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A DISAGGREGATIVE MODEL OF THE PHILIPPINE ECONOMY, 1949-65: PROVISIONAL SPECIFICATION

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A Disaggregative Model of the Philippine Economy, 1949-65: Provisional Specification

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This paper describes a tentative formulation of the econometric model of the Philippine economy at a disaggregative level which will be estimated and used: (1) to examine the nature of the trade-off possibilities among the policy objectives of output growth, price stability and external balance that existed during the period from 1949 to 1965[1], and (2) for purposes of planning and forecasting, upon proper modification of the estimated model to correspond to the altered economic environment in the years beyond the observation period[2]. The premise is that interrelations in particular sectors and/or in the aggregate are best seen in the light of the general economic structure of the economy during the period of study and that their empirical evaluation must take into account simultaneously the feedback effects inherent in a dynamic, multi-sectoral system.

It is necessary to emphasize at the outset the tentative character of the model as specified below. Only minimal use of data was entailed, purposely done so to avoid biasing the model toward statistical "goodness of fit" at a possible sacrifice in economic content in this

initial stage. Such considerations of course have to be made later for the model to be operational and also since there are competing hypotheses (initially less reasonable in one's judgment) that must be tested. It seems only natural therefore that some variables in the model below may be deleted or others introduced, the lag structure revised, etc. in the course of statistical estimation and analysis.

The structure of the model centers around the determination of price, output and foreign trade variables. For reasons given below, exogeneity of the money supply and wage rate variables is assumed. Other significant features of the model are discussed in what follows as a prelude to its formal specification:

(1) Treatment of foreign trade:

Philippine imports and exports constitute only a slight fraction of total exports and imports of her principal suppliers and purchasers[3]. Therefore, the small country assumption is appropriate; foreign demand for exports and supply of imports may be taken as perfectly elastic, implying exogenously determined import and export prices (in foreign currency). (These prices are distinguished in the model from the domestic price of exportables and of imported goods.)

Roughly a fifth of domestic production in the Philippines enters foreign trade and about the same

percentage of consumption is imported. Transactions with the foreign sector of course extends beyond merchandise trade but for the purpose of the present study external balance as an objective of economic policy is approximated simply by trade balance. Merchandise trade is the largest item in the Philippine balance of payments and the trade balance has always been severely adverse whenever the international reserves position deteriorates sharply -- as demonstrated by the steep falls of reserves in the years 1949, 1955, 1957 and 1961[4]. Restrictions on invisibles and capital movement were part of an extensive program of exchange controls in operation throughout most of the period; consequently, pursuit of external balance was not hindered by speculative invisible and capital outflows.

(2) Aggregation:

One major criticism against Keynesian macroanalysis is that it is "too aggregative". This objection applies with greater force to the study of the short-run problems in a small, open economy, where there are a few disparate sectors confronted by supply and demand conditions specific to each one[5]. The varying extent of substitutability in production and in consumption of their products suggests that much will be gained if separate treatment is given these sectors. So-called

structual changes that characterize the behavior of developing economies over time may in fact be shaped by the nature of the exogenous forces acting on each sector and by the mutual interaction of these sectors.

The disaggregation scheme adopted in the present study reflects the concern for the similarity of markets in the demand for and supply of commodities. Commodities are categorized as follows:

I. Agricultural goods, produced domestically

A. Food
B. Intermediate goods (Non-foods)

1. Used domestically
2. Exported

II. Industrial goods, produced domestically

A. Consumer goods, consumed domestically
B. Intermediate goods, used domestically
C. Capital goods, used domestically

1. Durable equipment
2. Construction

D. Exports
E. Change in stocks

III. Imported goods

A. Agricultural food
B. Industrial consumer goods
C. Intermediate goods
D. Capital goods

IV. Services

V. Public goods (government-produced)

It is of course possible to gain additional realism by further disaggregation but which would not seem warranted by the added cost in data collection and computation work and also inasmuch as this study is concerned with the overall behavior of the economy.

Data availability has been indeed a major concern in the process of disaggregation, as well as in the specification of the structural equations discussed below. Two recent developments have considerably improved the data situation for the purpose of this study. The recent work of a visiting research team from the National Planning Association has produced much improved estimates of intersectoral and foreign trade flows[6]. A consistent and comprehensive set of estimates of real flows in the Philippine economy for the period 1949-65 given in /16/ represents the culmination of the NPA team's examination of Philippine data. The classification of commodities adopted in the present study corresponds closely to the framework used in the presentation of the NPA estimates. More recently, a revised official National Income Accounts statement for the period 1946-67 was published[7], and as the NPA estimates made use of sectoral value added and other items in the previous National Income Accounts some modification of the former will have to be done.

Some observations may be noted at this point with reference to the disaggregation scheme shown above. First,

the entire output of food in agriculture is consumed domestically and hence agricultural exports consist only of intermediate products, part of agricultural intermediate goods output being purchased as inputs in domestic industrial production. Secondly, capital goods and intermediate goods are distinguished according to whether they are produced domestically or imported; this is done to be able to study more closely the increasing dependence of domestic industries on imported producer goods during the period of controls. Thirdly, the influence of foreign trade on domestic prices is put into sharper focus by distinguishing between tradable (agricultural and industrial) and non-tradable (services and government-produced) commodities. Finally, government is treated as a production sector engaged in producing collective consumption goods (national defense, public health, etc.) not otherwise forthcoming, making use of non-agricultural intermediate goods.

(3) Supply constraints

Keynesian macro-models generally assume demand determined output with supply adjusting elastically. This is clearly not valid for the less developed countries, where supply bottlenecks are a dominant problem. Supply constraints are represented in themodel somewhat differently for the agricultural and industrial sectors. Anticipating the formulation discussed more fully below, a supply function for each of the two classes of agricultural goods describes

output determination, quantity of production assumed to adjust dynamically to changes in the relative prices of output and inputs. In industry, an aggregate production function expresses current output in terms of the quantity of inputs which include agricultural intermediate goods, imported intermediate goods, and the stock of domestically-produced and imported capital goods. In addition, individual demand functions are specified for the sub-classes of industrial goods.

