MODELLING THE DEVELOPING ECONOMY: THE PHILIPPINES

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I. INTRODUCTION

IN recognition of the important uses to which macroeconomic models can be put, various attempts have been made over the years to model the developing economy.[1] Some of these models have been inspired by the assumption that the developing economy is chiefly characterized by supply bottlenecks. Productive backwardness is admittedly a dominant feature of developing countries. In addition, however, there is also the problem of insufficient aggregate demand evidenced by the existence of widespread underutilization of capacity; but this aspect has not been taken into account in the supply-oriented models. Realization of the importance of short-run factors has prompted the construction of a number of Keynesian models for developing countries. Unfortunately, however, the structures of these models have been transplanted from aggregate-demand models of developed economies with little or no adjustments for the special conditions in the developing countries. Consequently, numerous shortcomings in the resulting specifications are observed, ranging from ignoring the impact of quantitative restrictions to overlooking the possibility of capacity constraints on the supply side.

In this paper, a simple macroeconomic model of a developing economy is presented. Three distinctive features of this model may be noted. First, output is determined by factors on both the supply and demand sides rather than being solely supply-determined or demand-determined. Second, the real and monetary sectors are linked, not through the rate of interest, but through including liquidity in the consumption function and bank credit in the investment function. Third, import dependence of domestic production is emphasized. Historical simulation has been performed with the model for the Philippines for the period 1960–81 and the performance of the model may be considered to have been satisfactory.

II. THE MODEL

The model is structured in five blocks. Consumption and investment expendi-

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[1] See, for example, Chenery and Strout [8], Marwah [23], Behrman and Klein [2], UNCTAD [30], Beltran del Rio and Klein [3], Behrman [1], Persad [28], Otani and Park [25], Ghosh and Kazi [13], Chakraborty and Guha [7], Bharadwaj [4], Blitzer [5], Shishido [29].

tures are contained in the first block. The production equations are developed in the second block. The third block specifies the monetary sector. The fourth block contains the government sector while the fifth block presents the foreign trade sector.

The model consists of eight behavioral equations and nine definitions and identities. There are seventeen endogenous and nineteen predetermined variables of which eight are lagged endogenous variables. A variable with an asterisk is a predetermined variable while a variable without an asterisk is an endogenous variable. All variables are measured annually and refer to the current time period unless otherwise indicated by subscripts. All price variables are in index form.

Behavioral equations:

I. Expenditures

(1) $CP=\phi_1(YD, INT^*, L, CP^*_{-1})+u_1$

(2) $DFI=\phi_2(Y\cdot P, INT^*, CR^*, RE^*, MRIK, G^*, CNI^*_{-1})+u_2$

II. Production

(3) $Y^{P_0}=\phi_3(N^*, CNI)+u_3$

(4) $Y/Y^{P_0}=\phi_4(CNI, MRIK, Y)+u_4$

III. Monetary sector

(5) $L/P=\phi_5(INF, Y)+u_5$

IV. Government sector

(6) $T=\phi_6(Y\cdot P)+u_6$

V. Foreign trade sector

(7) $MC=\phi_7(X^*_{-1}, CP, G^*, PMC^*, P, EXR^*, MC^*_{-1})+u_7$

(8) $MRIK=\phi_8(X^*_{-1}, DFI, PMRIK^*, EXR^*, MRIK^*_{-1})+u_8$

Definitions and identities:

(9) $YD=Y-T/P$

(10) $CNI=CNI^*_{-1}+DFI$

(11) $INF=100(P-P^*_{-1})/P^*_{-1}$

(12) $M=MC+MRIK$

(13) $GDEF=G^*-T$

(14) $\Delta FER=X^*-M\cdot PM^*+FC^*$

(15) $FER=\Delta FER+FER^*_{-1}$

(16) $\Delta L=\Delta FER+GDEF+\Delta CR^*$

(17) $L=L^*_{-1}+\Delta L$

Variables are denoted as follows.

