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A MACRO-ECONOMIC MODEL OF THE PHILIPPINES, 1950-1969

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1. Introduction

In this paper we present a simple quantitative model of the Philippine economy for the period 1950-1969. Our aim was to construct a framework that could be used for medium-term projection purposes even after the February 1970 *de facto* devaluation of the peso. A secondary objective was to make the model sufficiently simple so that it could be elaborated with various submodels (pertaining to the monetary, foreign trade, government and production sectors, etc.) in later stages of our work. In pursuit of this aim, we have tried to use as few variables as possible consistent with our primary objective.

This basic model consists of 8 structural equations and 3 identities, estimated by ordinary least squares[2/] using annual data for 1950-1969 except the following: The employment equation uses only 1950-1968 data because of incomplete employment data for 1969.[3/] For the same reason, the production function is also based only on 1950-1968 data. Finally, the tax-yield equation, which involves the current value of imports as an explanatory variable, uses only 1955-1969 data. The reason is that free trade relations with the United States before 1955 made customs collections during the years 1950-1954 quite incomparable with those of later years.

After we had completed most of our work on the model, the National Economic Council issued revised national income accounts for 1968

and 1969 in addition to preliminary figures for 1970. We have not used the new data in our estimates, as the different sources and methods employed in arriving at the 1968 and 1969 figures make them non-comparable with the earlier 1950-1967 series. We plan to re-estimate the model when new 1950-1967 figures become available. Meanwhile it is necessary to warn the reader that all the estimates given in this paper are based on data which are in the process of revision and improvement.

2. The Model

Endogenous Variables

Y = GNP at 1955 prices; in million pesos

N = average of the May and October employment survey figures; in thousands

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

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

I = gross domestic investment at 1955 prices; in million pesos

T = direct and indirect taxes, divided by .01P; in million pesos

C_p = private consumption expenditures at 1955 prices; in million pesos

C_g = government consumption expenditures at 1955 prices; in million pesos

C = total consumption

K = capital stock at 1955 prices at beginning of year; in million pesos ($K_{1950} = 2.58\ Y_{1950}$)[4/]

A = net factor income from abroad at 1955 prices; in million pesos

Exogenous variables

W = annual money wage rate, computed as equal to the daily wage rate of unskilled industrial workers in Manila multiplied by 250; in pesos

$\bar{Z}$ = average of end-of-month money supply (currency plus demand deposits) from October of the previous year to September of the current year; in million pesos

X = exports of goods and services at 1955 prices; in million pesos

P_x = implicit price index for exports; P_x = 100 for 1955

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

Notational definitions

$P^m = 100\ P/P_m$

$X^* = .01\ P_x\ X$ (the current value of exports)

$M^* = .01\ P_m\ M$

$T^* = .01\ PT$

$Y^* = .01\ PY$

Structural equations (Numbers underneath regression coefficients are their t-values.)

(1) $Y = -2443.5 + \underset{(4.18)}{.9590\ N} + \underset{(4.39)}{.1994\ K}$

$R^2 = .991,\ s = 329.1,\ D.W. = .713$

(2) $N = 4112.8 + \underset{(16.62)}{.5877\ Y} + \underset{(2.29)}{13.11\ P} + \underset{(-4.46)}{2.561\ W}$

$R^2 = .990,\ s = 168.4,\ D.W. = 1.369$

(3) $P = 85.37 + .0043\ Y + .0423\ Z$
(-7.71) (18.22)

$\bar{R}^2 = .993, \quad s = 1.840, \quad D.W. = 1.828$

(4) $M = -2811.3 + .0885\ (Y-X)_M + .4431\ X + 7.244\ P_x + 20.75\ P$
(2.28) (2.04) (2.87) (2.88)

$\bar{R}^2 = .935, \quad s = 202.8, \quad D.W. = 1.988$

(5) $I = -251.24 + .1680\ Y + .5281\ M + 8.864\ P - 1.095\ W$
(9.09) (2.94) (2.47) (-3.51)

$\bar{R}^2 = .987, \quad s = 91.13, \quad D.W. = 2.215$

(6) $T^* = -72.627 + .0923\ Y^* + .0824\ M^*$
(10.74) (2.20)

$\bar{R}^2 = .996, \quad s = 47.64, \quad D.W. = 1.160$

(7) $C_p = 1902.8 + .8895\ (Y-T) - 27.59\ P + 1.087\ W$
(25.08) (-5.21) (2.31)

