Factors Affecting Money Supply in Bangladesh: An Empirical Analysis

Muhammad Mahboob Ali [γ]
Anisul M. Islam [♣]

Abstract

The study has empirically examined factors affecting Money Supply in Bangladesh using annual time series data from 1975-6 to 2008-09. Authors observed that high-powered money played a dominant role in the money supply process of Bangladesh, thus providing partial support for the monetarist hypothesis. However, beyond the monetarist view, additional variables in the light of the Keynesian and structuralist analysis, such as the availability of external resources and financial liberalization need to be taken into account in understanding the money supply process of the country. But some other structural variables such as government budget deficits, deposit interest rate, and bank branches were not found to be significant in explaining money supply function. However, the observed insignificance of these variables could be attributable to multicollinearity problem in the data and needed to be interpreted with caution. Since the presence of multicollinearity is not a serious problem in forecasting, it was also found that the estimated money supply models could be quite useful in forecasting money supply in Bangladesh. Moreover, the forecasting power of the estimated M1R and M2R models are also examined in this paper.

1.0   Introduction

The Economy of Bangladesh suffers from many problems emanating from both the aggregate supply and aggregate demand sides of the economy. The financial sector was controlled under the strict directives of government and

---

[γ] Atish Dipankar University of Science and Technology, Bangladesh

[♣] University of Houston-Downtown, USA

Bangladesh Bank till December 1989. Under the controlled and financially repressed conditions, the economy performed quite poorly with low level of savings and investment, inadequate capital formation, inappropriate technology, negative real rate of return, chronic deficit in the balance of trade, smuggling, and low degree of monetization, among others. To overcome these problems, financial sector reform program has been initiated since 1990's. These reforms included flexible interest rate, convertibility of 'taka', introduction of 91 days bill, recapitalization of banks, new procedure of loan classification system, introduction of REPO in the money market, strengthening of the money and capital markets, among others. Bangladeshi currency Taka was allowed convertibility on current account from 1994, which was an important development. However, floating exchange rate mechanism started from the year 2003. Monetary and fiscal policy of Bangladesh is yet to be properly coordinated and macro management of the country faces problems. Beyond the formal money and market, the informal money market also plays an important role in Bangladesh, especially in the rural sector. Both sectors play complementary relationship without any direct or one to one correspondence. Government also borrows large amounts from the banking channels as well as non –bank financial institutions and the postal savings channel. In Bangladesh, the capital market is growing but still quite underdeveloped. However, due to lack of good alternative opportunities, investors have little choice but to invest mainly in bank deposits, post office savings accounts, savings certificates, and Government bonds.

Since money matters and it matters significantly, understanding the money supply and its major determinants assumes critical significance for any country, particularly for a developing country like Bangladesh. The issue is particularly important for academics, researchers and policy makers at home and abroad. The policy makers need to understand these determinants so as to guide them in formulating monetary policy for prudent management of the macro-economy with the purpose of controlling inflation and promoting stable economic environment. With this in mind, the present study intends to proceed with a limited objective, i.e. to examine empirically some plausible determinants of money supply for Bangladesh, to what extent such estimated models can be used for forecasting money supply, and to examine how supply of money can be managed better to improve the macro-economy of the country. More specifically, understanding the money supply process is critical for a better management of the monetary sector of the country including the management of interest rate and credit flows, and in controlling inflation, unemployment, and for promoting stable environment for economic growth. This study utilizes annual time-series data from 1975-76 to 2008-09 to conduct

the empirical study and the regression analysis along with other relevant statistical stools will be utilized to estimate the empirical model.

2.0 Literature Review

As already mentioned, the money supply and its prudent management and control through the monetary policy pursued by the central bank of a country can play a significant role in the managing and controlling the real sector of the economy in order to achieve macroeconomic objectives such as low inflation and unemployment and high economic growth. In economics, several alternative indicators such as M1 and M2 money are generally used as measures money supply in a country. M1 is the narrow money supply, which includes currency outside banks plus demand deposit, and the broad money M2 includes currency outside banks plus demand deposit plus savings, time, and other deposits. Both M1 and M2 money can be significantly influenced by the amount of High-Powered money, which is also known as the monetary base. This High powered money consists of currency in circulation and the bank reserves as shown in Appendix Fig 1.