CNI = cumulative net fixed investment at constant price
CP = personal consumption expenditure at constant price
CR^* = bank credit to the private sector

ΔCR^* = change in bank credit to the private sector, i.e., $CR^* - CR^*_{-1}$
DFI = net domestic fixed investment at constant price
EXR^* = exchange rate (peso/U.S.$)
FC^* = net foreign capital inflow
FER = foreign exchange reserves
ΔFER = change in foreign exchange reserves, i.e., $FER - FER_{-1}$
G^* = government expenditure at current price
$GDEF$ = government deficit at current price
INF = percentage rate of inflation
INT^* = nominal market rate of interest
L = money supply defined as currency in circulation plus demand deposits
ΔL = change in money supply, i.e., $L - L_{-1}$
MC = imports of consumer goods at constant price
$MRIK$ = imports of raw materials, intermediate goods, and capital goods at constant price
M = total imports at constant price
N^* = total labor supply
P = general price level (1972 constant)
PM^* = price of total imports in domestic currency (1972 constant)
PMC^* = price of imported consumer goods in foreign currency (1972 constant)
$PMRIK^*$ = price of imported raw materials, intermediate goods, and capital goods in foreign currency (1972 constant)
RE^* = retained earnings plus depreciation allowance of the corporate sector
T = total tax revenue at current price
X^* = total exports at current price
Y^{P_0} = potential output at constant price
Y = gross domestic product at constant price
YD = personal disposable income at constant price
u_i = error term

Keynes, among others, envisaged that the real and monetary sectors were linked through the rate of interest. However, Keynesian reasoning in this regard is inappropriate in the context of a developing economy for two reasons. First, although the rate of interest may influence investment decisions, it does not act as a price that rations the supply of credit. Credit rationing according to some official policy directive is resorted to in such circumstances. Second, although the rate of interest may influence household decisions relating to consumption and saving, the rate of interest is not determined in the money market (because of its highly fragmented nature) but is administered by the central bank.

In view of the inapplicability of Keynesian logic to a developing economy, we consider the interaction between the real and monetary sectors to take place in the following way. First, the virtual absence of a market for financial assets means that the nonbusiness private sector's best alternative to holding cash balances is to buy consumer durables. That is, if individuals end up with more money than they wish to hold, they will spend the excess money to purchase consumer durables. In other words, the disequilibrium in the money market spills over to the commodity market. This is captured by including the supply of money in the household consumption function. Second, a credit rationing mechanism determines the volume of credit from the banking system to the private sector. This is incorporated by including credit as an argument in the investment demand function.

In block I, real personal consumption and real domestic fixed investment are determined. It is postulated that consumption is a distributed lag function of disposable income; hence personal disposable income and consumption of the previous year enter as arguments in the consumption function. Insertion of liquid assets (as represented by L) into the consumption function is justified on two grounds—liquid assets may either be regarded as a proxy measure for wealth which influences consumption (Zellner and Geisel [32]) or as providing a direct incentive to the consumer to spend.[2] The interest rate is also included as an explanatory variable.

Domestic fixed investment is the sum of private and public fixed investment. In considering net fixed private investment it is proposed that at each time period there is some desired level of capital stock which is different from the actual level. It is assumed that actual capital stock adjusts toward desired capital stock in a Cagan-Nerlove process (Cagan [6]; Nerlove [24]). The desired stock of capital of private investors is assumed to be determined according to the neoclassical theory of investment (Jorgenson and Siebert [17]), and therefore, the rate of interest and the value of output are included as arguments in the investment function. In a developing economy, however, the speed with which the actual capital stock adjusts to the desired capital stock is likely to be influenced by the availability of finance and imported inputs. Hence, credit to the private sector, retained earnings of business and imports of investment goods also enter the investment function as independent variables. Government expenditure is included as an explanatory variable to incorporate the contribution of public fixed investment to total domestic fixed investment.

