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Relationship between inflation and monetary indicators of Mongolia

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Судалгааны ажлын цуврал

2016 / № 12

Судалгааны ажлын цуврал нь Монголбанкинд хийгдэж буй болон Монголбанкны захиалгаар хөндлөнгийн байгууллагын хийсэн судалгааны ажлын үр дүнг бусад эдийн засагчид болон судлаач нарт нээлттэй хүргэх, судалгааны ажлын урьдчилсан үр дүнг танилцуулах, судалгааны ажилтай холбоотой санал, шүүмжийг авах болон хэлэлцүүлэг өрнүүлэх зорилготой. Судалгааны ажилд дурьдах аливаа дүгнэлт, дэвшүүлсэн санал нь зөвхөн хувь судлаачийн байр суурийг илэрхийлэх бөгөөд Монголбанкны албан ёсны байр суурийг илэрхийлэхгүй болно. Судалгааны ажлын үр дүнг ашиглахдаа хувь судлаачийн нэрийг дурьдах бөгөөд Монголбанк нь албан ёсны эх сурвалж болохгүйг анхаарна уу.

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СУДАЛГААНЫ АЖЛЫН ЦУВРАЛ

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Abstract

Including quarterly data from 1994-2004, and based on the classical theory of monetary policy and several empirical research, we have modeled the econometric model that indicate the relationship between money supply, exchange rate and inflation via CPI in the case of Mongolia. A series of tests have been done regarding to the true model. A positive finding is that the money supply and exchange rate have highly effects on inflation. This result may be developed in further study for the inflation targeting policy in Mongolia.

Keywords: Inflation, Econometric modelling, Econometric testing

JEL Classification: C30, C,50, C51, C52

I. INTRODUCTION

When discussing the causes of inflation in developing countries one finds that the literature contains two major competing hypotheses. First, there is the monetarist model, which sees inflation as a monetary phenomenon, the control of which requires a control of the money supply as a necessary and sufficient condition such that it grows at a rate consistent with the growth of demand for money with stable prices. The monetarist model is predicated upon the existence of a stable demand for money. Ghatak (1981:68) An existence of stable demand for money in Mongolia itself might be a disputable proposition due to the numerous deep structural changes and banking crises, which are underway within Mongolian economy since 1990.

Second, non monetary approach argues that there are non monetary causes of inflation. These causes featured structural characteristics. Chatak (1981:68) demonstrated that there are following structural characteristics. First, relative inelasticity supply of food in developing countries. The supply of essential food commodities may lag behind the demand causing food prices to rise. This characteristic would be observed in Mongolia. For instance, meat price fluctuations were one of the major changes in the CPI index and those meat price ups and downs were a consequence of seasonal shortages in meat supply during spring and early months of summer when the Mongols consider the meat to be leanest and therefore unsuitable for delivery and consumption. Second, the lack of internal financial resources as a distinctive group of reasons causing inflation. The shortage of government funding in the sphere of infrastructure is usually solved by inflationary consequences. Kirkpatrick and Nixon (1976:127) Third, cost inflation, which is derived by the increase in price of production factors, including electricity.

Many models set up in sphere of monetarist approach. Sani (1999) run regression between the broad and narrow money aggregates and the inflation rates in India and found that relationship is statistically significant. He used Ordinary least square method (OLS). Paul and Bhanumurthy (1999) employ the Vector autroregression (VAR) model to investigate relationship between the money supply and price in India and found the money-price relationship exists within that period and is very strong when money aggregate M3, which includes time deposits, is used supporting the monetarist notion of exogenous money supply and the impact of money on prices.

Brada and Kutan (1999) used F-tests of running nominal broad money, nominal average wages, and import prices in form of the exchange rate adjusted German whole sale index on the Consumer price index (CPI) in

Hungary, Poland and Czech Republic for the period over 1990-1998 to investigate the determinants of inflation in those countries. They show that foreign prices and the persistence of inflation were the key elements of inflation.

Kalra (1998) studies inflation and money demand in Albania, which is a small transition economy the size of Mongolia in terms of GDP between 1993-1997. His model supports the claim that determinants of inflation and money demand in transition economies are similar to those in market economies. In particular, for the long run, he establishes a positive relationship between the price level and the exchange rate.

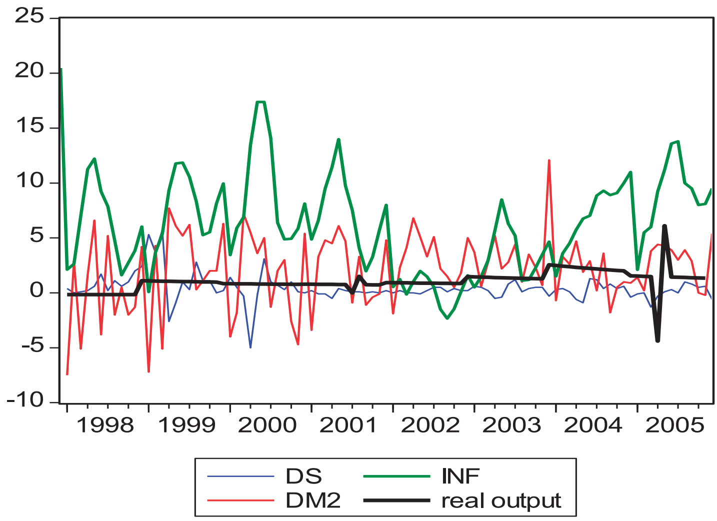
Although, considerable research has been conducted to identify the factors that influence inflation in transition economies, there has been much less effort in identifying the relationship between these factors and inflation in Mongolia. A question remains how these factors play a role in explaining of inflation. The objective of this study is to examine the impact of the real money supply, real output and exchange rate movements on price.

