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Efficacy of Pursued Monetary Policy in Bangladesh from 1975 to 2014.

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Abstract

The major objective of this paper is to examine the dynamic and causal linkages between Reserve Money (RM) with Net Foreign Asset (NFA) of Bangladesh Bank (BB) and Government Net Borrowing (GNB) from Bangladesh Bank over the period of 1975 to 2014. Though NFA is merely a part of RM but in reality it has an exogenous or autonomous nature. Therefore, we applied unit root tests, Johansen co-integration test, error-correction models and Granger causality test by taking care of the stochastic properties of the relevant variables. Both short run and long run relationships of RM with GNB and NFA of BB have been confirmed, i.e., RM is caused by GNB and inflows of foreign currencies. Thus BB's money supply depends on growth in as well as growth of NFA. The autonomous nature of NFA is weakening BB's scope to curb money supply. The paper attempts to fill in the existing gap in literature regarding monetary policy implementation process in Bangladesh.

Key words: Monetary Policy, Domestic Credit, Reserve Money, Broad Money, Co-integration, Bangladesh.

Introduction

The paper attempts to examine the dynamic causal relationship among some crucial monetary variables in Bangladesh. In the backdrop of conventional monetary economics and development strategy the central bank of many developing countries in the world focus on the empirical relationship among monetary variables like Reserve Money, Narrow Money, Broad Money, Government Credit, Private Sector credit, Income or growth rate, inflation etc. This emanates from the fact that controlling money supply becomes the major tool to stimulate real demand as well as economic growth and to stabilize price level in the economy. Despite

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of having voluminous theoretical and empirical literature in economic text perhaps there is no academic study in Bangladesh about how much Bangladesh Bank pursued policies to conduct monetary policy is effective. Though economic texts have some gross theoretical discussion they suffer from the practical knowledge of central banking in cases of Bangladesh. Discussing with many local academicians, researchers etc. the author of this paper perceived that there is a severe gap of knowledge of monetary policy conducting procedure in Bangladesh. How BB pursues the job of regular fine tuning, sterilization, keeps exchange rate stable etc. This paper will fill up some extent this gap for the existing appetiteness of the stakeholders.

Monetary policy in Bangladesh, as outlined in Bangladesh Bank order 1972, is formulated and conducted focusing on inflation and income growth rates as the basic policy targets. To achieve these targets an empirical rule oriented i.e. based prior experience of monetary aggregates such as reserve money, broad money and domestic credit (both private sector and government), Net Foreign Assets (NFA) etc. are also projected for a particular fiscal year, and subsequently monitored and controlled to achieve the desired targets, where they can be revised for newly developed backdrops in the economy. Bangladesh Bank is not fully independent as there is a significant level fiscal dominance still works from the government parts regarding borrowing of the government from the central bank as well as banking systems. However, in terms of policy initiation and implementation Bangladesh Bank enjoys full independence from the fiscal side. In case of issuance and sale of any bills BB does not need to care any other authority. Hence, this bank can float, apply and operate instruments in any extent they need to control the money supply. In Bangladesh as output growth gets priority over inflation control BB needs, like many other central banks in developing countries, to sacrifice some extent inflation to achieve the targeted economic growth. "Bangladesh Bank is in a position to conduct an independent monetary policy for price stability through a monetary or an inflation targeting strategy. Inflation targeting as a strategy of monetary policy, however, remains conditional on a set of stringent conditions and is considered not appropriate for Bangladesh at this juncture. Monetary targeting may, therefore, be considered an alternative option, given that under the present market-based exchange rate system, the Bangladesh Bank has gained an effective control over the monetary base and that there exists both a stable money demand function and a situation of monetary stability as envisaged by monetary economists for a monetary rule." Hossain (2004).

Broad Money (BM) is thought as the true representative of money stock of the economy. In this regard Bangladesh Banks sets a target of growth of Broad Money. Measuring empirical relation with the Broad Money (BM) BB fixes up a target of growth of Reserve Money (RM) on what it has direct control through administrative control on commercial banks as well as regular fine tuning activities. Thus, BB sets up RM to control money supply for achieving target of level of the BM. As BB is instrumentally independent from the fiscal side it largely becomes successful to keep the RM in its targeted level. There is a direct positive relation between Government Net Borrowing (GNB) and RM or Base Money. Hence, when GNB increases RM also increases and ultimately money supply in the economy increases. BB accommodates its targeted BM growth keeping coherence with the govt. target of bank borrowing declared in annual budgetary speech

in the assembly of the parliament. The same consequences occur when another important autonomous part of RM namely NFA changes. For regular fine tuning of Base Money as well as sterilization in case accretion of NFA BB uses Repo, Special Repo, Liquidity Supports (as Lender of the last resort), Treasury Bills, Govt. Treasury Bills and BB Bills etc.

BB gets intellectual supports to formulate monetary policy from the International Monetary Fund (IMF) and other the supranational organizations. In addition to that BB discuss with prominent domestic researchers, former BB governors and deputy governors, former other experienced bureaucrats of BB and MOF, professors etc. to polish up the monetary policy in the eve of its Monetary Policy Stance (MPS) finalization. According to their intellect and BBs own discretion it fixes target of RM to control money supply for achieving target of level of the BM. However, as RM has some components on those have no control of BB, such as NFA, governments' credit or borrowing from Bangladesh Bank etc, sometimes monetary policy cannot be implemented in its own course of the central bank. So, at end of the fiscal year level of RM crosses the desired and targeted level and hence, particularly inflation target is failed to achieve. In such a case to curb the money supply and thereby inflationary pressure BB usually tries to adopt tight monetary policy which did not beget success to stabilize the price level in all prior periods of the country's history. Therefore, it is necessary to examine the nexus between NFA and Reserve Money, Government Borrowing and Reserve Money, or Money Supply (i.e. Broad Money) etc. to investigate efficacy of the monetary policy in case of Bangladesh, i.e. whether policies are being adopted by the BB are hatching empirically the due results for the economy. Therefore, the objective of this paper is to examine the dynamics of the causal relationship among some targeted key monetary variables for monetary policy stockholders in case of Bangladesh economy from period of 1975 to 2014.

