

Title	A Quarterly Econometric Forecasting Model for Taiwan Economy (<Special Issue>Proceedings of the Asian Sub-Link Project Symposium)
Author(s)	Chiu, Yi-Chung
Citation	東南アジア研究 (1979), 17(2): 280-291
Issue Date	1979-09
URL	http://hdl.handle.net/2433/55964
Right	
Type	Journal Article
Textversion	publisher

A Quarterly Econometric Forecasting Model for Taiwan Economy

Yi-Chung CHIU*

I Introduction

This is a revised quarterly model¹⁾ of DGBAS: Directorate-General of Budget, Accounting & Statistics [1]. The main purpose of this model is the short-term forecast for the Taiwan economy. Because the short-run fluctuations are mainly caused by demand and price factors, the major parts of the model is built by equations related to these factors. To reflect the characteristics of the Taiwan economy, the model takes into account the following facts: first, the Taiwan economy is export-oriented [2]; i.e., the private investment is mainly

stimulated by exports;²⁾ second, the increasing openness of the economy [3], i.e., the impact from outside are increasingly strong;³⁾ third, the potential GNP will be enlarged by the accomplishment of the Ten Major Projects.⁴⁾

In regard to the forecast, one difficult problem is how to consider the shock caused by the severance of the diplomatic relationship between the Republic of China and the United States. So far, however, no serious problem seems to have been posed by this political factor.

II The Model

A Structure of the Model

The model consists of 28 behavioristic and institutional equations and 24

definitions. There are 52 endogenous variables and 19 exogenous variables.

The structure of the model is represented by the flow chart as follows:

* Council for Economic Planning & Development, Executive Yuan, Taipei, Taiwan

1) The modified equations are private fixed investment, inventory investment, export, import, labor demand, wage rate, wholesale price index, consumer price index, price deflator of inventory investment, price deflator of export, demand for money, total depreciation and depreciation in private sector function. It should be pointed out that the Aggregate and Supply Model designed by

Professor T. C. Liu in 1967 [4] laid the basis of present model. Had it not been for Prof. Liu, the present model could not have been completed.

2) Please see the equation of private fixed investment in section II.
3) Please see the equation of wholesale price index in section II.
4) Please see the equation of export in section II.

- | | |
|---|---|
| (7) N_L : Labor demand | (34) I_g : Grossfixed investment by government |
| (8) W : Wage rate | (35) $J\$$: Inventory investment |
| (9) WPI : Wholesale price index | (36) $X\$$: Export of goods and services |
| (10) CPI : Consumer price index | (37) $M\$$: Import of goods and services |
| (11) P_{ef} : Price deflator of food consumption | (38) $D\$$: Total depreciation |
| (12) P_{eo} : Price deflator of nonfood consumption | (39) $Gdp\$$: Gross domestic product (at current prices) |
| (13) P_{eg} : Price deflator of government consumption | (40) Gdp : Gross domestic product (at 1971 constant prices) |
| (14) P_i : Price deflator of fixed investment | (41) $NI\$$: National income |
| (15) P_j : Price deflator of inventory investment | (42) $Yd\$$: Disposable income |
| (16) P_x : Price deflator of exports | (43) $TD\$$: Total demand |
| (17) M_d : Demand for money | (44) TS : Total supply |
| (18) $Wage\$$: Wage income | (45) $Prop\$$: Property income |
| (19) $A\$$: Mixed income | (46) P : Price deflator of total supply (or total demand) |
| (20) D : Total depreciation | (47) P_{gdp} : Price deflator of gross domestic product |
| (21) D_{priv} : Depreciation in private sector | (48) P_c : Price deflator of private consumption |
| (22) $T_i\$$: Indirect taxes | (49) $M_s\$$: Money supply |
| (23) $T_p\$$: Business direct taxes | (50) K : Total capital stock |
| (24) $T_d\$$: Direct taxes | (51) K_{priv} : Private capital stock |
| (25) $S_e\$$: Public enterprise savings | (52) K_j : Inventory stock |
| (26) $Y_g\$$: Government income from property and enterprises | 2. Exogenous Variables |
| (27) $T_{gf}\$$: Transfer payments from government to households | (1) $C_g\$$: Government consumption |
| (28) $T_{fg}\$$: Transfer payments from households to government | (2) $I_{pe}\$$: Gross fixed investment by public enterprises |
| (29) $C_f\$$: Private food consumption | (3) $I_g\$$: Gross fixed investment by government |
| (30) $C_o\$$: Private nonfood consumption | (4) $R_g\$$: Interest on public debts |
| (31) C_g : Government consumption | (5) $FI_a\$$: Net factor income from abroad |
| (32) $I_{priv}\$$: Private fixed investment | (6) $Taf\$$: Transfer payments from abroad to family |
| (33) I_{pe} : Gross fixed investment by public enterprises | (7) P_r : Rice price index |