(4) Prices

The role of prices as a signalling device in production and consumption decisions becomes important -- an immediate consequence of disaggregation. The price of substitutes are entered as arguments in the supply and demand functions -- a feature in the present model never observed in aggregative models where substitution effects are inevitably concealed. The price of each commodity in turn is influenced in part by the level of production as expressed in the price equation. Thus there is postulated a mutual interaction between price and quantity of the product rather than a unilateral direction of causation.

The movement of prices over time has implications on the nature of the structural changes that take place in the economy. For example, the substitution of domestically produced consumer goods for imported ones may have been rapid during the period of controls in the Philippines for two related reasons: (i) imported consumer goods were curtailed severely, resulting in a sharp increase in the domestic price of consumer imports relative to the price of domestic substitutes; and (ii) imported producer goods were not controlled to as much extent as consumer goods, the relatively low price giving impetus to further growth of consumer goods producing industries. Similarly, the widespread shift from food production to export production within the agricultural sector may be explained by the continuing policy of the government to maintain the agricultural food price at a low level through liberal imports of food; post-war export prices (in domestic currency), moreover, showed a marked upward trend especially after 1960 when the effective exchange rate for exports continuously rose.

The stage is now set for a presentation of the structural equations and identities that make up the model. The theoretical background of each equation is discussed and

the variables appearing in it are defined. The order of presentation of the structural equations, designated for convenience by their dependent variables, is as follows:

A. Domestic supply equations

1. Supply of agricultural food
2. Supply of agricultural intermediate goods
3. Supply of industrial goods
4. Supply of industrial exports

B. Domestic demand equations

5. Demand for agricultural intermediate goods
6. Demand for domestically produced industrial consumer goods
7. Demand for domestically produced industrial intermediate goods
8. Demand for durable equipment (domestically produced plus imported)
9. Demand for construction

C. Domestic price equations

10. Price of agricultural food
11. Price of domestically produced agricultural intermediate goods
12. Price of domestically produced industrial consumer goods
13. Price of domestically produced industrial intermediate goods
14. Price of durable equipment
15. Price of construction
16. Price of imported industrial consumer goods
17. Price of imported intermediate goods
18. Price of imported capital goods

D. Value added equations

19. Value added in agriculture
20. Value added in industry
21. Value added in services
22. Value added in government

A. Domestic supply equations

There exists a rather voluminous literature on agricultural supply functions in the less developed countries.[8] The preponderance of evidence now appears to indicate that despite the existence of some forms of institutional constraints, farmers in the developing economies do respond to economic incentives significantly even in the short-run. The term "significantly" is used, one must add, in the statistical sense of being different from zero. Now the range of published estimates of price elasticities is rather wide and each estimate seems specific to a product, geographic area and time period investigated. This is understandable in view of the differences in the gestation period of different crops and in the degree of cultural and other restraints in agricultural adjustment for different countries and in different time periods. Two observations may be noted, however, on the pattern of estimates as it relates to the present study: (1) non-food crops tend to

be more price elastic than the food grains, probably due to the higher degree of commercialization in the non-food sector; and (ii) annual crops tend to adjust more quickly to desired acreage than the perrenials, as might be expected from the latter's longer gestation period [5, pp. 14-19]. In the Philippines rice and corn are the dominant food crops and happen to have shorter gestation periods than coconut, sugar, and logs -- the major non-foods. Therefore, supply considerations suggest at least a division of agricultural goods into food and non-foods (intermediate products).

On the demand side, the reason for disaggregating agricultural products into food and non-foods is even more obvious. The Philippines do not export agricultural food so that demand comes only from within. Agricultural intermediate products, on the other hand, are either purchased domestically as intermediate goods for industrial production or exported. As this study is also concerned with the determination of agricultural prices, such distinction seems appropriate.

It is of course more realistic to distinguish agricultural products more finely, possibly to the level of individual crops, when one tries to explain the movement of agricultural output over time. However, supply elasticities are also known to differ widely for different regions[9] so that estimates pertaining to individual crops still represent rough averages for the country. At any rate, it is doubtful whether the gain in accuracy over the two-way classification adopted here would offset the added costs entailed in making the model more complex. This is a recurrent theme that also forms the basis in the choice of the level of disaggregation in the other sectors.

Turning to the specification of the supply functions, two principal behavioral assumptions used concern (i) equilibrium relationship between the level of output and relative prices of output and inputs, and (ii) incomplete adjustment to equilibrium output.

(i) Relationship between equilibrium output and prices:

Agricultural producers are assumed to have in mind long-run (equilibrium, desired) relationships between the levels of output in food and non-food production and the

relative prices of the two classes of commodities and required inputs. These relationships are calculable given the agricultural production functions and the set of input and output prices. It is assumed that this calculation by the producers is consistent with profit maximization so that an increase in the relative price of say, non-foods will lead them to adjust to some desired production mix with relatively lower output of food.[10]

Area planted seems a more appropriate dependent variable to use, as is done with few exceptions in previous studies involving individual crops. It clearly reflects more accurately planned production compared to realized output which is affected by variations in yield, which in turn is affected by exogenous factors like weather conditions and technical change.[11] In the present case, two relevant considerations are the aggregative nature of the agricultural products under study and the difficulty of obtaining reliable data on area planted. Production of agricultural food and non-foods is widely dispersed geographically so that the effects of different weather conditions on average yield may well be mutually offsetting. Technical change has not been an important factor in Philippine agriculture until

very recently.[12] Hence the yield factor may reasonably be subsumed under the random error term in the regression. A more compelling reason for taking output as the dependent variable in the supply equation is that the available information provides data on area harvested rather than area planted with no guide at all for the necessary correction. In addition, area data are generally regarded as weaker than published production data.[13]

Most investigations of agricultural supply functions do not include the price of inputs as explanatory variables. Clearly, these prices are relevant to production plans and unless constant over the period of observation or assumed a priori to be only a minor influence on output decisions, they should appear in the supply equation. The non-agricultural wage rate for unskilled laborers proxies in the present study for the price of agricultural labor - for which available data leave much to be desired.[14] The opportunity cost of laborers staying in agricultural production is given by the wage rate for unskilled laborers outside agriculture multiplied by the probability of new migrants from agriculture finding jobs there. It does not seem unreasonable therefore to expect that changes in

agricultural wage rate should parallel the earnings of unskilled laborers in the non-agricultural sector.[15]

