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0. Introduction

The purpose of this paper is twofold: we present a consistent model of the Philippine economy based largely on the results of five previous papers (Encarnacion, Mariano and Bautista, 1971; Encarnacion, 1971; Bautista and Encarnacion, 1971; Mangahas and Encarnacion, 1971; Jurado and Encarnacion, 1971) and we give projected values through 1976 for most of the endogenous variables in the model. For the aggregative part of the model (which we call the basic model), we have also generated projections to the year 2001 to see its long-run implications.

Our previous papers estimated an aggregative model of the economy and submodels pertaining to the monetary, fiscal, production and foreign trade sectors. Some of the equations contained in these five models have been revised

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Computations were done at the U.P. Computer Center.

for purposes of this paper, and some new ones are included. We will confine most of our explanatory remarks to these equations (which will be identified by asterisks) since the other, unchanged equations have already been discussed in the cited papers.

As before, all estimates are ordinary least squares with annual data from the period 1950-1969. Definitions of all the variables are given in Appendix A.

1. Aggregative Relationships: The Basic Model

The heart of this part of the complete model is a set of three simultaneous equations involving real output Y, employment N and the price level P as dependent variables. These can be solved given the capital stock K, the money wage rate W and money supply Z. K and W are predetermined in the sense that their current values depend only on their lagged values and other lagged variables, while Z is determined in the monetary part of the model (see section 2 below) by variables that do not depend on any of the current values of Y, N and P. With a solution in hand, the other endogenous variables in the basic model are easily determined once the import price index P_m, the export price index P_x and real exports X are known. The latter two variables are generated by the foreign trade sector of the model (section 3) which requires, however, some data from the production

submodel (section 4) which in turn presupposes a solution of the basic model.

The basic model and the production and foreign trade submodels thus have to be solved simultaneously, but we do not attempt this in the present paper. Instead we follow a simpler computational procedure (to be explained in section 3) the results of which should differ little from the correct figures that would be obtained from a simultaneous solution.

The Basic Model

Numbers underneath regression coefficients are their t-values; the time series used for each regression is reported in parentheses after $\bar{R}^2$/s/DW if different from 1950-69.

*(1.1) $Y = 61.15 + \underset{(7.89)}{0.2640}\ K + \underset{(2.36)}{0.4948}\ N$

$\bar{R}^2$/s/DW	
.997/137.9/2.61	(56-68)

*(1.2) $N = 2203.3 + \underset{(23.66)}{0.4471}\ Y + \underset{(1.71)}{191.6}\ (100\ P/W)$

.984/151.8/2.34 (56-68)

(1.3) $P = 85.37 - \underset{(-7.71)}{0.0043}\ Y + \underset{(18.22)}{0.0423}\ Z$

.993/1.84/1.83

*(1.4) $W = -144.3 + \underset{(8.17)}{0.7879}\ W_{-1} + \underset{(3.87)}{4.0895}\ P_{-1}$

.982/33.9/2.19 (51-69)

(1.5) $I = -251.24 + \underset{(9.09)}{0.1680}\ Y + \underset{(2.94)}{0.3281}\ M + \underset{(2.47)}{8.864}\ P \underset{(-3.51)}{-1.095}\ W$

.987/91.1/2.21

(1.6) $T^* = -72.63 + \underset{(10.74)}{0.0923}\ Y^* + \underset{(2.20)}{0.0824}\ M^*$

.996/47.6/1.16 (55-69)

(1.7) $C_g = -80.12 + \underset{(33.45)}{0.9391}\ T$

.983/54.2/1.17

*(1.8) $A = -0.00843\ Y$

*(1.9) $C_p = Y - C_g - I - X + M - A$

(1.10) $K = K_{-1} + I_{-1}$

*(1.11) $M^* = X^*$

(1.12) $T = 100\ T^*/P$

(1.13) $M = 100M^*/P_m$

(1.14) $X^* = P_x X/100$

(1.15) $Y^* = PY/100$

(1.16) $C = C_p + C_g$

(1.17) $s = 1 - C/Y$

Earlier we had estimated eqs. (1.1) and (1.2) containing N from 1950-68 data, but a closer look at the employment series showed an extraordinary increase in employment between 1955 and 1956. The available employment figures for 1950-55 are estimated from the Central Bank index for employment which is based on a relatively small sample, while those for 1956-68 are the results of nation-wide surveys conducted by the Bureau of the Census and Statistics. The only explanation for the large 1955-56 increase seems to be the change in the estimation procedure, and we have thus chosen not to use the 1950-55 data.

The output, employment and price equations

Eqs. (1)-(3) are fundamental to the complete model and deserve more comment than we had given them earlier. Consider the hypothesis that the production function is Cobb-Douglas, the price level is determined á la some "generalized" quantity theory of money, and employment is determined by firms equating the marginal product of labor to the real wage.

If $Y = cK^{\alpha}N^{\beta}$, then $\log Y = \log c + \alpha \log K + \beta \log N$, and we have the following estimate:

$$\log Y = -0.196 + \underset{(6.69)}{0.6184} \log K + \underset{(2.13)}{0.3851} \log N$$

.997/.0046/2.87 (56-68)

It is interesting that the estimated coefficients add up to 1.003 which indicates practically constant returns to scale, but the relative elasticities of output with respect to capital and labor are the reverse of what have been observed in the more advanced countries where the coefficient of log N would be in the neighborhood of 0.7. Since the calculated $0.385 = \frac{\partial Y}{\partial N} \cdot \frac{N}{Y}$, the only apparent explanation would be the very much lower marginal productivity of labor which pulls down this figure despite the higher labor-output ratio.

Assuming $Z = kP^{\delta}Y^{\gamma}$, we have $\log Z = \log k + \delta \log P + \gamma \log Y$, or $\log P = -\frac{1}{\delta} \log k - \frac{\gamma}{\delta} \log Y + \frac{1}{\delta} \log Z$:

$$\log P = 1.447 - \underset{(-5.77)}{0.4412} \log Y + \underset{(12.14)}{0.7381} \log Z$$

.974/.0122/1.11

from which we can compute $\hat{\delta} = 1.354$ and $\hat{\gamma} = 0.597$. If we interpret $kP^{\delta}Y^{\gamma}$ as the demand for money, these estimates suggest a price-elasticity of demand exceeding unity much more than could probably be accounted for by any statistical bias resulting from the estimation procedure. Thus while the implied output-elasticity of demand less than unity could be rationalized in terms of economies of scale, the magnitude of the price-elasticity would be hard to explain

unless one brings in expectational elements. On this point one could argue that people want to hold proportionately larger cash balances when the price level increases in order to have the same real cash balances should prices rise further. In all this we are assuming that the price level adjusts so as to make the demand for money equal to its predetermined supply. Suppose that the price level is lower than what would be required for monetary equilibrium, and suppose momentarily that output is held fixed. The resulting excess supply of money then leads to larger expenditures which drive up the price level. The converse process is equally clear, and the equilibrium price level equates the demand for money to its supply -- a conclusion that is not affected by the fact that there is an output response to price changes due to greater employment when the real wage falls.

This leads us to consider the question of an employment function. Profit-maximizing firms will hire labor up to the point where its marginal productivity equals the real wage rate. From the estimated production function we have $\frac{\partial Y}{\partial N} \cdot N = 0.385\ Y$, and assuming that $\frac{\partial Y}{\partial N} = \frac{0.001\ W}{0.01\ P}$ (paying attention to the units in which the variables are expressed) gives an estimated $\hat{N} = 3.85\ YP/W$.

The following table compares $\hat{N}$ and actual N for representative years.

	1958	1961	1964	1967
$\hat{N}$	3300	4040	5050	5620
N	8556	9245	10320	11526

The calculated $\hat{N}$ is typically less than half the actual N, but the above formula for $\hat{N}$ is defective in an important respect. Our money wage rate W is the average pay of unskilled industrial workers in Greater Manila, which is higher than the wage rate of the marginal worker. It is also of course higher than the average pay of agricultural workers. We have calculated a wage series that is a weighted average of wages in the five production sectors (out of seven) for which wage series are available, each weight being the fraction of employed workers in a sector relative to total employment in the five sectors. This calculated wage -- call it W_o -- has varied between 2/3 and 3/4 of W, so that if W_o is used in place of W, the resulting $\hat{N}$ would be higher. If a further adjustment is made by considering the wage rate of the marginal worker, which may be as low as 2/3 of W_o, the calculated $\hat{N}$ should get us not too far from N.