- | | |
|--|---|
| (8) P_m : Price deflator of imports | $-.0034 \frac{P_{ef}}{(0.018) P_{Gdp}/100}$ |
| (9) P'_m : Imports price index (in US\$) | $+0.741 C_{f-1}$
(0.088) |
| (10) e : Effective exchange rates | $+0.545 DUM_{74} + 1.798 Q_1$
(0.326) (0.149) |
| (11) PW : World export price index | $-0.653 Q_2 + 0.492 Q_3$
(0.258) (0.160) |
| (12) TW : World trade quantum index | $R^2=0.991 \quad S^2=0.175$
$d=2.549$ |
| (13) i : Interest rate | |
| (14) u : Unemployment rate | |
| (15) DUM_{71} : Dummy variable,
DUM_{71} : 1, after 1971 I;
0, before
1970 IV | (2) <i>Private Nonfood Consumption</i>
$C_o = 27.043 + 0.186 \frac{Yd\$}{P/100}$
(0.042)
$-0.226 \frac{P_{co}}{(0.034) P_c/100}$ |
| (16) DUM_{74} : Dummy variable,
DUM_{74} : 1, after 1974 I;
0, before
1973 IV | $+0.148 \frac{M_s\$}{(0.026) P/100}$
$+3.923 Q_1 + 0.185 Q_2$
(0.305) (0.339)
$+2.420 Q_3$
(0.325)
$R^2=0.991 \quad S^2=0.697$
$d=2.136$ |
| (17) Q_1 : Dummy variable,
Q_1 : 1, for 1st quarter;
0, otherwise | |
| (18) Q_2 : Dummy variable,
Q_2 : 1, for 2nd quarter;
0, otherwise | (3) <i>Private Fixed Investment</i>
$I_{priv} = 1.050$
$+0.146 \sum_{i=1}^4 (C_f + C_o)_{-i}$
(0.023)
$+0.028 \sum_{i=1}^4 X_{-i}$
(0.015)
$-0.049 K_{priv-1}$
(0.013)
$-2.894 Q_1 - 2.118 Q_2$
(0.485) (0.477)
$-0.757 Q_3$
(0.477)
$R^2=0.903 \quad S^2=1.931$
$d=1.983$ |
| (19) Q_3 : Dummy variable,
Q_3 : 1, for 3rd quarter;
0, otherwise | |

C Estimated Structural Equations and Identities

The structural equations are estimated by OLS using the time series from 1st quarter of 1962 to the 4th quarter of 1978. The figures in the parentheses under the coefficients of the equation are the standard errors.

1. Estimated Structural Equations

(1) *Private Food Consumption*

$$C_f = 4.504 + 0.062 \frac{Yd\$}{(0.020) P_{Gdp}/100}$$

(4) *Inventory Investment*

$$J = 0.582 - 0.309 X - 0.095 K_{f-1}$$

$$+ 0.318 Gdp_{-1} - 5.192 Q_1$$

$$- 1.365 Q_2 - 4.631 Q_3$$

(0.110) (0.041)
(0.116) (1.097)
(0.879) (0.879)