Figure 1: High Powered Money as the Basis for Money Supply

Money Supply

Currency   Bank Reserves

High Powered Money (Monetary Base)
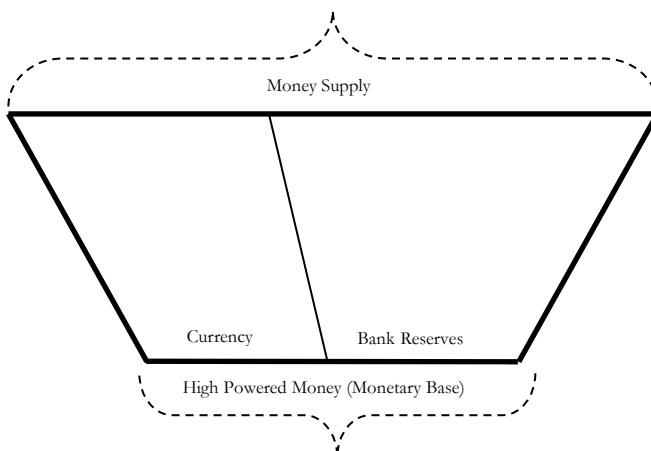
Monetarist view that supply of money can be considered as an exogenous variable since the central bank can control the stock of money supply and its process. But Gurley and Shaw (1960) have argued that the money supply itself could endogenous, being determined by other factors. In this spirit, three factors could be considered as proximate determinants of the money supply as suggested by Friedman and Schwartz (1963), which are: a) the stock of high–powered money; b) the ratio of deposit to reserve; c) the ratio of deposit to currency. Tobin (1965), however, disagrees with this approach and argues that to express the stock of money in terms of high-powered money, the reserve-deposit ratio and the currency-deposit ratio would result in an arithmetic tautology. However, Cramp (1970) opines that the quantity of money is largely endogenously determined in response to economic factors rather than exogenously determined by the central bank. On the other hand, Kaldor (1970) criticizes the Monetarist view that the quantity of money is determined by the demand of the public and that the central bank will be successful if it wants to change the quantity of money. The proponents of the Keynesian view argue that if the central bank tries to increase aggregate demand by open market purchases, it will be counter-productive because the public would not accept real cash balance in excess of their desired portfolio requirements. Polak (1997) developed a model which reflects the monetary approach to the balance of payments for use by the International Monetary Fund (IMF) in the 1950s. This model integrated monetary, income, and balance of payments analysis, and it became the basis for applying the IMF conditionality in approving IMF credits. In this framework, money supply plays a crucial role.

In the context of Bangladesh, Osmani, Bakht and Anwaruzzaman (1986) opined that fiscal policy affects the monetary sector in a variety of ways such as government deficit financing have contributed significantly to the expansion of money supply. They also observed that, contrary to the assumptions implicit in IMF stabilization programs, unplanned deficit financing is not the pre-dominant factor behind the breach of overall credit ceilings to Bangladesh.

In a different paper, Jones and Sattar (1988) observe that inflation in Bangladesh is not purely a monetary phenomenon. The empirical results obtain have highlighted the significant impact of non-monetary factors on prices while also raising the distinct possibility of effectively using monetary policy for influencing the real sector of the economy. Prices in Bangladesh are not purely market determined because price controls are pervasive throughout the economy.

Parikh and Starmer (1988) argue that money supply and prices are interrelated in Bangladesh. In their study, a framework is presented for investigating bivariate causal relations using Granger's notion of causality which is employed to test the relationship between the money supply and prices in Bangladesh, using monthly data for the period 1973 to 1986. The result indicates evidence of significant unidirectional feedback running from prices to money. The analysis is extended to investigate the relationship between rates of change in money and prices and once again there is evidence of feedback from prices to money. The main conclusion is that strict erogeneity of the money supply is rejected. These results are consistent with a "structuralist" view of the Bangladesh economy. On the other hand, Fernando (1991) examines that bivariate causal relation between money growth and inflation and money growth and output relating to Sri Lanka and found a unidirectional causation from money stock to prices which justified the hypothesis of the existence of demand-pull inflation in the Sri Lankan economy.   Momen (1992) tries to describe the behaviour of money and structuralism and examined the two opposite schools of thought, one known as the monetarist and the other as the structuralist, which have been engaged in a debate regarding the principal cause of inflation. The monetarists believe that money supply is the prime cause of inflation; while the structuralist argues that inflation is a consequence of structural rigidities in developing economies and development in poorer nations. In his study, he analyses data from 1958 to 1985 for ten (10) industrial and agricultural economies and found evidence that money supply is endogenous in less-developed nations while it is exogenous in the industrial economies. He suggests that IMF policy prescriptions for less-developed economies are not likely to be effective or relevant in such nations until their financial structures and level of industrialization have improved.

Bahar and Murtoza (1994) examine the money supply growth of Bangladesh over the time period of July 1986 to June 1994.On the supply side, reserve money is observed to be the main element. They commented that in the recent years the accumulation of net foreign assets greatly influenced by the behaviour of high powered money which is the main component of money supply. Huda (1998) also observed for Bangladesh that foreign transactions have a larger effect on year to year changes in money supply. The hypothesis of classical link between balance of payment and local money supply is rejected. The combined effect of government borrowing and net foreign asset on high–powered money was found to be more or less neutral on most of the occasion. Ali (2001) observed that money supply had a multiflow effect, which accentuates the process. Principal determinants of the money supply are also causative factors of demand for money. As such simultaneous effect of supply

of and demand for money creates equilibrium position in the monetary sector in Bangladesh.

Rahman and Reza (2004) depict that in the context of Bangladesh, over the period of 1979-2000, the money multipliers have proved to be unstable, so are its determinants, which are the currency deposit ratio, the total reserve ratio and the time deposit ratio. Again, the monetary base was also found to be unstable. Despite the instability in these variables, the monetary aggregates have proved to be stable. Farashuddin (2008) argue that monetary policy reforms in Bangladesh have crossed many hurdles. With further refinement towards higher credit intensity, greater mobilization and integration of the money market, monetary policy may play a more effective role in the mobilization of savings for investment, in combating inflation, and in achieving economic stabilization.

Sayed (2000) observe that underground economy in Bangladesh is prevailing strongly and the structural adjustment condition is inadequate, administered price is used often, and financial repression through the political process is quite serious. In such an environment, proper treatment of recognition lag, implementation lag, and impact lag of the components of money supply can ensure rational growth of this sector.

Hassan, Mustafa, Basher(2003) examine both long-term and short-term dynamic relationships among money supply and its components for Bangladesh economy within an Engle-Granger error-correction framework. They observe that MI and M2 money supply have very predictable long-run relation- ships with its components. Moreover, MI money supply has short-run relationship with its components but no short-term relationships exist among M2 and its components indicating the absence of a developed money market operation in Bangladesh.