Prices of other inputs in agriculture are neglected in the model on the assumption that they exert little influence on output decisions. Expected values of the determinants of desired level of output are assumed to correspond simply to their values in the previous period. Thus formally,

$$A^{*}_{it} = f_i \left(p^{A_i}_{t-1}/p^{A_j}_{t-1},\ w^{o}_{t-1}/p^{A_i}_{t-1}\right) ; \quad \underset{i \neq j}{i,j = 1,2}$$

where A^{*}_{1} = desired output in agricultural food production

A^{*}_{2} = desired output in agricultural intermediate goods production

w^{o} = money wage rate for non-agricultural unskilled labor

p^{A_i} = price index of A_i

(ii) Incomplete adjustment:

The annual change in output is postulated to depend on the difference between equilibrium and actual levels. The standard practice is to hypothesize a constant adjustment coefficient determined statistically and meant to reflect lags in the adjustment process due to market imperfections and other forms of institutional constraints.[16]

This assumption of incomplete adjustment may be formally written

$$A_{it} - A_{i,t-1} = \alpha_i (A^*_{it} - A_{i,t-1}) \quad ; \; i = 1,2$$

where A_i = actual output

α_i = (constant) speed of adjustment

A priori restriction on the adjustment coefficient is that $0 < \alpha_i \leq 2$. If $0 < \alpha_i < 1$, output adjustment is partial, i.e., supply "underadjusts" but there is a monotonic tendency to reach the equilibrium level; this is the more likely case. If $\alpha_i = 1$, adjustment is complete within one year. If the coefficient lies between 1 and 2, output "overadjusts", dampedly oscillating around the equilibrium level; $\alpha_i = 2$ implies that the output fluctuation has a constant amplitude. Values of α_i greater than 2 can be ruled out because of the implication that the oscillation will be explosive.

Expressing A^*_{it} as a linear function[17] of the relative prices, the foregoing relationships may be combined to suggest the regression equations

$$(1) \quad A_{1t} = a_1 + b_1 p^{A_1}_{t-1}/p^{A_2}_{t-1} + c_1 w^{o}_{t-1}/p^{A_1}_{t-1} + d_1 A_{1,t-1} + U_{1t}$$

$$(2) \quad A_{2t} = a_2 + b_2 p^{A_2}_{t-1}/p^{A_1}_{t-1} + c_2 w^{o}_{t-1}/p^{A_2}_{t-1} + d_2 A_{2,t-1} + U_{2t}$$

As all output variables in the model, A_1 and A_2 are expressed in constant (1955) pesos. The price variables p^{A_1} and p^{A_2} are represented by the wholesale price indices of domestically produced agricultural food and intermediate goods, respectively. An index of farm prices is clearly more appropriate but is also difficult to construct because of limited data. The more important reason, however, for using the wholesale price index is that it lies intermediate between the retail price which consumers face and the farm price pertinent to the suppliers; for simplicity, each commodity market is represented in the model with only a single price variable and the wholesale price index seems the best candidate.

w^o is treated in the model as an exogenous variable. The Philippines may reasonably be regarded as a labor surplus economy with a perfectly elastic supply of unskilled labor at the prevailing wage rate imposed by minimum wage and social security legislation.[18] Thus the creeping upward trend of the money wage rate for unskilled laborers observed until 1965 (when the legal minimum was raised) need only be attributed to the increasing compliance of industrial firms with the legal requirement.

The expected sign of the coefficients b_1 and b_2 is positive; of c_1 and c_2, negative. Since $d_i = 1 - \alpha_i$, the range of possible values of d_1 and d_2 is from 1 to -1.

The error term in the k^{th} behavioral equation in the model is denoted by U_k.

Supply of industrial goods is constrained by a production function which relates current output to the different classes of producer goods distinguished in the model:

$$(3) \quad R_t = a_3 + b_3 A_{2Dt} + c_3 M_{3t} + d_3 \sum_{i=1}^{t-1} R_{3qi} + e_3 \sum_{i=1}^{t-1} M_{4i} + f_3 z_t + U_{3t}$$

where R = output of industrial goods

A_{2D} = agricultural intermediate goods used domestically

M_3 = imported intermediate goods

R_{3q} = domestically produced durable equipment

M_4 = imported capital goods

z is a dummy variable taking on a value of unity for 1960-62 and zero for the rest of the observation period. Its use makes possible a shift of the production function

to allow for the accumulation of intermediate goods inventory and substantial capacity underutilization observed in industrial production during the period of transition to decontrol.[19] As controls on imports and foreign exchange were gradually being relaxed, the exchange rate applicable to producer goods imports was programmed to rise gradually to the free market rate, which was roughly twice the previously applied official rate. This provided enormous incentive for domestic industrial producers to increase their stock of imported producer goods in anticipation of the higher cost of procurement in succeeding periods. At the same time, domestic industries began to be exposed to foreign competition in consumer goods previously restricted for importation, with the probable effect of reversing the import substitution in the demand side engendered by the stringent controls earlier. Thus the years 1960 to 1962 represent a critical period of adjustment for the industrial sector.

The availability of skilled labor constitutes admittedly a further constraint on industrial production but for which little data exist in the Philippines. It may plausibly be represented by the trend variable t but is omitted in the regression equation because of the already serious problem of intercorrelation among the explanatory variables.

The stocks of imported and domestically produced durable equipment are obtained, as shown in (3), by cumulating annual purchases from the beginning of the observation period. This simple procedure implies equivalence among equipment of different vintages over the entire period and disregards depreciation and efficiency considerations. The generalization may be made, however, that the economic life of capital goods is much longer in the less developed countries compared to that in the developed countries.[20] Furthermore, any decline in efficiency due to physical wear might be counterbalanced by gains due to the learning process, i.e., operatives become more productive with increasing familiarity with the older machines. The representation of the capital stock variables as done above, therefore, would probably not entail considerable error. (Investment in construction R_{3c} is presumed to complement purchases of imported and domestically produced durable equipment; hence, it is not necessary to include this term as an explanatory variable in (3)).

