7 December 1971

A FOREIGN TRADE SUBMODEL
OF THE PHILIPPINE ECONOMY, 1950-1969

by

Romeo M. Bautista, and José Encarnación, Jr.

A Foreign Trade Submodel

of the Philippine Economy, 1950-1969 [1/]

by

Romeo M. Bautista and José Encarnación, Jr.

1. Introduction

This paper examines quantitatively the demand for imports and supply of exports in the Philippines at a disaggregative level during the period 1950-1969. Such a study may be of some interest in view of recent policy measures that depended for their effectiveness on the values of foreign trade parameters. Moreover the country will be faced in the near future with the task of fixing the peso exchange rate and possibly altering some aspects of its trade policy. An empirical knowledge of economic relationships involving foreign trade variables should prove helpful in analyzing the important consequences of such actions.

A macro-economic model of the Philippine economy has been presented in an earlier paper [1]. Exports and imports of goods and services are represented there as aggregates: the total export variable is taken as exogenous while the level of total imports is endogenously determined. In the present paper we try to explain imports of consumption goods, raw materials, capital equipment and services, and exports of major commodities which figured heavily in Philippine foreign trade during the period. The estimated equations reported here are therefore complementary and can be grafted to the "basic model" of the previous paper to generate medium-term projections of the different categories of imports and exports.

A word of caution in interpreting and using the results of this study is perhaps in order at this point. Apart from the well-known conceptual and statistical problems associated with the estimation of import demand and export supply functions (see e.g. $\underline{/}5\underline{/}$ and $\underline{/}4\underline{/}$), one should take notice of the imperfections of Philippine foreign trade data. For example, some bias in the recorded statistics is introduced by the varying extent of smuggling activities into and out of the country over the observation period.$\underline{2/}$ This is partly the reason for reporting in the Appendix alternative specifications of some import and export equations which appear theoretically plausible but show less statistical significance compared to those presented in the text.

2. Import Demand Equations

As mentioned earlier, imports are disaggregated for the purpose of this study into four classes: services, raw materials, capital equipment and consumption goods.$\underline{3/}$ The following equations indicate the quantitative influences on domestic demand for these import categories:

$$(1) \quad M_s = -41.547 + \underset{(14.2)}{.2200} M$$

$$\bar{R}^2 = .926 \qquad s = 51.51 \qquad D.W. = 2.40$$

$$(2) \quad M_r = -841.2 + \underset{(8.01)}{.5582} Y_n + \underset{(5.56)}{12.537} P - \underset{(-3.09)}{5.643} P_m$$

$$\bar{R}^2 = .978 \qquad s = 72.71 \qquad D.W. = 2.26$$

$$(3) \quad M_k = -184.9 + \underset{(2.86)}{.1188\, I} + \underset{(3.50)}{5.244\, P} - \underset{(-3.32)}{3.054\, P_m}$$

$$\bar{R}^2 = .931 \qquad s = 37.75 \qquad D.W. = 1.66$$

$$(4) \quad M_c = 1067.7 + .7800\, M - .5582\, Y_n - .1188\, I - 17.781\, P$$
$$+ 8.697\, P_m$$

where

M_i = imports of commodity class i at 1955 prices, in million pesos; i = s(services), r(raw materials), k(capital equipment), c(consumption goods)

M = total imports of goods and services at 1955 prices, in million pesos

Y_n = net value added in manufacturing at 1955 prices, in million pesos

P = implicit price index for GNP; P = 100 for 1955

P_m = implicit price index for imports; P_m = 100 for 1955

I = gross domestic investment at 1955 prices, in million pesos.

The variables M, P, P_m and I appear in the basic model. Annual data were used throughout. Eqs. (1), (2) and (3) were estimated by ordinary least squares, and (4) is a derived equation. Numbers underneath the regression coefficients are the corresponding t-values; all coefficients are seen to be statistically significant at the usual levels. More than 90 per cent of the total variation of the dependent variable in each equation is explained, as shown by the (adjusted) coefficient of determination. Finally, the values of the Durbin-Watson statistic do not indicate any obvious serial correlation.

Imports of services include <u>inter</u> <u>alia</u> freight and insurance charges (paid to foreign companies) on imports. Eq. (1) implies that a ₱1 million increase in total imports would lead to a rise in service imports of ₱.220 million. (The alternative regression equation (i) in the Appendix yields ΔM_s = .216 ΔM.)

