Short-Run Forecast of Indonesian Economy*

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1. Introduction

In the year 1998, the Indonesian economy received three exogenous shocks, i.e. currency crisis transmitted from Thai Baht crisis, collapse of oil price, and damage of agricultural sector by abnormal rain-fall shortage, and recorded a big negative growth and a rapid inflation. The government of Indonesia (GOI) has engaged intensively in preparing the necessary social safety network, and also a short-term eleven months plan (January - November 1999) until the emer gence of new cabinet. The current important planning tasks are three: (1) to accurately describe the mechanism of big downfall, (2) to clarify the future possible growth potential, and (3) to assess the important political tasks base on these exercises.

This paper is a follow-up study of foregoing two discussion papers (Fukuchi-Tokunaga, 1998a and 1998b), and aims a short-term forecast of Indonesian economy. We prepared the monthly time-series data until June 1988 and estimated a monthly model. We made two-steps forecast: first until December 1998, and then until December 1999 after introducing some recently available information.

The structure of this paper is as follows. In section 2 we briefly describe the model specification and estimated result. In section 3 we explain the results of prediction until December 1999. Section 4 concludes the paper.

2. Model Estimation

We prepared the monthly data for January 1995 - December 1998, and estimated the monthly model with eleven equations based on these monthly data of 26 samples, February 1996 - June 1999. The equations were estimated by Direct Least Square Method. Most of the explaining variables are lagged, so the estimates are expected to be consistent.

The structure of the model is shown in the causal map. The former model in Fukuchi-Tokunaga (1998) based on the data (February 1996-December 1997), and contained 11 equations and explained private foreign capital movement, exchange rate, export, import and GDP. The current model utilized a longer data (February 1996-December 1998), and contains 26 endogenous variables. The main improvements are: (1) subdivision of GDP into agricultural, manufacturing and other sectors, (2) explanation of private consumption and investment, (3) definition of domestic and FDI capital stocks, (4) definition of capital balance and foreign currency reserve.

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List of Variable

Endogenous Variables (26):

RATE	: Exchange Rate	(Rupiahs per US dollar)
POTIN$	: Private Non-FDI Capital Inflow	(1 M dollars)
SUMI$	: Sum of Private Non-FDI Capital Inflow	(1 M dollars)
FOTOUT$	: Private Non-FDI Capital Outflow	(1 M dollars)
POTB$	: Net Private Non-FDI Capital Inflow	(1 M dollar)
SPOT$	: Stock of Private Non-FDI Capital	(1 M dollar)
PCAPB$	: Net Private Capital Inflow	(1 M dollars)
CAPB$	: Net Capital Inflow	(1 M dollars)
X$	: Dollar Value of Export	(1 M dollars)
IM$	: Dollar Value of Import	(1 M dollars)
TB$	: Commodity Trade Balance	(1 M dollars)
SERB$	:Service Trade Balance	(1 M dollars)
CA$	: Current Account	(1 M dollars)
TOTB$	: Overall Balance	(1 M dollars)
FR$	: Foreign Currency Reserve	(1 M dollars)
XR	: Rupiah Value of Real Export	(1 B Rupiahs)
IMR	:Rupiah Value of Real Import	(1 B Rupiahs)
CPR	:Private Consumption Expenditure	(1 B Rupiahs)
IR	: Investment Expenditure	(1 B Rupiahs)
JR	: Adjustment Term in GDP	(1 B Rupiahs)
GDPR	: Rupiah Value of Real GDP	(1 B Rupiahs)
GDPAGR	: GDP of Agricultural Sector	(1 B Rupiahs)
GDPMAR	: GDP of Manufacturing Sector	(1 B Rupiahs)
GDPOR	: GDP of Other Sector	(1 B Rupiahs)
K	: Fixed Capital Stock	(1 B Rupiahs)
KFDI	: Foreign Direct Investment Stock	(1 M dollars)

Exogenous Variables (19):

AT$	: Adjustment Term of Balance-of-Payment	(1 M dollar)
CGR	: Government Current Expenditure	(1 B Rupiahs)
CPI	: Consumers Price Index	(1990=100)
CPIT	: Consumers Price Index of Thailand	(1990=100)
CPIK	: Consumers Price Index of Korea	(1990=100)
CPIUS	: Consumers Price Index of the United States	(1990=100)
CPIJ	: Consumers Price Index of Japan	(1990=100)
ERO$	: Errors and Omissions in Overall Balance	(1 M dollars)
FDIB$	: Balance of Foreign Direct Investment	(1 M dollars)
INT	:Interest Rate	(per cent)

