

Monetary Accommodations under External Supply Shocks in Korea: Some Empirical Results

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I. Introduction

In the formulation of stabilization programs, attention has been focused primarily on the effects of the financial variables on aggregate demand and their implications for the balance of payments. In contrast, this paper is concerned with an analysis of the implications of credit policies for production and how they relate to the development of the current account and the price level. It is well known that availability of credit is one of the factors that determine final demand in an economy. To the extent that domestic production of goods and services responds to changes in aggregate demand, one could characterize these output effects as being indirectly induced through credit policies. A direct connection between the level of current production and credit availability exists because of the need for firms to finance the cost of inputs for the duration of the production process, including the time required to sell the product. Production plans of the firm, the number of workers hired, and the size of the inventory of finished and intermediate goods and raw materials held by the firm are affected by the amount and terms of credit.

Tight credit policies affect the cost of credit, either directly, or as is more likely in most developing countries with administered

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lending rates and rationed bank credit, by driving firms into the unorganized money market. This transmission channel feeds directly from monetary policy into the supply side of the economy.¹ We incorporated into our model the hypothesis that restrictive credit policies result in: (i) disintermediation in the organized market; and (ii) resort to the unorganized money market for the financing of primary input costs.

In addition to the incorporation of the effects of credit policies on the supply side, the present paper also suggests a macro-framework for the analysis of import price shocks and the stagflationary effect of devaluation. In particular, the paper addresses the following issues: (i) Is it possible to bring inflation down in the short run and/or in the long run via a restrictive credit policy under import price shocks? (ii) Does currency devaluation result in stagflation in the economy through the channel of credit restriction and higher interest rates?

Our discussion here will be based on a modified version of the short-term forecasting model of the Korean economy developed by the Bank of Korea.² Section 2 gives a brief account of the basic structure of the model and the underlying price and output adjustment theory that is a core topic in this paper. Section 3 analyzes empirical results based on dynamic simulation with the stagflationary effects of devaluations and relative import price changes providing the main perturbations. Section 4 suggests improvements which could be made to the present formulation of the model.

II. The Model

1. Basic Structure of the Model

A very simple and abstract theoretical model of an open economy characterized by the presence of financial constraints is developed in this section. The model consists of four blocks: (i) the GNP block; (ii) the financial block; (iii) the price block; and (iv) the balance of payments (BOP) block. In the GNP block, output is

1 See Bruno (1979).

2 Hyun Chul Shin and Dae Sik Kim (1981).

composed of GNP in the agriculture, forestry and fishing (AFF) sector and non-AFF GNP. The former is assumed to be exogenous owing to the difficulty of endogenization since agricultural production is heavily affected by weather conditions and damages incurred through blight and harmful insects. A major component of the theoretical framework to be used here for formalization of the non-AFF GNP equation follows from a commodity market theory of price and output adjustment by firms under monopolistic competition. A detailed derivation of aggregate price and output adjustment relations from such microfoundations is given elsewhere.³ Here, the model will be modified to take into account an element that seems to be of key importance, namely, the role of working capital and credit rationing.⁴ Specifically, the output decision is based on a model of the firm that starts from the assumption that primary costs (wages and costs of intermediate inputs) are financed via credit. The interest rate that is relevant for the cost of credit is considered endogenous. The role of the interest rate and credit will be discussed in the explanation of the financial block.

Real gross expenditure consists of private consumption expenditure, private non-residential investment, private residential investment, inventory investment, government expenditure (government consumption and construction), net exports of goods and non-factor services, and net factor income from the rest of the world. Among these, private consumption expenditure is explained by real income and real total money balances, while non-residential investment is determined by non-agricultural output, domestic credit and the cost of credit.

While real government expenditure is determined exogenously, net exports of goods and non-factor services are determined in the BOP block. The net exports of factor services are treated as exogenous variables. What if planned supply falls short of or surpasses actual demand? Where inventory holdings exist, output can be assumed to be equal to planned output with inventories adjusting to any temporary discrepancies. Inventory investment is an adjusting item for commodity market clearing in the model.

³ Bruno (1979).

