Causality Analysis between Inflation, Budget Deficit and Money Supply: Empirical Evidence from Bangladesh

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Developing countries across the globe have always shared the misfortune of being unable to finance their proposed government expenditures using their public revenues. As a result, a budget deficit is a common feature of all underdeveloped nations, to which Bangladesh is no exception. Conventional economic notion asserts that rising gap between government's expenditure and revenue creates pressure to enhance money supply in the economy which in turn may trigger the domestic rate of inflation. In addition, monetary policy tools are also referred to be ineffective in controlling domestic inflation. Thus, the objective of the paper is to identify the causal relationships between Inflation, money supply and budget deficit in the context of Bangladesh incorporating relevant data from 1980 to 2014. Granger Causality test and Vector Error-Correction Model approach was used to identify the long-run and short-run causalities between the variables. The results coincide with the conventional economic conjecture as a unidirectional causality is found to be running from budget deficit to inflation in the short-run while no causality is found between money supply and inflation in both the short-run and the long-run.

Field of Research: Economics

1. Introduction

The notion of a deficit budget is referred to a situation where the governments' proposed expenditure budget for a given fiscal year is more than the amount of respective public revenues at disposal for the same time period considered. A Budget Deficit (BD), or also known as a fiscal gap, scenario is a common feature of almost all the underdeveloped nations across the world but the magnitude of deficit is relatively higher in developing nations that are in the transitional phase of being developed in future (Amin and Murshed 2017; Jimmy 2014; Aworinde 2013; Chihi and Normandin 2008; Saleh and Harvie 2005). Following their inabilities to finance their respective public projects with their own public funds, developing countries have to resort to the utilization of foreign funds, especially in the form of development assistance from foreign donor agencies and developed nations across the globe (Amin and Murshed 2018). The macroeconomic impacts of experiencing a BD have motivated many researchers and policymakers in conducting several investigations in order to draw conclusions regarding the relationship between BD and other important macroeconomic

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indicators (Burdekin and Langdana 2015; Nguyen 2015; Willet and Laney 2014; Laubach 2009).

However, there has not been any anonymity in describing the economies of having a BD. Some studies have advocated in favor of having a BD and have linked it with the attainment of economic growth, especially in the developing economies. Such views coincide with the Keynesian inspired export-led growth theory proposed in 1970 where BD was referred to as one of the pre-requisites to achieving economic growth (Oladipo and Akinbobola 2011). This theory was based on the notion that the government should ideally motivate the aggregate demand of the economy through large-scale public investment projects in order for the economy to grow. Thus, countries adopting this growth theory were keen on proposing large expenditure budgets despite their revenues being insufficient to finance those public investment proposals.

Conversely, BD has also been linked to exerting negative externalities in the overall economy (Biza et al. 2015; Lee and Ng 2015). For instance, the conventional economics conjectures, not in favor of economies having a deficit budget, assert that the rising gap between government's expenditure and its revenue creates pressure to enhance Money Supply (M2) in the economy which in turn may trigger the domestic rate of Inflation (INF) to go up. In addition, monetary policy tools are also referred to be ineffective in controlling domestic INF. Furthermore, high amounts of BD can also be linked to enhancement of public debt whereby the debt servicing burden of the government surmounts simultaneously.

The respective three phenomena INF, BD and M2 are clearly significant macroeconomic variable that has been examined in innumerable studies by an indefinite count of economists. Continuous government BD and reckoning government debt have turned into important concerning issue for both developed and developing countries. Widespread empirical and theoretical studies are proceeding throughout the world on various economies to analyze the relationship between BD and other macroeconomic variables. Declining tax revenue as a result of recession can be one of the main causes BD. On the other hand, soaring debt service payments on public debt of governments in developing countries can also be responsible for the expansion of BD in those countries.

Bangladesh is a country that is developing with time. Thus, like all other developing nations, BD has been a common feature of that nation. Moreover, the nation is reliant on foreign currency, particularly on development aid in order to mitigate its fiscal deficit. Hence, the aim of this paper is to analyze the causal relationship between BD, M2 and INF in context of Bangladesh considering the time period between 1980 and 2014. To the best of knowledge, no previous study focused on this tri-variate relationship exclusively for Bangladesh and this paper aims to fill this gap in the empirical literature. One of the absorbing investigations made by this paper which makes it distinctive from prior studies is that it discovers the impacts of M2 on BD and on INF in both short-run and long-run, specifically from the perspective of Bangladesh.

The following relevant questions are specifically addressed in this paper:

1. Is there any long-run relationship between BD, M2 and INF in Bangladesh?
2. Is there any causality running between these three macroeconomic variables?