Defining Money: One of the problems in defining as well as controlling money supply arises from the difficulty in measuring monetary aggregates which, in turn, is a result of the ambiguity in defining money itself. "Money is an ambiguous concept. The ambiguity arises of the same concept-money-to denote an asset that is important for explaining changes in the price level and an asset that renders a variety of services usually summarized by some undefined phrase." – A H Meltzer. From the above quote it is noteworthy that the two important aspects of the definition of money. Money is a difficult concept to define it and secondly, it is an asset. This difficulty of defining money arises from the function it performs. It can be anything that people agree to accept for exchange of goods. However, in addition to being a generally acceptable medium of exchange, money serves three other basic functions for us - a unit of account, a store of value and a standard of deferred payments. Thus anything that performs these functions can also be regarded as money. However, the facts that money is an asset provide us a useful clue to finding a working or operational definition of money. From the accounting view an asset gives its holders a claim and it implies an equivalent amount of liabilities for those against whom the claim is made. For example notes and coins (currencies), the most readily recognizable form of money, are assets for the holders of notes. It gives the notes holder's equivalent claims to the central bank which issues these notes. Therefore, all circulated notes and coins in Bangladesh are the BB's liabilities. Notes and coins are the only

element that forms money. There are also other liabilities of the central bank which are assets for the agents in the economy as well, and hence also form the basis of money supply. Despite of all this complexities of measuring or defining money it is thought that Broad Money (M2) is the actual representative of money stock of the economy. Number of literatures have used M2 as money stock for the economy. Hence, this paper as well as BB also considers M2 as money supply of the economy. BB cannot directly control M2 but it can control RM by its' direct use of instruments. M2 = mm*M0 where M0 is RM and mm is money multiplier. BB estimates MM by its previous experience for the coming fiscal year. Though it is not fixed or constant but it is thought that it does not incur any drastical change in particular year than it last years.

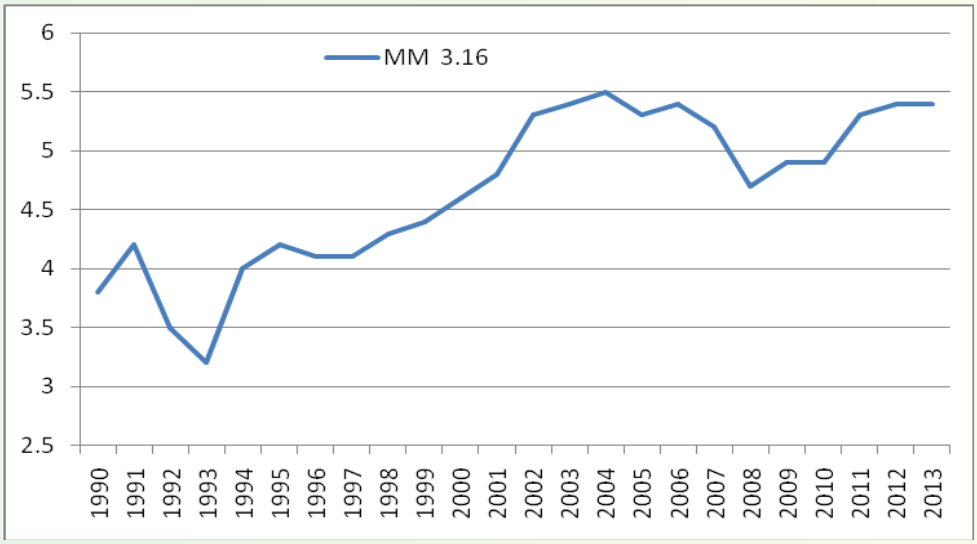

Figure 01: movement of money multiplier (mm) in Bangladesh.

From the above figure it is clear that except only for three years mm for the period of 1991-2014 was within range of 4.0 to 5.5 with low volatility. Hence, BB thinks that mm should be fixed within the short run period. Using this proportionate relation between RM and BM BB tries to maintain targeted level of BM by due manipulation level of RM.

The paper is outlined as per following sections. After introducing the issues in the first section, the second section deals with the theoretical debate, the third section focuses on data, variables, methodologies and econometric techniques. The fourth section highlights the results of the paper. The fifth section explains the empirical results with a brief policy recommendation and finally the sixth section draws conclusion.

2. Theoretical discourse and Debates

First and foremost the question may arise in mind of anybody that how and why BB operates maneuver of money supply in Bangladesh. BB does this virtuous job following the great articulation of Bangladesh Bank Order 1972 where it is mention very specifically that "Whereas, it is necessary to establish a central bank in Bangladesh to manage the monetary and credit

system of Bangladesh with a view to stabilizing domestic monetary value and maintaining a competitive external par value of the Bangladesh Taka towards fostering growth and development of country's productive resources in the best national interest." Upholding this holy national duty in shoulder BB performs monetary policy following the knowledge and implication of some traditional monetary theories. In this regard Fisher's quantity theory of money is worth to mention at first. Pre-Keynesian neoclassical economist Irving Fisher (1911) thinks that money has significant impact on price only if economy is running in full employment level. Let us make a short look on his famous quantity theory of money. The quantity theory of money postulates a one to one and proportional relationship between money supply and price level. This traditional quantity theory of money as presented by Fisher's equation is as follows

$$MV = PY \quad \text{.....(1)}$$

Where, the symbols have their usual connotations in Economics texts. Under the classical assumption of full employment and the short run stability of the velocity (V), equation (1) postulates the proportional relationship between money (M) and price (P) or between money (M) and Income (Y). However, equation (1) can also be written as

$$P = MV / Y \quad \text{.....,..... (2)}$$

By taking natural log in both side of equation (2), it can be rewritten as follows:

$$\hat{P} = \hat{M} + \hat{V} - \hat{Y} \quad \text{……(3)}$$

Where ^ indicates the growth rate of the relevant variables. Due to the full employment Output level (Y) and assumption of money velocity (V) in short run is fixed, so we can say that

$$P = f(M) \quad \text{.....(4)}$$

Equation (3) implies the proportionality between money and price (Classical view). Again if there is unemployment in the economy some also disagrees with this above type of one to one correspondence between price and money supply only and they rewrite the equation (3) as follows:

$$\hat{Y} = \hat{M} + \hat{V} - \hat{P} \quad \text{……(5)}$$

That is, if Money Supply (M) increases Output (Y) will also be increased (Keynesian view). As economy has some unemployment the extended money supply will help to generate employment for the unemployed resources by engaging them into production activities. So by this simple manipulation of Fisher equation we can assume that money supply has impact on income or GDP at least in short run when there is unused resources in the economy.

