An Empirical Study on Government Consumption and Investment Spending Effects in Korea

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I. Introduction

The impacts of fiscal policy on the economy have been extensively considered in the macroeconomic literature.

Keynesian analysis has focused on studying the effect of fiscal policy through its influence on the aggregate demand. Given an increase in government purchases or fiscal deficits, output expands by an amount larger than the original expenditure change. But it also produces higher interest rates, which depress private investment and so output. This is the mechanism of the indirect crowding out effect. The effectiveness of fiscal policy as a stabilization instrument hinges on the degree of crowding out caused by fiscal expansion.

According to standard macro models, government purchases have a multiplir effect on output no matter what the composition of the expenditure is. Along

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with this theoretical analysis, there exist several large scale econometric models that provide estimates for the multiplier of government purchases. The estimates vary depending on the model used, but they are in all cases significantly bigger than one(see de Leeuw and Gramlich(1968)). But this line of logic has been questioned by neoclassical economists lately. If goods and services provided by government are regarded as close substitutes for private consumption goods, then, as Bailey(1971) has pointed out, the multiplier effect vanishes. Barro(1981), focusing on the distinction between temporary versus permanent changes in government purchases, provides empirical evidence that the effect on real output of temporary changes(defense purchases related to war) is bigger than that of permanent changes(military as well as non-military, and state and local purchases). Seung-soo Han(1984) estimates the fiscal deficit multiplier as 2.31 using annual data for Korea during 1970-82. Kye-sik Lee(1988) gets the result that fiscal policy in Korea has been a powerfully effective instrument for economic stabilization, to the extent that government spending in Korea, whether debt- or tax-financed, has crowded in rather than crowded out household consumption. Aschauer(1985a) investigates the effects of fiscal policy on private consumption and aggragate demand within an explicit intertemporal optimization framework. Aschauer(1985b) has surveyed the various elements of fiscal policy from the perspective of a model with competitive equilibrium approach. Aschauer and Greenwood(1985) construct a neoclassical general equilibrium model elaborately over two periods to investigate the macroeconomic effects of fiscal policy with the policy variables being government consumption, government production service, public investment goods, transfer payments, labor income tax, corporate income tax. Government services would yield consumption benefits for individuals and production benefits for firms. Government consumption expenditures are allowed to influence utility directly by providing a current substitute for private consumption goods with no interaction with leisure. Government investments in public

capital, on the other hand, have the potential of enlarging society's future production possibilities and of augmenting the rate of return on private capital. This is the direct crowding-out or-in effect caused gy fiscal expansion.[1]

This paper is intended to focus on the latter issue and to analyze its implication empirically.

II. Model

1. theoretical background

'Crowding out', in a broad sense, refers to the displacement of private economic activity by public economic activity. More specifically, crowding out refers to the phenomena of government consumption, investment, borrowing, and saving displacing their private counterparts. Crowding out is shown to be a multidimensional concept. The degree of crowding out, the time horizon considered, direct and indirect crowding out constitute the four main categories.[2]

Each of the latter two has many subcategories. With direct or 'exante' crowding out governmental economic activity directly enters as an argument into structural private behavioral relationships without affecting the price level and the interest rate. Indirect or 'ex post' crowding out refers to crowding out in the reduced form of the model without there being any direct crowding out at the level of the structural private behavioral relationships ; rather than that, it has an indirect effect through price levels and the interest rates. The short run-long run dichotomy in the time horizon contrasts the impact effect of changes in government activity- for given values of the short-run exogenous but long-run endogenous(or predetermined) variables such as asset stocks and expectations about the future-

1) Refer Barro(1984) p. 304 and Arrow & Kurz(1970) for more detailed explanation.
2) see Buiter(1977) for the details.

with the long－run, steady－state effect of such changes when stocks and expectations have fully to the change in government policy. So the degree of crowding out with this multidimensional concept would be reflected in the measure of effectiveness of fiscal policy.

The analysis of fiscal policy in conventional macroeconomic models typically has stressed the first order importance of the financial aspects of public sector budgetary policy. Deficits－whether driven by a tax reduction of an increase in public expenditure－create excess supply in the bond market, upward pressure on interest rates, an ex post crowding out of expenditure on durable goods and /or an expansion of output and employment.

Recently, some macroeconomists have reconsidered the impact which the public sector's spending and tax decisions may have on macroeconomic variables. A variety of models have been constructed on the basis of optimizing agents making consumption and production decisions on the basis of available information in a competitive equilibrium setting. A logical outcome of this modelling strategy being near equivalence of debt and taxes in the financing of public expenditure, Ascauer (1985, 1989), Aschauer & Greenwood(1985), Barro(1981, 84) and others instead emphasize the real aspects of fiscal policies, placing considerable weight on the time profile and composition of public expenditure on goods and services. Government services would yield consumption benefits for individuals and production benefits for firms. Government consumption expenditures are allowed to influence utility directly by providing a current substitute for private consumption goods with no interaction with leisure. Government investments in public capital, on the other hand, have the potential of enlarging society's future production possibilities and of augmenting the rate of return on private capital. This is the direct effect caused by fiscal expansion I want examine.

2. methodology

In order to examine the relative magnitude on government consumption and government investment on private activities and real income in the theoretical hypothesis of Aschauer(1985, 89)－Barro(1981) model, the reduced form equations of the stationary state(long－run) multiplier may be expressed as following :

$Y = F_1(GC, GI, X_1)$

$PC = F_2(GC, GI, X_2)$

$IP = F_3(GC, GI, X_3)$

where, Y : output, PC : private consumption, IP : private investment, GC : government consumption, GI : government investment, X_1, X_2, X_3 are disturbance factors excluding explanatory variables.

If we assume that these equation system transforms into log－linear form approximately for the estimableness and then take first difference for each variable for transforming time series data into stationary state, and consider lags for explanatory and dependent variables, then we can derive OLS equation system as follows :

$$\Delta \ln Y_t = \alpha_1 + \beta_1 \Delta \ln Y_{t-1} + \gamma_{10} \Delta \ln gc_t + \gamma_{11} \Delta \ln GC_{t-1} + \delta_{10} \Delta \ln GI_t + \delta_{11} \Delta \ln GI_{t-1} + \varepsilon_{1t} \quad (2-1)$$

$$\Delta \ln PC_t = \alpha_2 + \beta_2 \Delta \ln PC_{t-1} + \gamma_{20} \Delta \ln GC_t + \gamma_{21} \Delta \ln GC_{t-1} + \delta_{20} \Delta \ln GI_t + \delta_{21} \Delta \ln GI_{t-1} + \varepsilon_{2t} \quad (2-2)$$

$$\Delta \ln IP_t = \alpha_3 \Delta \ln IP_{t-1} + \gamma_{30} \Delta \ln GC_t + \gamma_{31} \Delta \ln GC_{t-1} + \delta_{30} \Delta \ln GI_t + \delta_{31} \Delta \ln GI_t + \varepsilon_{3t} \quad (2-3)$$

where, β_i, γ_{ij}, δ_{ij} : coeffecient

Y_{t-1}, PC_{t-1}, IP_{t-1}, GC_{t-1}, GI_{t-1} : lagged explanatory variables (used second lag when necessary).