Production in the manufacturing sector is shown in eq. (2) to determine in part the level of raw material importation; the latter would increase <u>ceteris</u> <u>paribus</u> by more than half the increase in manufacturing value added. In addition, the highly significant coefficients of the price variables[4] having the expected signs reflect some degree of substitution (due to relative price changes) between domestic and foreign supplies, at least in the aggregate.

Quite naturally, a major determinant of imports of capital equipment and machinery, according to eq. (3), is domestic capital formation. It may be recalled that capital goods were high in the priority list during the period of import and exchange controls. A ₱1 million increase in real investment would seem to require at the margin an additional importation of about ₱.12 million worth of capital equipment. Relative price effects are also seen to be significant.

We have not been successful in obtaining any acceptable estimated equation for imports of consumption goods. (Our best result for M_c is eq. (iv) in the Appendix.) Eq. (4) above treats M_c as a residual variable, making use of the regression equations for M_r, M_k, and M_s and

taking total imports as determined in the basic model. It does not seem very unlikely that actual decisions on how much to allocate for imports of consumption goods during the period of controls were made on a similar basis, considering that import priorities have been biased against consumption goods.

3. Export Supply Equations

Exports are classified as "principal" commodities, "non-principal" commodities, and services. By "principal" commodities we mean here those that have appeared consistently in the Central Bank list of ten principal exports from 1950 to 1969, viz. logs and lumber, copra, coconut oil, copper concentrates, dessicated coconut, abaca, plywood and sugar. Together they represent from 80 to 85 per cent of the total value of annual merchandise exports over the period. For reasons given below the data do not provide adequate information for the estimation of an export supply equation for sugar. For the other principal exports and the two remaining export categories the estimated equations are as follows (the shorter time periods used in some estimates are dictated by data availability or a priori considerations):

$$(5) \quad X_{11} = -861.2 + \underset{(4.05)}{16.178} P_{11} - \underset{(-2.55)}{7.030} P_{p1} + \underset{(1.99)}{.327} Y_1$$

$$\bar{R}^2 = .877 \qquad s = 429.4 \qquad D.W. = .921$$

$$(6) \quad X_{cp} = -541.2 + \underset{(2.11)}{1.933} P_{cp} - \underset{(-2.42)}{1.755} P_{dc} + \underset{(5.83)}{.8421} Y_{cp}$$

$$\bar{R}^2 = .939 \qquad s = 32.08 \qquad D.W. = 2.40 \qquad 1962\text{-}1968$$

$$(7) \quad X_{co} = -1393.8 + \underset{(3.68)}{.8670} P_{co} + \underset{(3.42)}{60.365} \frac{W_n}{P_n} + \underset{(4.61)}{.4126} Y_{cp}$$

$$\bar{R}^2 = .882 \qquad s = 19.92 \qquad D.W. = 2.17 \qquad 1962\text{-}1968$$

$$(8) \quad X_{cc} = -912.4 + \underset{(2.46)}{.7245} SP_{cc} - \underset{(-2.36)}{.1138} SW_q + \underset{(2.66)}{156.7} t$$

$$\bar{R}^2 = .934 \qquad s = 25.25 \qquad D.W. = 2.90 \qquad 1956\text{-}1968$$

$$(9) \quad X_{dc} = -25.4 + \underset{(4.17)}{.1992} SP_{dc} - \underset{(-4.22)}{.1940} SP_{cp} + \underset{(2.27)}{.0768} N_n$$

$$\bar{R}^2 = .783 \qquad s = 3.44 \qquad D.W. - 1.33 \qquad 1956\text{-}1968$$

$$(10) \quad X_{ab} = 159.1 + \underset{(1.67)}{.1155} SP_{ab} - \underset{(-1.98)}{.0367} SW_a$$

$$\bar{R}^2 = .648 \qquad s = 11.16 \qquad D.W. = 1.40 \qquad 1956\text{-}1968$$

$$(11) \quad X_{pl} = -3249.1 + \underset{(12.63)}{.1444} Y_{pl}$$

$$\bar{R}^2 = .898 \qquad s = 11.84 \qquad D.W. = 1.44 \qquad 1950\text{-}1968$$

$$(12) \quad X_{np} = 34.4 + \underset{(3.19)}{.0460} X_{-1} + \underset{(5.68)}{42.33} ER$$

$$\bar{R}^2 = .933 \qquad s = 14.74 \qquad D.W. = 1.96 \qquad 1951\text{-}1969$$

$$(13) \quad X_s = -125.3 + \underset{(4.78)}{.7210} X_{s,-1} + \underset{(1.47)}{102.9} ER/.01 P$$

$$\bar{R}^2 = .604 \qquad s = 101.3 \qquad D.W. = 1.95$$

where

X_j = exports of principal commodity j, in thousand metric tons (except X_{pl}, in thousand board feet, and X_{11}, in million board feet); j = 11 (logs and lumber), cp (copra). co (coconut oil), cc (copper concentrates), dc (dessicated coconut), ab (abaca), pl (plywood).

