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SECTORAL EMPLOYMENT, INCOME DISTRIBUTION AND CONSUMPTION: A MACROMODEL WITH AN INPUT-OUTPUT STRUCTURE

by

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1. Introduction

Our primary objective in working on this paper was to construct a model based on Philippine data that would show interrelationships among: (a) the distribution of employment in the production sectors of the economy; (b) a measure of income distribution; and (c) consumption demand, hence saving and growth. The 1969 input-output table (the latest available) plus the plenitude of data from other sources made this objective feasible, although as it turned out, the only measure of income distribution that we found it possible to work with--at least for the present--was the ratio of the total wage bill to GNP, and it was necessary to adjust various data series to make them compatible.

Our secondary objective was to use the model in projection or purposes over the next few years. In particular, what would such a model imply (in the absence of changes in the underlying structure and in the assumptions regarding the exogenous variables) as to employment

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and the income distribution, and growth of GNP? The model as it stands, even after various adjustments, gives an employment figure for 1975 that appears too high in light of the present economic slow-down. The model, in its present form, is not equipped to handle recessionary phenomena.

2. Structure of the Model

2.1 Notation

Value figures are annual data in million pesos at 1967 prices except when otherwise stated. Employment is in thousand persons while wage rates are in pesos.

2.1.1 Macroeconomic Variables

Sources of data are indicated by the numbers in brackets which correspond to the data sources listed at the end of the paper. Table 1 gives the list of data. Lagged values of variables are denoted by negative subscripts, e.g. K_{-1} is capital stock one year earlier.

CG = government consumption expenditures [5]

CP = private consumption expenditures [5]

GDP = gross domestic product [5]

GNP = gross national product [5]

I = gross domestic investment [5]

K = capital stock at beginning of year; see Appendix B for method of estimation [5]

M = imports of goods and services [5]

N = employment--ILO estimates[1/] [3]

NF = full-time equivalent employment; see Appendix C for discussion [1](i) [3] [4]

NFIA = net factor income from abroad [5]

P = implicit price index for GNP, 1967 = 100 [5]

P' = .01 P

R = wage bill ratio; see Appendix D for discussion [2] [3] [5]

W = annual money wage rate, computed as equal to the daily wage rate of unskilled industrial workers in Manila multiplied by 250. Daily money wage from the Central Bank money wage rate index [2]

WB = total wage bill

W/P' = real wage rate, W/P' = W ÷ .01 P [2] [5]

X = exports of goods and services [5]

2.1.2 Sectoral Variables

The subscript i represents a major industry group (see Appendix E for subscript names).

CP_1 = private consumption of the low-income class

CP_2 = private consumption of the high-income class

WB = total wage bill

MPC_W = marginal propensity to consume out of wage income

CP* = private consumption with shares of mining/quarrying and commerce excluded

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[1/] The labor force estimates by the International Labor Office (ILO), [3], are derived from the Bureau of Census and Statistics' (BCS) labor force surveys. The population figures used by the BCS as control totals for their estimates were adjusted by the ILO to reflect the rate of population growth implied by the 1970 census. Thus population control figures are changed but the percentage distributions given by the BCS surveys are maintained.

CP_1^* = CP_1 adjusted

CP_2^* = CP_2 adjusted

c_{1i} = average family expenditure of the low-income class on output of sector i

y = average family income of the low-income class

C_{1i} = private consumption of the low-income class on output of sector i

C_{2i} = private consumption of the high-income class on output of sector i

$\hat{C}_{1i}$ = private consumption of the low-income class on output of sector i estimated by regression

C_i = sectoral private consumption

I_i = investment expenditures on sector i output

G_i = government current expenditures on sector i output

X_i = sectoral exports

M_i = imports of i goods

$D_{F,i}$ = final demand for i goods

$D^*_{F,i}$ = sectoral final demand at 1969 prices, in million pesos

D^*_F = matrix of $D^*_{F,i}$'s

$D^*_{T,i}$ = sectoral total demand at 1969 prices, in million pesos

D^*_T = matrix of $D^*_{T,i}$'s

N'_i = initial estimate of sectoral employment, before adjusting to control total

N_i = final estimate of sectoral employment, after adjusting to control total

W'_i = unadjusted sectoral wage rate; see Appendix D

W_i = adjusted sectoral wage rate; see Appendix D

W_i/P' = real sectoral wage rate

WB_i = sectoral wage bill; see Appendix D

2.1.3 Structural Parameters (see Tables 2 and 3 for the values of the structural parameters)

P_i^* = sectoral price index for 1969, with 1967 = 100

$(I-A)^{-1}$ = inverse matrix from the 1969 input-output table

γ_i = sectoral labor input coefficient for 1969: $\gamma_i = (N_i/D_{T,i})_{1969}$

h_i^I = ratio of sectoral to total investment in 1969

h_i^G = ratio of sectoral to total government consumption in 1969

h_i^X = ratio of sectoral to total exports in 1969

h_i^M = ratio of sectoral to total imports in 1969

2.2 Equation Blocs

2.2.1 Macroeconomic Bloc

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

(2) $GDP = -2780.0156 + \underset{(2.95)}{1.0807}\ NF + \underset{(5.49)}{0.2014}\ K \qquad \bar{R}^2 = 0.985$

(3) $NF = 11575.3125 + \underset{(8.88)}{0.2282}\ GDP - \underset{(-4.21)}{3.35021}\ W/P \qquad \bar{R}^2 = 0.979$

(4) $NFIA = -0.01\ GDP$

(5) $GNP = GDP + NFIA$

(6) $CP = -2220.34766 + \underset{(2.61)}{4464.94531}\ R_{-1} + \underset{(37.87)}{0.79737}\ GNP \qquad \bar{R}^2 = 0.998$