While these considerations do not suggest that the assumption of profit-maximization should be rejected, that is not our main interest. The objective here is to find an employment equation that may be used for projection purposes,

and eq. (1.2) is our best result. In accordance with theoretical expectations it says that the amount of labor demanded depends on the output to be produced and (the reciprocal of) the real wage. We are using W as a proxy for the relevant wage rate that influences the aggregate employment decision because, compared to W_o, it yields better statistical results. The reason for this is probably that W correlates more highly with the marginal wage rate, which is the relevant economic consideration, than does the composite W_o.

Since eq. (1.2) is linear in Y and P, for computational convenience we have chosen linear specifications for the equations of these two variables instead of the log-linear forms discussed above. For projection purposes over the medium term these two specifications should not give very different results.

According to eq. (1.1), the marginal productivity of capital is about 0.26, which is within the range of observed rates of return to capital in various industries. The low marginal productivity of labor, ₱495 per worker (at 1955 prices), conforms to our expectations but is still significantly different from zero. Eq. (1.2) implies a marginal employment-output ratio of 447 workers per ₱1 million, equivalent to a marginal output-employment ratio of about ₱2240 per worker. The price equation (1.3) indicates that

a ₱1 million increase in the money supply will leave the price level unchanged only if this is matched by an increase in real output amounting to about ₱10 million.

Reduced-form equations for Y, N and P

Eqs. (1.1)-(1.3) can be solved simultaneously to give the following reduced form:

$$Y = \frac{809420.7 + 1151.2\ W + 0.264\ WK + 400.8\ Z}{0.7788\ W + 40.67}$$

$$N = \frac{1630971.0 + 2230.6\ W + 0.118\ WK + 809.9\ Z - 21.65\ K}{0.7788\ W + 40.67}$$

$$P = \frac{61.55\ W + 0.0329\ WZ - 0.00113\ WK}{0.7788\ W + 40.67}$$

The nonlinearity of the employment equation (1.2) makes the reduced-form equations cumbersome to interpret in general, but we can consider some representative current values of the predetermined variables to see their effects on Y, N and P.

The following table of impact multipliers (the partial derivatives of the dependent variables with respect to the predetermined variables in the reduced-form equations) are evaluated at Z = 5000, W = 2500 and K = 55000.

	Z	W	K
Y	0.2016	-0.3933	0.3320
N	0.4075	-0.7952	0.1375
P	0.0414	0.0017	-0.0014

At current levels of the predetermined variables, the effect of a ₱100 million increase in the money supply is to increase real GNP by ₱20 million, employment by 40 thousand and the price level by 4 index points. A ₱100 increase in the annual money wage rate (equivalent to ₱0.40 per day) decreases output by ₱39 million and employment by 79 thousand; it also increases the price index by 0.17 points. An additional capital stock of ₱100 million increases output by ₱33 million and employment by 14 thousand, and reduces the price level 0.14 points.

Equations (1.4)-(1.9)

The wage equation (1.4) gives the current money wage rate as a function of lagged money wage and lagged price level. We consider a higher money wage to be the combined result of a pressure for higher wages on account of a higher cost of living the previous year and the greater inclination of employers to grant higher wages when the previous year's profit level (proxied by the price level) is higher. Alternatively, the wage equation can be thought of in terms

of an adjustment process where 0.21 of total adjustment takes place in the current period.

According to eq. (1.5), investment depends on output, imports, the wage rate and the price level. The latter two variables reflect profit considerations and their explanatory role is two-fold: higher prices and lower wage rates mean greater profits, generating the funds for more investment; they also serve as proxy for expectations as to the profitability of investment. The level of imports is another determinant, for most machinery and capital equipment have to be imported, and a lower volume of imports could constrain the amount of investment that can be undertaken. (In recent years the fraction of imports classified as consumer goods has averaged only about 15 per cent.) In effect (1.5) is a reduced form because of the role played by imports. A nonlinear specification would be superior from a theoretical viewpoint, but we have not pursued this possibility.

An alternative linear specification that seems worth reporting here rather than in an appendix is the following:

$$I = \underset{}{-1612.8} - \underset{(-1.96)}{204.7\ R_b} + \underset{(5.88)}{0.1937\ Y} + \underset{(5.30)}{22.48\ P}$$

$$.984/117.3/2.16$$

where R_b is the banks' lending rate of interest. While attractive in that it exhibits the classical response of

investment to some interest rate, we have opted for eq. (1.5) for inclusion in the formal model because of the clear importance of imports in the economy.

Eqs. (1.6) and (1.7) are self-explanatory -- current imports appearing in the tax-yield equation because of the large proportion of indirect taxes collected through customs. There is no discernible pattern over time in the behavior of net factor income from abroad, denoted by A, and the coefficient of Y in (1.8) is simply the average ratio of A to Y over the period 1950-69. We note that the components of A are not reported under either exports or imports in the national income accounts, so that it appears separately in the identity (1.9). This identity gives private consumption C_p as a residual. In an earlier version of the model we had taken A as the residual term in the identity, but for projection purposes such an assumption will not do since we may expect A to be relatively small and negative.

A digression on the consumption function

We cannot add an independent consumption function to the model (1.1)-(1.15), given Z, X, P_x and P_m, without overdetermining the system. For the sake of information, however, we report here two alternative specifications:

$$(a)\quad C_p = \underset{}{1902.8} + \underset{(25.08)}{0.8895}\,(Y - T) - \underset{(-5.21)}{27.59}\,P + \underset{(2.31)}{1.087}\,W$$

$$.996/156.2/1.69$$

$$(b)\quad C_p = \underset{}{3431.9} + \underset{(63.34)}{0.7936}\,(Y - T) - \underset{(-3.85)}{275.3}\,(100\,P/W)$$

$$.995/182.4/1.15$$

On theoretical grounds the form (b) seems preferable because it makes (private) consumption a function of (the reciprocal of) the real wage explicitly. Given the same disposable income Y - T, we expect an increase in the real wage to increase consumption because of the shift in income distribution towards the wage-earning class which is supposed to have a higher propensity to consume. The form (a), which was part of our earlier model, would seem similar except that P and W appear separately. It is slightly superior statistically in having a higher coefficient of determination, a lower standard error of estimate and a Durbin-Watson statistic that indicates less serial correlation.

However, (a) has a somewhat awkward implication. During the observation period we find that $-27.59\,P + 1.087\,W < 0$, so that (a) implies that proportionate increases in P and W (which leave the real wage unchanged) will reduce consumption <u>ceteris paribus</u>. Such a phenomenon could possibly be explained in terms of a money illusion on the part of wage-earners, making them reduce consumption when prices

increase even though their money incomes have also increased proportionately. But this would seem a bit contrived.

On the whole, (b) seems to be the better specification; its implied marginal propensity to consume of 0.79 also seems intuitively more credible than the 0.89 of (a). In any event, whether in the form (a) or (b), it is interesting that the consumption function gives roles to the variables P and W that are the opposite of those in the investment function (1.5).

Equations (1.10)-(1.17)

The definition of K in (1.10) in terms of cumulated gross investment seems reasonable for the sample period in view of World War II destruction of the country's capital stock. Reported depreciation being merely an accounting entry, the "net" capital stock derived from subtracting depreciation would not correspond exactly to the physically productive capital stock in existence, which is what is relevant to the production function. While our K overstates the relevant capital stock, a technical change component that increases the productivity of capital is missing from the production function (1.1). These two defects cancel each other out to some degree. (We should add that extensive experimentation with various specifications involving technical change parameters and alternative definitions of the capital stock produced less acceptable results than (1.1).)

For projection purposes we are assuming in eq. (1.11) that current imports will just equal current exports. This seems to be the most likely course of events, on the average over the next few years, because of two sets of opposing factors. On the one hand the import-dependence of the economy should lead the monetary authorities to permit more imports when export proceeds are higher. On the other hand, the servicing requirements of the large foreign debt would probably constrain the level of imports to the neighborhood of the export level. In effect the assumption is that the projected net capital inflow will just equal (the absolute value of) net factor income from abroad plus additions to the international reserve. To the extent that this would be an underestimate, imports, investment and output growth would also be understated.

