

The Bank of Korea Econometric Model

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I Introduction

During the past decade, a number of macroeconomic models have been constructed by the government as well as by private research institutes. The Bank of Korea started to build the nation's macroeconometric models in 1970. Since then several versions of annual or quarterly models have been constructed. These models were designed for short-term forecast as well as policy simulations. Simulations with these models, however, began to yield irrational results partly due to rapid changes in the structure of the Korean economy and partly due to

such external and internal shocks as the oil crisis and the August Emergency Measures in 1972 as disturbing factors. None of these models are, therefore, in use now.

This paper explains our recent effort to reconstruct our econometric model. Section II discusses a quarterly econometric model of Korea estimated over the period 1967. I–1976. IV. In section III, we report the results of *ex-post* simulations and policy simulations with the model. Section IV is the conclusions of this paper.

II Model

1 General Description of the Model

The model contains 19 behavioral equations, 12 identities and 3 statistical relationships. It is composed of five blocks; *i.e.*, expenditure block, price and wage block, balance of payment block, financial block and employment block. Compared with the last version of our quarterly model, its size has been significantly reduced. It was our intention to

eliminate some unpredictable exogenous variables from our model and thereby make it more manageable.

The model emphasizes short-run income determination from the demand side. The Keynesian-oriented real sector approach is modified to allow for the real total money stock which plays a role as a link between the real and monetary sectors. Most of the behavioral equations include lagged adjustment. Thus, the model may be termed a dynamic disequilibrium model.

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2 Data and Estimation Method

In estimating the model, we used the quarterly observations for the period from the first quarter of 1967 to the last quarter of 1976. The GNP variable, which shows an enormous seasonality due to agricultural production, has been seasonally adjusted by the X-11 method of the U.S. Bureau of the Census. All the other data are seasonally unadjusted, but seasonal dummies were used in the behavioral equations whenever they seemed to be required. Each equation was estimated by the ordinary-least-squares method.

3 Discussion of Behavioral Equations

Consumption Private consumption is disaggregated into food-beverage consumption and other consumption.¹⁾ Both of these consumption functions have the following specification.

$$C = f\left(GNPS - \frac{TV}{P}, C_{-1}, \frac{TM}{P}\right)$$

where C : real consumption; $GNPS$: real gross national product (seasonally adjusted); TV : nominal tax revenue; P : GNP deflator; TM : nominal total money stock.

The first and second argument of the function may be enough to represent the

1) From some theoretical points of view, the disaggregation of private consumption into durables and non-durables may be desirable. Unfortunately, this classification of data is not available in Korea.

permanent income hypothesis, but we added the real total money stock to see the effect of monetary policy on the real sectors of the economy. This total money stock may be interpreted as a proxy for wealth or liquid assets. This is one of the monetary-real linkages in the model.

During our sample period, food-beverage consumption is less income-elastic than other consumption in the short-run as well as in the long-run.

The nominal government consumption is determined exogenously, while its deflator is determined in the price block of the model.

Investment The fixed capital formation function is specified by the following simple dynamic equation.

$$\begin{aligned} IF = & a_0 + a_1 GNPS + a_2 IF_{-1} \\ & + a_3 \left[\frac{FM2V}{PGNP} - \left(\frac{FM2V}{PGNP} \right)_{-1} \right]_{-1} \\ & + a_4 D_1 + a_5 D_2 + a_6 D_3 \end{aligned}$$

where IF : fixed capital formation (excluding government construction); $GNPS$: real gross national product (seasonally adjusted); $FM2V$: total money stock; $PGNP$: GNP deflator; D_i : seasonal dummies.

The increase in the total money stock represents the increase in availability of funds and plays a role as one of the monetary-real linkages.

The inventory investment function is based on the following buffer-stock model.

$$INV = a_0 + a_1 S - a_2 (S - S_{-1}) - a_3 KINV_{-1}$$

where INV : inventory investment; S : sales; $KINV$: inventory stock.

In the actual estimation, we used gross national product as a proxy for sales. Nominal government construction is assumed to be determined exogenously, while its deflator is determined in the price block of the model.