The results of the research indicate that the dynamics of inflation are affected by previous month's exchange rate changes and money growth. It means that there is a need to lessen the influence of exchange rate expectation on economy and to improve efficiency of management of the monetary instrument. The paper is structured as follows. Section 1 investigates the nature of Mongolian inflation. Section 2 gives the methodology. Section 3 gives the results of the stationarity test and econometric estimation, including, autocorrelation test, heteroskedasticity test and Granger Sims F test. Section 4 gives the VAR analysis. Section 5 gives the discussion and conclusion.

II. INFLATION OF MONGOLIA

Similar to other transition economies, Mongolia's relative prices were badly distorted, therefore, the variety of prices, mostly those of energy, food, utilities and rents were taken out of the government control and rapidly liberalized during the first years of reform. Also, there were major fiscal imbalances due to the extensive but unsustainable social expenditure. These imbalances, whose true size was masked by the lack of transparency in public sector accounts, were exacerbated by the early phases of reform, including wage adjustments, price liberalization, exchange rate devaluation. As a result, governments in transition economies have been relatively unwilling to make unpopular decisions to reduce fiscal deficits, which, in turn, acted as the "motor of inflation". Moreover, Mongolia is an open and small economy. The openness of its economy motivates the inclusion of the exchange rate movements of Mongolian togrog against US dollar. An assumption is that the togrog's depreciation may increase the inflation rate, because the depreciation imports inflation from abroad.

Figure 1. Movements in M2, exchange rate, inflation and real output in Mongolia (Percentage)



Source: Bank of Mongolia, 2005. http://www.mongolbank.mn/ (2006/03/10).

The inflation rate in Mongolia declined dramatically from a peak of 325.5 per cent in 1992 to 11 and 9.5 per cent in 2004 and 2005 respectfully. (Figure 1).

III. DATA

In this study monthly statistical data are used. In 1996 and 1998 there were banking crises in Mongolia and as a result three major banks were liquidated. In his research, Frecaut and Sidgwick (1998) show that Mongolian banks liquidity worsening resulted in some part of the money supply has been lost the negative financial intermediation. Therefore, in order to reduce this negative impact, data from the December 1998 to December 2005 are used in estimations.

Variables:

Inf - inflation, beginning from the year
Inf0 - inflation based on monthly changes
CPI - consumer price index

M/P - real money supply (M2/CPI)
S - spot rate USD/ togrog
Y - nominal GDP
Y/P - Real output (GDP/CPI)

IV. METHODOLOGY

The price level is assumed to be a weighted average of tradable (P_{Tt}) and nontradables (P_{NTt}) and the price of tradables is determined by the exchange rate (St) and foreign price (P*t):

$$P_t = P_{Tt}^{\phi} P_{NTt}^{(1-)},\ 0<\phi<1,\quad \Rightarrow \quad \log(P_t) = \phi \log P_{Tt} + (1-\phi) * \log P_{NTt} \qquad (1)$$

Where, φ is the share of tradables in total expenditure. For simplicity, φ is assumed constant.

$$P_{Tt} = S_t P_t^* \Rightarrow \log P_{Tt} = \log(S_t) + \log(P_t^*) \qquad (2)$$

Equation (2) suggests that the price of tradables in domestic currency may change in response to a change either in the exchange rate or in the price of tradables in foreign currency or both. When the exchange rate remains fixed, the price of tradables in domestic currency changes with the change in the price of tradables in foreign currency may change when the exchange rate changes with or without a change in the price of tradables in foreign currency. For simplicity, P_t^* is normalized unity. Then equation (2) is written as:

$$\log P_{Tt} = \log(S_t) \qquad (2')$$

We assume that the price of nontradable changes in response to disequilibrium in the money market. (Hossain 2002:6) Within a flow disequilibrium in the money market, the price of non tradables may then change in response to the discrepancy between the log difference of actual real balances at the beginning of the period ($\Delta \log m_{t-i}$) and the log difference of real balances that individuals desire to hold at the end of the period ($\Delta \log m^d_t$), such that:

$$\log P_{NT} - \log P_{NTt-1} = \gamma(\Delta \log m_{t-1} - \Delta \log m^d_t) + u_t \qquad (3)$$

where m=M/P, (γ is the coefficient of adjustment, whose value is expected to lie between zero and unity; u is a random error term with zero mean and a constant variance. Equation (3) shows that only a proportion (γ) of disequilibrium in the money market is eliminated between periods t-1 and t.

