# A MACROECONOMIC MODEL FOR WEST MALAYSIA, 1949–68

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WHILE ECONOMETRIC model building is a firmly embedded practice in discussing the economies of the advanced countries, efforts in this direction are only just beginning in the developing nations. With improvements in data bases, several moderate size models have emerged, though much remains to be done [2] [11] [16] [17] [50] [54] [66] [67] [70]. Apart from being an addition to the growing list, the present model is an attempt to quantitatively analyze interrelationships between various sectors of the economy of West Malaysia[1] and the growth of that economy, a subject not completely unexplored [3] [11] [22] [38] [39] [60] [64]. Such a model, may serve as the basis both for projections into the future and for policies of stabilization and growth.

The West Malaysian economy after World War II is characterized both by considerable dependence on trade and a relatively high concentration of exports [3] [22] [30]. Dualism is also a feature, although strictly speaking the dichotomy is not between industrial enclaves and rural agriculture but between a subsistence economy exemplified by the cultivation of rice and other foodstuffs and a large-scale system of commercial agriculture—rubber and oil palm. This distinction is however somewhat blurred by small holders who grow rubber commercially, and even more so by those who grow both types of crops.

While historically exports have served her well,[2] the need for economic planning was manifest even in the 1950s. Consequently the 1950–70 period saw no less than three development plans [44] [45] [46] designed to

(i) raise income levels, especially in rural areas,
(ii) raise the standard of living through increased consumption, and
(iii) create more employment.

The performance of the economy under these plans has been extensively discussed [38] [39] [44] [45] and need not detain us at this point.

Any macroeconomic model for West Malaysia must therefore be built within the framework of the described situation. For convenience of exposition and estimation, the model is divided into sectors—demographic, manpower, con-

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[1] It is not possible to construct a model for the whole Malaysian economy because of data deficiencies with respect to the East Malaysian states.

[2] See Ariff [3], Khoo [30], and Lim [38] regarding the role of exports in Malaysian economic development.

sumption, investment, income distribution and taxes, and foreign trade. With some effort in searching for them, data as far back as 1949 are available, while 1968 is the latest year for which national accounts information is published. This gives a total of twenty annual observations.

## I. SECTORS OF THE MODEL

### A. *The Demographic Sector*

While an exogenous population variable is often assumed in economic growth models, the realization that this involves an oversimplification has resulted in models with elaborate demographic equations based on age specific birth and death rates, labor force participation rates, etc. [14] [16]. But these either limit feedback into the economic sectors or rely extensively on extraneous information. It is felt that in the present model feedbacks are an integral part of the system, but the construction of an elaborate demographic system would impose excessive strain on available data.

The hypothesis is that fertility is a result of planned decisions and these decisions are based on both demographic and economic factors.[3] The strength of the desire to increase family size is proportional to the deviation of actual family size ($P_{it}$) from some desired size ($P^*_{it}$), and if the attractiveness of alternative economic pursuits is represented by $S_{it}$, then planned births ($B^*_{it}$) is determined in the following manner:

$$B^*_{it}=\alpha_{1i}(P^*_{it}-P_{it})+\alpha_{2i}S_{it}\,, \qquad \alpha_{1i}>0\,, \quad \alpha_{2i}<0\,.$$

The desire for additional family members is a function of family income ($X_{it}$) and the number of children already in the family[4], represented by $B_{it-1}$. A reasonable proxy for $S_{it}$ is again $\Delta X_{it}$. Thus,

$$\begin{aligned} (P^*_{it}-P_{it}) &= \beta_{0i}+\beta_{1i}X_{it}+\beta_{2i}B_{it-1}\,, \qquad & \beta_{1i}\gtrless 0\,. \\ S_{it} &= \gamma_{1i}\partial X_{it}\,, & \gamma_{1i}>0\,. \end{aligned}$$

By further postulating that actual births equal desired except for a random component, we can write

$$\begin{aligned} B_{it} &= \alpha_{1i}\beta_{0i}+\alpha_{1i}\beta_{1i}X_{it}+\alpha_{1i}\beta_{2i}B_{it-1}+\alpha_{2i}\gamma_{1i}\Delta X_{it}+u_{it}\,, \\ &= \alpha'_{0i}+\alpha'_{1i}X_{it}+\alpha'_{2i}\Delta X_{it}+\alpha'_{3i}B_{it-1}+u_{it}\,. \qquad \text{(A.1)} \\ & \alpha'_{1i}\lesseqgtr 0\,, \qquad \alpha'_{2i}<0\,. \end{aligned}$$

Under restrictive assumptions, (A. 1) can be aggregated over families to give

$$B_t=\alpha'_0+\alpha'_1X_t+\alpha'_2\Delta X_t+\alpha'_3B_{t-1}+u_t\,. \qquad \text{(A.2)}$$

[3] Among the many factors determining fertility are: (i) infant mortality rates, (ii) education level of mothers, (iii) proportion of economically active population in agriculture, and (iv) employment. See also [12].

[4] The standard of living effect operates at high income levels while at low levels of living, income would determine how many children a family can afford to have.

Various versions of (A. 2) with different proxy variables for $S$ were estimated,[5] but the significance of coefficients was only moderate. A second experiment was the replacement of $B_{t-1}$ by size of population but this resulted in estimated parameters for the variable that were of the wrong sign. A third and perhaps more satisfactory alternative is to use birth rates ($b$) as the dependent variable. The best result appears to be the equation using $GDP$ as the income variable:[6]

$$\begin{aligned} b_t = 33.6840 - &\underset{(-2.5951)}{0.00165}[GDP_t^a + GDP_t^{na}] \\ &- \underset{(-2.3788)}{0.00177}\Delta[GDP_t^a + GDP_t^{na}] + \underset{(1.6890)}{0.4133}b_{t-1}\,. \qquad \text{(A.3)} \\ &R^2 = 0.9658\,, \quad F = 73.99\,, \quad S_y = 1.2444\,, \quad DW = 1.86\,. \end{aligned}$$

In the case of mortality, economic arguments enter with less force, but two groups of variables were tested. "Direct" economic variables, such as the improvement of medical services and education facilities entered the equation with correctly negative signs, while "indirect" variables representing economic development, such as $GDP$, motor vehicle registration, etc., have significantly wrong signs. The fits were reasonable, and given the failure of these variables, we have chosen the equation determining mortality rates ($d$) as

$$\begin{aligned} d_t = 0.1836 + &\underset{(13.3911)}{0.9517}d_{t-1}\,. \qquad \text{(A.4)} \\ &R^2 = 0.9557\,, \quad F = 179.32\,, \quad S_y = 0.7925\,, \quad DW = 1.40\,. \end{aligned}$$

The supply of labor to the economy depends not only on the age distribution of the population but also on economic conditions. The former determines the eligibility of a person to enter the labor force whereas the latter influences his desire to do so.[7] A number of economic variables can be used here. The introduction of GNP to represent market tightness has been criticized as being inadequate [69] and the most popular variable is employment [34] [37] [69]. The latter affects labor participation first, through falling employment, by reducing job opportunities and preventing workers from entering the market ("discouraged worker" hypothesis). Second, this leads to a fall in income, with the possibility of secondary workers, especially women, enter the labor force. The total supply of labor depends on population size $P$, which, through birth, is influenced by economic development, so $GDP$ has a direct role in the labor supply function. We have regressed $L$, total labor force, on $GDP$ and other variables. The best equations are

[5] Among others, the following were also tried as explanatory variables: (i) employment, (ii) total enrollment in schools, (iii) total cases treated in hospitals, (iv) total electricity consumption, and (v) motor vehicle registration. These are intended to represent not only income growth but also improvement in social and medical facilities under economic development.

[6] All variables used in this model are defined in Appendix A. Unless otherwise stated, estimates are obtained by OLS, the figures within parentheses below coefficients being $t$-ratios.

[7] For a discussion of these concepts and difficulties with respect to definitions and measurement, see Yeh and You [76].

$$L_t = 556.5800 + \underset{(2.2992)}{0.1049}(GDP_{t-1}^{a} + GDP_{t-1}^{na}) + \underset{(3.4305)}{0.1870}P_{t-1}\,. \qquad \text{(A.5)}$$

$$R^2 = 0.9758\,,\quad F = 169.6\,,\quad S_y = 88.8\,,\quad DW = 1.60\,.$$

$$L_t = 71.7368 + \underset{(1.2516)}{0.3293}(N_{t-1}^{a} + N_{t-1}^{na}) + \underset{(4.0501)}{0.2368}P_{t-1}\,.$$

$$R^2 = 0.9709\,,\quad F = 139.8\,,\quad S_y = 97.3\,,\quad DW = 0.93\,.$$

The positive coefficient attached to employment indicates the predominance of "discouraged workers," but its nonsignificance prompted us to favor (A. 5).