X = total exports of goods and services at 1955 prices, in million pesos.

X_{np} = exports of non-principal commodities at 1955 prices, in million pesos

X_s = exports of services at 1955 prices, in million pesos

P_j = export price index of commodity j (=100 in 1955)

Y_1 = domestic output of logs, in million board feet

Y_{cp} = domestic output of coconuts in copra terms, in thousand metric tons

Y_{pl} = domestic output of plywood, in thousand board feet

W_a = annual money wage rate in agriculture, in pesos

W_q = annual money wage rate in mining, in pesos

W_n = annual money wage rate in manufacturing, in pesos

N_n = labor employment in manufacturing, in thousands

P_n = implicit price index for manufacturing value added (= 100 in 1955)

ER = peso exchange rate to the U.S. dollar

t = time variable: 0 for 1950, 1 for 1951, etc.

and S stands for the symbol $\sum_{\tau=0}^{t-1}$ and the time subscript of the variable following it is suppressed, e.g. $SW_q = \sum_{\tau=0}^{t-1} W_{q\tau}$.

Logs and lumber

Eq. (5) relates exports of logs and lumber to the export price indices of logs and lumber and their export substitute, plywood, together with the domestic output of logs. The latter variable must be considered at least in part as policy-determined.

If export prices remained unchanged, an increase in log production of one million board feet would increase exports of logs and lumber by roughly one-third million board feet. The own-price elasticity of export supply is 1.33 at the mean values, implying that a 3 per cent increase in the export price index of logs and lumber would raise exports by about 4 per cent. The cross-price elasticity is -.405 so that a 10 per cent rise in the export price of plywood would lower exports of logs and lumber by about 4 per cent.

Coconut and coconut oil

The major coconut products exported -- copra, coconut oil and dessicated coconut -- may be considered substitutes in supply so that ceteris paribus a rise in the export price of one would induce domestic producers to export more of that commodity at the expense of the other two. In the estimation of supply functions for these three commodities, therefore, the export price of each could be expected to be significant. However, because the international copra and coconut oil markets are highly interdependent, the export prices of these two coconut products have moved uniformly over the years.[5/] Hicks [3, pp. 160 ff.] has correctly argued that the expansion of coconut oil exports relative to copra since 1962 was due not to increased export prices favoring coconut oil but to the reduction in international freight rates for coconut oil due to the introduction in 1962 of large ocean tankers. (The net effect in either case is to increase the profitability for

Philippine producers of exporting coconut oil relative to other coconut products.) This is supported by the significant coefficients of the dummy variable having the correct signs in eqs. (v) and (vi) of the Appendix.

The export equations (6) and (7) above for copra and coconut oil, respectively, pertain to the period 1962-1968. Supply of copra exports is explained in part by the export prices of copra and dessicated coconut; in addition, total coconut output (expressed in equivalent units of copra), considered a predetermined variable here because coconut is a perennial crop, appears to be another major determinant. According to eq. (6), a unit increase in the price index of copra would increase copra exports by 1.933 thousand metric tons; the corresponding figure is 1.755 in response to a unit decrease in the export price index of dessicated coconut.

The volume of coconut oil exports is shown in eq. (7) to depend on the export price, on the wage-price ratio in manufacturing, and on domestic coconut production. Coconut oil is used in the manufacture of certain foods and other industrial products (e.g., margarine, cooking oil, soap, pomade, etc.). The higher the manufacturing wage-price ratio the lower would be the (derived) demand locally for coconut oil and hence the higher the amount of coconut oil exported, as indicated by the positive coefficient of W_n/P_n in eq. (7). If other things remained unchanged, increasing domestic output of coconuts by 100 metric tons copra equivalent would raise coconut oil exports by about 41.3 metric

tons[6/]; a slightly higher increase would be induced by a half-percentage point increase in the export price index of coconut oil.