Each coefficient in equation (3), except f_3, is expected to be greater than zero.

Supply of industrial exports is given by

$$(4) \qquad R_{4t} = a_4 + b_4 p_t^{R_1}/p_{xt}^{R_4} + c_4 p_t^{R_2}/p_{xt}^{R_4} + d_4 \sum_{i=1}^{t-1} R_{5i} + U_{4t}$$

where R_4 = exported industrial goods (in 1955 pesos)

$p_x^{R_4}$ = index of export unit value (in pesos) of industrial exports

p^{R_1} = domestic wholesale price index of industrial consumer goods domestically produced

p^{R_2} = domestic wholesale price index of industrial intermediate goods domestically produced

R_5 = change in inventory of industrial goods (in 1955 pesos)

Equation (4) is essentially a short-run vent-for-surplus model of export trade in a small, open economy. If total production of industrial goods exceeds domestic demand in the current period, the excess supply may either be exported at the prevailing world market price or be kept as an increment in accumulated inventory. There is an economic choice to be made by the industrial producers. If the current world price is too low relative to the domestic price, the producer may decide to hold his excess output in anticipation of higher world price and/or increased home demand in the succeeding periods. But the accumulation of stocks is not a costless activity since storage facilities and the complement of insurance, handling, and related costs must be provided. These expenses necessarily increase as the level of stock grows. Therefore, both relative export

price and amount of accumulated stocks should influence the volume of exports for the current period.

The Philippines do not export capital goods; hence the relevant domestic price variables are the price indices of domestically produced industrial consumer goods and intermediate goods. These are deflated by the unit value of industrial exports, as they appear in (4); the a priori sign of the coefficients b_4 and c_4 is negative. Cumulation of stocks is shown to start in the beginning of the sample period;[21] the coefficient d_4 is expected to be greater than zero.

B. Domestic demand equations

There are five behavioral equations in the model that explain quantity demanded of certain classes of commodities. First in the list is agricultural intermediate products, demand for which comes from the industrial sector and from abroad.[22]

Cost minimizing calculations of domestic industrial producers lead them to demand agricultural intermediate goods at some desired ratio to the current output of industrial goods. This ratio is a function of the existing

technology and the current price of agricultural products relative to the price of industrial goods. It is also assumed that annual purchases by industry reflect incomplete adjustment to the desired ratio. Thus

$$(A_{2Dt}/R_t)^* = g(p^{A_2}/p^{R_1},\ t)$$

and $$A_{2Dt}/R_t - A_{2D,t-1}/R_{t-1} = \beta\left[(A_{2Dt}/R_t)^* - A_{2D,t-1}/R_{t-1}\right]$$

where A_{2D}/R = actual ratio of annual purchases of agricultural intermediate goods to industrial output

$(A_{2D}/R)^*$ = desired ratio

Then the regression equation suggested is

(5) $$A_{2Dt}/R_t = a_5 + b_5 p_t^{A_2}/p_t^{R_1} + c_5 t + d_5 A_{2D,t-1}/R_{t-1} + U_{5t}$$

Using the trend variable t as an independent variable allows a continuous shift of the function to reflect increasing efficiency in the use of raw materials in industrial production over time. The expected sign of c_5 is negative.

Agricultural intermediate products in the Philippines are used as inputs mainly in industrial consumer goods production.[23] The price variable representing the domestic price index of A_2 is therefore deflated simply by p^{R_1}; the coefficient b_5 is expected to be less than zero.

The *a priori* range of d_5 ($=1-\beta$) is from -1 to 1.

Turning now to the explanation of demand for domestically produced industrial consumer goods, traditional theory suggests that the price and income effects should be significant variables. The regression equation is written

$$(6) \qquad R_{1t} = a_6 + b_6 p_t^{R_1}/p_t^{M_2} + c_6 A_t^d + d_6 N_t^d + U_{6t}$$

where R_1 = expenditures on domestically produced industrial consumer goods (in 1955 pesos)

p^{M_2} = domestic wholesale price index of imported industrial consumer goods

A^d = disposable income of agricultural households (in 1955 pesos)

N^d = disposable income of non-agricultural households (in 1955 pesos)

Imported and domestically produced industrial consumer goods are assumed substitutable to a degree that may be determined from the value of the coefficient b_6, which is *a priori* less than zero. Government imports policy in the post-war period has generally tended to promote import substitution especially in industrial consumer goods and indeed the raw data indicate that "progress toward import substitution of final industrial goods was fairly steady during the period" [16, p. 147]. The means by which it was

achieved must be sought in the changing relative domestic prices of the two kinds of industrial consumer goods.

The income effect is represented in equation (6) by two disposable income terms corresponding to the two income sectors, agricultural and non-agricultural households. Estimation of the traditional income shares, i.e., wage, property, and entrepreneurial incomes, has never been reliably achieved in official Philippine statistics. For example, the official procedure used in estimating wage and non-wage incomes is to apply constant allocation ratios on Private Corporate Income, Non-corporate Income, and Government Property Income which were derived as far back as 1951.[24] The usual differentiation between wage and non-wage incomes in the consumption function is therefore infeasible. The present model distinguishes instead between agricultural and non-agricultural incomes in the consumption functions and should be able to throw light on any difference in consumption behavior between the two households. Recent evidence in the Philippines seems to suggest that the rate of saving is higher in the rural areas than in the urban areas.[25] This is surprising but may be explained by the fact that people in the agricultural regions lead simple lives and are not served

the wide array of consumer markets available in the cities. Thus the "demonstration effect" in consumption operates to a much lesser extent in the rural areas, with the result that rural consumers spend less of their smaller income compared to their urban counterparts.

Because the two income variables are highly correlated for the period of sample observation, it is not possible to derive unbiased estimates of the parameters c_6 and d_6 in (6) without obtaining an independent estimate of one of the parameters or establishing a relationship between the two using a different set of data. The latter procedure will be followed, employing the cross-section data provided by the 1961 PSSH survey of family incomes and expenditures [17].