Take the first order log differences of equations (1) and (2'), such that:

$$\log(P_t/P_{t-1}) = \phi \log P_{Tt}/P_{Tt-1} + (1-\phi) * \log P_{NTt}/ \log P_{NTt-1} \qquad (4)$$

$$\log(P_{Tt}/P_{Tt-1}) = \log(S_t/ S_{t-1}) \qquad (5)$$

Substitution of equations (3) and (5) into equation (4), following is yields:

$$\log(P_t/P_{t-1}) = \phi \log(S_t/ S_{t-1}) + (1-\phi)\gamma(\Delta \log m_{t-1} - \Delta \log m^d_t) + (1-\phi)u_t \qquad (6)$$

For simplicity, the demand for money is represented as a function of the level of real income (y):

$$m_d = f(y) \Rightarrow \Delta \log m^d_t = \beta_0 + \beta_1 * \Delta \log y_t \qquad (7)$$

Substitution of equation (7) into (6), after manipulations, yields:

$$\log(P_t/P_{t-1}) = - (1-\phi)\gamma\beta_0 + \phi \log(S/S_{t-1}) + (1-\phi)\gamma\Delta \log M_{t-1} - (1-\phi)\gamma (\Delta \log P_{t-1} - (1-)\gamma\beta_1\Delta \log y_t + (1-\phi)u_t \qquad (8)$$

In reduced form, equation (8) would be:

$$\log(P_t/P_{t-1}) = \theta_1 + \theta_2 \log((M_{t-1}/P_{t-1})/(M_{t-2}/P_{t-2})) + \theta_3 \log(S/S_{t-1}) + \theta_4 \log((Y_t/P_t)/(Y_t/P_{t-1}) + \theta_5, \text{ where } \theta_1 = - (1-\phi)\gamma\beta_0, \theta_2 = (1-\phi)\gamma, \theta_3 = \phi, \theta_4 = (1-\phi)\gamma\beta_1, \theta_5 = (1-\phi)u_t \qquad (9)$$

Equation (9) shows that inflation depends on change in exchange rate, real output of the current period and real money supply. These factors not only influence inflation, but also each other. For example, if an exchange rate appreciates, depositors will rise foreign currency deposits while might reduce domestic currency deposits, and consequently M2.

4.1. Results of stationarity test

Initially, the time series properties of data examined before estimating the regression. Key concepts are the ideas of stationarity, non-stationarity and conintegrability of economic series. For example, if variables are non-stationary, then shocks to the level of each variable produce permanent shifts. On the other hand, if time series are stationary, then shocks will tend to die off and the time series will revert to their mean values. Regressing two non-stationary series on each other may create problem of spurious regression, refers to the situation where correlation is found to be present between the ratios of variables even tough the original variables are uncorrelated or random. Therefore, the time series properties of data need to be examined.

Appendix A shows dynamics of variable. The fluctuation shown in the CPI and real output graph is related to that base year was changed in CPI calculation. Table 1 shows result of the stationary test.

Table 1. Result of stationarity test

Indicators	No difference				1 level				Second level			
	ADF	Test crit. value		Y/N	ADF	Test crit. value		Y/N	ADF	Test crit. value		Y/N
		1%	5%			1%	5%			1%	5%	
CPI	-1.85	-4.06	-3.46	N	-10.14	-4.06	-3.46	Y*				
Inf	-4.71	-3.50	-2.89	Y*								
Inf0	-7.6	-3.5	-2.89	Y*								
M2	0.26	-4.06	-3.46	N	-4.16	-3.50	-2.89	Y*				
S	- 2.29	-4.06	-3.46	N	-7.03	-3.50	-2.89	Y*				
Y	0.8	-4.06	-3.46	N	-13.4	-4.06	-3.46	Y*				

Note: 'Y' means data is stationary, 'N' means data is non stationary
** shows data is stationary at 1% of significance,*
*** shows data is stationary at 5% of significance.*

Source: Bank of Mongolia, 2005. http://www.mongolbank.mn/ (2006/03/10).

Table 1 shows that inf, inf0 is I(0) at 1 per cent level significance. Also, it shows that CPI, M2, Y and S are I(1) at 1 per cent level of significance. There are two versions of analysis dealing with non stationarity data: regression based on transforming to stationary data through its difference; and, cointegration analysis. In this study, the first order difference is used.

4.2. Test for autocorrelation

From the regression, we see that DW=2.15. The result might us suspect that there is an autocorrelation in model. This phenomenon means that the error terms are interrelated – that is, prior error information influences the value of the current error term. The current error term can be written as some function of previous error terms:

$$u_t = \alpha u_{t-1} + v_t$$

Thus, for more precise we will look at the residual's graph:To avoid some pitfalls of the Durbin-Watson statistic test, we apply the Breusch Godfrey statistic. Under the null hypothesis of no serial autocorrelation:

$H_0 : \rho_1 = \rho_2 = 0$, then we now calculate the BG: $(n-p)R^2 \approx X_p^2$ based on our output of BG serial autocorrelation. (Appendix B)

$$(n-p)R^2 = (95-1) * 0.006308 = 0.5929$$

Choose α = 5%, we have χ_1^2 = 18.5476 > (n-p)*R^2 = 0.5929, thus, we fail to reject the null hypothesis of no serial autocorrelation.

4.3. Test for heteroscedasticity

An important assumption of the classic linear regression model is that the variance of each disturbance term U_i, conditional on the chosen values of the explanatory variables, is some constant number equal to σ^2. Symbolically, it is can be expressed as:

$$E\,(u_i^2) = \sigma^2, \quad i = 1, 2, 3\ldots.n$$

With this assumption of homoskedasticity, our OLS will be BLUE. Thus, to test whether the model satisfies the assumption or not, heteroskedasticity is checked. This phenomenon is that the conditional variance of Y_i is not a constant. It increases as explanatory Xij increases that means:

$$E\,(u_i^2) = \sigma_i^2, \quad i = 1, 2, 3\ldots.n$$

Actually, if our model is heteroskedasticity, it may cause problems such as unbiased estimating of coefficients of explanatory variables, unnecessarily larger confidence interval. As consequence, a result of t-test and F-test will statistically be incorrect. To cope with the problem, White’s general heteroskedasticity test can be employed to test whether there is heteroskedasticity in the data.