Finally, we have the identity linking population ($P$), births ($b \cdot P$) and deaths ($d \cdot P$), and migration ($R$),

$$P_t = P_{t-1} + (b_t - d_t)P_t + R_t\,. \qquad \text{(A.6)}$$

In practice, very little migration occurred after World War II, the net immigration for the entire period 1947–56 being only 14,000 compared to a total increase of 1.37 million persons.[8]

B. *Employment*

In Malaysia, the problem in employment has always been the creation of job opportunities for a rapidly growing labor force.[9]

The relevant measure of labor demand is hours worked,[10] but only total employment by sectors is available for Malaysia.[11] The model used is the well-tried one that is derived from specifications of the production function [5] [9] [20]. If linearity is assumed, we may write[12]

$$GDP^*_t = \delta_0 + \delta_1 N^*_t + \delta_2 K_{t-1} + \delta_3 t\,,$$

where $GDP^*$, $N^*$ are desired $GDP$ and employment respectively, and $K$ is capital stock. This can be written as

$$N^*_t = -(\delta_0/\delta_1) + (1/\delta_1)GDP^*_t - (\delta_2/\delta_1)K_{t-1} - (\delta_3/\delta_1)t\,.$$

Further, letting

$$GDP^*_t = \epsilon_1 GDP_t + \epsilon_2 GDP_{t-1}\,,$$

and

$$N_t - N_{t-1} = \iota(N^*_t - N_{t-1})\,,$$

we have the labor requirements function

8 Immigration prohibition was implemented under the Immigration Ordinance of 1952 under which new immigration was forbidden except under restricted special circumstances. These conditions were made even more stringent in 1959 [38, p. 190].

9 Between 1962 and 1967, the increase in employment of 3.7 per cent p.a. was just sufficient to absorb the increase in labor supply (3.5 per cent p.a.). By 1967–70, the growth of employment averaged only 2.1 per cent [58].

10 Reasons for favoring "hours worked" are discussed by Evans [19]. For a different point of view, however, see Kuh [33] and Kuh and Schmalense [36].

11 In fact, even the series for total employment had to be strenuously constructed.

12 This form of production function was advocated by Kuh [34]. See also Evans [19] for an analysis of its properties.

$$N_t=\beta'_0+\beta'_1K_{t-1}+\beta'_2GDP_t+\beta'_3GDP_{t-1}+\beta'_4t+\beta'_5N_{t-1}\,,$$

with $\beta'_1<0$, $\beta'_2$, $\beta'_3>0$, if $\iota>0$, $\beta'_4<0$, and $\beta'_5>0$ only if $0<\iota<1$.

To reflect the changing composition of employment over time, we decomposed total employment into agricultural employment ($N^a$) and nonagricultural employment ($N^{na}$). Published figures (which we used) refer to paid employment, but real difficulties arise when it is realized first that a substantial portion of labor services are provided by unpaid family workers through the extended family [71] and second that considerable underemployment exists.[13] The agricultural employment equation was estimated as

$$\begin{aligned} N_t^a = -35.6962 - &\underset{(-3.5814)}{0.0117K_{t-1}^a} + \underset{(1.2809)}{0.0057GDP_t^a} - \underset{(-3.6311)}{0.0174\Delta GDP_t^a} \\ &+ \underset{(8.7182)}{1.1995N_{t-1}^a}\,. \end{aligned} \tag{B.1}$$

$$R^2=0.9644\,,\quad F=43.2\,,\quad S_y=5.09\,,\quad DW=2.51\,.$$

$GDP_t^a$ and $\Delta GDP_t^a$ were used instead of $GDP_t^a$ and $GDP_{t-1}^a$ as the former pair would be less multicollinear (the simple correlation between them was 0.463). The significantly negative coefficient for $\Delta GDP_t^a$ is somewhat surprising. One possible interpretation is that the change in agricultural output variable is a proxy for fluctuations in $GDP^a$, and that this adversely affects employment in agriculture.

Attempts to introduce capacity utilization and technological progress failed badly. The coefficient for $N_{t-1}^a$ indicates a negative adjustment coefficient and an unstable first order difference equation, but the coefficient was not significantly different from one either, so that arguments along the lines put forward by Kuh [33, pp. 243–44] may apply here.

The best equation for nonagricultural employment is estimated as

$$N_t^{na}=1{,}125.4893+\underset{(3.3873)}{0.1034(K_{t-1}^p+K_{t-1}^b)}+\underset{(0.7696)}{0.1838N_{t-1}^{na}}\,. \tag{B.2}$$

$$R^2=0.9617\,,\quad F=98.38\,,\quad S_y=75.91\,,\quad DW=2.04\,.$$

The variables $GDP_t^{na}$ and $GDP_{t-1}^{na}$ did not attain significance when introduced, but the magnitude of their coefficients, 0.1340 and 0.1287 respectively,[14] implies a much greater response of nonagricultural employment to changes in output than was the case with agricultural employment. This lack of significance is the result of multicollinearity, since the introduction of these two variables into (B. 2) reduced all coefficients to insignificance even at 10 per cent. Simple correlations among the set ($GDP_t^{na}$, $GDP_{t-1}^{na}$, $N_{t-1}^{na}$) are all above 0.9. However, while the omission of variables is theoretically unsatisfactory, the inclusion of these two variables did not result in any significant improvement in fit. The following table is self-explanatory in this respect.

[13] Lim [39, p. 78] quotes an underemployment figure of 25 per cent of all agricultural workers. Oshima [53, p. 61] reports a figure of around 33 per cent. To make matters worse, various censuses and surveys before 1967/68 defined "unemployment" to exclude "passive unemployment" altogether [76, p. 32].

[14] Snodgrass's [65, p. 18] finding of a negative relationship between changes in employment and in productivity is clearly refuted here.

| Explanatory Variables Included | $R^2$ |
|---|---|
| $(K_{t-1}^p+K_{t-1}^b)$, $N_{t-1}^{na}$ | 0.9617 |
| $(K_{t-1}^p+K_{t-1}^b)$, $N_{t-1}^{na}$, $GDP_t^{na}$ | 0.9625 |
| $(K_{t-1}^p+K_{t-1}^b)$, $N_{t-1}^{na}$, $GDP_{t-1}^{na}$ | 0.9628 |
| $(K_{t-1}^p+K_{t-1}^b)$, $N_{t-1}^{na}$, $GDP_t^{na}$, $GDP_{t-1}^{na}$ | 0.9628 |

The income elasticities for agriculture and nonagricultural employment are 0.0364 and 0.4418 respectively. These can be compared to Oshima's estimates for agriculture and manufacturing of 0.30 and 0.56 respectively [53, p. 68]. The coefficient of adjustment 0.8162 was also much higher. This is not unexpected. Over the period under study, there was a gradual shift of employment away from agriculture and into industry.[15] Manufacturing for instance which was around 15 per cent of total employment accounted for as many new jobs as agriculture. The significantly positive capital coefficient appears to contradict our model, but the same result was encountered by Kuh [33] while the models of the Enke-Tempo type [18] argue in favor of this relationship.

An attempt to introduce wages into employment determination by equating marginal productivity to real wages (as in [6] [74]) was unsuccessful, the wage variable usually having an insignificant coefficient.

C. *Consumption*

The importance attached to theory and empirical investigation in the consumption function stems in part from its relative share in total domestic expenditure, usually something like 80 per cent of the total. In addition, the amount of consumption expenditure imposes a limitation on the amount of resources available for investment.

As a first step at disaggregating consumption expenditure, we have considered three categories—food, household goods, and services. The model used is a well-tried variant of durable consumption [27] [68].

It involves the explicit introduction of stocks into the consumption function, and the use of a separate equation determining stocks. The consumption function would then take the form

$$C_t=\gamma'_0+\gamma'_1p_t+\gamma'_2Y_{t-1}+\gamma'_4C_{t-1}, \qquad (C.1)$$

where $C$ is consumption, $p$ is price, and $Y$ is income. The lagged dependent term results from the imposition of a partial adjustment mechanism for consumption.

For perishables $\phi$, the rate of depreciation would approximate unity in value, and $Y_{t-1}$ would have a near zero coefficient.

In addition to income, other variables have been used in consumption studies. Among these are:

[15] This shift was caused in part by the retrenchment of workers from rubber estates, and in part by the failure to meet planned targets with respect to land development in the development plans [58]. At the same time, the Pioneer Industry Policy and tax incentives initiated in 1958 have accelerated the drift of workers into industry.

(i) Wage income ($W$): Different types of income may have differential effects on consumption. Hence two income variables—$W$ and property income may be appropriate [19]. As an alternative, their ratio may be used, and is sometimes preferred as it avoids collinearity between the income variables.

(ii) Liquid assets: It is sometimes used as a proxy for wealth [19].[16]

Applying (C. 1) to the food sector, we obtained

$$C_t^f = 1{,}657.7678 - \underset{(-1.9321)}{13.1140} p_t^f + \underset{(7.0349)}{0.2829} Y_t^d + \underset{(3.0537)}{0.2764} C_{t-1}^f . \tag{C.2}$$

$$R^2 = 0.9942 , \quad S_y = 46.08 , \quad F = 427.71 , \quad DW = 1.84 .$$

The variable $Y_{t-1}^d$ had an insignificant coefficient and was omitted, implying that $\phi_f = 1$. Price and income elasticities at the means are respectively 0.6326 and 0.5636 in the short run, both reasonable in magnitude. The use of the alternative variables above produced less satisfactory results. An adjustment coefficient of 0.7354 indicates a mean lag of only 1.36 years.

Results for the household sector are generally similar with

$$C_t^h = -0.5295 + \underset{(7.4235)}{0.2024} Y_t^d - \underset{(-1.0713)}{0.0635} Y_{t-1}^d + \underset{(2.3463)}{0.5466} C_{t-1}^h . \tag{C.3}$$

$$R^2 = 0.9936 , \quad S_y = 34.46 , \quad F = 384.00 , \quad DW = 1.72 .$$

$\phi_h$ has the value 0.73 while the partial adjustment coefficient is 0.489. Income elasticity is 1.0347 in the short run and 2.1160 in the long run, the former being close to the expenditure elasticities calculated by Halim [23].[17] The price variable, when introduced, gave the wrong sign, while the alternative proxies for income were again insignificant.