Potential and actual output are determined in block II. Potential output is hypothesized to be determined by the capital stock and total labor supply. In the absence of reliable data, capital stock is proxied by cumulative net investment. The formulation of the potential output function explicitly recognizes a positive elasticity of substitution between capital and labor. The Wharton method (Klein and Summers [19]) has been used here to estimate full-capacity output.[3]

[2] Conceptually real money supply is the appropriate variable. However, nominal money supply has been used here to keep the model simple for simulation purposes. The same reasoning underlies the use of nominal values of RE^* and G^* in equations (2) and (7).

[3] Alternative measures suggested by Paish [26] and Godley and Shepherd [14] are also available for estimating capacity output. We have, however, selected to use the Wharton method because, as Hilton and Dolphin remark, "...we favour, as a capacity measure, a Wharton type index on the grounds that it is not very far from a theoretical concept of capacity utilisation,..." [15, p. 199].

In a developing economy, underutilization of capacity can be primarily attributed to a relative shortage of imported inputs (Winston [31]). In view of this, imports of raw materials and intermediate goods becomes a major explanatory variable in the capacity utilization function. Total expenditure on domestic goods is used to capture the influence of demand on the rate of capacity utilization. The justification for including a proxy for the capital stock as an argument is that, given the relative shortage of foreign exchange to import intermediate goods and raw materials to utilize existing capacity, it is likely that the larger the stock of capital the lower will be the rate of capacity utilization. Since potential output is determined separately, actual output is obtained from the equation for capacity utilization.[4]

The demand function for real cash balances is specified in block III. Both the neo-Fisherian and Keynesian hypotheses relating to the demand for money postulate that there is a desired demand for money which is a function of the level of economic activity and the opportunity cost of holding money (OCHM). In the context of a developed economy the rate of interest represents the OCHM. Many scholars, however, question the applicability of Keynesian monetary theory to developing countries and argue that, in view of the underdeveloped nature of the financial sector of these countries, the desired holdings of money are likely to be insensitive to the interest rate on financial assets and will predominantly be transactions balances. Nevertheless, following Park [27] and Lioi [22] it is argued here that financial underdevelopment does not negate the dependency of the demand for real cash balances on the OCHM. Rather, in the absence of a variety of financial assets, the asset choice of the owners of wealth in developing countries will be restricted to holding either money or real assets (such as property, consumer durables, gold and jewelery, etc.). In this situation, the OCHM can be approximated by the expected rate of inflation. It is assumed that the expected rate of inflation is equal to the current rate of inflation.[5] Hence, along with the level of economic activity, the current rate of inflation is included as an argument in the demand for money function.

An increase in the rate of inflation implies a rise in the prices of real assets and hence a fall in their rates of return; in other words, an increase in the inflation rate means a fall in the OCHM, and individuals will respond to this by increasing their demand for real balances, and vice versa.[6] Monetary equilibrium

4 It may be noted that inclusion of total expenditure as an explanatory variable in the capacity utilization function implies that the level of output produced is consistent with the level of aggregate demand in the economy. In other words, implicit fulfillment of the condition $Y=CP+DFI+G^*+X^*-MC-MRIK$ ensures equilibrium in the commodity market. The GNP identity has therefore not been explicitly introduced in the model.

5 It is assumed that price expectations are formed according to the extrapolative hypothesis and further that the elasticity of expectations is equal to unity.