White’s general heteroskedasticity test

This method requires reordering the observations with respect to the X variable that supposedly caused heteroskedasticity. Generally, it is widely used as it does not rely on the normality assumption and is easy to implement. By applying the method to the residuals obtained from regression, we have the following result:

Table 2. Result of general heteroskedasticity test

White Heteroskedasticity Test:				
F-statistic	1.829562	Probability		0.102404
Obs*R-squared	10.53625	Probability		0.103811
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-13.50217	4.313256	-3.130389	0.0024
LOG(M2(-1)*CPI(-2))/ (M2(-2)*CPI(-1))	752721.2	284534.2	2.645451	0.0097
(LOG(M2(-1)*CPI(-2))/ (M2(-2)*CPI(-1)))^2	-9.58E+11	3.62E+11	-2.646900	0.0096
LOG(S/S(-1))	-0.264644	0.498223	-0.531176	0.5966
(LOG(S/S(-1)))^2	-1.108064	12.22326	-0.090652	0.9280
LOG(Y*CPI(-1)/Y(-1)*CPI)	2.672177	0.855106	3.124966	0.0024
(LOG(Y*CPI(-1)/Y(-1)*CPI))^2	-0.132950	0.042590	-3.121622	0.0024
R-squared	0.110908	Mean dependent var		0.007150

Source: Bank of Mongolia, 2005. http://www.mongolbank.mn/ (2006/03/10).

Under the null hypothesis that there is no heteroskedasticity, we have $n*R^2$ follows the $\chi_{df}^{\ 2}$ distribution:

$$n * R^2 \sim \chi_{df}^{\ 2} = 0.111 * 95 = 10.545$$

Choose the critical chi_square value for 6 df, we have:

for 5%, $\chi^2_{\ df=5} = 12.59 > n*R^2$,

for 10%, $\chi^2_{\ df=5} = 10.65 > n*R^2$

Thus, for all practical purposes, we can conclude that there is no heteroskedasticity in the data.

4.4. Granger Sim's causality test

The theory says that there is the relationship between the factors that influence inflation. To test the hypothesis whether the change in M2 and exchange rate cause inflation, the Granger causality test is done. This can be carried out, if variables are time series. At the case that variables are I(1) or I(2), The Granger causality test should be carried out through variables' first or second level difference, respectively. Table 3 shows the results of the Granger Sims F test.

Table 3. Result of Granger causality test

No	Ho hypothesis	P-value	Ho hypothesis	P-Value
Monthly changes /M2-Inflation/				
m=13	M2 growth does not cause inflation	0.07	Inflation does not cause M2 growth	0.05
m=14	The change M2 does not cause the inflation	0.065	Inflation does not cause change in M2	0.03
Monthly changes (Exchange rate-Inflation)				
m=12	The change in exchange rate does not cause inflation	0.01	Inflation does not cause the change in exchange rate	0.94

Inflation (monthly changes)

No	Ho hypothesis	P-value	Ho hypothesis	P-Value
Monthly changes (Exchange rate-Inflation)				
m=3	The change in exchange rate does not cause inflation	0.00036	Inflation does not cause the change in exchange rate	0.00036
m=9	The change in exchange rate does not cause inflation	0..00226	Inflation does not cause the change in exchange rate	0.00016

Source: Bank of Mongolia, 2005. http://www.mongolbank.mn/ (2006/03/10).

The results consistent with the theoritical expectation. Table 3 shows that the null hypothesis that M2 growth does not cause inflation would not be rejected in all cases except when the estimation included 13 months lag. In other words, the Granger-Sims causality test says that the changes in M2 cause changes in the CPI in Mongolia. Similarly, the null hypothesis that the exchange rate changes can not be cause of inflation would not be rejected in all cases except when the estimation included 12 month lag. When inflation is measured by monthly changes basis, the null hypothesis that exchange rate changes can not be cause of inflation would not be rejected in all cases except when the estimation included 3 and 9 month lag.

V. VECTOR AUTOREGRESSION MODEL

In order to evaluate the feasibility of using inflation targeting, or even of more traditional and backward-looking approaches to monetary policy, in these transition economies, we estimate a vector autoregressive (VAR) model of the price level. This model shows which causal factors are the most important sources of continuing inflation and thus feasibility of reducing inflation by means of monetary policy. A VAR is an n-equation n-variable linear model in which each variable is in turn explained by its own lagged values, plus current and past values of the remaining n-1 variables. This simple frame work provides a systemic way to capture rich dynamics in multiple time series. As Sims (1980) and others argue, VARs hold out the promise of providing a coherent and credible approach to data description, forecasting, structural inference and policy analysis. (Stock and Watson 2001:101) From equation (9), following system can be derived. The system of equations is estimated using Eviews 5.0.

