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A Small Macro-Econometric Model

Bijan Bidabad
B.A., M.Sc., Ph.D., Post-Doc.
Professor
Economics and Chief Islamic Banking Advisor
Bank Melli, Iran
E-mail:bijan@bidabad.com

Abstract

Different sizes of macro-econometric models are used for different policy purposes. In this paper, we introduce a small macro-econometric model that includes macro-aggregates variables that can be solved dynamically and be used as a sample model to be estimated for other countries.

Keywords: Macro-Econometric, Econometric Model, Mathematical Model.

1. Introduction

The largest-scale macro-econometric model for Iran performed by the author is a high detailed model, and working with it is more cumbersome for those who need a general forecast scheme for major macro-variables. Indeed this model is used to draw a simple working scheme to fulfill general view's needs. In addition to its simplicity, this model substantially has a good performance. This model compromises the fiscal position of the government; a well understood transmission mechanism between monetary aggregates, price level, production, and balance of payments.

2. The Model

A very simple monetary model is presented according to the monetarist's view. The following flow chart presents the relationship between the main variables of the model. As it is seen, the liquidity is decomposed to the net domestic assets and net foreign assets of the banking system. The net foreign asset component is affected by the official exchange rate and the balance of payments. The net domestic assets consist of three components: private sector debt to the banking system, government debt to the banking system, and net of other assets. The private sector debt to the banking system is affected by gross domestic product (GDP). The government debt to the banking system is influenced by the government budget deficit and foreign exchange obligations account. The price level is defined as a function of liquidity. Change in GDP is affected by the balance of payments. The estimated results are presented in the following section. The econometric model was estimated by OLS technique. The sample period covers 1960-2001. To avoid integration problem, all level variables are used in their first differences.

2.1 Variables:

M2NFAE = Net foreign assets of the banking system (in billion dollars)

M2NGV = Net government debt to the banking system (in billion Rials)

M2LPV = Net Private sector debt to the banking system (in billion Rials)

M2NW = Other assets of the banking system (in billion Rials)

OBD = Government budget deficit (in billion Rials)

BOP = Balance of payments (million dollars)

GDPV = Nominal GDP (in billion Rials)

GDP = Gross Domestic Production at fixed prices of 1982 (in billion Rials)

PGDP = GDP deflator (base year=1982)

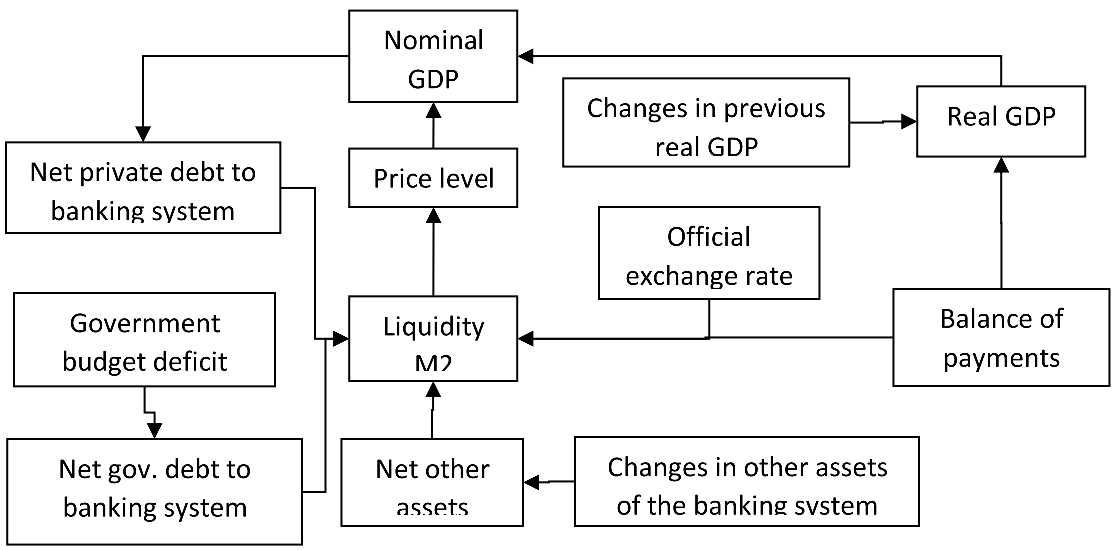
M2 = Liquidity (in billion Rials)

E = Exchange rate

D…. = Dummy variables.