6 The hypothesis that the demand for money balances is likely to be an increasing function of the inflation rate can also be arrived at on the basis of the quantity theory approach to inflation. Assume that there is a stable demand function for real balances. An increase in the supply of money will lead to a rise in the inflation rate. Since the general price level will have risen, individuals will attempt to restore their real balance positions by holding more money balances. See Johnson [16, pp. 122–24].

is also ensured in this process. Thus, starting from a position of equilibrium in the money market, let us suppose an increase in the supply of money occurs. As a result, the public will end up with more money balances than they wish to hold, and the excess balances will be spent on purchasing real assets. If this can stimulate an increase in real output, then monetary equilibrium will be restored through an increase in transaction balances held by the public. Alternatively, if real output does not increase, the rise in the inflation rate that results will induce the public to hold more real balances than before (since the OCHM has fallen) and equilibrium in the money market will thereby be reestablished.[7]

Nominal tax revenue is determined in block IV by nominal aggregate output. Imports are determined in block V. Total imports are divided into two categories: (i) imports of consumer goods and (ii) imports of raw materials, intermediate goods, and capital goods. For both categories of imports it is assumed that the actual level diverges from the desired level and also that actual imports adjust toward desired imports in a Cagan-Nerlove process. It is hypothesized that the desired level of imports of consumer goods is functionally related to private and public consumption expenditures, the exchange rate, the prices of imports and import-competing goods. Since a price series for import-competing goods is not available, the general price level is used as a proxy.[8]

In a developing country, restrictions are usually imposed on imports. Hence, the speed with which actual imports adjust toward desired imports will vary with changes in import restrictions; an increase in restrictions will slow down adjustment, and vice versa. Import control policies have been proxied by export proceeds of the previous year. The reasoning is that import restrictions are likely to vary with the foreign exchange position of the country; an improvement in the foreign exchange position is likely to lead, with a lag, to a relaxation of import controls, and vice versa. In terms of our proxy variable, the higher the value of exports of the previous year the less the restrictions on imports are likely to be, and vice versa. Hence, the value of exports of the previous year is included as an argument in the import demand function for consumer goods.

In the specification of the import demand function for investment goods it is postulated that the desired level of imports is functionally related to total investment expenditures in the economy, the price of imports and the exchange rate. In a developing economy characterized by a limited ability to produce capital goods, a large proportion of the demand for capital goods has to be met from imports. Therefore, an increase in investment expenditures is expected to cause an increase in imports of investment goods. Demand theory dictates the inclusion of the price variables. Since few capital goods are produced domestically, and furthermore, since most imported investment goods are likely to be non-competing with domestic investment goods, the price of domestically produced investment

7 It may be noted that in this approach the only role that the money market process plays is to determine the rate of inflation. In terms of our model, equations (5) and (11) can be solved simultaneously for the inflation rate and the general price level.

8 The prices of imported and domestic goods are entered separately, instead of in ratio form, in the import function. That is, we assume there is money illusion; as Leamer and Stern [21] point out, the assumption of no money illusion would be too strong.

goods is not included as an explanatory variable. The rationale for including the value of exports of the previous year as an argument is that it proxies import controls.

III. ESTIMATING THE MODEL

The simultaneous nature of our model dictates the use of the two stage least squares method (TSLS) for estimating the parameters. Hence TSLS has been employed for estimation purposes. However, it is possible that TSLS may yield poorer parameter estimates compared to ordinary least squares method (OLS).[9] In view of this, OLS has also been used to estimate the model parameters.[10] An arithmetic linear functional form has been used for each behavioral equation. The model has been estimated using annual Philippine data for the period 1960–81, the sources of data being various government and United Nations statistical publications.

The correlation matrices for some of the regression equations indicated the presence of multi-collinearity. This may have caused some regressors to become statistically insignificant. The problem of multi-collinearity could not be removed because it was neither possible to increase the number of observations nor to introduce additional information. It is, however, comforting to note that even if some of the regressors are correlated, the estimated equation may still be satisfactory for purposes of simulation; and this, after all, is the ultimate test to which we subject our model.

It is possible that some regressors were not significant at the 0.05 level because one or more "unimportant" regressors were included in the equation. We experimented by dropping those regressors which were insignificant and this led to statistical significance at the 0.05 level of the regressors that were retained. However, we have not accepted these results because most of the variables which were omitted on the ground that they were not significant at the 0.05 level, were in fact significant at the 0.10 level, and the consequence of omitting these relatively important variables would be that the resulting estimators would be biased and inconsistent.