Islam (2008) comments that Bangladesh Bank conducts monetary policy through targeting broad money (M2) as an intermediate instrument while reserve money (RM) serves as an operating instrument. He found that the currency-deposit ratio component in the multiplier model and net government borrowing, and movement of net foreign asset components in RM (reserve money) are the major contributors to changes in money supply. Since these components limit the degree of controllability of Bangladesh Bank over money supply, the conduct of prudent monetary policy in Bangladesh would crucially depend on taking into consideration the implications of changes in these key components.

3.0   Objectives of the Study

On the basis of aforesaid literature review, the study has been undertaken with the following limited objectives:

(i)   To determine factors which explain the variations in the supply of money;

(ii)   To examine the impact of external resource availability on money supply;

(iii)   To find out whether any structural change has taken place in the economy in Bangladesh due to continuous financial reform programs especially since the mid-nineties.

(iv)   To examine the strength the estimated model to forecast money supply in Bangladesh

(v)   To investigate the policy implications of the supply of money function.

4.0   Data and Methodology

Bangladesh became independent on 16th December of 1971. After independence her economy has to suffer due to legacy of the war. Immediately after independence, this study considers three years as transitional, hence considered to be abnormal periods. Thus the data from 1972-73 to 1974-75 were considering as abnormal period s and were dropped from the sample. Though we wanted to study from the date of birth of Bangladesh, we ended up starting our investigation from 1975 (July).

Although macro-economic stability programs and structural adjustment processes started in the middle of eighties, but due to various repression prevailing in the economy, financial liberalization started in earnest in the 1990's. To make the study more up-to-date, we have taken the latest available data for which the study period is extended up to 2008-09. As such study period is 1975-76 to 2008-09 totalling thirty-four years. The study considers period up to 1994-95 as period prior to effective reforms and since then as post-reform due to the fact that Taka, the currency of Bangladesh, was fully convertible on current account since 1994. As such, the time period of the study can be divided into two sub-periods as mentioned below:

a)   Sub period-1: Monetary Policy without reform measures i.e. 1975-76 to 1994-95.

  b) Sub period-2: Monetary Policy under reform measures i.e. 1995-96 to 2008-09.

Data in the study has been used extensively from the secondary sources i.e. published data in various issues of Economic Trends, Bangladesh Bank Bulletin, Bangladesh Arthanaitic Jarip, Bangladesh Arthanaitic Samikhaya, Statistical Year Book of Bangladesh, Annual Report of Bangladesh Bank, Statistical Pocket Book of Bangladesh, Bangladesh Bank Quarterly and the Twenty One Years of National Accounting of Bangladesh (1972-73 to 1991-92), among others. We have also consulted published books, journals and unpublished Ph.D. dissertations and research works that are relevant to the study. Exact sources of data are mentioned where appropriate.

        To estimate the money supply equations, the ordinary least square (OLS) method is generally used. The relevant variables were converted into real terms as appropriate by deflating the appropriate nominal variables by the corresponding Consumer Price Index (CPI). We have used ordinary least square estimation procedure to find out the best-fit equation. We used two alternative definitions of the money supply i.e. narrow money (M1) and Broad money (M2) where money supply is considered as the dependent variable in relevant equations. Besides the aforesaid statistical test, we also test whether serially correlated errors are present or not. As such the study has computed Durbin Watson statistics. Wherever serially correlated errors are present, we have used first order autoregressive i.e. AR (1) to remove auto correlations as appropriate.

5.0   Specification of the Model

Based on the review of the literature, we specify real (inflation-adjusted) money supply (MSR) to be determined endogenously and is hypothesized to depend on a number of variables such as the real high-powered money (HR), Deposit interest rate (DR), Real External Resources (ERR) as measured by the sum of foreign remittances and Foreign aid and loan, real Government Borrowing (GBORR) as a proxy for government budget deficits, the total number of bank branches (TNBB) to reflect the degree of access to banking facilities to the people, and a dummy variable D1 to reflect possible structural change in the money supply function due to reforms of the financial sector since 1994 when the local currency (Taka) was made convertible in the current account. The empirical model in general form can be written as follows with 'v' reflecting the error term:

MSR = (HR, DR, ERR, GOBRR, TNBB, D1, v) (1)

The specific linear from corresponding to the above general equation is given below:

MSR = a + b HR + c DR + d ERR + e GOBRR + f TNBB + g D1+ v (2)

Since money supply can be measured as narrow money (M1) as well as broad money M2, we rewrite equation (2) to have the following two versions, one for M1R and the other one for M2R with the same explanatory variables:

M1R = a + b HR + c DR + d ERR + e GOBRR + f TNBB + g D1+ v1   (2a)
M2R = a + b HR + c DR + d ERR + e GOBRR + f TNBB + g D1 + v2   (2b)

The expected signs of the coefficients are:
b > 0, c > 0; d > 0; e > 0; f > 0; g > 0 (3)

The money supply process primarily depends on high-powered money, which is expected to have a positive impact on money supply (b > 0). High-powered money equals currency in circulation including Bangladesh Bank notes and government notes and coins plus statutory reserve balances with Bangladesh Bank. It is treated in the liabilities side of the Bangladesh Bank. According to the monetarist perspective, when high-powered money rises, and other things remain the same, the money supply is expected to rise. The volume of high-powered money is determined by the behaviour of Bangladesh Bank, the central bank of the country. The central bank controls money supply subject to the behaviour of the public and commercial banks. With respect to the second explanatory variable, the deposit interest rate DR, the money supply is expected to respond positively to higher deposit interest rates (c > 0) as it provides greater incentives for commercial banks to expand loans to the private sector and the general public may have greater incentive to hold bank deposits instead of currency. These increased deposits are likely to expand money supply through the usual money multiplier process.