The remaining equations (1.12)-(1.17) in the basic model are merely definitional, the last being the saving ratio.

2. The Monetary Sector

In this section we consider a submodel for the monetary sector where money supply is an endogenous variable. In the basic model of section 1, money supply Z is defined as the average of end-of-month figures from October of the previous year to September of the current year. This

definition gave a better statistical fit for the price equation (1.3) than did alternative definitions, including one where money supply Z_m is the average of end-of-month figures from January to December.

A Monetary Submodel

This consists of the following 9 equations.

(2.1) Z_b = 288.9 + 0.3862 $L_{cb_{-1}}$ + 0.3837 B^g_{-1} + 0.3657 $F_{r_{-1}}$
(2.83) (11.39) (3.03)
monetary base; CB loans to banks; internal debt of govt; int'l reserve
.987/73.5/1.54

(2.2) Z_m = 1004.4 + 1.4284 Z_b − 70.200 R_r (RR ratio)
(64.57) (−8.46)
money stock
.995/63.0/1.55

(2.3) Z = 1038.1 + 1.3756 Z_b − 70.564 R_r
(53.59) (−7.30)
ave. end-of-month money supply
.993/73.3/1.39

(2.4) Z_c = 122.0 + 0.4137 Z_m
(70.07)
currency in circulation
.996/24.2/1.59

(2.5) $L_{bp}{}^a$ = 333.9 + 5.6784 Z_a − 246.231 R_r + 416.439 R_b
(6.04) (−3.53) (2.42)
pvt domestic credits; available reserves; w. ave. of int rates charged by bnks
.980/301.9/1.12

(2.6) $L_{bp}{}^a$ = 1156.0 − 224.541 R_b + 0.3169 Y − 128.73 W/P
(−1.56) (11.62) (−2.18)
.992/185.0/0.71

$$(2.7)\quad Z_a = Z_b - Z_c$$

$$(2.8)\quad F_r = F_{r_{-1}} - (M^* - X^*) + A_f$$

$$*(2.9)\quad \frac{100\, Z_c}{Z_m + D_{tp}} = 66.38 - \underset{(-6.60)}{0.0983}\, Y_{pc} + \underset{(2.62)}{145.77}\, T^*/Y^* - \underset{(-1.72)}{0.9405}\, R_b \qquad .972/1.14/1.64$$

The exogenous variables specific to this submodel are: B_g, government debt; R_r, reserve requirement ratio; R_d, rediscount rate; L_{cb}, Central Bank loans to banks; and A_f, a catch-all variable defined implicitly in the identity (2.8), where the international reserve F_r at year's end is given by its value at the beginning less the trade deficit plus A_f. In effect A_f includes all factors except the trade deficit that affect changes in the international reserve.

Except for eqs. (2.6) and (2.9), all equations in the submodel appear in an earlier version and have been discussed there. Eq. (2.6) is a demand function for bank loans to the private sector. The higher is the real wage, the less profitable is investment and consequently the lower is the demand for bank loans (which have financed much investment). It depends negatively on the rate of interest R_b and positively on current GNP. Eq. (2.5) is a supply function which makes the supply of bank credit depend on bank reserves Z_a, the reserve requirement ratio and the rate of interest.

The monetary base Z_b is given by (2.1) as a function of three predetermined variables, and money supply is determined by Z_b and R_r in (2.2) and (2.3). In (2.4), the amount of currency in circulation, Z_c, depends only on the stock of money, which is highly correlated with real income per capita. As this rises, less currency is held relative to the total amount of money.

Eq. (2.7) is merely definitional, the monetary base being the sum of bank reserves and currency in circulation.

Finally, the so-called currency ratio -- the ratio of Z_c to the stock of money plus private time (and savings) deposits D_{tp} -- is in (2.9) a function of real per capita income Y_{pc}, the tax ratio T^*/Y^* and the rate of interest R_b. Cagan (1965) has estimated a similar equation based on U.S. data and gives a thorough explanation for the relationship. Briefly, as per capita income increases we expect a lower currency ratio because more transactions are conducted by means of checking accounts. As an indicator of the cost of holding currency (instead of interest-bearing assets), the rate of interest has a negative effect on the currency ratio. It is the role of the tax ratio which is most interesting, and the explanation here is that a higher tax ratio induces more tax evasion which is more conveniently done when transactions are effected in currency instead of through the banking system.

Eqs. (2.1)-(2.8) just suffice to determine the variables appearing in the left-hand sides of those equations and also R_b, while D_{tp} is determined by (2.9) once Z_c and Z_m are known from (2.4) and (2.2). Y_{pc} is of course given by Y in the basic model and population, which is exogenous.

Linkages to the Basic Model

The main purpose in formulating the monetary submodel is to make money supply Z in the basic model endogenous. This is done with eq. (2.3) where Z is a function of the monetary base and the reserve requirement ratio. Given the monetary base, money supply depends negatively on R_r. The regression coefficient of R_r captures not only the effect of R_r but also those of the other tools of monetary policy that have been used by the Central Bank in conjunction with reserve requirements.

A feedback from the basic model to the monetary submodel is provided in eq. (2.8), where the trade deficit would affect the international reserve which in turn affects the monetary base and money supply the following year.// We have assumed in eq. (1.11), however, that there would be no trade deficit over the projection period.// Thus in effect, the monetary base would be determined solely by exogenous variables. Instead of making assumptions on the behavior of government debt, the international reserve, Central Bank

loans to banks and the reserve requirement ratio over the projection period in order to determine the behavior of money supply, we have taken the simpler course of assuming that money supply will increase 9 per cent annually from its 1971 value. (The growth rate of money supply between 1970 and 1971 was 10 per cent; the average over the period 1959-69 was 8.2 per cent.)

3. The Foreign Trade Sector

The foreign trade submodel consists of ten structural equations and three identities. There are seven estimated equations with supply of principal export commodities as dependent variables and three estimated equations explaining import demand for raw materials, capital goods, and services.

Foreign trade submodel

$$(3.1)\quad X_{11} = -861.2 + \underset{(4.05)}{16.178}\, P_{11} - \underset{(-2.55)}{7.030}\, P_{pl} + \underset{(1.99)}{0.327}\, Y_1$$

$$.877/429.4/.921$$

$$(3.2)\quad X_{cp} = -541.2 + \underset{(2.11)}{1.933}\, P_{cp} - \underset{(-2.42)}{1.755}\, P_{dc} + \underset{(5.83)}{0.8421}\, Y_{cp}$$

$$.939/32.08/2.40 \quad (62\text{-}68)$$

$$(3.3)\quad X_{co} = -1393.8 + \underset{(3.68)}{0.8670}\, P_{cp} + \underset{(3.42)}{60.365}\, W_n/P_n + \underset{(4.61)}{0.4126}\, Y_{cp}$$

$$.882/19.92/2.17 \quad (62\text{-}68)$$

(3.4) $X_{cc} = -912.4 + \underset{(2.46)}{0.7245}\ SP_{cc} - \underset{(-2.36)}{0.1138}\ SW_q + \underset{(2.66)}{156.7}\ t$

.934/25.25/2.90 (56-68)

(3.5) $X_{dc} = -25.4 + \underset{(4.17)}{0.1992}\ SP_{dc} - \underset{(-4.22)}{0.1942}\ SP_{cp} + \underset{(2.27)}{0.0768}\ N_n$

.783/3.44/1.33 (56-68)

(3.6) $X_{ab} = 159.1 + \underset{(1.67)}{0.1155}\ SP_{ab} - \underset{(-1.98)}{0.0367}\ SW_a$

.648/11.16/1.40 (56-68)

(3.7) $X_{pl} = -3249.1 + \underset{(12.63)}{0.1444}\ Y_{pl}$

.898/11.84/1.44 (50-68)

*(3.8) $X = X_s + X_{np} + \sum_{j \in V} \pi_j^o X_j$

where

$V = \{11, cp, co, cc, dc, ab, pl, su\}$

*(3.9) $P_x = \dfrac{\sum_{j \in V} P_j \pi_j^o X_j}{\sum_{j \in V} \pi_j^o X_j}$

(3.10) $M_r = -841.2 + \underset{(8.01)}{0.5582}\ Y_n + \underset{(5.56)}{12.537}\ P - \underset{(-3.09)}{5.643}\ P_m$

.978/72.71/2.26

(3.11) $M_k = -184.9 + \underset{(2.86)}{0.1188}\ I + \underset{(3.50)}{5.244}\ P - \underset{(-3.32)}{3.054}\ P_m$

.931/37.75/1.66

$$(3.12)\quad M_s = \underset{(14.2)}{0.2200\ M} - 41.55$$

.926/51.51/2.40

$$(3.13)\quad M_c = M - M_r - M_k - M_s$$

The equations shown above have been presented in an earlier paper (Bautista and Encarnacion, 1971), except for the identities (3.8) and (3.9). The latter relations define, respectively, total exports in 1955 prices as the sum of the different classes of exports distinguished in the study and the export price index as the average of export price indices of the principal commodities weighted by their values in 1955 prices. (These definitions differ from those of NEC; see Appendix B.)