Interestingly, this identity (equation 1) which is usually known as the equation of exchange, has generated several debates among economists. Firstly, whether the causation in the equation runs from left to right i.e. MV causes PY or from right to left i.e. PY causes MV. Secondly, whether velocity of money (V) and output (Y) are fixed (constant). Thirdly, whether money supply (M) is fixed by the central bank or money supply (M) is defined by the level of Output (Y). Fourthly, whether money supply (M) is defined by the level of Output (Y) or Output (Y) is defined by the Money supply (M). These debating issues are encountered by theorist in several ways. We shall make citation very few of them.

In the classical model output (Y) is taken as determined by availability of capital and labor

and Velocity (V) is assumed to be fixed and, therefore, any exogenous change in money supply leads to change in price level. Money in this case does not have any impact on the real variables of the economy.

However, Keynesians criticized and rejected Classical idea about the proportionality between money and price. They argued that money has effects both on price and output level at least in the short run. According to them increasing money supply causes inflation but also reduce unemployment in the economy. However, Keynes or his followers did not assume full employment. As additional money supply creates additional demand in the economy it augments output as well. Therefore, there is a direct but not necessarily proportional relationship between money and price. Thus, according to the Keynesian school the changes in wages, the price level and the rate of inflation are non-monetary phenomena and are caused by different structural factors not only by Money.

Fisher considered this equation as function of the demand for money. In his version money is demanded only for its medium of exchange role. Alfred Marshall and A.C. Pigou (1923) assume that people demanded money for both its medium of exchange role and store of value role. Thus, Fisher's theory rejects the dependence of the demand for money on interest rates while Marshall accepts the role of interest rate in determining the demand for money. Keynes considers money as tools for transaction, speculative and precautionary demand of the individuals and creates additional demand and thereby it raises income of the economy. Milton Friedman (1956), assumes that people hold money with the intention of using it for upcoming purchases of goods and services. Thus, he integrates asset theory and transactions theory of demand for money within the context of neoclassical theory.

"Money can lose its value through excessive abundance, if so much silver is coined as to heighten people's demand for silver bullion. For in this way, the coinage's estimation vanishes when it cannot buy as much silver as the money itself contains. The solution is to mint no more coinage until it recovers its par value. - J S Mill (1860)

The intuitive debate about the relationship among money, income and price has got its' pace following the publication of David Hume's most celebrated article 'Of Money' 1752. He firstly establishes a proportional relationship among income, money supply and the absolute price level of the economy.

The proponents of monetarism, central bankers and empirical researchers have long been concerned with the nature of the causation between money stock and real economic variables. If the real economic activities solely determine money supply, then monetary policy conductors would be powerless. If, however, changing in the money stock has a significant causal effect on changes in real economic variables, then monetary policy actions would be highly powerful. If a bidirectional causal relationship between money and real economic activities is existed; then, this would lead to an ambiguous implication of monetary policy. Such relation would mean that monetary policy would need to be implemented with special consideration of the feedback effects between real economic activities and money which means that there will be some Hobson's choice or trade off between them.

The classical school discussed that changes in prices, the most important target variable in achieving stabilization, is basically due to changes in money supply. That is, money supply

is neutral to put effect on the real variables of output growth or employment generations. The ultimate implication is that there is a unidirectional causality runs from money to price only and money has no impact on real sectors of the economy.

Monetary Economists criticize the orthodox-Keynesian as explained by the IS/LM model. Monetarist argument is that money supply manipulations by the monetary authority (Central Bank/FRB) were the principal cause of movements in the U.S business cycle Palley (1993).

According to early post-Keynesian scholars such as Joan Robinson (1956), Kaldor (1970), Davidson (1972) and Moore (1988), money appears in the economy along with production when banks agree to honor debt contracts with firms. As the economy grows, banks increase their loans to meet the growing needs of the system, either to pay remunerate for factors of production. The creation of money is thus parallel to the creation of income in the economy. There are three distinct theories of money supply endogeniety: those presented by Accommodationists', Structuralists' and the Liquidity Preference School.

In the backdrop of the presence of high inflation in different countries after World War II due to the adoption of easy monetary policy the Keynesian ideas again came under severe criticism by Monetarists. They held the view that money plays active role in changing both income and price and the causality is unidirectional from money not only to income and but also to prices. The proponent of the Monetarist is the New Classical/Rational Expectations School (RES), while the opponent is the Real Business Cycle School/ New Classical Macro Economics. The RES has ignored the existence of Phillips curve even in the short run. So, they believe that any change in money supply has a direct impact of prices. The RES assumes that real variables including output are determined of monetary factors. Therefore, money and prices have a direct and proportional relationship. On the other hand, the latter school also argues that the technogical shock is the dominant cause of changing income and price level in the economy.

Hicks (1967), Graziani (2003), Rochon (2004) argue that money creation is a result of the evolving debt caused by the relationship between borrowers and lenders. Hence, money is endogenous irrespective of the character of the central bank, the stage of development of the banking sector, financial innovations, or other institutional changes.

The unidirectional causality from money to price has also been attacked by many questions. Fisher (1985) claims the possibility of reverse causation and concludes that there is mutual interaction between money and other macro variables. Friedman and Schwartz (1963) also support this argument by stating that though the influence of money to economic activity is predominant, there is also the possibility of influences running from the other way (at least in the short run). The Banking school also supports the reverse causation between money and income; and, thereby, arguing for endogeneity of money supply in price changing.

Thus, despite the theoretical debate conclusion is that there is a strong probability of causality among money, income and price. Therefore, Bangladesh Bank maintains money supply of the economy keeping in mind that despite the theoretical disputes money does has either short run or long run or both ramifications on price or income or both. Beside these facts BB also try ensuring coherence with the fiscal plan, activities and targets by coordinating with government counterpart.

Here it is worth to mention that though similar studies have been conducted in several

countries in the world; there is no econometric study to the best of our knowledge that has exclusively examined the nexus between NFA and RM, PSC and RM, Government Borrowing and RM, therefore, the present study will fill an important gap in the existing literature and improve the understanding of monetary policy conducted by BB.