Consider now the foreign exchange availability variable ERR. Foreign currency availability plays a crucial role in the Bangladesh economy, particularly in the banking system. Fund management system of the commercial banks depends strongly on their international commitments and foreign exchange availability. These resources also add significantly to the bank deposits and hence the lending capacity of banking system. The possible impact of this factor is captured by an expected positive impact of the external resource variable (ERR) on money supply (d > 0). This is because the availability of these

foreign resources will enhance the deposit and loan creation capacity of the banking system, thus expanding money supply in the process.

Following Bakht and Anwaruzzaman (1986), fiscal deficit is included as another explanatory variable in the money supply function. Due to fiscal deficit, the government needs to borrow from the banking system, which affects the monetary stock of the country. Increase of government borrowings GOBRR as measured by real government borrowing from the banking sector is expected raise money supply of the country. Thus, government budget deficit can increase money supply to the extent that the central bank in particular and the banking system in general is under the control of the government and the government wants the banking system to finance the growing budget deficit. To the extent that the banking system lacks independence (as is generally the case in Bangladesh), the money supply is expected to be positively influenced by growing budget deficits as reflected by the GOBRR variable ($e > 0$).

Given that the financial system in Bangladesh is not yet well developed, some structural features may influence the money supply process. Two such variables are considered here, one is the number of bank branches and the other is a dummy variable capturing financial liberalization measures undertaken by the government. The total numbers of bank branches (TNBB) is expected to be positively related to money supply ($f > 0$). As more bank branches are opened up, access to banking system to the general public and businesses will rise and transaction cost of financial intermediation will decrease. This is expected to result in more bank deposits and loan creation, increasing money supply in the process.

Finally, the financial liberalization dummy variable (D1) is expected to have a positive effect on the money supply process ($g > 0$) as the liberalized banking and financial system will have more freedom and incentives to expand banking services to businesses and the general public, leading to increased borrowing and lending, thus expanding money supply. In this model, the dummy variable D1 will assume a value of zero for the years related to sub-period-1, i.e., 1975-76 to 1994-95 and a value of unity for sub-period-2, i.e. from 1995-96 to 2008-09.

6.0   Empirical Results

As discussed earlier and shown in Appendix Figure 1, money supply (both M1

and M2) are to be strongly determined by the monetary base or the High-powered money consisting of currency and bank reserves. This theoretical relationship is further explored using actual data of Bangladesh from 1975 to 2009 as depicted in Appendix Figure 2, which shows a strong positive relationship between the High-powered money (H) with the narrow money M1 in Bangladesh as shown by their common upward movement over time. Similar but somewhat weaker relationship is also shown between H and the broad money M2. It seems then that M1 is more strongly influenced by H than M2, which is not unexpected given that the broad money can be influenced by many more factors than the High-powered money alone and given the under-developed nature of the financial system in Bangladesh.

Figure 2: High Powered Money, M1 Money and M2 Money: 1975-76 to 2008-9

Table 1 gives descriptive statistics of the relevant variables. This table gives information on the mean, median, maximum, minimum, standard deviation, skewness, Kurtosis, Jarque-Bera statistics with their probability values, and the sample size. The skewness values show that there are slight positive and negative skewness in the data. Positive skewness shows up for M1R, M2R, HR, ERR, and GOBRR variables while negative skewness shows up for DR and TNBB variables. The Kurtosis values show that the two variables ERR, GOBRR, and TNBB have kurtosis values much above the normal distribution kurtosis value of 3. The Jarque-Bera tests for normality shows that most of the variables deviate from normal distribution as shown by the observed high Jarque-Bera values for which the null hypothesis of normal distribution is rejected, while the hypothesis of normal distribution seems to be valid for only the DR variable. However, these deviations of most variables from normal distribution are not likely to affect the regression results.

Table 1: Descriptive Statistics of the Variables

	M1R	M2R	HR	DR	ERR	GBORR	TNBB

Mean	1605.89	5812.73	1370.87	6.77	1743.72	1581.51	5289.00
Median	1188.14	4118.22	1108.31	6.97	1397.28	870.85	5716.00
Maximum	3933.86	17559.02	4109.35	9.11	4845.85	7804.07	6936.00
Minimum	576.60	913.01	302.03	4.22	573.76	447.28	1774.00
Std. Dev.	955.71	4630.69	944.81	1.48	987.02	1585.80	1272.49
Skewness	1.00	1.05	1.09	-0.28	1.70	2.15	-1.33
Kurtosis	2.98	3.04	3.65	2.19	5.29	8.23	4.14
Jarque-Bera	5.684882	6.217333	7.452390	1.348406	23.90681	64.88224	11.89891
Probability	0.058283	0.044660	0.024084	0.509562	0.000006	0.000000	0.002607
Observations	34	34	34	34	34	34	34

Table 2 gives the simple product moment correlation coefficients of different variables in the model. A look at the correlation coefficients among the explanatory variables reveals that a few explanatory variables have high correlation with some other explanatory variables. For example, HR is highly correlated with ERR, GOBRR, and TNBB while TNBB is moderately correlated with DR. These observed high correlations among the explanatory variables may cause some well-known multicollinearity problems in the estimation process, i.e. the coefficient estimates and their t-values may be suspect. As such, the empirical results from the regression analysis need to be interpreted with caution.