α_1 (i=1, 2, 3) : constant term

$\varepsilon_{i\,t}$(i=1, 2, 3) : error term with white noise

Δ : first difference operator.

The eq. (2−1) ~ (2−3) may give birth to the multicollinearity problem between government consumption and investment variable, so we also consider six regression equations using one explanatory variable of the two.[3] OLS equations considered total government spending variable as explanatory variable also can be derived as the eq.(2−4) ~ (2−6) for comparing the estimate results shown above.

$$\Delta \ln Y_t = \alpha_4 + \beta_4 \Delta \ln Y_{t-1} + \gamma_{40} \Delta \ln GT_t + \gamma_{41} \Delta \ln GT_{t-1} + \varepsilon_{4t} \quad (2-4)$$

$$\Delta \ln PC_t = \alpha_5 + \beta_5 \Delta \ln PC_{t-1} + \gamma_{50} \Delta \ln GT_t + \gamma_{51} \Delta \ln GT_{t-1} + \varepsilon_{5t} \quad (2-5)$$

$$\Delta \ln IP_t = \alpha_6 + \beta_6 \Delta \ln IP_{t-1} + \gamma_{60} \Delta \ln GT_t + \gamma_{61} \Delta \ln GT_{t-1} + \varepsilon_{6t} \quad (2-6)$$

where, β_i, γ_{ij}, δ_{ij} : coefficient

Y_{t-1}, PC_{t-1}, IP_{t-1}, GT_{t-1} : lagged explanatory variables (used second lag when necessary).

α_i (i=1, 2, 3) : constant term

ε_{it}(i=1, 2, 3) : error term with white noise

Δ : first difference operator.

To use dynamic multiplier analysis, I also employ Impulse response function

3) There exists the multicollinearity between government consumption(GC) and investment (GI) variables when using the raw data, but I can eliminate this problem after logarithmic difference data transformation.

Using the raw data :

$GC_t = 2425.41 + 1.13GI_t$, D.W.=1.12, R^2= .84, Q=8.04(sig.lev.=.24)
(8.22) (7.71)

$GI_t = -1510.04 + .74GC_t$, D. W.=1.05, R^2=.84, Q=6.58(sig.lev.=.36)
(−3.37) (7.71)

Using the log−difference transformation data :

$GC_t = .02 + .36\ GI_t$, D. W.=2.27, R^2=.11, Q=4.88(sig.lev.=.56)
(.35) (1.13)

$GI^t = .11 + .29\ GC_t$, D.W.=1.11, R^2=.11, Q=5.57(sig.lev.=.47)
(3.27) (1.13)

method, i. e. analysis of the system's response to innovations, The response is obtained by tracing out the system's moving average representation. The moving average representation expresses the current value of each variable in terms of current and lagged values of the residuals, i. s., innovation of each equation. Impulse traces the response of the system to a 1.0% shock in the errors.[4] It concerns itself soley with the dynamic properties of the model and looks at the single effect in isolation. Hence we can get cumulative elasticities as summing the responses coefficient of dependent variable to a change in fiscal variables in the OLS equations until the point converging the stationary state.

III. Empirical Analysis

1. data explanation

Annual data for each of these series from 1970 to 1987 are used in the estimation. The data sources used in empirical analysis, of annual data of 5 components of Korean real GDP – government consumption, government investment, private consumption, private investment, net export – are as follows :

GDP : Gross domestic product(1980 year constant prices, unit : 1 billion won) (sources : BOK, *National Accounts 1970–86,* 1987 and *National Accounts in 1987,* 1988).

PC : Final consumption expenditure of households(1980 year const prices, unit : 1 billion won) (sources : BOK, *National Accounts 1970–86,* 1987 and *National Accounts in 1987,* 1988).

4) Refer Doan & Litterman(1986 : ch. 12) and Pindyck & Rubinfeld(1986 : ch. 13) for Impulse response function and Dynamic multiplier method.

IP : Private Investment = Gross fixed capital formation − Producers of government services in the composition of gross capital formation by kind of economic activity(1980 year constant prices, unit : 1 billion won) (sources : BOK, *National Accounts 1970−86,* 1987 and *National Accounts in 1987,* 1988).

GT : Total government expenditure = Government final consumption expenditure+Producers of government services in the composition of gross capital formation by kind of economic activity(1980 year constant prices, unit : 1 billion won) (sources : BOK, *National Accounts 1970−86,* 1987 *National Accounts in 1987,* 1988).

GC : Government final consumption expenditure(1980 year constant prices, unit : 1 billion won) (sources : BOK, *National Accounts 1970−86,* 1987 and *National Accounts in 1987,* 1988).

GI : Government Investment = Producers of government services in the composition of gross capital formation by kind of economic activity(1980 year constant prices, unit : 1 billion won) (sources : BOK, *National Accounts 1970−86,* 1987 and *National Accounts in 1987,* 1988).

The raw data of each time series have shown nonstationary with time trend, but changed into stationary time series after log−difference data transformation for each series. So I used each data after this transformation. Hence the meaning of each estimated coefficient is change into the elasticity concept.

I also used dummy variables in 1980 and 1986 if the estimate result is not significant. The economic trough period owing to second oil crisis(1979−80), socio−political unrest etc. in Korea occurred in 1980, while the economic boom period in which it may be evaluated that actual GNP exceeds potential GNP in 1986.[5)]

If we look at the stylized facts of these time series data in Korea after

5) See Park(1989) and BOK(1988) for the details.

logarithmic difference transformation, we can find out the complementary relationship between government investment and private investment as observing the fact that the growth rate of government investment expenditure fluctuates with the growth rate of private investment expenditure – in boom period the growth rate of government investment rises, in recession period it falls, as shown [Graph 2]. Other while we observe that the growth rate of government consumption fluctuate irrelevant to the groiwth rate of private consumption as shown [Graph 1].

2. estimation results

The estimation results using logarithmic difference data transformation are appropriate in the test statistics(D.W.(Durbin Watson statistic), Ljung–Box Q–statistic, R^2) and the goodness of fit.[6)]

The OLS estimation results are shown in 〈Table 1〉 through 〈Table 5〉 and the cumulative elasticities of impulse responses shown at [Graph 3] – [Graph 16]. The explanation of the estmation results can be summarized as follows :

dep. var	expl var	OLS (a)	OLS dummy var(D)	cumulative elasticity (stationary state)
PC	GC	−.25 ··· −.19		−.07
	GI	.20 ··· .40		.26
IP	GC	−.34*··· .52*	−.48	.24* −.48^{D2}
	GI	.90 ··· 1.30	.92 1.46	.68 .92^{D2}
GDP	GC	−.12*··· −.10*	−.21 −.24(Y−G)	−.09* −.15^{D2}
	GI	.21 ··· .27	.47	.21 .33^{D2}
GDP	GT	−.20*··· .16* .14(Y−G−IS)*	−.26(Y−G)	−.278(Y−G)^{D1}
PC	GT		−.21	−.283^{D1}
IP	GT	−.14*	−.16*	

note) values at (a) are the range of several OLS estimate results.
coefficient with * is not significant even at 10% sig. level.
D : dummy variable(D1 : '80 year dummy, D2 : '86 year dummy).
Y : GDP, G : government spending, IS : increase in stock.

