A Macroeconometric Model of Inflation and Growth in South Korea

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1. INTRODUCTION

In this chapter, a relatively small annual macroeconometric model of the South Korean economy is formulated, estimated, and applied to some hypothetical policy choices over the past decade and a half. The principal endogenous variables of the model are output, the price level, the wage rate, imports, fixed investment, inventory investment, savings, consumption, and employment. The model projects variables in both current and constant prices. Behavioral relationships are postulated for the real variables and the price level, and current-price identities are utilized to derive values of some other variables.

In all, the model contains 17 stochastic equations and 24 identities. Its structure is recursive for each time period, and hence the estimation is carried out via ordinary least squares or the Cochrane-Orcutt iterative procedure. The sample period for estimation is taken to be 1963—77, with earlier years used for lagged values as required. Most of the behavioral equations are expressed in terms of variables in percentage change (growth rate) form. This tends to reduce, although not eliminate problems of autocorrelation and multicollinearity which often characterize time series of macrovariables in a

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rapidly growing economy.

The main policy instruments in the model are the exchange rate, the nominal money supply, and the farmers' selling price for agricultural products. In alternative versions of the model, the export level may be made purely exogenous, as a function of world exports, or a policy-exogenous variable which may be varied in different solutions. The main purely exogenous variables are the level of gross agricultural output, net factor income from abroad, population, and some export and import price variables. Table 1 lists all of the variables in the model.

The basic concepts underlying the model specification can be outlined in a few words, as follows:

a) Output is determined by expectations (Taylor, 1978) and by the availability of domestic credit. In the short run, the stock of fixed capital is not a binding constraint, but of course investment accelerates when facilities are intensively used. The relevant expectations include prices and effective demand levels, and for the latter the government's annual export target is the key variable.

b) Output growth then determines investment, and investment needs determine savings. Many Korean economists have consistently stressed that savings is not a constraint to Korean growth, but that it will respond to investment needs (Kim and Park, 1977). Therefore, to express this concept in the system, the model has no savings function (i.e. no consumption function.) Consumption is determined by the national accounts identity.

c) Prices are determined mainly by the relative levels of nominal money supply and the real demand for money, plus movements in the key primary price-the price of imports (Vogel, 1974; Laidler, 1976; Ball and Burns, 1976).

d) Non-agricultural employment is determined by non-agricultural output growth and real wage growth; there also is a wage equation, an equation for the labor share in national income, and an equation for urban

In essence, then, it is a demand-led model in a double (or triple) sense:

— demand expectations help determine output;

— output determines the increment in capital stock;

— the capital increment, plus foreign savings behavior, determine domestic savings.

It differs with respect to some other models by having a nonneclassical output supply function and by not having a consumption function The widespread view in Korea that savings is responsive to investment opportunities and trade policy tends to be supported by simple tests which show the Keynesian consumption function, in first difference form, to be relatively unstable.

Arnold Harberger pointed out to the authors that this residual specification of consumption also appears to accord with Korean reality in another respect: whether by policy design or not, inflation has been a mechanism whereby consumption was squeezed to allow for more real capital formation. The national accounts deflator for private consumption grew more rapidly than both the deflators for GDP and fixed capital formation during 1963—77.

In the past six years, South Korea has suffered a much higher rate of inflation than in the previous ten years. Inflation has become a major social issue, with urban groups feeling that they are suffering disproportionately from its consequences. The government has been concerned not only with social inequities generated by inflation but also with its effects on Korea's export competitiveness. The debate over appropriate policies for curtailing inflation has intensified in the last year or two with a variety of prescriptions offered. The government itself has shifted its tactics from time to time. Until recently, price controls had been attempted, with little success. In 1977 and early 1978 import liberalization moves were advocated and to some extent implemented, but subseqently they lost some of their appeal as the trade gap widened sharply, in a reversal of trends. Attempting to limit the rate of increase of grain prices has been an element of strategy from 1976 onward. Since the beginning of 1979 strong controls over the rate of expanapproaches (Economic Planning Board, 1979). Very recently, it has been considered necessary to dimish the growth rate of exports and GNP, partly because of the lack of success of other measures, and also because of the

Table 1. Listing of Variables in the Model

(all real variables are in 1970 constant prices)

1. Purely exogenous variables[a]	
A	real gross agricultural output
PIM	national accounts deflator for imports
IMUV	import unit value index (index of dollar prices of imports)
NFID	net factor income from abroad, in dollars
STD	statistical discrepancy in the national accounts
WDUM	wage rate dummy, = 1.0 in each of 1974—77 and 0 in prior years
PAB	index of famers' buying prices for inputs
POP	total population
2. Policy exogenous variables[a]	
PAS	index of farmers' selling prices
MM1	monthly average nominal money supply (Ml)
E	goods and services exports, in constant domestic currency (won)[b]
ER	exchange rate
IER	import effective exchange rate[c]
EER	export effective exchange rate[c]
EGD	goods exports in current dollars
ESD	services exports in current dollars

[a] Some of these variables are made endogenous in the "oil shock" policy experiments.