The best equation for the consumption of services is

$$C_t^s = -7.2206 + \underset{(1.4697)}{0.0308} (w_t N_t^a + w_t N_t^{na}) + \underset{(12.3016)}{0.9218} C_{t-1}^s . \tag{C.4}$$

$$R^2 = 0.9930 , \quad S_y = 21.21 , \quad F = 568.6 , \quad DW = 2.70 .$$

The variable total wage bill $W_t = w_t\ (N_t^a + N_t^{na})$, where $w_t$ is the average annual wage rate, is relatively the most successful of the income proxies introduced, but even this is insignificant at 5 per cent. Most of the variation in $C_t^s$ is explained by $C_{t-1}^s$.

As a final experiment, a test was made for nonlinearity [28] by including

[16] For a discussion of these and other explanatory variables, see [8] [19]. In addition, although lagged consumption enters our model via the adjustment mechanism, its use is compatible with a host of consumption hypotheses. See the references cited in [10].

[17] His estimates based on the 1957/1958 Household Budget Survey are

| | Rural | Urban |
|---|---|---|
| Clothing | 1.026 | 0.882 |
| Household goods | 1.159 | 0.883 |
| Housing | 0.638 | 0.956 |

Elasticities for other nations are also shown [23, p. 23].

$(Y_t^d)^2$ as an additional variable. In the food sector the coefficient was significant and the fit very good ($R^2=0.995$), but in all other sectors the experiment was unsuccessful.

D. *Fixed Investment and Capital Stock*

Investment functions describe how desired levels of investment are determined and the processes of adjustment of actual investments to their desired levels.[18] In line with other models for developing economies [2] [66] the model used is the accelerator type, and the distinction between agriculture and nonagriculture is maintained. The latter is further disaggregated into machinery and equipment, and building construction.

Desired capital stock ($K^*$) is postulated to be a function of total output ($GDP$) and government investment ($IG$) in the last period. The inclusion of $IG$ is in recognition both of the availability of financing [2, p. 84] and of the role of government investment in the Malaysian five-year plans.[19] Net investment is undertaken up to a fraction $\rho$ of the deviation of actual ($K$) from desired capital stock, while replacement investment is a fraction of capital stock, i.e., $\omega K_{t-1}$. Gross investment ($GI$) is the sum of net and replacement investment. The generalization of $\rho$ to a rational distributed lag $\rho(L)=\rho_1/(1+\rho_2 L)$, $L^k X_t = X_{t-k}$, leads to an equation of the form

$$GI_t=\delta'_0+\delta'_1 GDP_t+\delta'_2 IG_{t-1}+\delta'_3 K_{t-1}+\delta'_4 GI_{t-1}+u_t\,. \qquad \text{(D.1)}$$

In the agricultural sector, the role of government investment is evident from the following equation:

$$\begin{aligned} GI_t^a=35.6813+\ &\underset{(2.4476)}{0.0925GDP_t^a}-\underset{(-1.6369)}{0.0522K_{t-1}^a}+\underset{(5.0030)}{0.3641IG_{t-1}}\,. \\ R^2=0.8625\,,\quad &S_y=33.39\,,\quad F=14.53\,,\quad DW=0.67\,. \end{aligned}$$

The low investment accelerator of 0.09 is indicative of the decline in the terms of trade for agriculture,[20] while a small capital coefficient implies a slow rate of adjustment. With $\omega^a$ being estimated at 2.5 per cent,[21] $\rho$ is only 0.0772. An alternative form, however, fits much better, and has a better $DW$ statistic.

[18] While theoretical discussions of economic development have always given prominence to the role of capital formation [52], quantitative studies in this field are relatively few. For a recent study, see [32] and references therein.

[19] The following figures give some indication of its importance:

($ million)

| Investment | 1955 | 1960 | 1965 |
|---|---|---|---|
| Government | 150 | 188 | 526 |
| Nongovernment | 429 | 662 | 1,141 |

See [48] [49].

[20] Over the period under consideration, the share of agriculture in GDP at factor cost had fallen from 55.3 per cent in 1949 to 29.7 per cent in 1968.

[21] This is the rate of depreciation used in constructing our capital stock for agriculture [1]. Rates of depreciation for capital stock in plant and equipment, and in building construction are estimated at 1 per cent and 2.5 per cent respectively.

$$GI_t^a = 66.4685 - \underset{(-2.1019)}{0.0226}K_{t-1}^a - \underset{(-2.2542)}{0.1119}IG_{t-1} + \underset{(10.1141)}{1.3164}GI_{t-1}^a .$$

$$R^2 = 0.9768, \quad S_y = 14.12, \quad F = 104.13, \quad DW = 1.71 .$$

However, the coefficient of $IG_{t-1}$ is negative, while that for $GI_{t-1}^a$ implies an unstable difference equation. An explanation for both may be that a substantial portion of investment in agriculture is of government origin,[22] so that $GI_{t-1}^a$ overlaps with $IG_{t-1}$. Omitting the latter variable, we obtain

$$GI_t^a = 90.1717 - \underset{(-2.4962)}{0.0290}K_{t-1}^a + \underset{(12.8091)}{1.0767}GI_{t-1}^a . \qquad \text{(D.2)}$$

$$R^2 = 0.9688, \quad S_y = 15.82, \quad F = 122.42, \quad DW = 1.95 .$$

We experimented with total exports as an explanatory variable but its coefficient was both wrongly signed and nonsignificant.

For the plant and equipment sector, the best equation was estimated as

$$GI_t^p = -172.7584 + \underset{(3.4069)}{0.0922}NNP_t + \underset{(2.2694)}{0.2628}IG_{t-1} - \underset{(-1.2001)}{0.0764}K_{t-1}^p . \qquad \text{(D.3)}$$

$$R^2 = 0.9716, \quad F = 84.19, \quad S_y = 26.31, \quad DW = 1.90 .$$

$GI_{t-1}^p$ had an insignificant coefficient and was omitted, suggesting $\hat{\rho}_2 = 0$. With $\omega^p$ estimated to be 0.01, $\hat{\rho}_1$ is 0.1764, again implying a low rate of adjustment. Elasticities for $NNP_t$ and $IG_{t-1}$ are estimated at 1.9418 and 0.3399 respectively. The former indicates a high degree of response of investment to income changes, while the latter is, as expected, smaller in magnitude than its counterpart in the agricultural investment equation. The role of export earnings [3] [30] has been implicitly taken account of in the definition of NNP. Introducing the variable $(E^r + E^m + E^o)$ explicitly, we obtained the equation

$$GI_t^p = -63.6463 + \underset{(2.5816)}{0.0810}GDP^{na} - \underset{(-0.3349)}{0.0068}(E_t^r + E_t^m + E_t^o) + \underset{(2.8128)}{0.2256}GI_{t-1}^p ,$$

$$R^2 = 0.9722, \quad S_y = 26.02, \quad F = 86.2, \quad DW = 1.75 ,$$

which was less satisfactory than the preferred equation (D. 4). This result is in harmony with the findings of Khoo [30] and Ariff [3].

Building construction is somewhat different. In the long run, the demand for housing is determined by the size of the population or by the number of households. In terms of the "disease" model of Fisher-Kaysen [21], it determines how many are susceptible to the "disease." In the short run, however, demand is influenced by household income ($Y^d$) or liquid assets ($Q$). The former variable is slightly more successful than the latter. Thus,

[22] For the periods 1955–60 and 1961–65, we have calculated private and public investment in agriculture as follows:

($ million)

| Investment | 1955–60 | 1961–65 |
|---|---|---|
| Public | 227.5 | 467.9 |
| Private | 526.5 | 559.1 |
| Public/total(%) | 30.2 | 45.6 |

$$GI_t^b = -569.9352 + \underset{(1.4337)}{0.0449} Y_{t-1}^d + \underset{(4.2538)}{0.1099} P_t . \tag{D.4}$$
$$R^2 = 0.9450 , \quad S_y = 42.45 , \quad F = 137.24 , \quad DW = 1.15 .$$

Finally, given data on gross investment and estimates of respective rates of depreciation [1], it is possible to construct recursive series for capital stock using the identity

$$GI_t = \Delta K_t + \omega K_{t-1}.$$

Hence for the three sectors, with $\omega^a = \omega^b = 0.025$, $\omega^p = 0.10$, we have

$$K_t^a = 0.975 K_{t-1}^a + GI_t^a . \tag{D.5}$$
$$K_t^p = 0.900 K_{t-1}^p + GI_t^p . \tag{D.6}$$
$$K_t^b = 0.975 K_{t-1}^b + GI_t^b . \tag{D.7}$$

### E. *Wages and Prices*

Depending on the hypothesis adopted, a number of variables may be used to explain the wage rate. Unemployment variables are justified directly as a proxy for the excess supply of labor [41] [56] [57], and indirectly as a determinant of the change in trade union membership [25] [26]. Secondly, changes in price have been advanced as a variable because of automatic cost of living clauses in contracts and also because of the presence of the money illusion. In the Malaysian context, a third factor, productivity or output per head,[23] assumes considerable importance since it has been argued that high wages are paid not because of increases in productivity but because they are "expected" of manufacturing firms, which are foreign [39].[24] Apart from these three factors, cost-push arguments recommend the use of trade union membership [4] [26] [55], but strong unionized labor is not a feature here. The role of profit is more debatable,[25] but the lack of reliable data precludes its use here.