Price and Wage Equations The wholesale price is the backbone of our price block. Deflators such as consumption deflator, investment deflator and GNP deflator are partly determined by the wholesale price. The annual proportional change in wholesale price is determined by the following variables.

First, the unit value index of imports multiplied by the exchange rate represents the combined effect of foreign inflation and domestic foreign exchange rate policy. Next, the difference between proportional rate of change in the total money stock and GNP is considered as a demand side factor. On the other hand, the wage rate shows the cost side factor of inflation. Finally, changes in the price of public utilities are assumed to have significant effects on the wholesale price. Daily earnings in the manufacturing industries are considered to represent the wage rate. The specification of wage rate function is similar to that of the Wharton EFU Model.

Demand Functions for Money and Time Deposits The total money stock has four components: currency in circulation, demand deposits, time and savings deposits and resident's foreign currency deposits. Equations II-2-1~3 are the demand functions for currency, demand deposits and time and savings deposits,

respectively. Resident's foreign currency deposits are treated as exogenous since depositing in such accounts is limited to special cases.

Following the tradition of quantity theory of money, we assume that what matters to the holders of money is the real quantity rather than the nominal quantity of money. It is assumed to be a function of real GNP, nominal interest rates on time deposits and price expectations.

Even though the nominal interest rates are kept far below the market rates by the Monetary Board, we assume that they still have some effects on the choice of financial assets.

The price expectation variable was considered to be an opportunity cost for holding financial assets. The current quarter inflation rate rather than the distributed lag of the past inflation rate is used as a proxy for price expectations, since this method yields more reasonable results.

We also assume that the adjustment in the financial market is instantaneous, so that the demand and supply of money stock is considered to be equal in every quarter.

It is desirable to divide the demand for money stock depending upon the type of holder; *i.e.*, individual, business, government, *etc.* The work along this line remains to be done.

Export Demand Functions The foreign demand for Korean exports is divided into commodity demand and service demand. The real quantity of commod-

ity demand is assumed to depend on the volume of total world trade and relative prices, while the demand for service is determined exogenously. The relative price in the demand function for Korean exports is defined as the ratio of the unit value index of Korean exports to that of world exports.

Our estimates show that foreign demand for Korean exports is more elastic with respect to changes in the world trade volume rather than changes in relative price.

Since our export function is essentially a demand function, we do not explicitly incorporate the effect of the government's export promotion policy like export financing and the exemption of custom duties in relation to the import of materials for export purpose, *etc.* Our assumption is that these effects are somehow represented in relative prices.

Import Demand Functions The real quantity demand for foreign goods is determined by the level of real domestic GNP and the relative price. The relative price is defined by the ratio of the unit value index of Korean imports multiplied by the foreign exchange rate to the domestic wholesale price index.

Our estimates show that the income elasticity of imports is twice as high as the price elasticity of imports.

Labor Participation and Employment We have two behavioral equations in the employment block. One is the labor participation function, and the other is the labor demand function. The underlying assumption is that labor demand is

always satisfied during our sample period, hence that the employed population is equal to labor demand. Labor participation is assumed to be determined largely by employment opportunities, while the trend term in the equation is expected to represent the gradual change in social attitude with respect to labor participation.

Labor demand depends on the level of gross output originating, real wage rate and existing capital stock. The sign of capital stock in the labor demand function was unexpectedly positive. Since the economy was far below full employment during our sample period, the increase in capital stock does not seem to be a substitute for labor. On the contrary, more employment might have been required to match the increase in capital stock. In this sense, the positive sign in the capital stock variable seems to be acceptable.

4 Structural Equations of the Bank of Korea Econometric Model

(I) *Expenditure Block*

1. *Identities*

$$1) \quad GNP = CP + IF + II + G + X - M + FI + DISC$$

$$2) \quad GNPS = GNP / SF \cdot 100$$

$$3) \quad CP = CF + CO$$

$$4) \quad CG = NCG / PC$$

$$5) \quad IG = NIG / PI$$

$$6) \quad G = CG + IG$$

$$7) \quad KF = KF_{-1} + IF + IG - CCA$$

$$8) \quad KINV = KINV_{-1} + II$$

2. *Behavioral Equations (1967.1/4–1976.4/4)*

1) *Personal Consumption, Food and Beverages (OLS)*

$$CF = 95.392 + 0.084489 \left(\frac{GNPS}{PGNP} \right) - \frac{TV}{PGNP} + 0.38803 CF_{-1} + 0.045942 \frac{FM2V}{PGNP} - 44.899 D1 - 23.237 D2 - 17.458 D3$$

