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10. Abstract

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The International Demand for Philippine Coconut Products: an Aggregate Analysis

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THE INTERNATIONAL DEMAND FOR PHILIPPINE COCONUT PRODUCTS: AN AGGREGATE ANALYSIS*

Aida Recto Librero

International trade in coconuts comprises a variety of products, the major ones being coconut oil, copra and copra meal. Coconut oil constitutes approximately 14 per cent of the world trade in fats and oils. It serves many purposes both for human consumption and as an industrial oil. The traditional uses are in the manufacture of soap, margarine, shortening, and in baked goods and confectioneries. It also has important uses in chemical manufacture.

Based on a simultaneous equation model presented below, this paper analyzes the demand for copra, coconut oil and copra meal produced and exported by the Philippines.

I. The Economic Model

This section presents a theoretical framework of the market for Philippine coconut products and an economic model showing price and demand relationships. Four distinct features can be discerned from the model. First is the multiplicity of markets. Copra moves into domestic crushings, exports, or storage; coconut oil encompasses both domestic and export markets; and ignoring the small amount of copra meal consumed locally, this product is disposed of in the international market. Although trade in these commodities is widespread, the demands of all importing countries are aggregated, that is, export relationships do not take into account

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the ultimate destination of the products.[1] A second characteristic is the joint production relationships: meal and oil are produced from copra and their prices are linked together in the copra processing sector. The simultaneous determination of prices and quantities constitutes the third feature of the market. A fourth characteristic feature is the interdependence of coconut products with other sectors of the economy. The market for coconut products extends to at least three sectors: the fats and oil, the food market, and the feed livestock sector. Copra is one of the many sources of vegetable oils and feed meals and competes with numerous other oilseeds in the world market. Coconut oil has innumerable uses in the manufacture of many food and nonfood products where other oils can to some extent be substituted.

A simplified graphic model of the market for Philippine coconut is presented in Figure 1. It indicates the relationships between prices and quantities of the various coconut products, assuming a static economy and all other factors held constant.

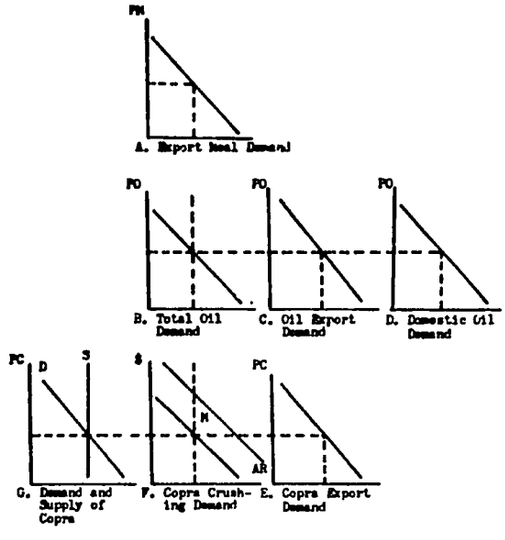

FIGURE 1
A SIMPLIFIED GRAPHIC MODEL OF THE PHILIPPINE COCONUT MARKET

[1] A regional analysis of the international demand for Philippine coconut products was made by Recto [8, pp. 152-82]. Countries importing coconut oil and desiccated coconut from the Philippines were grouped into (1) U.S. and (2) others; copra importers were grouped into 5 regions, namely: (1) U.S., (2) European Economic Community, (3) Canada and other Western Europe, (4) Latin America, and (5) others. Export demand functions for copra, coconut oil, and desiccated coconut were estimated for each region.