The Durbin-Watson [11] test indicated the presence of autocorrelated disturbance terms in some of the regressions. The Durbin [10] h-test was applied to test for autocorrelation in the case of regressions which contained lagged dependent variables as regressors. The Cochrane-Orcutt [9] procedure was used to correct for autocorrelation when OLS was the estimation technique used. However, it would not be legitimate to use this procedure to correct for autocorrelation when TSLS is employed because the application of OLS to the original equation to derive the estimator for the serial correlation coefficient would yield

9 Thus Evans has commented, "...in spite of the dangers inherent in using ordinary least squares, the hazards are smaller than if one uses simultaneous equation methods" [12, p. 172].

10 Full-information methods could not be used because our model is nonlinear and the total number of variables exceeds the number of observations.

an inconsistent estimator. Hence, when TSLS was used, the problem of autocorrelation was removed by adopting a procedure outlined in Kelejian and Oates [18].[11]

In order to use any simultaneous equation method of estimation without further modification, the number of observations must be greater than the total number of variables in the model. Since this was not the case for our model, estimation using TSLS appeared impossible. The technique of principal components, devised by Kloek and Mennes [20], was used to get around this problem by reducing the number of predetermined variables.[12]

Estimation results using OLS and TSLS are reported in Appendix. In general, parameter estimates obtained by using TSLS are not very different from those obtained by using OLS. In almost all cases, the signs of the estimated coefficients have remained unchanged although the size of the estimates have changed somewhat. With few exceptions, estimates which were statistically significant when OLS was used, were also significant when TSLS was used.

It is found that current income has no influence on consumption. Rather, the importance of past incomes in explaining consumption is brought out quite strongly. The long-run marginal propensity to consume is calculated to be 0.91 using OLS estimates and 0.84 using TSLS estimates.[13] The interest rate is not significant although the sign is in the expected direction. This is in agreement with the generally accepted argument that in a developing economy with an underdeveloped financial market, the interest rate would have little or no influence on consumption/saving decisions of households. Our results indicate the unquestionable influence of liquidity on consumption and is supportive to the monetarist claim that consumption can be controlled through responsible monetary policy.

In considering the investment demand function it is found that, contrary to the expectations of those who hold that the cost of finance is not important in determining investment in developing countries, the rate of interest is significant at the conventional level when TSLS is used. Our results underscore the im-

11 First, the current and lagged endogenous variables were regressed on all of the exogenous variables of the system and their lagged values in order to construct the calculated values. The current and lagged endogenous regressors were then replaced by these "purged" values and then consistent estimators of the coefficients in the regression equation were obtained. These TSLS estimators were used to generate a consistent estimator of the disturbance term, which, in turn, was used to obtain an estimator of the serial correlation coefficient. Using the latter, the original equation was transformed to rid it of autocorrelation.

12 While this method is perhaps the least offensive of the available choices, it should be noted that it is still deficient in the sense that we are no longer specifying the particular exogenous variables which enter the complete system. This increases the probability of mis-specification, and hence of biased parameter estimates from that source.

13 The consumption function was originally transformed from an equation in which consumption depended on an infinite distributed lag of income and the Koyck transformation was performed. The use of this procedure results in an upward "distributed lag" bias being imparted to the parameter estimates. Consequently, the long-run marginal propensity to consume is also biased upward.

portance of the availability of finance in determining investment. Thus credit is significant at the 0.10 level when OLS is used. Imports of producer goods are seen to be the most important factor affecting investment; an increase in the former will lead to an increase in the latter. This reflects the import-dependence of production. The impact of output on investment is ambiguous; it is significant at the 0.10 level when OLS is used but becomes non-significant when TSLS is the estimation procedure. The non-significance of the government expenditures variable probably reflects a "crowding out" effect of government investment on private investment.