$$Y_t = \theta + \sum_{i=1}^{p} A_i Y_{t-i} + u_t \,, \quad \text{where}$$

$$Y_t = \begin{bmatrix} d\log P_t \\ d\log(S_t) \\ d\log((M2/P)_t) \\ d\log((Y/P)_t) \end{bmatrix} \quad \theta = \begin{bmatrix} \theta_1 \\ \theta_2 \\ \theta_3 \\ \theta_4 \end{bmatrix} \quad A_i = \begin{bmatrix} \theta_{11,i} & \theta_{12,i} & \theta_{13,i} & \theta_{14,i} \\ \theta_{21,i} & \theta_{22,i} & \theta_{23,i} & \theta_{24,i} \\ \theta_{31,i} & \theta_{32,i} & \theta_{33,i} & \theta_{34,i} \\ \theta_{41,i} & \theta_{42,i} & \theta_{43,i} & \theta_{44,i} \end{bmatrix} \quad u_t = \begin{bmatrix} u_{1t} \\ u_{2t} \\ u_{3t} \\ u_{4t} \end{bmatrix}$$

Here, Pt is CPI and u is stochastic error term. Variables for VAR are log functions in exchange rate, real output, real money supply and inflation. Akaike and Schwartz criterion were chosen in determination of the lag length. Estimation is made in case of 2-12 months lag lengths. In compliance with this criterion, system with lag length 8 will be preferred. (Appendix C) The result of the system indicates that previous 1 and 2 months inflation negatively influences inflation. Rise in previous 2-4 months real money supply positively influence inflation. However, the growth in the nominal exchange rate of previous 1 and 2 months negatively influence inflation. Change in real output of previous 3 and 4 months influence positively on current inflation.

The impulse response function is shown in Appendix D. This function says influence of change in M2 on inflation is stronger than the influence of the exchange rate.

VI. DISCUSSION

Based on the econometric techniques, some tests have been done taking into account of the inflation model. The equation shows that inflation is strongly affected by exchange rate and money growth changes. Changes inflation of the prior period also has a significant impact on current inflation, but this effect takes longer to work its way through the economy than money supply and exchange rate changes. The model points to a dominant role of monetary policies in the behavior of inflation and shows a low persistence of inflation in Mongolia. Both factors contributed to the observed behavior of inflation.