Section A shows the export demand (which is equal to total demand) for copra meal while Sections C and D represent the domestic and export demands for coconut oil and add horizontally to produce the total oil demand in Section B. The oil and meal markets may be considered as independent of each other since they operate in different sectors – oil in the fats and oils market and meal in the feed and livestock sector; but being products with a common origin, their prices and quantities are linked together in the copra crushing demand (Section F). The revenue derived by processors is composed of the revenues from oil and meal, which are produced in fixed proportions from every unit of copra cursched. The average revenue function, *AR*, in Section F, which is the vertical summation of the oil and meal demand functions, shows the revenue per unit as the quantity of processed copra increases for each combination of oil and meal prices.[2] To derive the demand for copra at the farm level, marketing charges must be subtracted from the average revenue.

The copra market is divided into two sectors: the demand for domestic crushing and the export demand (Section E) *and* the horizontal summation of the two forms of the aggregate demand for copra (Section G). Copra prices are assumed to affect production in a lagged fashion; hence, the supply for any marketing year, defined as calendar year in this study, is completely inelastic with respect to current prices.

The theoretical framework developed above forms the basis for a nine-equation simultaneous model that depicts the major price determining forces in the coconut market. The model consists of four behavioral and five technical relationships, all assumed to be in linear form. Specification of the variables in the stochastic equations was based on economic theory and an extensive preliminary analysis.

In generalized form the functions are:[3]

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[2]For other graphical analysis of joint products, see Houck [3, p. 9] and Samuelson [9, p. 28]. The scale of the horizontal axis of Section A is 35 per cent of the scale of the horizontal axis of Section F; the scale of the same axis of Section B is 64 per cent of that of Section F. These factors are the conversion rates by weight of copra into meal and oil, respectively; hence a vertical line through the three horizontal axes connects quantities of meal and oil derived from a given quantity of copra.

[3]This model is in many ways similar to the soybean market model developed by Houck and Mann [3]. The market for Philippine coconuts is analogous to the United States soybean market in that both involve multiple markets and joint products.

Behavioral Relationships

1. Export Oil Demand: $QOX_t = f_1(PO_t/PSC_t, PPK_t, I_t, DV_t, u_1)$
2. Domestic Oil Demand: $QOD_t = f_2(PO_t, IP_t, DV_t, u_2)$
3. Copra Export Demand: $QCX_t = f_3(PC_t, PPK_t, QSBU_t, T_t, DV_t, u_3)$
4. Meal Export Demand: $QMX_t = f_4(PM_t/PSM_t, L_t, u_4)$

Technical Relationships:

5. Oil Production: $QOP_t = YO \cdot QCC_t$
6. Meal Production:[4] $QMX_t = YM \cdot QCC_t$
7. Price Linkage: $PC_t = YO \cdot PO_t + YM \cdot PM_t - M$
8. Market Clearing, Oil: $QOP_t = QOX_t + QOD_t$
9. Market Clearing, Copra: $QCP_t = QCC_t + QCX_t + SC$

where

QOX_t = quantity of coconut oil exported by the Philippines, in thousand metric tons

PO_t = wholesale price of coconut oil in the Philippines, in dollars per metric ton

PSC_t = weighted average index of the wholesale prices of soybean and cottonseed oil in the United States (1950 = 100)

PPK_t = import price of palm kernel oil at European ports, in dollars per metric ton

I_t = weighted average index of real national income of countries importing copra and coconut oil from the Philippines with the weights based on imports of vegetable oils and oilseeds from all sources.

DV_t = dummy variable defined as 1961 = 1 and other years = 0

QOD_t = quantity of coconut oil consumed domestically in the Philippines, in thousand metric tons

IP_t = real national income of the Philippines, in million pesos

[4]The quantity of copra meal exports was assumed equal to total copra meal production.

QCX_t = quantity of copra exported by the Philippines, in thousand metric tons

PC_t = wholesale price of copra in the Philippines, in dollars per metric ton

$QSBU_t$ = quantity of soybeans produced in the United States, in million bushels

T_t = time trend, 1950 = 1, 1951 = 2, etc.