⁴ This has been analyzed in the context of the finance of physical capital by McKinnon (1973) and Shaw (1973). Our approach here centers on the finance of variable inputs and has greatly benefited from the very interesting recent studies by Bruno (1979) and Keller (1980).

In the financial block, the total money stock (M_2) is assumed to be exogenous. The linkage between the real and monetary sectors is through domestic credit to the private sector and the curb market interest rates in addition to the total money stock.

The most descriptive adjective for credit markets in developing countries is "segmented." One source of finance is always the official banking system, perhaps with controlled interest rates and hidden costs such as requirements that borrowing firms keep minimum balances on deposit. Another source would be unorganized markets. For residual finance, firms go to the riskier informal credit market where the interest rate is sensitive to the volume of borrowing demand. This implies that the effective borrowing cost is a function of the pegged official interest rate and the credit supply, as well as factors affecting the supply of credit through the informal market.

In the price block, we adopted a method in which the wholesale price (WPI) is determined first and in turn influences the GNP deflator. With reference to the determination of the WPI, the model allows for both demand pressure and cost-push effects. The theoretical basis for this is the simultaneous determination of price and output described above in the GNP block.

Exports and imports of goods and services are determined in the balance of payments block, where real GNP, WPI, the net export unit price index, the exchange rate and world trade volume act as important explanatory variables.

2. Data and Estimation Method

The model has been estimated over 52 quarters from 1967Q1 to 1979Q4. All GNP-related variables are based on 1975 prices. We limited the estimation period to 1979 to leave 1980-1981 available for an ex-post forecast check. To variables that are subject to seasonal variation, an X-11 adjustment was applied. Ordinary least squares estimation was used.

For certain periods for which there were large discrepancies between estimates and actual values that could be attributed to changes in the structure of the economy, we applied dummy variables.

III. Simulation Results

In this section, we report a variety of simulation exercises performed to study some of the properties of the model.

To find a solution to the model, we relied on the Gauss-Seidel method which is commonly used in simulations of non-linear econometric models. The results of dynamic simulation with this method from 1975Q1 to 1979Q4 are shown in Table 1. As is evident from this table, ex-post simulation results for important variables are, on the whole, satisfactory.

Table 1

RESULTS OF HISTORICAL SIMULATION: 1975Q1 - 1979Q4

	RMSE	Mean	RMSE(%)
GNP	366.40	12,326.47	3.02
Non-agricultural GNP	364.10	9,736.37	3.31
Private consumption	137.10	8,184.63	1.73
Non-residential investment	227.63	2,889.62	8.24
Exports	300.42	4,590.30	6.03
Imports	352.34	5,821.36	6.14
Domestic credit to the private sector	116.45	6,013.22	1.39
GNP deflator	0.074	1.425	4.32
Wholesale price index	5.27	126.44	4.12

The fact that non-residential investment shows a somewhat sizeable discrepancy compared with other variables, should be interpreted in the light of the usual difficulties of econometric estimation of investment behaviour, which are due mainly to the underlying characteristics of investment demand. In addition to its considerable variance, investment demand is not only responsive to economic fluctuations, but is also heavily influenced by non-economic factors. On the other hand, estimation of exports and imports produced favourable results in view of their heavy dependence on foreign factors. Domestic credit extensions to the private sector, the GNP deflator and the WPI were explained

satisfactorily.

As the ability of the model to trace actual movements in the key macro variables is confirmed by the dynamic simulation within the sample period, we can proceed to the effects of supply-side disturbances and policy changes in order to see certain characteristics of the model. A substantial part of the recent escalation of inflation was attributed to foreign influences. Such supply shocks confront monetary policymakers with a dilemma. To the extent that such major price increases were due to foreign influences, it appeared that they could not be immediately prevented by domestic monetary restraint. The central bank was urged by some to accommodate the foreign-induced price increases, that is, to supply the monetary growth needed to sustain the higher prices resulting from foreign influences so as to maintain the normally desirable path of output and employment. An alternative option would be monetary restraint to put downward pressure on all domestic prices until the foreign-induced increases in the domestic price level were offset, with the possibility of a prolonged period of economic slack and reduced output. A third option is a compromise strategy, such as maintaining the previous target path of growth of the nominal GNP, with a somewhat higher price level and somewhat lower output and employment. The proper conduct of monetary policy in the face of such developments remains an unsettled issue.⁵

