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THE DEMAND FOR LDC EXPORTS OF PRIMARY COMMODITIES: THE CASE OF THE PHILIPPINES*

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The economic case for taxing exports rests on the elasticity of demand for the exports concerned, but the true values of these elasticities are controversial. The international demand for Philippine exports of coconut products is examined in this paper. The hypothesis that the Philippines is a 'small country' exporter of coconut products is rejected using the specification of a price-normalised demand equation and the implications of this finding are discussed.

Introduction

During the 1970s and the first half of the 1980s the Philippines attempted to exercise monopoly power in the international market for coconut oil through the imposition of an export tax on this commodity. The export tax scheme was abolished in 1985 in response to the apparent misappropriation of its revenues. Nevertheless, the question of whether an economic case could in principle be made for such a tax rested largely on an empirical matter that was never satisfactorily resolved: whether the 'small country' assumption applied to Philippine coconut oil exports. This issue is investigated in this paper.

A recent debate as to whether the 'small country' assumption is applicable to less developed country (LDC) exports of manufactured goods (Riedel (1988), Athukorala and Riedel (1991), and Muscatelli, Srinivasan and Vines (1992)), raises important methodological issues which are also potentially relevant for the analysis of international markets for primary commodities such as coconut products. These issues bear on the evaluation of the potential market power of exporters, which is in turn relevant for the design of optimal trade policy. In this paper these methodological issues are reviewed in the context of

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the export demand for primary commodities, taking the case of coconut oil products from the Philippines.

In the following section the characteristics of the Philippine coconut oil export market and the policy background to the analysis are described. Methodological issues regarding the estimation of export demand relationships are then discussed in light of the recent debate concerning LDC manufactured exports. The data used in the estimation procedure adopted to estimate an export demand function for this commodity are outlined. The estimation methodology utilised is the Phillips-Hansen 'fully modified' ordinary least squares (OLS) estimation procedure. The results, presented in the following section, lead to the conclusion that the 'small country' hypothesis must be rejected in the context of Philippine exports of coconut products. The implications this finding may have for the desirability of an export tax are then discussed.

The Case of Philippine Coconut Oil Exports

Coconut oil is a lauric oil with versatile uses. It is used in the production of various processed foods, although non-lauric oils such as soy-oil may be substituted if manipulated chemically. Lauric oils also have industrial uses, for example as lubricants and detergents, which account for half of coconut oil consumption; again, however, substitutes are available such as synthetic petroleum-based products (World Bank (1990) p. 188).

The Philippines is the world's largest exporter of coconut oil. Over the five year period 1986 to 1990 it accounted for two thirds of total world exports (Asian and Pacific Coconut Community, APCC, (1990)).[1] There is therefore an *a priori* reason for suspecting that the Philippines may possess some degree of market power. A substantial tax was imposed on Philippine exports of coconut oil, beginning in 1970. Intal and Power (1990) present estimates of nominal rates of (negative) protection for copra products for the period 1970 to 1986 which imply export tax rates of between 30 and 55 per cent, measured in terms of imports.

Early empirical evidence apparently supported the case for an export tax. For example, Librero (1971) estimated a standard export demand equation for coconut oil within a larger model of the domestic and international markets for coconut products using instrumental variables estimation, and obtained a demand elasticity of between –0.81 and –1.28. Other commentators argued in support of the 'small country' assumption on *a priori* grounds. For example, in an important study of the export supply of the interrelated commodities of coconut

1 For the same period, an average of 5.2% of the Philippines annual commodity export earnings and 18.5% of agricultural export earnings were derived from coconut oil exports.

oil and its raw material copra, Bautista (1978) assumed the export demand for Philippine coconut oil to be infinitely elastic given that it constitutes only a small fraction of the total vegetable oil consumption of its major trading partners, Western Europe and the US, and can be substituted for other vegetable oils. For the period 1985-1990, coconut oil represented 5.4 per cent of the total volume of edible oils consumed globally — the leading vegetable oil, soy-oil, was 28.5 per cent; palm oil, 16.8 per cent; and palm-kernel oil, the main lauric oil competitor, was 2.3 per cent (APCC).

