

Budget Deficit, Money Growth and Inflation: Empirical Evidence from Bangladesh

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Abstract

The dynamic causal relationship among budget deficit, money growth and inflation remains a contentious and lively issue in the literature. Even though the literature on this issue is voluminous, however for Bangladesh it is quite a few. The studies on Bangladesh suffer from methodological deficiency as they did not take into consideration the time series properties of the variables and also suffer from omitted variable bias. This paper overcomes the early studies in terms of data used and techniques applied. This paper also overcomes the methodological deficiency by considering Keynesian and monetarist's contention in analyzing inflation of Bangladesh. The main contribution of the paper is to address the issue of the short run dynamics of the considered variables within a long run relationship. The empirical results show that there is a unidirectional causality runs on budget deficit to money supply, which is supported both by Granger causality as well as by error correction model. The implication of the result is that in Bangladesh budget deficit is monetized by printing money. The study also found that there is a unidirectional causality from budget deficit to money supply and money supply to inflation. The implication of the result is that expansionary monetary policy to combat budget deficit has important effect on the inflationary pressure in Bangladesh, which is in line with the earlier studies in Bangladesh except Taslim (1982). The overall implication of the result is that inflation in Bangladesh is a fiscal driven monetary phenomenon. Therefore to maintain inflation at a tolerable rate budget deficit should be financed by other means than printing money.

Keywords: Budget deficit, inflation, Granger causality test, cointegration, error correction models.

1. Introduction

Budget deficits emerged as an important issue of discussion in the literature over the last decades in the backdrop of the attempts of many countries to achieve rapid economic growth through a sharp increase in government expenditure (exceeding tax collections).

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However, the underdeveloped and developing countries face the scarcity of tangible resources to meet the growing needs of its expenditure. Therefore they had to run in deficit budget, which is financed by borrowing from the domestic banking system or from foreign countries. However, this increased government expenditure crowds out private investment by increasing the interest rate. Therefore, it is a common attempt of the central bank of these countries to adopt accommodating monetary policy, which keeps the interest rate to the market equilibrium rate but erases crowding out. That is central bank monetizing deficit budget by printing money or by increasing money supply causes persistent increase in the domestic price level. Hence inflation emerges as a fiscal driven monetary phenomenon.

Both the theoretical and empirical studies argue that inflation is strictly a monetary phenomenon and that inflation occurs when the rate of growth of the money supply is higher than the growth rate of the economy. This is the conventional monetarist linkage from the creation of base money to inflation when central banks issue money at a rate that exceeds the demand for cash balances at the existing price level and the increased demand in the goods market pushes up the price level as public tries to get rid of its excess cash holdings. It is the contention of these economists that the central bank can eliminate the link between budget deficits and inflation by refusing to monetize the deficit, i.e., by not buying the bonds issued by governments.

Higher deficit policies may, however, lead to higher inflation even in the absence of monetization by central banks. The governments borrowing requirement will increase the net credit demands in the economy, drive up the interest rates and crowd out private investment. The resulting reduction in the growth rate of the economy will lead to a decrease in the amount of goods available for a given level of cash balances and hence the increase in the price level. The other channel through which deficits can lead to higher inflation when central bank do not monetize the debt of the private monetization of deficits. This occurs when the high interest rates induce the financial sector to develop new interest bearing assets that are almost as liquid as money and are risk free. Thus, the government debt not monetized by the central bank is monetized by the private sector and the inflationary effects of higher deficit policies prevail.

Thus, there is a causal relationship among budget deficit, money growth and inflation. However, the debate remains a contentious and empirical issue in the literature. The causal nexus among budget deficit, money growth and inflation has an important implication for conducting monetary policy with the aim of macroeconomic stabilization. However to achieve higher output, full employment and price level stability based on controlling the growth of money supply crucially depends on two prerequisites: first, development of an effective procedure for controlling the rate of growth of money stock and second, close identification of the linkages between the desired growth rate of money and the final objectives (Zaki, 1995).