(5.2600) (1.9536) (2.6247) (2.8725) (-10.247) (-4.8853) (-3.9047)

$R^2 = 0.9772$ $SEE = 8.91872$
 $D.W. = 2.2214$

2) *Personal Consumption, Other Goods and Services (OLS)*

$$CO = 35.366 + 0.11608 \left(\frac{GNPS}{PGNP} \right) - \frac{TV}{PGNP} + 0.56942 CO_{-1} + 0.025549 \frac{FM2V}{PGNP} - 37.044 D1 - 21.418 D2 - 29.381 D3$$

(4.4066) (2.3025) (3.5132) (1.5293) (-8.7436) (-5.9610) (-8.0309)

$R^2 = 0.989$ $SEE = 8.0045$
 $D.W. = 3.1952$

3) *Private Fixed Capital Formation (OLS)*

$$IF = -23.246 + 0.18927 GNPS - 1.9301 + 0.22371 IF_{-1} + 0.103514 \left(\frac{FM2V}{PGNP} \right)_{-1} - 35.216 D1 + 16.937 D2 - 6.7368 D3$$

(-1.9301) (4.9653) (1.4482) (2.1435) (-4.1217) (1.8288) (-0.81225)

$R^2 = 0.9389$ $SEE = 16.3642$
 $D.W. = 2.0284$

4) *Capital Consumption Allowance (OLS) CCA*

$$= -76.871 + 0.019037399 KF_{-1}$$

(-16.851) (31.005)

$R^2 = 0.962$ $SEE = 5.54367$
 $D.W. = 0.8802$

5) *Inventory Investment (OLS)*

$$II = 179.35 + 0.19503 GNPS - 0.18153 (GNPS - GNPS_{-1}) - 0.23619 KINV_{-1} - 274.82 D1 - 220.75 D2 - 289.04 D3$$

(7.0089) (2.4180) (-0.76494) (-2.2621) (-10.025) (-13.187) (-19.695)

$R^2 = 0.9679$ $SEE = 26.5284$
 $D.W. = 2.0644$

3. *Equation for Currency Conversion*

1) *Export of Goods and Services (OLS)*

$$X = -9.3078 + 0.98881 \left[\frac{(XGV + XSV) \cdot FXS}{PX \cdot 1000} \right]$$

(-12.386) (296.76)

$R^2 = 0.9996$ $SEE = 2.59958$
 $D.W. = 1.2106$

2) *Import of Goods and Services (OLS)*

$$M = 3.9837 + 0.92767 \left[\frac{(MGV + MSV) \cdot FXS}{PM \cdot 1000} \right]$$

(4.0944) (229.86)

$R^2 = 0.9993$ $SEE = 2.39079$
 $D.W. = 0.8969$

(II) *Financial Block*

1. *Identities*

$$FMIV = CURPV + DDV$$

$$FM2V = FMIV + DTV + DRFV$$

2. *Behavioral Equations*

1) *Demand for Currency in Circulation (OLS)*

$$\frac{CURPV}{PGNP}$$

$$= 52.879 + 0.09147 \text{ GNPS}$$

$$(3.8267) \quad (4.1239)$$

$$- 1.4421 \text{ RDB}$$

$$(-3.4296)$$

$$- 53.793 \text{ DOT (PGNP)}$$

$$(-2.4529)$$

$$+ 0.3918 \left(\frac{CURPV}{PGNP} \right)_{-1}$$

$$(2.9777)$$

$$- 7.8410 \text{ D1} - 21.117 \text{ D2}$$

$$(-2.3798) \quad (-6.8709)$$

$$- 6.8500 \text{ D3}$$

$$(-1.8387)$$

$$R^2 = 0.9834 \quad SEE = 6.44981$$

$$D.W. = 2.2992$$

2) Demand for Demand Deposits (OLS)