- $R^2=0.410 \quad S^2=6.527$
 $d=1.155$
 (5) *Export of Goods and Services*
 $X=-15.320+0.062 TW$
 (0.051)
 $+0.106 \frac{PW}{e/100 \cdot WPI/100}$
 (0.083)
 $+0.656 X_{-1}+0.017 K_{-1}$
 (0.106) (0.013)
 $-1.909 Q_1+1.960 Q_2$
 (1.037) (1.081)
 $+0.823 Q_3$
 (1.047)
 $R^2=0.980 \quad S^2=8.577$
 $d=2.181$
 (6) *Import of Goods and Services*
 $M=8.121+0.440 Gdp$
 (0.064)
 $+0.298 X_{-1}$
 (0.086)
 $-0.211 \frac{P'_m}{e/100 \cdot WPI/100}$
 (0.066)
 $-1.605 Q_1+1.609 Q_2$
 (0.836) (0.838)
 $+0.448 Q_3$
 (0.853)
 $R^2=0.979 \quad S^2=5.657$
 $d=1.374$
 (7) *Labor Demand*
 $N_L=2.544$
 $+0.012 Gdp+0.029 Gdp_{-1}$
 (0.007) (0.007)
 $-0.261 \frac{W}{P_{Gdp}/100}$
 (0.126)
 $-0.059 Q_1-0.017 Q_2$
 (0.064) (0.048)
 $+0.133 Q_3$
 (0.057)
 $R^2=0.984 \quad S^2=0.013$
 $d=0.599$
 (8) *Wage Rate*
 $\dot{W}=20.123$
 $-2.714 u+0.532 CPI$
 (0.909) (0.075)

- $+0.202 \frac{Gdp}{N_L}-0.898 Q_1$
 (0.201) (2.095)
 $-1.708 Q_2-1.131 Q_3$
 (2.118) (2.099)
 $R^2=0.648 \quad S^2=30.194$
 $d=0.817$
 (9) *Wholesale Price Index*
 $WPI=75.500+0.338 P_m$
 (0.117)
 $+0.032 DUM_{71} \cdot P_m$
 (0.030)
 $+0.163 DUM_{74} \cdot P_m$
 (0.040)
 $+15.027 \frac{M_s}{Gdp}$
 (8.307)
 $-2.719 \frac{K_{-1}}{Gdp}+0.491 Q_1$
 (1.892) (2.100)
 $+0.411 Q_2+0.459 Q_3$
 (2.064) (2.198)
 $R^2=0.981 \quad S^2=32.614$
 $d=0.559$
 (10) *Consumer Price Index*
 $CPI=-0.965$
 $+0.351 WPI+3.417 W$
 (0.032) (0.881)
 $+0.578 CPI_{-1}-0.749 Q_1$
 (0.044) (0.861)
 $+0.167 Q_2+1.250 Q_3$
 (0.859) (0.858)
 $R^2=0.997 \quad S^2=6.233$
 $d=1.425$
 (11) *Price Deflator of Food Consumption*
 $P_{cf}=-14.738$
 $+0.044 P_r+1.025 CPI$
 (0.017) (0.079)
 $+0.092 P_{cf-1}-0.055 Q_1$
 (0.065) (0.960)
 $+0.579 Q_2+1.390 Q_3$
 (0.948) (0.938)
 $R^2=0.998 \quad S^2=7.356$
 $d=0.927$
 (12) *Price Deflator of Nonfood Consumption*