Domestic demand for industrial intermediate goods comes from the agricultural and government sectors and is assumed to depend simply on the current levels of agricultural and government production. Input of intermediate goods from industry constitutes only a small fraction of total value of output in these two sectors. The regression equation is

$$(7) \qquad R_{2t} = a_7 + b_7 A_{1t} + c_7 A_{2t} + d_7 G_t + U_{7t}$$

where R_2 = domestic sales of industrial intermediate products (in 1955 pesos)

G = government expenditures (in 1955 pesos)

The coefficients b_7, c_7 and d_7 are expected to be greater than zero.

In explaining investment demand, the model distinguishes between expenditures on durable equipment and construction, durable equipment defined in the present instance to include both domestically produced and imported. The specification of the two investment functions is discussed jointly.

Desired investment is assumed to be influenced solely by profit expectations.[26] Adjustment to the desired level is again incomplete, the annual change in realized investment postulated to depend on the difference between desired and actual levels and on the current stock of liquid assets. Investment plans cannot be implemented if the available funds fall short of that required. Capital funds are of course scarce in the LDC's; hence, the amount of liquid assets (in real terms) constitutes an important short-run constraint in the adjustment process in addition to the institutional factors bearing on the lag structure.

No reliable data exist for total profit income in the Philippines, as indicated earlier. National income is an appropriate substitute if the view is accepted that real wage income remained constant over the period of sample observation. The lagged value of national income is taken to represent the profit expectations variable on the assumption that producers as a group form their expectations on future profits on the basis of the preceding year's performance of the economy.

The regression equations suggested by the foregoing discussion may be written

$$(8) \qquad I_{q,t} = a_8 + b_8 NI_{t-1} + c_8 L_t / p_t^{I_q} + d_8 I_{q,t-1} + U_{8t}$$

$$(9) \qquad R_{3c,t} = a_9 + b_9 NI_{t-1} + c_9 L_t / p_t^{R_{3c}} + d_9 R_{3c,t-1} + U_{9t}$$

where I_q $(\equiv M_4 + R_{3q})$ = expenditures on imported and domestically produced durable equipment (in 1955 pesos)

R_{3c} = expenditures on construction (in 1955 pesos)

NI = national income (in 1955 pesos)

L = sum of currency in circulation and demand deposits (in current pesos)

p^{I_q} = price index of durable equipment

$p^{R_{3c}}$ = price index of construction

M_{4t}, imports of durable equipment, is an exogenous variable in the model, as argued earlier; equation (8) is in effect an investment function determining the demand for domestically produced durable equipment, R_{3q}.

L_t is also treated as exogenous, representing the monetary instrument variable. Given the wide variety of monetary policy measures available and actually employed during the period, the presumption must be that the monetary authorities were able to exercise control of the money in circulation. In 1960, for example, seven different types of monetary measures were implemented.[27] The major non-bank financial institutions are, moreover, government-owned,[28] and "a specific provision in the Central Bank Act under Section 114 requires the strict coordination of all government credit institutions with the general credit policies of the Central Bank" [8, p. 102]

It is of course possible, if tedious, to explain the movement of money supply over the years in terms of the multitude of more basic policy instruments affecting it, but for the purpose of this study it would suffice to treat money stock as a summary instrument variable for monetary policy.

C. Domestic price equations

Government efforts in keeping food prices from rising at a politically unacceptable rate consisted in large part of direct importation of food and its distribution and marketing by government agencies [29].

Agricultural food imports (M_1) supplement domestic production to constitute total market supply. The equilibrium price is assumed to equate domestic demand to total availability, actual price reflecting incomplete adjustment to the equilibrium price. Thus, denoting the equilibrium price of agricultural food relative to the consumer price level by $(p_t^{A1}/p_t)^*$, we have

$$D\left[(p_t^{A1}/p)^*,\ A_t^d,\ N_t^d\right] = A_{1t} + M_{1t}$$

and

$$p_t^{A1}/p_t - p_{t-1}^{A1}/p_{t-1} = \gamma\left[(p_t^{A1}/p_t)^* - p_{t-1}^{A1}/p_{t-1}\right]$$

The following regression equation is suggested:

$$(10)\quad p_t^{A1}/p_t = a_{10} + b_{10}(A_{1t} + M_{1t}) + c_{10}A_t^d + d_{10}N_t^d + e_{10}p_{t-1}^{A1}/p_{t-1} + U_{10t}$$

Again, because of the multicollinearity problem, the results of the 1961 survey of family income and expenditure in [17] will be used to relate c_{10} and d_{10}, which are expected to be both greater than zero.

The coefficient e_{10} is equal to $(1-\gamma)$ and should have an absolute value between zero and one.

The a priori sign of the coefficient b_{10} is negative.

Exports of agricultural intermediate products face an infinitely elastic foreign demand at the prevailing world price. The model assumes that domestic demand has a first claim on agricultural intermediate goods, with exports determined residually. It is further assumed that the domestic price of agricultural intermediate products adjusts in part to the world price, the annual change in domestic price being further influenced by the current change in domestic demand. These two assumptions seem plausible from an examination of raw data on the domestic price and export unit value of agricultural intermediate products -- neither one is consistently higher than the other over the post-war years. The regression equation may be written

$$(11) \quad p_t^{A2} - p_{t-1}^{A2} = b_{11}(p_{t-1}^{A2}) + c_{11}(A_{2Dt} - A_{2D,t-1}) + U_{11t}$$

where p_x^{A2} is the unit export value index of agricultural intermediate products, assumed exogenous.

An increase in demand in the current period would raise domestic price even if the previous domestic price had

coincided with the current world price; therefore, the expected sign of c_{11} is positive.

The coefficient b_{11} has an a priori range of values from 0 to 2.