Eq. (3.1) relates exports of logs and lumber to the export price indices of logs and lumber and their export substitute, plywood. The dependent variable is also shown to be determined in part by the domestic output of logs, which to a large extent is policy-determined.

The export equations (3.2) and (3.3) above for copra and coconut oil, respectively, were obtained using data for the period 1962-1968. Due to the introduction in 1962 of large ocean tankers, international freight rates for coconut oil were reduced drastically, shifting the supply functions of the major coconut products exported (copra,

coconut oil and dessicated coconut). The volume of copra exports is explained by the export prices of copra and dessicated coconut and by total coconut output. Export supply of coconut oil is shown to depend on the export price, on the wage-price ratio in manufacturing, and on domestic coconut production.

In the absence of a copper smelting plant in the Philippines, the entire output of copper concentrates is being exported. Underlying eq. (3.4) above is a production relation and an investment function. Let

$$(3.4.1) \quad X_{cc} = f(K_{cc}, N_{cc})$$

$$(3.4.2) \quad I_{cc} = \alpha_0 + \alpha_1 P_{cc} + \alpha_2 W_q + \alpha_3 X_{cc}$$

$$(3.4.3) \quad K_{cc} = \sum_{-\infty}^{t-1} I_{cc} = \sum_{-\infty}^{-1} I_{cc} + \sum_{0}^{t-1} I_{cc}$$

where K_{cc}, N_{cc} and I_{cc} denote, respectively, the amount of capital, employment and investment in the production of copper concentrates. Eq. (3.4.1) 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. (3.4.2), i.e. investment depends linearly 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. (3.4.3) 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:

$$(3.4.4) \quad X_{cc} = a_0 + a_1 SP_{cc} + a_2 SW_q + a_3 t + a_4 SX_{cc} + a_5 N_{cc}$$

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

The estimated export equation (3.4) seems to indicate that the last two terms in eq. (3.4.4) have no significant influence. However, it is possible that the effects of the employment and output variables are captured in the coefficients of the price and wage variables.

Practically the entire domestic output of dessicated coconut is exported. Eq. (3.5) 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. (3.5) is employment in the manufacturing sector, which proxies for the amount of labor employed in the production of dessicated coconut.

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. (3.6) shows that export supply of unmanufactured 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 quantity of plywood exported is shown in eq. (3.7) to depend solely on the domestic output of plywood, which in turn is determined by past levels of production and export price of plywood relative to logs and lumber (see below).

Three classes of exports distinguished in (3.8) are left unexplained for the purposes of this paper. It has been argued previously (Bautista and Encarnacion, 1971) 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. For the rest of merchandise exports

(X_{np}) and exports of services (X_s), annual rates of growth will be assumed based on their performance in the more recent years rather than the entire period of observation.

Turning now to the import equations, raw material importation is seen in eq. (3.10) to be determined in part by the level of production in manufacturing. In addition, the highly significant coefficients of the price variables 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. (3.11), 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. Relative price effects are also seen to be significant.

Imports of services include as a principal component freight and insurance charges (paid to foreign companies) on imports. Eq. (3.12) appears to explain adequately the variation of service imports in terms solely of total imports.

We have not been successful in obtaining any acceptable estimated equation for imports of consumption goods. The identity (3.13) above treats the level of

consumption imports as a residual. 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.

All the endogenous foreign trade variables appear in the left-hand side of the equations. The rest of the variables in (3.1)-(3.13) are either exogenous (e.g., all export prices) or explained elsewhere in the model. Specifically, M, I and P are endogenous variables in the basic model while P_n, N_n and Y_n are explained in the production submodel. As will be shown below, there is simultaneity in the determination of these variables and some foreign trade variables.

Forecasts of exogenous variables

Values of the exogenous variables for the projection years are obtained in either of two ways. For W_n, W_a and Y_{pl}, regression equations are used in which the explanatory variables are predetermined, viz.,

$$W_n = \underset{}{-60.0} + \underset{(8.16)}{0.8510}\ W_{n-1} + \underset{(2.12)}{2.9037}\ P_{n-1} \qquad *(3.14)$$

$$.982/39.4/2.28$$

$$W_a = 10.5 + \underset{(3.40)}{0.6139}\ W_{a-1} + \underset{(2.69)}{2.2129}\ P_{a-1} \qquad *(3.15)$$

$$.760/56.2/1.91 \quad (51\text{-}69)$$

$$Y_{pl} = -48.9 + \underset{(2.91)}{25.23}\, S(P_{pl}/P_{ll}) + \underset{(3.49)}{0.0756}\, SY_{pl} \qquad *(3.16)$$

.828/91.34/.912

For the rest of the exogenous variables, annual rates of increase for 1972 through 1976 are assumed on the basis of past trends and a priori expectations for the projection period. These are given below, in per cent:

P_{ll}, P_{pl}	: 4.0	X_{su}	: 2.0
P_{cp}, P_{co}	: 3.0	X_{np}	: 10.0
P_{dc}	: 5.0	X_{s}	: 7.5
P_{cc}, P_{ab}, P_{su}	: 2.0	Y_{l}	: 0.0
P_{m}	: 2.0	Y_{cp}	: 3.31

Determination of endogenous variables and predictions through 1976

It is necessary at this point to make explicit the interdependence among some aggregative, production and foreign trade variables. Notice first from (3.3) and (3.5) that the export variables X_{co} and X_{dc} are determined in part by the (endogenous) production variables P_n and N_n, respectively. As will be shown in Section 4 below, the latter variables depend in turn on the aggregative variables Y and T. Similarly the import variable M_s is seen from eq. (3.10) to be determined by total imports M which depends

on X, from the basic model. Both M_r and M_k depend on the aggregative variable P, from (3.11) and (3.12), I and Y_n also appearing as explanatory variables for M_r and M_k, respectively. In the reduced form, the price variable P is dependent on past values of I and investment is shown in (1.5) to depend directly on M and hence indirectly on X. Finally Y_n will be seen in Section 4 to depend on disposable income (Y - T).

To avoid a simultaneous solution of the nonlinear relationships, a two-stage iteration procedure is employed to generate the projections of the endogenous variables of the model. First, trial values of P_n and N_n for the first projection year 1972 are obtained from the following estimated equations:

$$P_n = \underset{(18.63)}{-5.65 + 1.0751\ P_{n-1}}$$

$$.950/5.35/1.61$$

$$N_n = \underset{(6.70)}{74.0 + 0.9573\ N_{n-1}}$$

$$.800/52.5/2.56 \quad (57\text{-}68)$$

These values of P_n and N_n are then used jointly with the values of the predetermined variables in (3.3) and (3.5) to derive trial values of X_{co} and X_{dc}, respectively. The predicted values of the other export variables are directly obtainable from the rest of the export equations

using the forecast values of the exogenous variables; together with the values of X_{co} and X_{dc} they provide trial values for X and P_x using (3.8) and (3.9), respectively.These are used in the basic model to obtain values of Y and T which in turn are used in the production submodel (see section 4) to generate new values of P_n and N_n, respectively. These are substituted in (3.3) and (3.5) to obtain new values of X_{co} and X_{dc} and hence also of X and P_x, using (3.8) and (3.9).