As is to be expected in an economy with a relative abundance of labor and a relative scarcity of capital, capital stock is the most important determinant of potential output; increases in the labor force appears to have had no impact on potential output. The extent to which potential output has been realized, that is, the degree of capacity utilization, has been determined primarily by the availability of imported investment goods. If capacity utilization is constrained by a shortage of imported investment goods, then one would expect that in a developing country where there is a relative shortage of foreign exchange, the larger the stock of capital the lower would be the rate of capacity utilization. This is indeed found to be true. The performance of aggregate demand in explaining the rate of capacity utilization is somewhat ambiguous. It turns out to be statistically significant when TSLS method is employed but is not significant when OLS is used. Although this aspect requires further investigation before any firm conclusions can be drawn, our results nonetheless indicate that the possibility of dependence of the rate of capacity utilization in a developing economy on the level of aggregate demand cannot be easily dismissed.

The transactions demand for money is expected to be particularly important in a developing economy characterized by a small and fragmented financial sector. This is indeed found to be true for the Philippines. The opportunity cost of holding cash balances, as captured by the rate of inflation, is also found to exert influence on the demand for money. This evidence cautions those who hold that the transactions demand is the only component of the total demand for money in developing countries.

Coming to imports we find that import restrictions, as proxied by exports in the previous year, have systematically influenced imports of consumer goods. Since it is expected that a larger export revenue in the previous year will normally lead to a relaxation of import controls in the current year, and vice versa, the positive association of the previous year's exports with imports of the current year reflect the use of import control measures. The level of aggregate consumption also emerges as a determinant of imports of consumer goods; a portion of any increase in consumption expenditures will spill over into imports. Both the price of imports in foreign currency and the exchange rate has influenced consumer goods imports. Statistical insignificance of the domestic price variable reflects low substitutability between imports and domestic goods; this result should, however, be treated with caution since the general price level, and not the price of import-competing goods, has been used.

In the case of imports of investment goods, exports of the previous year are found to be significant; this may be taken to reflect the practice of import controls. Investment expenditures are also significant at the 0.05 level; the positive sign of the coefficient brings out the import-dependence of investment. The exchange rate also emerges as an important determinant of imports.

IV. SIMULATION OF THE MODEL

One criterion that is generally used to evaluate a macroeconomic model is the statistical "fit" of individual equations to the data. In the case of our model the $\bar{R}^2$ for all equations are quite satisfactory. However, statistical considerations alone are inadequate for evaluating a multi-equation model. This is because the behavior of the model as a dynamic system may bear little relation to the way individual equations fit the historical data. The reason for this may be that a structural instability was built into the model that is unrepresentative of the real world. Such an instability may not appear in any single equation but could result when the equations of the model are combined and solved simultaneously.

So a second criterion that is used to evaluate a macroeconomic model is the "fit" of the individual variables in a simulation context. That is, the model is tested by performing an historical simulation to examine how closely each endogenous variable tracks its corresponding historical data series. We have, therefore, subjected our model to the simulation test. The model was simulated for the period 1960–81 using parameter estimates obtained through both OLS and TSLS. The simulation performed was expost or historical. It was also dynamic; that is, all endogenous variables appearing as independent variables together with lagged dependent variables assumed their solution values. For the initial year, however, the values of the lagged endogenous variables are taken from outside the system.

The results of the simulation exercise are shown in Table I.[14] Two measures have been used to evaluate the simulation performance of the model; these are the root-mean-square (RMS) simulation error and the RMS per cent error.[15] Both are measures of deviation of the simulated variable from its actual time path, the second one being in percentage terms. The RMS error is evaluated by comparing it with the average size of the variable in question.

The simulation performance of the model may be considered to have been

14 Due to space limits it is not possible to show results in more detailed form for each individual variable. These are, however, available from the author on request.