Price determination in the industrial sector differs significantly from the pricing of agricultural goods. The demand function for each class of industrial goods has been specified earlier. The model assumes that demand for these commodities is realized ex post with annual changes in industrial stocks and exports accounting for the difference between annual production (determined in equation (3) above) and total industrial demand. Ex ante supply of each category of industrial products is a function of output and input prices; market adjustment therefore implies that input prices and the level of demand should influence the current price of the product. Thus, for industrial and intermediate goods, the price equations may be written, respectively:

$$(12)\quad p_t^{R1} = a_{12} + b_{12}R_{1t} + c_{12}p_t^{I}q + d_{12}p_t^{M}3 + e_{12}p_t^{A}2 + f_{12}w_t^{o} + U_{12t}$$

$$(13)\quad p_t^{R2} = a_{13} + b_{13}R_{2t} + c_{13}p_t^{I}q + d_{13}p_t^{A}3 + e_{13}p_t^{A}2 + f_{13}w_t^{o} + U_{13t}$$

where p^{M3} is the domestic price index of imported intermediate goods.

Equations (12) and (13) are consistent with cost-plus pricing policies commonly assumed in the empirical literature. The pricing process here considered is however not purely supply oriented, as indicated by the presence of R_1 and R_2 as explanatory variables. In the case of (12) it must be noted that the influence of p^{M2}, the domestic price of industrial consumer goods imports (which compete with domestic supply) is already taken into account by the inclusion of R_1 which as shown in equation (6) is affected by p^{M2}.

The price of producer goods is similarly determined; the regression equations for the price of durable equipment and construction are given, respectively, by

$$(14)\quad p_t^{Iq} = a_{14} + b_{14}Iqt + c_{14}p_t^{M4} + d_{14}w_t^{o} + U_{14t}$$

$$(15)\quad p_t^{R3c} = a_{15} + b_{15}R_{3ct} + c_{15}p_t^{Iq} + d_{15}p_t^{A2} + e_{15}w_t^{o} + U_{15t}$$

where p^{M4} is the domestic price index of imported capital equipment.

Logs and timber, which are included in the agricultural intermediate goods class, serve as inputs in construction; p^{A2} therefore appears as an explanatory variable in (15).

It is expected that all the coefficients in equations (12), (13), (14), and (15) are greater than zero.

Domestic prices of imported goods reflect the scarcity value of imports, which at the level of disaggregation used here were effectively controlled by the government throughout the period under study. Thus, instead of an import demand function with the volume of imports as dependent variable, it is more appropriate to express the domestic price of each class of imported commodities in terms of the quantity of imports and the relevant variables influencing import demand.

Agricultural food imports are assumed indistinguishable from domestic supply once they reach the market. This implies that their market price is the same; equation (10) above describes price determination in the market for agricultural food.

The domestic price of imported industrial consumer goods is a function of import quantity available, price of competing domestically produced industrial consumer goods and disposable incomes of the agricultural and non-agricultural households:

$$(16) \quad p_t^{M2} = a_{16} + b_{16}M_{2t} + c_{16}p_t^{R1} + d_{16}A_t^d + e_{16}N_t^d + U_{16t}$$

The form of equation (16) may be considered an inverse of the more commonly used import demand function. In a period of import controls with the domestic currency highly overvalued, available imports are sold at a price the market will bear so that the direction of causation is clearly from import quantity to domestic price of imported goods.

All the coefficients in (16), except b_{16}, are presumably greater than zero.

Imported intermediate goods do not compete with those domestically produced; hence, their domestic price may be assumed to depend only on the allowed quantity and the current volume of industrial production. The regression equation is written

$$(17) \quad p_t^{M_3} = a_{17} + b_{17}M_{3t} + c_{17}R_t + U_{17t}$$

The a priori sign of the coefficient b_{17} is negative while that of c_{17}, positive.

The last category of imported goods distinguished in the model is durable equipment. Earlier, an investment demand function (equation (8)) for all durable equipment (domestically produced and imported) is formulated in which national income lagged one period proxies for profit expectations while the amount of liquid assets is assumed to

constitute a short-run constraint in implementing investment plans. These variables enter likewise in the domestic price equation for imported capital goods, which is given by

$$(18) \quad p_t^{M4} = a_{18} + b_{18}M_{4t} + c_{18}L_t/p_t^{M4} + d_{18}NI_{t-1} + U_{18t}$$

The a priori sign of b_{18} is negative; all the other coefficients are expected to be greater than zero.

D. Value added equations

The final set of behavioral equations in the model concerns the explanation of value added in the various production sectors. The assumption is made that net value added is a function simply of the gross value of sectoral output and the trend variable t to allow for any technological drift over the years. The one exception is in the service sector, where the value of output is left undefined in model. It is assumed instead that the net value added in services depends on current national income. Thus

$$(19) \quad V_t^A = b_{19}A_{1t} + c_{19}A_{2t} + d_{19}t + U_{19t}$$

$$(20) \quad V_t^R = b_{20}R_t + c_{20}t + U_{20t}$$

$$(21) \quad V_t^G = b_{21}G_t + c_{21}t + U_{21t}$$

$$(22) \quad V_t^S = b_{22}NI_t + c_{22}t + U_{22t}$$

where V^i = net value added in sector i (in 1955 pesos); i = A(agriculture, R(industry), G(government), and S(services).

IDENTITIES

The set of non-stochastic relationships or identities will now be presented to complete the model.

Data on inventories of agricultural products in the Philippines are generally not available. In a recent NPA study, it was concluded that although "there were some significant fluctuations in stocks of some (non-food) products" [24, p.A-3], they generally tended to cancel each other so that in the aggregative estimates inventory change as an end use was simply ignored. Here total output of agricultural intermediate goods is likewise taken as the sum of domestic purchases by industry and agricultural exports. Equation (2) has total output (A_2) as the dependent variable while the volume of agricultural products purchased domestically (A_{2D}) is explained in (5); therefore, agricultural exports may be obtained as a residual, i.e.,

$$(23) \quad A_{2E} = A_{2t} - A_{2Dt}$$

The annual change in the stocks of industrial goods is also determined residually in the model from the identity

$$(24) \quad R_{5t} = R_t - R_{1t} - R_{2t} - R_{3t} - R_{4t}$$

where each term in the right hand side appears as a dependent variable (measured in 1955 pesos) elsewhere in the model.