The import equations (3.10) - (3.13) are used to solve for the projected values for 1972 of M_r, M_k, M_s and M_c after the values of M, P and I have been obtained from the basic model and Y_n from the production submodel.

The procedure is repeated for the succeeding years in generating the projections of the foreign trade variables through 1976.

4. The Production Sector

The projection model for the production sector consists of 27 equations, (4.1) - (4.27). The endogenous variables, in addition to the seven sectoral values-added, prices, and employment levels, are wage levels in three of the sectors (mining and quarrying; transport, storage, communications and utilities; and commerce), the price of copper concentrates, and capital stock and investment in the manufacturing sector. There are twenty-two predetermined variables, of which fifteen are lagged endogenous and seven are exogenous. All the exogenous variables are determined in the basic model. It will be noted that GNP is among these exogenous variables, given from the start, and not built-up from the summation of sectoral values-added. This implies that Depreciation + Indirect Taxes + Net Factor Income from Abroad is simply determined as the residual of GNP from the sectoral value-added summation.

The production model is cast in sectoral blocks, none of which interacts with any other. Simultaneities are found within four of these blocks, and the other three are entirely recursive. The number of equations per block is uneven; supply relations are presented first, then employment relations, and then demand relations. Price-responsive supply relations are used, instead of input-output functions.

This avoids the use of proxy capital variables (Mangahas and Encarnacion, 1971). Secondly, it maintains a degree of consistency with the basic model, in which GNP reacts strongly to the general price level.

Employment is typically represented as output-determined rather than output-determining. After numerous regressions, it was possible only twice to include a wage variable as a determinant of employment. In a third sector a wage variable has been introduced simply as a cost-push factor affecting the sectoral price level. Aggregate employment, N, is also determined in the basic model. Employment in the agricultural sector is determined as the residual of aggregate employment from the sum of employment in the six non-agricultural sectors. This allows consistency, and for that matter is not unappealing theoretically.

The price level is determined in four of the sectors by means of a traditional demand function. In the other three sectors the price level is determined by a combination of demand-pull and cost-push.

The production model follows. The endogenous variables are:

Y_i for all sectors i, total =	7
P_i for all sectors i, total =	7
N_i for all sectors i, total =	7
W_i for i = q, t and r	3
P_{cc}, K_n, ΔK_n	3
	27

The predetermined variables are:

Lagged endogenous

Y_{i-1} for all sectors i, total	=	7
P_{q-1}		1
N_{q-1}		1
W_{i-1} for i = q, t and r		3
P_{cc-1}, K_{n-1}, ΔK_{n-1}		3
		15

Exogenous

N, Y, T, W, I, P, P_{-1}, total = 7.

Agriculture, Fishing and Forestry

$$(4.1)\quad Y_a = \underset{}{-58.10} + \underset{(14.14)}{0.9454}\, Y_{a-1} + \underset{(1.71)}{3.026}\, P_a$$

.983/110.07/2.52

$$(4.2)\quad N_a = N - \sum_{i \neq a} N_i$$

$$(4.3)\quad Y_a = \underset{}{103.0} + \underset{(17.50)}{0.2532}\,(Y - T) - \underset{(-3.94)}{10.26}\, P_a + \underset{(4.74)}{1.235}\, W$$

.995/48.4/1.66 (52-68)

Mining and Quarrying

$$(4.4)\quad Y_q = \underset{}{31.67} + \underset{(12.19)}{0.9491}\, Y_{q-1} + \underset{(2.74)}{0.5218}\, P_q$$

.973/11.2/1.29

(4.5) $N_q = N_{q-1} (Y_q/Y_{q-1})$

(4.6) $P_q = 43.7 + \underset{(6.65)}{0.2542} P_{cc} + \underset{(3.24)}{0.0154} W_q$

.932/6.4/1.14 (52-69)

(4.7) $P_{cc} = 1.02 P_{cc-1}$

(4.8) $W_q = -103.3 + \underset{(16.70)}{0.9652} W_{q-1} + 2.6078 P_{q-1}$

.986/61.6/1.99 (53-69)

Manufacturing

(4.9) $Y_n = 270.5 + \underset{(2.73)}{0.2236} K_n + \underset{(3.41)}{9.973} P_n$

.985/45.9/1.31 (56-68)

(4.10) $K_n = K_{n-1} + \Delta K_{n-1}$

(4.11) $\Delta K_n = -681.8 + \underset{(3.76)}{0.0806} I + \underset{(1.746)}{6.6912} (100 P_n/P)$

.545/50.5/2.38 (59-68)

(4.12) $N_n = 514.4 + \underset{(11.54)}{0.3097} Y_n$

.917/34.5/1.63 (56-68)

(4.13) $Y_n = 198.2 + \underset{(3.349)}{0.0701} (Y - T) - \underset{(-2.438)}{3.092} P_n + \underset{(7.587)}{0.7285} Y_{n-1}$

.995/38.0/2.22

Construction

(4.14) $Y_c = 0.25 + \underset{(2.63)}{0.4634} Y_{c-1} + \underset{(2.92)}{1.7604} P_c$

.777/33.8/2.15

(4.15) $N_c = 8.09 + \underset{(4.766)}{0.6016}\ Y_c$

.644/32.7/1.26 (56-68)

(4.16) $P_c = 32.6 + \underset{(12.99)}{0.8121}\ P - \underset{(-1.51)}{2.136}\ (100\ Y_c/Y)$

.936/5.1/1.13

Transport, Storage, Communications and Utilities

(4.17) $Y_t = -45.6 + \underset{(16.28)}{0.8474}\ Y_{t-1} + \underset{(2.93)}{1.229}\ P_t$

.999/4.0/1.74

(4.18) $N_t = 13.4 - \underset{(1.836)}{0.03128}\ W_t + \underset{(10.8)}{0.7324}\ Y_t$

.943/14.7/1.59 (56-68)

(4.19) $P_t = 26.51 + \underset{(6.823)}{0.53213}\ P + \underset{(2.466)}{0.00514}\ W_t$

.942/4.06/0.57 (52-69)

(4.20) $W_t = -182.4 + \underset{(2.46)}{0.6103}\ W_{t-1} + \underset{(1.99)}{9.127}\ P_{-1}$

.930/98.9/1.59

Commerce

(4.21) $Y_r = -110.8 + \underset{(4.74)}{0.7421}\ Y_{r-1} + \underset{(1.75)}{4.742}\ P_r$

.995/22.75/2.62 (55-69)

(4.22) $N_r = 305.4 - \underset{(-2.23)}{0.2840}\ W_r + \underset{(7.11)}{0.7859}\ Y_r$

.933/47.4/1.70 (56-68)

$$(4.23)\quad Y_r = \underset{}{200.5} - \underset{(-2.82)}{2.485}\, P_r + \underset{(30.6)}{0.1540}\,(Y - T)$$

.994/35.3/0.93

$$(4.24)\quad W_r = \underset{}{201.7} + \underset{(2.92)}{0.5794}\, W_{r-1} + \underset{(1.81)}{6.102}\, P_r$$

.899/106.4/1.57 (53-69)

Services

$$(4.25)\quad Y_s = \underset{}{64.55} + \underset{(103.2)}{1.0364}\, Y_{s-1}$$

.998/38.8/1.89

$$(4.26)\quad N_s = \underset{}{-95.6} + \underset{(14.8)}{0.4245}\, Y_s$$

.948/62.9/0.89 (56-68)

$$(4.27)\quad P_s = \underset{}{31.67} - \underset{(-3.01)}{0.0218}\, Y_s + \underset{(2.70)}{0.00294}\,(Y - T) + \underset{(4.45)}{0.5775}\, P + \underset{(2.42)}{0.01421}\, Y_{s-1}$$

.996/0.93 1.78

In agriculture, projection of Y_a and P_a requires the joint solution of (4.1) and (4.3); this is given in the set of reduced form equations below as (4.28) and (4.29).