[b] Clearly there is interdependence among the exogenous valuations of E, EGD, ESD, and ER (or EER). In some versions of the model E is made endogenous via use of a logistic share equation, as explained later in the text; when that is done, some of the other trade-related variables are made endogenous as well.

[c] The "export effective exchange rate" computed as the ratio of the national accounts won valuation of goods and services exports (in current prices) to the balance of payments dollar valuation of goods and services exports. it differs from the official exchange rate because: i) the national accountls (NA) figure includes exports of deep-sea fishing products, whereas the BOP figure does not; ii) the BOP figure includes factor income from abroad, whereas the NA figure does not; iii) the BOP figure includes exports of freight and insurance services to foreign companies, whereas the NA figure does not; and iv) the EER concept implicitly is averaged over daily values for each year. Similarly, the IER differs from the ER because of the treatment of imports of freight and insur-

Table 1. (Continued)

3. Endogenous variables

YA	agricultural value added
PYA	agricultural value added deflator
YN	non-agricultural value added
PYN	non-agricultural value added deflator
IV	inventory accmulation
Y	GDP
PY	GDP deflator
CG	government consumption
PCG	government consumption deflator
WC	manufacturing wage index (nominal)
IF	gross fixed capital formation
K	capital stock
PIF	fixed investment deflator
RDEPR	depreciation allowances
PIV	price deflator for inventories
IM	total imports in domestic currency
IMPO	commodity imports in current dollars
IMCD	total imports in current dollars
IMS	service imports in current dollars
ECD	total exports in current dollars
BPCE	balance of payments in current dollars
BPWC	balance of payments in current won
SD	domestic savings
S	total savings
NMA	manufacturing employment (in thousands of persons)
YLC	total labor income in current prices
WS	the wage share in national income
UPOP	urban population
RPOP	rural population

apparent conviction of the public that the sustained export drive is finally having deterious side effects. And also very recently, after five years of strong real wage increases, wage control measures have been discussed.

Given these concerns, we have attempted to address the model to some issues of inflation and growth, while making no pretense of a comprehensive examination of all strategies. Specifically, in a historical context we have sibly, inflation; to the role of the money supply for growth and inflation also; and to the effects of the 1974—75 "oil shock" on domestic economic peformance. We also discuss other evidence on the role of wage increases, agricultural price increases, and import liberalization in determining overall inflation rates.

2. THE EQUATIONS OF THE MODEL

As noted above, the system as a whole is triangular in structure, so that, for any time period, the solution of an equation depends upon information only from the equations above it in the structure. The equations are given here in their triangular sequence, with symbols as defined in Table 1. Some notational conventions are as follows:

— the prefix D refers to the percentage-change form of the variable
— the prefix T refers to the first-difference form of the variable
— the suffix C means current-price (nominal) valuation of the variable
— subscriptt denote annual time periods

The model begins with equations for value added and prices in agriculture and non-agriculture, and then it continues through other price and macroeconomic expenditure variables and concludes with equations for wages, unemployment, the wage share of national income, and urban population. As there is no statistical private consumption function, private consumption is determined by the national accounts identity. It is a residual variable, below the other expenditure variables in the recursive order of the system. Hence the system's performance in tracking private consumption is a good indication of the amount of accumulated error in the entire set of expenditure variable equations.

Many of the other identities in the model are trivial relationships required to convert from current to constant prices, and vice-versa.[1] The agricultural equations which initiate the system are little more than statistical

1) The identities required to convert from percentage change form to level form

regularities, based on near-identities. Important behavioral relationships commence with the third equation, for non-agricultural income.

In the reporting of the equations, the numbers in parentheses are T-ratios, *OLSQ* means ordinary least squares, CORC means Cochrane-Orcutt iterative procedure, SM connotes the standard error of estimate of the equation divided by the mean value of the dependent variable, and the years refer to the regression sample period, if it is not 1963—77. In several instances, some alternatives have the letters a, b, etc. in the equation number.