3. The Analytical Framework

3.1 Data

This study is based on the annual data for the period 1975 to 2014. Choosing this period is reasoned that after a prolonged socioeconomic and political chaos and influences of their legacies the country started to run in full suing in the present capitalistic mood and restoration of socioeconomic normalcy was in 1975-76. After independence in December, 1971 country was following the socialist principle and from 1972 to 1975 was a period of massive turmoil due to political crises, natural calamity, acute supply shock of food grain etc. Data of this period excluded from the study because of these turbulences of this post war country those can affect both demand and supply side of the economy. We have got the data for this study from the various published issues of Economic Trends by the BB. Yearly data of the Reserve Money (M0) and Broad Money (M2), Net Domestic Assets (NDA) of BB, Government Borrowing (GNB) from BB and Net Foreign Assets (NFA) of BB are

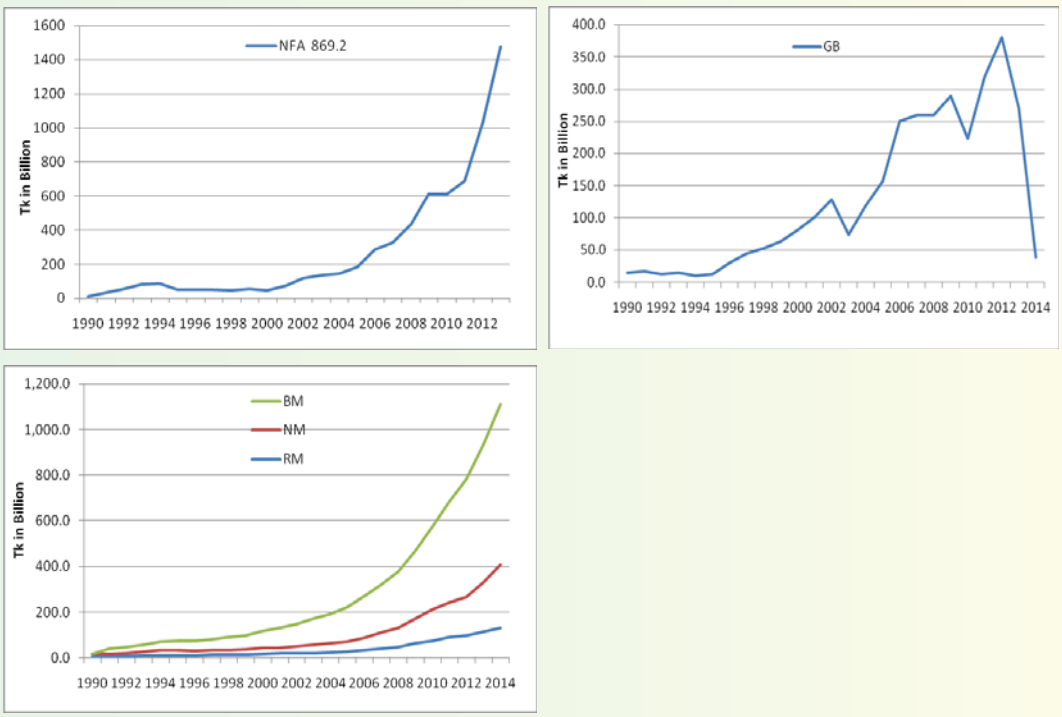

Figure2: Trends of M0, M1, M2, PSC, GB, NFA

collected from the various issues of Economic Trend published by BB on monthly basis. Plots of the year on year (Y-o-Y) growth of some of the time series are shown in Figure 1.

The Figure 1 shows that the M0, M1, M2, NFA and GB exhibit a synchronized gesture i.e. having a tendency to move together implies that they are likely to be causally linked to each other. This causal link, obviously, has further been tested by the various econometric tests considering time series properties of the data.

Methodology and Variables:

Broad Money (BM) centric money supply strategies have been followed by BB to curb the growth of money stock in the economy. BB cannot control BM directly by its market operation or by policy variables. What it can do is that RM can be manipulated by its' usual central bank tools. By controlling RM BB tries to maneuver BM whereas relation between them is defined by BM = mm*RM and mm (= money multiplier) is thought to be fixed in short run. This RM has two major components such as Net Foreign Assets (NFA) and Net Domestic Assets (NDA) of BB. NDA can be broken down into another three major sources which are Net Credit to Government (GNB), Credit to Other Non-financial Public Sector (CONFP) and Credit to Deposit Money Banks (CDMB). CONFP and CDMB consist very negligible amount of NDA and usually do not have any significant cause of change NDA. So, GNB is the major part of NDA. The following table will clarify the calculation process and relation among the concerned variables of this study. Hence, we can finally think that the two major components of RM are NFA and GNB. Our prime target is to analyze the impact of changes of NFA and GNB on movement of RM and thus to figure out the influence of them on money supply.

Table 1: RM and its component **(Taka in Crore)**

Year	Components of NDA					NDA	NFA	RM	BM	mm
	GNB	CONFP	Pvt.	CDMB	Others (Net)					
	1	2	3	4	5	1+…+4 = 6	7	5+6 = 8	9	9/8=10
1990	1489.23	870.5	0	4109.4	-1085.6	6468.7	869.2	7337.9	23157.1	3.16
1991	1677.7	932.6	0	3939.0	-1185.8	5363.5	1137.2	6500.7	25004.4	3.8
1992	1196.9	902.6	0	3373.0	-2037.0	3435.5	3386.6	6822.1	28525.9	4.2
1993	1447.8	882.6	0	2897.2	-1945.7	3281.9	5662.9	8944.8	31535.6	3.5
1994	1009.6	1635.9	0	2576.7	-2073.4	3148.8	8159.1	11307.9	36403.0	3.2
1995	1254.0	1056.8	15.7	2733.8	-3202.7	1857.6	8772.4	10630.0	42212.3	4.0
1996	3036.8	1195.5	15.7	3413.7	-1955.7	5706.0	5297.0	11003.0	45690.5	4.2
1997	4488.9	1192.6	15.7	3600.3	-1823.4	7474.1	4920.4	12394.5	50627.5	4.1
1998	5295.5	1404.8	15.7	3749.4	-2152.9	8312.5	5305.1	13617.6	55869.1	4.1
1999	6359.9	1365.6	808.4	4622.8	-3031.2	10125.5	4617.2	14742.7	63027.1	4.3
2000	8098.0	1320.7	900.4	4289.2	-3210.3	11398.0	5666.1	17064.1	74762.4	4.4
2001	10107.3	1305.1	987.5	4368.6	-2653.5	14115.0	4812.4	18927.4	87174.2	4.6
2002	12834.3	1277.6	1008.1	4729.3	-6506.7	13342.6	7230.4	20573.0	98616.0	4.8
2003	7353.3	1281.9	1141.7	4846.8	-4991.9	9631.8	11809.7	21441.5	113994.5	5.3
2004	11847.6	1241.1	1241.3	5852.1	-9854.0	10328.1	13542.3	23870.4	129721.2	5.4
2005	15674.3	1105.6	1341.4	6132.5	-11531.6	12722.2	14678.2	27400.4	151446.4	5.5
2006	25026.1	1016.0	1429.9	6346.3	-18503.9	15314.4	18640.3	33954.7	180674.2	5.3