Copper concentrates

In the absence of a copper smelting plant in the Philippines, the entire output of copper concentrates is being exported. Underlying eq. (8) above is a production relation and an investment function. Let

$$(14) \qquad X_{cc} = f(K_{cc}, N_{cc})$$

$$(15) \qquad I_{cc} = g(X_{cc}, P_{cc}, W_q)$$

$$(16) \qquad K_{cc} = \sum_{-\infty}^{t-1} I_{cc} = \sum_{-\infty}^{-1} I_{cc} + \sum_{0}^{t-1} I_{cc}$$

where K_{cc}, N_{cc} and I_{cc} denote, respectively, the amount of capital, employment and investment in the production of copper concentrates. Eq. (14) states that output of copper concentrates is dependent on the capital stock and the level of employment. An investment function similar to that used in the basic model is postulated in eq. (15), i.e. investment depends on the level of output, the price level and the money wage rate, for the latter two variables affect the profitability of investment. Finally, eq. (16) defines the capital stock in period t as the cumulated previous investments through period t-1. This set of relationships suggests a regression equation of the form:

$$(17) \quad X_{cc} = a_0 + a_1 SP_{cc} + a_2 SW_q + a_3 t + a_4 SX_{cc} + a_5 N_{cc}$$

where the constant term a_0 already includes $\sum_{-\infty}^{-1} I_{cc}$.[7/]

The estimated export equation (8) seems to indicate that the last two terms in eq. (17) have no significant influence.[8] However, it is possible that the effects of the employment and output variables are captured in the coefficients of the price and wage variables (c.f. eqs. (vii) and (viii) in the Appendix).

Dessicated coconut

Practically the entire domestic output of dessicated coconut is exported. Eq. (9) above also assumes some implicit production and investment functions as in our discussion of copper concentrates. Past export prices of copra and dessicated coconut, through their influence on past investments (hence, on current capital stock) can explain at a significant level exports of dessicated coconut. Another explanatory variable appearing in eq. (9) is employment in the manufacturing sector, which proxies for the amount of labor employed in the production of dessicated coconut.

Abaca

No reliable set of data is available on the extent of domestic production of unmanufactured abaca. Because of the export orientation of the industry, however, we have followed the procedure used above in deriving the regression equations for exports of copper concentrates and dessicated coconut. Eq. (10) shows that export supply of un-manufactured abaca is determined by past export prices and - in view

of the labor intensiveness of abaca production - agricultural wage rates. The t-values of the coefficients are somewhat low and the independent variables can explain only about 65 per cent of the variation in abaca exports during 1956-1968.

The elasticities at the mean values with respect to the price and wage variables are 2.27 and -2.98, respectively, indicating greater responsiveness of abaca exports to wage rate changes.

Plywood

The quantity of plywood exported is shown in eq. (11) to depend solely on the domestic output of plywood. The latter variable in turn is explained in eq. (xx) of the Appendix by past levels of production and export price of plywood relative to logs and lumber, serving as proxy for capital stock in the industry as in eq. (17). According to eq. (11), an increase in domestic plywood production of 100 thousand board feet would increase current exports by slightly less than 15 thousand board feet. (The average share of plywood exports to total output during the period was 13.3 per cent.)

Sugar

Philippine sugar exports constitute a virtual monopsony of the United States. This is attributable to the "special ties" between the two countries and the considerably higher prices offered by the regulated

U.S. market compared to international market prices over the years. A
system of tariff exemptions[9]/and quotas has characterized the sugar trade
since 1934. The Philippines had a fixed quota of 952 thousand short tons
until 1960 (the year of the Cuban crisis); the total U.S. quota has
varied thereafter from year to year as shown in Figure 1.

The annual sugar export to the United States is also plotted on
a time scale in Figure 1. One may infer from even a cursory comparison
that the volume of exports tended to adjust to the U.S. quota during the
period under examination. Building up of productive capacity describes
the first few years; by 1954 the sugar industry was in a position to
fill the fixed U.S. quota allocation and did so through 1959, except in
1957 when drought in the sugar-producing regions drastically reduced
domestic output that year. There was an additional allocation of 171.4
thousand short tons in 1960 which was fully met, but a further increase
in the quota to 1,428.7 thousand short tons the next year proved too
large for domestic capacity. The subsequent years saw a generally
diminishing amount of supplementary allocation to the basic quota of
1,050 thousand short tons "raw value", the total quota being practically
filled.[10]/

From the foregoing observations it is clear that the only relevant
variable which could explain annual sugar exports during the period is
the U.S. quota, considering that the volume of exports to countries other
than the United States has been insignificant.[11]/ Thus, given prevailing
price conditions, if domestic capacity (after allowance for the domestic

quota) can absorb increases in the U.S. quota, then actual exports would approximate the quota, and there would be a corresponding increase in capacity through time provided long-run expectations were favorable, as what happened in 1950-1954.