$$\frac{DDV}{PGNP}$$

$$= 78.296 + 0.10518 \text{ GNPS}$$

$$(4.2219) \quad (3.7044)$$

$$- 2.9748 \text{ RDB}$$

$$(-4.6965)$$

$$- 166.66 \text{ DOT (PGNP)}$$

$$(-6.4174)$$

$$+ 0.54152 \left(\frac{DDV}{PGNP} \right)_{-1}$$

$$(5.5868)$$

$$R^2 = 0.9888 \quad SEE = 9.06857$$

$$D.W. = 2.1334$$

3) Demand for Time and Savings Deposits (OLS)

$$\frac{DTV}{PGNP}$$

$$= -25.47 + 0.062594 \text{ GNPS}$$

$$(-1.7301) \quad (1.5207)$$

$$+ 1.4995 \text{ RDB}$$

$$(9.3547)$$

$$- \text{DOT (PGNP)} \cdot 400$$

$$+ 0.95933 \left(\frac{DTV}{PGNP} \right)_{-1}$$

$$(24.483)$$

$$+ 24.863 \text{ D1} + 21.309 \text{ D2}$$

$$(2.4946) \quad (2.2797)$$

$$+ 12.405 \text{ D3}$$

$$(1.1168)$$

$$R^2 = 0.994 \quad SEE = 19.9536$$

$$D.W. = 1.34$$

(III) Price and Wage Block

1. Behavioral Equations

1) Wholesale Price (OLS)

$$\frac{PW - PW_{-4}}{PW_{-4}} = -0.11435$$

$$(-4.6586)$$

$$+ 0.47891 \left(\frac{PMG \cdot FXS}{PMG_{-4} \cdot FXS_{-4}} - 1 \right)$$

$$(12.935)$$

$$+ 0.16854 \left(\frac{WR}{WR_{-4}} - 1 \right)$$

$$(2.2652)$$

$$+ 0.04317 \left(\frac{FM2V}{FM2V_{-4}} - \frac{GNPS}{GNPS_{-4}} \right)$$

$$(1.0159)$$

$$+ 0.86325 \left(\frac{PPU}{PPU_{-4}} - 1 \right)$$

$$(6.4533)$$

$$+ 0.14333 \left(\frac{PW_{-4}}{PW_{-8}} - 1 \right)$$

$$(2.5018)$$

$$R^2 = 0.9156 \quad SEE = 0.0354975$$

$$D.W. = 1.763$$

2) Daily Earnings in Manufacturing Industries (OLS)

$$WR - WR_{-4} = 297.24$$

$$(3.1676)$$

$$+ 848.86 (PC_{-1} - PC_{-5})$$

$$(7.1944)$$

$$- 12.045 \sum_{i=0}^3 U_{-i}$$

$$(-2.8258)$$

$$- 0.52516 (WR_{-4} - WR_{-8})$$

$$(-2.7478)$$

$$R^2 = 0.7645 \quad SEE = 77.3242$$

$$D.W. = 0.477$$

3) Implicit Consumption Deflator (OLS)

$$PC = -0.05813 + 0.011108 \text{ PW}$$

$$(-4.3018) \quad (7.4691)$$

$$+ 0.60087 \text{ PC}_{-1}$$

$$(9.9281)$$

$$R^2 = 0.998 \quad SEE = 0.0323724$$

$$D.W. = 1.8409$$

4) Implicit Investment Deflator (OLS)