(7) $I = GNP - CP - CG - X + M$

(8) $N = 0.93636\ NF$

2.2.2 Input-output Bloc

(9.1) $CP = CP_1 + CP_2$

(9.2) $\Delta CP_1 = (1 + \theta_{-1})(\Delta WB_{-1})(MPC_w)$

(9.3) $\theta_{-1} = (WB_{-1} - WB_{-2})/WB_{-2}$

(9.4) $CP^* = CP - C_q - C_r$

(9.5) $C_q = 0.00092\ CP$

(9.6) $C_r = 0.24956\ CP$

(9.7) $CP_1^* = (CP^*/CP)CP_1$

(9.8) $CP_2^* = (CP^*/CP)CP_2$

(9.9) $c_{la} = e^{4.86294}\ y^{0.33253}$

(9.10) $c_{ln} = e^{2.26317}\ y^{0.61202}$

(9.11) $c_{lc} = e^{-0.03641}\ y^{0.73031}$

(9.12) $c_{lt} = e^{1.14139}\ y^{0.55480}$

(9.13) $c_{ls} = e^{-1.07619}\ y^{0.88389}$

(9.14) $y = 1.85\ W/P'$

(9.15) $\hat{C}_{li} = (1/1.85)c_{li}\ N \qquad i = a,n,c,t,s$

(9.16) $C_{li} = (\hat{C}_{li}/\sum\hat{C}_{li})CP_1^* \qquad i = a,n,c,t,s$

(9.17) $C_{2a} = 0.31\ CP_2^*$

(9.18) $C_{2n} = 0.41\ CP_2^*$

(9.19) $C_{2c} = 0.10\ CP_2^*$

(9.20) $C_{2t} = 0.05\ CP_2^*$

(9.21) $C_{2s} = 0.13\ CP_2^*$

(9.22) $C_i = C_{1i} + C_{2i} \qquad i = a,n,c,t,s$

$$(10)\quad I_i = h_i^I \cdot I$$

$$(11)\quad G_i = h_i^G \cdot CG$$

$$(12)\quad X_i = h_i^X \cdot X$$

$$(13)\quad M_i = h_i^M \cdot M$$

$$(14)\quad D_{F,i} = C_i + I_i + G_i + X_i - M_i$$

$$(15)\quad D^*_{F,i} = D_{F,i}(.01\ P^*_i)$$

$$(16)\quad D^*_T = (I-A)^{-1} D^*_F$$

$$(17)\quad N'_i = \gamma_i\ D^*_{T,i}$$

$$(18)\quad N_i = (N'_i/\textstyle\sum N'_i)N$$

$$(19)\quad WB_i = (W_i/P')N_i/1000$$

$$(20)\quad WB = \textstyle\sum_i WB_i$$

$$(21)\quad R = WB/GNP$$

2.3 The Macroeconomic Structure

Equations (1)-(8) can be considered as the macroeconomic bloc of the model. The principal endogenous variables are GNP, GDP, NF and CP. We assume that investment I is obtained simply as a residual, while NFIA is a fixed proportion of GDP. It is straightforward to consider variants where NFIA is directly estimated and I is a policy variable.

The model is designed to allow an investigation of the effects of income distribution (the wage bill ratio) on such variables as consumption and employment. The wage bill ratio, defined as the wage bill

divided by GNP, reflects the proportion of total income going to wage earners and, assuming varying marginal propensities to consume out of wage and non-wage incomes, may be used to explain changes in the aggregate level of consumption brought about by changes in the income distribution.

The wage bill is computed from the products of sectoral employment (N_i) and the adjusted sectoral wage rates (W_i). Use of the Central Bank (CB) sectoral wage rates gives estimates of the wage bill which are too large, with wage bill ratios as high as .966 (for 1956). Apparently, the CB's survey results on sectoral wage rates are biased upward, which can be explained by the fact that about 60% of firms in the CB sample come from the Greater Manila area thus unduly raising the observed wage rates. A different series of sectoral wage rates appeared necessary, while we derived by adjusting the CB rates downward using the implied wage rates in the 1961 and 1965 input-output tables as control figures (see Appendix D). But no matter how measured, wage bill ratios have been decreasing over time--any desired redistribution of national income from non-wage to wage earners has not been accomplished.

The model was fitted to annual observations for the sample period 1956-1969. Three linear equations were estimated for aggregate production, employment and consumption.

Equation (2) is a production function which is linear in K and N. Ordinary least squares using observed values of current outputs and inputs was employed. Objections have been raised against this procedure because

it ignores expectations and lagged adjustments underlying a more adequate theory of the production function.[2/] In this model we opted for a simple direct estimation because of the lack of an appropriate input utilization index series for our time data requirements.

Equation (3) is an employment (full-time equivalent) demand function. We discarded an earlier attempt to use an equilibrium approach in determining the level of employment. Initially, we tried to include supply-determining factors using the unemployment rate as an explanatory variable.(among others). The results were not convincing under standard statistical criteria, however. Since the Philippines is faced with a labor-surplus situation anyway, we felt that a labor demand function by itself would be suitable for short-run projection needs.

Equation (6) is our aggregate consumption function. In addition to GNP, we have added the wage bill ratio as an explanatory variable. The basis for this feature is that changes in the distribution of income between wage and non-wage income affect the economy's overall consumption level. In Appendix F we show that the marginal propensity to consume out of wage income is greater than the propensity to consume out of non-wage income. Equation (7) gives investment as a residual. Equation (8) converts employment's full-time equivalent to a head count.

