increase the productive capacity of domestic rice farmers.

Caution should be exercised in interpreting these results as implying that reinstatement of a tax on Thai rice exports would necessarily be desirable for Thailand. Such a tax may have important effects not captured by statistical analysis. It could provoke retaliation on the part of Thailand's trading partners. It would have adverse income distributional consequences within Thailand in so far as it depresses the domestic producer price of rice, the principal commodity produced by the country's poorest people (Warr 1993).

It remains possible that the true long-run elasticity of export demand is greater than indicated by the present econometric analysis, and by previous studies. The reason is that a significant rise in the world price of rice may ultimately bring forth

export supplies from producers not currently present in the world market and therefore not captured in the historical data which can be used for econometric analysis. The long run supply response of international competitors - and hence the long run elasticity of export demand for Thai rice - may thus be more elastic than the statistical data reveals. Future econometric research may well find means of coping with these issues, but at present, statistically based estimates of long-run export demand elasticities must be regarded with caution. They probably should be viewed as lower bound estimates of the true long-run export demand elasticities.

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Table 1 Phillips-Perron Tests for Unit Root Non-Stationarity[a]

Series	Test			
	Original Series		First-differenced series	
	$Z(t_{\alpha}^{*})$	α^{*}	$Z(t_{\alpha}^{*})$	α^{*}
$\ln X_d$	-2.596†	0.77	-10.044†††	-0.07
$\ln P_X$	-1.538	0.92	-5.941†††	0.24
$\ln P_{Xw}$	-1.625	0.93	-4.478†††	0.46
$\ln Y_w$	1.412	1.02	-7.021†††	-0.08
$\ln(P_X / P_{Xw})$	2.063	0.85	-6.351†††	0.17

Notes:

a H_0 : Unit Root non-stationarity.

†, ††, †††: reject null hypothesis at 10 per cent, 5 per cent and 1 per cent levels of significance levels, respectively.

Table 2 Estimated Export Demand Equation for Thai Rice, 1976(i)-1990(iv)[a]

(*i*) $\ln X_d^t = -1.088 - 1.247 \ln(P_X^t / P_{Xw}^t) + 1.238 \ln Y_w^t$
(1.004) (0.251) (0.215)

$\hat{Z}_\alpha$ = -34.18*** $\hat{Z}_t$ = -4.92***

(*ii*) $\ln P_X^t = -0.601 - 0.519 \ln X_d^t + 1.028 \ln P_{Xw}^t + 0.634 \ln Y_w^t$
(0.899) (0.082) (0.147) (0.156)

ε_d = -1.928 η_d = 1.223
(0.303) (0.240)

(*iii*) $\ln(P_X^t / P_{Xw}^t) = -0.495 - 0.567 \ln X_d^t + 0.686 \ln Y_w^t$
(0.690) (0.096) (0.185)

ε_d = -1.764 η_d = 1.210
(0.299) (0.260)

Notes:

[a] standard errors in parentheses.

*** Reject null hypothesis of no cointegration at 1% significance level.