We tried to analyze and compare the multiplier effects of these policy choices with simulations of the model. Four types of simulation exercise were performed for the period from the first quarter of 1976 through the fourth quarter of 1979. The price shock and the other simulations of the model were as follows:

- SIM 1: The import unit price index was increased by 10 percent above the actual data.
- SIM 2: The exchange rate was increased by 10 percent above the actual data.
- SIM 3: The total money stock (M2) was increased by 10 percent above the actual data under the case of SIM 1.
- SIM 4: The total money stock (M2) was decreased by 10 percent from the actual data under the case of SIM 1.

5 See Gramlich (1979).

Table 2 indicates the results of the simulations in terms of selected macroeconomic variables as a percent change from control.

Table 2
SIMULATION RESULTS, SHOCK-CONTROL, %

	GNP				GNAG			
	SIM 1	SIM 2	SIM 3	SIM 4	SIM 1	SIM 2	SIM 3	SIM 4
Year 1	-0.43	-0.25	-0.30	-0.56	-0.56	-0.38	-0.42	-0.70
Year 2	-0.42	-0.26	-0.28	-0.56	-0.54	-0.39	-0.40	-0.69
Year 3	-0.43	-0.30	-0.28	-0.58	-0.55	-0.44	-0.49	-0.72
Year 4	-0.45	-0.34	-0.29	-0.51	-0.56	-0.48	-0.49	-0.73
Year 5	-0.46	-0.38	-0.29	-0.52	-0.56	-0.51	-0.48	-0.74
	PW				XGS			
	SIM 1	SIM 2	SIM 3	SIM 4	SIM 1	SIM 2	SIM 3	SIM 4
Year 1	5.30	5.34	6.21	5.39	-0.17	4.50	-0.17	-0.17
Year 2	5.78	5.89	6.66	5.89	-0.29	6.60	-0.28	-0.29
Year 3	5.85	6.06	6.70	5.99	-0.34	6.72	-0.33	-0.35
Year 4	5.86	6.12	6.69	6.02	-0.36	6.83	-0.35	-0.36
Year 5	5.86	6.21	6.68	6.04	-0.35	6.82	-0.34	-0.35
	MGS							
	SIM 1	SIM 2	SIM 3	SIM 4				
Year 1	-3.12	-3.13	-2.71	-3.84				
Year 2	-2.09	-2.11	-1.84	-3.11				
Year 3	-1.73	-1.57	-1.20	-2.77				
Year 4	-1.57	-1.44	-1.02	-2.61				
Year 5	-1.47	-1.37	-0.92	-2.53				

The permanent 10 per cent increase in the import unit price index causes wholesale prices to increase by 5.3 percent in the first year and by an additional 0.48 percent in the second year. The rapid rise in price level reduces real money holdings, depressing consumption and investment on the expenditure side. Higher import prices work only indirectly to reduce real exports by way of effects on the export unit value index due to higher domestic price levels. There is a decrease in real imports of 3.12 percent in the first year, but imports do not decline significantly thereafter. The immediate decline can be explained by a fall in real income in addition to the direct relative price effect. After the first year, the relative domestic price rise discourages further substitution away from imports. A decrease in consumption, investment and exports reduces domestic demand and tends to cause real GNP to fall. On the supply side, the repercussions of the non-agricultural GNP work directly to reduce output by 0.55 percent on average. This reflects both the foreign disturbance and a rise in the marginal borrowing cost. In our model, the unofficial market interest rate is positively dependent on foreign price levels as has already been discussed. As a consequence of combined negative responses from both the demand and supply sides, the real GNP declines by 0.44 percent on average.