QMX_t = quantity of copra meal exports of the Philippines, in thousand metric tons

PM_t = wholesale price of copra meal in the Philippines, in dollars per metric ton

PSM_t = index of the wholesale price of soybean meal in the United States

L_t = total animal units for the United States, Western Europe, Canada and Japan

QOP_t = quantity of oil produced in the Philippines, in thousand metric tons

YO = oil yield for every metric ton of copra crushed (= .640)

QCC_t = quantity of copra crushed in the Philippines, in thousand metric tons

YM = meal yield for every metric ton of copra crushed (= .350)

M = marketing margin

QCP_t = quantity of copra produced in the Philippines, in thousand metric tons

SC = a residual defined as the quantity of copra produced minus the sum of copra crushed and exported, in thousand metric tons

u_1, u_2, u_3, u_4 = disturbance terms

The subscript t indicates current calendar year.

Demand for Coconut Oil

The market demand for coconut oil is a derived demand and is composed of two segments: (1) the demand for crude coconut oil by refineries which in turn supply manufacturers of margarine,

shortening, and other oil-using foods and (2) the demand by soap and chemical manufacturers and other industrial users. Important factors that affect the quantity of oil demanded in the foreign market are the price of coconut oil expressed as a jointly determined variable and the price of substitute oils and income, both exogenous variables. Coconut and palm kernel oils have a high lauric acid content and are highly substitutable in many uses. Soybean and cottonseed oils are two of the most important oils in the world market. The United States being the largest producer and world supplier of soybean and cottonseed oils both on commercial and concessional bases and at the same time the largest importer of Philippine coconut oil, its prices were used. The income variable reflects a measure of the real national income of copra and coconut oil importing countries weighted by their relative importance in the world fats and oils market.

In international markets, major policy changes like the devaluation of an exporting country's currency would affect the flow of products. The devaluation of the Philippine peso[5] played a significant role in the growth of coconut exports of the country. The increase in the peso value of the dollar provided higher earnings for the exporters and therefore was a major factor in determining the quantity exported. To take account of this devaluation a dummy was added to the equation.

The domestic demand for coconut oil in the Philippines is also a derived demand. The quantity of oil consumed was expressed jointly as a function of its price and two other variables – real national income and a dummy variable.

Demand for Copra

The total demand for copra is the sum of the foreign demand and the crushing demand by domestic processors, the latter being derived from the meal and oil demand functions since the quantities of oil and meal are fixed by the amount of copra crushed. Copra is a raw material in processing operations, thus the foreign demand for copra is derived from the demand for oil – and meal-using products

[5]The Philippine peso went through a process of gradual devaluation which started in April 1960 and was completed in 1965. The value of the peso declined from 2 pesos per dollar in 1960 to 3.87 pesos in 1965.

faced by foreign processors. With a 64 per cent oil yield, its demand is overwhelmingly dominated by the oil sector. The quantity demanded, therefore, is influenced by the price and supply of competing oils and oilseeds. Preliminary analysis showed that world palm kernel oil price and soybean production in the United States significantly influenced the demand for Philippine copra. The soybean variable entered in quantity terms. The use of soybeans rather than either oil or meal captures the effect of the competition from both oil and meal. Copra being a source of copra meal, it might be expected that trends in feeding practices and livestock production in importing countries would affect the demand for it. Livestock units did not appear significant; livestock feeding technology and other factors were represented by a time trend.

Just as in coconut oil, a dummy variable was included as one of the explanatory variables in the copra export demand function to reflect the significance of the devaluation of the Philippine peso.

Demand for Copra Meal

Since practically all copra meal produced in the Philippines is sold in the foreign market, total demand was assumed to be the same as the export demand. Like the demand for oil and copra, the demand for meal is a derived demand. The export meal demand is derived from the demand for manufactured and farm mixed livestock feeds in importing countries. The quantity exported was expressed jointly in a function with the meal price and two exogenous variables: livestock numbers and price of other oilseed meals. Livestock units in importing countries include cattle, hogs, poultry, and sheep which were combined into one unit based on the protein consumption of each type of animal. The price of soybean meal appeared as a deflator for the price of copra meal. A dummy variable to capture the effect of the devaluation was also added in the copra meal export demand equation.