Value added in the government sector (V^G) is allocated between factor payments to agricultural households (V^G_A) and factor payments to non-agricultural households (V^G_N) using the allocation ratios derived in [15, pp.A:14-15], viz.: $V^G_N/V^G = 51.5\%$, $V^G_A/V^G = 48.5\%$.

Thus

$$(25) \quad V^G_t = V^G_{At} + V^G_{Nt}$$

$$(26) \quad V^G_{Nt} = 1.06\ V^G_{At}$$

Personal income earned in each household sector -- agricultural and non-agricultural -- may be computed therefore as the sum of sectoral value added and its share of government value added. To determine disposable income in agricultural households (A^d) and in non-agricultural households (N^d), tax payments made in each sector is subtracted from personal income. The average tax rate on agricultural income (r^A) and on non-agricultural income (r^N) are defined such that

$$(27) \quad A^d_t = (1-r^A_t)(V^A_t + V^G_{At})$$

$$(28) \quad N^d_t = (1-r^N_t)(V^N_t + V^G_{Nt})$$

The model treats the tax rate variables r^A and r^N as instruments of fiscal policy. Their variation over the years may be attributed to changes in tax legislation and differing degrees of enforcement of existing tax laws; in either case, it is reasonable to assume that the government has direct influence on the effective tax rates on income in the two household sectors.

The final identities in the model define the aggregative target variables to which economic policy is presumed to be directed. National income (NI) is the sum of net value added in the four production sectors. Thus

$$(29) \quad NI_t = V_t^A + V_t^N + V_t^G + V_t^S$$

Because the model does not touch on the price of product in services and government, the consumer price index (p) is defined rather narrowly as the weighted average of the price indices of agricultural food (p^{A1}), domestically produced industrial consumer goods (p^{R1}), and imported industrial consumer goods (p^{M2}). Thus

$$(30) \quad p_t = \underset{\sim}{A}_1 p_t^{A1} + \underset{\sim}{R}_1 p_t^{R1} + \underset{\sim}{M}_2 p_t^{M2}$$

where the weights $\underset{\sim}{i}$ ($i=A_1, R_1, M_2$) represent the share of each class of commodities to total consumption expenditures

in 1955.

Finally, the trade balance (B) is the difference between total exports and total imports, i.e.,

$$(31) \quad B_t = A_{2Et} + R_{4t} - M_{1t} - M_{2t} - M_{3t} - M_{4t}$$

The complete list of endogenous and exogenous variables follows:

I. Endogenous variables

A. Current (31)

A_{1t}, A_{2t}, A_{2Dt}, A_{2Et}, R_{1t}, R_{2t}, R_{3qt}, R_{3ct}, R_{4t}, R_{5t}, R_t, V^G_{At}, V^G_{Nt}, V^A_t, V^R_t, V^G_t, V^S_t, NI_t, A_t, N_t, B_t, p^{A1}_t, p^{A2}_t, p^{R1}_t, p^{R2}_t, p^{Iq}_t, p^{R3c}_t, p^{M2}_t, p^{M3}_t, p^{M4}_t, p_t

B. Lagged (11)

$A_{1,t-1}$, $A_{2,t-1}$, $A_{2D,t-1}$, $R_{3q,t-1}$, $R_{3c,t-1}$, $\sum_{i=1}^{t-1} R_{3qi}$, R_{t-1}, NI_{t-1}, p^{A1}_{t-1}, p^{A2}_{t-1}, p_{t-1}

II. Exogenous variables

A. Current (12)

M_{1t}, M_{2t}, M_{3t}, M_{4t}, r^A_t, r^N_t, L_t, G_t, w^o_t, p^{A2}_{xt}, p^{R4}_{xt}, t

B. Lagged (3)

$\sum_{i=1}^{t-1} M_{4i}$, w_{t-1}, $M_{4,t-1}$

RMB:abg
22.I.71

APPENDIX

The post-war experience of the Philippines exemplifies the significant influence of government policy on the direction of economic activity among developing economies during the period. The Philippine case is uncommon-- and thus holds special interest-- in some important respects. In the first place, there was minimal direct government participation in the production of nonpublic goods. Instead, a whole set of policy tools were used to modify or alter the economic environment in seeking to achieve some policy objectives.

A second salient feature of the economy is that, throughout the period from 1949 to 1965, there was effective control on the part of the government of the level and composition of imports. In the face of a severe balance of payments crisis in 1949, controls on imports and foreign exchange were established while the pre-war exchange rate of the overvalued peso was maintained. Sixteen years passed before the government saw fit to adopt officially a more realistic exchange rate and even after "full decontrol" was started, letters of credit for selected categories of imported commodities were subject to time deposits which required a reserve of one hundred per cent (imposed in 1962 and abolished in 1966). Given the overvaluation of the domestic currency and the strategic importance of imported goods to certain sectors of the economy, government control of imports served as a powerful instrument in redirecting economic activity during the period.

Thirdly, concerning policy objectives, price stability was sought actively in both words and deeds. Government pronouncements on the desirability of stable prices pervaded the monetary literature. Monetary

policy was very often restrictive and fiscal policy rather conservative. Government efforts in bringing about a stable price level was remarkably successful, especially in the fifties when the general wholesale price index registered a statistically zero rate of increase. This is in sharp contrast with the experience of other less developed countries which relied heavily on monetary expansion and active fiscal policy to increase output with generally an accompanying substantial rise in prices. The interesting question arises therefore on the extent to which the government's preoccupation in holding the price line had entailed a sacrifice in output growth. The balance of payments problem, everpresent during the period, was of course intimately related to the objectives of price stability and output growth so that any trade-off relationship must take on a triangular character.

The Philippine example strongly suggests that long-run growth of output is not the only motivation of economic policy in less developed countries. Policy-makers in say, a small open economy are also faced year by year with problems that have to do with such related and possibly conflicting goals of price stabillity and external balance. An empirical knowledge, based on recent experience, of (1) the short-term reactions of the economy to exogenous disturbances of either domestic or foreign origin, (2) the relationship between policy instruments and targets, and (3) the trade-off possibilities existing among the objective variables, would seem necessary in coping with the problem of short-term adjustment.