2007	25931.1	988.0	1576.1	6442.1	-24273.0	10664.3	28758.4	39422.7	211504.4	5.4
2008	25997.3	946.4	1696.8	7334.2	-21226.4	14748.3	32813.8	47562.1	248794.9	5.2
2009	28955.4	853.1	2022.1	6846.8	-19155.5	19521.9	43227.5	62749.4	296499.7	4.7
2010	22320.6	830.7	2588.7	6613.9	-19392.1	12961.8	61181.0	74142.8	363031.2	4.9
2011	32049.7	776.7	3143.7	18608.8	-26186.6	28392.3	61342.1	89734.4	440519.9	4.9
2012	38044.0	1181.9	3598.7	22627.4	-36579.4	28872.6	68930.1	97802.7	517109.5	5.3
2013	27069.0	1354.5	4180.2	10219.0	-33579.3	9243.4	103246.0	112489.4	603505.6	5.4
2014	3840.6	1202.7	4272.7	6279.2	-33216.5	-17621.3	147496.6	129875.3	700623.5	5.4

Causality among M0 and M2: The hypothesis is that causality is running from Broad Money (M2) to Reserve Money or so-called Base Money (M0). The Post-Keynesian argument is that in the money creation process bank loan disbursed by the banks is caused additional deposits and those new deposits of the banks provokes the central bank to change the M0 and the same process also affects the level of M2. By definition Reserve Money (M0) = Circulated Currency that is Out of Banking System + Cash in Tills of The Commercial Banks + Deposits of The Scheduled Banks to The Central Bank, and Broad Money (M2) = Circulated Currency that is Out of Banking System + Demand Deposits + Time Deposits i.e. there is a common part in both M0 and M2 which is Circulated Currency that is Out of Banking System. Due to such common important part of M0 and M2 changes of M0 can change the M2 too. In addition to that conventional thought is that each M0 and M2 are the true money stock of the economy.

M0-Government Credit from BB causality: In Bangladesh Government credit by BB is a major source of RM. Government credit is an autonomous component of RM as central bank has no right to dishonor government borrowing demand. So, curbing money supply can be seriously hindered by the excessive and unplanned government borrowing particularly from the central bank. Such over borrowing of government can be a direct cause of expansion of RM. Therefore, it is necessary to examine the nexus between RM and GNB level. This is a hypothesis to examine whether empirically BB is successful to curb money supply despite of continual government borrowing. Like many other developing countries the Government of Bangladesh borrows from BB to finance government expenditure especially for development work for the particular fiscal year.

M0- NFA Causality: BB sets up RM to control money supply for achieving desired level of the BM. However, as RM has some components over those have no control of Bangladesh Bank, such as NFA and sometimes monetary policy cannot be implemented in its own course of the central bank due to the unexpected and automatic increase of NFA. When foreign currencies (FC) enter into the country BB needs to buy these from commercial banks basically to proper management of exchange rate. BB needs to buy and sale the FC to the par value of taka at desired level. On the other hand, when BB buys FC from the market automatically domestic currency i.e. money supply of the economy increases. So, when inflow of FC increases money supply of the economy also can be increased. In this situation to curb the money supply and thereby inflationary pressure of the economy BB ultimately fails to adopt tight monetary policy. That is, if sometimes BB is supposed to it pursue tight monetary policy sometimes unintended expansion of NFA can cause of increased M0 as BB needs to buy foreign currencies from DMBs to preserve par value of local currency for overseas transactions. Therefore, it is

necessary to examine the nexus between reserve money and NFA of BB in case of Bangladesh.

3.3 Unit Root or Stationarity Tests

To test the causality and co-integration among variables, at first, the stationary properties of the time series is to be checked by unit root test. That is, it has to be tested whether the considered variables are I(1). If the-variables are found to be I(1) they are stationary. This can be done in various ways: Dickey Fuller test, Augmented Dickey Fuller test, Phillips-Perron test etc. with trend or without trend, with or without intercept or both or none. This study applies Augmented Dickey-Fuller (ADF) test, which is based on the regression equation with an intercept and a trend in the form as follows:

$$\Delta Yt = a1 + a2t + bYt\text{-}1 + \sum_{..}^{k} \rho i \Delta Yt\text{-}1 + \varepsilon t \quad \text{----------(4)}$$

where, $\Delta Yt = Yt, - Yt\text{-}1$ and Y is the variable under consideration, k is the number of lags in the dependent variable, chosen by Schwarz information criterion and ε1 is the stochastic error term considering maximum 01 (one) lag period. The null hypothesis of a unit root implies that the coefficient of Yt-1 is zero. If the null hypothesis is rejected then the series is stationary and no differencing in the series is necessary to establish stationarity. The result is also further justified by Phillips and Perron (1988) test using Bertlett – Kernel estimation method with Newey-West Bandwidth. The results of these tests are presented in Table 2.