@Trend = Time trend

2.3 Relationship between the main variables of the monetary model



2.4 The Mathematical Model

The following system of equations was built and estimated:

D(M2NFAE) = C(11)*BOP/1000+C(12)*D72+C(13)*D69+C(14)*D60+C(15)*D7680

D(M2NGV) = C(20)+ C(21)*OBD +C(22)*D79 +C(23)*D80

D(M2LPV) = C(31)*D(GDPV)+C(32)*D80

D(M2NW) = C(41)*D7780+C(42)*D79+C(43)*D80+C(44)*@TREND

D(PGDP) = C(51)*D(M2) +C(52)*D80

D(GDP) =C(60)+C(61)*BOP/1000+ C(62)*D(GDP(-1))+C(63)*D5659 +C(64)*D65 +C(65)*D55

M2 = M2NFAE * E + (M2NGV + M2LPV + M2NW)

GDPV = GDP * PGDP

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Estimation results

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System: SYS_INF

Estimation Method: Least Squares

Date: 12/03/03 Time: 15:57

Sample: 1339 1380 (1960-2001)

Included observations: 42

Total system (unbalanced) observations 251

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	Coefficient	Std. Error	t-Statistic	Prob.
C(11)	0.914673	0.097201	9.410124	0.0000
C(12)	-21.40064	1.346235	-15.89666	0.0000
C(13)	9.443943	1.346362	7.014414	0.0000
C(14)	5.263224	1.367823	3.847885	0.0002
C(15)	-2.368778	0.621046	-3.814173	0.0002
C(20)	-274.1686	167.8247	-1.633661	0.1037
C(21)	1.257852	0.055344	22.72777	0.0000
C(22)	-14060.40	975.8079	-14.40899	0.0000
C(23)	11626.61	962.0447	12.08531	0.0000
C(31)	0.309446	0.012301	25.15634	0.0000
C(32)	33424.48	2846.179	11.74363	0.0000
C(41)	-12933.99	598.0382	-21.62736	0.0000
C(42)	29662.57	960.1021	30.89523	0.0000
C(43)	4877.350	960.1694	5.079677	0.0000
C(44)	-15.28007	5.684013	-2.688254	0.0077
C(51)	7.03E-06	2.96E-07	23.79357	0.0000
C(52)	-0.294803	0.032899	-8.960742	0.0000
C(60)	6249.474	1531.646	4.080234	0.0001
C(61)	1354.759	568.7077	2.382171	0.0180

C(62)	0.368434	0.093348	3.946897	0.0001
C(63)	-23153.95	4256.940	-5.439107	0.0000
C(64)	-26557.75	8121.092	-3.270219	0.0012
C(65)	23064.76	8199.437	2.812969	0.0053

==

Determinant residual covariance 5.51E+22

Equation: D(M2NFAE) = C(11)*BOP/1000+C(12)*D72+C(13)*D69 +C(14)*D60+C(15)*D7680

Observations: 42

R-squared	0.913271	Mean dependent var	0.132592
Adjusted R-squared	0.903895	S.D. dependent var	4.341973
S.E. of regression	1.346047	Sum squared resid	67.03814
Durbin-Watson stat	2.147208		

Equation: D(M2NGV) = C(20)+ C(21)*OBD +C(22)*D79+C(23)*D80

Observations: 42

R-squared	0.971197	Mean dependent var	2320.165
Adjusted R-squared	0.968084	S.D. dependent var	5260.589
S.E. of regression	939.8117	Sum squared resid	32680103
Durbin-Watson stat	2.238885		

Equation: D(M2LPV) = C(31)*D(GDPV)+C(32)*D80

Observations: 42

R-squared	0.960945	Mean dependent var	5773.873
Adjusted R-squared	0.959969	S.D. dependent var	13071.46
S.E. of regression	2615.321	Sum squared resid	2.74E+08
Durbin-Watson stat	1.049681		

Equation: D(M2NW) = C(41)*D7780+C(42)*D79+C(43)*D80+C(44) *@TREND

Observations: 42

R-squared	0.967070	Mean dependent var	-692.9867
Adjusted R-squared	0.964470	S.D. dependent var	4158.716
S.E. of regression	783.8891	Sum squared resid	23350323
Durbin-Watson stat	3.436861		

Equation: D(PGDP) = C(51)*D(M2) +C(52)*D80

Observations: 42

R-squared	0.923764	Mean dependent var	0.047743
Adjusted R-squared	0.921858	S.D. dependent var	0.089887
S.E. of regression	0.025127	Sum squared resid	0.025254
Durbin-Watson stat	2.826425		