Identities and Technical Relations

The yields of oil and meal, *YO* and *YM*, respectively, are assumed as technological constants with a magnitude of 630 and 350 kilograms per metric ton of copra crushed. The quantity of oil produced is equal to the oil yield times the quantity of copra

crushed. Similarly, the quantity of meal produced (which is equal to the quantity exported) equals the quantity of copra crushed multiplied by the meal yield.

In Figure 1 the vertical line connecting the meal demand, the total oil demand, and the crushing demand shows the linkage between the prices of the two products obtained from copra processing. This linkage is described by equation (7).

To derive the demand for copra at the farm level, marketing costs, *M*, must be subtracted from the sum of the two products, $YO \cdot PO$ and $YM \cdot PM$, which gives the average revenue from the sale of oil and meal by processors. In the empirical analysis that follows, wholesale prices instead of prices received by farmers were used in the regressions; thus the marketing margin represents only the handling and processing expenses between the wholesaler and the processor. In this model, the margin was assumed a predetermined variable.

Equations (8) and (9) are market clearing equations, one for oil and another for copra. The annual quantities of copra crushed in domestic mills were estimated using the series on copra meal exports and applying a meal yield of 350 kilograms per metric ton of copra crushed. The supply of copra was assumed to be the same as the quantity produced and since the latter does not equal the sum of copra crushed and exported a residual, *SC*, was added to represent stocks, unrecorded exports, and possible errors in measurement.

In the model, nine variables are considered endogenous, namely: *QOX, QOD, QOP, PO, QCC, QCX, PC, QMX,* and *PM*. All others are assumed predetermined. The system, therefore, is complete in the sense that there are as many equations as there are jointly determined variables.

II. Results of the Statistical Estimation

The structural parameters of the behavioral equations in the simultaneous equation model were estimated using two stage *(2SLS)* and three stage *(3SLS)* least squares techniques. An extensive preliminary analysis was made using ordinary least squares *(OLS)*, the results of the final specifications of which are also presented for

comparison with the other estimates.[6] The study covered the period from 1950 to 1967. Two sets of estimates, Model I and Model II, for each of the *2SLS* and *3SLS* calculations were made. Both models have nine jointly determined variables – *QOX, QOD, QOP, PO, QCC, QCX, PC, QMX,* and *PM.* In Model I, there are 10 exogenous variables – *PPK, I, DV, IP, QSBU, T, QCP, L, M,* and *SC* – and the price ratios, *PO/PSC* and *PM/PSM,* were "explained" by simple identities. In Model II, two equations, *PO/PSC* as a function of the two component prices and *PM/PSM* also as a function of *PM* and *PSM,* were added to the behavioral equations of the simultaneous equation model and *PSC* and *PSM* added to the set of predetermined variables in the reduced form equations.

In general, the estimates of the structural parameters exhibited the correct signs, that is, signs which are consistent with postulated behavior and theoretical expectations. The own-product price coefficients were negative and large relative to the estimated standard errors. The palm kernel oil price coefficients in the copra and coconut oil export demand functions were positive and statistically significant. Both domestic and foreign demands responded positively to income. In all equations the dummy variable exhibited a negative sign.

It is particularly interesting to note that the estimates obtained from *OLS, 2SLS,* and *3SLS* and from both models were quite close to one another. In all methods the signs of the coefficients were similar and no major change in magnitude occurred. Although subject to bias and inconsistency, the *OLS* estimates did not differ greatly from those of the *2SLS* and *3SLS.*

Export Demand Functions for Coconut Oil

The estimates of aggregate demand functions for Philippine exports of coconut oil are presented in Table 1. The *PO/PSC* coefficients implied a demand elasticity with respect to the price ratio of –.838 to –1.315 computed at the mean values. The direct

[6]If there are two or more endogenous variables in one equation the coefficients estimated from *OLS* are biased and inconsistent [4]. The *2SLS* and *3SLS* procedures give unbiased and consistent estimates of structural parameters of a simultaneous equation system [11; 12].