- (12) $P_{c_o} = 8.203 + 0.454 \text{ CPI}$
 (0.066)
 $+ 0.463 P_{c_o-1} + 1.512 Q_1$
 (0.082) (0.730)
 $- 0.028 Q_2 - 0.278 Q_3$
 (0.742) (0.729)
 $R^2 = 0.997 \quad S^2 = 4.517$
 $d = 0.621$
- (13) *Price Deflator of Government Consumption*
 $P_{c_g} = -22.042 + 0.674 P$
 (0.109)
 $+ 0.490 P_{c_g-1} - 0.713 Q_1$
 (0.086) (2.113)
 $+ 1.075 Q_2 + 3.219 Q_3$
 (2.127) (2.114)
 $R^2 = 0.990 \quad S^2 = 37.573$
 $d = 2.548$
- (14) *Price Deflator of Fixed Investment*
 $P_i = 10.957$
 $+ 0.326 P_m + 3.410 W$
 (0.094) (1.491)
 $+ 0.501 P_{i-1} + 2.769 Q_1$
 (0.121) (1.792)
 $+ 2.363 Q_2 + 2.500 Q_3$
 (1.796) (1.787)
 $R^2 = 0.986 \quad S^2 = 26.973$
 $d = 1.285$
- (15) *Price Deflator of Inventory Investment*
 $P_j = 3.956 + 0.158 P_m$
 (0.123)
 $+ 0.796 WPI + 4.031 Q_1$
 (0.154) (2.713)
 $+ 2.242 Q_2 + 3.656 Q_3$
 (2.703) (2.692)
 $R^2 = 0.963 \quad S^2 = 61.431$
 $d = 1.845$
- (16) *Price Deflator of Export*
 $P_x = -4.155$
 $+ 1.018 WPI - 0.480 Q_1$
 (0.024) (2.598)
 $- 0.638 Q_2 + 0.225 Q_3$
 (2.598) (2.597)
 $R^2 = 0.966 \quad S^2 = 57.325$
- (17) *Demand for Money*
 $d = 0.816$
 $\ln Md = -0.027 + 0.891 \cdot$
 (0.135)
 $\ln (C_f + C_o + C_g + I_{priv}$
 $+ I_{pc} + I_g + J) + 0.253 \cdot$
 (0.058)
 $\ln X - 0.363 \ln i + 0.103 Q_1$
 (0.096) (0.025)
 $+ 0.042 Q_2 + 0.092 Q_3$
 (0.027) (0.030)
 $R^2 = 0.988 \quad S^2 = 0.005$
 $d = 0.488$
- (18) *Wage Income*
 $Wage\$ = 5.002$
 $+ 2.216 (W \times N_L)$
 (0.035)
 $- 1.115 Q_1 + 0.517 Q_2$
 (1.282) (1.283)
 $- 0.878 Q_3$
 (1.281)
 $R^2 = 0.984 \quad S^2 = 13.950$
 $d = 0.383$
- (19) *Mixed Income*
 $A\$ = 2.902$
 $+ 0.149 (Wage\$ + Prop\$)$
 (0.006)
 $- 0.514 Q_1 - 2.696 Q_2$
 (0.660) (0.660)
 $- 1.443 Q_3$
 (0.659)
 $R^2 = 0.905 \quad S^2 = 3.685$
 $d = 1.593$
- (20) *Total Depreciation*
 $D = -5.272 + 0.012 \frac{K_{-1} + K}{2}$
 (0.0002)
 $+ 29.199 \frac{Gdp}{K_{-1}} + 0.012 Q_1$
 (3.090) (0.100)
 $+ 0.160 Q_2 + 0.049 Q_3$
 (0.100) (0.103)
 $R^2 = 0.985 \quad S^2 = 0.081$
 $d = 0.547$
- (21) *Depreciation in Private Sector*