The conclusion therefore is that the peculiarities of the sugar market preclude any meaningful attempt at a statistical estimation of an export supply function for sugar, and that predictions of future sugar exports will have to be based primarily on forecasts of the U.S. quota and domestic capacity.

Non-principal merchandise exports

The rest of merchandise exports consists of diverse products from the manufacturing, mining and agricultural sectors. It is seen from eq. (12) that total exports lagged one year and the exchange rate together can explain more than 90 per cent of the total variation of the non-principal exports during the period under study. X_{-1} plays the role of a scale variable which proxies for the general expectation on the export markets. The exchange rate variable is also found to be a significant influence, reflecting the profitability of exports in peso terms. Thus, raising the exchange rate by ₱1 would seem to generate an increase in the volume of non-principal merchandise exports by ₱42.3 million.

thousand short tons

LEGEND:

□ U. S. sugar export quota
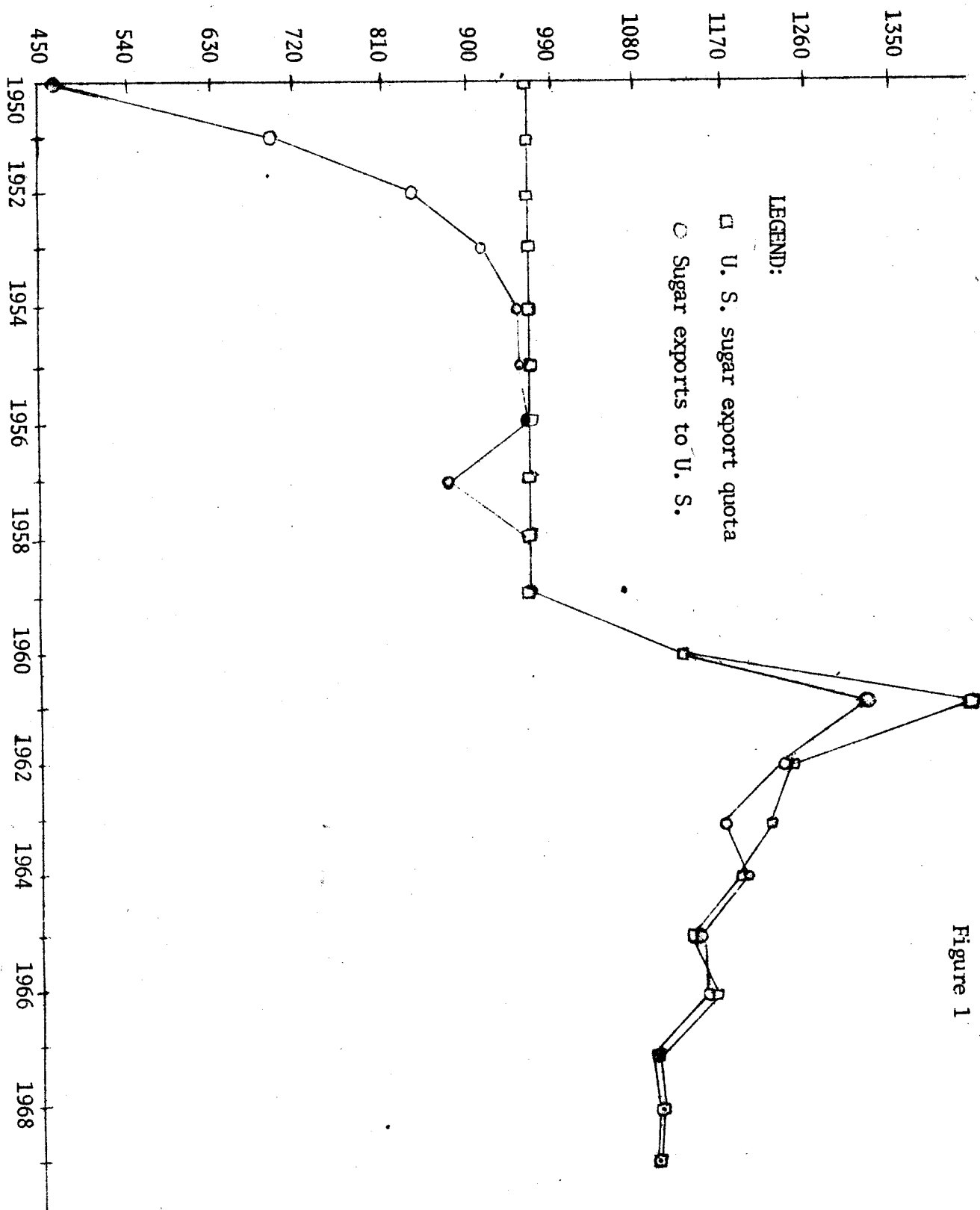
○ Sugar exports to U. S.