Like many other developing countries public expenditure as a fraction of national output

show that public sector has an inevitable trend of growth in the long run (Scully, 1989). Bangladesh is one of them whose relative size of public sector has grown over the last decades. The ratio of public expenditure to gross domestic product has almost doubled from the period 1973 to 2008. In Bangladesh budget deficits are highly exogenous, deficit monetization by the central bank was routine and monetary policy was subordinate to fiscal policy. A stabilization and liberalization package was introduced in the early 1990s and gradual steps were taken towards capital account liberalization which resulted in the full convertibility of the Taka. Domestic borrowing by the treasury was initiated at that time which introduced an alternative source of financing for the government.

Apart from the introduction in section One; the paper is organized as follows. Section Two contains a review of the theoretical and empirical literature. The analytical framework consisting of data and the tests of the main statistical properties required for vector error correction mechanism (VECM) are presented in section Three. Section Four analyzes the nature of the model and results. Section Five concludes the paper with policy implications.

2. Review of the Literature

2.1 Theoretical Debate

The dynamic linkages among budget deficit, money growth and inflation have long been discussed in the theoretical literature. The Classical school explained the proportional relationship between money supply and absolute price level without considering the impact of fiscal variables. However, Keynesians rejected the Classical ideas and proposed quantitative theory of government debt. According to Keynesians the change in wages, the price level and the rate of inflation are non-monetary phenomena and are caused by structural factors such as autonomous spending that constitutes investment by business and government spending, is the main source of instability in the economy.

The follower of Classical school, the Monetarists (lead by Milton Friedman) argued that money plays an active role and leads to the changes in income and prices. According to them to meet the increase of government expenditure over its income (without increase in taxes) government adopts cheap monetary policy i.e. print money (known as seigniorage) which accrues in the hands of taxpayers which leads to the persistent rise in the price level. This argument attribute to the Monetarists contention that inflation is always and everywhere a monetary phenomena (Blanchard et.al.2003). Monetarists' hypothesis is also justified by the quantity theory of money. The recent development of the new Keynesian theory, based on dynamic general macroeconomics models with imperfect competition postulates that individual expectations with respect to current and future fiscal action could affect inflation directly and induce money expansion through a higher price level.

The theoretical debate reveals that the dynamic causal relationship among budget deficit, money growth and inflation can be presented in a tri-variate system to test the direction of causality among them.

2.2 Empirical Studies

The empirical studies on budget deficit, money growth and inflation are plenty and still growing with mixed results. Some of the studies (Darrat, 2000; Saleh and Harvie, 2005; and Narayan et. al. 2006 etc.) did not find any significant relationship among the considered variables, which is consistent with the New Keynesian standard model with Ricardian fiscal regimes. While several other studies (Siegel, 1987; Joines, 1985; Spinelli, 1999; Ozata, 2000; Nachega, 2005 etc.) finds significant positive inflationary effect of budget deficit, which is consistent with the monetarist contention and fiscal theory of price level. King and Plosser (1985) examined the linkages among budget deficit, money growth and inflation for the US and twelve other developed and developing countries. Using postwar data under neoclassical macroeconomic models the study found little evidence that deficit played an important role in postwar inflation exerting pressure on the central bank to print money. For a wide sample of 32 developed and developing countries Karras (1994) finds that deficits are not monetized and therefore are not inflationary. Sargent and Wallace (1981) argues that inflation is linked to how budget deficits are financed and deficits lead to inflation to the extent that they are monetized. Choudhury and Parai (1991) found that budget deficits as well as the growth rate of the money supply have significant impact of inflation in Peru.

2.3 The Bangladesh Perspective

For Bangladesh, there are no previous studies that empirically examine the relationship among budget deficit, money growth and inflation as outlined in this paper. As to the empirical evidence on Bangladesh, there are a few studies (Jones and Sattar, 1988; Chowdhury et al 1995; Ahmed, 1999) linking money, prices, income and interest rate, but no substantial study using appropriate econometric methodology considering the time series properties of data. These studies tried to establish monetarist contention that money had significant role on the other macro and monetary variables without considering the impact of fiscal variables in determining monetary variables.

With the aid of Granger causality test based on monthly data (June 1974 through December 1985), Jones and Sattar (1988) were able to examine the causal link between money – income and money - inflation in Bangladesh. They also found the evidence of unidirectional impact of money on output, with lag of twenty four to thirty six months. The implication of their result is that monetary expansion could have a significant impact on output growth, although as a consequence the economy may experience moderate to high inflation in the short run.