The results of experimenting with these variables can be briefly described. We used the wage rate ($w$) rather than its change as the dependent variable.[26] The unemployment variables $u_t = (U_t / [N_t^a + N_t^{na}])$ and $1/u_t$ were wrongly signed when introduced separately, but were reduced to insignificance with the introduction of other variables. This result is not unexpected, since our unemployment

23 See also Kuh [35] and Vanderkamp [75].

24 As late as 1970, foreign interests accounted for 61 per cent of the total share of capital invested in the corporate sector [46, Table 4–7]. The following figures are illustrative.

(%)

| Sector | Domestic Ownership | Foreign Ownership |
|---|---|---|
| Agriculture | 24.7 | 75.3 |
| Mining | 27.6 | 72.4 |
| Manufacturing | 40.4 | 59.6 |
| Commerce | 36.5 | 63.5 |

25 For evidence in favor of and against the use of this variable, see Lipsey and Steuer [40].

26 Heyhon Song [66] argues that $\Delta w_t$ is a better variable since $w_t$ may be trending. We found no such evidence for our $w_t$ series.

variable took no account of the (considerable amount of) underemployed (see [51]). In addition, in so far as a large proportion of those unemployed were "untrained," the effect of $u_t$ on $w_t$ would be reduced [51, p. 207]. Both the price and productivity variables were however highly significant. The best equation is

$$W_t = -0.5937 + \underset{(4.8301)}{0.3526}\left(\frac{GDP_t^a + GDP_t^{na}}{N_t^a + N_t^{na}}\right) + \underset{(2.2861)}{0.0036}p_{t-1}$$

$$+ \underset{(3.3696)}{0.4485}w_{t-1}\,. \tag{E.1}$$

$$R^2 = 0.9805\,,\quad S_y = 0.0338\,,\quad F = 124.79\,,\quad DW = 1.43\,.$$

We experimented with both $p_t$ and $p_{t-1}$ with the latter coming off considerably better, implying that wages follow prices with roughly a one-year lag. Both prices and productivity exert upward pressures on wages, with their relative contribution to explaining $w_t$ in the ratio of 2.1 to 1.0 respectively.[27] Arguments saying that high wages are unrelated to productivity would seem to be rejected here.

The use of $w_{t-1}$ can be explained in terms of expectations regarding prices [72] or wages [56] or both [42]. A coefficient of 0.4485 implies a long-run wage relation of the form

$$W = -1.0765 + 0.6393\left(\frac{GDP^a + GDP^{na}}{N^a + N^{na}}\right) + 0.0065p\,.$$

Long-run elasticities of 0.8112 and 0.3870 for productivity and price indicate much greater response of wages to changes in productivity rather than price.

The price variable which enters the wage equation is properly endogenous.

Of the more common variables introduced, the level of wages is clearly a cost-push factor and enters the equation without a lag because while wages follow price changes, it is expected that price, considered as a markup on unit costs [19] [63], adjusts almost immediately to changes in unit costs. Other variables for costs include productivity [63] and indirect taxation [31]. In addition, two other variables are necessary in a developing nation. Import price ($p^M$) affects domestic price levels since some raw materials for production have to be imported, while money supply ($F^{ND}$) exerts pressures on price [24] [66]. Finally, demand factors can be represented by the introduction of a capacity variable ($C_p$).

Of the variables introduced, $C_p$, and the ratio of indirect taxes to consumption $[(T^e + T^m + T^o)/(C^f + C^h + C^s)]$ were insignificant while $F^{ND}$ was jointly significant with $p^M$ and $w$. The equation is

$$p_t = -22.2356 + \underset{(6.8101)}{0.8524}p_t^M + \underset{(2.9207)}{0.2512}w_t + \underset{(3.7961)}{0.0101}F_t^{ND}\,. \tag{E.2}$$

$$R^2 = 0.9139\,,\quad S_y = 2.72\,,\quad F = 25.33\,,\quad DW = 2.42\,.$$

The introduction of productivity in place of $F^{ND}$ produced considerable improvement.

27 "Contribution" is calculated as the product of the coefficient estimate and the mean value of the variable in question.

$$p_t = 33.1394 + \underset{(7.4740)}{0.6048 p_t^M} + \underset{(9.0968)}{40.6549 w_t} - \underset{(-5.1617)}{14.4383} \left( \frac{GDP_t^a + GDP_t^{na}}{N_t^a + N_t^{na}} \right). \tag{E.3}$$

$$R^2 = 0.9602, \quad S_y = 1.87, \quad F = 59.06, \quad DW = 2.67.$$

The considerable influence of import price is shown by the size and significance of the coefficient. In terms of relative contribution to the explanation of $p$, $p^M$, $w$ and $[(GDP^a + GDP^{na})/(N^a + N^{na})]$ accounted for 37.9 per cent, 23.2 per cent, and 18.9 per cent respectively. In West Malaysia, the effect of productivity is anti-inflationary. The effects of concommitant changes in wages and import price given productivity is shown in Table I. The greater influence of $p^M$ is again manifest.

TABLE I

EFFECTS ON THE PRICE LEVEL OF CHANGES IN WAGES AND IMPORT PRICE

%

| Percent Change in Wages | Percent Change in Import Price | | | | | |
|---|---|---|---|---|---|---|
| | 0 | 2 | 4 | 6 | 8 | 10 |
| 0 | 0.00 | 1.22 | 2.44 | 3.66 | 4.87 | 6.09 |
| 2 | 0.74 | 1.96 | 3.18 | 4.40 | 5.62 | 6.84 |
| 4 | 1.49 | 2.71 | 3.93 | 5.14 | 6.36 | 7.58 |
| 6 | 2.24 | 3.45 | 4.67 | 5.89 | 7.11 | 8.33 |
| 8 | 2.98 | 4.20 | 5.42 | 6.64 | 7.85 | 9.07 |
| 10 | 3.72 | 4.94 | 6.16 | 7.38 | 8.60 | 9.82 |

Considering both wage and price equations together, a 1 per cent change in price leads to a 0.70 per cent change in wages in the same direction, which in turn leads to a further 0.26 per cent change in price, so that in the absence of other intervening factors, the wage-price spiral is damped. However, if import price rises simultaneously by 1 per cent, the effect is to raise the price level by nearly 0.9 per cent.

Finally, an equation was introduced to determine the price index for food. Variables similar to those described were used. The explanatory power was moderately good, with the best equation being

$$p_t^f = 22.8416 + \underset{(4.8065)}{0.1738 p_t^m} + \underset{(1.9622)}{0.0010 GDP_t^a} + \underset{(3.8088)}{0.5782 p_{t-1}^f}. \tag{E.4}$$

$$R^2 = 0.9426, \quad S_y = 0.76, \quad F = 39.80, \quad DW = 1.59.$$

The long-run relation is

$$p^f = 54.1527 + 0.4120 p^M + 0.0024 GDP^a,$$

with elasticities of 0.4194 and 0.0450 for $p^M$ and $GDP^a$ respectively. $GDP^a$ was included to represent supply conditions of food. A theoretically more appropriate variable is labor productivity, $GDP^a/N^n$ however this variable was insignificant even at 20 per cent when introduced, and the $R^2$ of 0.9214 was somewhat lower. The magnitudes of other estimated coefficients remained virtually unchanged.

F. *Taxation*

Besides direct taxes, we have disaggregated indirect taxes into three broad categories: imports ($T^m$), exports ($T^e$), and "all others" ($T^o$). For the first two categories, the equations

$$T_t^m = 34.2395 + \underset{(6.2546)}{0.1280}(M_t^p + M_t^f + M_t^r + M_t^m)\,,$$

$$R^2 = 0.8349\,,\quad S_y = 41.35\,,\quad F = 39.12\,,\quad DW = 0.52\,,$$

$$T_t^e = 1.0505 + \underset{(4.6488)}{0.0806}(E_t^r + E_t^m + E_t^o)\,,$$

$$R^2 = 0.7481\,,\quad S_y = 37.12\,,\quad F = 21.61\,,\quad DW = 1.25\,,$$

are not quite satisfactory, though they indicate import and export taxation at the marginal rates of 12.8 per cent and 8.1 per cent respectively. From a policy point of view, however, it may be better to consider the tax rates $t^m$, $t^e$ as exogenous variables subject to government control, i.e., $T_t^m = t_t^m \cdot M_t$ and $T_t^e = t_t^e \cdot E_t$ where $M$ and $E$ are total imports and exports. These equations are linearized and their least squares estimates are[28]

$$T_t^m = -266.2184 + \underset{(18.5435)}{1{,}887.1953}t_t^m + \underset{(31.2460)}{0.1406}(M_t^p + M_t^f + M_t^r + M_t^m)\,. \tag{F.1}$$

$$R^2 = 0.9932\,,\quad S_y = 8.99\,,\quad F = 585.99\,,\quad DW = 0.96\,.$$

$$T_t^e = -197.6870 + \underset{(27.9593)}{2{,}621.2832}t_t^e + \underset{(29.6659)}{0.0753}(E_t^r + E_t^m + E_t^o)\,. \tag{F.2}$$

$$R^2 = 0.9956\,,\quad S_y = 5.42\,,\quad F = 897.93\,,\quad DW = 2.20\,.$$

The third class of indirect taxes is an amalgam of various duties, and as such is made to depend on the general level of economic activity, represented by *NNP*

$$T_t^o = -229.6248 + \underset{(13.0658)}{0.1175}NNP_t\,. \tag{F.3}$$

$$R^2 = 0.9536\,,\quad S_y = 40.81\,,\quad F = 170.72\,,\quad DW = 1.51\,.$$

The possibility of lags in tax payments suggests the use of $NNP_{t-1}$ as well, but this coefficient turned out to be insignificant, while $R^2$ was raised by only 0.0015.