Table 2: Product Moment Simple Correlation Matrix of Relevant Variables

	M1R	M2R	HR	DR	ERR	GBORR	TNBB
M1R	1.00	0.99	0.98	-0.04	0.95	0.71	0.73
M2R	0.99	1.00	0.99	0.01	0.96	0.69	0.75
HR	0.98	0.99	1.00	0.03	0.95	0.70	0.76
DR	-0.04	0.01	0.03	1.00	0.07	-0.20	0.45
ERR	0.95	0.96	0.95	0.07	1.00	0.65	0.68
GOBRR	0.71	0.69	0.70	-0.20	0.65	1.00	0.53
TNBB	0.73	0.74	0.76	0.45	0.68	0.53	1.00

Table 3 gives the OLS regression results for the M1R dependent variable. Since serial correlation was not significant, the OLS regression was used to estimate

the model. The R2 and adjusted R2 values are quite high and the F-value (F=283; probability of F = 0.00) shows that the overall regression is statistically significant at better than 1% level of significance. However, in terms of individual variables, three variables were found to have strong and significant effects on M1R. These variables are: HR, DR, ERR, and D1. The high powered money (HR), the external resources (ERR), and the financial liberalization dummy variables has had the expected positive effects, while the deposit rate (DR) came out with unexpected negative and significant effects on M1R. This unexpected result could be due to the presence of strong multicollinearity in the data. But other two variables, the government borrowing (GOBRR) and the bank branches (TNBB) variables were not found to exert any statistically significant effect on M1R.

Table 3: Dependent Variable: M1R

Dependent Variable: M1R				
Method: Least Squares				
Sample: 1976 2009				
Included observations: 34				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	328.4640	133.2125	2.465714	0.0203
HR	0.333088	0.144419	2.306397	0.0290
DR	-58.33650	27.67594	-2.107842	0.0445
ERR	0.455430	0.106001	4.296464	0.0002
GBORR	-0.030329	0.023745	-1.277295	0.2124
TNBB	0.050766	0.048834	1.039570	0.3078
D1	455.5312	97.89741	4.653148	0.0001
R-squared	0.984368	Mean dependent var		1605.897
Adjusted R-squared	0.980894	S.D. dependent var		955.7140
S.E. of regression	132.1017	Akaike info criterion		12.78626
Sum squared resid	471172.9	Schwarz criterion		13.10051
Log likelihood	-210.3664	F-statistic		283.3737
Durbin-Watson stat	1.576048	Prob(F-statistic)		0.000000

Table 4: Dependent Variable: M2R without correction for autocorrelation

Dependent Variable: M2R				
Method: Least Squares				
Date: 09/25/10 Time: 14:01				
Sample: 1976 2009				
Included observations: 34				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-821.5108	510.6732	-1.608682	0.1193
HR	2.885635	0.553635	5.212164	0.0000
DR	-68.24788	106.0963	-0.643263	0.5255
ERR	1.498251	0.406357	3.687028	0.0010
GBORR	-0.147206	0.091027	-1.617163	0.1175

TNBB	0.017599	0.187205	0.094009	0.9258
D1	1513.052	375.2919	4.031667	0.0004
R-squared	0.990215	Mean dependent var		5812.733
Adjusted R-squared	0.988040	S.D. dependent var		4630.698
S.E. of regression	506.4146	Akaike info criterion		15.47383
Sum squared resid	6924305.	Schwarz criterion		15.78808
Log likelihood	-256.0551	F-statistic		455.3785
Durbin-Watson stat	0.839027	Prob(F-statistic)		0.000000

Table 4 reports M2R regression estimates without correction for autocorrelation. The results are similar to the M1R regression in that HR, ERR, and D1 are statistically significant with their expected positive signs. However, there is significant autocorrelation as shown by low D-W statistics of 0.84. The model was then re-estimated with correction for first order serial correlation and the results are shown in Table 5. The AR(1) coefficient is statistically significant and the D-W statistics shows that the serial correlation problem is resolved. The R2 and the adjusted R2 values were quite high and the F value (F=1323.51; Probability of F = 0.00) was also highly statistically significant at better than 1% level of significance. The above indicates that the overall M2R regression model seems to be quite acceptable. In terms of individual coefficients in this re-estimated M2R model, the HR and the ERR variables still retains their expected positive sign and statistical significance, but the previously significant dummy variable D1 loses its significance. The other variables: DR, GOBRR, and TNBB are not statistically significant in this model, but the DR came out with expected sign.

Table 5: Dependent Variable: M2R with correction for autocorrelation AR(1)

Dependent Variable: M2R				
Method: Least Squares				
Date: 08/16/10 Time: 09:33				
Sample(adjusted): 1977 2009				
Included observations: 33 after adjusting endpoints				
Convergence achieved after 153 iterations				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	315186.1	9719751.	0.032427	0.9744
HR	1.504929	0.397962	3.781592	0.0009
DR	39.73812	74.95140	0.530185	0.6007
ERR	0.829115	0.340045	2.438253	0.0222
GBORR	0.016230	0.044123	0.367844	0.7161
TNBB	-0.686515	0.394733	-1.739187	0.0943
D1	293.9767	435.6492	0.674802	0.5060
AR(1)	0.998963	0.032494	30.74255	0.0000
R-squared	0.997309	Mean dependent var		5961.210
Adjusted R-squared	0.996555	S.D. dependent var		4619.578
S.E. of regression	271.1312	Akaike info criterion		14.25030
Sum squared resid	1837804.	Schwarz criterion		14.61309
Log likelihood	-227.1299	F-statistic		1323.510
Durbin-Watson stat	1.582771	Prob(F-statistic)		0.000000

If we compare the results of the M1R and M2R models, the results indicate that overall M1R model performed somewhat better than the M2R model in explaining money supply in Bangladesh. Further, two variables came out very strong and robust across both models of money supply in Bangladesh: the high powered money (HR) and the external resources variable (ERR). These results are not surprising in the context of a poor developing country like Bangladesh where the banking and financial system are yet quite underdeveloped and relies heavily on external resources in promoting economic and financial activities in the country. The impacts of other variables such as deposit rates (DR), government borrowing (GOBRR) to finance budget deficits, and the number of bank branches are not very clear cut across the two models.