Table 2: Test for Cointegration

	Scharz info Criterion with intercept				With intercept				
Unit Root Tests									
	Augmented Dickey-Fuller Test				Phillips-Perron Test				
	Data on Level								
Variables	Lag Length	ADF Statistic	Crit. value at 1%	P-Value	PP Statistic	Estimation Method	Crit. Value	Bandwidth	P-Value
M0	1	-1.0166	-3.621	0.7373	-0.9848	Bartlett Kernel	-3.621	Newey-West Automatic	0.7486
M2	1	-1.8216	-3.6268	0.3645	-1.3067	,,	-3.621	,,	0.6162
NFA	1	-0.6277	-3.621	0.8522	-0.1303	,,	-3.621	,,	0.9385
GNB	1	1.6158	-3.621	0.9993	4.1796	,,	-3.621	,,	1.0000
	Data on First Difference								
	Lag Length	ADF Statistic	Critical value at 1%	P-Value	PP Statistic	Estimation Method	Estimation Method	Bandwidth	P-Value
M0	1	-5.1415	-3.6268	0.0002	-5.1528	Bartlett Kernel	-3.6268	Newey-West Automatic	0.0002
M2	1	-3.9596	-3.6268	0.0042	-4.0318	,,	-3.6267	,,	0.0035
NFA	1	-6.7633	-3.6329	0.0000	-14.3663	,,	-3.6268	,,	0.0000
GNB	1	-5.7748	-3.6211	0.0000	5.8013	,,	-3.621	,,	0.0000

Note: *** denotes the rejection of the null hypothesis at the 1% level.

Table 2 reveals that all the considered time series are non stationary in level form i.e. they are not 1(0) at their levels while the first difference made them stationary. That is each of the series are integrated of order 1 or simply they are 1(1). Both the ADF and the PP test provide the same result as shown in the table 1.

3.4 Testing for Co-integration

The second step to test the causality and co-integration involves searching for common stochastic trend between the concerned variables. Informally this can be understood from the graphical representation of the series as given in Figure l. The figure shows that all the series have an upward trend and moving in a synchronized way. Empirically this can be tested either by Engle-Granger two step co-integration procedures or by Johansen-Juselius test of co-integration techniques. We relied on Johansen-Juselius co-integration technique. In this technique two test statistics known as the trace statistic and the maximum eigenvalue are used to identify the number of co-integrating vectors. The Trace test statistic for the null hypothesis that there are at most r distinct co-integrating vectors is

$$ltrace = T \sum_{i=r+} \ln(1-lI) \quad \ldots\ldots\ldots\ldots(5)$$

where, lI's are the N-r smallest squared canonical correlations between Xt-k and ΔXt (where Xt = (gm1 or gm2 or gcpi)) and where all variables in Xt, are assumed 1(1)), corrected for the effects of the lagged differences of the Xt process.

The maximum eigenvalue statistic for testing the null hypothesis of at most r co-integrating vectors against the alternative hypothesis of r + l co-integrating vectors is given by

$$lmax = -T \ln(1-lr+1) \quad \ldots\ldots\ldots\ldots(6)$$

Johansen (1988) shows that equations (5) and (6) have non-standard distributions under the null hypothesis and provide approximate critical values for the statistic, generated by Monte Carlo methods. Considering linear deterministic trends of the data we have used options of trending and stochasticness of the series during estimation of the likelihood ratios in cointegration tests. As all data are yearly data we considered only one lag period for these tests. We have conducted both bilateral and multilateral contegartion test and results are shown in the following two tables:

Table 3: Johansen's test for multiple co-integrating vectors

			Trace Test		Maximum Eigen value Test	
Variables	Null Hypo	Alt. Hypo	Trace Statistic	Critical values at 1%	Max-Eigen value Statistic	Critical values at 1%
	H0	H1	LR		LR	
M0→M2	r= 1	r>1	36.27367	19.93711	25.06575	18.52001
	r<2	r>1	11.20791	6.634897	11.20791	6.634897
M0 →NFA	r= 0	r>1	50.70942	19.93711	33.30617	18.52001
	r<1	r>1	17.40325	6.634897	17.40325	6.634897
M0 →GNB	r= 0	r>1	46.43287	19.93711	29.27535	18.52001
	r<1	r>1	17.15752	6.63489	17.15752	6.63489

Table 3 reveals the Johansen's test for bi-variate and multiple co-integrating coefficients/ significance. Both the trace tests and maximum Eigenvalue tests suggest that the considered time series are significantly co-integrated. The likelihood ratios of these tests indicate that there is co-integration between many of the considered pairs and among the multiple series. So, the result indicates that there is a stable long run relationship among RM and BM, RM and NFA and RM and GNB in case of Bangladesh. In addition to that relationship between RM and its other components such as CONFP and CDMB are not reported here as they did not hatch positive cointegration results. So, adoption of appropriate monetary policy depends on controlling of GNB and NFA. We shall focus on those implications in details latter. Before going to Granger Causality tests and Error Correction Model to be sure about short run dynamics of concerned variables we want to briefly report the conintegration equation result:

GBM = 4.208094 GRM ……(1)

(0.12547)

GRM = 0.099590 GNFA ……..(2)

(0.06815)

GRM = 0.034771 GGNB……..…(3)

(0.06815)

From the cointegration result alluded in appendix we can have the above three cointegration Equations 1, 2 and 3 where standard errors are in parentheses. From these equations we can confirm that under 1% significance level all parameters are significant and pass the econometric test. These three equations show there is a long run relationship between BM and RM, RM and NFA of BB and RM and Government Borrowing. More over equation (1) explain that if growth rate of RM increases 1% growth rate of BM increases about 4.208% and growth rate of NFA of BB increases 1% growth rate of RM increases about at 0.1% and finally if GNB increases 1% RM increases 0.034%.

3.5 Granger Causality in the ECM-VAR

If there is co-integration between two or more series, there is stable long run equilibrium relationship between them. However, in the short run there may have disequilibrium. The error correction mechanism corrects for disequilibrium and ties the short run behavior to its long run value (Sargan, 1964). Empirically, if two series {Yt: t = 0,1....} and {Xj: t = 0,1....} are 1(1) process, then in general, Zt = Yt -, γX, is an 1(1) process for any number of γ. Nevertheless, it is possible that for some $\gamma \neq 0$, Zt, Y,- γXt is an 1(0) process. The co-integrating relationship Zt -- Yt - γX, represent a long run or equilibrium relationship between two variables. The notions of co-integration provide the basis for modeling both the short run and long run relationship simultaneously. A Vector Error Correction (VEC) Model is a restricted VAR Model designed for use with nostationary series that are known to be cointegrated. VEC Model is a model that is built with a specification so that it restricts the long run behabior of the endogenous variables to converge to their cointegrating