Within the Philippines, the export tax was highly controversial. The debate over the desirability of an export tax on coconut products was mixed with criticism of the manner in which its proceeds were administered. During the Marcos presidency (1967-1986), and especially from 1973 to 1985, an allegedly corrupt set of semi-private institutions was entrusted with the management of the funds collected from the tax, known as the 'coconut levy'. According to the government of the time, the funds were used for the benefit of small farmers, but it was widely reported that large sums were misused (Intal and Power (1990, 1991)). The coconut levy became associated in the public mind with the Marcos government's reputation for 'crony capitalism'.

In 1985 the critics of the export tax on coconut oil prevailed and the coconut levy was abolished. Nevertheless, aside from the important distributional issues that were involved, the analytical question of whether an export tax on Philippine coconut products could in principle be justified remained unresolved, as it does today. Given the absence of adequate econometric studies of the export demand for Philippine coconut oil, it has yet to be established satisfactorily whether the small country assumption is valid is this case. The analysis of this paper is directed to this issue. The question of how the revenue from any export tax should be distributed is not addressed in this paper.

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, for example, 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.[2]

The supply of exports of the country is usually defined as a function of export price relative to domestic price and some domestic production capacity variable, and expressed re-normalised with the export price 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 estimated in isolation using OLS under the assumption of an infinitely elastic export supply curve or a stable demand curve (see Goldstein and Khan (1985) for a survey).

This methodology, and in particular the treatment of quantity demanded as the dependent variable (normalisation in quantities), has been criticised on the grounds that OLS estimates of the demand elasticities will be biased downwards. Riedel (1988) and Athukorala and Riedel (1991), referring to previous studies of developing country exports of manufactures, argue that it is preferable to estimate the demand equation normalised in prices when using OLS, since, in this manner, the 'small country' hypothesis that demand is infinitely elastic with respect to price can be tested. They state:

> [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).

Renormalising (1) in prices gives

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

The structural relationships between equations (1) and (2)are: $a_0 = -c_0 / c_1$, $a_1 = 1 / c_1$ and $a_2 = -c_3 / c_1$. If the small country hypothesis is maintained, then $c_1 = 0$ and $c_3 = 0$: world income should have no impact on exports even if the 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.

2 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 problematic than for manufactured goods.

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 supports the small-country hypothesis whilst the usual demand equation specification points to a low price and a high income elasticity of demand for these commodities — the two equations fitted the data equally 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 endogeneity of right-hand side regressors and for serial correlation.

Phillips and Loretan (1991) 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. adopt: they obtain FM long-run export demand and supply elasticities by estimating demand and supply equations separately, finding 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' (op. cit. pp. 1472-1473). That is, similar long-run export elasticities were obtained. Muscatelli et al. then go on to estimate jointly the export demand and supply equations, specified as an ECM, with the long-run relationships imposed.

Data for Estimation

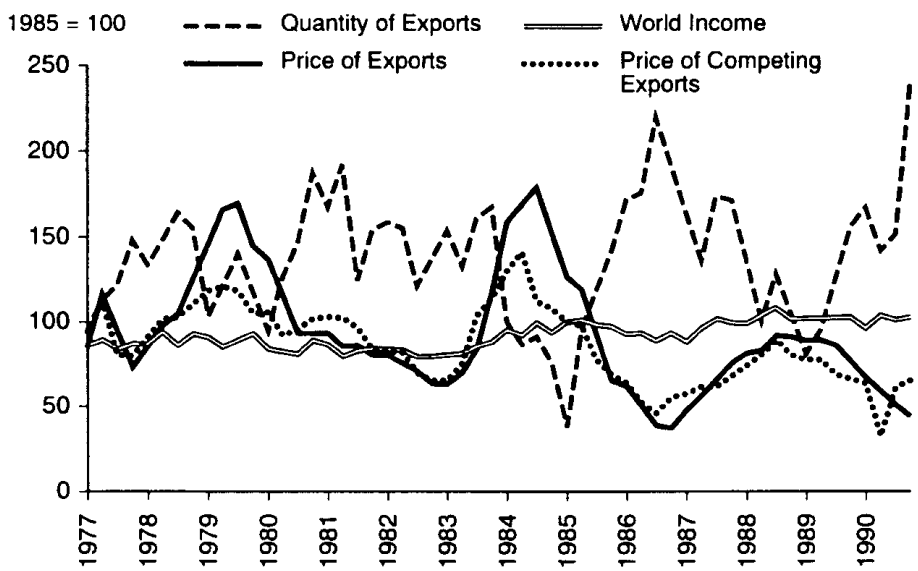
Appropriate quarterly data were available for the estimation of an export demand equation for Philippine coconut oil, but not data, or a suitable proxy, for the production capacity variable which would be included in an export supply equation. However, equation (1), and its re-normalised versions, can be estimated in isolation using the Phillips-Hansen procedure (and therefore the Muscatelli et al. application). This is the approach followed here.