$$D_{priv} = -3.951$$

$$+0.007 \frac{K_{priv} + K_{priv-1}}{2} \quad (0.001)$$

$$+20.543 \frac{Gdp}{K_{priv-1}} \quad (2.535)$$

$$-0.301 Q_1 - 0.327 Q_2 \quad (0.136) \quad (0.136)$$

$$+0.188 Q_3 \quad (0.139)$$

$$R^2 = 0.900 \quad S^2 = 0.152$$

$$d = 1.657$$

(22) *Indirect Taxes*

$$T_i\$ = -1.003$$

$$+0.159 Gdp\$ - 0.494 Q_1 \quad (0.002) \quad (0.306)$$

$$+0.524 Q_2 - 0.027 Q_3 \quad (0.306) \quad (0.305)$$

$$R^2 = 0.993 \quad S^2 = 0.791$$

$$d = 2.701$$

(23) *Business Direct Taxes*

$$T_p\$ = -1.412$$

$$+0.124 (NI\$ + R_o\$ - Y_o\$ \quad (0.007)$$

$$- A\$ - Wage\$) + 0.312 Q_1 \quad (0.231)$$

$$+0.967 Q_2 + 1.507 Q_3 \quad (0.231) \quad (0.230)$$

$$R^2 = 0.848 \quad S^2 = 0.451$$

$$d = 1.706$$

(24) *Direct Taxes*

$$Td\$ = -2.355$$

$$+0.071 (NI\$ + R_o\$ \quad (0.002)$$

$$- Y_o\$) + 1.021 Q_1 \quad (0.229)$$

$$+1.550 Q_2 + 1.627 Q_3 \quad (0.229) \quad (0.229)$$

$$R^2 = 0.963 \quad S^2 = 0.446$$

$$d = 1.574$$

(25) *Public Enterprise Savings*

$$S_e\$ = -0.061$$

$$+0.022 Gdp\$ - 0.219 Q_1 \quad (0.001) \quad (0.128)$$

$$+0.063 Q_2 - 0.005 Q_3 \quad (0.127) \quad (0.127)$$

$$R^2 = 0.989 \quad S^2 = 0.137$$

$$d = 1.770$$

(26) *Government Income from Property and Enterprises*

$$Y_g\$ = 0.376$$

$$+0.029 Gdp\$ + 0.057 Q_1 \quad (0.003) \quad (0.525)$$

$$+1.682 Q_2 - 0.501 Q_3 \quad (0.524) \quad (0.524)$$

$$R^2 = 0.639 \quad S^2 = 2.331$$

$$d = 2.044$$

(27) *Transfer Payments from Government to Households*

$$T_{g,h}\$ = -0.065$$

$$+0.003 Gdp\$ + 0.063 Q_1 \quad (0.0002) \quad (0.050)$$

$$+0.154 Q_2 - 0.045 Q_3 \quad (0.050) \quad (0.050)$$

$$R^2 = 0.722 \quad S^2 = 0.022$$

$$d = 1.803$$

(28) *Transfer Payments from Households to Government*

$$T_{h,g}\$ = -0.509$$

$$+0.034 NI\$ + 0.019 Q_1 \quad (0.002) \quad (0.247)$$

$$+0.294 Q_2 - 0.407 Q_3 \quad (0.246) \quad (0.246)$$

$$R^2 = 0.847 \quad S^2 = 0.514$$

$$d = 1.713$$

2. Identities

$$(29) C_f\$ = C_f \cdot P_{cf} / 100$$

$$(30) C_o\$ = C_o \cdot P_{co} / 100$$

$$(31) C_g = \frac{C_g\$}{P_{cg} / 100}$$

$$(32) I_{priv}\$ = I_{priv} \cdot P_i / 100$$

$$(33) I_{pe} = \frac{I_{pe}\$}{P_i / 100}$$

$$(34) I_g = \frac{I_g\$}{P_i / 100}$$

$$\begin{aligned}
 (35) \quad J\$ &= J \cdot P_j / 100 & (44) \quad TS &= Gdp + M \\
 (36) \quad X\$ &= X \cdot P_x / 100 & (45) \quad Prop\$ &= NI\$ + R_o\$ - T_f\$ - S_c\$ \\
 & & & \quad - Y_o\$ - Wage\$ - A\$ \\
 (37) \quad M\$ &= M \cdot P_m / 100 & (46) \quad P &= \frac{TD\$}{TS} \times 100 \\
 (38) \quad D\$ &= D \cdot P_i / 100 & (47) \quad P_{Gdp} &= \frac{Gdp\$}{Gdp} \times 100 \\
 (39) \quad Gdp\$ &= C_f\$ + C_o\$ + C_g\$ + I_{priv}\$ \\
 & \quad + I_{pc}\$ + I_g\$ + J\$ + X\$ - M\$ & (48) \quad P_c &= \frac{C_f\$ + C_o\$ + C_g\$}{C_f + C_o + C_g} \times 100 \\
 (40) \quad Gdp &= C_f + C_o + C_g + I_{priv} + I_{pc} \\
 & \quad + I_g + J + X - M & (49) \quad M_a\$ &= M_a \cdot P / 100 \\
 (41) \quad NI\$ &= Gdp\$ - T_i\$ - D\$ + Fla\$ & (50) \quad K - K_{-1} &= I_{priv} + I_{pc} + I_g - D \\
 (42) \quad Y_a\$ &= NI\$ - T_a\$ - Y_o\$ - S_c\$ \\
 & \quad + T_{of}\$ - T_{fo}\$ + T_{af}\$ + R_o\$ & (51) \quad K_{priv} - K_{priv-1} &= I_{priv} - D_{priv} \\
 (43) \quad TD\$ &= Gdp\$ + M\$ & (52) \quad K_j - K_{j-1} &= J
 \end{aligned}$$

III Discussion of the Equations

Private Food Consumption The explanatory variables in food consumption function are disposable income, relative price of food, and food consumption lagged by one period [5]. There is a dummy variable ($DUM_{74}=1$ after 1974 I; $=0$ before 1973 IV) in food consumption function to reflect an upward-shift of that function after 1974, when the world-wide recession occurred.⁵⁾

According to the estimated food consumption function, the short-run and long-run MPC of food were 0.062, 0.239 respectively during the sample period. The price elasticity was 0.173 in the 4th quarter, last year.⁶⁾ The upward-shift of consumption function after 1974 was

0.545 billion NT\$ at 1971 price⁷⁾ (0.031 billion US\$ at current prices).