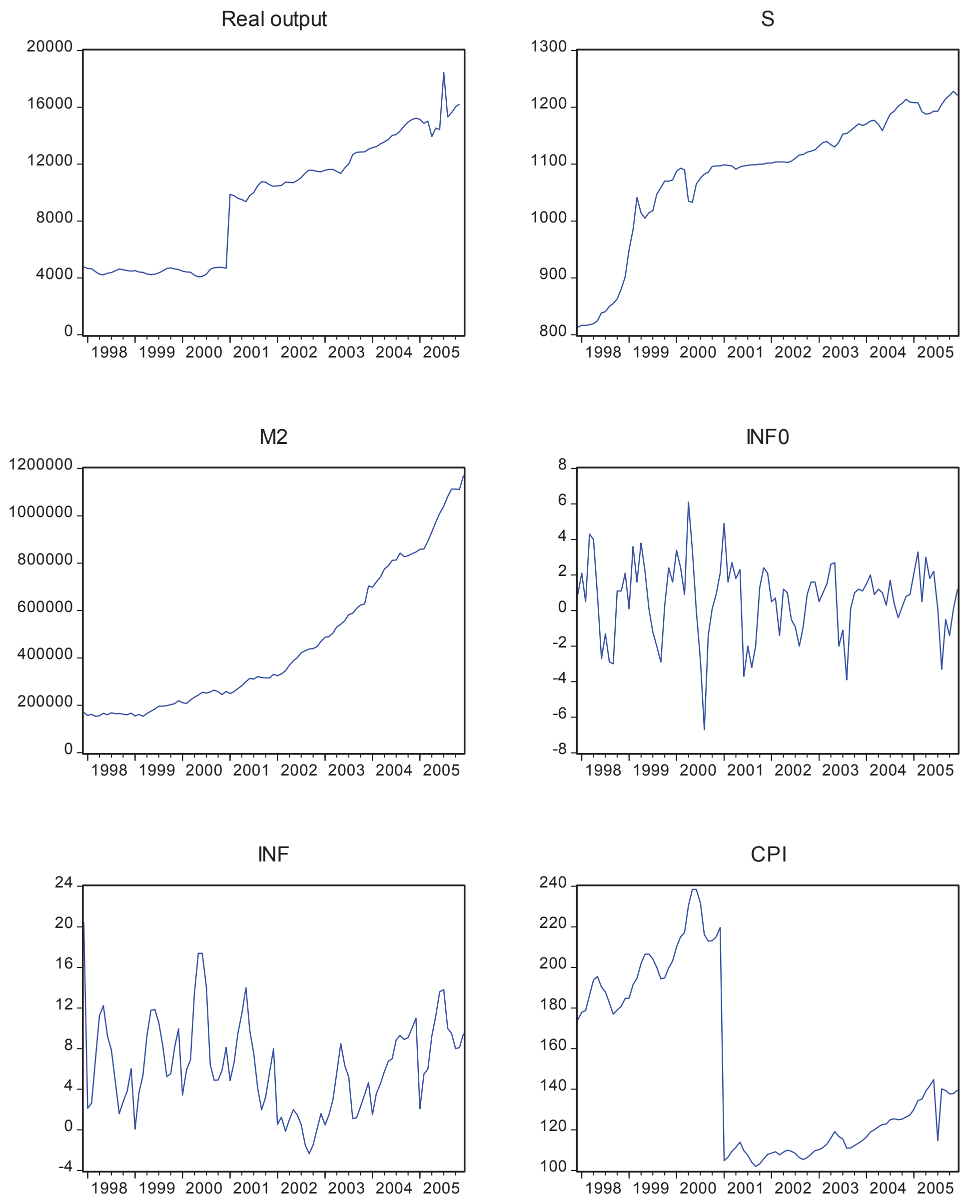
VII. CONCLUSION

Our results are based on real money, real output, exchange rate and CPI data from 1997-2005. The econometric results show that it is feasible to estimate robust money supply, exchange rate, and real output and inflation equations for Mongolia. The model expresses inflation as a function of money, the exchange rate and real output. In fact, the dynamics of inflation are affected by previous month exchange rate changes and money growth. It means that Central bank should make arrangements to reduce dollarization to lessen the influence of exchange rate expectation on economy and to improve efficiency of management of the monetary instrument.

In addition, in order to have effective management of money supply, the development of money market should be accelerated. The money market development will not only contribute to controlling inflation, but also it will contribute to effective allocation of the resources and channeling of money into real economy. Consequently, it would assist the economic growth. Finally, the estimation of the model may have some errors. It is due to possibility to get a good econometric estimation may be constrained. In the future, there is necessity to continue estimation, using experience and achievements in research work done by foreign scholars.

APPENDIX A

Figure 1. Dynamics of variable, 1997-2005, Mongolia



Source: Bank of Mongolia, 2005. http://www.mongolbank.mn/ (2006/03/10).

APPENDIX B

Table 1. Breusch-Godfrey Serial Correlation LM Test

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.326475	Probability	0.569166
Obs*R-squared	0.343367	Probability	0.557892

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 05/13/06 Time: 22:20
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.001243	0.033239	0.037397	0.9703
LOG(M2(-1)*CPI(-2))/ (M2(-2)*CPI(-1))	14768.07	81149.72	0.181985	0.8560
LOG(S/S(-1))	-0.020670	0.680637	-0.030368	0.9758
LOG(Y*CPI(-1))/(Y(-1)*CPI)	-58609.43	408751.9	-0.143386	0.8863
RESID(-1)	0.063466	0.111075	0.571380	0.5692

R-squared	0.003614	Mean dependent var	-3.61E-17
Adjusted R-squared	-0.040669	S.D. dependent var	0.078135
S.E. of regression	0.079708	Akaike info criterion	-2.169693
Sum squared resid	0.571806	Schwarz criterion	-2.035278
Log likelihood	108.0604	F-statistic	0.081619
Durbin-Watson stat	1.999949	Prob(F-statistic)	0.987832

Source: Bank of Mongolia, 2005. http://www.mongolbank.mn/ (2006/03/10).

APPENDIX C

Table 3. VAR estimation results

Vector Autoregression Estimates
Date: 05/13/06 Time: 21:37
Sample (adjusted): 1998M09 2005M12
Included observations: 88 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	LOG(CPI/ CPI(-1))	LOG(M2* CPI(-1))/ (M2(-1)*CPI)	LOG(S/S(-1))	LOG(Y* CPI(-1))/ (Y(-1)*CPI)
LOG(CPI(-1)/CPI(-2))	-1.905727	3.85E-07	0.049813	1.42E-07
	(0.77476)	(3.3E-07)	(0.09750)	(9.3E-08)
	[-2.45976]	[1.16872]	[0.51089]	[1.51881]
LOG(CPI(-2)/CPI(-3))	-1.455926	5.61E-07	0.096546	1.66E-07
	(0.96902)	(4.1E-07)	(0.12195)	(1.2E-07)
	[-1.50247]	[1.36234]	[0.79168]	[1.42750]
LOG(CPI(-3)/CPI(-4))	0.396598	-6.33E-08	-0.063749	-3.29E-08
	(0.90195)	(3.8E-07)	(0.11351)	(1.1E-07)
	[0.43971]	[-0.16538]	[-0.56161]	[-0.30336]
LOG(CPI(-4)/CPI(-5))	1.093964	-2.80E-07	0.119615	-1.11E-07
	(1.01967)	(4.3E-07)	(0.12832)	(1.2E-07)
	[1.07286]	[-0.64672]	[0.93213]	[-0.90770]
LOG(CPI(-5)/CPI(-6))	1.493678	-7.78E-07	0.139813	-2.09E-07
	(0.98240)	(4.2E-07)	(0.12363)	(1.2E-07)
	[1.52043]	[-1.86554]	[1.13087]	[-1.77322]
LOG(CPI(-6)/CPI(-7))	2.319928	-1.73E-06	-0.339016	-3.85E-07
	(2.26693)	(9.6E-07)	(0.28529)	(2.7E-07)
	[1.02338]	[-1.80107]	[-1.18832]	[-1.41158]
LOG(CPI(-7)/CPI(-8))	-3.222662	2.08E-06	0.553517	4.92E-07
	(2.75324)	(1.2E-06)	(0.34649)	(3.3E-07)
	[-1.17050]	[1.78026]	[1.59749]	[1.48710]
LOG(CPI(-8)/CPI(-9))	0.173766	-1.22E-07	-0.027853	-3.06E-08