The mining sector is represented recursively. Employment grows in proportion to output, by assumption. The employment regressions for this sector were exceedingly poor, and, since mining employment is a very small fraction

of total employment, it was decided to use a simple employment-growth assumption. The growth of output, in turn, depends on the price level for mining products. Important factors determining the latter have been found to be the price of copper concentrates and the wage levels of mining workers. The copper price is projected to grow at 2% per annum, the rationale being the expected continuance of world inflation. The mining wage level has a growth dependent on the lagged mining product price, i.e., improved mining product prices allow firms to raise their wages more than they otherwise would in the following year.

In manufacturing, employment is made a linear function of output. Production in turn depends both on the capital stock in the sector and the price level of manufactured goods, viz., when prices are higher, manufacturers are induced to use their capital goods more productively. Production and the price level are determined by the supply function (4.9) jointly with the demand function (4.13), the solution given below as (4.30) and (4.31). The capital stock is projected by means of an investment function. Investment in the manufacturing sector is then made a function of aggregate investment, the general price level (both determined in the basic model), and the manufactured goods price level.

In construction, output and the price level are determined by supply function (4.14) and price equation (4.16), the solution being (4.32) and (4.33). GNP enters the price equation non-linearly, but since it is exogenous to the submodel, no computational problems arise. As usual, employment is determined directly by output.

Transportation etc. is another recursive sector. An increase in the general price level will spark an increase greater than otherwise in wages the following year. Current wages and the general level of inflation determine product prices in this sector, which consists mostly of regulated industries, and these prices in turn determine the extent to which output will grow. Output and the wage rate then jointly determine the level of employment.

Output and the price level in the commerce sector are jointly determined by a supply (4.21) and a demand function (4.23), the solution being (4.34) and (4.35). Output and the wage rate for workers in commerce then determine employment. The current price level is used to explain the wage rate, the reasoning being similar to that in the case of mining. Interpreted as a wage-adjustment equation, (4.24) says that 0.42 of the long-term adjustment of the wage rate to the product price level takes place during the year.

In the services sector, production is projected by a simple growth function, and thereupon is used directly to determine employment and the price level.

The reduced-form equations referred to above are:

$$(4.28)\quad Y_a = -21.41 + 0.0577\,(Y - T) + 0.7301\,Y_{a-1} + 0.2813\,W$$

$$(4.29)\quad P_a = 12.126 + 0.01905\,(Y - T) - 0.0712\,Y_{a-1} + 0.0930\,W$$

$$(4.30)\quad Y_n = 215.31 + 0.05351\,(Y - T) + 0.5561\,Y_{n-1} + 0.0529\,K_n$$

$$(4.31)\quad P_n = -5.534 + 0.0558\,Y_{n-1} - 0.0171\,K_n + 0.0054\,(Y - T)$$

$$(4.32)\quad Y_c = \frac{(57.64 + 0.4634\,Y_{c-1} + 1.4296\,P)\,Y}{376.0214 + Y}$$

$$(4.33)\quad P_c = \frac{-53.40 + 98.9822\,Y_{c-1} + 32.6\,Y + 0.8121\,PY}{376.0214 + Y}$$

$$(4.34)\quad Y_r = 93.46 + 0.1010\,(Y - T) + 0.2552\,Y_{r-1}$$

$$(4.35)\quad P_r = 43.07 + 0.0213\,(Y - T) - 0.1027\,Y_{r-1}$$

5. The Fiscal Sector

This section gives a slightly revised version of the fiscal submodel presented in a previous paper (Jurado and Encarnacion, 1971), using more recently available data on tax collections for fiscal year 1970. This new data enables estimates of the corresponding figures for calendar year 1969. As described in the cited paper, our estimate of tax revenues

during calendar year t is given by: 0.54 (tax revenues in fiscal year t) + 0.46 (tax revenues in fiscal year t + 1). The corresponding weights in the case of expenditures are 0.53 and 0.47, respectively.

A Fiscal Submodel

Tax Revenues

*(5.1) $T_{bd} = 322.72 + \underset{(8.09)}{0.0200}\ Y^* + \underset{(5.88)}{0.0027}\ U_{tr}.Y^* - \underset{(-3.97)}{0.3027}\ W$

.990/8.17/1.461 (57-69)

*(5.2) $T_{pd} = -120.30 + \underset{(17.74)}{0.0151}\ Y_{p-1}$

.963/13.98/0.893 (57-69)

*(5.3) $T_{bi} = -144.46 + \underset{(23.21)}{0.0270}\ Y^*$

.978/28.02/1.641 (57-69)

*(5.4) $T_{im} = -13.82 + \underset{(4.51)}{0.0636}\ M^* + \underset{(3.99)}{7.2121}\ R_{dm}$

.887/66.24/2.149

*(5.5) $T_{oi} = -7.59 + \underset{(3.45)}{0.0022}\ (Y^* - X^*) + \underset{(3.59)}{0.0105}\ X^*$

.958/5.95/1.456

*(5.6) $T_n = -22.63 + \underset{(68.72)}{0.7589}\ T^*$

.995/41.30/0.712

$$(5.7)\quad T_{ao} = T_n - (T_{bd} + T_{pd} + T_{bi} + T_{im} + T_{oi})$$

Expenditures

$$*(5.8)\quad G_{ed} = \underset{(14.03)}{76.67} + \underset{}{0.3210}\ (T_n + \Delta B_n)$$

.933/69.51/1.884 (55-69)

$$*(5.9)\quad G_{sd} = -1198.94 + \underset{(2.85)}{0.0959}\ (T_n + B_n) + \underset{(10.70)}{0.0429}\ H + \underset{(3.01)}{0.2967}\ W$$

.995/20.34/1.554 (55-69)

$$*(5.10)\quad G_{nd} = -218.80 + \underset{(5.77)}{0.1074}\ T_n + \underset{(5.28)}{0.2352}\ W$$

.994/9.35/1.377 (55-69)

$$*(5.11)\quad G_{ds} = -18.07 + \underset{(10.93)}{0.0707}\ B_{n-1}$$

.894/19.32/0.897 (55-69)

$$(5.12)\quad G_{gg} = -621.82 + \underset{(6.57)}{0.0194}\ H + \underset{(3.91)}{0.1741}\ W$$

.981/16.30/1.019 (55-69)

$$(5.13)\quad G_n = G_{ed} + G_{sd} + G_{nd} + G_{ds} + G_{gg}$$

$$*(5.14)\quad Y_p = 1597.45 + \underset{(49.99)}{0.8081}\ Y^* - \underset{(-2.28)}{1.0734}\ W$$

.999/122.65/1.587

In (5.1), business income tax receipts, T_{bd}, depends negatively on the money wage rate. The higher is the latter,

the lower is net business income on which the tax falls. The dummy variable U_{tr} equals 0 for years previous to 1968, 1 for years beginning with 1968 when new tax rates became effective. Eq. (5.1) can be written in the form $T_{bd} = a + (b + c\ U_{tr})Y^* + dW$ which shows more clearly the effect of the new tax rates.

Import duties, T_{im}, depend partly on the variable R_{dm} (the percentage of the regular tariff rate applicable to imports from the United States, multiplied by the ratio of imports from the United States to total imports) in (5.4). In (5.5), receipts from "other indirect taxes" are explained by current exports and current GNP net of exports, since different tax rates apply to those categories of goods. Eqs. (5.2)-(5.3) are straightforward, and (5.6) simply determines the tax receipts of the national government, T_n, as a function of total tax collections.

Expenditures for economic development, G_{ed}, is explained in (5.8) in terms only of tax receipts plus the change in the outstanding debt of the national government. (In the earlier version of this submodel, we used government debt in the specification, which does not seem appropriate since the dependent variable refers to the expenditures of the national government only.)

The equation for social development expenditures, (5.9), is in effect a reduced form; so is (5.10) for defense

expenditures. "General government" expenditures are determined in (5.12) by population size and the money wage rate.

The equation for personal income, (5.14), is included here to determine the independent variable in (5.2). An explanation for the negative coefficient of W would be that a higher W implies lower employment and lower profits, other things equal.

Assumptions on the Exogenous Variables

The variables exogenous to the submodel are all determined in the basic model except for the following: population H, end-of-year debt of the national government B_n, ΔB_n, R_{dm} and U_{tr}. In order to make projections through 1976 we need to specify the behavior of these variables over the projection period.