$$PI = 0.049562 + 0.0075563 \text{ PW}$$

$$(1.3896) \quad (2.1536)$$

$$+ 0.64775 \text{ PI}_{-1}$$

$$(3.7022)$$

$$R^2=0.9832 \quad SEE=0.0741052$$

$$D.W.=1.2183$$

5) *Implicit Export Deflator (OLS)*

$$PX=0.0027228 \\ (0.17363)$$

$$+0.000032083 \text{ FXS} \cdot PXG \\ (100.74)$$

$$R^2=0.9963 \quad SEE=0.0387748$$

$$D.W.=0.3072$$

6) *Implicit Import Deflator (OLS)*

$$PM=0.086359 \\ (10.09)$$

$$+0.000029459 \text{ FXS} \cdot PMG \\ (211.56)$$

$$R^2=0.9992 \quad SEE=0.0269264$$

$$D.W.=0.7451$$

7) *Unit Value Index of Exports (OLS)*

$$PXG=74.966 \\ (8.8587)$$

$$-0.12368 \text{ FXS} + 0.60749 \text{ PMW} \\ (-3.6897) \quad (11.264)$$

$$+0.0078416 \text{ WR} \\ (1.3142)$$

$$R^2=0.959 \quad SEE=5.81319$$

$$D.W.=0.4671$$

8) *Unit Value Index of Import (OLS)*

$$PMG=-1.5574 + 0.54972 \text{ PXW} \\ (-0.56794) \quad (5.9199)$$

$$+0.47325 \text{ PMG}_{-1} \\ (5.06)$$

$$R^2=0.9874 \quad SEE=6.04047$$

$$D.W.=0.5863$$

9) *Equation for the Approximation of Implicit GNP Deflator (OLS)*

$$PGNP=-0.010902 + 1.0101 \cdot \\ (-0.36683) \quad (49.515)$$

$$\left(\frac{PC(CP+CG)+PI(IF+IG)}{CP+CG+IF+IG+X-M} \right. \\ \left. + \frac{PX \cdot X - PM \cdot M}{X-M} \right)$$

$$R^2=0.9847 \quad SEE=0.074376$$

$$D.W.=2.4231$$

(IV) *Balance of Payment Block*

1) *Export of Goods (OLS)*

$$\log \left(\frac{XGV}{PXG} \cdot 100 \right) = -6.4225 \\ (-5.7075)$$

$$-1.0376 \log \left(\frac{PXG}{PXW} \right)_{-1} \\ (-3.5313)$$

$$+2.3024 \log (XW) \\ (6.5682)$$

$$+0.23404 \log \left(\frac{XGV}{PXG} \cdot 100 \right)_{-1} \\ (2.1642)$$

$$R^2=0.9828 \quad SEE=0.118586$$

$$D.W.=1.8569$$

2) *Import of Goods (OLS)*

$$\log (MGV/PMG \cdot 100) = -0.10059 \\ (-0.12887)$$

$$-0.4609 \log \left(\frac{PMG \cdot FXS}{PW} \right)_{-1} \\ (-2.864)$$

$$+1.1361 \log (GNPS) \\ (4.8991)$$

$$+0.31612 \log \left(\frac{MGV}{PMG} \cdot 100 \right)_{-1} \\ (2.349)$$

$$R^2=0.9483 \quad SEE=0.103976$$

$$D.W.=2.09$$

(V) *Employment Block*

1. *Identities*

$$U=(LF-LE)/LF \cdot 100$$

2. *Behavioral Equations*

1) *Labor Participation (OLS)*

$$\frac{LF}{POP} = 0.049633 + 0.96546 \frac{LE}{POP} \\ (7.5213) \quad (79.415)$$

$$-0.00026364 \text{ TREND} \\ (-3.8655)$$

$$R^2=0.9942 \quad SEE=0.00495498$$

$$D.W.=2.068$$

2) *Labor Demand (OLS)*

$$\log (LE) = 5.652 \\ (8.4334)$$

$$+0.34742 \log (GNPS) \\ (3.3755)$$

$$\begin{aligned}
&+0.22963 \log(KF) & +0.25633 D3 \\
&\quad (1.5029) & \quad (30.555) \\
&-0.14447 \log\left(\frac{WR}{PGNP}\right) & R^2=0.9908 \quad SEE=0.0174391 \\
&\quad (-3.422) & D.W.=2.01796 \\
&+0.12677 D1+0.31007 D2 \\
&\quad (15.101) \quad (37.987)
\end{aligned}$$