	(0.23640)	(1.0E-07)	(0.02975)	(2.8E-08)
	[0.73504]	[-1.21582]	[-0.93620]	[-1.07669]
LOG(M2(-1)*CPI(-2))/ (M2(-2)*CPI(-1))	-1124091.	1.386720	-89362.55	0.179253
	(986053.)	(0.41873)	(124093.)	(0.11857)
	[-1.13999]	[3.31173]	[-0.72012]	[1.51174]
LOG(M2(-2)*CPI(-3))/ (M2(-3)*CPI(-2))	1093976.	-0.141522	-217720.2	-0.146104
	(1243121)	(0.52790)	(156445.)	(0.14949)
	[0.88002]	[-0.26809]	[-1.39167]	[-0.97737]
LOG(M2(-3)*CPI(-4))/ (M2(-4)*CPI(-3))	346029.1	-0.244107	672719.2	-0.074277
	(1293073)	(0.54911)	(162731.)	(0.15549)
	[0.26760]	[-0.44455]	[4.13392]	[-0.47769]
LOG(M2(-4)*CPI(-5))/ (M2(-5)*CPI(-4))	-58857.95	-0.371673	-105891.4	-0.017779
	(1464681)	(0.62198)	(184328.)	(0.17613)
	[-0.04018]	[-0.59756]	[-0.57447]	[-0.10094]
LOG(M2(-5)*CPI(-6))/ (M2(-6)*CPI(-5))	-1552052.	0.716890	-513732.7	0.210684
	(1348657)	(0.57271)	(169727.)	(0.16218)
	[-1.15081]	[1.25175]	[-3.02682]	[1.29909]
LOG(M2(-6)*CPI(-7))/ (M2(-7)*CPI(-6))	2474585.	-1.129148	136029.1	-0.283720
	(1411145)	(0.59925)	(177591.)	(0.16969)
	[1.75360]	[-1.88428]	[0.76597]	[-1.67197]
LOG(M2(-7)*CPI(-8))/ (M2(-8)*CPI(-7))	-1143934.	0.939088	237714.7	0.171714
	(1395789)	(0.59273)	(175658.)	(0.16785)
	[-0.81956]	[1.58435]	[1.35328]	[1.02305]
LOG(M2(-8)*CPI(-9))/ (M2(-9)*CPI(-8))	-67434.69	-0.145912	-108200.7	-0.025623
	(1028418)	(0.43672)	(129425.)	(0.12367)
	[-0.06557]	[-0.33411]	[-0.83601]	[-0.20719]

LOG(S(-1)/S(-2))	0.155353	4.08E-07	0.440338	-1.93E-08
	(1.03339)	(4.4E-07)	(0.13005)	(1.2E-07)
	[0.15033]	[0.92977]	[3.38591]	[-0.15495]
LOG(S(-2)/S(-3))	1.015424	-5.25E-07	-0.009314	-1.67E-07
	(1.22519)	(5.2E-07)	(0.15419)	(1.5E-07)
	[0.82879]	[-1.00976]	[-0.06041]	[-1.13610]
LOG(S(-3)/S(-4))	-1.183008	5.24E-07	-0.038728	1.16E-07
	(1.24061)	(5.3E-07)	(0.15613)	(1.5E-07)
	[-0.95357]	[0.99527]	[-0.24805]	[0.78005]
LOG(S(-4)/S(-5))	1.352778	-6.44E-07	-0.165691	-1.40E-07
	(1.12576)	(4.8E-07)	(0.14167)	(1.4E-07)
	[1.20166]	[-1.34696]	[-1.16952]	[-1.03730]
LOG(S(-5)/S(-6))	-0.003316	4.29E-08	0.066897	1.17E-08
	(1.15627)	(4.9E-07)	(0.14551)	(1.4E-07)
	[-0.00287]	[0.08732]	[0.45973]	[0.08379]
LOG(S(-6)/S(-7))	1.477402	-7.62E-07	-0.261629	-2.10E-07
	(1.08621)	(4.6E-07)	(0.13670)	(1.3E-07)
	[1.36015]	[-1.65249]	[-1.91393]	[-1.60482]
LOG(S(-7)/S(-8))	-2.959893	1.43E-06	0.307172	3.80E-07
	(1.13053)	(4.8E-07)	(0.14228)	(1.4E-07)
	[-2.61814]	[2.98850]	[2.15899]	[2.79388]
LOG(S(-8)/S(-9))	0.801482	-6.81E-07	-0.167112	-1.32E-07
	(1.03107)	(4.4E-07)	(0.12976)	(1.2E-07)
	[0.77733]	[-1.55471]	[-1.28787]	[-1.06650]
LOG(Y(-1)*CPI(-2))/ (Y(-2)*CPI(-1))	-10885739	1.491124	730348.7	1.355489
	(7750605)	(3.29132)	(975403.)	(0.93202)
	[-1.40450]	[0.45305]	[0.74877]	[1.45436]
LOG(Y(-2)*CPI(-3))/ (Y(-3)*CPI(-2))	-1826348.	2.288617	1119506.	0.915619
	(8682990)	(3.68726)	(1092742)	(1.04414)
	[-0.21034]	[0.62068]	[1.02449]	[0.87691]