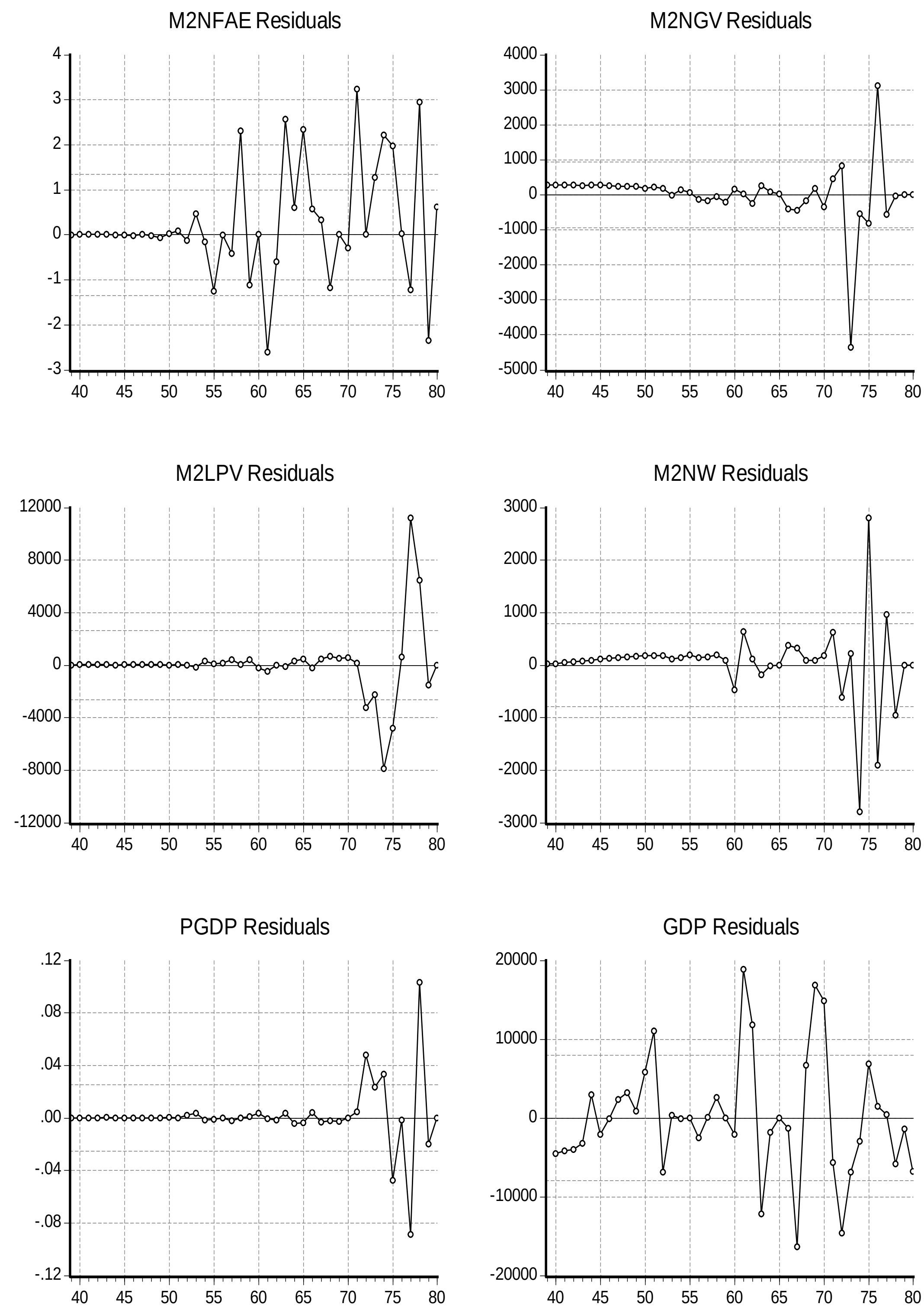
Equation:D(GDP)=C(60)+C(61)*BOP/1000+C(62)*D(GDP(-1))+C(63)*D5659+C(64)*D65+C(65)* D55

Observations: 41

R-squared	0.706315	Mean dependent var	6893.122
Adjusted R-squared	0.664359	S.D. dependent var	13732.14
S.E. of regression	7955.646	Sum squared resid	2.22E+09
Durbin-Watson stat	1.521260		

As it is seen in the estimated results, the net foreign assets of the banking system has a positive significant relationship with the balance of payments. The coefficient on C(21) is positive and significant, supporting a positive link between the government budget deficit and the government debt to the banking system. Equation (5) suggests that nominal GDP is positively and significantly related to the liquidity, supporting the monetarists' view. In other words, any change in the money supply will affect the nominal GDP. In addition, net private sector debt to the banking system is positively and significantly correlated with nominal GDP. Equation (6) suggests that real GDP at fixed prices is positively and significantly related to the BOP. In Iran, the interest rate does not affect the real output. Indeed, monetary transmission policy affects the general price level, leaving trivial effects on the real output.