Direct tax receipts ($T^d$) are made a function of national income.

$$T_t^d = -208.6552 + \underset{(11.1456)}{0.1102}NNP_t\,. \tag{F.4}$$

$$R^2 = 0.9379\,,\quad S_y = 44.87\,,\quad F = 124.22\,,\quad DW = 1.28\,.$$

Since $T^d$ includes corporate taxation, an attempt was made to decompose income into wage and nonwage income, but the results were affected by multicollinearity.

[28] The error involved in linearization is small. For equations (F. 1) and (F. 2) the mean absolute percentage errors of "prediction" (MAPE's) for the sample period 1950–68 are:
Equation (F. 1): MAPE=2.68%
Equation (F. 2): MAPE=2.16%

The explanatory power appears satisfactory, and implies an average rate of taxation of 11.0 per cent of national income. The presence of lags was taken care of by introducing $NNP_{t-1}$, but again multicollinearity imposed upon us the necessity to specify a priori weights for $NNP_t$ and $NNP_{t-1}$. The best result appears to be

$$T_t^d = -224.9565 + 0.0583(NNP_t + NNP_{t-1}) . \tag{F.5}$$
$$R^2 = 0.9723 , \quad S_y = 30.20 , \quad F = 294.68 , \quad DW = 1.18 .$$

G. *Income and Output*

Apart from the foreign sector, to be discussed later, the model is closed by equations for income and output. From the national accounting identity, national income ($NNP$) at factor cost is composed of consumption + fixed investment + change in stocks ($\Delta S$) + exports − imports − indirect taxes and depreciation, or

$$\begin{aligned} NNP_t = {} & C_t^f + C_t^h + C_t^s + G_t + GI_t^p + GI_t^a + GI_t^b + \Delta S_t \\ & + E_t^r + E_t^m + E_t^o + (SR_t^n) + (SR_t^f) - M_t^p - M_t^f - M_t^r \\ & - M_t^m - (SP_t^n) - (SP_t^f) - T_t^e - T_t^m - T_t^o - DP_t , \end{aligned} \tag{G.1}$$

where $G$ and $DP$ represent government consumption and depreciation respectively.[29]

A rough approximation to disposable income is national income less direct taxes [18] [65],

$$Y_t^d = NNP_t - T_t^d . \tag{G.2}$$

Gross domestic product is then $NNP$ plus depreciation and indirect taxes[30] less net factor payments. In this model, we have distinguished between agricultural ($GDP^a$) and nonagricultural ($GDP^{na}$) value added, so that

$$GDP_t^a + GDP_t^{na} = NNP_t + DP_t + (SP_t^f) - (SR_t^f) + T_t^e + T_t^m + T_t^o . \tag{G.3}$$

We need therefore to determine either $GDP^a$ or $GDP^{na}$, and the other component of $GDP$ would be calculated from (G. 3). To divide the various components of $GDP$ into agriculture and nonagriculture requires that the proportions of consumption, investment, etc., going into each sector be known. The most straightforward way of doing this is to examine an input-output table for the economy. Unfortunately, only a table for 1965 was available, and it was decided not to assume that 1965 was representative of the whole period 1949–68. The alternative was to regress $GDP^a$ or $GDP^{na}$ on their components, though multicollinearity will be a serious problem. To minimize its effects, we have regressed $GDP^a$ and $GDP^{na}$ on subsets of components.[31] Equations for the latter were better determined than those for the former. The best equation is

[29] The variables $M^p$, $M^f$, $M^r$, $M^m$, $E^r$, $E^m$, $E^o$, $(SR^n)$, $(SR^f)$, $(SP^n)$, $(SP^f)$ belong to the foreign sector, and their definitions are found there as well as in the Appendix A.

[30] Actually there is a small amount of subsidies to deduct from indirect taxes.

[31] The regression of $GDP^{na}$ on all its components—gross investment, exports, imports, consumption, etc., was affected by multicollinearity. Compared to equation (G. 4), it explained only 1.3 per cent more of the variation in nonagricultural output. The additional coefficients were all insignificant at 20 per cent or more.

$$GDP_t^{na} = 1{,}321.3547 + \underset{(7.2540)}{4.7861}(GI_t^p + GI_t^b) + \underset{(3.1526)}{0.3814}(E_t^r + E_t^m + E_t^o)$$
$$- \underset{(-2.3085)}{0.9717}(M_t^p + M_t^f + M_t^r + M_t^m)\,. \qquad \text{(G.4)}$$
$$R^2 = 0.9879\,, \quad S_y = 167.10\,, \quad F = 202.45\,, \quad DW = 1.54\,.$$

$GDP^a$ was therefore determined from (G. 3).

Finally, in the West Malaysian national accounting framework, depreciation allowance was taken to be 6.5 per cent of $GDP$, or

$$DP_t = 0.065(GDP_t^a + GDP_t^{na})\,. \qquad \text{(G.5)}$$

## H. *Foreign Trade*

Exports and imports constitute leakages in the circular flow of income. This leakage, measured as a percentage of GNP is bound to be large for a country like Malaysia.[32] It is therefore necessary to focus attention on the foreign trade sector, especially since the "foreign trade proportion" itself has been used as a measure of economic development [7]. But the content of these flows is no less important than the magnitude, and we have set up an eleven-equation submodel for this sector.

### 1. *Merchandise imports*

Merchandise imports are divided into food, raw materials, manufactured goods, machinery, and equipment. The food import equation is only a special case of the demand function for food, and hence depends on import price ($p^M$) and income.[33] Among the proxies for income tried, total export receipts is the most successful, while the use of $M_{t-1}^f$ explains the effect of the past history of incomes on food imports

$$M_t^f = 567.6199 - \underset{(-2.8794)}{2.1129}p^M + \underset{(1.5114)}{0.0286}(E_{t-1}^r + E_{t-1}^m + E_{t-1}^o)$$
$$+ \underset{(2.0307)}{0.3432}M_{t-1}^f\,. \qquad \text{(H.1)}$$
$$R^2 = 0.8437\,, \quad S_y = 33.50\,, \quad F = 11.53\,, \quad DW = 1.78\,.$$

The fit was only moderate while the coefficient variable export earnings was significant at only 10 per cent. All other variants of the equation gave poorer results. The import price elasticity of 0.3518 was, as expected, low.

The equipment import function ($M^p$) may be taken as a special case of an investment function. Hence there is a direct relationship between $M^p$ and fixed investment, and since the nonagricultural sector may be the larger importer of equipment, we have used $GI^p$ as a variable. Our estimated equation is

[32] Historically, the proportion of total exports to GNP has been declining over the post-war years, with exports accounting for 66 per cent of GNP in 1960 and 49 per cent in 1968, but exports obviously still play an important role.

[33] See [62] for criticism of the use of import price indices in import demand functions.

$$M_t^p = -2.0671 + \underset{(6.9816)}{1.3793GI_t^p} + \underset{(2.5883)}{0.2910M_{t-1}^p} .$$

$$R^2 = 0.9882 , \quad S_y = 31.17 , \quad F = 313.33 , \quad DW = 2.27 .$$

The inclusion of $(GDP_t^{na} + GDP_t^a)/P_t$ as an explanatory variable can be explained in terms of it being a proxy for the stage of economic development of the country, as well as for the pressure of demand. Explanatory power was considerably improved, with

$$M_t^p = -204.0140 + \underset{(10.0401)}{1.3354GI_t^p} + \underset{(4.7487)}{317.9321}\left(\frac{GDP_t^a + GDP_t^{na}}{P_t}\right)$$

$$+ \underset{(3.2273)}{0.2460M_{t-1}^p} . \qquad \text{(H.2)}$$

$$R^2 = 0.9948 , \quad S_y = 21.01 , \quad F = 480.57 , \quad DW = 2.54 .$$

$p^M$ was however insignificant and wrongly signed. The hypothesis that a nonlinear relationship is appropriate here is based on the observation that in developing countries, as $GI/GNP$ increases, $M^p/GNP$ increases and $d(M^p)/d(GNP)$ increases. In other words, as the country develops, the proportion of gross investment to national income increases. Part of this increase is brought about by a corresponding increase in the import of capital goods, so that the ratio of capital goods imports to national income is also raised at an increasing rate. An appropriate formulation of the $M^p$ import function taking this into account is

$$M^p = \theta_0 + \theta_1 GNP + \theta_2 GNP^2 + \text{other variables}.$$

Then $$\frac{\partial(M^p)}{\partial(GNP)} = \theta_1 + 2\theta_2 GNP ,$$

which increases as $GNP$ increases, since $\theta_2 > O$. No such evidence was found in this case; all nonlinear terms introduced were insignificant.

In the import of manufactured goods ($M^m$) equation, a number of proxies were introduced to represent income—consumption, $NNP$, disposable income, and nonagricultural $GDP$. The best equation is

$$M_t^m = -182.4313 + \underset{(2.7084)}{0.0532NNP_t} + \underset{(2.0673)}{378.6027}\left(\frac{GDP_t^a + GDP_t^{na}}{P_t}\right)$$

$$+ \underset{(2.2158)}{0.3572M_{t-1}^m} . \qquad \text{(H.3)}$$

$$R^2 = 0.9477 , \quad S_y = 42.66 , \quad F = 41.12 , \quad DW = 1.43 .$$

The income ($NNP$) elasticity of 0.4724 is a trifle low,[34] and with the development of import substituting industries, this elasticity is expected to decline over time.