TABLE I

ESTIMATES OF COCONUT OIL EXPORT DEMAND FUNCTIONS, 1950-1967
(Quantity of coconut oil exports in thousand metric tons)

Equation	Constant	Coconut Oil Price Deflated by the Soybean-Cottonseed Oil price Index PO_t/PSC_t	Palm Kernel Oil Price (dollars per metric ton) PPK_t	Income Index 1950 = 100 I_t	Dummy Variable DV_t	R^2
OLS	−142.23	−0.40005 (4.333)	+0.33681 (2.472)	+1.7818 (11.517)	−88.391 (3.229)	.92
2SLS-I	−138.67	−0.54033 (5.588)	+0.41535 (3.238)	+1.8822 (12.856)	−91.876 (3.636)	
3SLS-I	−150.76	−0.49872 (5.562)	+0.43043 (3.634)	+1.8504 (13.091)	−88.489 (3.511)	
2SLS-II	−141.80	−0.41689 (4.414)	+0.34624 (2.530)	+1.7939 (11.534)	−88.809 (3.240)	
3SLS-II	−163.62	−0.34406 (4.434)	+0.37485 (3.477)	+1.7396 (12.968)	−87.084 (3.501)	

Figures in parenthesis are *t* values.

The demand for coconut oil exports was highly elastic with respect to the income of importing countries. In all five estimates, the elasticity coefficients were greater than + 2.0. A growth in income of importing countries by one per cent implies a 2.3 to 2.5 per cent increase in the demand for coconut oil exports of the Philippines.

The devaluation of the Philippine peso occurred as a gradual process and the negative sign for the coefficient of the dummy variable indicated that exporters, anticipating a further decline in the peso, were holding their supplies in the early stage of the devaluation process and releasing them later. Coconut oil exports of the country increased sharply from 74.4 thousand metric tons in 1961 to 147.6 thousand in 1962.

Domestic Demand Functions for Coconut Oil

The domestic demand functions indicated negative and statistically significant price coefficients with implied elasticities of -.302 to -.381 (Table 2). The coefficient for real national income was highly significant and, together with the price variable, explained 92 per cent of the variation in domestic consumption of coconut oil. The income elasticity at the means was just a little over unity, implying that a one per cent growth in the Philippine national income would result in the same percentage increase in the demand for coconut oil for domestic consumption.

Export Demand Functions for Copra

The demand for copra exports was quite inelastic, the elasticities implied by the copra price coefficients ranging from -.387 to -.514 (Table 3). A 10 per cent decline in copra price would result in a 4 to 5 per cent rise in the demand for copra exports. The cross elasticity of copra export demand with respect to the price of palm kernel oil was less than that for coconut oil. The elasticity coefficient was in the neighborhood of + .3 compared to above unity for coconut oil.

With respect to soybean production in the United States, a 100 million bushel rise in its production implies a reduction of about 80 thousand metric tons in the demand for copra exports from the Philippines. At the rate at which soybean production is

TABLE 2

ESTIMATES OF COCONUT OIL DEMAND FUNCTIONS IN THE PHILIPPINES, 1950-1967
(Quantity of coconut oil demanded domestically in thousand metric tons)

Equation	Constant	Coconut Oil Price (dollars per metric ton) PO_t	Philippine Real National Income (million pesos) IP_t	Dummy Variable (1961 = 1) DV_t	R^2
OLS	21.164	−0.09197 (2.510)	+0.00933 (13.338)	−15.208 (1.942)	.93
2SLS-I	24.496	−0.10247 (3.065)	+0.00930 (15.015)	−15.600 (2.250)	
3SLS-I	28.395	−0.11603 (3.727)	+0.00930 (15.084)	−16.161 (2.336)	
2SLS-II	23.059	−0.09794 (2.594)	+0.00931 (13.289)	−15.431 (1.967)	
3SLS-II	23.072	−0.10279 (3.007)	+0.00945 (14.208)	−14.897 (2.029)	

Figures in parenthesis are *t* values.