The remainder of the paper is as follows. Section 2 sheds light on an overview of BD, M2 and INF scenario in the economy of Bangladesh which is followed by section 3 that provides the literature review. Moving on, sections 4 and 5 discuss the empirical model used in the paper and explains the different time-series econometric methodologies applied respectively. Section 6 provides the results obtained throughout the tests carried out in the paper. Finally, section 7 puts down the conclusions followed by the policy recommendations.

2. An Overview of Budget Deficit, Money Supply and Inflation Scenario in Bangladesh Economy

2.1. Budget Deficit Scenario

BD depicting the hiatus between government expenditure and government revenue for a given fiscal year has been a matter of concern for all governments in the history of Bangladesh. Ever since its independence in 1971, Bangladesh has experienced a shortfall in its fiscal budget. The government has assorted sources of revenue but a signification part is extracted from direct and indirect taxes. Government's main objective is to maximize the revenue so that the necessary expenditures can take place without enabling the possibility of a tentative rise in the difference between revenue and expenditure. Since 1971 Bangladesh government has been encountering BD. During this particular period of time span, immense fiscal deficit occurred as the competence of resources was fewer than investment prerequisite. The administration of BD is essential for a developing nation like Bangladesh. Figure 1 below illustrates a trend in the Bangladesh government budget since the 90s. It can be seen that the nation registered its highest fiscal gap in 1992 which, in monetary terms, was around 1.25% of Bangladesh's GDP. According to the statistics provided in the figure, a negative trend is witnessed in recent times which imply that the public expenditure-revenue gap in the country is reducing with time.

**Figure 1: The Budget Deficit Trends in Bangladesh (1990-2015)**
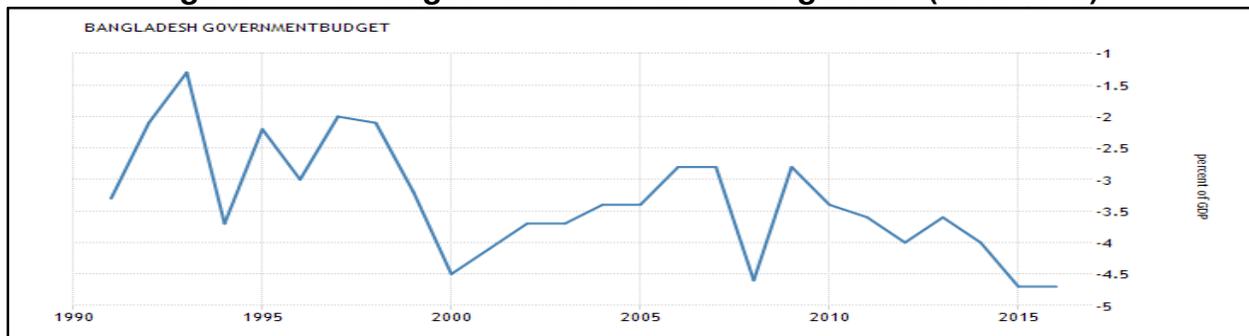
Source: Bangladesh Ministry of Foreign Affairs (MOFA)

BD is a delicate condition as it has a prodigious effect on the economy aggregately in terms of infrastructure, healthcare, and literacy, agricultural and industrial sector, power and energy etc. There are several highlighting events due to which BD takes place in Bangladesh. Firstly, National Board of Revenue mainly collects tax revenue for which direct taxes are preferred sources rather than indirect taxes. Hence, inefficiency in the process of revenue collection may result in BD. In addition, capital-intensive infrastructure development raising the volume of government expenditure and the unwillingness of taxpayers to pay tax in stipulated time can also result in BD. Subsidy is another notion that creates a market distortion which affects the economy and national income as it is an assistance from the government's pocket to a non-returning expense. Also, deficiency indiscretion can cause unrequired expenses along with unfinished projects that have already incurred suck cost that cannot be recovered add up to government expenditure that can lead to BD as well.

2.2. Money Supply Trends in Bangladesh

The government of Bangladesh has historically employed expansionary monetary policies within the economy which can be easily understood from the upward trend in M2 growth in the country. A clear picture of the trends in M2 growth in Bangladesh between 1990 and 2016 is given in Figure 2. Bangladesh experienced a prolific M2 worth BDT 9387.21 billion to BDT 9540.54 billion between 2015 and 2016. Bangladesh has a mean annual growth in its M2 worth BDT 277.17 billion over the last two and a half decades or so. During this period, the M2 has more than tripled in value which clearly depicts the government's expansionary monetary policy. The country's M2 emerged to an all-time peak of BDT 9540.54 billion in December 2016 while the lowest recorded drop in M2 to BDT 207.37 billion was found around March 1990.