6) See Ljung and Box(1978) or Doan & Litterman(1986 : ch. 1) for Ljung–Box Q–statistic.

So we can say that the empirical analysis shown above is as follows :

		empirical results
PC	GC	partially crowded out
	GI	(+)
IP	GC	not significant((−) sig. with dummy).
	GI	(+)
GDP	GC	not significant((−) sig. with dummy, (−) sig. with [GDP−GT] and dummy)
	GI	(+)
GDP	GT	not significant((−) sig. with [GDP−GT], not sig. with [GDP−GT−IST]).
PC	GT	(−)
IP	GT	not significant.

note) PC : private consumption, IP : private investment,
GC : government consumption, GI : government investment,
GT : total gov. spending, GDP : gross domestic product.

The main empirical meaning of the results based on the analysis of annual data of 5 components of Korean real GDP − government consumption, government investment, private consumption, private investment, net export − can be summarized as follows :

1) There exists a significant positive relationship between government investment spending and private activities (i. e. private investment, private consumption, real GDP) which is consistent with the theoretical results.

2) The response of private investment and GDP to the change in government consumption expenditures is statistically insignificant, but increase in government consumption expenditure partially crowds out private consumption.

3) The response of private consumption, private investment and GDP to the change in total government spending is statistically insignificant, probably because the large share of consumption component in total government spending has a dominant effect on private spending.[7]

7) As another estimation results, Evans(1988) investigates whether a neoclassical model can explain output and investment using annual data during 1953−83 in Korea. The model disaggregates government purchases into defense purchases, nondefense consumption purchases and government investment and splits each of these into a permanent component and a transitory component. The OLS regressions reported permanent defense purchases multiplier 5.78, permanent nondefense purchases multiplier −0. 14, permanent government investment multiplier 5.62, transitory nondefense purchases multiplier −4.92, transitory government investment multiplier −1.24, budget dificit multiplier −1.23.

Ⅳ. Concluding Remarks

The above empirical results confirm the hypotheses of the Aschauer type models, and the results suggest that a model treating government expenditures as a single expenditure component is not adequate.

To capture the effect of some government expenditures on real output, it seems more appropriate to treat this kind of purchase as public capital that increases the marginal product of the private production process, as considered externalities between public capital and private capital.

Several limitations of this study may exist. First, this positive analysis should follow a more thorough assessment of the normative aspect further. Second, it is also desirable to analyze the policy effect when distinguishing between temporary and permanent change in government expenditures. Further research on these problems would be fruitful.

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〈國文要約〉

정부소비 및 정부투자지출의 경제적 효과에 관한 실증적 연구

金 誠 恂

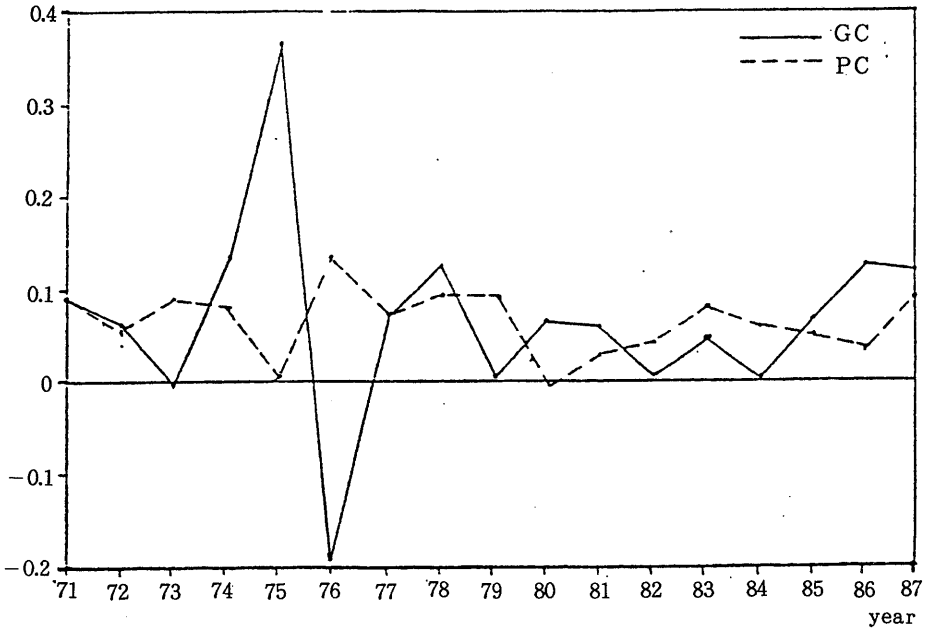
최근의 연구는 政府支出이 多樣한 機能을 발휘하여, 消費性支出은 民間消費를 代替하기도 하며, 投資性支出은 총생산물 공급증대를 가져오는 측면이 있다고 보고 있다. 이에 따라 정부지출의 이와같은 多樣한 要素가 민간경제에 미치는 效果分析을 실증적으로 시도하였다.

그 실증결과는 우리나라의 경우 政府投資支出이 민간투자활동을 부양하는 성향을 보이는 반면, 정부소비지출은 민간소비지출을 부분적으로 구축함을 나타내고 있다. 그러므로 이러한 結果는 국민소득모형상에서 政府支出을 單一支出要素로 취급하는 것이 적절치 않음을 示唆한다. 따라서 공공지출변화의 민간경제활동에 대한 영향을 분석함에 있어서, 정부투자지출은 민간생산과정상에서 限界生産을 增大시키는 公共資本으로, 그리고 정부소비지출은 民間消費에 대한 代替財로 구분하여 달리 취급하는 것이 보다 적절하리라 思料된다.

