Money Supply Function for Bangladesh: An Empirical Analysis

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Abstract

The study had empirically tested the money supply function for Bangladesh using annual time series data. Authors observed that high-powered money played a very significant role in the money supply process of Bangladesh, particularly with respect to the narrow money supply M1, thus providing some support for the monetarist model. However, beyond the monetarist view, additional variables in the light of the Keynesian and structuralist analysis, such as bank rate, external resources, and financial liberalization need to be taken into account in understanding the money supply process of the country. These other variables were also found to exert some influence on the broad money supply in Bangladesh. However, given the poor performance of the narrow money model and the existence of multicollinearity problem in both models, the estimated results, even for the broad money model, need to be interpreted with caution.

Keywords: Money supply, Bangladesh, High Powered Money.

Introduction

The economy of Bangladesh suffers from many problems from both supply and demand sides of the real economy. The monetary sector of the country, particularly the management of money, credit, and interest rate may also have significant implications for the problems facing the real sectors of the economy. Bangladesh suffers from poverty, imperfection in both factor and product markets, continuous disequilibria in the economy, deficient administrative structure, inappropriate tax structure, heavy dependence on the external sector, lack of

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capital stock, and massive unemployment. The country is not only technologically and managerially inefficient but also underdeveloped in transport, telecommunication, and energy sectors. High unemployment, low standard of living, low level of saving, surplus of unskilled labor, acute balance of trade deficit and low growth rates are prevailing in the economy. Besides, political instability causes serious problem for the economy. The country still doesn't have any effective governance system to ensure corporate governance and corporate social responsibility of the country.

Further, both the agricultural and the industrial sectors have yet to develop to their full potential. Public and private investment cannot be properly utilized. Default cultures in the monetary and banking sectors have become prominent in the economy. Monetary and fiscal policy of the country is yet to be properly coordinated and macro management of the country faces problems.

Besides, the formal and the informal money markets play important roles in Bangladesh, especially in the rural sector. Both sectors play complementary relationship without any direct or one to one relationship. Government also borrows large amounts from the banking channels. Bangladesh Bank, the central bank of the country, cannot yet independently determine monetary policy. The government still plays an important role in the financial sector as a major borrower from the banking system as well as influencing monetary policy of the Bangladesh Bank. In Bangladesh, there is a very limited scope for individuals to invest in the capital market and the lack of alternative opportunities for investment compels them to invest mainly in bank deposits, post office savings, saving certificates and Government bonds.

This study has a very limited objective, i.e., to estimate empirically the money supply function for Bangladesh and then examine how supply of money can be managed better to improve the country's economy. 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 economic growth. Time-series annual data are used to conduct the empirical study and regression analysis and other statistical stools are employed to conduct the empirical study.

Literature Review

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 managing and controlling the real sector to achieve low inflation and

unemployment and high economic growth. In economics, several alternative indicators such as M1 or M2 money are used as measures of 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 saving deposit. 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 Figures 1 and 2 and serves as the base, based on which both M1 and M2 are determined through a money multiplier process.

Three factors are 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 the monetarist approach to determine the money supply function. He argues that to express the stock of money in terms of high-powered money, the reserve-deposit ratio and the currency-deposit ratio are showing an arithmetic tautology. 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 adherents of the Keynesian view argue that it will not be possible for the central bank to increase aggregate demand by open market purchase, because the public would not accept real cash balance more than their needs and portfolio requirements.

Osmani, Bakht and Anwaruzzaman (1986) have shown that fiscal policy affects the monetary sector in a variety of ways. Large deficit financing contributes significantly to the expansion of money supply. They also observe that contrary to the assumption implicit in the IMF stabilization programme, unplanned deficit financing is not the pre-dominant factor behind the breach of overall credit ceilings to Bangladesh. They found that a "reserve crowding out", whereby the private sector had been pulling resources away from the government sector through the process of inflation, induced transfer of resources.