Chowdhury *et. al* (1995) investigated the relationship between money, prices, output and the exchange rate in Bangladesh and concluded that the inflationary process of Bangladesh cannot be explained solely by the ‘monetarist’ or the ‘structuralist’ explanation. That is, there is no straightforward cause and effect relationship between money and inflation, while money supply exert a significant unidirectional impact on real output.

The above studies share the common conclusion that causal relationships between money

and income is unidirectional in Bangladesh. However, they did not consider the impact of fiscal variables in determining the monetary variables. Therefore the reliability of the above result may be undermined. These studies did not also examine the time series properties of the data such as stationarity and co-integration and they concluded using arbitrary lag length whether the relationship among variables is short run or long run. This study is an improvement over the existing studies as it examined the stationarity and co-integration approach and applied the error correction approach to understand the short run implication of long run relationship among considered variables. This is therefore very first of this kind of study and tries to overcome the drawbacks of the early studies.

The two major objective of this study are-

- i) Gaining an insight into the channels through which budget deficit has been operating in Bangladesh since independence.
- ii) The existence and the nature of a stable long run relationship among budget deficits, money growth and inflation and the short run dynamics of the inflationary process as of 1974.

The study is based on the annual data from the period 1974 to 2012. In order to analyze short-run dynamics and long-run relationships among budget deficits, money and inflation, the study makes use of Vector Autoregression (VAR) and Vector Error Correction (VEC) specifications in this study. As unrestricted VARs do not impose co-integration on its variables rather a VEC model needs to be set up if the variables are known to be non-stationary and cointegrated. The study uses both the ADF and PP test to see whether the considered variables are stationary or not. Then the Johansen Juselius test is applied to examine the cointegration of the variables.

3. The Analytical Framework

3.1 Data

This study is based on the annual data for the period 1974 to 2012 taken from the international financial statistics (IFS) data disk 2013. Broad money (M_2) is considered as monetary stock. Though some early studies (Jones and Sattar, 1988; Chowdhury *et. al* 1995, Hossian, 2009a) used both narrow money (M_1) and broad money (M_2) we relied on the later studies (Ibrahim, 1999) which show that the broad money (M_2) is a preferable intermediate target to stabilize the economy and M_2 is found to be cointegrated with other macrovariables and is thus superior as a long run policy variable. Government budget deficit is the difference between its expenditure (both development and non-development) and income. Consumers' price index with base 1973-74 = 100 is considered as the basis for calculating subsequent price levels.

3.2 Testing for Integration (Augmented Dickey Fuller Test)

First, the stationary properties of the time series ($\ln bd$, $\ln m_2$ and $\ln cpi$) have been tested to examine the presence of unit root. This is necessary to test whether the considered variables

are $I(1)$. If the variables are integrated of order one i.e $I(1)$, they are stationary. This is accomplished by applying augmented Dickey-Fuller (ADF) test. This test is based on the following regression equation with a constant and a trend of the form:

$$\Delta Y_t = a_1 + a_2 t + b Y_{t-1} + \sum_{i=1}^m d_i \Delta Y_{t-i} + \varepsilon_t \dots\dots\dots(1)$$

where, $\Delta Y_t = Y_t - Y_{t-1}$ and Y is the variable under consideration, m is the number of lags in the dependent variable, is chosen by Akaike Information criterion and ε_t is the stochastic error term. The null hypothesis of a unit root implies that the coefficient of Y_{t-1} is zero. If the null hypothesis is rejected, then the series is stationary and no differencing in the series is necessary to induce stationary. The result is also further justified by Phillips and Perron (1988) test and KPSS test. The results of these tests are as follows in Table 1.

Table 1: Test for Integration

Variable	ADF		Phillips-Perron	
	Level	First Difference	Level	First Difference
lnbd	-2.008	-5.209*	-0.569	-6.324*
lnm2	-1.451	-3.538**	-0.714	-4.499*
lnpci	-2.561	-4.435*	-0.812	-5.775*

Note: * and ** denotes the rejection of the null hypothesis at the 1% level and 5% level respectively.