INTUS	: Interest Rate of United States	(per cent)
INTJ	: Interest Rate of Japan	(per cent)
OCAPB$	: Official Capital Balance	(1 M dollars)
RATET	: Exchange Rate of Thailand	(Bahts per US dollar)
RATEK	: Exchange Rate of Korea	(Wons per US dollar)
RATEJ	: Exchange Rate of Japan	(Yens per US dollar)
TIME	: Number of Month	(.....)
WEIGHTJ	: Ratio of Japan to USA in Export Share	(.....)
WPI	: Wholesale Price Index	(1990=100)

Short-Term Monthly Model of Indonesian Economy (February 1996 - June 1998)

(E-1) Exchange Rate (RATE)

(RATE)/(CPI)*(CPIUS)=-107.117+ 1101.8*(ER1) - 0.54139*(CAPB$(-2))

(-0.16) (4.18) (-4.93)

-14.59*((INT) - (INT)(-1)) - 1127*D15 + u

(-1.05) (-5.48)

(ER1) = ((RATET)/(CPIT) + (RATEK)/(CPIK))/2

R^2=0.9567, RA^2=0.9014, R=0.9781, RA=0.9494, S=282.71, d =2.24

(E-2) Private Non-FDI Capital Inflow (POTIN$)

(POTIN$)= 12221.2-43.47*(RATE/CPI)(-1) + 0.2626*(TOT$)(-3)

(6.50) (-2.27) (4.26)

-469.0*((RATET/CPIT) - 1526*(INTUS)(-3) + 978.8*D13-1891*D14+u

(-1.41) (-4.27) (8.56) (-9.21)

R^2=0.9548, RA^2=0.8883, R=0.9771, RA=0.9425, S=259.96, d =1.63

(E-3) Sum of Private Non-FDI Capital Inflow (SUMI$)

(SUMI$) = POTIN$(-6) + POTIN$(-7) + POTIN$(-8) + POTIN$(-9) +

POTIN$(-10) + POTIN$(-11) + POTIN$(-12)

(E-4) Private Non-FDI Capital Outflow (POTOUT$)

(POTOUT$)=(-)11.34 - 15.59*((RATE)/(CPI))(-3) + 0.1443*(SUMI$)+

(-0.04) (-3.52) (10.27)

14.92*((INTUS)-(INTUS(-1))+844.8*D12 + u

(1.99) (7.15)

R^2=0.9133, RA^2=0.8079, R=0.9557, RA=0.8988, S=157.83, d = 0.41

(E-5) Net Private Non-FDI Capital Inflow (POTB$)

(POTB$) = (PFIN$) - (FOUT$)

(E-6) Outstanding Stock of Private Non-FDI Capital (SPOT$)

(SPOT$) = (SPOT$)(-1) + (POTB$)

(E-7) Net Private Capital Balance (PCAPB$)

(PCAPB$) = (POTB$) + (FDI$)

(E-8) Net Capital Balance (CAPB$)

(CAPB$) = (PCAPB$) + (OCAPB$)

(E-9) Rupiah Value of Export (XR)

(XR) = (-)3662.62 + 19882*((RATE)/(WPI)/(ER2))(-1) + 0.1354*(GDP(-1))

(-1.78) (1.16) (2.10)

+ 0.2677*(IMR(-1)) + 0.5211*(XR(-1)) + u

(3.21) (3.70)

R^2=0.9185, RA^2=0.8189, R=0.9584, RA=0.9049, S=429.49, d = 0.88

(ER2) = ((1/(CPIUS) + (WEIGHTJ)*(RATEJ)/(CPIJ))

(E-10) Dollar Value of Export (X$)

LOG((X$)/(XR))= 0.1425- 0.1197*LOG(RATE) - 0.1242*D1+ 0.4482*D2

(0.82) (-5.58) (-4.97) (7.24)

- 0.2636*D3 + u

(-4.56)

R^2=0.8692, RA^2=0.7180, R=0.9323, RA=0.8474, S=0.0519, d = 0.93

(E-11) Rupiah Value of Import (IMR)

(IMR)/(GDP)(-1) = 0.0203 + 3.325E-06*(FR$)(-6) + 0.9061*(IMR(-1)/GDP(-2))

(0.67) (1.47) (8.28)

- 4.309E-03*((RATE)/(WPI))(-1) + u

(-3.52)

R^2=0.8318, RA^2=0.6588, R=0.9121, RA=0.8117, S=0.0201, d = 1.26

(E-12) Dollar Value of Import (IM$)