Private Nonfood Consumption Disposable income and a relative price are related to nonfood consumption function. There is another explanatory variable, real liquidity, in this function to serve as an approximation of wealth effect.

MPC of nonfood was 0.186 during the sample period. The price elasticity was 0.608 in the 4th quarter last year.⁸⁾ The nonfood consumption would increase by 0.148 billion NT\$ if liquidity increased by 1 billion NT\$.⁹⁾

Private Fixed Investment The major factors that determine private fixed investment

5) As food consumption maintain the ordinary increasing rate in the recession period after 1974, so food consumption function will shift upwards.

6) Elasticity of private food consumption with respect to price

$$= \frac{\partial C_f}{\partial P} \times \frac{P}{C_f} = 0.034 \times 5.093 = 0.173$$

7) Please see the coefficient of DUM_{74} of food consumption function.

8) Elasticity of private nonfood consumption with respect to price

$$= \frac{\partial C_o}{\partial P} \times \frac{P}{C_o} = 0.226 \times 2.692 = 0.608$$

9) Please see the coefficient of $\frac{M_a\$}{P/100}$ of nonfood consumption function.

are expected export, expressed by summation of lagged exports ($\sum_{i=1}^4 X_{-i}$), expected sales of consumers' goods in domestic market, expressed by summation of lagged consumption ($\sum_{i=1}^4 (C_f + C_o)_{-i}$), and stock adjustment, expressed by capital stock lagged by one period (K_{priv-1}) [6]. All these factors are included in private fixed investment function as explanatory variables, and the estimated results are significant.

The expected exports is included, because it is believed that the expectation of sales expansion at foreign markets makes domestic enterprises increase their investment.

In 1978 IV, the elasticities of investment with respect to the expected sales of export goods the same of consumers' goods and capital stocks are 0.415,¹⁰⁾ 1.879¹¹⁾ and 1.421¹²⁾ respectively.

Inventory Investment The change in in-

10) Elasticity of private fixed investment with respect to expected export

$$= \frac{\partial I_{priv}}{\partial \sum_{i=1}^4 X_{-i}} \times \frac{\sum_{i=1}^4 X_{-i}}{I_{priv}} = 0.028 \times 14.825 = 0.415$$

11) Elasticity of private fixed investment with respect to the expected sales of consumer's goods

$$= \frac{\partial I_{priv}}{\partial \sum_{i=1}^4 (C_f + C_o)_{-i}} \times \frac{\sum_{i=1}^4 (C_f + C_o)_{-i}}{I_{priv}} = 0.146 \times 12.869 = 1.879$$

12) The elasticity of private fixed investment with respect to capital stock

$$= \frac{\partial I_{priv}}{\partial K_{priv-1}} \times \frac{K_{priv-1}}{I_{priv}} = 0.049 \times 28.993 = 1.421$$

ventory stock depends on expectation of sales, expressed by gross domestic product lagged by one period; realized sales, expressed by export; and stock adjustment, expressed by inventory stock lagged by one period. It may be interpreted that the change in inventory stock caused by expectation of sales is intended, and the one caused by realized sales is unintended [7]. According to the estimated results of the total change in inventory stock, 2.324 billion NT\$, in the 4th quarter of 78, the portion caused by intended inventory investment was 37.027 billion NT\$,¹³⁾ the portion caused by unintended inventory investment was -22.569 billion NT\$,¹⁴⁾ the residual: -12.716 billion NT\$ was caused by stock adjustment, seasonal change and other factors.

Exports The explanatory variables are the world trade, competitive power ($\frac{PW}{e/100 \cdot WPI/100}$), capital stock lagged by one period and export lagged by one period.