7.0   Forecasting Money Supply

As mentioned earlier, the interpretation of the individual coefficients are suspect due to the presence of multicollinearity among some explanatory

variables included in both models. However, given the high explanatory power of the estimated models and the strong and significant F values indicating the overall significance of the regression models, one can safely argue that these models would be very helpful in forecasting the both types of money supply for Bangladesh. The forecasting power of the estimated M1R and M2R models are now examined and the results are reported in this section.

Figure 3: Actual Values, Forecast values, and Forecast Errors of the M1R Model
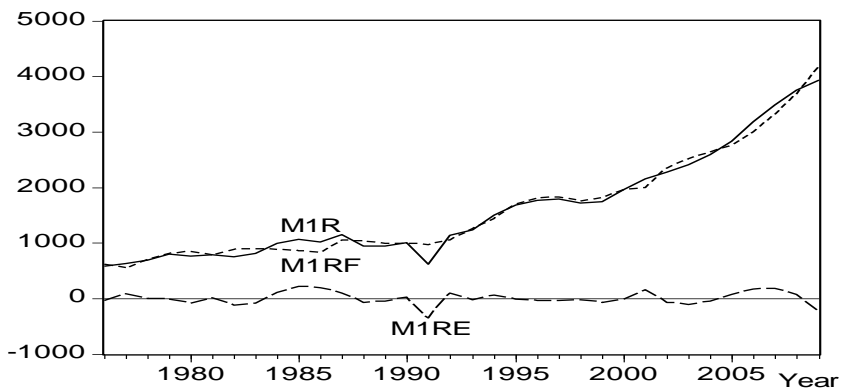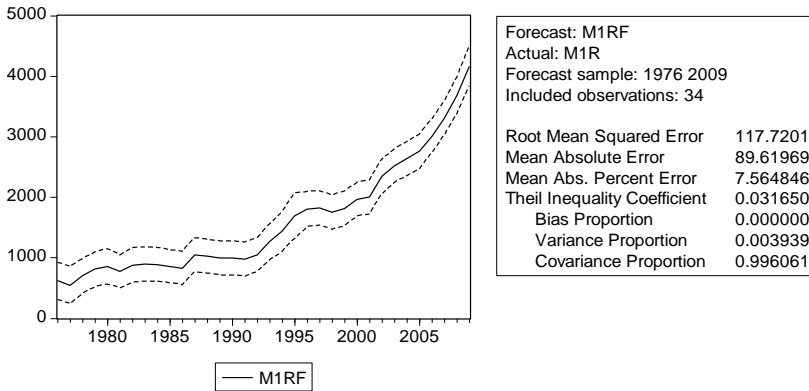

Figure 3 reports the actual values of M1R with its forecast value (M1RF) and the corresponding forecast error (M1RE). This figure shows that the forecast values trace the historical (within sample) actual values quite well with the exception of year 1991, when the financial reform programs were being initiated. To judge the forecasting power of the estimated M1R model more rigorously, the forecast values were plotted along with the standard two standard deviation bands around those values and several forecast evaluation statistics such as root mean square error (RMSE), mean absolute error (MAE), mean absolute percentage error (MAPE), and Their inequality coefficient (Theil coefficient) were reported in Figure 4. This figure shows the 2s.d. band is not too wide and the forecast evaluation statistics shows the RMSE = 117.72 with the mean absolute error of 89.62 and the mean absolute percentage error of about 7.56%.

Figure 4: Forecast Band and Forecast Evaluation of the M1R Model

Forecast: M1RF	
Actual: M1R	
Forecast sample: 1976 2009	
Included observations: 34	
Root Mean Squared Error	117.7201
Mean Absolute Error	89.61969
Mean Abs. Percent Error	7.564846
Theil Inequality Coefficient	0.031650
Bias Proportion	0.000000
Variance Proportion	0.003939
Covariance Proportion	0.996061

The mean absolute percentage error of 7.56% is a bit higher than conventional 5% acceptable error range, but still seems to be reasonable in the context of a developing country. The theil inequality coefficient of 0.03 is much less than one indicating that the estimated model performed much better than the simple naïve model forecasts where the forecast value is assumed to be same as the last year's actual value (Ft=At-1).