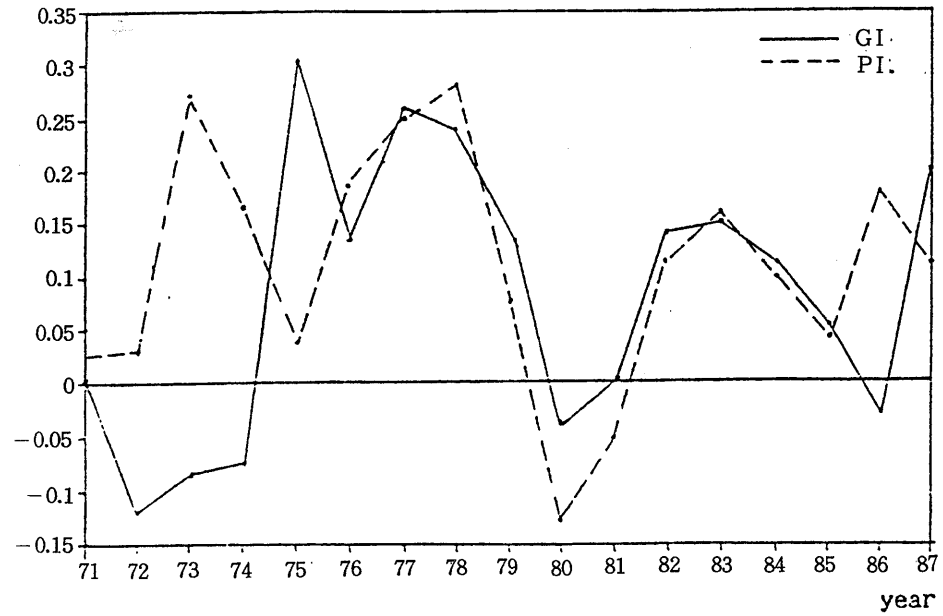
이 硏究分析의 意義는 우리나라의 경우 實證的으로 ① 政府支出이 民間經濟에 미치는 효과가 그 지출 내역에 따라 민간경제 各 部門에 미치는 效果가 相異함을 보였으며, ② 政府投資支出은 民間經濟活動을 浮揚하는 효과가 있는 반면, 政府消費支出은 민간경제활동을 驅逐하는 효과가 있다는 것을 보인 點 등을 들 수 있겠다.

〈GRAPHS AND TABLES〉

[Graph 1] Government and Private consumption Growth Rates



[Graph 2] Government and Private investment Growth Rates



〈Table 1〉 Effect of GC and GI on PC (OLS I)

eq.	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
const.	.55	.04	.06	.04	.06	.05	.07	.05	.49	.04
	(4.09)	(2.15)	(2.50)	(3.09)	(3.41)	(3.40)	(4.08)	(2.00)	(4.80)	(2.95)
GC_0	−.23	−.25	−.20				−.19	−.17	−.25	−.20
	(−3.77)*(−3.79)*(−2.18)"						(−2.31)^(−2.14)"(−4.19)*(−2.39)^			
GC_1								.11		
								(1.22)		
GI_0	.22	.22		.16	.16				.20	.18
	(3.08)^	(3.12)^		(2.55)^	(2.58)^				(3.06)^	(2.60)^
GI_1				.22	.24	.21				.07
				(3.99)*	(4.45)*	(3.10)^				(.86)
GC_{01}								−.06		
								(−.42)		
GI_{01}				.39	.40					.25
				(4.42)*	(4.81)*					(2.86)^
PC_1	−.15	−.12	.03	−.53	−.53	−.32	.02	.24		
	(−.73)	(−1.55)	(.12)	(−2.55)	(−2.87)	(−1.42)	(.07)	(.75)		
PC_2		.17	.07		−.25					
		(.84)	(.25)		(−1.44)					
D. W.	1.43	1.29	1.41	1.32	.98	1.48	1.44	1.58	1.81	1.72
R_2	.69	.72	.38	.71	.77	.51	.37	.46	.68	.70
Q	6.56	4.15	3.77	1.87	5.76	2.40	3.51	6.50	4.73	3.25
(S. l.)	.36	.66	.71	.93	.45	.88	.74	.37	.58	.78

Netes) The figures in parentheses are t−values.

" significant at 10% sig. level, ^ 5% s. l., * 1% s. l.

Subscript of each variable is no. of lags

GC : Gov'nt Consumption, GI : Gov'nt Investment,

PC : Private Consumption, PI : Private Investment.

〈Table 2〉 Effect of GC and GI on IP (OLS II)

eq.	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
const	.04	.04	−.01	.004	−.002	.03	.03	.09
	(0.74)	(.79)	(−.29)	(.07)	(−.03)	(.82)	(.14)	(2.22)
GC_0	.63			.52	−.11	−.34	−.17	
	(1.47)			(1.27)	(−.34)	(−1.38)	(−.46)	
GC_1							−.13	.23
							(−.51)	(.96)
GI_0	.93	.46	.70	.39	.64	.72	.66	
	(2.06)"	(1.55)	(2.19)"	(1.34)	(2.24)*	(2.69)*	(2.19)*	
GI_1		.44	.45	.92	.30		.30	
		(1.98)"	(1.70)	(2.13)"	(.95)		(.87)	
GC_{01}							−.30	
							(−59)	
GI_{01}		.90	1.15	1.30	.94		.95	
		(2.16)"	(2.43)*	(2.54)*	(2.65)*		(2.56)*	
IP_1	.17	.16	−.18	−.06				.70
	(.52)	(.51)	(−.55)	(−.18)				(2.73)
IP_2	−.77	−.48		−.63				−.66
	(−3.30)	(−2.15)		(−2.56)				
D. W.	1.19	1.29	1.42	1.39	1.59	1.72	1.70	1.59
R^2	.67	.68	.49	.74	.48	.43	.50	.52
Q	6.65	4.20	6.23	7.28	6.85	3.10	5.70	2.69
(s. l.)	.35	.65	.40	.30	.33	.79	.46	.84

Notes) The same as previous table

〈Table 3〉 Effect of GC and GI on IP (using dummy variables)

eq.	(a)′	(b)′	(e)′
const.	−.001	−.04	−.05
	(−.03)	(−1.49)	(−1.45)
GC_0	−.48		−.40
	(−2.84)*		(−1.85)**
GI_0	.92	.88	1.07
	(3.63)*	(5.59)*	(5.37)*
GI_1		.59	.21
		(5.47)*	(1.11)
GI_{01}		1.46	1.28
		(6.66)*	(5.65)*
IP_1	.23	−.06	
	(1.07)	(−.39)	
IP_2	−.23	−.38	
	(−1.32)	(−3.60)	
D2	.27	.24	.29
	(3.63)	(5.47)	(4.15)
D. W.	2.36	2.09	1.68
R^2	.85	.94	.84
Q	3.83	6.62	7.23
(s. l.)	.70	.36	.30

Notes) The same as above
D2 : 1986 year dummy variable

〈Table 4〉 Effect of GC and GI on GDP (OLS III)

eq.	(a)	(a′)	(b)	(c)
const.	.07	.06	.10	3.57
	(3.02)	(3.70)	(6.33)	(3.58)
GC_0	−.12	−.21	−.24	−.10
	(−1.21)	(−3.33)*	(−3.32)*	(−1.09)
GI_0	.27	.47		.21
	(2.03)**	(4.96)*		(1.96)**
GDP_1	−.28	−.43	.05	
	(−.82)	(−2.01)	(.29)	
D1			−.13	
			(−4.40)	
D2		.11	.05	
		(4.07)	(1.54)	
D. W.	1.63	1.99	1.97	2.15
R^2	.34	.78	.80	.29
Q	7.87	3.68	2.61	8.11
(s. l.)	.25	.72	.85	.23