5 List of Variables

Notation	Definitions	Unit of Measure, etc.
<i>CCA</i>	Capital Consumption Allowance	Const. 1970 Won, bil. Won
<i>CF</i>	Personal Consumption, Food and Beverages	"
<i>CG</i>	Government Consumption Expenditures	"
<i>CO</i>	Personal Consumption, Other Goods and Services	Const. 1970 Won, bil. Won
<i>CP</i>	Private Consumption	Const. 1970 Won, bil. Won
<i>CURPV</i>	Currency in Circulation	Current Won, bil. Won
<i>DDV</i>	Demand Deposits	"
<i>*DISC</i>	Statistical Discrepancy	Const. 1970 Won, bil. Won
<i>*DRFV</i>	Resident's Foreign Currency Deposits	Current Won, bil. Won
<i>DTV</i>	Time and Savings Deposits	"
<i>*FI</i>	Net Factor Income from the rest of the World	Const. 1970 Won, bil. Won
<i>FM 1V</i>	Money Supply (M1)	Current Won, bil. Won
<i>FM 2V</i>	Money Supply (M2)	"
<i>*FXS</i>	Official Exchange Rates of Won to US\$	Current Won
<i>G</i>	Government Expenditure	Const. 1970 Won, bil. Won
<i>GNP</i>	Gross National Product	"
<i>GNPS</i>	Gross National Product (seasonally adjusted)	"
<i>IF</i>	Fixed Capital Formation	"
<i>IG</i>	Government Construction Investment	"
<i>II</i>	Inventory Investment	"
<i>KF</i>	Capital Stock	"
<i>KINV</i>	Inventory Stock	"
<i>LE</i>	Employed Population	In Thousand Persons
<i>LF</i>	Economically Active Population	"
<i>M</i>	Import of Goods and Services	Const. 1970 Won, bil. Won
<i>MGV</i>	Import of Goods (BOP)	Current US\$, mil. US\$
<i>*MSV</i>	Import of Services (BOP)	"
<i>MV</i>	Import of Goods and Services (BOP)	"
<i>*NCG</i>	Nominal Government Consumption	Current Won, bil. Won
<i>*NIG</i>	Nominal Government Construction Investment	"
<i>PC</i>	Implicit Consumption Deflator	1970=1.0
<i>PI</i>	Implicit Fixed Investment Deflator	"
<i>PGNP</i>	GNP Deflator	"
<i>PM</i>	Import Deflator	"
<i>PMG</i>	Unit Value Index of Imports	1970=100
<i>*PMW</i>	Unit Value Index of World Imports	"
<i>*POP</i>	Population 14 Years and Over	In Thousand Persons
<i>*PPU</i>	Price Index of Public Utilities	1975=100
<i>PW</i>	Wholesale Price Index	"
<i>PX</i>	Export Deflator	1970=1.0
<i>PXG</i>	Unit Value Index of Exports	1970=100
<i>*PXW</i>	Unit Value Index of World Exports	"

Notation	Definitions	Unit of Measure, etc.
* <i>RDB</i>	Interest Rates on Time Deposits (1 year Maturity)	Percentage Rate
* <i>SF</i>	Seasonal Factor for GNP	—
* <i>TREND</i>	Time Trend	—
* <i>TV</i>	Tax Revenues	Current Won, bil. Won
<i>U</i>	Unemployment Rate	Percentage Rate
<i>X</i>	Export of Goods and Services	Const. 1970 Won, bil. Won
<i>XGV</i>	Export of Goods (BOP)	Current US\$, mil. US\$
* <i>XSV</i>	Export of Services (BOP)	"
<i>XV</i>	Export of Goods and Services (BOP)	"
* <i>XW</i>	World Export Quantity Index	1970=100
<i>WR</i>	Daily Earnings in Manufacturing Industries	Current Won

Note: * denotes exogenous variables.

III Simulation of the Model

1 Dynamic Simulation

The validity of an econometric model depends on the predictive ability of the behavior of the model. To check the predictive ability, dynamic simulations both within and outside the sample period were performed by solving our non-linear simultaneous equation model by the Gauss-Seidel method.

Figure 1 shows the predicted values and the actual values of major endogenous variables. Even though the predicted value of GNP closely follows the actual values, we found some problems in the prediction of its components. First, the private consumption function underestimated the actual values within the sample period, but it overestimated the actual values outside the sample period. Next, the predicted fixed capital formation was less volatile than the actual values, and the inventory investment also showed significant forecasting errors. On the other hand, the unemployment rate

seems to suffer from incorrect treatment of its seasonality.

The root mean square error (*RMSE*)²⁾ and the adjusted Theil's U statistics (*ATU*)³⁾ of major endogenous variables can be found in Table 1. The inventory investment function seems to be performing poorly, yielding the biggest *RMSE*. The adjusted Theil's U statistics are, however, close to zero for most of the endogenous variables.