LOG(IM$/IMR)=1.2831 - 0.3022*LOG(RATE) - 0.4422* D3542

(8.04) (2.30) (-10.80)

- 0.2538*D3436 - 0.1468*D3341 + u

(-6.26) (-5.57)

R^2=0.9477, RA^2=0.8818, R=0.9735, RA=0.9390, S=0.0547, d = 1.94

(E-13) Definition of Trade Balance (TB$)

(TB$) = (X$) - (IM$)

(E-14) Dollar Value Service Trade Balance (SERB$)

(SERB$) = -233.95 - 14.32E-04*(SPCAP$)*(INTUS)(-1)

(-1.02) (-4.51)

-0.04121*((X$)+(IM$))- 10.79*((RATE)/(CPI)(-1)

(-1.48) (-4.48)

-260.48*D9 + 169.22*D10 + u

(-11.53) (3.63)

R^2=0.8737, RA^2=0.7161, R=0.9347, RA=0.8462, S=57.34, d = 2.11

(E-15) Definition of Current Balance (CA$)

(CA$) = (TB$) + (SERB$)

(E-16) Definition of Total Balance (TOTB$)

(TOTB$) = (CA$) + (CAPB$) + (ERO$)

(E-17) Definition of Foreign Currency Reserve (FR$)

(FR$)=(FR$)(-1)+(TOTB$)+(AT$)

(E-18) Definition of Rupiah Value of Real GDP (GDPR)

(GDPR)=(GDPSGR) + (GDPMAR) + (GDPOR)

(E-19) Rupiah Value of GDP of Agricultural Sector (GDPAGR)

(GDPAGR) =2301.32 + 0.7430*(GDPAGR)(-1) - 198.71*D16 + u

(2.32) (6.44) (-2.03)

R^2=0.6500, RA^2=0.3882, R=0.8062, RA=0.6230, S=262.30, d = 0.75

(E-20) Rupiah Value of GDP of Manufacturing Sector (GDPMAR)

(GDPMAR)/(K)(-1) =0.08373 + 1.6209E-06*(IMR)(-1) + 0.3157E-04*

(7.14) (2.79) (1.28)

(KFDI)/(K))(-1) - 93.82*(RATE) /(RATE)(-1) - 12.75*(TIME)

(-2.16) (-7.84)

- 43.63*D17 - 82.43*D18 + u

(-1.11) (-3.31)

R^2=0.9394, RA^2=0.8517, R=0.9692, RA=0.9229, S=0.0039, d = 0.80

(E-21) Rupiah Value of GDP of Other Sector (GDPOR)

$$(GDPO)/(K)(-1) = 0.08263 + 0.5706*((KFDI)/(K))(-1) + 0.06682*$$
$$(5.27) \quad (4.77) \quad (11.10)$$
$$(STCAP\$)(-1) - 16.08*(TIME) + u$$
$$(-8.46)$$

R^2=0.9940, RA^2=0.9867, R=0.9970, RA=0.9933, S=0.0025, d = 0.64

(E-22) Private Consumption Expenditure (CPR)

$$(CPR)=-213.33+0.1347*(GDP)(-1) +8491*(CPI)(-1)/(CPI)(-2)$$
$$(-0.06)\ (2.27) \quad (2.49)$$
$$113.0*(INT)(-5)+0.1516*(IMR)(-6)+0.4134*(CPR)(-1)+u$$
$$(-2.98) \quad (3.13) \quad (3.49)$$

R^2=0.8791, RA^2=0.7274, R=0.9376, RA=0.8529, S=278.82, d = 1.60

(E-23) Investment Expenditure (IR)

$$(IR)=-14862+0.7841*(GDP)(-1)-16.21*(INT)(-1)-0.02260*(K)(-2)$$
$$(-7.36)(11.36) \quad (-1.85) \quad (-3.85)$$
$$+0.1226*(IMR)(-7)+u$$
$$(1.75)$$

R^2=0.9352, RA^2=0.8545, R=0.9670, RA=0.9244, S=498.83, d = 0.88

(E-24) Definition of Rupiah Value of Adjustment Term (JR)

$$(JR) = (GDPR) - (CPR) - (CGR) - (IR) - (XR) + (IMR)$$

(E-25) Definition of Fixed Capital Stock (K)