Notes) The same as above
D1 : 1980 year dummy, D2 : 1986 year dummy
Dependent variable of (b) is [GDP−GT] term.
GT : total government spending

〈Table 5〉 Effect of GT on PC, IP, GDP (OLS IV)

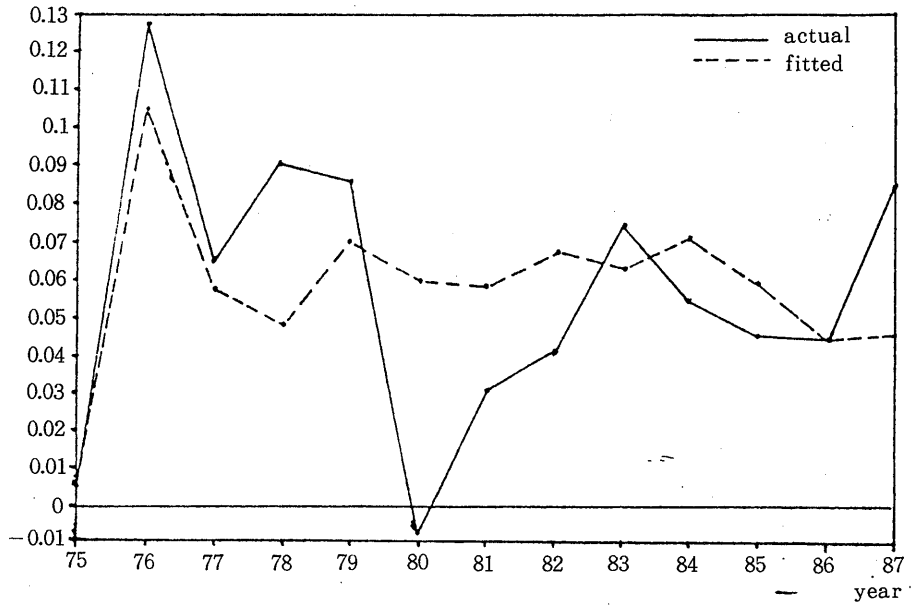
eq.	GDP_a	GDP_b	$\overset{\circ}{GDP1}_a$	$GDP1_b$	$GDP2_a$	$GDP2_b$	$\overset{\circ}{PC}$	IP_a	IP_b
const.	.07	.07	.10	.10	.08	.04	.07	.07	.06
	(3.21)	(2.49)	(6.58)	(3.39)	(2.97)	(1.29)	(4.91)	(1.49)	(1.16)
GT_0	.04	−.01	−.26	−.20	−.16	−.08	−.21	−.14	−.16
	(.34)	(−.11)	(−2.86)	(−1.30)	(−1.29)	(−.61)	(−2.68)	(−.42)	(−.46)
GT_1	.11					.22			
	(.86)					(1.54)			
GT_{01}	.16					.14			
	(.72)					(.61)			
X_1		.14	.07	.04	.23	.38	.23	.43	.48
		(.43)	(.41)	(.12)	(.84)	(1.38)	(.93)	(1.42)	(1.53)
D1			−.14				−.09		
			(−4.57)				(−3.07)		
D2									.10
									(.86)
D. W.	1.67	1.94	2.04	1.75	1.40	1.45	1.88	1.41	1.28
R^2	.07	.02	.70	.15	.18	.35	.61	.17	.23
Q	5.43	4.91	3.80	4.94	4.10	7.42	5.17	12.30	17.37
(s. l.)	.49	.55	.70	.55	.66	.28	.52	.06	.01

Notes) The same as above

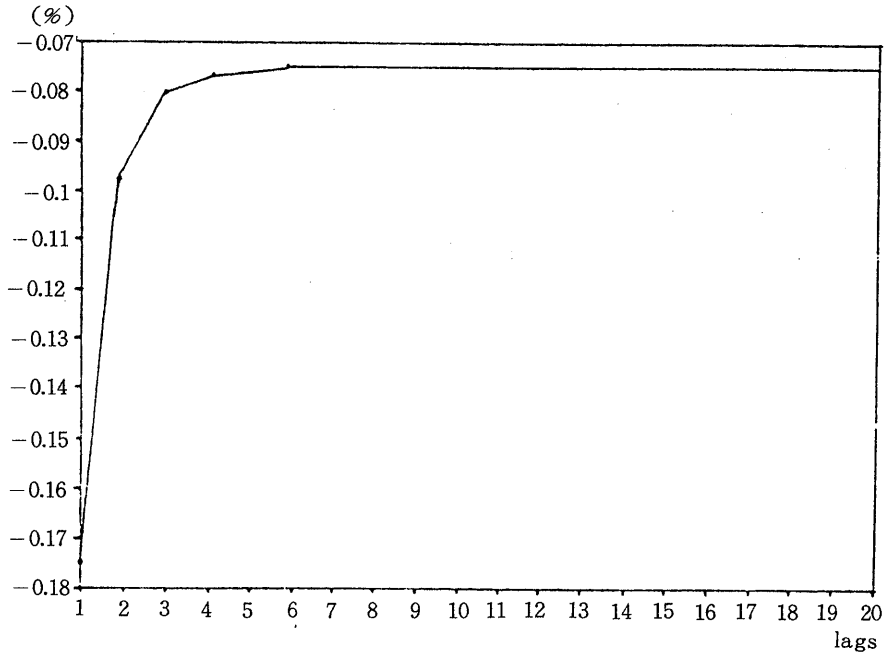
X : dependent variable of each equation

GDPI : [GDP−GT], GDP2 : [GDP−GT−Increase in stock]

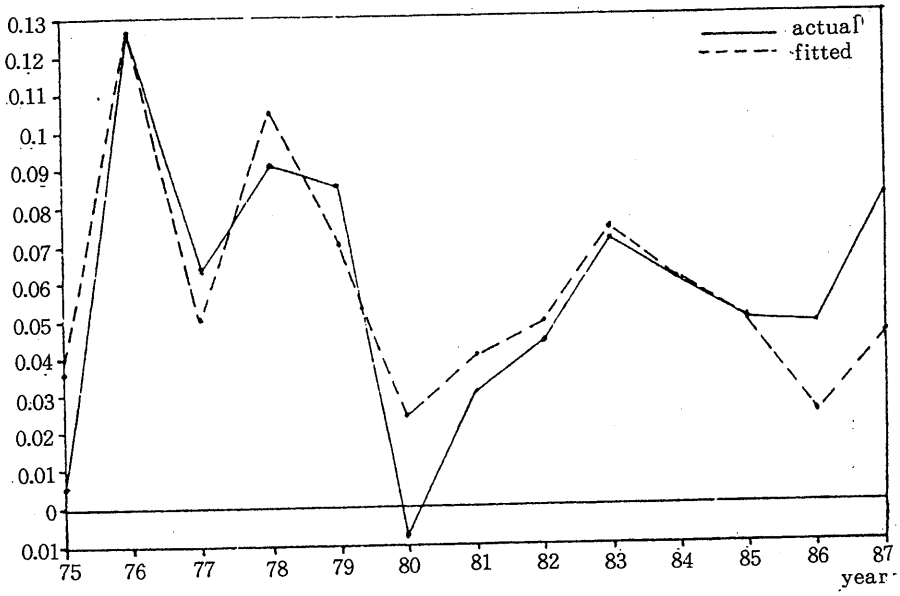
[Graph 3] Fitness of regression PC on GC(eq. (g) in ⟨T. 1⟩)