**Figure 2: Broad Money (M2) Supply growth in Bangladesh (1990-2016)**
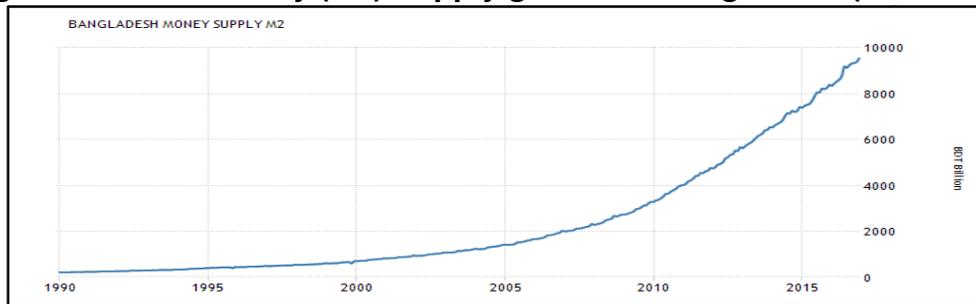
Source: The Bangladesh Bank (2016)

2.3. Inflationary Scenario in Bangladesh

INF is commonly perceived as the corroborated persistent change in the price level of goods and services over a certain period of time. It is a macroeconomic phenomenon that has great significance in the macroeconomic study of an economy. The difficulties associated with INF are quite alarming in the context of both developing and developed country's economy. Figure 3 shows the changes in inflationary rates in Bangladesh over the period between 1980 and 2014. The inflationary rate graph shown in the figure shows that there had been booms and busts with regard to the rate of INF in

Bangladesh. INF in the country peaked in 1995 reaching to a value of around 10.3% while the lowest rate of INF was just two years back in 1993 reaching around 3%.

Figure 3: Inflationary Rate trends in Bangladesh (1980-2014)
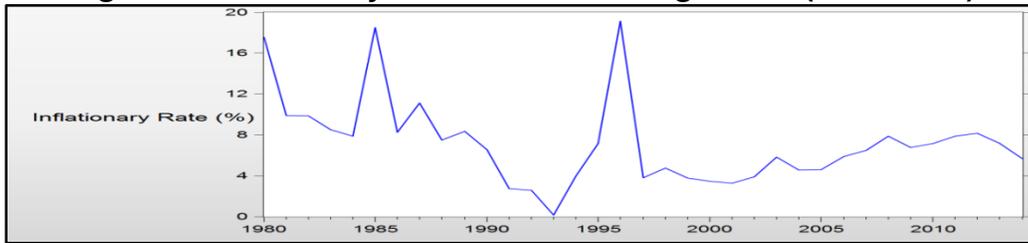
Source: World Development Indicators, 2016

3. Literature Review

The literature review section has been divided into two subsections. First of all, theoretical frameworks are provided to provide a mechanism of linkage between BD, M2 and INF. This is followed by empirical findings in which some of the previous papers on similar topics have been summarized.

3.1. Theoretical Framework

Macroeconomic theory proclaims that as the gap between government expenditure and revenue increase, there is a tendency for the government to adopt expansionary monetary policies whereby M2 in the economy increases simultaneously. It is essential for the government to pursue expansionary monetary policies in order to raise its revenues, mainly generated from indirect and direct taxations. Thus, in order to accumulate a large number of tax revenues the national income has to be increased; which demands monetary injection into the economy raising investment levels and creating greater employment opportunities. Hence, rising BD can be linked to increment in M2 in this manner.

However, conventional economic notions also assert that expansionary monetary policies can trigger INF in the economy. This is because whenever the government alters the level of M2, the local money market experiences a disequilibrium which imposes negative externalities on the overall economy. In order to restore the equilibrium, domestic price level also increases as a mechanism to compensate for the decrease in money's marginal value. This can be shown using the quantity theory of money:

$$M V = P Y$$

Where M, V, P, and Y refer to supply of money, velocity of money circulation, price level and real output. According to this theory, an increase in M2 would lead to a simultaneous increase in price level, ceteris paribus. Thus, a rise in M2 can attribute to triggering INF in the economy. This positive relationship between M2 and INF can also be shown graphically in figure 4 (see appendix). Figure 4 shows a domestic money market which is initially is in equilibrium at point E_0. Suppose, in order to increase its tax

revenue, the government decides to adopt an expansionary monetary policy by reducing the interest rate (from r_0 to r_1) which will lead to a rightward shift in the M2 line (from M_0 to M_1). As a result, the real money balance will increase as well (from M/P_0 to M/P_1), holding money demand to be constant. Thus, the money market equilibrium will also shift from E_0 to E_1. Therefore, in order to restore the initial equilibrium (i.e. bring back the real money balance back to its initial value, M/P_0) the domestic price level has to be increased which will reduce the real money balance in the long-run.