[2/] Coen and Hickman (1970) have made estimates of a production function from estimates of the factor demand relations. They argued that the production function is a constraint relating desired or expected output to desired factor inputs which are generally not observable variables.

Equations (2) and (3) give the following reduced form equations:

(2a) GDP = 12913.9645 + 0.2674 K - 480.5644 W/P

(3a) NF = 14522.0506 + 0.0611 K - 444.6788 W/P

The macro indices corresponding to the final demand vectors of the input-output table are broken down among the various sectors. The other macro totals are used as control totals for the endogenous variables generated by the input-output bloc.

2.4 The Sectoral Structure

The presence of an input-output structure in the model enables us to link the demand and production sides of the macro model. The 1969 inter-industry transactions table provides the numerical requirements for tracing intermediate inputs and outputs among the various sectors. The inverse coefficient matrix enables one to trace the effects of a compositional shift of final demand on sectoral output levels. Finally, one can determine the nonproduced factor-requirements through the primary-input quadrant.

The bloc of sectoral equations in the model is used to derive sectoral final demand, sectoral output and employment, and the sectoral wage bills. Except for private consumption expenditures, the sectoral distribution of the final demand vectors as given in the 1969 input-output table of the Philippine economy is assumed to be maintained over time.[3/] The 1969 table has fixed coefficients of the Leontief-type

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[3/] Preston (1974) argues that an important part of modern input-output analysis is the development of techniques to model the adjustment of input coefficients in response to changing prices and technology. We were unable to take this matter into account.

For our purposes, we collapsed the twelve-sector aggregated tables prepared by the National Economic and Development Authority (NEDA) into a seven-sector model. This allowed us to use a sectoral classification scheme consistent with the seven-sector classification used in the national accounts and in most of the available sectoral data.

In this model, we wanted to trace the effects of a change in the wage/non-wage composition of total income on the sectoral composition of final demand, specifically on private consumption.[4/] All the other final demand vectors were assumed to maintain their sectoral shares as given in the 1969 table. To achieve this, we assumed that there are only two income classes. For the low-income group, we assumed that that all of its income consists of wages. As an initial step, private consumption is broken down into subtotals CP_1 and CP_2, representing the consumption of the low- and high-income classes respectively. Then CP_1 and CP_2 are broken down among the different sectors. For the low-income class, the breakdown was assumed to be dependent on income elasticities while for the high-income group, a prorating scheme was used. Due to data limitations, sectoral consumption functions were estimated for only five sectors, namely: agriculture, manufacturing, construction, transportation and services. For the two remaining sectors, another prorating method was employed. All this is shown in Appendix A.

4/ Basically the same assumption was used by Paukert, Skolka and Maton (1974) in a model showing the relationship between income distribution and employment traced through the effects of a simulated change in their income distribution measure on the composition of demand. They found for Philippine data that an income redistribution leads to increased demand on products which are more labor-intensive.

For the low-income class, we estimated regression equations of the form

$$(22) \quad c_{li} = e^{a_i} y^{b_i} \qquad i = a,n,c,t,s$$

where

c_{li} = average family expenditures of the low-income class on the output of sector i at 1967 prices

y = average family income of the low-income class at 1967 prices

b_i = income elasticity of average family expenditures (low-income class)

Equations (22) were estimated using detailed budget studies of 21 commodity items for 1971. The 1971 BCS survey of family expenditures contains data on average family income and total expenditures on 21 commodity-items. We introduced a correspondence between these items and five sectors in our 1969 input-output table, namely agriculture, manufacturing, construction, transportation, and services (see Table 5). For the two remaining sectors, commerce and mining/quarrying, we used a prorating scheme.

To get a dichotomy between our low- and high-income groups, we cumulated total family income given in Table 4 from the lowest income class up, until it approximated our estimated total wage bill for 1971. The assumption used here is that low-income families derive all their income from wages. The low-income subsample consists of the first ten income classes in Table 4. With equations (22) estimated by ordinary least squares on the log-linear transformation, we used the product of real wage rate and the approximate number of workers per family as an estimate of average family income for this low-income group. Hence, we obtained for this group its sectoral consumption expenditures. To get

the final breakdown of the total consumption expenditures for the five sectors, equations (9.16) were applied. In breaking down C_{2i}, fixed shares were maintained.

The remaining equations (10)-(20) derive final and total demands as well as sectoral employment and sectoral wage bills. The sectoral distribution of each of the four remaining components of final demand (I, CG, X and M) are assumed to be unaffected by changes in the distribution of income. Thus the distributions given in the 1969 input-output table are maintained and, for each component, sectoral demand is estimated by prorating the control total from the macromodel with the corresponding distribution coefficient (equations (10)-(13)).

Since the 1969 inverse matrix of coefficients reflects inter-industry flows of goods valued at (current) 1969 prices, it can apply only to values of final demand measured in 1969 prices. Equation (15) converts each element of the final demand vector, which is expressed in 1967 prices, to 1969-based prices in order for us to be able to use the 1969 input-output inverse matrix. This new vector of final demand is then pre-multiplied by the inverse matrix in equation (16) to get the vector of total demands.

Equation (17) derives our initial estimates of sectoral employment by applying labor input coefficients implied by the 1969 table. These initial figures are then adjusted using the aggregate employment figure N as control total (equation (18)). Finally sectoral wage bills are derived by multiplying the given real sectoral wage rates by sectoral

employment (equation (19)) and the wage bill ratio is then determined (equation (20)).

3. Prediction Errors

We expect structural changes to have occurred since the sample period, requiring changes in the coefficients in the model. Martial law was declared in 1972, and behavioral relationships have changed since then. The year 1973 was a period of adjustment, so that 1974 is the only year we have for testing the model. Using actual values of the exogenous variables to forecast the endogenous variables for 1974 enables us to evaluate the forecast errors generated by the model. The forecast errors, in turn, give us guidelines to make adjustments in some of the coefficients of our estimated equations.