2.1 Agricultural Income in Current Prices

(1) $DYAC_t = -0.02562 + 1.1476\ DA_t + 1.17413\ DPAS_t$

$\qquad\qquad(-0.9096)\quad(5.8862)\qquad(8.7938)$

$OLSQ,\ R^2 = .9258,\ D.W. = 2.5845,\ SM = 0.1908$

Comments

a) Equation (1) says that the percentage change in current-price agricultural value added is closely related to the sum of the percentage change in agricultural output and the percentage change in the index of farmers' selling prices. This equation is a near-dentity, as reflected in the fact the coefficients of the explanatory variables are close to unity in value and the intercept term does not differ significantly from zero. Two factors prevent the equation from being specified as an identity: a) omission of variations in agricultural input prices and input-output ratios, and b) statistical differences in the sample surveys for determining gross output, value added, and prices.

b) The change in gross agricultural output is exogenous for this model, but it would be possible to consider making it endogenous via inclusion of a production function. The agricultural price variable is regarded as a policy instrument, for it is strongly influenced by two annual policy decisions: the support price levels for grains, and the amount of imports of agricultural products. However, it should be recognized that the government's control over the agricultural price index is limited, and it becomes weaker over time

(2) $PYA_t = -0.00359 + 0.98953\ PAS_t$

$(-0.2791)\ (131.458)$

$OLSQ,\ R^2 = .9992,\ D.W. = 1.9137,\ SM = 0.0210$

2.3 Real Agricultural Value Added

(3) $YA_t = YAC_t / PYA_t$

2.4 Real Non-agriculttural Value Added

(4) $DYN = -0.04208(1-\rho) + 0.29237(DMMI_{t-1} - \rho DMMI_{t-2})$

$(-1.9293)\qquad(7.6488)$

$+0.23492(DE_t - \rho DE_{t-1})$

(10.2065)

$+0.06058(DPYN_{t-1} - \rho DPYN_{t-2}) + \rho DYN_{t-1};$

(1.0780)

$\rho = -0.56060$

(-2.6219)

$CORC,\ R^2 = .8909,\ D.W. = 2.3933,\ SM = 0.1246$

(4a) $DYN_t = -0,02624 + 0.16541(DMMI_t + DMMI_{t-1})$

$(-1.1139)\ (5.8330)$

$+0.13959\ DE_t + 0.07338 DPYN_{t-1}$

$(4.8209)\qquad(1.1909)$

$OLSQ,\ R^2 = 0.8596,\ D.W. = 2.7196,\ SM = 0.1414$

Comments

a) Equation (4) is most readily interpreted as it is written in (4a), without the factors ρ and $(1-\rho)$ and without the lagged terms involving ρ. They entered the equation in the course of the Cochrane-Orcutt iterations in order to remove some of the autocorrelation among the residuals. The variable $DPYN_{t-1}$ is taken to represent expectations for the rate of non-agricultural price change in year t. Following Taylor (1978), the relevant set of price expectations variables should include the interest rate and the wage rate, both with negative coefficients in the equation for DYN_t. Official interest rates have been controlled at non-market levels for most of the sample period, and no reliable survey of unofficial money market rates is available; hence that variable had to be dropped. Wage rates were included in some ant. The lagged price variable alone, then, becomes a proxy for expected profits, and its coefficient has the correct sign.

b) Export targets for each year have been announced in advance by the government, and through various incentive measures they were met almost exactly in all but one or two years. Hence the export variable (in rate of change form) may be regarded either as an expectational variable used in firms' production planning, or as an autonomous expenditure variable.

c) The money supply is assumed to affect production through the availability of domestic credit to finance working capital expenditures.[2] The lag reflects the lead time required to plan raw materials purchases. The M2 concept of money supply worked as well as Ml in equation (4) and also in (5) below.