Ali (2001) observes that money supply has a multiflow effect, which accentuates the process. Principal determinants of the money supply are also causative factors of the demand for money. As such, the simultaneous effect of supply of and demand for money creates equilibrium position in the monetary sector in Bangladesh. Maroney, Hassan, Basher, and Isik (2004) indicate that within the context of Bangladesh, monetary policy is more important than fiscal policy. As a

significant amount of development expenditure for Bangladesh comes from foreign aid and grants, they argue that this aid must be channeled to productive activities so that it contributes to economic growth.

Objectives of The study

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

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

(ii)   To evaluate the impact of High powered money and bank rate on money supply;

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

(iv)   To analyze the impact of government budget deficits on money supply;

(v)   To analyze the impact of the number of bank branches on money supply;

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

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

Data and Methodology

Bangladesh became independent on 16th December of 1971. After independence her economy had to suffer due to the legacy of the war. This study considers the three immediate post-independence years as transitional, hence abnormal periods. Thus the data from 1972-73 to 1974-75, considered as transitional period, has been dropped. 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 programmes and structural adjustment processes started in the middle of the eighties, due to various repressions prevailing in the economy, financial liberalization started in earnest in the 1990s. To make the study more up-to-date, we have taken the latest available data for which the study period is extended up to 2003 (June). As such, the study period is 1975-76 to 2002-03 totaling twenty-eight years. The time period of the study can be divided into two sub-periods as mentioned below:

a)   Sub period-1: Monetary Policy under administrative control, i.e., 1975-76 to 1989-90.

b)   Sub period-2: Monetary Policy under reform measures, i.e., 1990-91 to 2002-03.

Data has been used extensively from the secondary sources, viz, various issues of Economic Trends, Bangladesh Bank Bulletin, Bangladesh Arthanaitic Jarip, Bangladesh Arthanaitic Samikhya, Statistical Year Book of Bangladesh, Annual Report of Bangladesh Bank, Statistical Pocket Book of Bangladesh, Bangladesh Bank Quarterly, Twenty one years of national accounting of Bangladesh (1972-73 to 1991-92) etc. 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 required.

To estimate the money supply equations, the ordinary least square (OLS) method is generally used. The relevant variables are 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 use two alternative definitions of the money supply, i.e., narrow money (M_1) and broad money (M_2) 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 transformation, i.e. AR (1) to remove autocorrelations.

Specification of the model

Based on the review of the literature, we specify real (inflation-adjusted) money supply (MSR) to depend on: real high-powered money (HR), deposit interest rate (R), real external resources (ERR) as measured by the sum of foreign remittances, and foreign aid and loan, government expenditures as % of government revenues (GERR) as a proxy for government budget deficits (in this formulation, a value above 100 represents deficits and below 100 represents budget surplus, thus avoiding positive and negative values), 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 1991. The dummy variable will assume a value of zero for the years related to sub-period-1, i.e., 1975-76 to 1989-90 and a value of unity for sub-period-2, i.e., from 1990-91 to 2002-03.

MSR = (HR, R, ERR, GERR, TNBB, D1)   (1)

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

MSR = a + b HR + c R + d ERR + e GERR + f TNBB + g D1   (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 R + d ERR + e GERR + f TNBB + g D1   (2a)

M2R = a + b HR + c R + d ERR + e GERR + f TNBB + g D1   (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 (R), 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 pubic 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. 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 borrowing from Bangladesh Bank will 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 are 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 GERR 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 number of bank branches (TNBB) is expected to be positively related to money supply ($f > 0$). As more bank branches are opened up, the access to banking system to the general public and businesses will rise and the 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.

Empirical Results

As discussed earlier and shown in Appendix Figures 1 and 2, money supply (both M1 and M2) are to be strongly determined by the amount of high-powered money (H) in the economy, later consisting of currency and bank reserves. This theoretical relationship is further explored using actual data of Bangladesh from 1975 to 2003 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 a bit 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.

Tables representing estimation results are given in Appendix tables 1 through 5. 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, and ERR variables while negative skewness shows up for R, GERR, and TNBB variables. The Kurtosis values shows that the two variables ERR and TNBB have kurtosis values much above the normal kurtosis value of 3. The Jarque-Bera tests for normality show that the only those two 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 the remaining variables. These slight deviations of a few variables from normal distribution are not likely to affect the regression results.