Table 6 shows the percentage errors generated by the model's predictions. To make the results of the model approximate actual values for 1974, we consider the following adjusted equations:

(2') $GDP = -2780.0156 + 1.0807\ NF + 0.188\ K$

(3') $NF = 11575.3125 + 0.2\ GDP - 3.35021\ W/P'$

(6') $CP = 0.96\ (-2230.34766 + 4464.94531\ R_{-1} + 0.79737\ GNP)$

(8') $N = 0.90016\ NF$

Equation (2') involves a downward adjustment of the marginal productivity of capital. The aggregate technology for the economy shows an increasing trend in the capital-labor ratio, which should lead to a diminishing marginal productivity of capital. In addition there has been

a large increase in the government sector's share of gross domestic capital formation, which has a relatively low productivity. From 1970 to 1973, this share has grown from 6.68% to 13.14%. Furthermore, in a study on industry capital utilization in the Philippines for 1972, Bautista (1974) states that "close to 3/5 of installed capital in the sampled establishments remained unutilized," The simplest way to handle this was to adjust the marginal product of capital in a downward direction.

Equation (3') carries an adjusted coefficient of the GDP variable in (3). We expect the increasing capital-labor ratio to increase the marginal product of labor relative to capital. Hence every unit of GDP requires less of NF.

Equation (6') in turn involves the application of a factor less than one to the entire consumption function. This was felt necessary considering that the economy has been experiencing double-digit inflation since 1969. A downward shift of the consumption function would be expected on account of the squeeze on the real incomes of wage earners.

Equation (8') adjusts the conversion factor used to derive N from NF to reflect a lower N to NF ratio. Such a change is called for by the increase in the average number of hours worked by labor which has caused this ratio to decrease from 0.93636 in 1968 to 0.90016 in 1974.

4. Projection Results

Projections for 1975-1979 were made using the adjusted model described in section 3 [equations (2'), (3'), (6') and (8') were substituted for equations (2), (3), (6) and (8) respectively]. No attempt was made to make longer-run projections since our assumption of a constant input-output structure is valid only for the short run.

Initial values used for the projections were values for 1974, consisting of the following: K = 138828, I = 7952, and R = 0.27750. The variables exogenous to the model were assumed to maintain growth rates equivalent to their respective average annual growth rates over the last five years (1970-1974).

The results of the projection exercise are shown in Tables 7 and 8. The growth rates computed for 1975 in Table 7 reflect percentage differences between actual values for 1974 and projected values for 1975.

The projections show GNP increasing at an average annual growth rate of 6.36 per cent and private consumption, CP, growing at a slightly higher rate of 7.13 per cent. The employment level N increases over the five-year projection period but its growth rate declines continuously from 7.46 per cent in 1975 to 4.80 per cent in 1979.

The projections show the wage bill ratio continuing its decline. By 1979 R will have gone down to 0.22387--labor would be receiving less than a fourth of GNP.

Curiously it seems, the sectoral projections show an increasing share for agricultural output in total private consumption and a corresponding increase in its share in total employment. The service sector on the other hand moves in the opposite direction with its shares of total private consumption demand as well as of total employment both declining. These deviate from the usual expectations of a growing service sector and a declining agricultural sector characteristic of development. Yet these results are consistent with declining real wages.

5. Concluding Remark

The value of a projection model lies in its portrayal of likely directions given past and present trends. On the likely assumption that we have not been experiencing a completely optimal state of affairs, what we want to do is <u>falsify</u> whatever projections we may have. Signals can be read from the projections, and depending on our priorities, we would want to change one or more of the likely courses of events.

Appendix A

Sectoral Decomposition of Private Consumption

To start with, we broke down private consumption CP into consumption of the low- and high-income groups. That is

$$CP = CP_1 + CP_2$$

where CP_1 is consumption of the low-income class and CP_2 is consumption of the high-income class. CP_1 is obtained by making use of the marginal propensity to consume out of wage income MPC_w which is shown to be equal to 0.915 in Appendix F. The change in consumption ΔCP_1 is taken to be equal to the product of MPC_w and the change in the wage bill WB. We have

$$\text{(A1)} \quad \Delta CP_1 = (0.915)\Delta WB$$

To avoid simultaneity problems, however, we consider the use of lagged values:

$$\text{(A2)} \quad CP_1 = (0.915)(WB_{-1} - WB_{-2}) + CP_{1,-1}$$

where $CP_{1,-1}$ is the consumption of the low-income class in the preceding year. This requires some adjustment however, and we use instead:

$$\text{(A3)} \quad CP_1 = (0.915)(1 + \theta_{-1})(WB_{-1} - WB_{-2}) + CP_{1,-1}$$

where

$$\theta_{-1} = (WB_{-1} - WB_{-2})/WB_{-2}$$

Equation (A3) was calculated using 1971 data expressed in constant 1967 prices as initial values. From the 1971 BCS survey of family income

and expenditures we obtained the sectoral consumption of the low- and high-income groups. This is shown in Table A-1.