TABLE 3

ESTIMATES OF COPRA EXPORT DEMAND FUNCTIONS, 1950-1967
(Quantity of copra exports in thousand metric tons)

Equation	Constant	Copra Price (dollars per metric ton) PC_t	Palm Kernel Oil Price (dollars per metric ton) PPK_t	United States Soybean Production (million bushels) $QSBU_t$	Time Trend T_t	Dummy Variable (1961 = 1) DV_t	R^2
OLS	898.18	−2.2346 (2.002)	+0.9051 (1.352)	−0.79143 (1.565)	+44.706 (2.162)	−154.47 (1.360)	.60
2SLS-I	904.29	−2.4729 (2.539)	+1.0041 (1.776)	−0.78857 (1.906)	+44.931 (2.655)	−142.72 (1.512)	
3SLS-I	876.22	−1.8848 (2.065)	+0.7970 (1.571)	−0.75879 (2.207)	+42.575 (3.042)	−166.37 (1.808)	
2SLS-II	905.03	−2.5016 (2.115)	+1.0160 (1.473)	−0.78822 (1.555)	+44.958 (2.168)	−141.31 (1.225)	
3SLS-II	923.20	−2.0000 (1.926)	+0.6689 (1.164)	−0.62429 (1.553)	+36.232 (2.206)	−149.59 (1.469)	

Figures in parenthesis are t values.

growing in the U. S., copra seems to be facing a strong competition from soybeans.

Two other variables in the copra export demand equation are time trend and the dummy variable, with the coefficient of the former having a positive sign and that of the latter negative. A sharp decline in copra exports occurred from 1960 to 1961, the year which registered the greatest amount of unrecorded exports. This was followed by an almost equal amount of increase from 1961 to 1962 and a tremendous rise from 1962 to 1963. This probably reflects the effect of the devaluation of the Philippine peso on copra trade. While part of the expansion in copra exports during this period might be due to a decline, if not an end, in copra smuggling, some part must be attributed to a rise in real exports.

Export Demand Functions for Copra Meal

The demand for copra meal faced by Philippine exporters is inelastic, the elasticity with respect to the copra meal-soybean meal price ratio ranging from -.442 to -.638 (Table 4). The direct price elasticity derived from the linearized coefficients, -.434 to -.627, was very close to the elasticities with respect to the price ratio.

A variable that would significantly affect the demand for copra meal is the growth in the livestock population of importing countries.[10] The livestock units coefficient was positive and highly significant.

Price Elasticities of Demand at the Wholesale and Farm Levels

From the oil export, oil domestic, copra export, and copra meal export demands, the price elasticities of total coconut oil demand, copra crushing demand, and total copra demand can be derived. The total oil demand elasticity represents a weighted average of the export and domestic demands, with the proportion exported and domestically consumed used as weight. The price elasticity of total oil demand ranged from -.620 obtained from 3*SLS*-II to -.895 estimated from the 2*SLS*-I coefficient.

[10]Animal units include (1) all livestock and poultry fed on farms in the U.S. converted into standard units based on high protein feeds consumed [6; 10] and (2) cattle, pigs, and chickens weighted .8, .2, and .001, respectively, in Western Europe, Canada, and Japan [1, p. 3].