2 Policy Simulation

In order to see the short-term effects of government policies, dynamic simulations were conducted for the period 1974.I–1976.IV. The short-term effect of a certain policy is measured through the

2) $RMSE = \sqrt{\frac{1}{n} \sum_{t=1}^n \left(\frac{E_t - A_t}{A_{t-1}} \right)^2}$, where E_t is the predicted value and A_t is the actual value of a variable.

3) $ATU = \sqrt{\frac{MSE}{\sum_{t=1}^n A_t^2/n}}$, where *MSE* is the mean square error.

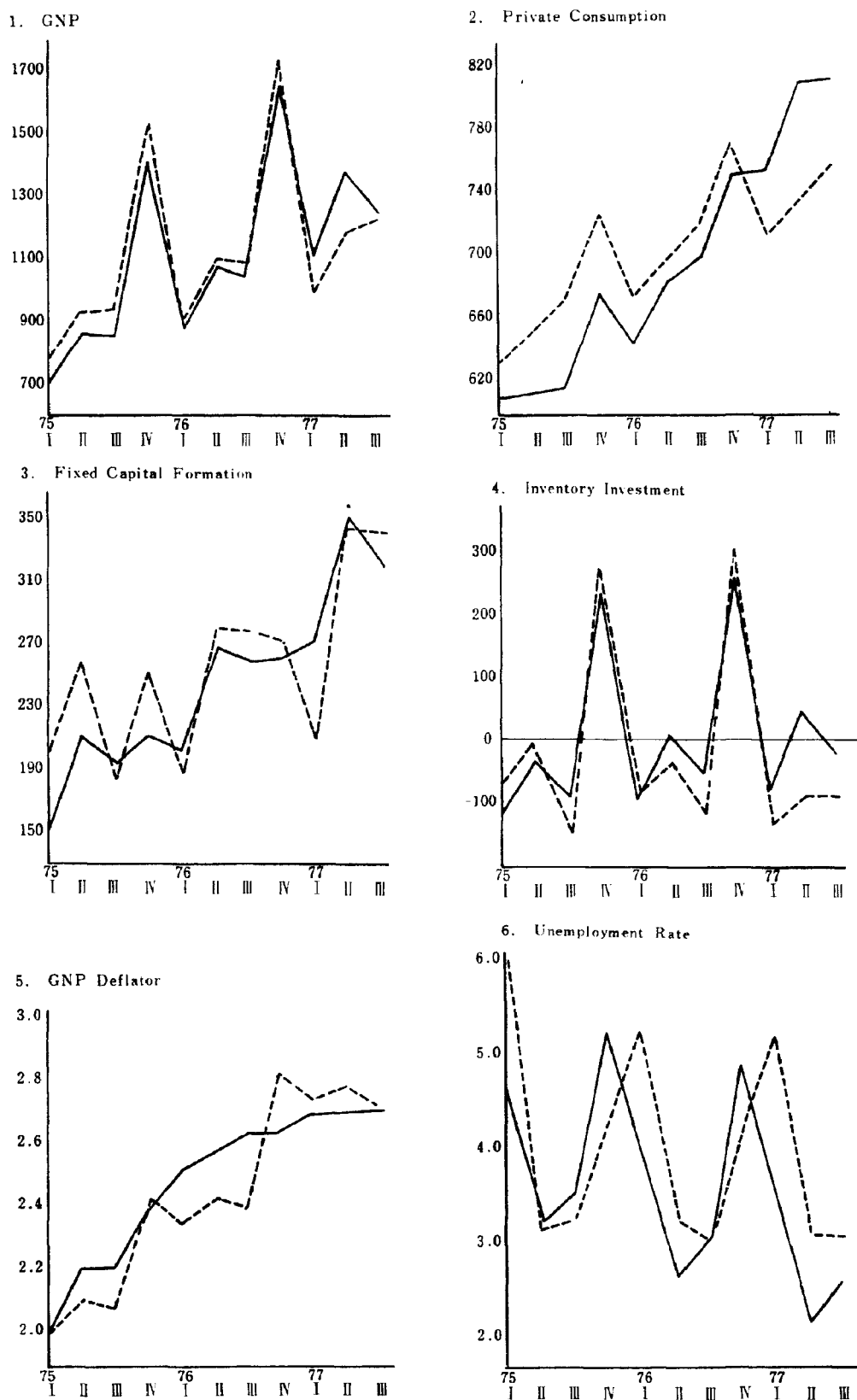


Fig. 1 Model Solution Vs. Actual Observations*

* The solid lines plot the predicted values and the dotted line show the actual values.