Figure 5: Actual Values, Forecast values, and Forecast Errors of the M2R Model
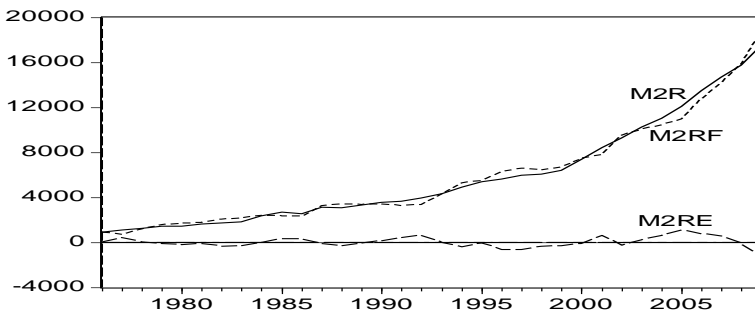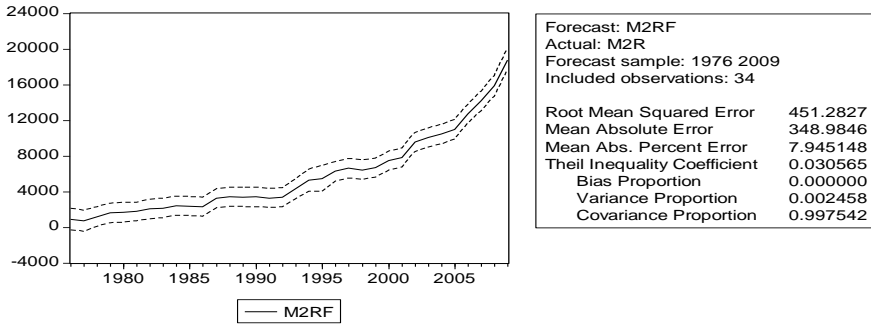

Figure 5 reports the actual values of M2R with its forecast value (M2RF) and the corresponding forecast error (F2RE) based on the estimated M2R regression model without he AR(1) correction, i.e. based on the simple regression model reported in Table 4. This figure shows that the forecast values trace the historical (within sample) actual values quite well. To judge the forecasting power of the estimated M2R model more rigorously, the forecast
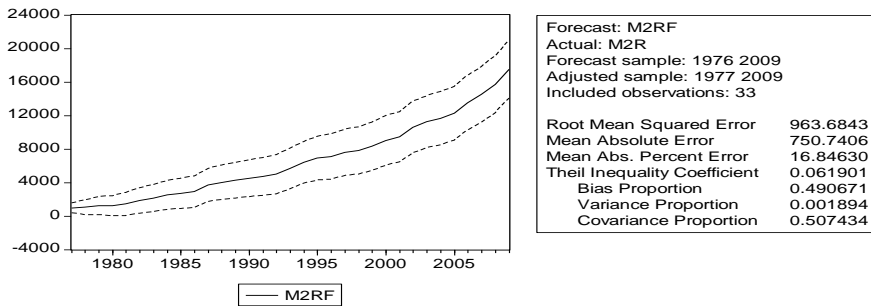
values were plotted along with the standard two standard deviation bands around those values and several forecast evaluation statistics in Figure 6.

Figure 6: Forecast Band and Forecast Evaluation of the M2R Model without **AR(1)**

Forecast: M2RF	
Actual: M2R	
Forecast sample: 1976 2009	
Included observations: 34	
Root Mean Squared Error	451.2827
Mean Absolute Error	348.9846
Mean Abs. Percent Error	7.945148
Theil Inequality Coefficient	0.030565
Bias Proportion	0.000000
Variance Proportion	0.002458
Covariance Proportion	0.997542

This figure shows the 2 s.d. band around the M2R forecast is similar to the M1R band. However, the forecast evaluation statistics for the M2R model shows that the RMSE = 451.28, the mean absolute error of 348.98, and the mean absolute percentage error (MAPE) of about 7.95% are slightly higher than the corresponding statistics reported earlier for M1R Model. If we use the M2R model with correction for autocorrelation, the forecasting power of the model deteriorates significantly as shown in Figure 7, which shows the band is a bit wider compared to both the M1R model band and the M2R model band without AR(1) correction. In the M2R model with AR(1) correction, all the forecast evaluation statistics are quite unfavorable. The RMSE of 963.68, mean error of 750.74 and the mean absolute error of error of 16.84% are all worse than the corresponding statics for both the M1R forecast and the M2R forecast without the AR(1) correction. It thus appear that the AR(1) correction does not help improve forecast error, rather makes it even worse.

Figure 7: Forecast Band and Forecast Evaluation of the M2R Model with AR(1)

Forecast: M2RF	
Actual: M2R	
Forecast sample: 1976 2009	
Adjusted sample: 1977 2009	
Included observations: 33	
Root Mean Squared Error	963.6843
Mean Absolute Error	750.7406
Mean Abs. Percent Error	16.84630
Theil Inequality Coefficient	0.061901
Bias Proportion	0.490671
Variance Proportion	0.001894
Covariance Proportion	0.507434

8.0   Conclusion and Policy Implications

The study has empirically estimated the supply of money for Bangladesh using time series annual data from 1975-76 to 2008-09 and utilizing the traditional linear regression analysis. The model is estimated for both the narrow and broad money, and in both cases, high-powered money played a significant positive role in explaining the money supply process in Bangladesh, thus providing partial support to the monetarist hypothesis. However, beyond the monetarist view, additional variables in the light of the Keynesian and structuralist analysis, such as the availability of external resources and financial liberalization were found significant and hence need to be taken into account in understanding the money supply process of the country. But some other structural variables such as government budget deficits, deposit interest rate, and bank branches were not found to be significant in explaining money supply function. However, the observed insignificance of these variables could be attributable to multicollinearity problem in the data. Since the presence of multicollinearity is not a serious problem in forecasting, the paper utilized the estimated models to forecast both M1R and M2R money supply and found that the estimated simple linear regression models without correction for autocorrelations for both M1R and M2R performed quite well in within-sample forecasting of the country's money supply. It was also found that correction for autocorrelation in the M2R model (where autocorrelation was present) made the forecast accuracy worse than the simple model without such corrections. It was thus concluded that the simple regression models could be quite useful in forecasting both the broad and narrow money supply in Bangladesh. However, the empirical results, especially those pertaining to the sign and statistical significance of the individual coefficients, need to be interpreted with caution because of the multicoillinearity problem in the data.