Figure 1

Other specifications for the supply function of the non-principal export commodities were tried, including some price, wage and sectoral output variables as arguments. The more significant results are given in the Appendix.

Services

The major components of Philippine exports of services are expenditures of foreign visitors and governments, freight and insurance (paid to local companies) on export shipments, and "other services." Eq. (13) indicates that the level of service exports adjusts to the peso exchange rate deflated by the general price index. At $P = 220$, an increase in the exchange rate by ₱1 would result in an immediate increase of service exports by ₱31.9 million. The adjustment coefficient is .279, obtained by subtracting the coefficient of $X_{s, -1}$ from one.

4. "Predictions" for 1970

Table 1 compares the estimated values of the imports of services, raw materials and capital equipment for 1970 with the observed values. Two sets of the submodel's "predictions" are shown: a) using observed values of the variables M, I and P (which are exogenous in the submodel); and b) using the 1970 estimates of the basic model for these variables (cf. $\int 1 \_7$, section 6).

Table 1:   Import estimates for 1970

Variable	Observed Value	Predicted Value		% Difference
M_s	694	a)	752	9.8
		b)	813	17.1
M_r	2167	a)	2198	1.4
		b)	2132	(1.6)
M_k	549	a)	622	13.3
		b)	580	5.6

It would be unreasonable to expect the estimates of the submodel to approximate closely the observed values, considering that 1970 was a very atypical year for the foreign trade sector. Due in large measure to the de facto peso devaluation in February, import and export price indices rose sharply in 1970 as indicated by the following percentage increases over the 1969 levels: P_m - 23.9, P_{pl} - 31.0, P_{dc} - 45.0, P_{11} - 50.8, P_{cc} - 55.4, P_{cp} - 57.2, P_{co} - 69.1 and P_{ab} - 79.6 These values are well beyond the observed annual changes during the period under study. Thus it becomes hazardous to make comparisons between observed and predicted values of the dependent variables of the submodel. The problem is even more severe in the case of exports because the official estimates have not incorporated an "effective exchange rate" for 1970 that takes into account the 80 per cent surrender requirement (Central Bank Circular No. 289) and the subsequent imposition of the stabilization tax (R.A. 6125).

5. Concluding Remarks

One major conclusion that emerges from the empirical results presented above is the generally high degree of responsiveness of the export industries to price changes. It follows that domestic policies affecting the peso exchange rate and external developments in the export markets can influence significantly the pattern of domestic production and volume of exports.

The exogeneity of export and import prices assumed in this study, which has allowed us to concentrate on the estimation of import demand and export supply equations only, appears justifiable if one accepts the relative smallness of Philippine trade transactions in the world market. This assumption has not been actually tested and the possibility remains that world prices in certain export markets, e.g. copra and coconut oil, are in fact influenced by the volume of our exports. In such cases an examination of foreign demand for these export commodities would seem also warranted.[12]

The foreign trade submodel presented in this paper could also be improved by distinguishing the major trading partners and key regions, which would make possible analysis of shifts in our foreign trade in the face of external developments. Finally, recognizing that trade flows represent only one aspect of the balance of payments, it would be desirable to incorporate in a foreign sector submodel foreign aid, direct foreign investment and capital movements especially as they relate to monetary and production sector variables.

Appendix: <u>Other Regression Results</u>

A. Import equations; 1950-1969 data

(i) M_s = -42.7 + .2745 $(M - M_s)$
(10.85)

$\bar{R}^2 = .880$ s = 65.84   D.W. = 2.43

(ii) M_k = -466.3 + .1586 I + 4.6918 P^m + .0763 $(\dfrac{M^* - X^*}{.01\ P_m})$

$\bar{R}^2 = .930$ s = 38.07   D.W. = 1.55

(iii) M_r = -1533.6 + .7884 Y_n + 11.901 P^m
(19.80)   (3.28)

$\bar{R}^2 = .961$ s = 96.87   D.W. = 1.34

(iv) M_c = 174.9 - .2059 Y_n + .1226 X + 1.707 P_x
(-3.90)   (2.13)   (2.77)

$\bar{R}^2 = .442$ s = 52.59   D.W. = 2.310

where

P^m = 100 P/P_m

$M^* - X^*$ = trade deficit at current prices, in million pesos

Y_n = net value added in manufacturing at 1955 prices, in million pesos.