d) It has been suggested that, owing to the omission of physical capital

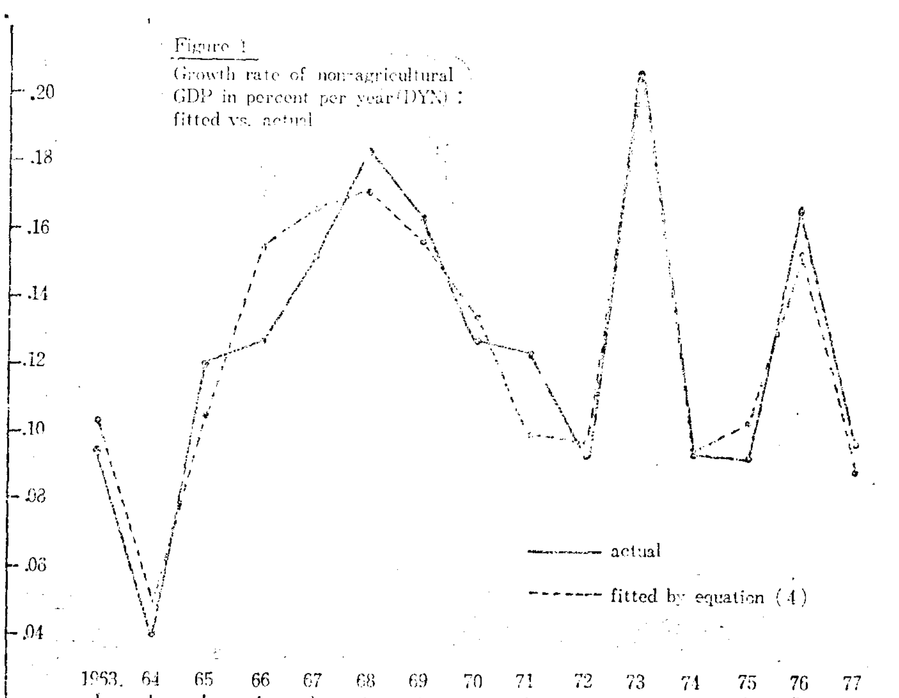

Figure 1
Growth rate of non-agricultural GDP in percent per year (DYN): fitted vs. actual

2) For discussions of the role of money in the aggregate production function, see

stock, equation (4) may fit the data better in years of underutilization of capacity. Moowever, while rigorous tests have not been performed on this point, casual inspection of the patterns of residuals in equation (4) shows that the equation fits as well in high-growth years as in low-growth years.

2.5 Non-agricultural Value Added Deflator

(5) $DPYN_t = 0.05700 - 0.64306\ DYN_t$
$(1.1919)\ (-3.4749)$
$+0.33281(DPYN_{t-1} + DPYN_{t-2}) + 0.21729\ DPIM$
$(4.1515) \qquad (5.4443)$
$+0.14528\ DMM1_{t-1}$
(2.3466)

OLSQ, $R^2 = .8918$, $D.W. = 2.2534$, $SM = 0.1502$

(5a) $DPYN_t = 0.07022 - 0.94616\ DYN_t$
$(1.4969)\ (-3.6323)$
$+0.32208(DPYN_{t-1} + DPYN_{t-2}) + 0.20389\ DPIM_t$
$(3.9520) \qquad (5.0559)$
$+0.12492(DMM1_t + DMM1_{t-1})$
(2.1402)

OLSQ, $R^2 = .8849$, $D.W. = 1.6718$, $SM = 0.1550$

Comments

a) The form of the above price equations is derived from a simple portfolio-balance demand-for-real-cash-balances hypothesis, plus a representation of the effects of international inflation (Harberger, 1963; Laidler, 1976). The portfolio balance approach suggests that real demand for money may be determined partly by real output growth (DYN_t), which detemines the increased transactions demand for money, and also by the expected return on money relative to other assets. For the latter, we have used a lagged inflation variable which is intended to represent inflationary expectations. Price increases then are a function of the difference between the rates of change of the nominal money supply and the real demand for money. In implementing this hypothesis empirically, it was found that the coefficient of the ficant.[3] A large number of alternative equations were estimated, and that variable's coefficient became significant only when it was combined with the lagged money supply change (as in equation (5a)). The elasticity of inflation with respect to the nominal money supply is about 13%—14% in alternative equations.

b) The real output variable DYN_t may also influence prices through greater supply on the goods markets: Consumption growth tends to be rather smooth, owing to permanent income effects, so short-run fluctuations in output represent fluctuations in net excess supply. In alternative equations, the elasticity of prices with respect to this variable remained consistently around −0.6. It is high in absolute value in equation (5a) because the fifth right-hand term includes two variables and hence is larger numerically.

c) Expectations turn out to be quite important in determining price movements, with a rather stable elasticity of about 33%. Import prices also have been important, owing to the relatively inelastic demand for imported grains and petroleum products. The elasticity of domestic inflation with respect to imported prices turns out to be 21%—22%.

d) In estimating alternative equations, it was found that output fluctuations and cost factors alone can explain 73% of the variation in the rate of inflation.

e) When substituted for the money variable, the governments's net domestic borrowing is equally significant, for two reasons: i) it is the clearest measure of the government deficit, and ii) it represents an important component of high-powered money-thus it operates on the price level through both fiscal and monetary channels.

f) To derive a more complete money-inflation relationship, the effects of money supply on output and prices must be taken into account. Substituting equation (4) into equation (5) suggests that the total effect of money supply

3) Vogel (1974) finds a similar result for a few countries in his Latin American sample. See also the model for Japan by Aghevli and Rodriguez (1979); their

expansion on the price level has been nil over the sample period. This implies that, within a limited range of variation around the actual historical money supply growth rates, changes in those growth rates would not have altered the rate of inflation. Apparently most of the money supply growth over 1963—77 serviced genuine transactions demands; that is not surprising, given the low rate of monetization of the 1963 Korean economy, by international standards, and the very rapid rate of real industrial output growth over 1963—77. This lack of monetary influence on prices is confirmed in the system simulation results reported subsequently, but we hasten to add that it is not necessarily correct to assume that it will continue in the post-sample period. Another caveat is that the expectational *mechanism* is assumed stable, i.e., that the double lag price increase term remains valid as the determinant of inflationary expectations. Either an abrupt or a prolonged shift in monetary policy could affect the psychology of inflation and hence change the structure of equation (5) as regards expetation.[4] These issues are discussed again in the concluding section.