Table A-1

Sectoral Consumption Expenditures
By Income Class, 1971

Sector	Low	High	Total
Agriculture	12,601.124	3,245.206	15,846.330
Manufacturing	3,338.222	4,270.354	7,608.576
Construction	1,659.615	1,006.284	2,665.899
Transportation	1,320.035	541.949	1,861.984
Services	2,040.704	1,352.809	3,393.513
Total	20,959.700	10,416.602	31,376.302

Once CP_1 is obtained, CP_2 is obtained as a residual. Prior to breaking down CP_1 and CP_2 into the different sectors, consumption for the two sectors of mining/quarrying and commerce was netted out. We have

(A4) $CP^* = CP - C_q - C_r$

where

(A5) $C_q = 0.00092\ CP$

$C_r = 0.24956\ CP$

The adjusted CP_1 and CP_2 are

(A6) $CP_1^* = (CP^*/CP)CP_1$

$CP_2^* = (CP^*/CP)CP_2$

In the next stage, we break down CP_1^* and CP_2^* among the five sectors of agriculture, manufacturing, construction, transportation and services. To do this, we made the sectoral consumption of the low-income class dependent on income elasticities. For the low-income subsample we estimated equations of the form

(A7) $c_{li} = e^{a_1} y^{b_1}$ $\quad i = a,n,c,t,s$

where c_{li} is the average consumption expenditure of the low-income class on output of sector i and y is average family income in that class. Using ordinary least-squares on the natural log-linear transformations the following regression equations were obtained:

(A8) $\ln c_{la} = 4.86294 + 0.33253 \ln y$ $\quad (17.5) \quad \bar{R}^2 = 0.971$

$\ln c_{ln} = 2.26317 + 0.61202 \ln y$ $\quad (17.0) \quad \bar{R}^2 = 0.969$

$\ln c_{lc} = -0.03641 + 0.73031 \ln y$ $\quad (17.4) \quad \bar{R}^2 = 0.971$

$\ln c_{lt} = 1.14139 + 0.55480 \ln y$ $\quad (10.8) \quad \bar{R}^2 = 0.928$

$\ln c_{ls} = -1.07619 + 0.88389 \ln y$ $\quad (12.0) \quad \bar{R}^2 = 0.940$

To estimate y, we multiply the number of workers per family by the wage rate. Appropriate deflators were used to express the relevant variables in constant 1967 prices. From Mangahas (1974), we got the

number of workers per family using his regression equation.

(A9) $n_f = 0.81 + 0.1831\ s$

Where n_f is the number of family members employed and s is family size. The value of 5.68 for s gives 1.85 for n_f. Hence we have

(A10) $y = 1.85\ W/P'$

Substituting (A10) in (A7) and dividing by 1.85, we got consumption per worker. An estimate of total consumption on the output of sector i was obtained by multiplying by the number of workers N. Hence we have

(A11) $\hat{C}_{1i} = (1/1.85)c_i N$

To get the final breakdown of CP_1^*, we used

(A12) $C_{1i} = (\hat{C}_{1i}/\sum \hat{C}_{1i})CP_1^*$

To break down CP_2^*, we used the following equations:

(A13) $C_{2a} = 0.31\ CP_2^*$

$C_{2n} = 0.41\ CP_2^*$

$C_{2t} = 0.05\ CP_2^*$

$C_{2s} = 0.13\ CP_2^*$

$C_{2c} = 0.10\ CP_2^*$

The fixed coefficients were obtained using sectoral shares of the high-income class given in Table A-1. Finally, the total shares of the five sectors are obtained from

(A14) $C_i = C_{1i} + C_{2i}$ $\qquad i = a,n,c,t,s.$

Appendix B

Note on Estimating the Capital Stock Series

Data for the capital stock series are obtained by taking the overall average of the total incremental capital-output ratio (ICOR) for the period 1946 to 1970 which is equal to 3.34. Then the capital stock at the beginning of year 1956 is estimated by multiplying the 1955 GNP (at 1967 prices) by the coefficient 3.34. To obtain the capital stock for the succeeding years, the following equation is used:

$$K = K_{-1} + I_{-1}$$

where K = capital stock for the current year

K_{-1} = capital stock for the previous year

I_{-1} = gross domestic investment for the previous year

The equation above defines K in terms of cumulated gross investment. It is assumed here that investment in the current period is not productive until the succeeding period.

Appendix C

Estimation of Full-time Equivalent Employment

Full-time equivalent employment is estimated by multiplying the number of employed persons at work by the average hours worked during the survey week and then dividing the total hours worked by 50 which is the "normal" full-time working hours.[1/]

In this paper the "normal" full-time working hours is redefined as equal to 40 only such that the Mijares-Tidalgo figures are multiplied by 5/4 or 1.25 in order to change the "normal" full-time weekly work standard from 50 hours to 40 hours.

To get the ILO full-time equivalent employment the following formula is used:

$$NF = (NF^*/N^*)N$$

where NF = ILO full-time equivalent employment

NF* = BCS full-time equivalent employment (Mijares-Tidalgo figures x 1.25)

N* = BCS employment figure

N = ILO employment figure

[1/] T.A. Mijares and R.L. Tidalgo, "Labour Absorption in the Philippines," paper read at the Conference on Manpower Problems in East and Southeast Asia held on May 22-28, 1971 at the University of Singapore.

Appendix D

Estimation of Wage Bill Ratio, Total Wage Bill and Adjusted Sectoral Wage Rates

The wage bill ratio (R) is the ratio of the total (current) wage bill to GNP at current prices, equal also to WB/GNP.

The total (current) wage bill (WB*) derives from the sum of the adjusted wage rate for each sector (W_i) multiplied by the corresponding ILO sectoral employment figure (N_i):

$$WB^* = \sum_i WB_i^* = \sum_i W_i N_i / 1000$$

Adjustments in the sectoral wage rate series were made because the CB indexes of average monthly earnings are biased toward urban areas which have higher pay relative to rural areas. The adjusted wage rate (W_i) is computed by dividing the CB annual earnings of wage earners for each sector (W_i') by the following deflation factors:

Sector[1/]	Deflation factor[2/]
a	1.814
q	1.437[3/]
n	2.074
t	2.115
r	1.734

[1/] See Appendix E for subscript names.