B. Export equations; principal commodities

(v) X_{cp} = 181.0 - .1862 W + .7034 Y_{cp} - 140.3 U_{fr}
(-1.93)   (7.58)   (-2.31)

$\bar{R}^2 = .802$ s = 55.05   D.W. = 1.23   1951-1969

(vi) X_{co} = -97.4 + 64.98 $\dfrac{P_{co}}{P_n}$ + .0901 Y_{cp} + 92.47 U_{fr}
(1.54)   (1.56)   (2.76)

$\bar{R}^2 = .850$ s = 32.07   D.W. = 1.60   1952-1969

(vii) X_{cc} = -82.5 + 5.333 N_q + 163.30 $S\frac{P_{cc}}{P}$
$\qquad\qquad\qquad$ (2.12) $\qquad$ (2.76)

$\qquad$ $\bar{R}^2$ = .573 $\qquad$ s = 64.23 $\qquad$ D.W. = 1.90 $\quad$ 1956-1968

(viii) X_{cc} = -403.1 + .8854 SP_{cc} - 2.569 SP + 246.4 t
$\qquad\qquad\qquad$ (2.88) $\qquad$ (-2.79) $\qquad$ (3.00)

$\qquad$ $\bar{R}^2$ = .940 $\qquad$ s = 23.99) $\qquad$ D.W. = 3.05 $\quad$ 1956-1968

(ix) X_{dc} = 40.4 + .1910 SP_{dc} - .1725 SP_{cp}
$\qquad\qquad\qquad$ (3.37) $\qquad$ (-3.22)

$\qquad$ $\bar{R}^2$ = .693 $\qquad$ s = 4.09 $\qquad$ D.W. = 1.31 $\quad$ 1956-1968

where

$\quad$ U_{fr} = dummy variable for freight rate: equals 0 for 1951-1961,
$\qquad\qquad$ 1 for 1962-1969

$\quad$ W $\quad$ = annual money wage rate for unskilled laborers, in pesos

$\quad$ N_q $\quad$ = labor employment in mining, in thousands.

C. Export equations; non-principal commodities

(x) X_{np} = 40.0 + .0387 Y_n + .6591 P_x
$\qquad\qquad\qquad$ (1.78) $\qquad$ (2.34)

$\qquad$ $\bar{R}^2$ = .790 $\qquad$ s = 27.21 $\qquad$ D.W. = 1.41

(xi) X_{np} = 25.3 + .0188 $(Y_a + Y_q + Y_n)$ + .5604 P_x
$\qquad\qquad\qquad$ (2.01) $\qquad\qquad\qquad\qquad$ (1.87)

$\qquad$ $\bar{R}^2$ = .799 $\qquad$ s = 26.65 $\qquad$ D.W. = 1.44

(xii) X_{np} = -13.6 + .912 X_{-1} + 56.61 ER/.001W
$\qquad\qquad\qquad$ (8.50) $\qquad$ (4.31)

$\qquad$ $\bar{R}^2$ = .906 $\qquad$ s = 17.43 $\qquad$ D.W. = 1.58 $\quad$ 1951-1969

(xiii) $X_{np} = 4.03 + \underset{(6.81)}{.0971} X_{-1} + \underset{(2.24)}{.7754} P_x/.001 W$

$\bar{R}^2 = .846 \qquad s = 22.33 \qquad D.W. = 1.73 \qquad 1951-1969$

(xiv) $X_{np} = -42.3 + \underset{(8.56)}{.0881} X_{-1} + \underset{(5.18)}{85.52} ER/.001 W_n$

$\bar{R}^2 = .924 \qquad s = 15.73 \qquad D.W. = 1.98 \qquad 1952=1969$

(xv) $X_{np} = -11.5 + \underset{(5.58)}{.0933} X_{-1} + \underset{(2.16)}{1.129} P_x/.001 W_n$

$\bar{R}^2 = .838 \qquad s = 22.95 \qquad D.W. = 1.74 \qquad 1952-1969$

(xvi) $X_{np} = -32.2 + \underset{(5.40)}{.0111} Y + \underset{(2.62)}{68.50} ER/.001 W_n$

$\bar{R}^2 = .848 \qquad s = 22.25 \qquad D.W. = 1.13 \qquad 1952-1969$

(xvii) $X_{np} = -29.0 + \underset{(3.92)}{.0608} Y_n + \underset{(2.62)}{81.89} ER/.001 W_n$