The quarterly data cover the period 1977(i)-1990(iv). Using the notation of equation (1) above, X_d^t is the volume of coconut oil

exported from the Philippines, P_x^t is the f.o.b. price of Philippine coconut oil in US dollars, and P_{Xw}^t is a US dollar export price index of vegetable oils and oilseeds. Given that coconut oil is largely exported for use in manufacturing industry, Y_w^t was specified as a trade weighted index of industrial production of the main coconut oil importing countries, in US dollars. The predominant trading partners in this case are the US and EC, accounting for an average of 43 and 39 per cent of Philippine coconut oil exports, respectively, over the estimation period. The series are plotted in Figure 1.

FIGURE 1

Coconut Oil and Income Data
1977(i)–1990(iv)



Whilst primary commodity prices in general tend to be volatile, the prices of vegetable oils are particularly so. In a World Bank ranking of primary commodity price instability indices, coconut oil was *the most unstable* (World Bank 1990, pp. 180-181). Casual observation of Figure 1 confirms the price instability of coconut oil and might lead one to suspect that this is a commodity with a low price elasticity of demand, at least in the short run.

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 $Z(t_a^*)$ statistic of Phillips and Perron (1988), which tests for unit root non-stationarity versus stationarity around a deterministic trend.[3]

In Table 1 the estimated $Z(t_a^*)$ statistics for each series are reported along with the corresponding estimates of the autoregressive coefficient a^*. The null hypothesis of unit-root non-stationarity for all series could not be rejected at the 10 per cent significance level. First-differencing each series, the null hypothesis of non-stationarity was mostly rejected at high levels of significance. Thus, the evidence suggests that the series are $I(1)$ and it is therefore justifiable to include all series in the estimating equation.

TABLE 1

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

Series	Test			
	Original Series		First-differenced series	
	$Z(t_a^*)$	a^*	$Z(t_a^*)$	a^*
$\ln X_d$	–2.999	0.702	–6.948***	–0.0005
$\ln P_x$	–2.516	0.895	–3.598**	0.613
$\ln P_{Xw}$	–2.597	0.752	–6.719***	0.020
$\ln Y_w$	–1.963	0.878	–4.945***	0.308
$\ln(P_X / P_{Xw})$	–3.119	0.654	–7.546***	–0.093

Notes:

[a] H_0: Unit Root non-stationarity.

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

Estimation Results

Results from estimating the export demand equation under different normalisation specifications using the Phillips-Hansen procedure are presented in Table 2.[4] When the standard demand equation (normal-

3 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.

4 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).

ised in quantities) is estimated with the restriction of homogeneity in prices imposed (equation (*i*)), a relatively low price elasticity of demand of –1.143, is obtained, although the estimate falls at the upper bound of that found by Librero. The estimated income elasticity of demand was not significantly different from zero.

TABLE 2

Estimated Export Demand Equations for Philippine Coconut Oil[a]

(*i*) $$\ln X_d^t = \underset{(2.630)}{4.892} - \underset{(0.249)}{1.143}\ln(P_X^t / P_{Xw}^t) - \underset{(0.581)}{0.016}\ln Y_w^t$$

$$\varepsilon_d = -1.143, \quad \hat{Z}_a = -34.18^{***} \quad \hat{Z}_t = -5.51^{***}$$