It is evident on Table 1 that all the considered time series are non stationary i.e. $I(0)$ at their levels, but becomes stationary at first difference. That is each of the series lnbd, lnm2 and lnpci are integrated of order 1, $I(1)$.

3.3 Testing for Cointegration (Johansen-Juselius test)

If two or more time series become stationary after first differences and they tend to have common stochastic trend implying that they may have long run stable relationship. That is integration of order one means the considered series are cointegrated. In this case all the considered time series lnbd, lnm2 and lnpci are $I(1)$ meaning that there can be stable long run relationship among them. The existence of linear independent can be presented empirically by the following cointegrating relationship:

$$\sum_{j=1}^3 \chi_{ji} Y_{jt} = v_{it} \quad i = 1, \dots, r \quad (2)$$

The v_{it} are $I(0)$ series, although the Y_{jt} are $I(1)$. Under $I(0)$ of v_{it} the long run relationship of Y_{jt} ($j= 1, \dots, 3$) is determined by $3-r$ common trends. This can be tested empirically either by Engle-Granger (1987) two step cointegration procedures or by Johansen-Juselius

cointegration (1990) technique. This paper applied Johansen-Juselius cointegration technique, which needs to identify the number of cointegrating vectors, namely the trace statistic and the maximum eigenvalue test statistic. The Trace test statistic for the null hypothesis that there are at most r distinct cointegrating vectors is

$$\lambda_{trace} = T \sum_{i=r+1}^N \ln(1 - \lambda_i) \dots\dots\dots(3)$$

where, λ_i 's are the $N-r$ smallest squared canonical correlations between Y_{t-k} and ΔY_t (where and all the variables in Y_t are assumed $I(1)$), corrected for the effects of the lagged differences.

The maximum eigenvalue statistic for testing the null hypothesis of at most r cointegrating vectors against the alternative hypothesis of $r + 1$ cointegrating vectors is given by

$$\lambda_{max} = -T \ln(1 - \lambda_{r+1}) \dots\dots\dots(4)$$

Table 2 shows the results of the application of Johansen procedure, which shows that equations (3) and (4) have non-standard distributions under the null hypothesis and provides approximate critical values for the statistic, generated by Monte Carlo methods.

Table 2: Johansen's test for multiple cointegrating vectors

Hypothesized cointegrating Ho	Number of relationship H ₁	Test Statistic LR	5% Critical Value	1% Critical Value
$r = 0$	$r > 0$	39.14*	29.68	35.65
$r \leq 1$	$r > 1$	14.87	15.41	20.04
$r \leq 2$	$r = 3$	3.43	3.76	6.65

Note: * denotes rejection of Ho at 1% level. Likelihood ratio (LR) test indicates 1 cointegration vector for the group of variables.

Table-3 suggests that the considered time series are cointegrated. That is there is at least one cointegrated relationship at 1% level of significance implying that there is a stable long run relationship among budget deficit, money growth and price in Bangladesh. That is implementation of apposite monetary policy in the backdrop of budget deficit have some important long run implications on changes in the price level and so on the inflation in Bangladesh.

3.4 Granger Causality in the ECM-VAR¹

If two or more time series are cointegrated there is stable long run equilibrium relationship among them. However, in the short run they may be out of equilibrium i.e. in 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 $\{Y_t; t = 0, 1, \dots\}$ and $\{X_t; t = 0, 1, \dots\}$ are $I(1)$ process, then in general, $Z_t = Y_t - \gamma X_t$ is an $I(1)$ process for any number of γ . Nevertheless, it is possible that for some $\gamma \neq 0$, $Z_t = Y_t - \gamma X_t$ is an $I(0)$ process, which means it has constant mean, constant variance and autocorrelations that depend only on the time distance between any two variables in the series and is asymptotically uncorrelated. If such a γ exists, we can say that Y_t and X_t are cointegrated and γ is the cointegration parameter (Wooldridge, 2003). The cointegrating relationship $Z_t = Y_t - \gamma X_t$ represents a long run or equilibrium relationship between two variables. Since the considered variables are cointegrated, then according to Granger representation theorem (Engle and Granger, 1987), the relationship among money, income and price can be expressed as the error correction mechanism as follows:

$$\Delta \ln bd = \mu_{11} + \mu_{gdp} v_{t-i} + \sum_{i=1}^k \delta_{11,i} \Delta \ln bd_{t-i} + \sum_{i=1}^k \delta_{12,i} \Delta \ln m2_{t-i} + \sum_{i=1}^k \delta_{13,i} \Delta \ln cpi_{t-i} + u_1 \quad (5)$$

$$\Delta \ln m2 = \mu_{21} + \mu_{m2} v_{t-i} + \sum_{i=1}^k \delta_{21,i} \Delta \ln bd_{t-i} + \sum_{i=1}^k \delta_{22,i} \Delta \ln m2_{t-i} + \sum_{i=1}^k \delta_{23,i} \Delta \ln cpi_{t-i} + u_2 \quad (6)$$

$$\Delta \ln cpi = \mu_{31} + \mu_{cpi} v_{t-i} + \sum_{i=1}^k \delta_{31,i} \Delta \ln bd_{t-i} + \sum_{i=1}^k \delta_{32,i} \Delta \ln m2_{t-i} + \sum_{i=1}^k \delta_{33,i} \Delta \ln cpi_{t-i} + u_3 \quad (7)$$

This equation system represents vector autoregression (VAR) in first differences, which also has error correction terms and allows examining the short run dynamics of the long run relationship among the considered variables. The coefficient of the error correction term must be seen as correcting towards equilibrium subspace i.e. how adjustment is taken place in the short run to maintain stable equilibrium long run relationship among the considered variables. The coefficient of the lagged values of the variables shows whether the independent variables cause the corresponding dependent variable (Ramos, 2001). The result of the causality tests are shown in table 3.

1 This section draws on Hossain et.al. 2009.

Table 3: Temporal causality results based on Granger causality (F statistic)

Dependent Variable	Significant levels of F-statistics			t statistic
	$\Delta \ln bd$	$\Delta \ln m2$	$\Delta \ln cpi$	On ECM t_{-1}
$\Delta \ln bd$	-	0.432	0.167	-0.998
$\Delta \ln m2$	2.038**	-	0.2915	1.598***
$\Delta \ln cpi$	2.450**	5.045*	-	-4.9881*

Note: * denotes 1% level of significance, ** denotes 5% level of significance, ***denotes 10% level of significance,

Table 3 reveals that budget deficit is neither caused by money supply nor by price level, but there is a unidirectional causality runs on budget deficit to money supply, which is supported both by Granger causality as well as by error correction model. The implication of the result is that in Bangladesh budget deficit is monetized i.e. by printing money. The table also shows that persistent increase in price level is caused by budget deficit via money supply. That is there is a unidirectional causality from budget deficit to money supply and money supply to inflation. The implication of the result is that expansionary monetary policy has important effect on the inflationary pressure in Bangladesh, which is in line with the earlier studies in Bangladesh except Taslim (1982). The result found from Granger causality test is also supported by the error correction model (ECM). The ECM also shows unidirectional causality from money supply to inflation. However, neither the Granger causality test nor the ECM supports bidirectional causality among the variables as found in different studies.

4.0 Conclusion and Policy Implications

The prime objective of the paper is to examine the dynamic causal linkages among budget deficit, money growth and inflation in Bangladesh over the period of 1974 to 2012 applying cointegration, error-correction models and Granger causality tests taking care of the stochastic properties of the variables. The major contribution of the paper is to address the issue of the short run dynamics of the considered variables within a long run relationship. The paper can be considered as an improvement over the early studies in terms of data used and time series techniques applied. The study found that budget deficit is neither caused by money supply nor by price level, but there is a unidirectional causality runs form budget deficit to money supply, which is supported both by Granger causality as well as by error correction model. The implication of the result is that in Bangladesh budget deficit is monetized i.e. by printing money. The study also found that there is a unidirectional causality from budget deficit to money supply and money supply to inflation. The implication of the result is that expansionary monetary policy has important effect on the inflationary pressure in Bangladesh, which is in line with the earlier studies in Bangladesh except Taslim (1982). The overall implication of the result is that inflation in Bangladesh is a fiscal driven monetary phenomenon. Therefore to maintain inflation at a tolerable rate budget deficit should be financed by other means than printing money.

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