$$(K) = (1-0.005)*(K)(-1) + (IR)$$

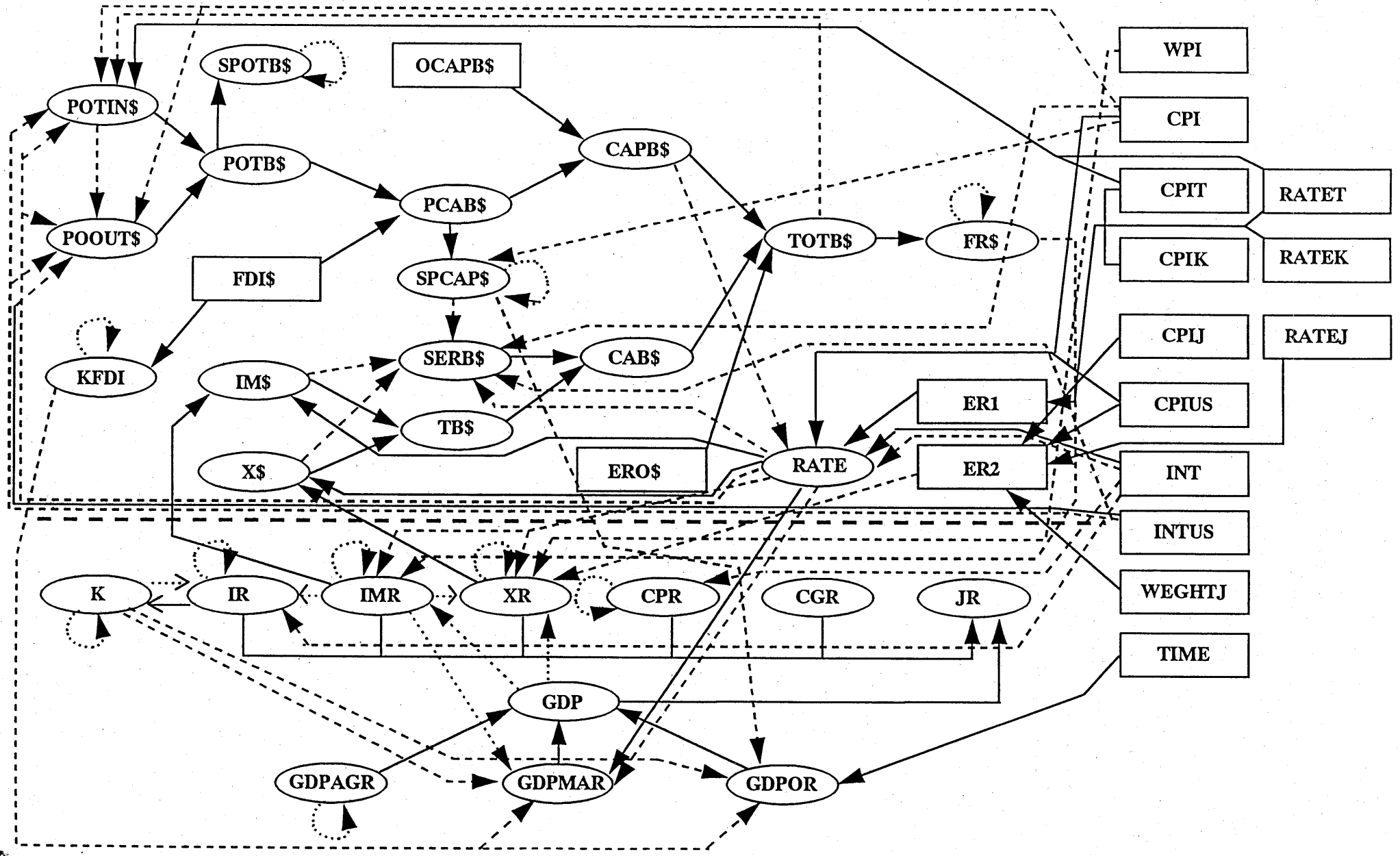
(E-26) Foreign Direct Investment Stock (KFDI)

$$(KFDI)/(K))(-1) - 93.82*(RATE)\ /(RATE)(-1) - 12.75*(TIME)$$
$$(-2.16) \quad (-7.84)$$
$$- 43.63*D17 - 82.43*D18 + u$$
$$(-1.11) \quad (-3.31)$$

R^2=0.9047, RA^2=0.7900, R=0.9512, RA=0.8888, S=0.0031, d = 1.07

(Note) R(RA) shows the multiple correlation coefficient before (after) thecorrection of degree of freedom. S shows the standard deviation of equationerror. d shows Durbin-Watson statistic. Number in parenthesis is t-value.

Figure 1. **Causal Map of Indonesian Model**



Final test (July 1997-June 1998) and revisions.