(*ii*) $$\ln P_x^t = \underset{(2.253)}{-0.817} - \underset{(0.110)}{0.470}\ln X_d^t + \underset{(0.112)}{1.33}\ln P_{Xw}^t + \underset{(0.374)}{0.571}\ln Y_w^t$$

$$\varepsilon_d = \underset{(0.498)}{-2.128}$$

(*iii*) $$\ln(P_x^t / P_{Xw}^t) = \underset{(1.539)}{0.858} - \underset{(0.083)}{0.500}\ln X_d^t + \underset{(0.304)}{0.364}\ln Y_w^t$$

$$\varepsilon_d = \underset{(0.337)}{-2.000}$$

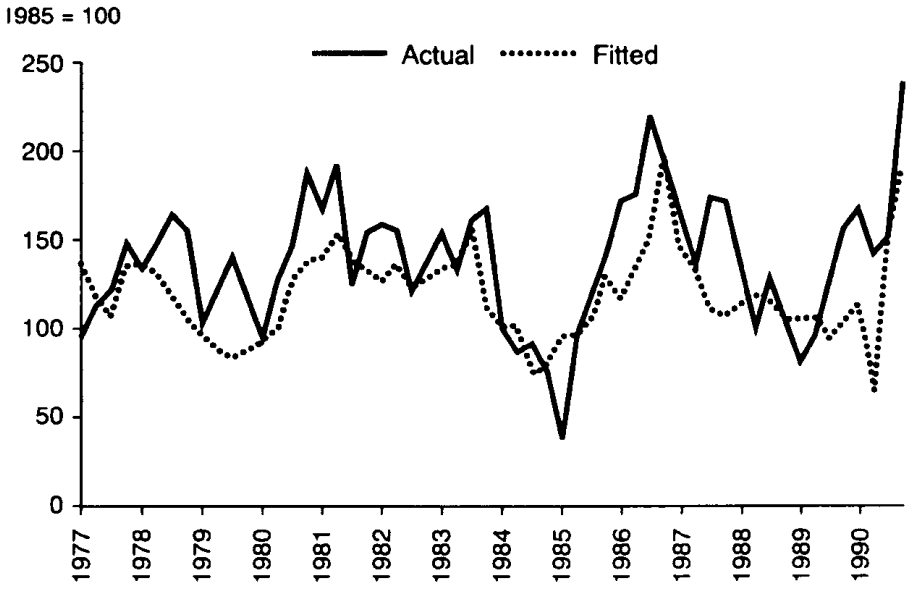
Notes:
[a] standard errors in parentheses.
*** Reject null hypothesis of no cointegration at per cent significance level.

The performance of the demand model is shown in Figure 2 where the predicted volume of coconut oil exports is seen to track actual exports reasonably well. A test of the null hypothesis of no cointegration was strongly rejected using the $\hat{Z}_a$ and $\hat{Z}_t$ tests of Phillips and Ouliaris (1990), supporting the interpretation of the estimated parameters as long-run elasticities. When the demand equation is re-normalised in prices (equation ii)) an implied long-run elasticity of demand of approximately twice this magnitude is obtained, –2.128. It can readily be confirmed that the 95 per cent confidence intervals for the two demand elasticity estimates overlap. The income coefficient is again insignificant. Finally, with price homogeneity imposed (equation (iii)), the estimated long-run price elasticity of demand is –2.

It would seem, therefore, that normalisation is only a moderately important matter for estimation of the price elasticity of export demand

FIGURE 2

Actual and Fitted Philippine Exports of Coconut Oil 1977(i)–1990(iv)



for this primary commodity. Athukorala and Riedel (1991) report very different conclusions for the case of manufactured goods, but empirical result from this analysis is not inconsistent with the analytical argument these authors make. The Philippines appears not to be a 'small country' exporter of coconut oil. The Athukorala-Riedel argument implies that if the Philippines *had* been a 'small country' in this context, then the normalisation issue would have been more significant.

The low estimate of the price elasticity of demand for coconut oil is consistent with the outcome of a detailed study by Goddard and Glance (1989) of the demand for fats and oils in the US., Canada and Japan, where lower than expected substitution elasticities were found between the major oils, and low price elasticities of demand were obtained. For example, the price elasticity of demand for coconut oil in the US was estimated at –0.55.

The apparently inelastic demand for coconut oil with respect to income might be explained by the mature nature of the US and EC markets, the industrial production levels of which are used in the construction of the trade weighted income index. At very low levels of income, and low daily calorific intake, vegetable oils are likely to be considered a luxury good, as income increases calories derived from

vegetable oils increase rapidly, reflected in a high income elasticity of demand; once caloric intake exceeds 3,000 per person per day, as in mature market economies, demand becomes inelastic with respect to income (World Bank, 1990, p. 183). The implication is that increased demand for Philippine coconut oil exports is most likely to arise from increasing incomes in less mature markets.