For H we assume an annual growth rate of 3.0 per cent, which is somewhat less than the 3.1 per cent considered by the Bureau of Census and Statistics. We expect that the current efforts directed at family planning should show a dampening effect on population expansion in the next few years.

For B_n, we assume a growth rate of 20 percent for the presidential election year 1973 and 8 percent for the non-presidential election years. These rates approximate but are

lower than the 23.5 percent and 8.2 percent average growth rates of B_n for those types of years observed during the past twenty years. The assumed lower rates are based on the expectation that the more intensive efforts at tax collection currently being pursued will improve tax yields and consequently reduce the need to incur obligations in the future.

R_{dm} is equal to $tr(\frac{M_{us}}{M})$ where tr is the tariff rate applicable to imports from the United States and $\frac{M_{us}}{M}$ the ratio of imports from the United States to total Philippine import; tr is equal to 0.90 for 1965-1973 and 1.00 for 1974 and onwards. $\frac{M_{us}}{M}$ has fluctuated between 0.34 in 1967 and 0.28 in 1970. On the expectation that the recent devaluation of the dollar will make United States products more competitive, we have assumed a ratio of 0.30 for $\frac{M_{us}}{M}$ for 1972-1976.

Finally, U_{tr} = 1 for the entire 1972-1976 period.

6. Projections

Here we present the values of the endogenous variables over the period 1972-76 as projected by the assumptions stated in the preceding sections. In the case of the variables in the basic model we also report projected values at 5-year intervals up to the year 2001 to see whether the results would be credible. As it turns out, the basic model

in its present version does not appear suitable for long-term projections.

As earlier stated, we assume an annual growth rate of 9 per cent for money supply Z, starting from its 1971 value. Data for the money wage rate W is not yet available for 1971, and we have estimated this by means of eq. (1.4) to start off the solution of the basic model for 1972. The value of capital stock K for 1972 is based on the NEC's advance estimate for investment in 1971. The import price index P_m is assumed to increase 2.5 per cent each year from its 1971 value. With these data inputs (and X and P_x from the foreign trade submodel, which uses first differences for its projections), the model generates solutions through 1976.

For the period 1977-2001 we have assumed simply that X increases 7.5 per cent and P_x 2.5 per cent annually in order to solve the basic model.

Projected Values of Endogenous Variables
(BASIC MODEL)

	1972	1973	1974	1975	1976	Average Growth Rate
Y	22441	24703	25054	26483	27989	5.68
N	13796	14364	14968	15605	16275	4.22
P	220.5	236.0	252.9	271.5	292.0	7.27
W	2710.1	2892.7	3100.0	3332.4	3591.6	7.29
I	3717	3985	4218	4447	4678	5.92
T*	5258	5950	6712	7577	8564	12.97
C_g	2160	2287	2412	2541	2674	5.48
A	(189)	(200)	(211)	(223)	(236)	5.71
C_p	17715	18693	19773	20933	22166	5.76
K	58914	62631	66616	70834	75281	6.32
M*	9297	10468	11400	12337	13321	9.42
T	2385	2521	2654	2791	2933	5.31
M	3694	4057	4310	4551	4793	6.74
X*	9297	10468	11400	12337	13321	9.42
Y*	49482	55939	63362	71901	81728	13.36
C	19875	20980	22185	23474	24840	5.73
s	.1144	.1149	.1145	.1136	.1125	(0.42)
100 P/W	8.14	8.16	8.16	8.15	8.13	(0.03)

	1987	1986	1991	1996	2001	Average Growth Rate
Y	36764	48127	62437	79835	99908	5.21
N	20174	25230	31608	39373	48338	4.46
P	430	652	1007	1573	2472	8.97
W	5375	8280	12950	20416	32309	9.23
I	6067	7727	9548	11300	12473	3.96
T*	16269	31723	62553	123281	239991	14.31
C_g	3471	4488	5752	7279	9035	4.98
A	- 310	- 406	- 526	- 673	- 842	- 5.21
C_P	29372	38956	51449	67365	87046	5.62
K	101209	134776	177019	228866	287595	5.48
M*	21241	34501	56039	91022	147845	10.19
T	3781	4864	6211	7837	9706	4.90
M	6756	9698	13923	19989	28696	7.50
X*	21241	34501	56039	91022	147845	10.19
Y*	158176	313858	628818	1255878	2470273	14.64
C	32843	43444	57201	74644	96081	5.55
s	.11	.10	.08	.07	.04	-4.34
100 P/W	8.00	7.87	7.78	7.70	7.65	

Projected Values of Endogenous Variables (Foreign Trade Sector)

	1972	1973	1974	1975	1976	Average Growth Rate
X_{ll}	3807.6	3977.1	4153.4	4336.7	4527.4	4.42
X_{cp}	715.2	750.7	786.8	823.5	860.8	4.74
X_{co}	457.6	542.4	596.7	635.8	668.1	10.04
X_{cc}	945.5	964.7	951.5	905.3	825.5	(3.26)
X_{dc}	70.1	71.1	74.6	80.4	88.3	5.98
X_{ab}	41.6	30.8	17.1	0.6	(18.7)	(845.9)
X_{pl}	79.9	88.7	98.1	108.3	119.2	10.52
X	2738	3016	3184	3342	3505	6.39
P_x	340.3	349.7	359.4	369.8	380.6	2.84
M_s	771.1	851.0	906.7	959.7	1012.9	7.07
M_r	2426.7	2614.5	2850.5	3126.8	3438.6	9.11
M_k	596.2	690.1	786.5	891.1	1005.3	13.96
M_c	286.1	287.5	152.4	(40.5)	(277.8)	(189.75)

Projected Values of Endogenous Variables (Production Sector)

	1972	1973	1974	1975	1976	Average Growth Rate
Y_a	5799	5915	6461	6999	7544	5.46
N_a	7669	7983	8273	8604	8935	3.11
P_a	266	304	313	321	332	4.64
Y_q	583	697	809	919	1027	12.19
N_q	90	108	125	142	159	12.26
P_q	208	215	222	229	236	2.56
W_q	3278	3605	3937	4276	4620	7.16
Y_n	3423	3475	3584	3728	3895	2.62
N_n	1575	1591	1624	1669	1721	1.79
P_n	229	227	232	240	251	1.87
Y_c	585	656	712	765	819	7.03
N_c	360	402	461	479	506	7.17
P_c	210	223	237	252	269	5.10
Y_t	822	865	915	971	1034	4.72
N_t	488	512	539	570	605	4.41
P_t	165	174	185	196	209	4.36
W_t	4056	4318	4607	4937	5309	5.56
Y_r	2841	2959	3111	3280	3461	4.04
N_r	1662	1714	1787	1872	1967	3.43
P_r	180	203	216	228	240	5.99
W_r	3086	3227	3391	3560	3728	3.86
Y_s	4823	5063	5312	5570	5837	3.90
N_s	1952	2054	2159	2269	2382	4.08
P_s	178	188	200	212	226	4.91

Projected Values of Endogenous Variables
(Government Submodel)

	1972	1973	1974	1975	1976	Average Growth Rate
T_{bd}	626	566	652	946	1091	16.52
T_{pd}	451	464	540	627	727	12.85
T_{bi}	1192	1366	1566	1797	2062	14.69
T_{im}	579	654	713	778	836	9.60
T_{oi}	178	202	226	253	283	12.20
T_{n}	3968	4493	5071	5728	6477	13.03
T_{ao}	942	1241	1374	1332	1478	12.61
G_{ed}	1520	1978	1924	2150	2408	12.77
G_{sd}	1729	1970	2068	2258	2468	9.35
G_{nd}	845	944	1055	1179	1320	11.80
G_{ds}	450	488	589	638	690	11.38
G_{gg}	615	670	730	795	865	8.88
G_{n}	5159	6051	6366	7019	7750	10.79
Y_{p}	38675	43697	49473	56124	63787	13.32

7. Summary Remarks

In this paper we have presented a model of the Philippine economy consisting of eqs. (1.1)-(1.17), (2.1)-(2.9), (3.1)-(3.16), (4.1)-(4.27) and (5.1)-(5.14), a total of 83 equations of which 62 were estimated; 17 equations are identities or definitions, and 4 are merely posited for projection purposes. These 4 pertain to the determination of current imports (1.11), net factor income from abroad (1.8), employment in the mining sector (4.5) and the price index for copper concentrates (4.7). The last is in effect simply a function of time, and if we consider the exogenous variables specific to the foreign trade submodel as functions of time also, we would have the following 10 variables exogenous to the complete model: P_m, B_g, B_n, R_r, R_d, L_{cb}, A_f, R_{dm}, H, t.