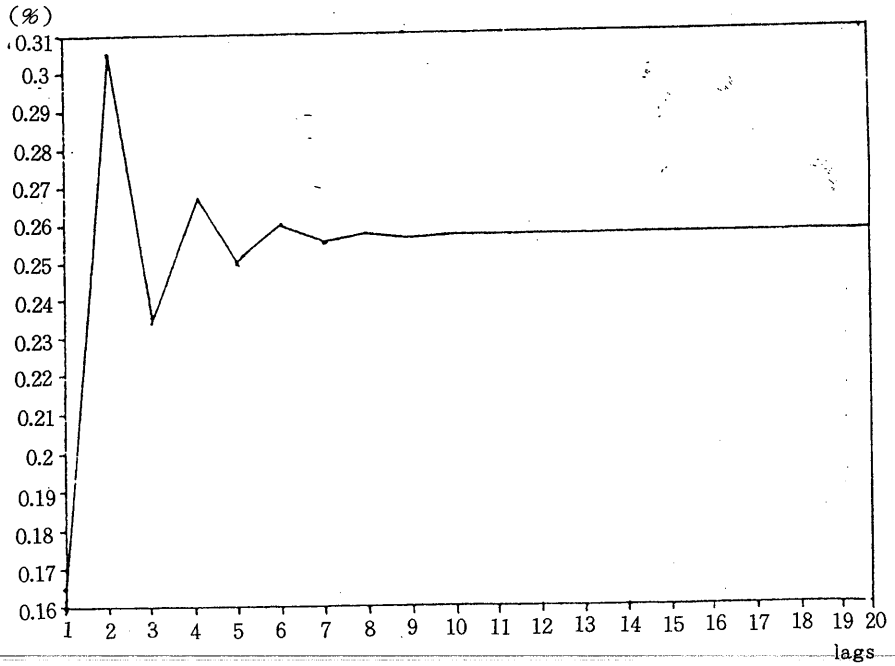
[Graph 4] Cumulative responses of PC to GC shock.



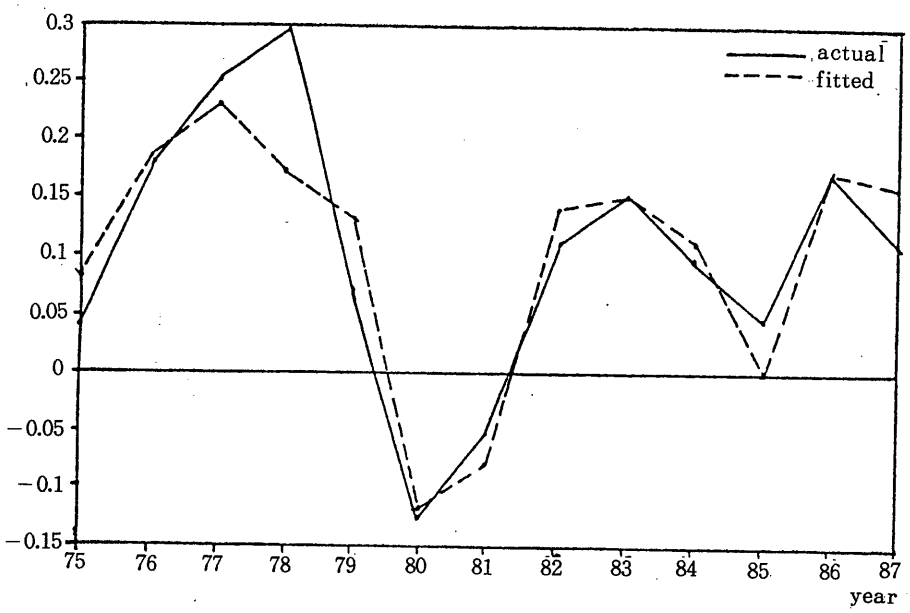
[Graph 5] Fitness of regression PC on GI (eq. (d) in <T. 1>)



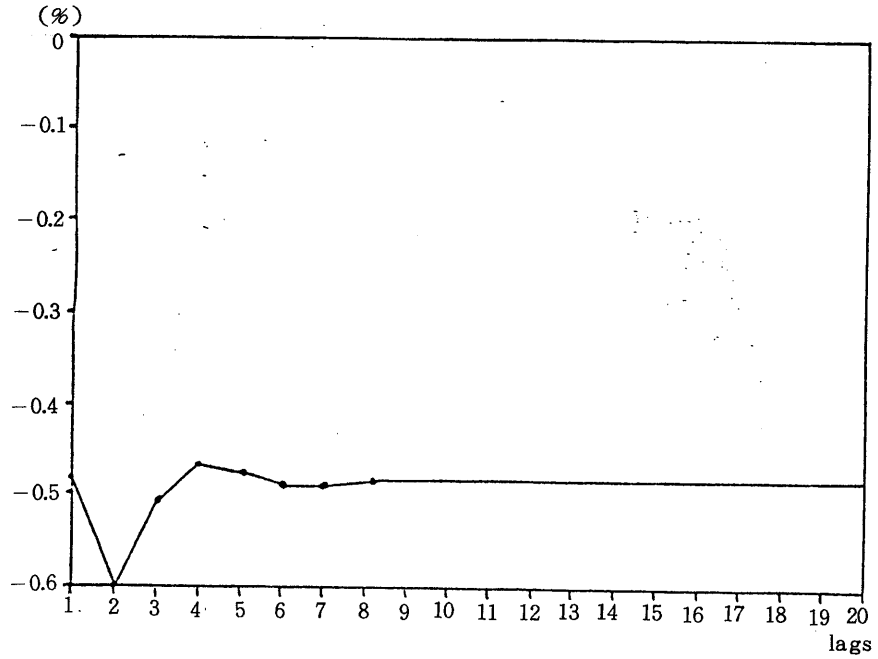
[Graph 6] Cumulative responses of PC to GI shock.