The volume of raw materials imports is assumed to depend on nonagricultural value added, import price, as well as the composition of domestic output, represented here by the ratio $GDP_t^{na}/GDP_t$. Each of these variables was significant

[34] Dutta [15] gave a corresponding estimate of 0.71 in the short run for the period 1951/I–1960/I for India.

singly, but possible multicollinearity between them prevented their being used together. The best fitting equation is

$$M_t^r = 63.5455 + \underset{(0.9781)}{0.0312GDP_t^{na}} + \underset{(3.3253)}{0.6937M_{t-1}^r}, \tag{H.4}$$

$$R^2 = 0.8653, \quad S_y = 81.11, \quad F = 22.35, \quad DW = 2.00,$$

but the income variable is not significant. Raw material imports are income inelastic, with short run and long run elasticities of 0.2028 and 0.6621 respectively. The import price variable, when introduced, gave an elasticity of between $-1.5$ and $-1.8$.

2. *Merchandise exports*

In developing countries where exports account for a large proportion of domestic output, the importance of this variable as an indicator of the purchasing power of the people needs no elaboration. The theories of Chenery and Maizels (see [43]) are all based on the relation between domestic savings and export volume, while studies of export instability have focused on its effects on the domestic economy [3] [30].

While the variables determining exports are exogenous, there is some virtue in writing down equations for exports in that a forecast of exports will have to be made when values of endogenous variables are to be predicted.

The basic relationship considered is one in which exports are functions of export price ($p^e$) and world income. These classes of exports are distinguished—raw materials, which account for roughly 70 per cent of total exports, manufactures which are becoming increasingly important and account for 24 per cent of the total, and "all others."[35] Three income variables were tried in the regressions:

(i) the world index of industrial production $IP$ [73],

(ii) the world index of exports $EW$, and

(iii) the total $GNP$ of the United States, United Kingdom, and Japan $GNP^w$ [29].

The best equations are

$$E_t^r = -350.111 + \underset{(4.8055)}{3.3980IP_t} + \underset{(11.1088)}{19.3404p_t^e}. \tag{H.5}$$

$$R^2 = 0.9435, \quad S_y = 156.93, \quad F = 81.04, \quad DW = 1.56.$$

$$E_t^m = 19.8889 + \underset{(3.4943)}{13.3898EW_t} - \underset{(-2.9145)}{12.8573EW_{t-1}} + \underset{(4.5423)}{0.7295E_{t-1}^m}. \tag{H.6}$$

$$R^2 = 0.9826, \quad S_y = 71.80, \quad F = 177.14, \quad DW = 1.77.$$

$$E_t^o = -12.2880 + \underset{(1.9543)}{1.4486EW_t} - \underset{(-1.6105)}{1.4449EW_{t-1}} + \underset{(6.7264)}{1.0905E_{t-1}^o}. \tag{H.7}$$

$$R^2 = 0.9889, \quad S_y = 12.88, \quad F = 281.28, \quad DW = 1.57.$$

35 The classifications are essentially somewhat rough. "Raw materials" included SITC groups 2, 3, 4, and 5. "Manufactured goods" included groups 6, 7, and 8, while other groups were lumped under "all other exports."

For equation (H. 5) the price and income elasticities are 0.9545 and 0.2317 respectively, while the addition of $E_{t-1}^r$ did not add to explaining $E_t^r$. The former appears somewhat high, in view of the much publicized arguments about low elasticities of export supply for rubber and tin. For equation (H. 6), the closeness in absolute value of the coefficients of $EW_t$ and $EW_{t-1}$ suggests that the export of manufactures is a function of the change in world income. The income elasticity is only 0.11 in the short run and 0.4066 in the long run. The equation also shows that if there were no change in world exports, $E_t^m$ would be some 20 per cent lower than $E_{t-1}^m$. The same kind of argument holds for equation (H. 7), except that the value of the coefficient of $E_{t-1}^o$ is greater than unity, implying a 5–10 per cent increase in $E^o$ in the absence of changes in $EW_t$.

It is also interesting to compare income elasticities for total merchandise imports and exports, whose functions are estimated as

$$E_t = -821.9576 + \underset{(13.8741)}{12.1134}IP_t + \underset{(9.7790)}{21.0218}p^e .$$

$$R^2 = 0.9709 , \quad S_y = 193.77 , \quad F = 163.21 , \quad DW = 1.00 .$$

$$M_t = 58.5391 + \underset{(3.7436)}{0.2610}GNP_t + \underset{(2.0706)}{0.3636}M_{t-1} .$$

$$R^2 = 0.9689 , \quad S_y = 125.86 , \quad F = 115.04 , \quad DW = 1.94 .$$

With export income elasticity (0.5792) almost equal to the import income elasticity (0.6183), the implication is that if domestic GNP and world production increase at the same rate, the net foreign balance of this country would remain as the same percentage of GNP provided that imports and exports of services are also in balance.

### 3. *Trade in services*

The trade in services consists either of flows of factor services, or of nonfactor services like travel expenditure, transportation charges, private remittances, and other services. As such, receipts from the latter category of services is made to depend on world economic prosperity. Thus,

$$SR_t^n = 26.6539 + \underset{(2.3844)}{0.0706}GNP_t^w + \underset{(4.3921)}{0.6659}SR_{t-1}^n . \tag{H.8}$$

$$R^2 = 0.8634 , \quad S_y = 24.07 , \quad F = 21.97 , \quad DW = 1.87.$$

Income elasticity is 0.2139 in the short run and 0.6402 in the long run. Nonfactor payments include payments for foreign travel transportation services rendered to the country. The latter is linked to the volume of merchandise imports [59], while the former would be a function of disposable income. The best equation is

$$SP_t^n = -160.9560 + \underset{(4.4697)}{0.1249}(M_t^p + M_t^r + M_t^f + M_t^m) + \underset{(3.9653)}{0.5048}SP_{t-1}^n . \tag{H.9}$$

$$R^2 = 0.9811 , \quad S_y = 28.08 , \quad F = 193.00 , \quad DW = 1.50 .$$

The short run elasticity of 1.5259 indicates a high degree of response of non-factor payments to imports of goods.

Receipts from factor services are largely in the form of investment income from abroad. The prime consideration of such investment is profitability, and economic and political stability in the country receiving the investment, economic infrastructure and availability of miscellaneous facilities are all determinants of this profitability in a development content. These factors are by no means easily quantifiable; indeed the use of proxies like GNP and total exports have all proved unsuccessful. The best result is obtained by a trend equation of the form

$$SR_t^f = 4.1401 + \underset{(1.8806)}{3.5521t} + \underset{(4.5873)}{0.7218SR_{t-1}^f}, \qquad \text{(H.10)}$$

$$R^2 = 0.9841, \quad S_y = 13.06, \quad F = 245.16, \quad DW = 1.01,$$

which gives an autonomous rate of growth of factor service receipts of 1.00 per cent p.a. in the long run.

Factor service payments are made functions of merchandise imports, the change in merchandise imports, GNP and its change, as well as gross investment. The last variable has its justification in that a substantial part of the outflow may be repatriation of profits accruing to foreign investment in this country. This variable turned out to have the wrong sign, while total imports performed better than GNP. The best equation is

$$SP_t^f = 32.8942 + \underset{(1.4377)}{0.0518(M_t^p + M_t^f + M_t^r + M_t^m)}$$

$$+ \underset{(3.2758)}{0.3400\Delta(M_t^p + M_t^f + M_t^r + M_t^m)} + \underset{(3.9525)}{0.4638SP_{t-1}^f}. \qquad \text{(H.11)}$$

$$R^2 = 0.8351, \quad S_y = 66.97, \quad F = 10.76, \quad DW = 2.11.$$

## II. ESTIMATION OF THE MODEL

The model described above contains thirty-eight endogenous variables and thirteen exogenous variables (Appendix A). For purposes of estimation, a total of nineteen observations, involving annual data from 1950 to 1968, are available and the OLS method is used throughout. This procedure is biased and inconsistent, but with so few observations it is not at all certain that the additional computational burden of, say, 2SLS will be rewarded by improved estimates.

The equations of the entire model are the thirty behavioral equations (A. 3), (A. 4), (A. 5), (B. 1), (B. 2), (C. 2), (C. 3), (C. 4), (D. 2), (D. 3), (D. 4), (E. 1), (E. 3), (E. 4), (F. 1), (F. 2), (F. 3), (F. 5), (G. 4), (H. 1), (H. 2), (H. 3), (H. 4), (H. 5), (H. 6), (H. 7), (H. 8), (H. 9), (H. 10), (H. 11), and the eight identities: (A. 6), (D. 5), (D. 6), (D. 7), (G. 1), (G. 2), (G. 3), and (G. 5).

The above model is in the nature of a prototype, which it is hoped can provide some guidance for future research. Many shortcomings remain. A major criticism of the methodology adopted here would be that undue emphasis has been placed on levels of significance and degrees of fit.[36] It is hoped that with more and better data, a more sophisticated approach to the problems of specification can be adopted.

The problem of multicollinearity has also not been solved in a satisfactory way. Table II contains estimated coefficients that are insignificant at 10 per cent and their simple correlations with other explanatory variables in their respective equations. The expedient adopted here, that of omitting collinear variables, is theoretically indefensible; although in practice, the loss of explanatory power and the change in values of estimated coefficients of respective equations have fortunately been negligible.