TABLE 4

ESTIMATES OF COPRA MEAL EXPORT DEMAND FUNCTIONS, 1950-1967
(Quantity of copra meal exports in thousand metric tons)

Equation	Constant	Copra Meal Soybean Meal Price Ratio PM_t/PSM_t	Livestock Units (thousand units) L_t	Dummy Variable DV_t	R^2
OLS	−649.41	−0.80337 (1.767)	+0.00364 (10.284)	−51.748 (2.363)	.89
2SLS-I	−633.04	−1.15900 (2.054)	+0.00363 (11.450)	−48.492 (2.419)	
3SLS-I	−635.54	−1.12750 (2.449)	+0.00367 (11.661)	−48.819 (2.459)	
2SLS-II	−648.55	−0.82205 (1.738)	+0.00364 (10.283)	−51.577 (2.351)	
3SLS-II	−628.82	−0.81567 (2.381)	+0.00355 (10.962)	−53.467 (2.729)	

Figures in parenthesis are t values.

The demand for copra crushing is linked together with the demand for its joint products, oil and meal, and therefore, changes in the demand for the latter could change the demand for copra crushings. The price elasticity of demand for copra crushings is a weighted harmonic average of the price elasticity of the demand for oil and meal with the average value of copra attributable to the sales of oil and meal as weight [2]. At the same marketing level, that is, at wholesale, the price elasticity of copra crushing demand ranged from -.593 to -.855. Together with the copra export demand, the elasticity with respect to price fell in the -.464 to -.610 range.

For any given quantity, the price elasticity of demand at the wholesale level is absolutely greater than that at the farm level if the marketing margin is held constant and if the demand curves are assumed linear. With the slopes of the demand curves the same and $M > O$, the price at wholesale is higher than the farm price for any given quantity; hence, the elasticity at a higher level of marketing is greater than at a lower level. Moreover, the higher the margin, the greater the difference between elasticities at different levels of marketing.

The crushing and export demands for copra are price inelastic; consequently, the demand at the farm level is more inelastic. Assuming a $50 per metric ton marketing and processing charges, the elasticity with respect to price ranges from -.350 to -.460. All other things remaining the same, a 10 per cent change in the farm price of copra would result in a 3.5 to 4.6 per cent change in the quantity demanded in the opposite direction. With the costs of marketing and processing at $80 per metric ton, the elasticity ranges from -.283 to -.371.

III. Partial Equilibrium Analysis Using the Solved Reduced Form Equations

The solved reduced form equations express each of the jointly determined variables as a function of all the predetermined variables in the system. They incorporate all the constraints on the structure and preserve the simultaneity of the model. The coefficients of these equations indicate a quantitative measure of the impact of changes in the predetermined variables on each of the endogenous variables in the model.

The direction and magnitude of the consequences of changes in income, copra supply, marketing margin, and prices of soybean and cottonseed oil are presented in Table 5. An increase in the world income index shifted the oil export demand function upward; and although the oil price increased, the quantity demanded still increased. With the supply of copra remaining the same, the increase in copra crushings was counterbalanced by a reduction in copra exports.

An expansion in the available supply of copra will set forth a reduction in its price and the prices of its joint products; consequently, there will be an increase in the quantity demanded. The larger output will induce additional crushings by domestic mills but a greater proportion of the increase in supply will go to foreign markets as copra.

The costs of marketing coconuts in the Philippines are quite high because of the large number of intermediaries involved in the process and the high cost of transportation in the country [7, pp. 104-112]. A reduction in these costs has implications not only in terms of lower oil and meal prices but also a larger quantity of these products demanded in the foreign market and the increased returns to the processing sector.

A decline in the price of soybean and cottonseed oils in the U. S. resulted in a lower coconut oil price. In spite of this, however, a smaller quantity was demanded, thus showing that the downward shift of the demand curve more than offsets the decrease in the price of coconut oil. A larger quantity than before was demanded by the domestic market, but this was not sufficiently large to prevent a decline in the total amount of coconut oil demanded. Consequently, the processing sector suffered from a reduction in copra crushings. The meal supply shifted to the left, and with the meal demand unchanged this increased the price of copra meal.

The imposition of a fixed tariff on a commodity causes a parallel shift in the export demand function by the amount of the tariff, that is, at any given price, importers will be willing to buy a volume which is less than before. The effect of this policy can be viewed as an increase in the effective purchase price of the importing country (the new price plus the tariff) but a reduction in the effective price received by the exporting country.