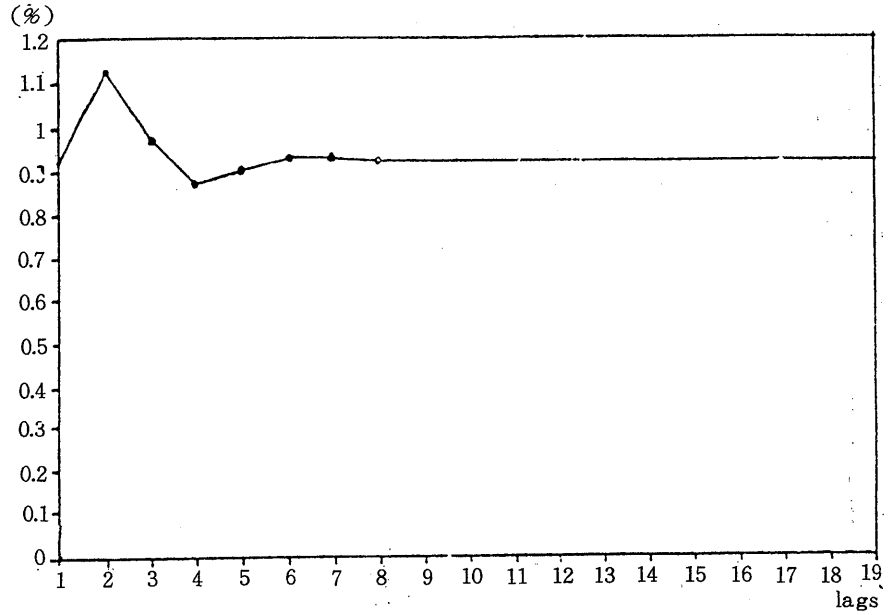
[Graph 7] Fitness of regression IP on GC, GI(eq. (a′) in T. 3)



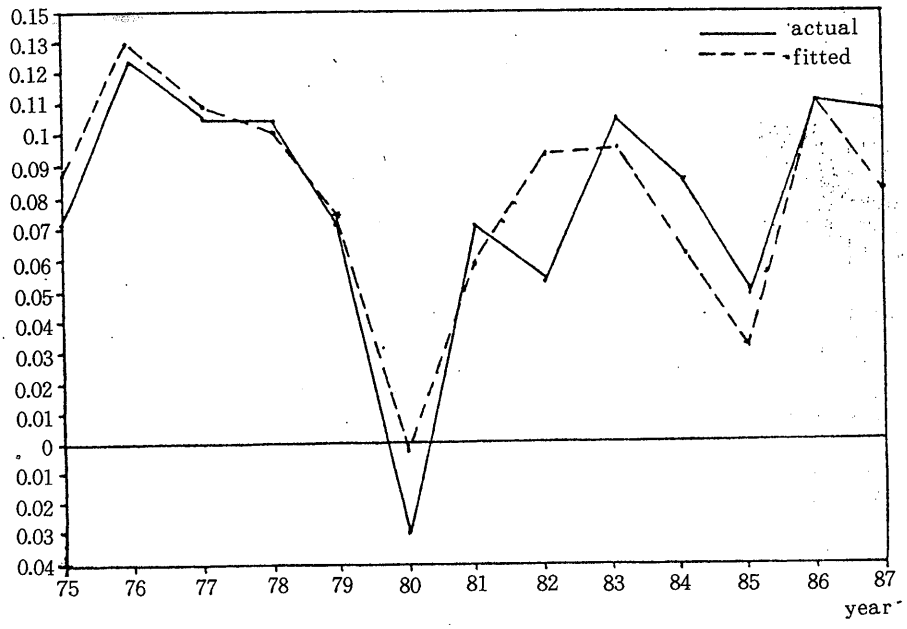
[Graph 8] Cumulative responses of IP to GC shock.



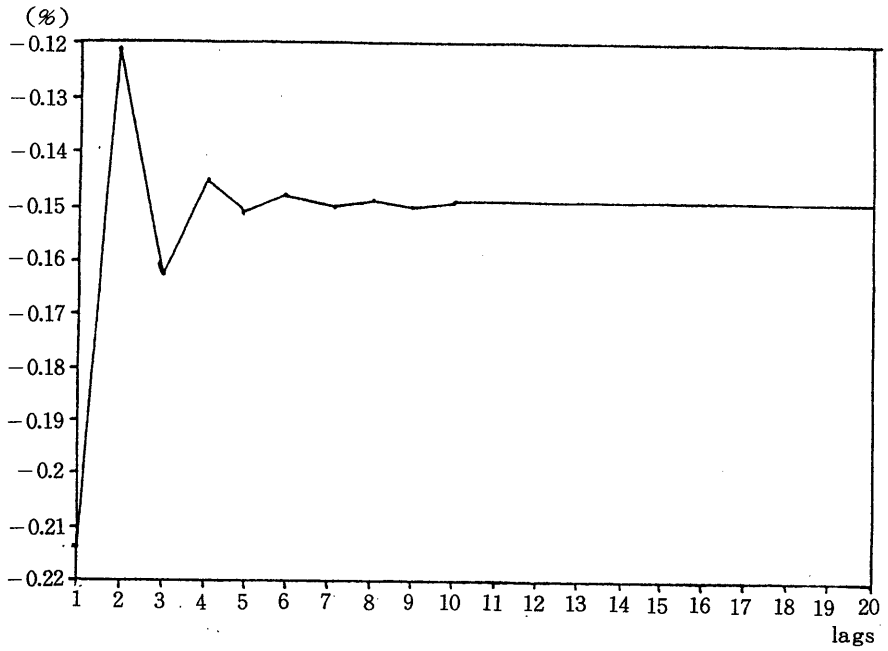
[Graph 9] Cumulative responses of IP to GI shock.



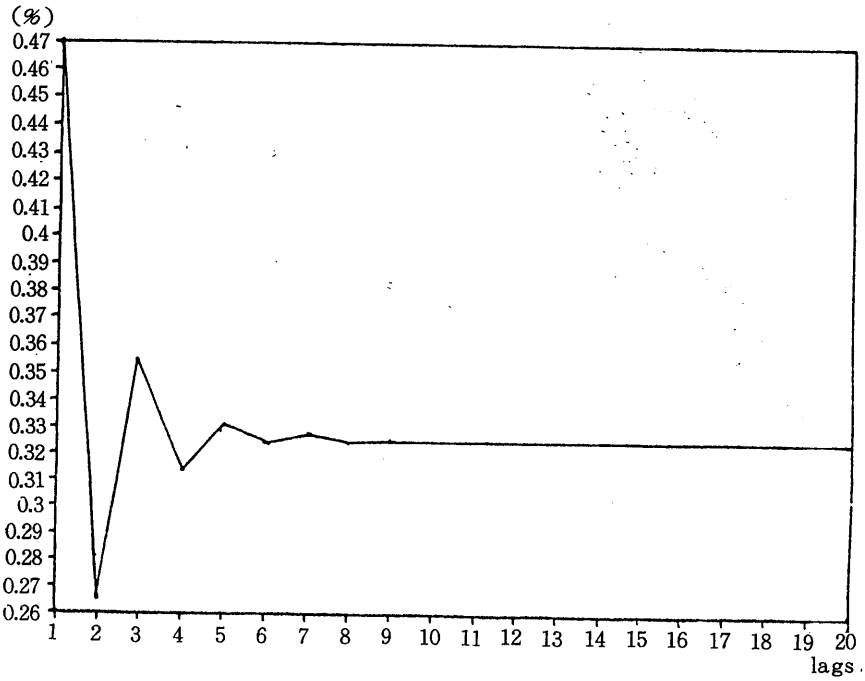
[Graph 10] Fitness of regression GDP on GC, GI (eq (a') in T. 4)