2.6 Non-agricultural Value Added in Current Prices

(6) $YNC_t = YN_t \cdot PYN_t$

2.7 GDP in Constant and Current Prices

(7) $Y_t = YA_t + YN_t$

(8) $YC_t = YAC_t + YNC_t$

(9) $PY_t = YC_t / Y_t$

2.8 Government Consumption Expenditures and Their Price Index

(10) $CG_t = 107.368 + 0.09103\ YN_t$

$(20.0759)\ (39.9658)$

$OLSQ,\ R^2 = .9919,\ D.W. = 1.6568,\ SM = 0.0325$

(11) $PCG_t = 0.10098 + 1.20803\ WC_t$

4) Equation (5) was re-estimated via two-stage least squares, using fitted values of DYN from equation (4). The results were very similar to those reported above. With the 2SLS estimate, when (4) was substituted into (5), the total

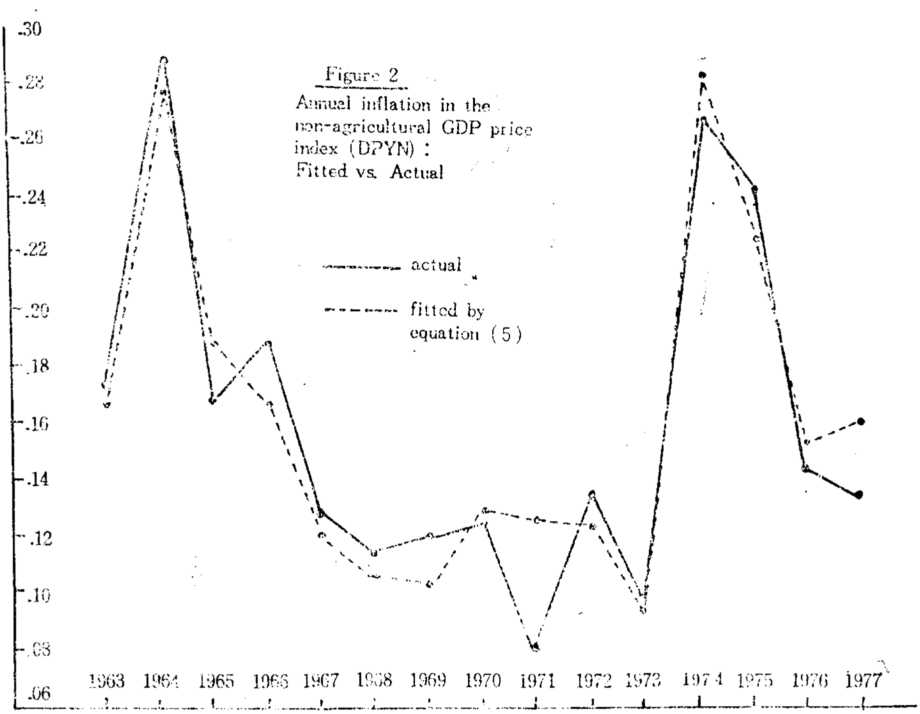

Figure 2
Annual inflation in the non-agricultural GDP price index (DPYN) : Fitted vs. Actual

(3.5795) (58.4205)

OLSQ, $R^2 = .9962$, *D. W.* $= 1.7094$, $SM = 0.0522$

(12) $CGC_t = CG_t \cdot PCG_t$

Comments

The wage rate is used as the explanatory variable for the government consumption price index because wage costs are much greater than materials costs in the government budget. The wage variable WC_t is the manfacturing wage rate, but clearly service sector wages closely follow the pattern of the manufacturing sector. Attempting to relate the government consumption deflator to the GDP deflator or other national accounts deflators yields a much poorer fit.