[2/] This is the average of the 1961 and 1965 ratios of CB wage rate to the input-output table implied wage rate per sector. The 1969 input-output figures were not used because there was no ILO sectoral employment figure for that year, which is needed in estimating the implied wage rate. The implied wage rate is computed by dividing the input-output sectoral wage bill by the corresponding ILO sectoral employment figure.

[3/] Only the figure for 1961 is used for sector q because the 1965 ratio is too low.

Since there are no available wage rate series for sectors c and s, we computed their wage rates by multiplying the weighted average of the adjusted wage rates of four sectors for each year of the period under study (1956-1969) by the factors λ_i, i = c, s. These factors are the averages of the 1961 and 1965 ratios of the implied (by the input-output tables) wage rates ($W_{i,I-O}$) to the weighted averages. Specifically, let Z be the set {a,n,t,r,}. For each year we can calculate the weighted average

$$(D1) \quad \bar{W} = \sum_{i \in Z} W_i N_i / \sum_{i \in Z} N_i$$

Also, we can calculate

$$(D2) \quad \lambda_i = 1/2\left(W^{61}_{i,I-O}/\bar{W}^{61} + W^{65}_{i,I-O}/\bar{W}^{65}\right) \qquad i = c,s$$

by using the values of (D1) for 1961 and 1965 and the wage rates implied by the 1961 and 1965 input-output tables. We then take it that for other years,

$$(D3) \quad W_i = \lambda_i \bar{W} \qquad i = c,s$$

where $\lambda_c = 2.045$ and $\lambda_s = 2.462$.

Appendix E

Sectoral Subscript Names and Comparison Between NEDA and our Sectoral Breakdown

The sectoral subscript i takes the following letters:

a	for Agriculture, fishing and forestry
q	for Mining and quarrying
n	for Manufacturing
c	for Construction
t	for Transportation, communication, storage and utilities
r	for Commerce
s	for Services

The 1969 input-output table of the Philippines[1/] features a 12-sector transactions table. To derive the seven major sectors from this table, some sectors are combined to form a particular sector. The following is a comparison of the 12-sectors (NEDA) and our 7-sectors:

NEDA I-O Code	Sectors	Our I-O Code	Sectors
1	Agriculture	1	Agriculture, fishing and forestry
2	Fisheries		
3	Forestry and logging		
4	Mining	2	Mining and quarrying
5	Food manufactures	3	Manufacturing
6	Other manufactures		
7	Construction	4	Construction
8	Utilities	5	Transportation, communication storage and utilities
9	Transportation		
10	Trade	6	Commerce
11	Banking insurance and real estate		
12	Other services	7	Services

[1/] NEDA, "Aggregated 1969 Transactions Table at Producers' Prices" (mimeo).

Appendix F

Estimating the Marginal Propensities to Consume Out of Wage and Non-wage Income

We may roughly estimate the propensities to consume out of wage income and out of non-wage income by making use of the following equation:

$$\text{(F1)} \quad \Delta CP = MPC_W \cdot \Delta WB + MPC_{NW} \cdot \Delta NWB$$

where

ΔWB = change in the wage bill

ΔNWB = change in the non-wage bill

$MPC_W = \frac{\Delta CP}{\Delta WB}$ = the propensity to consume out of wage income

$MPC_{NW} = \frac{\Delta CP}{\Delta NWB}$ = the propensity to consume out of non-wage income

Noting that the mean values for CP, R and GNP over the sample period were as follows:

$\overline{CP} = 16913.8$

$\overline{R} = 0.43082$

$\overline{GNP} = 21584.08$

and using the estimated consumption function, we make the following observations:

(a) At mean value, a one per cent (.01) increase in R keeping GNP constant will mean an increase in the wage bill of 215.8M, a decrease in non-wage bill of the same amount, and an increase in consumption of 44.6M.

(b) At mean values, a 1M peso increase in GNP, keeping R constant (no change in the distribution between wage and non-wage income) will mean an increase in the wage bill of .43M, an increase in the non-wage bill of .57M and an increase in consumption of .797M.

In summary, we have these two cases:

	ΔR	ΔGNP	ΔWB	ΔNWB	ΔCP
case a:	.01	0	215.8	-215.8	44.6
case b:	.00	1	0.43	0.57	0.797

We estimate values for MPC_W and MPC_{NW} by substituting into equation (F1) for each of both cases

case a $\quad 44.6 = MPC_W \cdot 215.8 + MPC_{NW} \cdot (-215.8)$

case b $\quad .797 = MPC_W \cdot 0.43 + MPC_{NW} \cdot 0.57$

Solving simultaneously, we have the following results:

$$MPC_W = 0.915$$

$$MPC_{NW} = 0.708$$

which show that the propensity to consume out of wage income is larger than the propensity to consume out of non-wage income.