TABLE 5

THE IMPACT OF CHANGES IN SELECTED EXOGENOUS VARIABLES IN THE ENDOGENOUS VARIABLES
(All quantities in thousand metric tons and prices in dollars per metric ton)

Variable	Increase in World Income By 5 Percentage Points	Increase in Copra Supply By 100,000 Metric Tons	Decrease in the Marketing Margin By $10 per Metric Ton	Decrease in the Soybean-Cottonseed Oil Price Index By 10 Percent
QOX – Oil exports	+5.461	+21.668	+4.084	−9.241
QOD – Domestic oil demand	−0.840	+ 4.804	+0.905	+ 1.422
PO – Oil price	+7.243	−41.405	−7.804	−12.255
QOP – Oil production	+4.621	+26.473	+4.990	−7.819
QMX – Meal exports	+2.527	+14.477	+2.729	−4.276
PM – Meal price	−2.299	−13.175	−2.483	+3.981
QCX – Copra exports	−7.220	+58.636	−7.796	+12.216
PC – Copra price	+3.831	−31.110	+4.136	−6.482
QCC – Copra crushings	+7.220	+41.364	+7.796	−12.216

By 1974 all the coconut oil exports of the Philippines to the United States will be subject to a one cent per pound tariff or approximately $22 per metric ton. This policy will affect primarily the coconut oil sector; but, because of the interdependence among the markets of the three coconut products, there will be spillover effects in the other sectors. Assuming that the other functions stay the same, the simultaneous impact of the tariff may be summarized as follows: an increase in the price of copra meal and a drop in the quantity exported; a fall in coconut oil exports, an increase in the domestic demand, and a net decline in total oil demand; a fall in copra price and an increase in copra exports. With the supply remaining the same, copra crushings would change by the same amount in the opposite direction.

IV. Conclusions and Implications

What conclusions and implications can be drawn from the analysis of the market for Philippine coconut products? First, this study shows that the market for Philippine coconut products is subject to empirical analysis using tools of economic theory and applied statistics. Some of the assumptions to simplify the theoretical framework were abstractions from reality. However, the analysis provides a better understanding of the economic forces working on the market for Philippine coconuts.

Second, an expansion in the production of copra in the Philippines will bring about a fall in the price of copra, coconut oil, and copra meal. With the inelastic demand for these products the price fall would result in a lower revenue for the exporters and producers. However, this inelasticity of demand in the developed countries is probably a short-run phenomenon. It was found that palm kernel, soybean, and cottonseed oils substitute for coconut oil. Not covered by the study is the threat posed by the petrochemical industry which supplies the raw materials for the manufacture of synthetic detergents. Supplies of natural oils and synthetics have been growing at a rapid rate so that in the long run it may be said that the response of buyers to price changes may be greater.

The inelastic demand also means that a rise in prices would increase the revenue. However, if the higher price persists and is

expected to persist, it will encourage substitution. This calls for policies that will increase production and try to stabilize the prices of coconut products.

Third, the analysis of the impact on prices and quantities of a change in the marketing margin indicates the need for a more efficient marketing of coconut products. Smaller marketing costs could result in increased consumption both in the domestic and foreign markets and a better position for coconut oil and copra meal in the world market. Likewise, it implies a greater value added to manufacturing if the copra processing is done in the Philippines and more coconut oil and copra meal are exported. Improvement in the road and transportation network is therefore imperative if the coconut industry is to face competition with other oils and with coconut oil traded by other countries.

Fourth, in the interest of both exporting and importing countries, the freest possible flow of trade must be secured. The imposition of a tariff means a higher price paid by importers and a lower price received by exporters. A tariff imposed on coconut oil will induce a reduction in domestic crushings of copra. For a country that depends to a large degree on the coconut industry for employment, income, and foreign exchange revenue, the tariff could have severe consequences.

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