Because the main purpose is the short-term projection, we implemented the final test for July 1997 to June 1998. The results are compiled in Table 1 in the form of percent error (MAPE, %) for the final five period (February -June, 1998) and last three periods (April-June 1998)(column 1and 2). We found relatively big errors for capital transaction and total balance. Because these variables were tentative estimates for April-June 1998, we renewedtheinformationandused next values.

	FIN$	FOUT$	TOT$
April,1988	(-)376	0	(-)4469
May,1988	(-)847	144	(-)1273
June,1988	105	(-)303	¥98

After that, we repeated the final test, and the corresponding MAPEs are reported at columns 3 and 4. We confirmed that MAPE for final three periods are controlled less than 10 per cent, and applied this version for projection until December 1998.

3. Short-term Forecast until December 1999.

Projection until December 1998. The data of many exogenous variables are available until November 1999 including the price levels, interest rates and exchange rates in Indonesia, Thailand, Korea, U.S.A and Japan. The foreign currency reserve in December 1998 is known (US$ 13,827 M). So, international balances are preassumed so that the resulted foreign currency reserve would coincide with this actual value. The resulted rate of real GDP growth is preassumed as roughly (-) 14 %. Under these premises, we projected the values of variables until December 1998.9

Table. 1. List of MAPE(%) in the final test.

Name	(1) 5 periods	(2) 3 periods	(3) 5 periods	(4) 3 periods
CPR	1.84	2.49	1.84	2.49
IR	5.09	4.26	5.09	4.26
XR	5.81	3.60	5.81	3.60
IMR	8.47	8.25	8.47	8.25
GDPAG	2.16	3.03	2.16	3.03
GDPMA	4.47	4.89	4.47	4.89
GDPO	2.31	1.74	2.31	1.74
GDP	1.31	0.69	1.31	0.69
X$	6.68	3.85	6.68	3.85
IM$	9.45	8.38	9.45	8.38
POTIN$	79.40	106.03	15.84	0.10
POTOUT$	2.70	0.60	2.70	0.60
SPOTH$	4.44	5.62	4.44	5.62
FR$	32.51	32.13	13.60	0.60
SUMIN$	0.46	0.56	0.46	0.56
RATE	9.80	9.55	9.80	9.55
K	1.84	1.67	1.84	1.67

Table 2. Result of Forecast Until December 1999

NAME	X(Dec,1997)	X(Dec,1998)	X(Dec,1999)	SUM(1997)	SUM(1998)	SUM(1999)
(GDP)						
GDP14	35537.25	28588.13	30097.31	433685.99	372987.57	355853.04
CPR14	23610.41	11282.11	11048.48	273592.00	230132.05	128262.28
CGR14	2742.43	2499.00	2499.00	31700.99	29325.01	29988.00
IR14	10676.23	5085.81	6104.57	134034.00	80255.48	64852.93
XR14	12479.90	7143.63	7899.79	121510.00	110109.66	84931.56
IMR14	14783.32	5443.86	8765.29	144030.99	91287.23	77513.44
GDPAG	7983.73	7261.88	8530.14	102331.00	97464.04	99137.81
GDPMA	9458.31	7355.10	7409.76	108632.00	93727.45	88566.44
GDPO	18095.20	13971.15	14157.41	222722.99	181797.08	168148.79
X$	4704.00	2789.86	3094.31	53551.00	42488.61	33387.63
IM$	3178.00	1275.64	2069.35	41681.00	20809.83	18463.15
TB$	1526.00	1514.21	1024.96	11870.00	21678.79	14924.48
SERB$	-1102.15	-660.28	-672.64	-14964.00	-12251.00	-7752.90
CA$	423.85	853.93	352.32	-3094.00	9427.79	7171.58
CAPB$	-1892.42	176.00	876.00	4756.00	-7657.00	10512.00
TOTB$	-1488.00	-382.00	1017.32	-1664.00	-2760.00	15151.58
FR$	16587.00	13827.00	28978.58	229711.00	187592.00	269705.94
RATE	4909.00	8483.24	8276.11	34934.00	112880.65	96391.20
(CAPITAL STOCK & PRICE)						
K	160413.32	132438.65	110927.71	1795495.59	1775861.24	1417886.87
KFDI	5734.80	2975.88	4036.68	83003.48	44856.43	43380.76
CPI	211.62	376.16	423.87	2378.60	3822.26	4818.38