Table 1

List of Data

Year	CG	CP	GDP	GNP	I	I_{-1}	K	K_{-1}	M	N	NF	NFIA	P	R	R_{-1}	W	W/P'	X
1956	1526	12869	16198	15994	2837	2512	49522	47010	3537	8236	7564	(345)	60.0	0.51958		1315.0	2191.66	2503
1957	1601	13382	16596	16816	3336	2837	52359	49522	4073	8780	8511	(322)	62.3	0.49837	0.51958	1300.0	2086.67	2350
1958	1664	13916	17605	17478	3302	3336	55695	52359	3524	9004	8648	(230)	63.6	0.47900	0.49837	1307.5	2055.81	2247
1959	1799	14472	19097	18637	3694	3302	58997	55695	2966	9156	9246	(288)	65.1	0.45489	0.47900	1317.5	2023.80	2098
1960	1911	15057	19489	19014	3288	3694	62691	58997	3253	9096	9221	(311)	68.2	0.44236	0.45489	1320.0	1935.48	2486
1961	2028	25801	20830	20229	3746	3288	65979	62691	3312	9732	10090	(166)	70.4	0.44642	0.44236	1352.5	1921.16	2567
1962	2079	16707	22070	21360	3649	3746	69725	65979	3339	10311	10547	(66)	75.2	0.42020	0.44642	1392.5	1851.72	2974
1963	2245	17708	24648	22862	4334	3649	73374	69725	3182	10533	10870	(73)	82.0	0.37817	0.42020	1467.5	1789.63	3543
1964	2334	18408	25616	23435	4956	4334	77708	73374	3836	-	-	(95)	85.9	-	0.37817	1482.5	1725.84	3754
1965	2436	19319	27135	24650	5184	4956	82664	77708	4068	10656	11937	(127)	89.4	0.38816	-	1585.0	1772.93	4264
1966	2439	20313	28288	25840	5274	5184	87848	82664	4263	11309	12262	(149)	94.5	0.42095	0.38816	1702.5	1801.58	4525
1967	2542	21276	29515	27348	6260	5274	93122	87848	5239	11559	-	(305)	100.0	0.37521	0.42095	1782.5	1782.50	4676
1968	2648	22146	29896	28781	6482	6260	99381	93122	5638	10815	11929	(411)	105.6	0.34659	0.37521	1982.5	1877.36	4258
1969	2902	23178	31137	30468	6506	6482	105863	99381	5489	-	-	(282)	111.9	-	0.34659	2075.0	1854.33	4040

Table 2

Structural Parameters: 1969

Sector	P_i^*	Y_i	h_i^I	h_i^G	h_i^X	h_i^M
a	120.2	.529	.0163	.0137	.2558	.0346
q	113.2	.051	.0097	.0038	.1522	.0787
h	105.4	.069	.5104	.1350	.3415	.8062
c	119.4	.129	.3571	.0226	.0150	.0008
t	107.9	.183	.0075	.0396	.0529	.0132
r	103.6	.122	.0987	.0331	.1019	.0107
s	111.6	.231	0	.7581	.0803	.0552

Source of basic data: NEDA, "Aggregated 1969 Transactions Table at Producers' Prices" (mimeo).

Table 3

Inverse Matrix of Coefficients: 1969

Sectors	1	2	3	4	5	6	7
1 Agriculture, Fishery and Forestry	1.09086990	0.08921027	0.38321310	0.15812421	0.08571315	0.02312611	0.09030700
2 Mining and Quarrying	0.00305977	1.01364517	0.04324739	0.02935972	0.00892127	0.00249512	0.00630999
3 Manufacturing	0.08387178	0.27930367	1.36359767	0.49457151	0.27659404	0.07133698	0.19048554
4 Construction	0.00062728	0.00266588	0.00349577	1.02183437	0.00300473	0.01613079	0.00382886
5 Transportation, Communication and Storage	0.01070946	0.03758166	0.03779003	0.03332395	1.06674957	0.03433136	0.02918560
6 Commerce	0.03171997	0.08217537	0.12112439	0.12490487	0.08832353	1.10639763	0.06685477
7 Services	0.02584473	0.04583006	0.04855433	0.08260047	0.06918526	0.08008516	1.08373547

Source of basic data: NEDA, "Aggregated 1969 Transactions Table at Producers' Prices" (mimeo).

Table 4

Total and Average Family Income and Average Consumption Expenditures by Sector, by Income Class: 1971

Income Class	Total Family Income (thousands of pesos)	Average Family Income (pesos)	Average Consumption Expenditures 1/ (thousands of pesos)			
			a	[illegible]	c	t	s
Under ₱500	110,939	337	981	405	82	92	82
₱500 to ₱999	578,431	754	1139	512	117	129	110
₱1,000 to ₱1,499	965,995	1,250	1310	688	150	152	157
₱1,500 to ₱1,999	1,304,067	1,743	1485	862	207	180	210
₱2,000 to ₱2,499	1,372,351	2,246	1632	1026	259	195	252
₱2,500 to ₱2,999	1,418,773	2,744	1763	1157	279	234	324
₱3,000 to ₱3,999	2,736,975	3,447	1879	1362	371	259	435
₱4,000 to ₱4,999	2,112,879	4,448	2143	1636	461	300	626
₱5,000 to ₱5,999	1,723,439	5,454	2341	1999	550	440	782
₱6,000 to ₱7,999	2,769,251	6,872	2621	2450	703	526	1088
₱8,000 to ₱9,999	2,017,560	8,927	2957	2930	1123	557	1533
₱10,000 to ₱14,999	2,811,168	12,014	3496	3809	1475	859	1974
₱15,000 to ₱19,999	1,220,236	17,186	4314	5381	2069	1194	2961
₱20,000 and over	2,572,221	31,756	4352	5525	3216	1608	4125
T O T A L	23,714,284						

Source: Bureau of Census and Statistics, Survey of Households Bulletin, Family Income and Expenditures, 1971, Series No. 34.

1/ Computed from Table 5.