relationship while allowing for short run adjustment dynamics. Simply considering a two variable system with one cointegrating equation and with no lag difference terms the cointegrating equation should be as follows:

$$Yt = \beta Xt \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(6)$$

This co-integrating relationship between Yt and Xt implies according to Granger representation theorem (Engle and Granger, 1987) says that the relationship between the two variables can be expressed as the error correction mechanism as follows:

$$\Delta Y1 = \lambda 1Zt\text{-}1 + \sum_{i=1}^{m} \delta i\Delta Xt\text{-}1 + \sum_{i=1}^{n} \delta j\Delta Yt\text{-}1 + u1t \quad \ldots\ldots\ldots\ldots\ldots\ldots(7)$$

$$\Delta Xt = \lambda 2Zt\text{-}1 + \sum_{i=1}^{m} \xi i\Delta Xt\text{-}1 + \sum_{i=1}^{n} \zeta j\Delta Yt\text{-}j + u2t \ldots\ldots\ldots\ldots\ldots\ldots\ldots(8)$$

where, $Zt = Yt - \gamma Xt$, and u1t and u2t, are white noise error terms. In long run equilibrium these errors should zero. In these two equations, the series Yt and Xt are co-integrated when at least one of the coefficients $\lambda 1$ or $\lambda 2$ is statistically different from zero. If $\lambda 1 \neq 0$ and $\lambda 2 = 0$, then Xt will lead Yt in the long run. The opposite will occur if $\lambda 2 \neq 0$ and $\lambda 1 = 0$. If both $\lambda 1 \neq 0$ and $\lambda 2 \neq 0$, then feedback relationship exists between Yt and Xt. The coefficients δi's and ζi's represents the short run dynamics or speed of the adjustment between Yt and Xt. If δi's are not all zero, movements in the Xt will lead to Yt in the short run.

Table 4: Temporal causality results based on Granger causality

Dependent Variable	Significant Levels of t-statistic on ECM_{t-1}			
	GRM	GBM	GNFA	GGNB
GRM	…	4.899***	6.572***	5.914
GBM	7.918***	…	5.928***	5.198
GNFA	…	…	….	-2.249
GGNB	5.491***	3.561***	6.313***	….

Note: ***, ** and * denote1%, 5% and 10% level of significance respectively.

Table 5: Vector Error Correction Model (F-statistic)

Dept. Variable	Significant Levels of F-statistic			
	GRM	GBM	GNFA	GGNB
GRM	…	7.611***	2.749*	2.867*
GBM	…	…	…	…..
GNFA	4.265**	…	…	….
GGNB	7.587*	2.779*	2.635*	….

Note: ***, ** and * denote1%, 5% and 10% level of significance respectively.

Table 4 and 5 briefly indicate that in Granger sense there is both unidirectional and bidirectional causality among many of the important pairs of variables implying that expansionary monetary policy has important effect on both of the real and nominal sectors, which is showing coherence with many earlier studies in Bangladesh. This result is also in supported by the Johansen co-integration technique shown in table 2. Though in case of Error Correction Model (ECM) the speed of the error correction in short run is not reported in table the co-integration coefficients say the same result of Johansen co-integration technique. Precisely, the higher supply of money plays the vital role in Bangladesh for the development of other macroeconomic variables which we shall elaborately look in the next section of this paper.

4. Results

M2-M0 Causality: The hypothesis that causality is running from Reserve Money or Base Money (M0) to Broad Money (M2). The result is supported by Error Correction Model (ECM). The Post-Keynesian argument is that in the money creation process bank loan disbursed by the commercial banks is further caused of additional deposits and those new deposits of the commercial banks provokes the central bank to change the M0. The hypothesis is accepted and, hence, there is long run equilibrium between M0 and M2. The neoclassical argument is that the central bank wishes to control the overall liquidity situation in the economy so long as reserve money is kept at a level of consistent to the

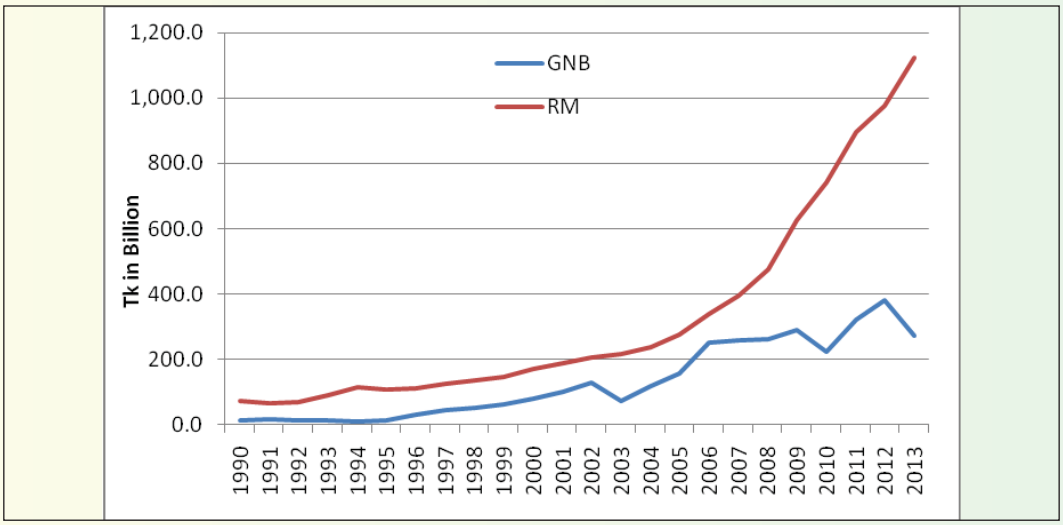

Figure 03: Nexus between GNB and RM in Bangladesh.

desired broad money expansion of the economy. As our hypothesis is accepted it means that BB has high level ability to influence the BM supply of Bangladesh by manipulation RM over the full concerned period.