Consider the effects of an increase in the exchange rate of the won per U.S. dollar (i.e., a devaluation) by 10 percent. As a devaluation resembles an increase in foreign prices, its effects are similar to those described above. Thus, the same framework could be used in order to work out the effects. However, they are not symmetrical in their effects on real exports. One of the key factors that determines the effect of a discrete change in the exchange rate of a country on its trade balance is the effect on that country's costs and prices. The larger the rise in money costs, domestic prices, and export prices (in domestic currency) that is induced by a devaluation, the smaller will be the competitive price advantage achieved by the country from the devaluation and, hence, the smaller will be the improvement in the trade balance.

There is an immediate and permanent improvement in the trade balance in the devaluation simulation. Real exports increase by 4.5 percent by the end of the first year following the devaluation and by 6.7 percent on average thereafter. Furthermore, real imports decrease by 3.13 percent in the first year owing to the in-

crease in import costs, but they do not continue to fall owing to changes in relative prices between domestic price levels and import prices in domestic currency.

By and large, the effect of a devaluation shows itself in a cost-push influence on the wholesale price level (increase) and on the supply of output (decrease). It can now be seen how an exchange rate change will affect domestic prices and output in the model. The exchange rate enters the equations for wholesale prices and non-agricultural GNP jointly with the import price index. Both equations have a number of interesting implications for cost increases, growth, and inflation. An increase in import prices caused by a devaluation causes credit requirements to grow owing to cost increases. This forces more borrowers to the curb market, even keeping credit constant, thus raising marginal borrowing costs. Increases in import costs and interest rates increase inflation rate and reduce output growth. This implies that stagflation in the economy is the result of devaluation. These predictions are in general agreement with what one expects in a semi-industrialized economy like Korea.

Real balance (absorption) effects at work in our model, owing to higher domestic prices, serve to depress consumption and investment. There is a faster rate of increase in domestic prices by 5.9 percent on average and a reduction in real GNP by 0.25 percent in the first year and 0.3 percent on average thereafter.

Price shocks from the supply side can occur even at low levels of aggregate demand. Standard remedies for dealing with supply-side inflation are not necessarily appropriate.

We introduced an exogenous disturbance (increase in import prices) and made alterations in monetary policy. In our model, changes in monetary growth directly influence consumption through changes in real cash balances and indirectly influence investment through changes in domestic credit to the private sector. Changes in credit also change the interest rate, which affects the supply side. The simulation exercises clarify some of the quantitative implications of different monetary policy responses to the foreign disturbance.⁶ One interesting result is the poor perfor-

⁶ We refrain from making any judgements concerning which policy would be most effective in a global sense, since effectiveness would vary according to the magnitude of the

mance of the restrictive monetary policy. It is ineffective because it has a weak anti-inflationary effect and reinforces the cost-push stagflationary influences on the economy. We can interpret this fact as the result of the existence of a segmented domestic money market. Its existence implies that a monetary contraction could be expected to have a stagflationary effect coming from the supply side, quite independently of any subsequent demand effects. It is important to note the role played by financial costs in the equations for wholesale prices and non-agricultural GNP in reinforcing the stagflationary effect. Policies restricting money supply growth will not necessarily be anti-inflationary since the increase in interest rates that they induce will drive prices up. Rather, the brunt of the resulting credit restriction falls on output. Short-run orthodoxy in a semi-industrialized economy may have price effects precisely opposite to those usually assumed for an advanced economy.

In practice, though, "what policymakers should do" is not so straightforward as our results imply. Perhaps our most important finding is that whatever the monetary response, shocks are very costly. If their impact on output is minimized by increasing money supply growth, the shock-induced inflation can linger for several years. If their inflationary impact is minimized by a restrictive policy, the cost in terms of low output and high inflation is sizeable. Various intermediate approaches are possible, but all result in some combination of persistent slower growth, higher inflation or both. If nothing else, this shows scope for policies other than macro responses to minimize price shocks.

IV. Concluding Comments

In this paper, we have used a short-term forecasting model of the Korean economy to simulate the effects of changes in import prices, devaluation, and monetary responses to foreign disturbances on selected macroeconomic variables.