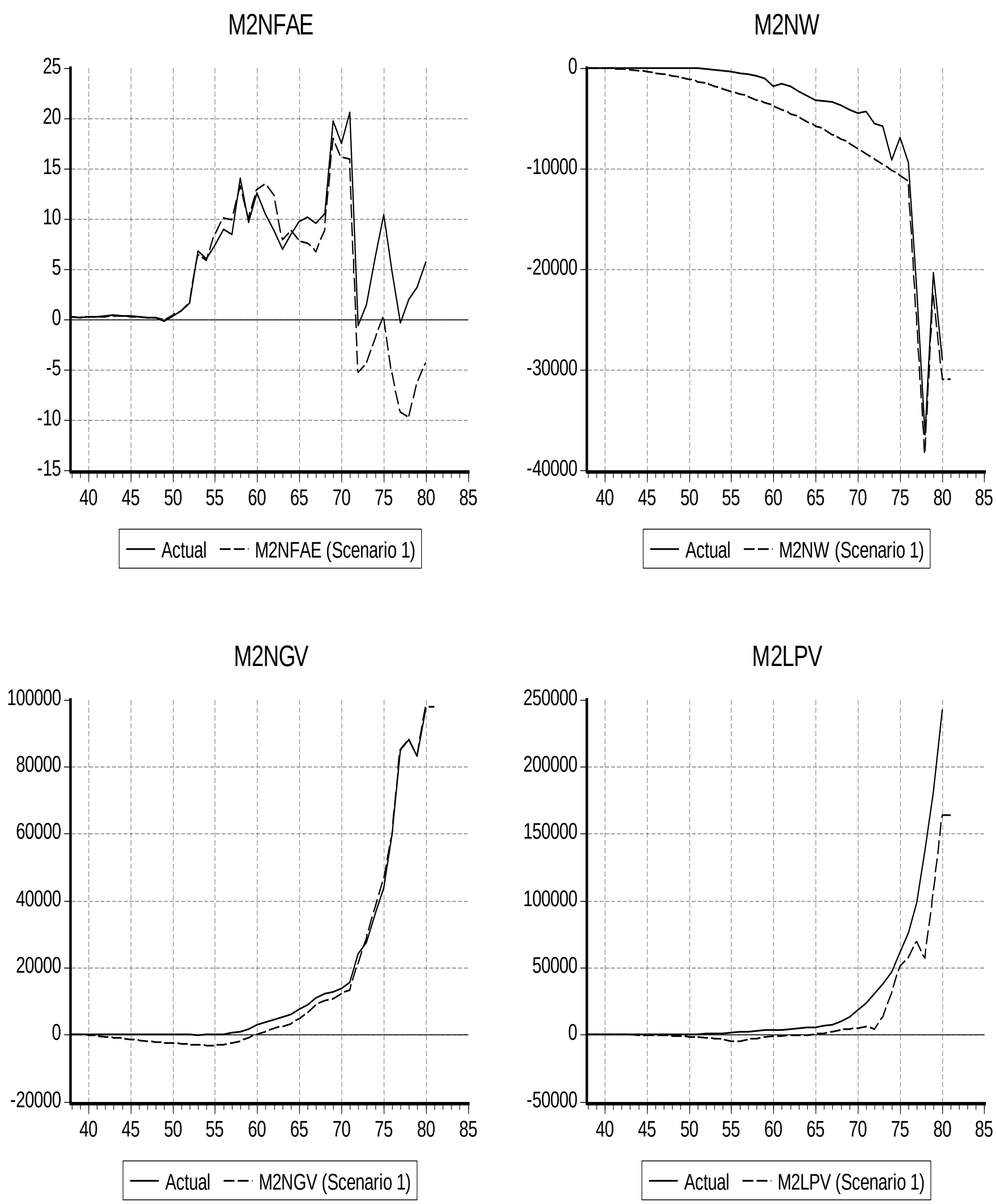
Graph 1 Plot of residuals of estimated equations