$\bar{R}^2 = .780 \qquad s = 26.81 \qquad D.W. = .822 \qquad 1952-1969$

(xviii) $X_{np} = -38.9 + \underset{(6.69)}{.7662} X_{np,-1\frac{1}{2}} + \underset{(3.23)}{52.12} ER/.001 W$

$\bar{R}^2 = .868 \qquad s = 20.71 \qquad D.W. = 20.71 \qquad 1952-1969$

(xix) $X_{np} = -59.4 + \underset{(6.34)}{.7270} X_{np,-1\frac{1}{2}} + \underset{(3.54)}{77.84} ER/.001 W_n$

$\bar{R}^2 = .879 \qquad s = 19.90 \qquad D.W. = 2.16 \qquad 1952-1969$

where

Y_a = net value added in agriculture at 1955 prices, in million pesos

Y_q = net value added in mining at 1955 prices, in million pesos.

D. Domestic output equation

$$(xx) \quad Y_{pl} = -48.9 + \underset{(2.91)}{884.0} \; S\frac{P_{pl}}{P_{11}} + \underset{(3.49)}{.0756} \; SY_{pl}$$

$$\bar{R}^2 = .858 \qquad s = 91.34 \qquad D.W. = .912$$

Footnotes

1. This paper is part of a research project of the National Economic Council and the second author. Opinions expressed are not to be interpreted as those of the Government of the Philippines, however, but only of the authors. We are grateful to A.A. Castro, and U.A. Zafra for helpful discussions, to F. Santos and P. Sazon for research assistance, and to NEC Chairman G.P. Sicat for supporting our work. Computations were made at the University of the Philippines Computer Center.

2. See $\lfloor 2 \rfloor$ for an attempt at comparing official Philippine foreign trade data with those of major trading partners.

3. G.P. Sicat $\lfloor 7 \rfloor$ has investigated Philippine import demand on a much more disaggregative basis -- to the 3-digit SITC level. However, due to data limitations, the dependent variables could only be expressed in monetary terms and C.I.F. value in dollars was chosen as the unit of imports.

4. In the absence of available data on price indices of the different categories of imports we have assumed that the price index for all imports P_m reflect the behavior of the import price indices of raw materials and capital equipment. These two import classes together account for about 62 per cent of total imports during the observation period.

5. The correlation coefficient between the two variables is .992 for 1950-1969.

6. For each ton of copra .63 ton of coconut oil can be produced.

7. In effect, investments prior to the observation period are irrelevant to the estimation of the regression coefficients.

8. Labor employment in the mining sector was actually used as proxy variable for N_{cc}, since we have no separate data for N_{cc}.

9. Philippine sugar exports were fully exempt from U.S. tariffs before the Laurel-Langley Agreemnt of 1955 introduced a schedule of increasing percentages of the tariff duty which will reach 100 per cent in 1974.

10. Actual sugar exports to the United States and the U.S. sugar quota cannot be expected to be strictly equal for several reasons: export shipments are at a higher degree of polarization than the "raw value" equivalent, weight losses are incurred in transit, there are unexpected delays in shipment, etc.

11. The Philippines exported from 2 to 5 per cent of annual sugar output to other countries during the operation of the export barter policy (1955-1960), whereby "marginal exports" were allowed to be bartered for imports outside the exchange and import control system.

12. A purely demand-oriented model of Philippine export trade in coconut products is presented in $\underline{/6\,7}$.

References

/_1_7   Encarnación, J., Mariano, R.S. and Bautista, R.M., "A Macro-
        Economic Model of the Philippines, 1950-1969",
        Philippine Economic Journal (to appear).

/_2_7   Hicks, G.L., "Philippine Foreign Trade, 1950-1965: Basic Data
        and Major Characteristics", National Planning
        Association Field Work Report No. 10; September, 1966.

/_3_7   _____, "The Philippine Coconut Industry: Growth and
        Change, 1900-1965", National Planning Association
        Field Work Report No. 17; June, 1967.

/_4_7   Kemp, M.C., The Demand for Canadian Imports; 1926-1955.
        University of Toronto Press, 1962.

/_5_7   Orcutt, G.H., "Measurement of Price Elasticities in International
        Trade", Review of Economics and Statistics, XXXII
        (May, 1950), pp. 117-132.

/_6_7   Recto-Librero, A., "The International Demand for Philippine
        Coconut Products: An Aggregate Analysis",
        Philippine Economic Journal (to appear).

/_7_7   Sicat, G.P., "Import Demand and Import Substitution in the
        Philippines, 1953-1963", IEDR Discussion Paper No.
        69-2, University of the Philippines School of
        Economics; January 25, 1969.