Several caveats are required. First, the level of employment and wages is exogenous to the model. This is an important limitation,

policy package, the range in which the magnitude can change, and the initial conditions. Therefore, any empirical results must be interpreted with these elements in mind.

as no feedback on the level of prices from the depressed output is permitted through labour markets and wage costs. Second, explicit incorporation of government distributional policies towards hard-hit sectors might be advisable. Third, we employed aggregate net export functions, but in practice trade is composed of very heterogeneous commodities. Separate equations for different types of goods would increase the realism of the model.

It is a universally acknowledged truth that even in industrial economies where conflicting interests are adjusted and reconciled through a free-market mechanism, the econometric model has serious limitations. In an economy like Korea where production and distribution are heavily influenced by government regulation and by monopoly, these limitations are magnified. We are in a period of great change in the management of the Korean economy from government-led to private-centred with increased emphasis on private business and the free-market mechanism. This trend can be expected to increase the applicability of econometric models. An ongoing research effort is crucial if the model is to reflect adequately the characteristics of the ever-changing economic structure.

Although the model simulations may not fully replicate the real world, they may nevertheless be viewed as an illustrative application of a technique applicable to developing countries. This is the intended contribution of the paper.

APPENDIX

A SHORT-TERM FORECASTING MODEL OF THE KOREAN ECONOMY⁷

GNP BLOCK

1 Definitional Equations

1 (a) Gross National Product

$$\text{GNP} = \text{CON} + \text{IME} + \text{IFPH} + \text{II} + \text{XGS} - \text{MGS} + \overline{\text{XFI}} \\ - \overline{\text{MFI}} + \overline{\text{G}} + \overline{\text{SD}}$$

1 (b) Inventory Investment

$$\text{II} = \text{GNAG} + \overline{\text{GAS}} - (\text{CON} + \text{IME} + \text{IFPH} + \text{XGS} - \text{MGS} \\ + \overline{\text{XFI}} - \overline{\text{MFI}} + \overline{\text{G}} + \overline{\text{SD}})$$

2 Behavioural Equations

2(a) Private Consumption Expenditure

$$\ln \text{CON} = 0.52419 + 0.169631 \ln \text{GNP} + 0.0349391 \\ (2.6378) \quad (2.5749) \quad (2.16)$$

$$\ln \left(\frac{M_2}{\text{PGNP}} \right) + 0.73411 \ln \text{CON}_{-1} \\ (8.1096)$$

$$R^2 = 0.9959 \quad \text{D.W.} = 1.9586$$

2(b) Private non-residential investment

$$\text{IME} = -162.65 + 1.608 \sum_{i=1}^4 \left[\frac{\text{DCP}}{\text{PW}} - \left(\frac{\text{DCP}}{\text{PW}} \right)_{-1} \right]_{i/4} \\ (-0.92) \quad (2.86) \\ + 0.1815 \text{GNAG} - 0.1596 \text{RP} + 0.5677 \text{IME}_{-1} \\ (4.55) \quad (-1.48) \quad (3.93)$$

7 All equations are estimated by OLS; t-values are given in parentheses.

$$\begin{array}{c} -422 \quad \overline{\text{IFPD}} \\ (-4.39) \end{array}$$

$$R^2 = 0.9692 \quad \text{D.W.} = 1.68$$

2(c) Private residential investment

$$\text{IFPH} = -112.45 + 462.15 \sum_{i=1}^3 \left(\frac{\text{GNP}}{\text{POP}} \right)_{-i/4} + 0.83199 \quad (9.2202)$$

$$(-1.8745) \quad (2.2286)$$

$$\text{IFPH}_{-1} - 100.27 \overline{\text{DH13}} + 145.44 \overline{\text{DH23}}$$

$$(-3.4310) \quad (2.5307)$$

$$R^2 = 0.9340 \quad \text{D.W.} = 2.3130$$

2 (d) Non-agricultural GNP

$$\ln \text{GNAG} = 4.4196 - 0.08542 \ln \left(\frac{\overline{\text{PMGI}} \cdot \overline{\text{FXSA}}}{\overline{\text{PW}}} \right)$$