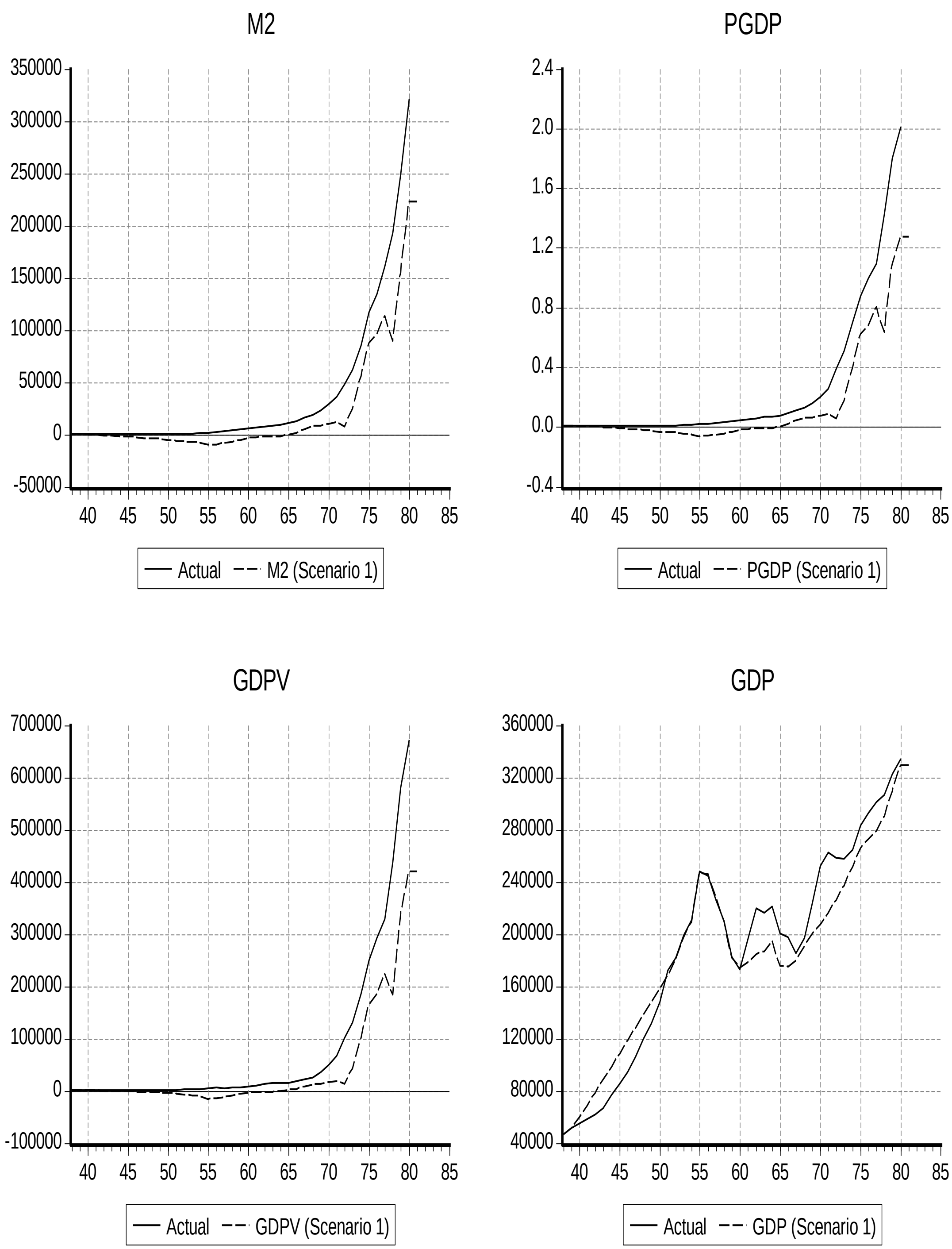


2.5 Dynamic Simulation

To evaluate the performance of the model, we solved the whole system for the whole ex-post sample period through dynamic simulation. Graph 2 plots the actual value of the endogenous variables versus their simulated values. The 8 plots of Graph I show the high dynamic response and credibility of the model to build simulated series as near as the actual series with a concordance of turning points.

Graph 2 Simulated versus actual values of the endogenous variables in the dynamic solution





As it is seen, the model simulation has a good performance and can be used for policy evaluation and forecasting purposes.

This small model is an adaptable model that can be used for other countries as well.

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