Table 2 gives the simple product moment correlation coefficient 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, GERR, and TNBB while TNBB is highly correlated with HR. 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 3 (not reported to save space; but available from the authors upon request) gives the OLS regression results for the M1R dependent variable. The R^2 and adjusted R^2 values are quite high and the F-value also shows that the overall regression is statistically significant. However, in terms of individual variables, only the HR (High Powered money) is statistically significant, while the rest of the variables are not statistically significant. Further, the Durbin-Watson statistic shows that this regression suffers from positive serial correlation problem as shown by the low Durbin-Watson value.

Table 4 reports regression results for the same dependent variable M1R with adjustment for the first order serial correlation. Although the serial correlation of residuals is taken care of by this process, the resulting regression estimates reflect very poor and disappointing performance in the sense that none of the variables shows any statistical significance except the auto-regressive coefficient and the High Powered money (HR) variables. The deposit rate variable (R), GERR, and D1 variables even came out with unexpected negative signs, although none of them are statistically significant. The ERR and TNBB variables came out with

expected positive signs, but they were not significant either. This poor result may be partly due to high collinearity among some of the explanatory variables as discussed earlier. Thus, it appears that the H1R function is dominated by only high-powered money.

Table 5 reports the regression results for the dependent variable M2R. This equation seems to perform quite well in terms of standard statistical criterion, in spite of the possible multicollinearity problems mentioned earlier. The R^2 and the adjusted R^2 values are quite high, and the high F-value (F-statistics of 244.9) with the associated very low probability value indicates that the overall regression is highly significant at better than 1% significance level. The Durbin-Watson statistic is close to 2.0, which indicates absence of any linear first order serial correlation of the residuals (although non-linear and/or higher order serial correlation may still exist). In this table, the variables HR, R, ERR, and D1 variables each came out with the expected positive signs and all are statistically significant at better than 5% level of significance except R and D1, which are significant at better than 10% level. Thus, it seems that high powered money, deposit interest rate, external resources, and the financial liberalization contribute positively and significantly in the expansion of the broadly defined money supply (M2R) in Bangladesh. Most dominant of course appears to be the high-powered money.

However, the other two variables, GERR and TNBB came out with the unexpected negative signs and GERR is not statistically significant. The negative but marginally significant coefficient of TNBB is somewhat surprising. The anomalies observed for these two variables may be attributed at least partially to the presence of multicollinearity among some explanatory variables. It is to be noted here that due to the multicollinearity problem, one needs to be careful with the interpretation of the coefficients of all the variables reported in this table, not only for the variables which show statistical anomaly. Having said that, given high R^2 and F values, and given the absence of serial correlation, one can safely argue that this simple linear model would be very helpful in forecasting the broad money variable M2R for Bangladesh, in spite of our caution in interpreting the signs, magnitudes, and statistical significance of the reported individual coefficients. As mentioned earlier, the individual coefficient needs to be interpreted with caution because of this problem.

Conclusion and Policy Implications

The study has empirically estimated the supply of money function for Bangladesh using annual time series data from 1975-76 to 2002-2003 and utilizing the

traditional linear regression analysis. Although the model is estimated for both narrow and broad money, the narrow money function did not perform well, but the broad money function seems to be quite satisfactory, especially if one wants to forecast the broad money for the country. In terms of individual variables, the high-powered money seems to play a very prominent role in the money supply process, in particular, the supply of broadly defined money. In this sense, the monetarist model fits well in the money supply function for Bangladesh. Beyond this, it also appears that the deposit interest rate, external resource availability, and the post-1990 financial liberalization have had strong positive impact on the broad money supply of Bangladesh. For the narrow money supply, only high-powered money appears to have some influence.