LOG(Y(-3)*CPI(-4))/ (Y(-4)*CPI(-3))	13443056	-4.027681	-3557529.	-1.265146
	(9433807)	(4.00609)	(1187231)	(1.13443)
	[1.42499]	[-1.00539]	[-2.99649]	[-1.11523]
LOG(Y(-4)*CPI(-5))/ (Y(-5)*CPI(-4))	7011021.	-0.803888	1647293.	-0.684973
	(1.0E+07)	(4.43331)	(1313841)	(1.25541)
	[0.67156]	[-0.18133]	[1.25380]	[-0.54562]
LOG(Y(-5)*CPI(-6))/ (Y(-6)*CPI(-5))	7908307.	-5.957737	2022657.	-1.392761
	(9385601)	(3.98562)	(1181165)	(1.12863)
	[0.84260]	[-1.49481]	[1.71243]	[-1.23403]
LOG(Y(-6)*CPI(-7))/ (Y(-7)*CPI(-6))	-348752.9	-4.630817	-4110652.	-0.641311
	(1.9E+07)	(8.13381)	(2410507)	(2.30330)
	[-0.01821]	[-0.56933]	[-1.70531]	[-0.27843]
LOG(Y(-7)*CPI(-8))/ (Y(-8)*CPI(-7))	-39101574	26.37749	5794043.	6.187904
	(3.3E+07)	(13.9246)	(4126641)	(3.94310)
	[-1.19247]	[1.89431]	[1.40406]	[1.56930]
LOG(Y(-8)*CPI(-9))/ (Y(-9)*CPI(-8))	24101866	-15.03451	-3661395.	-3.565944
	(2.0E+07)	(8.55885)	(2536469)	(2.42365)
	[1.19583]	[-1.75660]	[-1.44350]	[-1.47131]
C	-0.041462	2.73E-08	0.005251	5.98E-09
	(0.05376)	(2.3E-08)	(0.00677)	(6.5E-09)
	[-0.77120]	[1.19648]	[0.77611]	[0.92568]
R-squared	0.334984	0.959647	0.501628	0.921828
Adj. R-squared	-0.051934	0.936169	0.211666	0.876346
Sum sq. resids	0.449364	8.10E-14	0.007117	6.50E-15
S.E. equation	0.090389	3.84E-08	0.011375	1.09E-08
F-statistic	0.865775	40.87386	1.729980	20.26804
Log likelihood	107.3328	1398.468	289.7283	1509.497
Akaike AIC	-1.689383	-31.03337	-5.834734	-33.55675
Schwarz SC	-0.760381	-30.10437	-4.905733	-32.62775
Mean dependent	-0.003045	3.58E-07	0.004117	1.15E-07

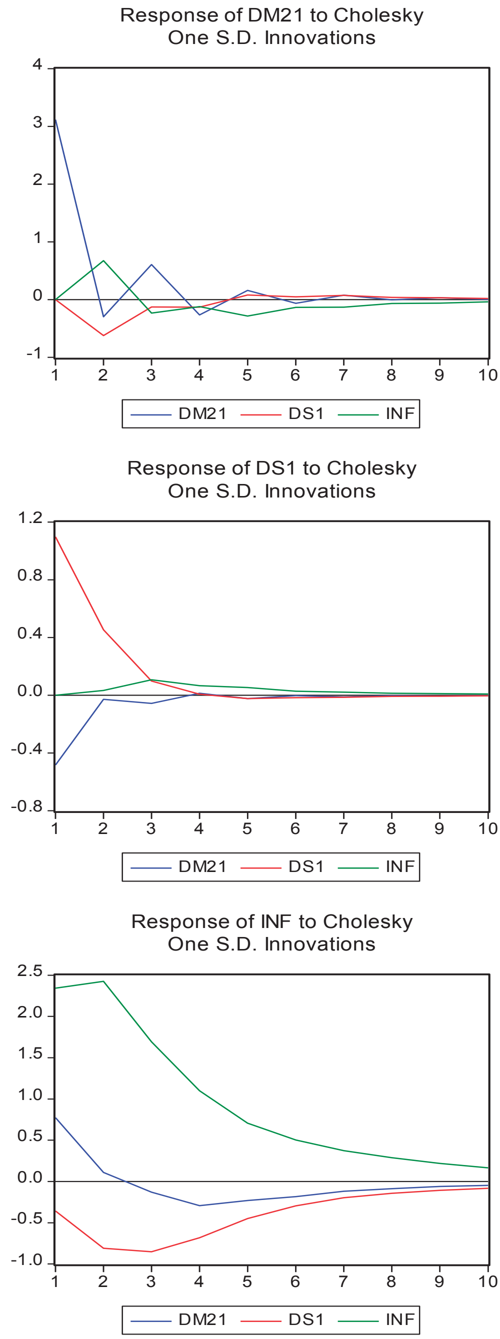
S.D. dependent	0.088130	1.52E-07	0.012812	3.09E-08

Determinant resid covariance (dof adj.)	5.05E-40
Determinant resid covariance	7.70E-41
Log likelihood	3564.591
Akaike information criterion	-78.01344
Schwarz criterion	-74.29743

Source: Bank of Mongolia, 2005. http://www.mongolbank.mn/ (2006/03/10)

APPENDIX D

Figure 2. Impulse response function (Inflation from beginning of year)



Source: Bank of Mongolia, 2005. http://www.mongolbank.mn/ (2006/03/10).

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