For projection purposes we took money supply as predetermined; otherwise we would have had to make separate assumptions on all the determinants of money supply in (2.1) and (2.3).

Except in a few cases, the results of the projections through 1976 seem generally within possible ranges. Abaca exports are projected to negative values in the later years, indicating the weakness of the corresponding equation. Imports of consumer goods, which are calculated residually,

also turn out negative. In the production submodel, output and employment in the transportation sector are projected to fall in absolute terms, while the mining sector's projections appear to be on the high side. The growth rates projected for the manufacturing sector seem disturbingly low.

The projections of the variables in the basic model over the period 1977-2001 yield somewhat lower growth rates for aggregate output and capital stock, compared to the period 1972-76. Growth rates for the price level and the wage rate are higher. The saving fraction falls from 0.11 to 0.04 over the 25-year period, a result due mainly to the assumptions made on imports relative to exports and the specification of the investment function (though of course other specifications play a role). What one may conclude from this particular result is that, since we may reasonably expect the saving fraction not to fall secularly, the performance of the economy would be somewhat better than indicated by the long-term projections.

It should be emphasized that projections are not forecasts. If projected values fall short of targets, and the underlying assumptions are taken to be correct, the fact should simply serve as a signal to policymakers that new directions in policy may be necessary if targets are to be met.

Appendix A. List of Symbols

All values are expressed in million pesos at 1955 prices, except where (*) appears at the end of a definition, in which case the variable is at current prices. All flow variables are defined over the calendar year. All price indices have base year 1955, so that (e.g.) P = 100 for 1955. The unit for employment and population is a thousand persons.

A : net factor income from abroad

A_f : $F_r - F_{r_{-1}} + M^* - X^*$, a variable implicitly defined in this identity (*)

B_g : internal debt outstanding of the government, end of year (*)

B_n : internal and external debt outstanding of the national government, end of year (*)

ΔB_n : change in B_n during the year (*)

D_{tp} : private time deposits in the commercial banking system and savings banks, average over the year (*)

F_r : international reserves, end of year (*)

G_h : national government expenditures for h (= ds for debt service, ed for economic development, gg for general government, nd for national defense, sd for social development) (*)

H : population

I : gross domestic investment

K : capital stock

K_n : deflated book value of fiscal assets in manufacturing, beginning of the year

ΔK_n : change in K_n during the year

L_{bp}^a : private domestic credits of the commercial banking system, average of beginning and end of year figures (*)

L_{cb} : Central Bank loans and advances to the commercial banking system, end of year (*)

M : imports of goods and services

M^* : imports of goods and services (*)

M_c : imports of consumer goods

M_k : imports of capital goods

M_r : imports of raw materials

M_s : imports of services

N : average of the May and October employment survey figures

N_i : employment in sector i (= a for agriculture, c for construction, n for manufacturing, q for mining and quarrying, r for commerce, s for services, t for transport, storage, communications and utilities)

P : implicit price index for GNP

P_i : implicit price index for sector i (= a for agriculture, c for construction, n for manufacturing, q for mining and quarrying, r for commerce, s for services, t for transport, storage, communications and utilities)

P_j : export price index of commodity j (= ab for abaca, cc for copper concentrates, co for coconut oil, cp for copra, dc for dessicated coconut, ll for logs and lumber, pl for plywood, su for sugar)

π_j^o : price of export good j in 1955

R_b : weighted average of interest rates charged by banks, in percentage units

R_d : CB rediscount rate, average over the year, in percentage unit

R_{dm} : percentage of regular tariff rate applicable to imports from the United States multiplied by ratio of imports from the US to total imports

R_r : ratio of required reserves to total deposits in the commercial banking system, average of beginning and end of year figures, in percentage units

S : stands for $\sum_{\tau=0}^{t-1}$, the time subscript of the variable following it being suppressed, e.g. $SP_u = \sum_{\tau=0}^{t-1} P_{u\tau}$

s : saving ratio

T : direct and indirect taxes deflated by P

T* : direct and indirect taxes (*)

t : time variable (= 0 for 1950, 1 for 1951, 2 for 1952, etc.)

T_k : receipts from k (= ao for "all other" national taxes, bd for direct income taxes from business enterprises, bi for indirect taxes from business enterprises, im for import duties, oi for "other indirect taxes", pd for direct income taxes of persons) (*)

T_n : total tax receipts of the national government (*)

U_{tr} : dummy variable for a change in tax rates (=1 for years beginning 1968, 0 for years prior to 1968)

W : annual money wage rate

W_i : annual money wage rate in sector i (= a for agriculture, n for manufacturing, q for mining and quarrying, r for commerce, t for transport, storage, communication and utilities)

X : exports of goods and services

X* : exports of goods and services (*)

X_j : exports of commodity j (= ab for abaca, cc for copper concentrates, co for coconut oil, cp for copra, dc for dessicated coconut, ll for logs and lumber, pl for plywood, su for sugar; all in thousand metric tons except for ll and pl, in thousand board feet)

X_{np} : exports of non-principal commodities

X_s : exports of services

Y : gross national product

Y^* : gross national product (*)

Y_{cp} : total coconut production in copra terms, in thousand metric tons

Y_i : net value added in sector i (= a for agriculture, c for construction, n for manufacturing, q for mining and quarrying, r for commerce, s for services, t for transport, storage, communication and utilities)

Y_l : domestic output of logs, in million board feet

Y_p : compensation of employees plus entrepreneurial and property income of persons(*)

Y_{pl} : domestic production of plywood, in thousand square feet

Z : average of end-of-month money supply (currency plus demand deposits) from October of the previous year to September of the current year (*)

Z_a : available reserves of the commercial banking system, average of beginning and end of year figures (*)

Z_b : monetary base, equal to Z_c plus Z_a (*)

Z_c : currency in circulation, average of end-of-month figures over the year (*)

Z_m : stock of money, equal to Z_c plus private demand deposits, average over the year (*)

Appendix B. Alternative Calculations for X and P_x

The National Income Branch of the National Economic Council has used until 1969 domestic price indices of principal export commodities in Manila furnished by the Central Bank in deriving the price deflator for total exports. To obtain total exports in 1955 prices in the national accounts, the current dollar value is converted to pesos using the effective exchange rate for exports and deflated by the export price index.

Because the movement of domestic prices of export products do not match exactly the export prices, values of X and P_x implied by eqs. (3.8) and (3.9), respectively, are not the same as the NEC figures for the period of observation. The two sets of values are tabulated below. The surprising discrepancy between the two X values for 1955 is explained by the fact that until 1958 the Central Bank has provided slightly different values of total value of exports (FOB) in dollars for its global balance of payments summary (the NEC source) and its table on external trade as presented in the Statistical Bulletin (our source).

Year	Computed X using eq. (3.8)	NEC total exports in 1955 prices	Computed P_x using eq. (3.9)	NEC price deflator for total exports
1950	757	767	124.3	122.9
1951	902	841	132.6	126.8
1952	999	979	100.6	100.8
1953	942	924	119.1	123.5
1954	1048	1030	110.2	108.5
1955	1151	1131	100.0	100.0
1956	1208	1175	97.8	104.1
1957	1106	1103	97.7	109.2
1958	1050	1055	101.7	120.8
1959	986	985	110.7	136.4
1960	1170	1167	120.2	133.0
1961	1192	1193	133.0	138.1
1962	1228	1186	174.6	167.1
1963	1540	1447	179.1	200.0
1964	1716	1582	183.8	194.2
1965	2086	1849	207.0	199.6
1966	2298	2319	204.5	197.7
1967	2174	2175	209.2	216.2
1968	1842	1845	223.3	243.0
1969	1860	1874	228.0	233.3

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