Having recognized the limitations of the estimated results, the paper

however can make some policy recommendations. Firstly, it is clear that the high-powered money plays a significant role in the money supply process in Bangladesh. Since the central bank of the country has strong control of the high-powered money, it is strongly argued that Bangladesh Bank needs to have more independence in conducting monetary policy independent of political interference in the country and need to pay serious attention to manage and control the High-powered money in order to have strong influence over both narrow and broad money supply. Secondly, since external resources has had significant effects both types of money supply, the central bank also needs to monitor external resources carefully in understanding and then managing the money supply process of the country. Thirdly, central bank independence is expected to have a better monetary policy, which may be helpful to have a much better management of the interest rate and credit flows of the country. Fourthly, the above mentioned better management of the monetary sector may bring about a much better outcome in the real sector of the economy in terms of achieving lower rate of inflation and unemployment, and a higher rate of economic growth. Fifthly, since financial liberalization was found to have strong impact on the money supply function, it is argued here that various distortions still existing in the financial markets need to be improved through continued and hopefully prudent financial reforms. Without removing imperfection from the banking system and financial markets, the country cannot have the opportunity to attain sustainable economic development.

Before concluding, the authors would like to give some direction for further research in this important area. As mentioned above, the estimated models for both narrow and broad money suffer from multicollinearity problem. Future research may consider applying different methods to overcome this and other statistical and econometric problems. Further research may also consider testing for non-stationary of the variables prior to estimating a regression model. If the variables were found to be non-stationary, the traditional regression analysis would not apply. In such a situation, one needs to conduct cointegration analysis to examine the existence of any long-run relationship among the variables, causalities as well as short-run dynamics of the system. These latter methods were not used in this paper in order to focus the paper on simple models first.

References

Ali,Muhammad Mahboob 2001. Determinants of Supply of and Demand for Money: A case study of Bangladesh, Student Ways, Dhaka, Bangladesh.

Bahar ,H. and Murtoza,M.G.1994. "Review of the money supply of Bangladesh over the period 1998-87 to 1993-94",a paper presented in the seminar on "Monetary policy in Bangladesh "from 16-16 October held in Bangladesh Bank.

Bangladesh Arthanaitic Samikhya 1997 . Ministry of Finance, The Government of the People's republic of Bangladesh, Dhaka, June.

Bangladesh Arthanaitic Samikhya 2010. Ministry of Finance, The Government of the People's Republic of Bangladesh, Dhaka, June.

Bangladesh Bank.1996.Economic Trends,Volume:XX11,No.5,May

Bangladesh Bank.2000 Economic Trends,Volume:XXV,No.6,June

Bangladesh Bank.2010 Economic Trends,Volume:XXXV,No.2,February

Cramp,A.B.1970."Does Money supply matter?", Lloyds Bank Review

Farashuddin, Mohammaed 2008."Monetary Policy and Financial Sector Reform",

Rehman Sobhan, SR Osmani, Mustafizur Rahman (eds.),Emerging Issues in Bangladesh Economy, Center For Policy Dialogue and The University Press Limited, Dhaka, Bangladesh.

Fernando,U.F.Nimal 1991. "Money growth, inflation, output and causality: The Srilankan experience,1978-1988",Central Bank of Sri Lanka Staff Studies,Vol.21,No.1&2

Friedman, M. and Schwartz,A.J.1963."A Monetary History of the United States,1867-1960",National Bureau of Economic Research Studies in Business Cycles,No.12,University Press, Princeton, USA.

Gurely,K. and Shaw ,E.1960. Money in a Theory of Finance   ,The Brooking institutions ,Wahington,USA

Hassan, M. Kabir , Mustafa ,Muhammad and Basher, Sved Abul 2003. "The Money Supply Process in Bangladesh: An Error-Correction Approach", The Indian Journal of Economics , Vol LXXXIII, April

Huda,M.N. 1998."Approach to money supply analysis", Journal of the Institute of Bankers Bangladesh,Vol.27

Islam, Md. Ezazul 2008. "Money Supply Process in Bangladesh: An Empirical Analysis ", Bangladesh Bank, Policy Analysis Unit (PAU) , Working Paper Series: WP 0805

Kaldor,N., 1970. The Neo Monetarism, Lloyds Bank Review,No.97

Momen, A. 1992. "Money, structuralism and the International Monetary Fund: An auto regression assessment of controversy", The Bangladesh Development Studies, Vol. XX, No. 4.

Osmani, S.R. ,Bakht,Z. and Anwaruzzaman,C. 1986.The Impact of Fiscal policy on the Monetary sector of Bangladesh, Bangladesh Institute of Development Studies, Research Report no. 50.

Parikh, A. and Starmer, C . 1988. "The relationship between the money supply and prices in Bangladesh", The Bangladesh Development Studies, Vol. XVI, No. 3.

Polak, Jacques .1997. The IMF Monetary Model at Forty, IMF Working Paper No.WP/97/49 , pp. 1-20,   April

Rahman,A.K.M.Atiqur and Reza,Sadat 2004."Stability of Money Multiplier and Money Supply in Bangladesh", Bangladesh Arthonity Samity Samoyki-2004.