15 The RMS simulation error for the variable Y_t, for example, is defined as follows:

$$\text{RMS error} = \frac{1}{T}\sqrt{\sum_{t=1}^{T}(Y_t^s - Y_t^a)^2},$$

where Y_t^s and Y_t^a are the simulated and actual values of Y_t and T is the number of time periods in the simulation.

$$\text{RMS per cent error} = \frac{1}{T}\sqrt{\sum_{t=1}^{T}[(Y_t^s - Y_t^a)/Y_t^a]^2 \times 100}$$

TABLE I

HISTORICAL SIMULATION

Variable	Simulation Using Parameter Estimates Obtained by OLS		Simulation Using Parameter Estimates Obtained by TSLS	
	RMS Error	RMS Per Cent Error	RMS Error	RMS Per Cent Error
Personal consumption	2,608	6.31	2,820	7.18
Fixed investment expenditures	551	12.67	1,313	29.16
Potential output	597	1.12	8,330	16.33
Gross domestic product	1,394	3.42	1,759	4.22
General price level	0.163	41.82	0.135	16.58
Imports of consumer goods	276	21.75	386	31.52
Imports of investment goods	451	13.71	482	15.86
Tax revenue	723	40.52	585	22.81

satisfactory.[16] It is generally expected that simulation performance of a model would improve with the use of more sophisticated estimation techniques. This has not been the case here since simulations performed with OLS-estimates have been better than those using TSLS-estimates. This is, however, not too surprising because when TSLS is the estimation method used, the mis-specification of a single variable may cause distortions which are worse than those caused by simultaneity bias.

Simulation of the general price level has not been very satisfactory. The hypothesis regarding price determination put forward in the model is that only monetary factors determine prices. One reason for unsatisfactory simulation of the general price level could therefore be that structural factors have also influenced prices. Since taxes are related to nominal GDP, unsatisfactory simulation of the price level has also affected the simulation of tax-revenue. Given the relatively small size of the model, simulation of the other variables may be considered to have been satisfactory.

V. CONCLUSION

Macroeconomic models built for developing countries have usually been either supply-oriented (Harrod-Domar type) or demand-oriented (Keynesian type). In this paper it has been argued that such models are inadequate for explaining the reality in developing countries. A model which explicitly takes cognizance of the fact that constraints may exist on both the demand and supply sides has

16 Normally, if a model is linear, its characteristic roots can be used to determine whether the system is stable or not. However, since our model is nonlinear, the characteristic roots cannot be used to determine stability of the model solution. In this situation if the time-paths of the variables predicted by the model bear a reasonable resemblence to the actual behavior of the economy, this may be taken as an indication that the dynamic structure of the model is representative of that of the actual economy. In terms of this "rule-of-thumb" approach to the determination of stability of a model, it appears that our model is dynamically stable.

been designed and tested for the Philippines. Parameter estimates derived and the results of expost simulation performed with the model show that it satisfactorily explains the situation in a typical developing economy.

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APPENDIX

ESTIMATION RESULTS

Estimation results using OLS and TSLS are given below. Numbers in parentheses are t-values. $\bar{R}^2$, DW, and h are respectively the coefficient of determination adjusted for the degrees of freedom, the Durbin-Watson statistic, and the Durbin statistic. An asterisk indicates that the variable is statistically significant at the 0.05 level.

Estimation of the model using OLS:

(1) $$CP = \underset{(1.60)}{998.165} + \underset{(0.88)}{0.225}YD - \underset{(0.61)}{124.41}INT + \underset{(1.99)}{0.147}L^* + \underset{(7.94)}{0.754}CP^*_{-1}$$

$$\bar{R}^2 = 0.96, \ DW = 1.65, \ h = 0.811$$

(2) $DFI = 5{,}052.065^* + 0.068(Y \cdot P) - 793.061INT + 0.033CR$
(2.43) (1.51) (1.17) (1.65)

$+ 0.991RE + 0.360MRIK^* + 0.608G - 0.016CNI_{-1}$
(0.70) (1.98) (0.59) (0.27)