3.2. Empirical Findings

In a study by Parida*et al.* (2002), using Vector Auto Regression (VAR) model approach, the authors examined the causal relationships between fiscal deficit and M2 and price level in the context of India. They used 40 years annual time series data from 1961 to 2001. The results of their investigation confirmed a bidirectional causality between fiscal deficit and M2 while two unidirectional causalities were also found to be running from price level to fiscal deficit and M2.

Solomon and De Wet (2004) described Tanzania as an economy that had historically experienced higher INF rates along with prolonged periods of fiscal deficit. In their study, the authors examined the causal nexus between fiscal deficit and INF. Cointegration analysis was also performed using data from 1967 to 2001. In light of the findings, the authors opined that shocks in BD and GDP deteriorated the INF in Tanzania. This study also referred to other studies by Sargent and Wallace (1981) and Easterly and Schmidt-Hebbel (1994) which furthermore asserted that there were numerous other factors like unstable demand for money, exchange rate depreciation and taxation that could attribute to inflationary pressures within the economy in the short-run.

Oladipo and Akinbobola (2011) discussed the relationship of BD with other macroeconomic variables. This study employed annual time series data from 1971 to 2005 which was acquired from the Central Bank of Nigeria and the International Financial Statistics database. The causal examination was done in an empirical approach by hiring the pair-wise Granger causality test to determine the causal relationship among BD, INF rate, exchange rate and GDP. The key finding of this paper was that a unidirectional causality was found to be stemming from BD to INF in the long-run. In addition, an indirect effect of BD on INF was also found whereby BD led to exchange rate fluctuations which in turn attributed to a rise in the inflationary rate in the economy of Nigeria.

Abel.*et.al.* (2012) examined whether BD can stimulate inflationary pressures on the Nigerian economy or not using annual data between 1980 and 2009. In their study, the authors employed cointegration analyses and performed the Vector Error-Correction Model (VECM) causality techniques as well. The results obtained from the econometric tests revealed a unidirectional causal association running from BD and INF without the feedback. In addition, BD was also found to trigger monetary expansion in the Nigerian economy as seen from another unidirectional causality running from BD to M2. The authors referred the impact of BD on INF as a direct impact while the impact on M2 was

classified as an indirect one. However, a possible limitation of this paper lies in its approach that it only accounted for the short-run causal relationships, turning a blind eye on the long-run causalities.

Koyuncu (2014) stated that INF was disadvantageous for any economy irrespective of the economy being an underdeveloped or least developed or developed economy since an increase in the price level, in general, reduces the purchasing power of the respective population and therefore adversely affects the aggregate demand. In contrast, a lower rate of INF in the economy can attribute to greater purchasing power which in turn would reflect a rise in the overall standard of living in the economy. Thus, this paper strongly advocated in favor of keeping INF at lower rates in order to generate the optimal level of social welfare in the economy. Quarterly data from 1987Q1 to 2014Q4 in the context of Turkey was accumulated in this paper in order to understand the interlinkage between BD, M2 and INF. As part of the several econometric tools, the author resorted to using of time-series unit root tests, Johansen cointegration techniques, VAR approach, Granger causality analysis, variance decomposition method and impulse response functions. The regression model was a linear one in which INF was expressed as a function of M2 and BD. In line with the estimated results, the author concluded that BD in Turkey would trigger INF only if the BD is accompanied by a monetary expansion by the government. Thus, the BD and increase in M2 together attributed to higher INF in Turkey during the period of study in this paper.

In order to understand the multidimensional impacts of BD on the key macroeconomic indicators of Uganda were reviewed by Lawanga and Mawejje (2014) using annual time series data stemming across 1999 and 2011. Two of the relationships of interest in this paper were the direct association between BD and INF and the indirect impact of BD on M2 via the lending interest rate mechanism. The authors incorporated VECM, pair-wise Granger causality analysis and variance decomposition tools to examine these relationships. The results found in this paper confirmed a unidirectional causality running from INF to BD while another unidirectional causality stemmed from BD to the lending interest rate. Moreover, the results tend to imply that an indirect effect of a change in BD can be referred to initiate a change in the M2 in Uganda since rising BD led to rise in the lending interest rates as well whereby fewer funds were likely to be tapped from the financial institutions, ultimately curbing the level of M2 within the economy of Uganda. The variance decomposition results showed that the variation in INF was mostly explained by the variation in lending interest rate which implies that M2 is a determinant of INF in the economy via an indirect mechanism involving lending interest rates.