NAME	X(Dec,97/96)	X(Dec,98/97)	X(Dec,99/98)	GR(98,%)	GR(99,%)	GR(1-11,99)
(GDP)						
GDP14	-0.9195	-19.5545	5.2790	-13.9959	-4.5939	-4.7234
CPR14	5.3688	-52.2155	-2.0708	-15.8849	-44.2658	-44.4364
CGR14	-2.3248	-8.8766	0.0000	-7.4950	2.2608	2.2608
IR14	-4.8766	-52.3632	20.0313	-40.1230	-19.1919	-20.1436
XR14	31.9692	-42.7589	10.5851	-9.3822	-22.8664	-23.6809
IMR14	46.2581	-63.1757	61.0125	-36.6197	-15.0884	-17.8440
GDPAG	0.2273	-9.0415	17.4646	-4.7561	1.7173	1.4166
GDPMA	-0.1184	-22.2367	0.7432	-13.7202	-5.5064	-5.5404
GDPO	-1.8267	-22.7908	1.3332	-18.3753	-7.5074	-7.5944
(TRADE)						
X$	0.4699	-40.6918	10.9128	-20.6577	-21.4198	-22.2209
IM$	-16.9367	-59.8602	62.2201	-50.0736	-11.2768	-14.0591
TB$	78.2710	-0.7724	-32.3108	82.6351	-31.1563	-30.0555
SERB$	-5.0858	-40.0919	1.8719	-18.1302	-36.7162	-36.9527
CA$	-238.8704	101.4722	-58.7416	-404.7116	-23.9314	-21.0929
CAPB$	-240.6700	-109.3003	397.7273	-260.9966	-237.2861	-237.2861
TOTB$	-211.2939	-74.3280	-366.3139	65.8654	-648.9704	-658.6666
FR$	-9.1173	-16.6395	109.5797	-18.3356	43.7726	39.9909
RATE	106.0008	72.8100	-2.4417	223.1255	-14.6079	-14.8432
(CAPITAL STOCK & PRICE)						
K	21.1306	-17.4391	-16.2422	-1.0935	-20.1578	-19.7137
KFDI	-4.8909	-48.1084	35.6467	-45.9584	-3.2898	-4.3151
CPI	11.6022	77.7535	12.6825	60.6936	26.0611	25.4236

Table 3. Monthly Forecast of Indonesia (Until December 1999)

Name	Period	GDP	Growth Rate(%)
(Monthly Forecast)			
GDP14	98.07	33407.2347	14.7508
GDP14	98.08	31328.2711	-6.2231
GDP14	98.09	31610.3195	0.9003
GDP14	98.10	30126.0416	-4.6955
GDP14	98.11	29656.5619	-1.5584
GDP14	98.12	28588.1286	-3.6027
GDP14	99.01	29945.7860	4.7490
GDP14	99.02	29501.9155	-1.4822
GDP14	99.03	29476.9161	-0.0847
GDP14	99.04	29311.6619	-0.5606
GDP14	99.05	29611.4260	1.0227
GDP14	99.06	29453.5258	-0.5332
GDP14	99.07	29523.3294	0.2370
GDP14	99.08	29571.8089	0.1642
GDP14	99.09	29670.3482	0.3332
GDP14	99.10	29770.2374	0.3367
GDP14	99.11	29918.7769	0.4990
GDP14	99.12	30097.3090	0.5967
(Quarterly Forecast)			
GDP14	98.1Q	98337.0085	-10.1453
GDP14	98.2Q	89934.0000	-8.5451
GDP14	98.3Q	96345.8253	7.1295
GDP14	98.4Q	88370.7322	-8.2776
GDP14	99.1Q	88924.6177	0.6268
GDP14	99.2Q	88376.6137	-0.6163
GDP14	99.3Q	88765.4866	0.4400
GDP14	99.4Q	89786.3232	1.1500
(Semi-annaul Forecast)			
GDP14	98.1-6	188271.0085	-14.0982
GDP14	98.7-12	184716.5575	-1.8879
GDP14	99.1-6	177301.2314	-4.0144
GDP14	99.7-12	178551.8098	0.7053
(Annaul Forecast)			
GDP14	1998	372987.5660	-13.9959
GDP14	1999	355853.0412	-4.5939

(Note) GDP14 only implies that it's data compilation based on 14 quarterly periods.

Figure 2. Almost Complete Recovery: Monthly GDP Level Would Come Back to 1997 December Level.