$$(3.08) \quad (-2.22)$$

$$- 0.09223 \ln \text{RP} + 0.47056 \sum_{i=1}^3 \ln \text{GNP}_{-i/3}$$

$$(-2.16) \quad (2.43)$$

$$+ 0.017 \text{T}$$

$$(3.6)$$

$$R^2 = 0.9946 \quad \text{D.W.} = 1.78$$

FINANCIAL BLOCK

1 Definitional Equations

1 (a) Domestic credits to the private sector

$$DCP = \overline{M}_2 - NFA - \overline{NOT}$$

2 Behavioural Equations

2 (a)

$$\begin{aligned} NFA = & 0.35081 + 0.00021271 (\overline{OB} \cdot \overline{FXSA}) \\ & (0.1323) \quad (30.725) \\ & + 0.9656 \overline{NFA}_{-1} - 91.022 \overline{DWR24} + 84.139 \overline{DF23} \\ & (100.81) \quad (5.2719) \quad (7.1281) \end{aligned}$$

$$R^2 = 0.9962 \quad D.W. = 1.9775$$

2 (b) Curb market interest rates

$$\begin{aligned} RP = & 23.03 + 1.19495 RT - 3.968 \left(\frac{DCP}{GNAG} \right) \\ & (7.4) \quad (9.43) \quad (-1.89) \\ & + 0.023 \frac{(\overline{PMGI} \cdot \overline{FXSA})_{-1}}{(\overline{PMGI} \cdot \overline{FXSA})_{.5}} - 4.1928 \overline{DRP1} \\ & (1.013) \quad (-2.55) \end{aligned}$$

$$R^2 = 0.8603 \quad D.W. = 1.893$$

PRICE BLOCK

1 Wholesale prices

$$\begin{aligned} \ln (PW) = & -2.68896 + 0.3618 * \ln (\overline{PMGI} \cdot \overline{FXSA}) \\ & (-9.43) \end{aligned}$$

* Parameter value imposed, derived from input-output analysis.

$$+ 0.10733 \ln \left(\frac{\overline{WR} \cdot \overline{EMP}}{\overline{GNAG}} \right) + 0.1478 \ln (RP)$$

(1.29) (3.60)

$$+ 0.262876 \ln (PW_{-1})$$

(3.60)

$$+ 0.111496 \ln \left(\frac{\sum_{i=1}^4 GNP_{-i} \cdot PGNP_{-i}}{4} \right)$$

(1.83)

$$- 0.0972 \overline{DPW}$$

(-3.42)

$$R^2 = 0.9932 \quad D.W. = 0.6865$$

2 GNP deflator

$$\ln (PGNP) = -0.412312 + 0.7274 \ln (PW)$$

(-5.53) (2.57)

$$+ 0.386491 \ln (PW_{-1}) - 0.118583 \overline{DPGNP}$$

(1.35) (-2.93)

$$R^2 = 0.9906 \quad D.W. = 0.4709$$

3 Export unit value index

$$\ln PXGI = 6.0285 + 0.2508 \ln PW - 0.8794 \ln \overline{FXSA}$$

(15.8) (3.69) (-10.0)

$$+ 0.538 \ln \overline{TWMV}$$

(9.36)

$$R^2 = 0.9818 \quad D.W. = 1.779$$

BALANCE OF PAYMENTS BLOCK

1 Definitional Equations

1 (a) Over-all balance

$$OB = XVD - MVD + \overline{RES}$$

2 Behavioural Equations

2 (a) Exports of commodities and non-factor services

$$XGS = -17.325 + 0.16482 \overline{FSXE} \cdot \left(\frac{\overline{PEIW}}{\overline{PXGI}} \right) \\ (-0.22792) (1.3413) \\ + 0.0032983 \sum_{i=1}^4 (\overline{TWMV} \cdot \overline{FXSA})_{-i/4} + 0.9272 \\ (1.3167) (15.317)$$

$$XGS_{-1}$$

$$R^2 = 0.9913 \quad D.W. = 1.5376$$

2 (b) Imports of commodities and non-factor services

$$MGS = -649.89 - 1.8277 \sum_{i=1}^2 \left(\frac{\overline{PMGI} \cdot \overline{FXSA}}{\overline{PW}} \right)_{-i/2} \\ (-2.0862) (-2.8283) \\ + 0.3156 (\overline{GNP+MGS}) + 0.27872 MGS_{-1} \\ (5.6997) (1.9011)$$