M0-Government Credit from BB causality in Bangladesh: Government credit from BB is a major source of RM. Government credit is an autonomous component of RM as central bank

has no right to dishonor government borrowing demand. So, curbing money supply can be seriously hindered by the excessive and unplanned government borrowing particularly from the central bank. Such over borrowing of government is a direct cause of expansion of RM. Therefore, it is necessary to curb the government borrowing from BB to control money supply

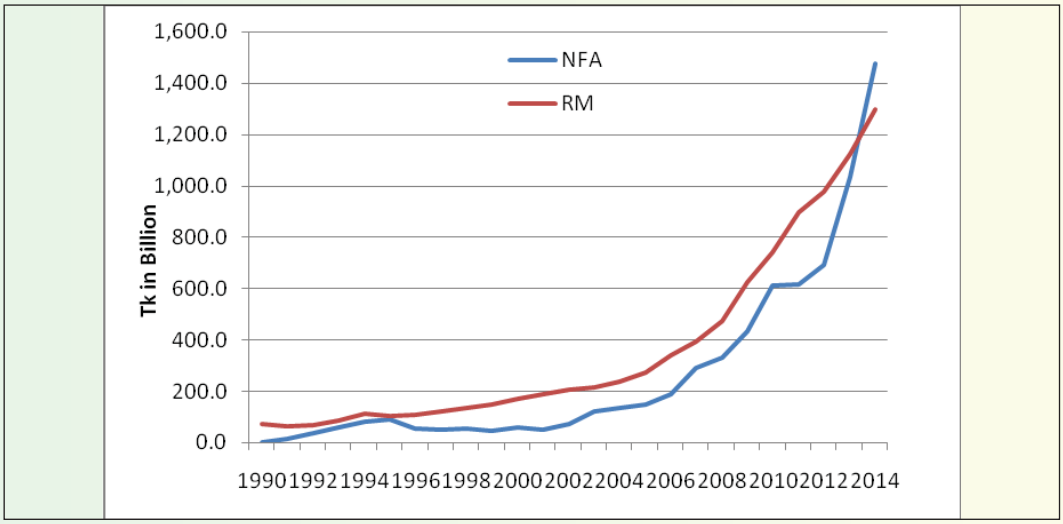

Figure 4: Nexus between NFA and RM in Bangladesh.

of the economy. According to the Johansen procedure of cointegration test we have got there is a log run equilibrium relationship between RM and GNB. As ECM model supports the result so there is a short run relation between them also may exist. The figure 3 says there is a similar movement between RM and GNB means that perhaps RM has strong linkage GNB.

NFA –M0 causality: The data shows that growth in NFA causes growth in RM. This result was strongly supported by both Granger Causality and ECM model. So the continuous autonomous growth in NFA has become an increasingly important determinant of RM growth in case of Bangladesh. RM has two components NFA and NDA. As NFA increases monetary base of the economy also increases and then BB takes steps to sterilize them by using its usual instruments. In case of an undesired expansion of NFA BB reduces NDA to curb the unintentional growth RM. This process will be fall in serious trouble if NDA tends to become a negligible part of RM due to the reckless expansion of NFA in the days to come. The figure 4 exhibits similar movement of RM and NFA means that they may have strong link which is supported by Johansen procedure of conintegration, ECM model and Granger causality techniques.

5. Policy Implications:

The results reported in the last section indicate that the findings have great importance in macroeconomic policy implications. It was evident in these results that RM and BM are highly cointegrated in case of Bangladesh and level of RM is strongly determined by the level of Government Borrowing and NFA of BB. So GNB and NFA of BB are strongly

endogenous in the money supply process for the concerned period in Bangladesh. This revealed endogeniety may be attributed to the large budget deficits, large trade deficits and big influx of foreign remittance after adoption managed floating exchange rate in 2004 which ultimately cause high growth of money stock in the economy. The consequences of this endogeniety briefly resultant the following policy implications:

BB works under the control of the government of Bangladesh. It is not independent like a central bank enjoys independence in a developed country. Nevertheless, it is independent in terms of policy initiation. So it can issue any instrument any time it wants. However, this power is gradually decaying as continuation autonomous increase of NFA is going on which is a big cautionary signal for BB for the days to come.

We have got that NFA Granger causes RM. Both ECM model and Johansen Cointegration tests has supported that NFA has both short run and long run relationship with RM. It means that effectiveness of monetary policy based on money supply control is thus seriously limited by autonomous and continuous growth of NFA. Gradual increase of NFA is making BB an instrumentally incapable central bank and losing sterilization power for coming days.

In case of Bangladesh government credit from BB is a robust source of RM. The result is jointly confirmed by the Johansen Cointegration, ECM model and Granger Causality Tests. It is also an autonomous component of RM in the sense that central bank cannot deny government cheques whenever they want borrow money from BB. There is a long run and short run equilibrium relationship between GB and RM. As the result is proved by Granger Causality test it evident that there is dynamic and causal link between GB and RM of the economy. So, curbing money supply is seriously hindered by the excessive and unplanned government borrowing particularly from the central bank over the concerned period and ultimately was a direct cause of expansion of RM. Therefore, empirically efficacy of monetary policy in Bangladesh is a subject to control of government borrowing from BB and continual increase of government borrowing is extremely detrimental for a successful monetary policy.

6. Conclusion

The major objective of the paper is to examine the dynamic and causal linkages between RM as well as BM with NFA of BB and GNB from BB over the period of 1975 to 2014. Applying unit root tests, Johansen cointegration test, error-correction models and Granger causality test through taking care of the stochastic properties of the regarded variables we have got very intuitive results. Many important policy implications can be inferred by the results of the study. Both short run and long run dynamics of the RM with GNB and NFA of BB have been tested and confirmed. So, the results provide several important useful insights especially for the monetary authority of the country. In this credit fixing regime of monetary policy post Keynesian claim is accepted by the econometric tests i.e. excessive GNB causes increase money supply of the economy. In the market oriented monetary policy regime period starting from early 1990s in which various financial sector reforms in the

name of structural adjustment: deregulation (i.e. decontrol of interest rates), liberalization (i.e. adopting Floating Exchange Rate) and privatization (i.e. giving permission of private banking) in the financial sector were undertaken keeping in thought about traditional neoclassical views and which were supported by our findings too. Reserve money (M0) is caused by domestic credit as well as inflow of foreign currencies (FC). The vast portion of literati of economics in Bangladesh is absolutely unaware about the process and efficacy of monetary policy in Bangladesh. So, the paper is a big contribution in the fulfilling of existing literature gap regarding monetary policy formulation and implementation process in case of Bangladesh as it is basically to the best of our knowledge the first output in its kind in the country.

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