K_{-1} is a proxy for production capacity. It is used to express the impact of the construction of infrastructure in the Ten Major Projects.

In the 4th quarter last year, the elasticity of export with respect to the world trade and competitive power was

13) The portion caused by intended inventory investment

$$= 116.436 \times 0.318 = 37.027 \text{ (billion NT\$)}$$

14) The portion caused by unintended inventory investment

$$= 73.039 \times 0.309 = 22.569 \text{ (billion NT\$)}$$

0.131 and 0.220 respectively.¹⁵⁾ The same with respect to production capacity and X_{-1} are 0.202% and 0.640% respectively.¹⁶⁾ Imports M depend on Gdp , X_{-1} , and relative price $\left(\frac{P'_m}{e/100 \cdot WPI/100}\right)$. The inclusion of Gdp as an explanatory variable is based on the consideration that import increases as production expands, because Taiwan is poor in natural resources.

X_{-1} is then the proxy for import capability or source of foreign exchange for imports [8]. In the sample period, marginal propensity to import was 0.440.

Labor Demand Demand for labor depends on expected production, expressed by domestic production lagged by one period, and real wage rate. The realized employment is, however, adjusted simultaneously with the actual production (Gdp).

Wage Rate The change of wage rate is determined by the gap between labor

supply and demand; *i.e.*, unemployment rate [9], the changes of productivity and living costs.

Wholesale and Consumer Prices Wholesale price (WPI) depends on import price, excess money supply $\left(\frac{M_t \$}{Gdp}\right)$ [10], and demand-supply pressure $\left(\frac{K_{-1}}{Gdp}\right)$.¹⁷⁾

There are dummy variables in the coefficient of import price to express the increasing important effect of import price on Taiwan economy due to the increasing openness of the economy.¹⁸⁾

Consumer price depends on wholesale prices and wage rate. The rigidity of the price is expressed by consumer price lagged by one period. Rigidity is taken into account similarly in the following price functions.

The Implicit Price Deflator The implicit price deflators are largely determined by wholesale price (WPI) and consumer price (CPI). The price of rice is used as an explanatory and policy variable in the deflator of food consumption function. It is virtually controlled by government.

Demand for Money Demand for money is determined by interest rate and the quantity of goods sold in domestic and foreign markets. The elasticity of demand for money with respect to the total transaction and the interest rate are

15) The elasticity of exports with respect to the world trade

$$= \frac{\partial X}{\partial TW} \times \frac{TW}{X} = 0.062 \times 2.114 = 0.131$$

The elasticity of export with respect to competitive power

$$= \frac{\partial X}{\partial Comp} \times \frac{Comp}{X} = 0.106 \times 2.077 = 0.220$$

where $Comp: \frac{PW}{e \cdot WPI}$

16) The elasticity of export with respect to production capacity

$$= \frac{\partial X}{\partial K_{-1}} \times \frac{K_{-1}}{X} = 0.017 \times 11.892 = 0.202$$

The elasticity of export with respect to market size

$$= \frac{\partial X}{\partial X_{-1}} \times \frac{X_{-1}}{X} = 0.656 \times 0.976 = 0.640$$

17) Capital stock is the proxy for potential productivity, and gross domestic is the expenditure for final products.

18) According to the wholesale price function, the coefficients of P_m are 0.338 during 1961–1971, 0.370 during 1971–1974, 0.533 during 1974–1978.

1.144 and 0.363 respectively.¹⁹⁾

Wage Income Wage income is determined by the wage rate and employment. The portion of the payments other than wages such as fringe benefits was 2% according to the estimation of this function.

Mixed Income Mixed income that comes from agricultural and unincorporated enterprise sectors is explained by wages plus property income ($Wage\$ + Prop\$$) [11].

Other Equations Depreciation is determined by capital stock and adjusted by

production level. Tax is determined by taxable income. According to the estimation, the average tax rates were 15.9% for indirect tax, 7.1% for direct tax, and 12.4% for profit tax. Transfer payments from government to households such as pension, public assistance and scholarship are explained by production level ($Gdp\$$). Transfer payments from households to government such as donation, administration and penalty fees are explained by national income.