TABLE II

THE MULTICOLLINEARITY PROBLEM: INSIGNIFICANT COEFFICIENTS AND SIMPLE CORRELATIONS WITH OTHER EXPLANATORY VARIABLES

| Equation | Variable | $t$-value of Coefficient | Significance Level (%) | Simple Correlations |
|---|---|---|---|---|
| (B. 1) | $GDP^a$ | 1.2809 | 12.5 | $r(GDP_t^a, K_{t-1}^a)=0.60$ |
| (B. 2) | $N_t^{na}$ | 0.7696 | 25.0 | $r(N_{t-1}^{na}, K_{t-1}^p+K_{t-1}^b)=0.86$ |
| (C. 7) | $Y_{t-1}^d$ | 0.9034 | 20.0 | $r(Y_t^d, Y_{t-1}^d)=0.94$ |
| (D. 4) | $K_{t-1}^p$ | −1.2001 | 12.5 | $r(K_{t-1}^p, NNP_t)=0.98$ |
| | | | | $r(K_{t-1}^p, IG_{t-1})=0.95$ |
| (H. 4) | $GDP_t^{na}$ | 0.9781 | 20.0 | $r(GDP_t^{na}, M_{t-1}^r)=0.75$ |

The problem of autocorrelation arose in a few of the estimated equations but is only serious in one—equation (D. 4).[37] Resources at our disposable do not permit the use of autoregressive least squares (ALS), but it is possible to make rough adjustments. Taking as an estimate of $\rho$, the first order autoregression coefficient, $1-(1/2)d \approx \hat{\rho}$, where $d$ is the Durbin-Watson statistic, a transformation of all variables according to $X^*_t = X_t - \hat{\rho}X_{t-1}$ can be undertaken and OLS applied to the transformed variables. The results of applying this procedure to equation (D. 4) is

$$GI_t^b = -3.8446 + \underset{(2.1617)}{0.0620Y_{t-1}^d} + \underset{(4.3243)}{0.1360P_t} . \qquad \text{(D.4')}$$

$$R^2=0.8971\,,\quad S_y=35.89\,,\quad F=65.39\,,\quad DW=1.52\,.$$

It is obvious from a comparison between (D. 4) and (D. 4′) that the coefficient estimates are not much affected by the transformation, although (D. 4′) has a $DW$ value which would point to no autocorrelation among its residuals.

[36] See the arguments contained in A. Shourie, "The Use of Macroeconomic Models of Developing Countries for Forecasts and Policy Prescription: Some Reflections on Current Practice," *Oxford Economic Papers*, Vol. 24, No. 1 (March 1972), pp. 1–35. It should be noted, however, that the issue of poor data should not be overemphasized, the inadequate data used in model-building by econometricians are also used by governments in national planning.

[37] The $DW$ value for equation (H. 10) of 1.10 is above the 1 per cent lower bound of 0.83, and the hypothesis of no autocorrelation cannot be rejected.

This brief discussion above has pointed to some directions for future research. Among others must be included the specification of the model itself. The absence of a monetary sector should be remedied. At the same time, although the model has been constructed within the national accounting framework, it is by no means clear that a growth model type approach is less useful. Finally, while the results reported in this paper are encouraging, it would be appropriate to end on this cautionary note.

## REFERENCES


1. ABRAHAM, W. I., and GILL, M. S. "The Growth and Composition of Malaysia's Capital Stock," *Malayan Economic Review,* Vol. 14, No. 2 (October 1969).
2. ADELMAN, I., and KIM, M. J. "An Econometric Model of the Korean Economy 1956–1966," in *Practical Approaches to Development Planning; Korea's Second Five-Year Plan,* ed. I. Adelman (Baltimore: Johns Hopkins Press, 1969).
3. ARIFF, K. A. M. "Export Trade and the Malayan Economy," Ph. D. dissertation, University of Lancaster, 1970.
4. ASHENFELTER, O. C.; JOHNSON, G. E.; and PENCAVEL, J. H. "Trade Unions and the Rate of Change of Money Wages in United States Manufacturing Industry," *Review of Economic Studies,* Vol. 39 (1), No. 117 (January 1972).
5. BALL, R. J., and ST. CYR, E. B. A. "Short Term Employment Functions in British Manufacturing Industry," *Review of Economic Studies,* Vol. 33 (3), No. 95 (July 1966).
6. BLACK, S. W., and KELEJIAN, H. H. "A Macro-Model of the U.S. Labor Market," *Econometrica,* Vol. 38, No. 5 (September 1970).
7. BLOMQUIST, G. C. "An Analysis of the Factors Related to the Variation in the Foreign Trade Proportion among Countries," *Developing Economies,* Vol. 8, No. 2 (January 1970).
8. BOWERS, D. A., and BAIRD, R. N. *Elementary Mathematical Macroeconomics* (Englewood Cliffs, N.J.: Prentice-Hall, 1971).
9. BRECHLING, F. "The Relationship between Output and Employment in British Manufacturing Industry," *Review of Economic Studies,* Vol. 32 (3), No. 91 (July 1965).
10. BRIDGE, J. L. *Applied Econometrics* (Amsterdam: North-Holland Publishing Co., 1971).
11. CHEONG, K. C. "Preliminary Estimates of a Statistical Model for West Malaysia 1957–1968," *Kajian Ekonomi Malaysia,* Vol. 9, No. 1 (June 1972).
12. COALE, A. J., and HOOVER, E. M. *Population Growth and Economic Development in Low Income Countries* (Princeton: Princeton University Press, 1965).
13. CONRAD, A. H. "Econometric Models in Development Planning—Pakistan, Argentina, Liberia," in *Development Policy—Theory and Practice,* ed. G. F. Papanek (Cambridge, Mass.: Harvard University Press, 1968).
14. DENTON, F. T., and SPENCER, B. G. "A Simulation Analysis of the Effects of Population Change on a Neoclassical Economy," *Journal of Political Economy,* Vol. 81, No. 2, Part I (March/April 1973).
15. DUTTA, M. "Import Structure of India," *Review of Economics and Statistics,* Vol. 47, No. 3 (August 1965).
16. ENCARNACION, Jr., J. "An Economic—Demographic Model of the Philippines," Paper presented at the KDI Advisory Service Conference, Seoul, October 10–12, 1973.
17. ENCARNACION, Jr., J.; BAUTISTA, R. M.; MANGAHAS, M.; and JURADO, G. M. "An Econometric Model of the Philippines with Projections through 1976," Paper presented at the KDI Advisory Service Conference, Seoul, October 10–12, 1973.
18. ENKE, S. "Economic Consequences of Rapid Population Growth," *Economic Journal,* Vol. 81, No. 324 (December 1971).
19. EVANS, M. *Macroeconomic Activity: Theory, Forecasting and Control* (New York: Harper and Row, 1969).

20. FAIR, R. C. *The Short-run Demand for Workers and Hours* (Amsterdam: North-Holland Publishing Co., 1969).
21. FISHER, F. M., and KAYSEN, C. *A Study in Econometrics: The Demand for Electricity in the United States* (Amsterdam: North-Holland Publishing Co., 1962).
22. FISK, E. K., and SILCOCK, T. H., ed. *The Political Economy of Independent Malaya* (Singapore: Eastern University Press, 1963).
23. HALIM, I. A. "A Study of Total Expenditure Elasticities for West Malaysia," mimeographed (Kuala Lumpur: Universiti Kebangsaan Malaysia, 1971).
24. HARBERGER, A. C. "The Dynamics of Inflation in Chile," in *Measurement in Economics,* ed. C. F. Christ (Stanford: Stanford University Press, 1963).
25. HINES, A. G. "Trade Unions and Wage Inflation in the United Kingdom, 1893–1961," *Review of Economic Studies,* Vol. 31 (4), No. 88 (October 1964).
26. ————. "Wage Inflation in the United Kingdom, 1948–1962: A Disaggregated Study," *Economic Journal,* Vol. 79, No. 313 (March 1969).
27. HOUTHAKKER, H. S., and TAYLOR, L. D. *Consumer Demand in the United States 1929–1970* (Cambridge, Mass.: Harvard University Press, 1966).
28. HUSBY, R. D. "A Non-linear Consumption Function Estimated from Time Series and Cross-Section Data," *Review of Economics and Statistics,* Vol. 53, No. 1 (February 1971).
29. International Monetary Fund. *International Financial Statistics,* various issues.
30. KHOO, S. J. "Malayan Exports: Instability and Prospects," Ph.D. dissertation, Cornell University, 1967.
31. KLEIN, L. R. "A Postwar Quarterly Model: Description and Applications," in *N.B.E.R.: Models of Income Determination* (Princeton: Princeton University Press, 1964).
32. KRISHNAMURTY, K., and SASTRY, D. U. "Some Aspects of Corporate Behaviour in India: A Cross-Section Analysis of Investment, Dividends and External Finance for the Chemical Industry, 1962–1967," *Indian Economic Review,* Vol. 6, No. 2 (October 1971).
33. KUH, E. "Income Distribution and Employment over the Business Cycle," in *The Brookings Quarterly Econometric Model of the United States,* ed. J. S. Duesenberry et al. (Chicago: Rand-McNally, 1965).
34. ————. "Measurement of Potential Output," *American Economic Review,* Vol. 56, No. 4, Part 1 (September 1966).
35. ————. "A Productivity Theory of Wage Levels: An Alternative to the Phillips Curve," *Review of Economic Studies,* Vol. 34, No. 100 (October 1967).
36. KUH, E., and SCHMALENSE, R. L. *An Introduction to Applied Macroeconomics* (Amsterdam: North-Holland Publishing Co., 1973).
37. LEBERGOTT, S. "The Labour Force and Marriages as Endogenous Variables," in *The Brookings Quarterly Econometric Model of the United States,* ed. J. S. Duesenberry et al. (Chicago: Rand-McNally, 1965).
38. LIM, C. Y. *Economic Development of Modern Malaya* (Kuala Lumpur: Oxford University Press, 1967).
39. LIM, D. *Economic Growth and Development in West Malaysia, 1947–1970* (Kuala Lumpur: Oxford University Press, 1973).
40. LIPSEY, R. G., and STEUER, M. D. "The Relation between Profits and Wage Rates," *Economica,* Vol. 28, No. 110 (May 1961).
41. LO, S. Y. *The Development Performance of West Malaysia 1955–1967* (Kuala Lumpur: Heinemann Educational Books, 1972).
42. LUCAS, R. E., Jr., and RAPPING, L. A. "Price Expectations and the Phillips Curve," *American Economic Review,* Vol. 59, No. 3 (June 1969).
43. MAIZELS, A. *Exports and Economic Growth of Developing Countries* (Cambridge: Cambridge University Press, 1968).
44. Malaya, Federation of. *Second Five-Year Plan 1961–1965* (Kuala Lumpur: Government Printer, 1961).
45. Malaysia. *First Malaysia Plan 1966–1970* (Kuala Lumpur: Government Printer, 1965).