2.9 Gross Fixed Capital Formation

(13) $IF_t = -229.546 + 0.83476\ YN_{t-1} - 0.23038\ K_{t-1}$

(−1.5251) (2.0400) (−1.0628)

$$(13a)\quad IF_t=142.863(1-\rho)+0.24332(YN_{t-1}-\rho YN_{t-2})$$
$$\qquad (1.1353) \qquad (3.9393)$$
$$+0.89950(TMM1_t-\rho TMM1_{t-1})+\rho IF_{t-1};$$
$$(3.3388)$$
$$\rho=0.76003$$
$$(4.5294)$$

CORC, $R^2=.9871$, $D.W.=1.6361$, $SM=0.076$

$$(13b)\quad IF_t=225.328(1-\rho)+0.36070(YN_{t-1}-\rho YN_{t-2})$$
$$\qquad (1.3838) \qquad (2.9436)$$
$$-0.088624(K_{t-1}-\rho K_{t-2})+0.99637(TMM1_{t-1}-\rho TMM1_{t-2})$$
$$(-1.3065) \qquad\qquad (3.7586)$$
$$+\rho IF_{t-1}; \qquad \rho=0.82742$$
$$\qquad\qquad (5.7063)$$

CORC, $R^2=.9888$, $D.W.=1.8162$, $SM=0.0738$

$$(13c)\quad IF_2=-47.9309(1-\rho)+0.40573(YN_{t-1}-\rho YN_{t-2})$$
$$\qquad (-0.5856) \qquad (12.3721)$$
$$\underset{(-2.2064)}{-17.6665}\left[\left(\frac{100\cdot IV}{Y}\right)_{t-1}-\rho\left(\frac{100\cdot IV}{Y}\right)_{t-2}\right]+\rho\ IF_{t-1}$$
$$\rho=0.61593$$
$$(3.0280)$$

CORC, $R^2=.9832$; $D.W.=1.7413$, $SM=0.0863$

Comments

Equation (13) is of the standard accelerator form. An improved explanation of historical behavior can be obtained by including the lagged increment in the money supply, or inventories, in the right-hand side arguments. Both variables are statistically significant, and inclusion of either one of them reduces the forecasting error (standard error of estimate) by about a third.

2.10 Price Deflator for Fixed Investment

$$(14)\quad DPIF_t=0.04545(1-\rho)+0.44028(DPIM_t-\rho DPIM_{t-1}$$
$$\qquad (-2.9448) \qquad (11.0436)$$
$$+0.13283(DIF_t-\rho DIF_{t-1})+\rho DPIF_{t-1};$$
$$(2.4452)$$
$$\rho=-0.46470$$
$$(-2.0326)$$

Comments

Given the large component of imported capital goods in total investment, the cost of investment goods was hypothesized to depend in part on the price index for imports. Also, supply and demand conditions on the capital goods market, as represented by the growth rate of fixed investment, contribute to explaining movements in the investment goods price index.

2.11 Depreciation and Capital Stock Accumulation

(15) $RDEPR_t = -163.683(1-\rho) + 0.12856(Y - \rho Y_{t-1} + \rho RDEPR_{t-1};$
(-4.1557) (13.3462)
$\rho = 0.77317$
(4.7217)

CORC, $R^2 = .9905$, $D.W. = 1.5715$, $SM = 0.0690$, 1962—77

Comments

Real GDP and the level of capital stock worked about equally well as the explanatory variable for the level of (real) capital consumption allowances.

(16) $K_t = K_{t-1} - RDEPR_t + IF_t$

2.12 Inventory Investment and Its Price Index

(17) $IV_t = -31.6107 - 0.27651\ TE_t + 0.25855\ TY_t$
$(-1.8877)(-3.9449)$ (2.8602)
$+ 153.061\ DPY_t + 22.02127 \left(\frac{TIMPO}{IMUV}\right)_t$
(2.2171) (2.4185)

OLSQ, $R^2 = .8393$, $D.W. = 1.3489$, $SM = 0.3965$

Comments

a) The first difference in GDP (TY_t) stands for increases in the supply of goods, and hence for inventory accumulation. The most dynamic element on the demand side, the first difference in exports (TE_t). represents inventory decumulation. Even though these two variables are positively correlated, as revealed by equation (4), they turn out to have the expected opposite signs in explaining inventory behavior

b) The other two variables with positive effects on inventory accumulation of inflation in the GDP deflator (DPY_t), and the real (dollar) increment in commodity imports.

$$(18)\quad PIV_t = 0.25337(1-\rho) + 0.01527(PAS_t - \rho PAS_{t-1})$$
$$\quad (2.7610) \qquad (28.3686)$$
$$-0.01019(IV_t - \rho IV_{t-1}) + \rho PIV_{t-1};\ \rho = -0.77392$$
$$(-5.8938) \qquad\qquad (-4.7331)$$
$$OLSQ,\ R^2 = .9635,\ D.W. = 2.1880,\ SM = 0.1618$$

Comments

Agricultural goods figure importantly in inventory accumulation, and hence the index of farmers' selling prices (PAS_t) is very important in explaining the price of inventories. Also, the (excess) supply of inventories has a negative influence on the price.