IV Test of the Model

The test in this section is the final-test suggested by Prof. Goldberger [12]. The test statistics for the sample period is that of Theil U inequality coefficient [13].

$$U_j = \frac{\sqrt{\frac{1}{n} \sum_i (P_{ij} - A_{ij})^2}}{\sqrt{\frac{1}{n} \sum_i P_{ij}^2} + \sqrt{\frac{1}{n} \sum_i A_{ij}^2}}, \text{ where}$$

P : Computed value A : Actual value.

According to the historical simulation result (1965 I-1978 IV), the model performs quite well. The Theil U coefficients are 2.6% for domestic production (Gdp), and 1.7% for general price (P).

V Concluding Remarks

According to the forecasting experiences by DGBAS [14], the results are quite satisfactory.²⁰⁾ But more attention

should be given to the adjustment of the investment and export functions. Due to the severance of the diplomatic relationship between the Republic of China and the United States, the func-

19) The elasticity of demand for money with respect to total transaction

$$= \frac{\partial \ln Md}{\partial \ln (C_f + C_o + C_g + I_{pr} + I_v + I_{pe} + I_g + J)} + \frac{\partial \ln Md}{\partial \ln X}$$

$$= 0.891 + 0.253 = 1.144$$

The elasticity of demand for money with respect to interest

$$= \frac{\partial \ln Md}{\partial \ln i} = 0.363$$

20) According to the forecast for the fourth quarter, 1978 by DGBAS, gross domestic product is 124.371 billion NT\$ at 1971 prices, wholesale price index is 195.04, while actual values of these two variables are 124.316 billion NT\$ and 191.45. The errors are 0.04%, 1.88% respectively.

tions of these two equations will be disturbed and should be adjusted. Nevertheless, the shock isn't easy to measure in the short-run.

The model here contains several shortcomings. First, several important characteristics of the Taiwan economy are not considered. For example, the important

role of light industry and the limitation of labor supply are not treated in this model. Second, the productions and unemployment rate determination are not included in the model.²¹⁾ Third, the estimation of the model is made by OLS method. All these must be improved.

References

1. "Study on the Quarterly Model of Taiwan Economy," DGBAS, Executive Yuan, June, 1978.
2. Tzong-shian Yu, "A Short-term Macroeconomic Model of Taiwan," Selected English Series, No. 8, The Institute of Economics, Academia Sinica, April, 1971, p. 1.
3. Chau-nan Chen, Jo-ho Hsu and Tsuey-lian Kao, "A Model of Imported Inflation for an Increasingly Open Economy — with Particular Reference to Taiwan," *Academia Economic Papers*, Vol. 4, No. 1, The Institute of Economics, Academia Sinica, March, 1976, pp. 105–123.
4. Liu, T. C., "Government Revenue, Expenditure, and Supply-Demand of National Products," July 12, 1967.
5. Dutta, M., *Econometric Methods*. 1975, p. 187.
6. Pindyck, R. S. and D. L. Rubinfeld, *Econometric Model and Economic Forecasts*. McGraw-Hill Book Company, 1976, pp. 215–216.
7. Evans, M. K. and L. R. Klein, *The Wharton Econometric Forecasting Model*. University of Pennsylvania, 1968, p. 28.
8. Tzong-shian Yu, "The Econometric Model of Taiwan and Its Forecasts," *Annual Bulletin of the China Council for East Asian Studies*, No. 8, 1969.
9. Zellner, A., *Readings in Economic Statistics and Econometrics*. 1968, p. 690.
10. Chau-nan Chen and Jo-ho Hsu, "Money, Trade and Prices in Taiwan: 1953–72," *Academia Economic Papers*, Vol. 1, No. 2, The Institute of Economics, Academia Sinica, September, 1973.
11. Klein, L. R. and A. S. Goldberger, *An Econometric Model of the United States, 1929–1952*. Netherlands, Second Printing, 1964, p. 52.
12. Goldberger, A. S., *Impact Multipliers and Dynamic Properties of the Klein-Goldberger Model*. North-Holland Publishing Company, 1959, p. 49.
13. Theil, H., *Economic Forecasts and Policy*. North-Holland Publishing Company, 1961.
14. "Quarterly National Economic Trends, Taiwan Area, the Republic of China." DGBAS. Executive Yuan, 1978.

21) The reason why unemployment rate is not determined is that the data are not reliable.