The optimal rate of export tax implied by these results is surprisingly similar to the rates actually applied in the Philippines under the 'coconut levy' scheme abolished in 1985. Under the strong assumptions set out in Corden (1974, Ch. 7), and especially that of no trade policy retaliation on the part of importing countries, the optimal rate of export tax, measured in terms of importables, is given by

$$t^* = -1 / \varepsilon_d, \tag{3}$$

where ε_d denotes the elasticity of export demand, as before (Corden 1974). The upper bound estimate for ε_d implies an optimal export tax rate of 47 per cent, well within the range of the tax rates actually applied between 1970 and 1985.

Concluding Remarks

The demand relationship for Philippine exports of coconut oil is examined in this paper. Relatively robust estimates of the long-run price elasticity of demand for this commodity are obtained, at between –1.143 and –2.128, depending on the 'normalisation' used during estimation. The 'small country' hypothesis is rejected using the specification of a price-normalised demand equation, suggesting the potential existence of an optimal export tax for Philippine coconut oil exports. Recent studies of demand for LDC exports of manufactured goods have suggested the central importance of the normalisation that is used during estimation — whether export prices or quantities demanded are treated as the dependent variable. Results for Philippine coconut oil exports suggest that this methodological issue may be far less important in the case of primary commodity exports. The reason may be that the 'small country' hypothesis does not apply in this case, whereas it typically does apply to LDC exports of manufactured goods. If the small country hypothesis had applied, the normalisation used would presumably have been a more important issue.

The Philippines 'coconut levy' scheme of the 1970s and 1980s was discredited by allegations of corruption in its administration. These features of the scheme, as it was reportedly applied, were indefensible; but these features are not intrinsic to the operation of such a scheme. The econometric results of this study, if valid, suggest that on economic efficiency grounds alone an export tax on coconut oil, properly administered, could be justified. Indeed, the econometric results suggest that, leaving aside the important issue of the distribution of tax

revenues, the *rate* of tax historically applied — around 40 per cent — may have been approximately optimal!

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 coconut products may ultimately bring forth supplies from new 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 Philippine exports — may thus be more elastic than the statistical data reveals. This is presumably the central reason why commodity agreements have almost invariably failed. The long run demand for exports may be substantially more elastic than statistical analysis suggests. Further 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.

The case for a tax on Philippine coconut product exports cannot be dismissed. If an export tax were to be reintroduced, it should of course be administered very differently from the former 'export levy'. However, setting such a tax at the high rates suggested by the econometric evidence could not be recommended. Much lower rates, perhaps in the range of 10 to 15 per cent, would seem appropriate. In addition to the above statistical qualifications regarding the true long-run demand elasticity, imposition of such a tax would have important effects not captured by statistical analysis. It may bring forth retaliatory responses from the Philippines' trading partners. It would also have undesirable income distributional consequences within the Philippines. Coconut producers are predominantly low-income smallholders (Intal and Power 1990, Balisacan 1993, Coxhead and Warr 1991 and 1995). By depressing domestic prices of coconut products, an export tax would further impoverish some of the country's poorest people unless effective compensatory mechanisms were in place.

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Data Appendix

X_d^t volume of coconut oil exported from the Philippines, metric tons. United Coconut Association of the Philippines (UCAP). *Coconut Statistics*, Manila, various issues.

P_X^t f.o.b. price of Philippine coconut oil in US dollars. UCAP, *Coconut Statistics.*

P_{Xw}^t Export price index of vegetable oils and oilseeds in US dollars. UNCTAD, *Handbook of International Trade and Development*, various issues.

Y_w^y Trade weighted index of industrial production in US dollars. Industrial production data, EEC-12 and US: OECD, *Main Economics Indicators Historical Statistics, 1969-88* and *Main Economic Indicators*, various issues. Trade weights are based on annual coconut oil exports to the EEC and the US.

Other Data Sources: Asian and Pacific Coconut Community, (1990). *Coconut Statistical Yearbook*, Jakarta. 'United Nations Trade Data' obtained from STARS International Trade System, International Economic Data Bank, Australian National University.