2.13 Total Imports in Domestic Currency

$$(19)\quad DIM_t = 0.03671 + 0.73290\ DIF_t + 0.76226\ DYN_t$$
$$(0.3863)\ (4.5552) \qquad (1.1345)$$
$$-0.23055\ DIMUV_t - 0.49057\ DIER_t$$
$$(-1.8390) \qquad (2.7505)$$
$$OLSQ,\ R^2 = .9125,\ D.W. = 2.3618,\ SM = 0.3508$$

Comments

The close relation between investment demand and imported capital goods is revealed by the investment growth rate variable (DIF_t) in this equation, and the demand for other classes of goods is represented by the growth of real non-agricultural GDP(DYN_t). Imports contribute partly to the building up of stocks in some years, and so it is not surprising that lagged stock accumulation negatively affects current imports. The change in the won price of imported goods is decomposed in this equation into its two components: inflation in the dollar price of imported goods ($DIMUV$) and the change in the effective import exchange rate ($DIER$).

$$(20)\quad IMC_t = IM_t \cdot PIM_t$$

2.14 Imports in Dollars

$$(21)\quad DIMPO_t = 0.11375 + 0.83413\ DIF_t + 0.82465\ DIMUV_t$$

$$-0.59227\ DIER_t$$
$$(-3.8101)$$

$OLSQ$, $R^2=.9308$, $D.W.=1.6999$, $SM=0.2783$

$$\text{(21a)}\quad DIMPO_t = \underset{(0.0789)}{0.00784} + \underset{(3.1072)}{0.65958}\ DIF_t - \underset{(-1.4685)}{0.03320} \left[\frac{100 \cdot IV}{Y}\right]_{t-1}$$
$$+ \underset{(6.3131)}{0.82817}\ DIMUV_t + \underset{(2.0656)}{1.27008}\ DYN_t - \underset{(-1.8381)}{0.26934}\ DER_t$$

$OLSQ$, $R^2=.9398$, $D.W.=1.4873$, $SM=0.2870$

Comments

a) $IMPO_t$ denotes *commodity* exports in current dollars. The explanatory variables DER_t and $DIER_t$ represent the percentage change in the official exchange rate and the effective import exchange rate,[5] respectively; they have similar coefficients and degrees of significance in alternative equations.

b) The variable $DIMUV_t$ is the percentage change in the "import unit value index" which is an index of inflation in the dollar value of imports. The elasticity of real dollar imports with respect to this index of its price is $-(1-\beta)$, where β is the coefficient of $DIMUV_t$ in the estimated equation. The value of $(1-\beta)$ is stable at about 0.17. Owing to the typically discrete character of the exchange rate movements, to some degree they are anticipated and hence importers' reactions to them are spread over more than one year. Hence we would expect import demand in the short run to be more inelastic with respect to dollar cost increases than to exchange rate movementst. In the equation with the most significant coefficient for DER_t (21a), this tends to be confirmed: the elasticity with respect to the dollar price index is -0.17 and with respect to the exchange rate is -0.27. The same phenomenon is observed in equation (19).

c) In the equations below, total dollar imports are derived by converting total won imports, and then service imports are obtained by the difference with respect to dollar commodity imports. An alternative procedure is to eliminate equation (19) and to replace it by an equation for service imports in dollars. That procedure was tested and gave a poorer forecasting so far mance than the one used.

d) In another test, equation (21) was replaced by five equations for SITC groups of commodity imports(food, minerals and fuels, etc.). While some of the commodity group equations turned out very well, not all did, and the best sample period forecasts of aggregate commodity imports were obtained by using equation (21).

e) Figure 3 shows the sample performance of equation (21).

2.15 Service Imports

(22) $IMCD_t = IMC_t / IER_t$

(23) $IMS_t = IMCD_t - IMPO_t$

2.16 The Balance of Payments

(24) $ECD_t = EGD_t + ESD_t$

(25) $BPD_t = ECD_t - IMCD_t + NFID_t$

(26) $EC_t = ECD_t \cdot EER_t$

(27) $BPWC_t = EC_t - IMC_t + NFID_t \cdot ER_t$

Comments

As a practical matter, exports are forecast by Korean policy-making bodies first in terms of current dollar commodity (EGD_t) and service (ESD_t) exports. These are then converted into current won exports by use of the export effective exchange rate (EER_t). Conversion of these variables into constant dollar and constant won exports requires use of the export unit value index ($EXUV_t$) and the national accounts export deflator (PE_t).