Table 5

Total and Average Private Consumption Expenditures by Expenditure Group, by Sector: 1971

Sector and Expenditure Group	Total Private Consumption Expenditure (thousands of pesos)	Average Private Consumption Expenditure (pesos)
I. Agriculture, fishing and forestry	11,684,904	1,841
A. Food consumed at home	11,684,904	1,841
1. Cereals and cereal products	5,572,363	878
2. Fish and other sea foods	2,530,308	399
3. Meat and eggs	2,018,560	318
4. Roots, vegetables and fruits	1,563,673	246
II. Manufacturing	8,813,429	1,388
A. Food consumed at home	2,843,042	488
1. Milk and dairy products	739,191	116
2. Miscellaneous	2,103,851	331
B. Food consumed outside	767,621	121
C. Alcoholic beverages	483,317	76
D. Tobacco	938,204	148
E. Household furnishings and equipment	653,900	103
F. Household operation	682,330	108
G. Clothing and other wear	1,762,686	278
H. Special occasions of family	682,329	108
1. Food and refreshments	568,608	90
2. Alcoholic beverages	85,291	13
3. Tobacco	28,430	4
III. Construction	2,672,460	421
A. Housing	2,672,460	421
IV. Transportation, communication, storage and utilities	1,847,977	291
A. Fuel, light and water	1,023,495	161
B. Transportation and communication	824,482	130

(Continuation of Table 5)

Sector and Expenditure Group	Total Private Consumption Expenditure (thousands of pesos)	Average Private Consumption Expenditure (pesos)
V. Services	3,383,222	533
A. Personal care	454,887	72
B. Medical care	511,748	81
C. Recreation	511,748	81
D. Education	1,051,926	166
E. Gifts and contributions	170,583	27
F. Taxes paid	85,291	13
G. Services, etc.	0	0
H. Personal effects	170,583	27
I. Miscellaneous goods and services	426,456	67

Source: Bureau of the Census and Statistics, Survey of Households Bulletin, Family Income and Expenditures, 1971, series no. 34.

Table 6

Forecast Errors for 1974

Endogenous Variables	Actual Value	Predicted Value	Percentage Error
GDP	39796	44556	11.96
GNP	40655	44110	8.50
NF	15357	17772	15.73
NFIA	86	(446)	
CP	29214	34212	17.11
I	9469	8785	(7.22)
R	0.25862	0.31482	21.73

(Note: NFIA, which has always been negative prior to 1974, assumed a positive value in 1974 apparently as a result of a change in estimation procedure.)

Table 7

Projections of Macroeconomic Variables and Their Growth Rates 1975 - 1979

Variable & Growth Rate (r in %)	1975	1976	1977	1978	1979
K	149,387	160070	171315	183684	197274
r_k	6.77	7.16	7.03	7.22	7.40
GDP	43135	46046	49068	52337	55878
r_{GDP}	8,39	6.75	6.57	6.67	6.77
GNP	42704	45586	48577	51813	55319
r_{GNP}	5.04	6.75	6.57	6.67	6.77
NF	16503	17339	18179	19052	19965
r_{NF}	7.47	5.07	4.85	4.81	4.80
N	14855	15608	16364	17150	17971
r_N	7.46	5.07	4.85	4.81	4.80
NFIA	(431)	(460)	(491)	(523)	(559)
r_{NFIA}		6.73	6.74	6.52	6.89
CP	31666	33830	36128	38566	41211
r_{CP}	8·40	6.84	6.80	6.75	6.86
I	10683	11245	12369	13590	14918
r_I	12.82	5.18	10.0	9.88	9.78
R	. 26050	.25073	. 24166	.23268	.22387
r_R	.70	(3.73)	(3.63)	(3.73)	(3.79)

Table 8

Projections of Sectoral Private Consumption Expenditures
& Sectoral Employment and Their Percent Distributions
1975-1979

CP

Sector	1975		1976		1977		1978		1979	
	Amount	% Share of total	Amount	% Share of total	Amount	% Share of total	Amount	% Share of total	Amount	% Share of total
a	5745	18.13	6209	18.33	6731	18.64	7298	18.93	7915	19.21
q	29	.10	31	.10	33	.10	35	.09	38	.10
n	11983	37.81	12777	37.72	13512	37.41	14306	37.10	15163	36.80
c	1361	4.30	1475	4.36	1622	4.49	1783	4.63	1959	4.76
t	1293	4.08	1384	4.09	1473	4.08	1570	4.07	1674	4.08
r	7932	25.03	8455	24.96	9016	24.96	9625	24.96	10285	24.96
s	3352	10.58	3549	10.48	3740	10.36	3950	10.25	4178	10.14
Total	31695	100.00	33880	100.00	36127	100.00	38567	100.00	41212	100.00

N

Sector	1975		1976		1977		1978		1979	
	Amount	% Share of total	Amount	% Share of total	Amount	% Share of total	Amount	% Share of total	Amount	% Share of total
a	8046	54.28	8484	54.36	8899	54.38	9331	54.41	9782	54.43
q	53	.36	56	.36	56	.35	56	.33	56	.32
n	1631	11.01	1698	10.88	1771	10.83	1846	10.77	1925	10.72
c	814	5.50	849	5.44	916	5.60	985	5.75	1058	5.89
t	560	3.78	589	3.78	614	3.76	640	3.74	667	3.72
r	1621	10.94	1701	10.90	1784	10.91	1870	10.91	1959	10.90
s	2129	14.37	2230	14.29	2325	14.91	2423	14.13	2529	14.05
Total	14824	100.00	15607	100.00	16365	100.00	17151	100.00	17972	100.00

Sources of Data

[1](i) Bureau of the Census and Statistics, Survey of Households Bulletin, (Labor Force, October Surveys), Series 3-26, 1957-1968.

(ii) Bureau of the Census and Statistics, Survey of Family Income and Expenditures. 1971

[2] Central Bank of the Philippines, Statistical Bulletin, vol. XXIV, December 1972.

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