$\bar{R}^2 = .996, \quad s = 156.2, \quad D.W. = 1.694$

(8) $C_g = -80.116 + .9391\ T$
(33.45)

$\bar{R}^2 = .983, \quad s = 54.25, \quad D.W. = 1.170$

Identities

(9) $C = C_p + C_g$

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

(11) $A = Y - I - C + M - X$

We are reporting the Durbin-Watson statistics above for the sake of information, bearing in mind that this statistic was designed for regression equations where the explanatory variables are all exogenous. It should also be clear that the estimated equations are linear approximations to presumably nonlinear relationships, and caution should therefore be exercised in drawing inferences

from the model on the basis of assigned values to the variables that are far beyond the range of observations. For example, it would make no sense to set $K = 0$ and $N = 0$ and then conclude that output would be negative.

According to eq. (1) the marginal productivity of labor is about ₱960 per year (at 1955 prices) and that of capital is .20, both of which seem "reasonable" on the basis of micro-information. (The money-wage rate in 1969 was ₱1,220 at 1955 values.) The low Durbin-Watson led us to consider the possibility that the residual $Y - \hat{Y}$ might be positively correlated with $\Delta Y/I_{-1}$ indicating that relatively low values of $\Delta Y/I_{-1}$ might mean excess capacity during the current year, in which case $Y - \hat{Y}$ would be low or negative. Given a positive correlation, the hypothesis of excess capacity could then be tested in various ways. As it turned out, however, there was no correlation between the two. We also tried the usual alternative specifications, but the resulting coefficients and implications were generally unacceptable. One approach we thought potentially interesting was to take N, I_{-1} and K_{-1} as explanatory variables (alternatively, N, I_{-1}, I_{-2} and K_{-2}), but this also gave poor results.

Eq. (2) may be considered as a labor demand function: the amount of employment depends not only on the output to be produced but also on the money wage rate and the price level, in accordance with standard theoretical considerations. Eq. (2) indicates that *ceteris paribus*, employment is reduced by about 256 thousand if the annual wage rate is increased by ₱100 (or ₱0.40 per day on the basis of 250 working days per

year), but since output decreases with employment by eq. (1), the fall in employment would be greater. As the reduced-form equations given in the next section will show, the total impact is a reduction in employment by over half a million.

The price equation (3) provides a good explanation of P, which may be called the general price level, in terms of money supply (lagged three months)[5] and real output. It implies that a ₱1 million increase in the money supply would have no effect on the general price level provided there is a concomitant increase in real output of about ₱10 million.

The import equation (4) is somewhat unusual. According to this, imports are determined by real income less exports, the export price index and exports, and the ratio of the general price level to import prices. We felt that export earnings partly determined imports, for the monetary authorities tend to be more liberal in their policies regarding importations when export earnings are high. Accordingly, we decided to split the usual explanatory variable Y into two parts, Y-X and X. We also added P_x and P^m to take account of "foreign exchange budget" and relative price effects. As we had expected, the coefficient of X is much greater than that of Y-X,[6] and the coefficients of P_x and of P^m are both positive. The higher is the general price level, the higher is the level of imports because these become relatively cheaper; conversely, higher import prices lead to lower imports.

Since investment is undertaken for the output it would produce, its profitability depends positively on the price level and negatively on the money wage rate. This is reflected in eq. (5) which makes investment

a function of P and W. The volume of imports is another determinant of investment, for machinery and capital equipment are mostly imported, but the major determinant is real income.

The tax-yield equation (6) includes imports as an explanatory variable, considering that a large proportion of indirect taxes is collected through customs. In recent years, the ratio of customs collections on imports to total taxes has averaged about 19%. Current values of the variables are used for obvious reasons.

We think the consumption function (7) is rather interesting. While it gives a marginal propensity to consume of .89, which seems credible, it also takes account of the effects of money wage and price level changes. We expect that an increase in the money wage rate increases consumption, as wage-earners are supposed to have higher propensities to consume compared to rentiers. Also, a rise in the price level reduces consumption, for if disposable income and the money wage are held fixed, an increase in prices can only reduce the level of consumption.

We tried a dummy variable in eq. (8) for Presidential election years, but the result was not significant. Neither was a dummy variable for biennial election years.

Our definition of K in eq. (10) in terms of cumulated gross investment seems reasonable for the sample period, considering World War II destruction of the country's capital stock. Also, we are assuming that investment in the current period is not productive until the succeeding period, which is more realistic than the alternative assumption that capital stock