2.17 Private Consumption

(28) $CP_t = Y_t - E_t - IF_t - IV_t - CG_t + IM_t - STD_t$

(29) $CPC_t = YC_t - EC_t - FC_t - IVC_t + CGC_t + IMC_t - STDC_t$

(30) $PCP_t = CPC_t / CP_t$

Comments

The variables STD_t, $STDC_t$ are the (exogenous) national accounts statistical discrepancy, in constant and current prices. They are used in the sam-

2.18 Savings

(31) $SD_t = Y_t - CP_t - CG_t$

(32) $SDC_t = YC_t - CPC_t - CGC_t$

(33) $S_t = SD_t + IM_t - E_t$

(34) $SC_t = SDC_t + IMC_t - EC_t$

2.18 Savings

(31) $SD_t = Y_t - CP_t - CG_t$

(32) $SDC_t = YC_t - CPC_t - CGC_t$

(33) $S_t = SD_t + IM_t - E_t$

(34) $SC_t = SDC_t + IMC_t - EC_t$

2.19 The Manufacturing Wage Index

(35) $DWC_t = -0.01383(1-\rho) + 0.77422\ DYN_{t-1} - \rho DYN_{t-2})$
$\qquad(-0.2600) \qquad\qquad (2.8635)$
$\quad + 0.71774(DPYN_{t-1} - \rho DPYN_{t-2})$
$\qquad(4.7469)$
$\quad + 0.08347(WDUM_{t-1} - \rho WDUM^{\prime}_{-2}) + \rho DWC_{t-1}; \quad \rho = -0.54124$
$\qquad(5.1134) \qquad\qquad\qquad\qquad\qquad\qquad (-2.4084)$

CORC, $R^2 = .8784$, *D. W.* $= 2.3479$, $SM = 0.1474$

Comments

a) Short-run acceleration in output growth, represented by DYN_{t-1}, causes additional pressure on the labor market, and labor supply to urban areas

b) Lagged price changes are reflected in higher wage demands in the current year's wage negotiations.

c) The wage dummy variable registers the structural change which occurred about 1974, when massive migration of Korean labor to the Middle East began. During 1970—73, wages grew by about 12% per year, but during 1974—78 they grew by about 32% per year. In real terms, wages kept pace with productivity increases until 1974—78, when the real wages grew more rapidly than productivity.

2.20 Manufacturing Employment

$$(36)\quad TNMA_t = \underset{(-0.1850)}{-6.6205} + \underset{(5.4045)}{0.7514}\ TYN_t \underset{(-2.9712)}{-517.493}(DWC_{t-1} - DPYN_{t-1})$$

$OLSQ$, $R^2 = .7088$, $D.\ W. = 1.8001$, $SM = 0.4832$

Comments

The first explanatory variable is the increment in real manufacturing output (value added), and the second is the wage rate relative to the general non-agricultural price index, lagged one year. As expected, output growth has a positive effect on employment and relative wage increases have negative effects.

2.21 Wage Income and the Wage Share

$$(37)\quad TYLC = \underset{(-2.0952)}{-50.1363} + \underset{(24.4055)}{1744.86}\ DWC_t + \underset{(1.9652)}{0.27683}\ TNMA_t$$

$OLSQ$, $R^2 = .9860$, $D.\ W. = 2.9558$, $SM = 0.1576$

$$(38)\quad WS_t = WS_{t-1}\ (1 + DYLC_t)/(1 + DYC_t)$$

Comments

a) If the dependent variable were manufacturing wage income, then equation (37) would be an identity; as it is, we are assuming a regular statistical relationship between manufacturing wage rates and employment, on the one hand, and labor income for all sectors on the other.

onal income, assuming that national income and GDP grow at approximately the same rate in the short run.

2.22 Urban and Rural Population

(39) $$TUPOP_t = \underset{(5.2721)}{2279.48} - \underset{(-6.3609)}{1510.21}\left(\frac{YA}{YN}\right)_{t-1} - \underset{(-2.0856)}{756.056}\left(\frac{PAS}{PAB}\right)_{t-1}$$

OLSQ, $R^2 = .7713$, $D.W. = 2.0398$, $SM = 0.1868$

(40) $UPOP_t = UPOP_{t-1} + TUPOP_t$

(41) $RPOP_t = POP_t - UPOP_t$

Comments

Equation (39) effectively is a simple annual migration function which says that the increment in urban population is a negative function of i) lagged relative real output in agriculture, and ii) the lagged agricultural terms of trade.

* * * *

This completes a description of the basic version of the model. Clearly several kinds of extensions are possible; the principal ones might involve a) endogenizing some of the presently exogenous variables and b) along with making the money supply endogenous, formulating equations for a financial subsector to incorporate more specific detail on monetary and fiscal policies.