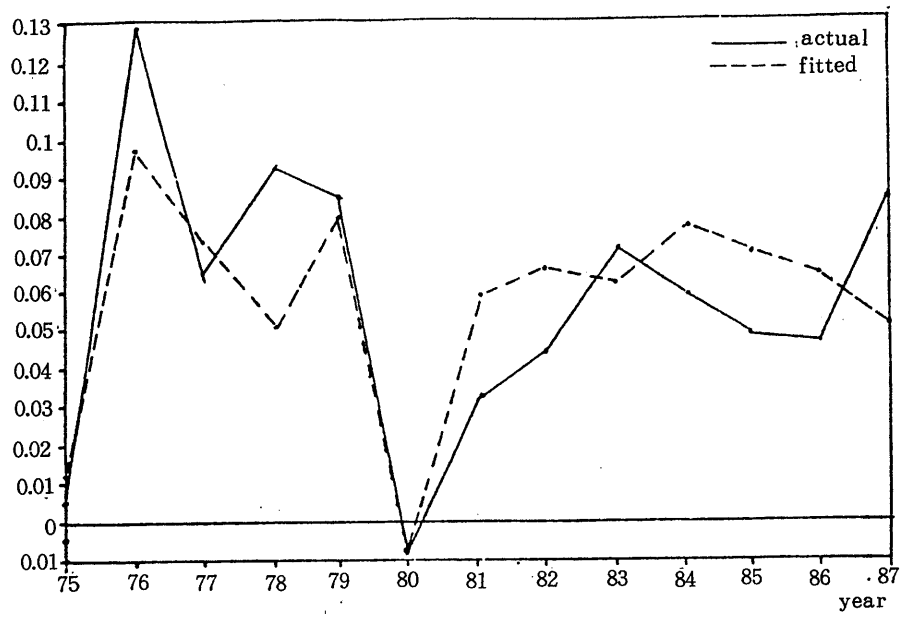
[Graph 11] Cumulative responses of GDP to GC shock.



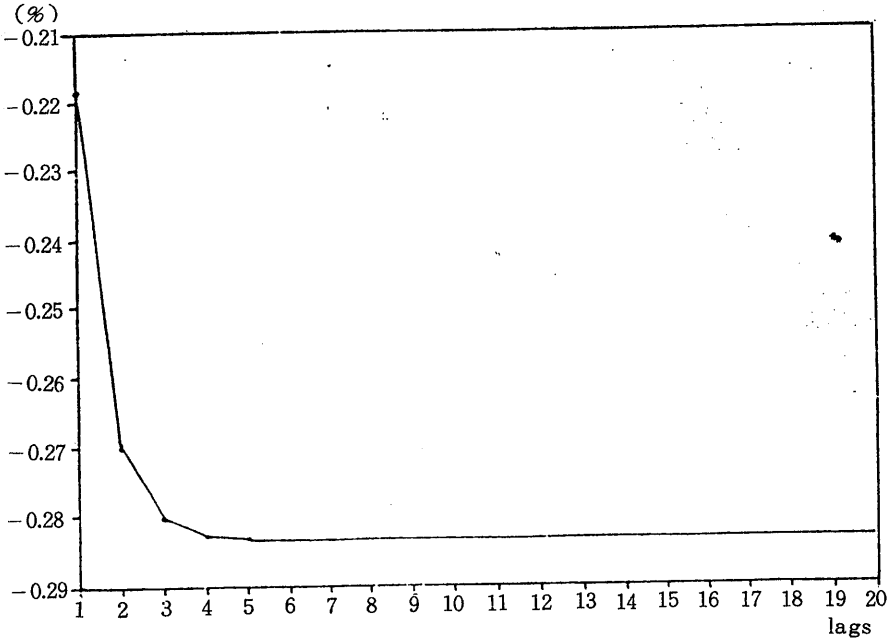
[Graph 12] Cumulative responses of GDP to GI shock.



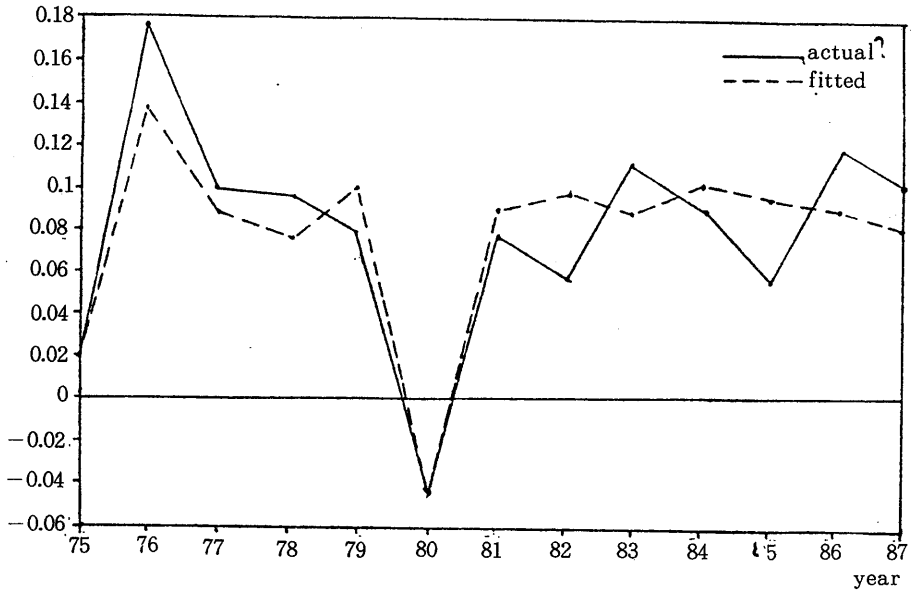
[Graph 13] Fitness of regression PC on GT(eq. PC in T. 5)



[Graph 14] Cumulative responses of PC to GT shock.



[Graph 15] Fitness of regression [GDP−GT] on GT(eq. GDP1$_a$ in T. 5)



[Graph 16] Cumulative responses of [GDP−GT] to GT shock.