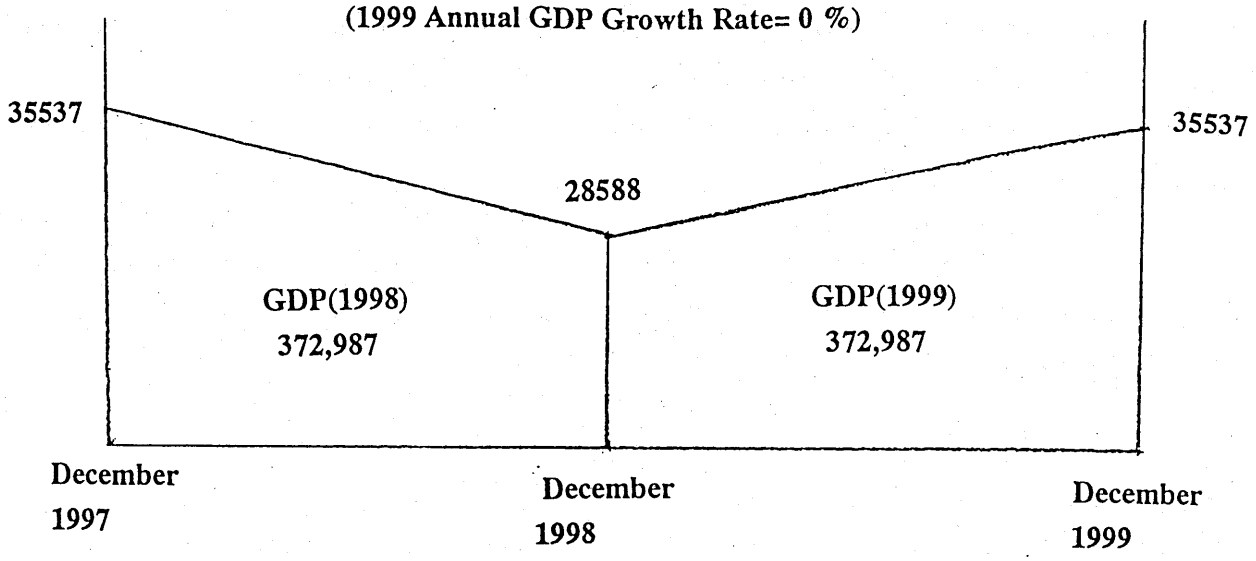


Figure.2. Complete Stagnation: Monthly GDP Level Would be Constant Through January-December 1999.

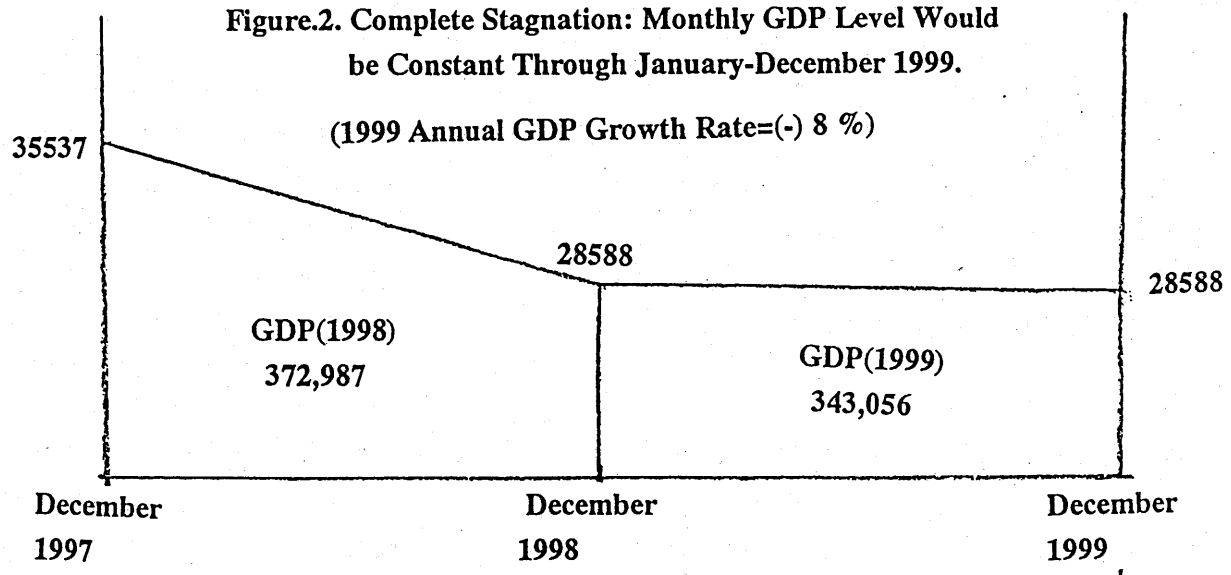
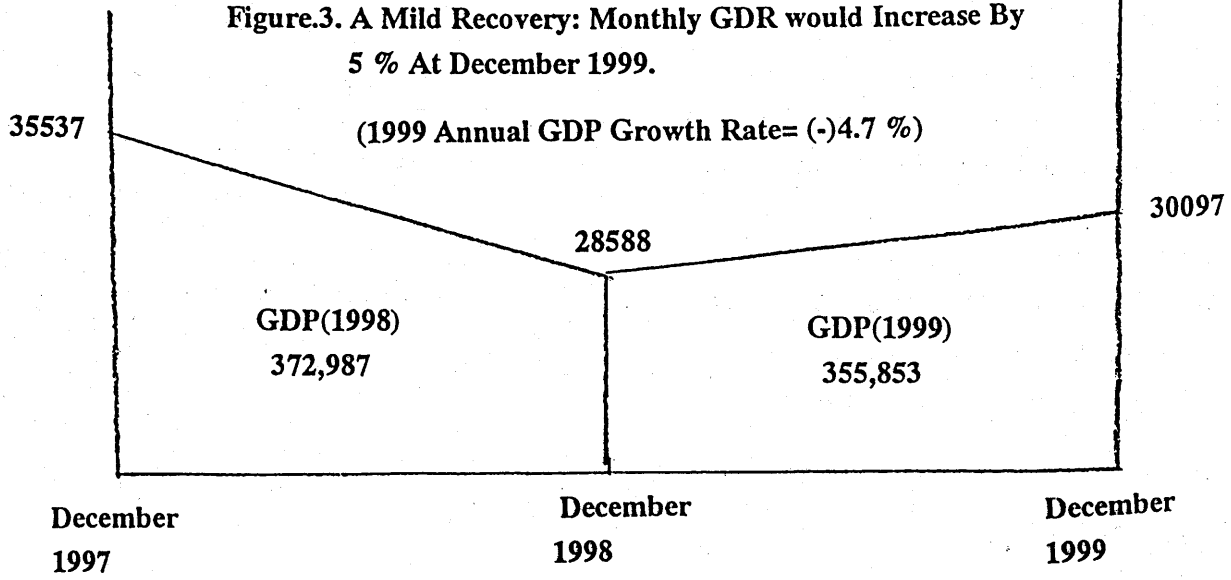