Table 1 RMSE and Theil's U Statistic

	Within the Sample Period 1975.I-1976.IV		Outside the Sample Period 1977.I-III	
	RMSE	ATU	RMSE	ATU
GNP	0.075	0.00007	0.125	0.00011
Private Consumption	0.052	0.00008	0.082	0.00011
Fixed Capital Formation	0.146	0.00061	0.014	0.00046
Inventory Investment	2.294	0.01433	0.693	0.00607
Exports	0.131	0.00036	0.054	0.00011
Imports	0.101	0.00003	0.160	0.00036
Total Money Stock	0.028	0.00031	0.056	0.00001
GNP Deflator	0.062	0.02647	0.020	0.00720
Wholesale Price Index	0.082	0.00037	0.035	0.00029
Unemployment Rate	0.195	0.04650	0.270	0.06927

difference between the shocked and the control solution.

1) *A 10% devaluation of domestic currency*

The simulation results show that the quantity of export increases and that of import decreases due to the devaluation. However, the import restraining effect of devaluation is much less than the export augmenting effect and vanishes after 2 years. It is also found that the devaluation has a significant inflationary effect and has a positive effect on the real GNP.

Table 2 Effect of Devaluation*

	1974	1975	1976
Exports (bil. 1970 Won)	36.28	48.5	68.0
Imports (")	-3.9	-1.2	9.9
GNP (")	24.2	30.0	51.3
GNP deflator (1970=1)	0.095	0.146	0.172

* Figures represent the difference between the shocked and the control solution.

2) *A 50.0 billion Won increase in total money stock*

The total money stock plays a vital role in our model. It acts as a linkage between the monetary and real sectors. In Korea, the total money stock is considered one of the monetary policy

targets. The government, therefore, pronounces the target rate of growth of total money stock every year.

We slightly modified our model in order to make the total money stock exogenous. With this modified model, we conducted a policy simulation starting from the first quarter of 1974.

It is interesting to note that the increase in total money stock has contrasting effects on real GNP and the GNP deflator. It has a positive effect on real GNP during the first two years, but this effect reverses in its third year. On the other hand, it has a positive effect on the GNP deflator throughout our simulation period. It is also found that the increase in the total money stock has a negligible effect on exports, but has a significant boosting effect on imports.

Table 3 Effect of Total Money Stock Increase*

	1974	1975	1976
GNP (bil. 1970 Won)	11.56	20.80	-21.55
Exports (")	0.02	-0.02	-0.01
Imports (")	5.82	8.38	4.74
GNP deflators (1970=1)	0.01	0.002	0.001

* Figures represent the difference between the shocked and the control solution.

IV Conclusions

The model has been developed not only for the short-term forecast but also for policy simulations. The prerequisite for an econometric model to be useful for policy analysis is that it is capable of simulating the actual economy reasonably well.

As we have seen in the *ex-post* simulation of our model, further refinements of the model are badly required in order to use it for policy simulations. The following are considered as the bare essentials for the improvements of our model.

First, the supply constraint of the economy needs to be incorporated into the model. The model has been used in forecasting the Korean economy for the period 1978.IV–1979.IV. It overesti-

mated the GNP of 1978.IV, mainly because it could not incorporate the significant retardation in agricultural production. This forecasting error could have been reduced if our model explicitly included the supply constraints.

Next, much remains to be improved in the specifications of some behavioral equations such as wholesale price equations, inventory investment equations, etc. The model only takes into account the exchange rate between U.S. dollar and Korean Won, but the recent violent changes in the price of Japanese Yen forces us to include it in our model. Finally, we are required to put more efforts in finding the missing links between the variables in our model.

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