$\bar{R}^2 = 0.91,\ DW = 2.04$

(3) $Y^{P_0} = 14{,}107.4^* + 0.002N + 0.072CNI^*$
(1.79) (0.001) (2.32)

$\bar{R}^2 = 0.95,\ DW = 2.00$

(4) $Y/Y^{P_0} = 0.699^* - 0.0005CNI^* + 0.0011MRIK^* + 0.00006Y$
(34.95) (10.00) (1.87) (0.52)

$\bar{R}^2 = 0.90,\ DW = 2.37$

(5) $L/P = 3{,}630.164^* - 12.28INF + 0.04Y^*$
(12.60) (1.06) (5.71)

$\bar{R}^2 = 0.79,\ DW = 1.98$

(6) $T = -958.46^* + 0.141(Y \cdot P)^*$
(3.24) (9.33)

$\bar{R}^2 = 0.96,\ DW = 1.68$

(7) $MC = -217.518 + 0.031X^*_{-1} + 0.068CP^* + 0.090G - 62.114PMC^*$
(0.37) (2.58) (2.83) (1.46) (2.14)

$+ 987.278P - 114.729EXR^* + 0.167MC_{-1}$
(0.88) (2.15) (0.62)

$\bar{R}^2 = 0.97,\ DW = 2.54,\ h = 1.69$

(8) $MRIK = -1{,}247.25 + 0.287X^*_{-1} + 0.154DFI^* - 999.812PMRIK$
(0.86) (1.98) (2.68) (0.65)

$- 1{,}233.82EXR^* + 0.306MRIK_{-1}$
(4.57) (1.34)

$\bar{R}^2 = 0.94,\ DW = 1.27,\ h = 1.89$

Estimation of the model using TSLS:

(1) $CP = 3{,}349.42^* + 0.121YD - 172.746INT + 0.859L^* + 0.854CP^*_{-1}$
(2.10) (0.20) (0.68) (1.85) (7.18)

$\bar{R}^2 = 0.98,\ DW = 1.87,\ h = 0.523$

(2) $DFI = 6{,}807.338^* + 0.059(Y \cdot P) - 1{,}325.216INT^* + 0.008CR$
(2.31) (0.66) (1.95) (0.17)

$+ 0.210RE + 0.473MRIK^* + 0.596G - 0.218CNI$
(0.14) (1.95) (0.52) (1.70)

$\bar{R}^2 = 0.91,\ DW = 1.87$

(3) $Y^{P_0} = 21{,}233.8^* + 0.004N + 0.088CNI^*$
(2.76) (0.004) (9.78)

$\bar{R}^2 = 0.96,\ DW = 1.92$

(4) $Y/Y^{P_0}=0.764^*-0.0002CNI^*+0.0003MRIK^*+0.00002Y^*$
(3.54) (2.50) (3.00) (2.06)

$\bar{R}^2=0.81,\ DW=1.96$

(5) $L/P=2{,}986.83^*+40.534INF^*+0.120Y^*$
(9.16) (2.56) (4.14)

$\bar{R}^2=0.83,\ DW=1.95$

(6) $T=-822.838^*+0.136(Y\cdot P)^*$
(2.73) (13.61)

$\bar{R}^2=0.91,\ DW=1.82$

(7) $MC=-251.662+0.025X^*_{-1}+0.047CP^*+0.087G-118.369PMC$
(0.42) (2.78) (3.62) (1.45) (1.57)

$+1{,}071.408P-122.987EXR^*+0.202MC_{-1}$
(1.00) (2.24) (0.95)

$\bar{R}^2=0.97,\ DW=2.56,\ h=-2.73$

(8) $MRIK=-804.895+0.327X^*_{-1}+0.117DFI^*-249.419PMRIK$
(1.06) (2.84) (2.17) (0.18)

$-1{,}134.28EXR^*+0.265MRIK^*_{-1}$
(4.36) (1.94)

$\bar{R}^2=0.93,\ DW=1.66,\ h=1.09$