46. ————. *Midterm Review of the Second Malaysia Plan, 1971–1975* (Kuala Lumpur: Government Printer, 1973).
47. Malaysia, Department of Statistics. *Monthly Statistical Bulletin of West Malaysia,* various issues.
48. ————. *National Accounts of West Malaysia, 1950–1960* (Kuala Lumpur, 1960).
49. ————. *National Accounts of West Malaysia, 1960–1968* (Kuala Lumpur, 1968).
50. MARWAH, K. "An Econometric Model of India: Estimating Prices, Their Role and Sources of Change," *Indian Economic Review,* Vol. 7, No. 1 (April 1972).
51. MODIGLIANI, F., and TARANTELLI, E. "A Generalization of the Phillips Curve for a Developing Country," *Review of Economic Studies,* Vol. 40, No. 122 (April 1973).
52. NURKSE, R. *Problems of Capital Formation in Underdeveloped Countries* (Oxford: Oxford University Press, 1953).
53. OSHIMA, H. "Labour Absorption in East and Southeast Asia: A Summary with Interpretation of Postwar Experience," *Malayan Economic Review,* Vol. 16, No. 2 (October 1971).
54. PAVLOPOULOS, P. *A Statistical Model for the Greek Economy 1949–1959* (Amsterdam: North-Holland Publishing Co., 1966).
55. PERRY, G. L. "The Determinants of Wage Rate Changes and the Inflation—Unemployment Trade Off for the United States," *Review of Economic Studies,* Vol. 31 (4), No. 88 (October 1964).
56. PHELPS, E. S. "Money Wage Dynamics and Labour Market Equilibrium," in *Microeconomic Foundations of Employment and Inflation Theory,* ed. E. S. Phelps (London: Macmillan & Co., 1971).
57. PHILLIPS, A. W. "The Relation between Unemployment and the Rate of Change of Money Wage Rates, United Kingdom, 1861–1957," *Economica,* Vol. 25, No. 100 (November 1958).
58. PONNIAH, V. J. *The West Malaysian Labour Force: Growth and Structural Change in the Post-war Period* (Kuala Lumpur: F.E.A., University of Malaya, 1972).
59. PRACHOWNY, M. *A Structural Model of the U.S. Balance of Payments* (Amsterdam: North-Holland Publishing Co., 1969).
60. PUTHUCHEARY, J. J. *Ownership and Control in the Malayan Economy* (Singapore: Eastern University Press, 1960).
61. ROBINSON, S. "Sources of Growth in Less Developed Countries: A Cross Section Study," *Quarterly Journal of Economics,* Vol. 85, No. 3 (August 1971).
62. SARANTIDES, S. A. "Import Demand Functions for Greece, 1953–1964," *Economia Internazionale,* Vol. 25, No. 1 (February 1972).
63. SCHULTZE, C. L., and TRYON, J. L. "Prices and Wages," in *The Brookings Quarterly Econometric Model of the United States,* ed. J. S. Duesenberry et al. (Chicago: Rand-McNally, 1965).
64. SILCOCK, T. H. *Readings in Malayan Economics* (Singapore: Eastern Universities Press, 1961).
65. SNODGRASS, D. R. "A Survey of Labour Utilisation in West Malaysia 1971–1975," mimeographed (Kuala Lumpur: Economic Planning Unit, 1970).
66. SONG, H. "An Econometric Forecasting Model of the Korean Economy," Paper presented at the KDI Advisory Service Conference, Seoul, October 10–12, 1973.
67. SOONTHORNSIMA, C. "A Macroeconomic Model for Economic Development of Thailand," Ph. D. dissertation, University of Michigan, 1963.
68. STONE, R., and ROWE, D. A. "The Market Demand for Durable Goods," *Econometrica,* Vol. 25, No. 3 (July 1957).
69. STRAND, K., and DEMBURG, T. "Cyclical Variation in Civilian Labour Force Participation," *Review of Economics and Statistics,* Vol. 46, No. 4 (November 1964).
70. SUITS, D. B. *An Econometric Model of the Greek Economy* (Athens: Centre of Economic Research, 1964).
71. TURNHAM, D. *The Employment Problem in Less Developed Countries* (Paris: Organization for Economic Cooperation and Development, 1971).

72. TUNOVSKY, S. J. "The Expectations Hypothesis and the Aggregate Wage Equation: Some Empirical Evidence for Canada," *Economica,* Vol. 39, No. 153 (February 1972).
73. United Nations, Statistical Office. *Monthly Bulletin of Statistics,* various issues.
74. VAN RIJCKEGHEM, W. "An Econometric Model for a Dual Economy: The Case of Puerto Rico," Paper presented at the 1969 European Meeting of the Econometric Society, Brussels, October 1969.
75. VANDERKAMP, J. "Wage and Price Level Determination: An Empirical Model for Canada," *Economica,* Vol. 33, No. 130 (May 1966).
76. YEH, S., and YOU, P. S. "Labour Force Supply in Southeast Asia," *Malayan Economic Review,* Vol. 16, No. 2 (October 1971).

## APPENDIX A

## LIST OF VARIABLES*

A. *Endogenous*

$b$ : Crude birth rate; births per 1,000 population.
$C^f$ : Private consumption expenditure for food, beverages, and tobacco, $ million.
$C^h$ : Private consumption expenditure for household goods, $ million.
$C^s$ : Private consumption expenditure for services, $ million.
$d$ : Crude death rate; deaths per 1,000 population.
$E^r$ : Merchandise exports of raw materials (SITC 2, 3, 4, 5), $ million.
$E^m$ : Merchandise exports of manufactured goods (SITC 6, 7, 8), $ million.
$E^o$ : All other merchandise exports (SITC 0, 1, 9), $ million.
$DP$ : Depreciation allowance, $ million.
$GDP^a$ : Gross domestic product at factor cost in agriculture, forestry, and fishing, $ million.
$GDP^{na}$ : Gross domestic product at factor cost, nonagriculture, $ million.
$GI^a$ : Gross investment in agriculture (planting of perennial crops), $ million.
$GI^b$ : Gross investment in building and construction, $ million.
$GI^p$ : Gross investment in machinery and equipment, $ million.
$K^a$ : Capital stock, agriculture, $ million.
$K^b$ : Capital stock, building, and construction, $ million.
$K^p$ : Capital stock, machinery, and equipment, $ million.
$L$ : Labor force, 1,000 persons.
$M^f$ : Merchandise imports of food (SITC 0, 1, 4), $ million.
$M^r$ : Merchandise imports of raw materials (SITC 2, 3, 5), $ million.
$M^p$ : Merchandise imports of machinery and equipment (SITC 7, 9), $ million.
$M^m$ : Merchandise imports of manufactured goods (SITC 6, 8), $ million.
$N^a$ : Total agricultural employment, 1,000 persons.
$N^{na}$ : Nonagricultural employment, 1,000 persons.

* All variables expressed in value terms are in constant 1959 dollars.

$p$ : Retail price index, 1958 = 100.
$NNP$ : Net national product at factor cost, $ million.
$p^f$ : Retail price index for food, 1958 = 100.
$P$ : Midyear population, 1,000 persons.
$SP^f$ : Payments for factor services, $ million.
$SP^n$ : Payments for nonfactor services, $ million.
$SR^f$ : Receipts from factor services, $ million.
$SR^n$ : Receipts from nonfactor services, $ million.
$T^d$ : Direct tax revenue from corporations and households, $ million.
$T^e$ : Indirect tax revenue from exports, $ million.
$T^m$ : Indirect tax revenue from imports, $ million.
$T^o$ : Indirect tax revenue from all other sources, $ million.
$w$ : Annual wage rate, $1,000.
$Y^d$ : Disposable income, $ million.

B. *Exogenous*

$EW$ : Index of world exports, 1958 = 100.
$G$ : General government consumption expenditure.
$GNP^w$ : Gross national product of the United States, United Kingdom, and Japan, $ billion (U.S.).
$IP$ : World index of industrial production, excluding East Europe, China, North Korea, and North Vietnam, 1958 = 100.
$IG$ : Public investment expenditure, $ million.
$P^e$ : Index of export unit value calculated from rubber, tin, palm oil, timber, and iron ore unit values, 1959 = 100.
$P^M$ : Import price index, 1958 = 100.
$\Delta S$ : Change in stock, calculated as a residual in the National Income Identity, $ million.
$TR$ : Current net transfer to households, $ million.
$t^d$ : Average direct tax rate.
$t^e$ : Average indirect tax rate on exports.
$t^m$ : Average indirect tax rate on imports.
$t$ : Time trend, 1949 = 1.0.