Figure.3. A Mild Recovery: Monthly GDR would Increase By 5 % At December 1999.



Projection until December 1999. We fixed some conditions: (a) government consumption expenditure is maintained as constant, (b) rate of inflation (CPI, WPI) is monthly one percent, (c) real exchange rate of Thailand, Korea and Japan remain as constant, (d) interest rates are held constant, (e) net official transaction balance increases to US$ 12.20 B, (f) non-FDI private capital inflow and outflow are US$ 3.39 B and US$ 9.83 B, respectively.

Table 2 summarizes the results of two-steps projection of main endogenous variables until December 1998 and December 1999, and records the annual sum of 1997, 1998 and 1999, growth rates in 1997,1998 and 1999, and the ratios between December of 1997, 1998 and 1999. As a reference to the eleven months plan, we also calculated the growth rate in January-November 1999. Table 3 shows the forecasts on monthly, quarterly and annual basis. The result of forecasts is also shown in Figure 2.

(1)The annual growth rate of GDP is (-) 4.72%, while the level of monthly GDP in December 1999 will be 5.27% higher than December 1998.
(2)The private consumption in December 1999 will be 2% less than the level of December 1998, so it largely decreases on the annual basis.
(3)The monthly investment expenditure will recover by 20% between December 1998 and December 1999, but it decrease by 20% on annual basis.
(4)The export on dollar and Rupiah terms increase by 10% between December 1998 and December 1999, but largely decreases on annual basis.
(5)The import on dollar and Rupiah terms will largely recover through 1999, but the annual change will be (-) 14-17%.
(6)The trade surplus will be around US$ 15 B.
(7)The current balance will be around US$ 7 B.
(8)The foreign currency reserve will recover quickly.
(9)The national capital stock will deteriorate further. The FDI stock will mildly recover, but it's level will still be far bellow than the level of December 1997.

4. Conclusion

We constructed a monthly model based on the data of February 1997-June 1998, and tried a two-steps projection until December 1998 and December 1999. In a sense each projection is a within-sample and out-of-sample projection. We showed a scenario of a mild recovery through the year 1999. An interesting observation is that the annual growth rates of many variables are still negative while each of them actually has showed a mild recovery. As a whole, this modeling exercise confirmed the usefulness of short-term policy modeling even in a very unstable period of Indonesian economy. The monthly model is expected to serve for many useful conditional forecasts to assess the impacts of alternative policy measures.

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