$$R^2 = 0.9856 \quad D.W. = 1.7141$$

3 Exports and Imports Conversion Equations (from constant won to current U.S.\$)

3(a) Exports of commodities and non-factor services

$$\text{XVD} = -3.4353 + 1.0015 (\text{XGS} \cdot \overline{\text{PX}} / \overline{\text{FXSA}}) \cdot 100 \\ (0.69111) (1334.1)$$

$$R^2 = 1.0$$

$$\text{D.W.} = 1.8501$$

3(b) Imports of commodities and non-factor services

$$\text{MVD} = 0.31915 + 0.99978 (\text{MGS} \cdot \overline{\text{PM}} / \overline{\text{FXSA}}) \cdot 100 \\ (0.042896) (1100.7)$$

$$R^2 = 1.0$$

$$\text{D.W.} = 2.1109$$

List of Variables

Endogenous Variables

GNP	Gross National Product (constant billions ⁸)
CON	Private consumption expenditure (constant billions)
IME	Private non-residential investment (constant billions)
IFPH	Residential investment (constant billions)
II	Inventory investment (constant billions)
XGS	Exports of commodities and non-factor services (constant billions)
MGS	Imports of commodities and non-factor services (constant billions)
GNAG	Non-agricultural GNP (constant billions)
PGNP	GNP deflator (1975 = 1.0)
PW	Wholesale price index (1975 = 100)
PXGI	Export unit value index (1975 = 100)
NFA	Net foreign assets of monetary institutions (billions)
DCP	Domestic credit to private sector (billions)
RP	Curb market interest rates (% p.a.)
XVD	Exports of commodities and non-factor services (millions of dollars)
MVD	Imports of commodities and non-factor services (millions of dollars)
OB	Over-all balance (millions of dollars)

Exogenous Variables

$\overline{\text{XFI}}$	Exports of factor services (constant billions)
$\overline{\text{MFI}}$	Imports of factor services (constant billions)
$\overline{\text{POP}}$	Population, 14 years and over (thousands of persons)
$\overline{\text{M}}$	Money supply (billions)
$\overline{\text{RT}}$	Interest rate on time deposits (% p.a.)
$\overline{\text{NOT}}$	Other assets (billions)
$\overline{\text{FXSA}}$	Exchange rate of won to U.S.\$ (won)
$\overline{\text{FXSE}}$	Exchange rate of won to U.S.\$ including export subsidy (won)

8 At 1975 constant market price, in billion won.

<u>WR</u>	Daily earnings in manufacturing industry (won)
<u>EMP</u>	Employed population aged 14 years and over (thousands of persons)
<u>RES</u>	Over-all balance except trade balance (millions of dollars)
<u>PX</u>	Export deflator (1975 = 1.0)
<u>PM</u>	Import deflator (1975 = 1.0)
<u>PEIW</u>	Export price index of world manufactured goods (1970 = 100)
<u>PMGI</u>	Import unit value index (1975 = 100)
<u>TWMV</u>	World imports (billion won)
<u>G</u>	Government expenditure (constant billions)
<u>SD</u>	Statistical discrepancy (constant billions)
<u>GAG</u>	Agricultural GNP (constant billions)
<u>IFPD</u>	Dummy variables (1975Q3 = 1, 0 otherwise)
<u>DH13</u>	Dummy variables (1973Q1 and 1975Q2, Q3 = 1, 0 otherwise)
<u>DH23</u>	Dummy variables (1977Q3 = 1, 0 otherwise)
<u>DWR24</u>	Dummy variables (1975Q1 = 1, 0 otherwise)
<u>DIF23</u>	Dummy variables (1976Q4 and 1977Q2 = 1, 0 other- wise)
<u>DRP1</u>	Dummy variables (1972Q3, Q4 and 1973Q1, Q2 = 1, 0 otherwise)
<u>DPW</u>	Dummy variables (1973Q4 = 1, 0 otherwise)
<u>DPGNP</u>	Dummy variables (1974Q3 and 1975Q3 = 1, 0 other- wise)

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