FOOTNOTES

1. The motivation for the proposed study of trade-offs among such policy objectives in the Philippines for 1949-65 is discussed in the appendix.

2. As done, for example, in [19].

3. In the period under study, Philippiner merchandise trade was transacted mainly with major industrial countries, viz.: United States, Japan, Germany, Netherlands and United Kingdom. For the geographical composition of individual commodities in Philippine foreign trade, see [6], where the ten principal imports are listed by country of origin (Table 66, pp.235-243) and the ten principal exports by country of destination (Table 64, pp. 207-226).

4. See Table 3 (p. 30) and Table 60 (p. 163) in [6].

5. See [21, pp. 3-5]. Seers cogently argues for an analytic distinction between the economic structures in the less developed countries and the advanced economies.

6. See [15] , [10] and [26].

7. See [25].

8. A bibliography of the more substantial empirical studies recently published is provided in [5 pp. 14-19];see also [18].

9. See the summary of estimates of price elasticities given in Table I-1, [5, pp. 15-19] which include regional estimates in rice and corn production in the Philippines.

10. Indeed, cursory examination of Philippine agricultural data on both area and output vis-a-vis relative prices readily confirms this illustrative example.

11. Since land is not the only factor of production, a more saisfactory, if infeasible due to lack of data, measure of planned production would include all inputs used in agriculture.

    There is little evidence that yield in Philippine agriculture is influenced by price; see [2, p. 265] and [14, p.26].

12. The movement of the two partial productivity indices output/land and output/labor was erratic and exhibited only modest improvement at best over the period 1950-1966; see Table 10 in [11, p. 182] and Table 22 in [26, p. 68].

13. See /11, p.181/ and /26, p. 58/

14. The agricultural money wage rate published in the annual reports of the Central Bank until 1963 represents a weighted average of farm wage rates of plowmen, planters, harvesters and common laborers in nine agricultural regions. It does not include payment in kind, which is a significant part of total wages. (The 1961 PSSH survey /17/ , for example, attributes about a fourth of total agricultural wages to payment in kind.)

15. In examining intersectoral wage differentials in the Philippines, Hicks and McNicoll conclude: "The picture of the labor market ... is therefore one in which there is no sharp distinction between the traditional and modern sectors. Rather, the former agricultural laborer who turns his hands to small scale manufacturing can initially expect only marginally increased wages ... Manufacturing, of course, is not the whole modern sector, but in most other parts of it median wages are approximately the same". /11, pp.254-55/

16. For a discussion of the various forms of constraints operating in agricultural adjustments in the less developed countries, see, for example, /5, pp. 6-8/ and the references cited there.

17. In the absence of a priori preference for using any particular non-linear form, each behavioral relationship in the model is expressed as linear in coefficients to avoid estimation and simulation difficulties associated with non-linear functions as well as problems in the interpretation of test statistics. It must be noted however that the linear form may be considered as the first two terms of a Taylor series expansion of the non-linear function at a particular point, e.g., the sample means.

18. Similar views are expressed in /20/ and /22/. The inability of Philippine manufacturing to absorb labor to an extent suggested by relative factor endowments is explained in /4/ to be in part attributable to the prevailing wage rate higher than its equilibrium value, i.e., not reflecting the scarcity value of labor.

19. The sharp increase in the stock of raw materials in manufacturing for these years is discernible from data on the value of inventories in /1/for the years 1956-1965.

20. Bauer and Yamey, for example, has observed in several less developed countries that "much labor is often spent in prolonging the life of capital equipment of all kinds and capital equipment is kept in use long after it has reached a condition in which it would be scrapped in wealthier countries " /3, p. 120/.

21. The influence of stock accu ulations previous to t=1 on the dependent variable is subsumed in the constant term a_4 . Suppose the following relationship holds:

$$R_{4t} = a'_4 + d'_4 \sum_{i=-\infty}^{t-1} R_{5i} + U'_{4t}$$

But $$\sum_{i=-\infty}^{t-1} R_{5i} = \sum_{i=-\infty}^{0} R_{5i} + \sum_{i=1}^{t-1} R_{5i}$$

Therefore $$R_{4t} = (a'_4 + d'_4 \sum_{i=-\infty}^{0} R_{5i}) + d'_4 \sum_{i=1}^{t-1} + U'_{5t}$$

In effect, changes in stocks prior to the observation period are irrelevant to the estimation of the coefficient d_4.

22. The service and government sectors purchase only inappreciable amount of agricultural intermediate goods; see, for example, [24].

23. Construction activity uses a small portion of total agricultural intermediate products, mainly logs and timber. For simplicity, the product price of construction is not included as a deflator for p_{A2} in equation (5).

24. See, for example, [23, p. 23].

25. See [12, p. 5:40].

26. In the only published empirical study of investment functions in the Philippines, Hooley and Sicat [13] found a "strong profit-push type of (investment) behavior" from 1961-62 cross-section data of about 200 manufacturing firms. Other explanatory variables were considered, e.g., current and lagged sales, capital stock, retained earnings and depreciation, but profits clearly emerged as the major determinant of manufacturing investment.

27. See [7, pp. 120-122].

28. Of the ₱463 M. total loans granted by non-bank financial institutions in 1965, for example, ₱459.8M came from the government institutions, viz: Agricultural Credit Administration, Government Service Insurance System, Social Security System and National Investment Development Corporation; see Tables 45 and 46 in [6, pp. 133-134].

29. The Price Stabilization Corporation (PRISCO) was created in October 1950 (Executive Order No. 350) at a capitalization of ₱30 M to maintain price supports on rice and corn and to finance all food imports. Its functions were later taken over by other government agencies. The National Rice and Corn Corporation (NARIC) was reactivated as an independent corporation in June 1951 (Republic Act 663) and assigned the stabilization of rice and corn prices and given the monopoly of importing rice. Food items other than rice and corn fell under the hands of the National marketing Corporation (R. A. 1345) created "not for the purpose of making a profit but to tender an essential public service", /9, p. 329/.

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