However, the performance of the two other variables, budget deficit and the number of bank branches, came out with unexpected negative signs. These anomalies may be at least partially attributed to the presence of strong multicollinearity in the sample data and /or data problems. In spite of these problems and given the overall satisfactory performance of the broad money model, the estimated model can be used quite well to forecast at least the broad money supply of Bangladesh.

The study thus concludes that that the high-powered money plays a very important role in the money supply process of Bangladesh, thus providing some support for the monetarist model. However, beyond the monetarist view, additional variables such as deposit interest rate, external resources, and financial liberalization need to be taken into account in understanding the money supply process of the country as these other variables were also found to exert strong influence on the broad money supply in Bangladesh. However, given the poor performance of the narrow money model and the existence of multicollinearity problem in both models, the estimated results, even for the broad money model, need to be interpreted with caution.

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 politics of the country and pay serious attention to manage and control the high-powered money in order to have a strong influence over both M1 and M2 money supply. Secondly, such 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. Thirdly, 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 rates of inflation and unemployment, and a higher rate of economic growth.

Further, various distortions from the financial markets should be removed. Without removing imperfection from the markets, the country cannot have the opportunity to attain sustainable economic development. As such, equal importance on monetary and fiscal policy should be given and both policies should be allowed to work in a complementary fashion. Besides, introduction of fully floating exchange rate system may create problem for the economy as monetary management system still cannot be significantly improved and distortions cannot be removed.

Bangladesh Bank should work independently in order to have a prudent management and regulation of the money supply. Bangladesh Bank should also be concerned with the stability of exchange rates, which may require it to keep a strong focus on inflation control. Even when currencies are flexible, frequent exchange rate changes and sharp devaluations are undesirable in general. Small changes in flexible exchange rates are to be expected, but acceleration in the trend and abrupt changes may pose serious problems. Bangladesh Bank with a supervisory function has a key role to play in developing and implementing adequate prudential regulations and an effective supervision of financial institutions. Commercial banks in Bangladesh are not playing a proper and constructive role.

Before concluding, the authors would like to give some direction for further research in this important area. As mentioned above, the narrow money model did not perform well and both the narrow and broad money models suffer from multicollinearity problem. Future research may consider methods to overcome this and other statistical and econometric problems. Further research may also consider testing for non-stationariness 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.

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APPENDIX

Table 1: Descriptive Statistics of the Variables

	M1R	M2R	HR	R	ERR	GERR	TNBB	D1
Mean	1244.62	4039.91	1026.79	8.51	812.49	111.17	5020.28	0.464286
Median	1039.95	3408.76	943.53	8.00	753.77	102.70	5495.00	0.000000
Maximum	2404.48	10249.18	2208.62	11.30	1736.49	178.82	6278.00	1.000000
Minimum	576.60	913.00	302.02	5.50	385.98	7.24	1774.00	0.000000
Std. Dev.	545.97	2582.46	552.99	1.87	277.81	42.85	1241.57	0.507875
Skewness	0.64	0.81	0.56	-0.01	1.76	-0.26	-1.34	0.143223
Kurtosis	2.17	2.77	2.34	1.66	6.44	2.27	3.84	1.020513
Jarque-Bera	2.76	3.13	1.97	2.07	28.46	0.93	9.29	4.667158
Probability	0.25	0.20	0.37	0.35	0.00	0.62	0.01	0.096948
Observations	28	28	28	28	28	28	28	13.00000

Table 2: Simple Correlation Matrix

	M1R	M2R	HR	R	ERR	GERR	TNBB
M1R	1	0.97	0.95	-0.64	0.86	0.69	0.73
M2R	0.97	1	0.99	-0.61	0.88	0.76	0.77
HR	0.95	0.99	1	-0.63	0.85	0.79	0.80
BR	-0.64	-0.61	-0.63	1	-0.47	-0.52	-0.21
ERR	0.86	0.88	0.85	-0.47	1	0.50	0.61
GERR	0.69	0.76	0.79	-0.52	0.50	1	0.79
TNBB	0.73	0.77	0.80	-0.21	0.61	0.79	1

Table 3: Dependent Variable: M1R
(Results not reported here to save space)

Table 4: Dependent Variable: M1R with AR (1)
Method: Least Squares with AR (1)

Sample (adjusted): 1977 2003
Included observations: 27 after adjusting endpoints
Convergence achieved after 36 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	127.3536	512.5685	0.248462	0.8064
HR	0.670696	0.309500	2.167033	0.0431
R	-80.49861	49.87907	-1.613875	0.1230
ERR	0.193978	0.281785	0.688389	0.4995
GERR	-1.050870	1.938256	-0.542173	0.5940
TNBB	0.193727	0.165712	1.169062	0.2568
D1	-102.8350	203.2913	-0.505851	0.6188
AR(1)	0.478967	0.257157	1.862548	0.0781
R-squared	0.941022	Mean dependent var		1269.371
Adjusted R-squared	0.919293	S.D. dependent var		540.1444
S.E. of regression	153.4495	Akaike info criterion		13.14581
Sum squared resid	447388.2	Schwarz criterion		13.52977
Log likelihood	-169.4685	F-statistic		43.30757
Durbin-Watson stat	2.091242	Prob(F-statistic)		0.000000
Inverted AR Roots	.48			

Table 5: Dependent Variable: M2R
Method: Least Squares

Sample: 1976 2003
Included observations: 28

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1073.212	453.1760	-2.368200	0.0275
HR	3.792977	0.479464	7.910861	0.0000
R	155.8817	85.53072	1.822523	0.0826
ERR	1.877937	0.571879	3.283799	0.0035
GERR	-2.422760	5.015611	-0.483044	0.6341
TNBB	-0.297104	0.166500	-1.784409	0.0888
D1	837.3419	460.6288	1.817824	0.0834
R-squared	0.985022	Mean dependent var		4039.917
Adjusted R-squared	0.980743	S.D. dependent var		2582.464
S.E. of regression	358.3708	Akaike info criterion		14.81333
Sum squared resid	2697022.	Schwarz criterion		15.14638
Log likelihood	-200.3866	F-statistic		230.1770
Durbin-Watson stat	1.965149	Prob (F-statistic)		0.000000

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

Money Supply

Currency   Bank Reserves
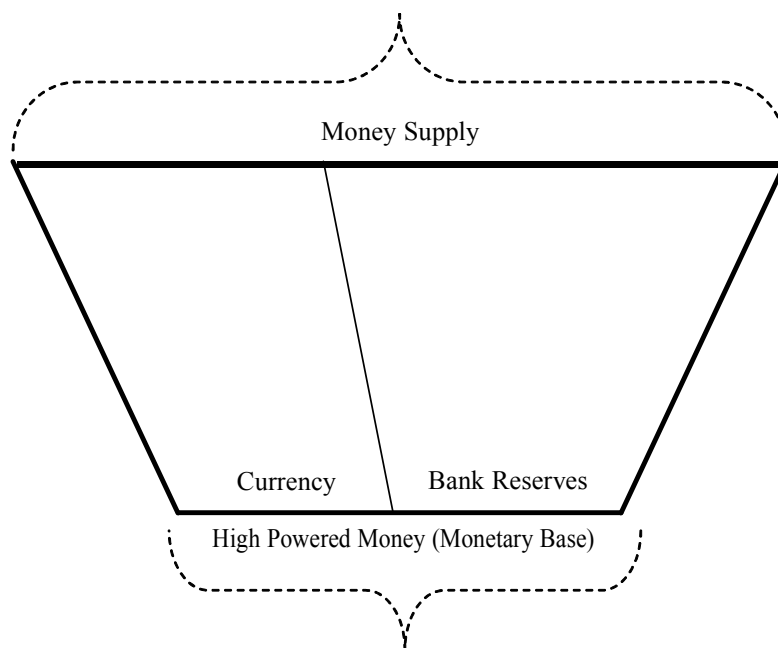
High Powered Money (Monetary Base)

**Figure 2 : High Powered Money, M1 Money and M2
Money: 1975-76 to 2002-2003**

M 2

M 1

H