The impacts of INF on M2 and economic growth in Ethiopia were probed by Denbel*et al.* (2016). The authors tapped annual time series data from 1970/71 to 2010/11 to perform Johansen cointegration test, VECM and pair-wise Granger causality tests to determine the short and long-run causal effects of INF on M2 and growth of the Ethiopian economy. In line with the quantity theory of money, which relates in the form of a direct and proportional relationship between M2 and overall price level, the authors expressed INF as a log-log function of M2 and Real GDP. The results reflected unidirectional causal associations running from M2 and RGDP to INF whereby the

authors opined that M2 and RGDP negatively affected INF in Ethiopia. The authors also remarked that in the long-run, a bidirectional causal association existed between M2 and INF while a unidirectional causality was also found to be running from RGDP to INF. Thus, considering both the short-run and long-run results, the authors have recommended for appropriate monetary policies to be executed for ensuring price stability in the economy since rising M2 is found to be statistically significant in triggering INF in Ethiopia.

A possible limitation of the aforementioned studies was the fact that in most of the studies the authors either focused on the short-run or the long-run causal analyses without emphasizing the possible differences in the causal relationships over time horizons. Moreover, the existing literature discussing the relationships between BD, M2 and INF is somewhat biased in taking the African developing countries as references, while not shedding much light in the context of the South Asian counterparts. Thus, this paper attempts to bridge this gap by analyzing the causal associations in the context of Bangladesh. However, judging from the nation's increasing trend in M2 against which there has not been much volatility in the domestic INF over that last decade, it can be hypothesized that in the long run, monetary expansions does not result in excessive inflationary pressures on the economy.

4. Empirical Model and Description of Data

As far as the empirical model is concerned, the authors modify the model used by Parida*et al.* (2002) following the availability of relevant data regarding the three main macroeconomic variables of this paper. The regression model features a simple linear model in which INF was expressed as a function of BD and M2. A justification of expressing INF as a function of BD and M2 can be explained by the example that when a government declares a deficit budget for a given fiscal year, it tends to instigate an expansionary monetary policy in the economy as well. Following this monetary expansion, the government eventually aims to raise its volume of public revenue since increasing M2 would lead to greater investments which in turn would add to the GDP of the country and would ultimately enhance the possibilities of generating more amounts of tax and non-tax revenues for the government. However, a possible negative consequence of the monetary expansion could be in the form of rising rate of INF in the economy. This could happen because the rise in investments following the monetary expansion would create new jobs and the per capita GDP of the nation would also go up. This, in turn, would be reflected in the form of a rise in the demand for goods and services in the economy, driving their prices up and thus triggering INF.
The regression model can be specified as follows:

$$INF_t = \alpha_0 + \alpha_1 (BD)_t + \alpha_2 (M2)_t + \varepsilon_t \text{----------------------------- (i)}$$

where the subscript t refers to the particular year (time). Data regarding all these three variables were incorporated from a couple of sources and the period of study ranged from 1980 to 2014. The INF data was proxied by the Consumer Price Index (CPI) data and was retrieved from the World Development Indicators (WDI) database of the World

Bank. According to this data source, CPI reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly and the Laspeyres formula is generally used in calculating the rate of CPI. On the other hand, the BD data was manually calculated using the difference between government tax revenue and proposed expenditure budget figures that were accumulated from several versions of the Statistical Year Book of Bangladesh published by the Bangladesh Bureau of Statistics. The value of the BD was measured in terms of million Bangladeshi Taka. Finally, M2 data was acquired from the WDI website as well and was measured in terms of the local currency unit (Bangladeshi Taka). According to the data source, M2 is basically the broad money which is the sum of currency outside banks; demand deposits other than those of the central government; the time, savings, and foreign currency deposits of resident sectors other than the central government; bank and traveler's checks; and other securities such as certificates of deposit and commercial paper.

5. Methodology

5.1. Augmented Dickey-Fuller Test for Stationarity

At first, data of all the variables were tested for a unit root in order to check the stationarity of the variables that were considered in this study. The authors used the Augmented Dickey-Fuller (ADF) stationarity test to detect possible existence of unit roots in the data set. Testing time series data for stationarity is a prerequisite for moving forward since the presence of unit roots would lead to the regression being spurious unless there is the existence of at least one cointegrating relationship. The variables should ideally be stationary at either at their levels, I(0), or at their first difference forms, I(1). Once the variables are found to be stationary, cointegration test is to be followed.

5.2. Johansen Test of Cointegration

Johansen procedure is applied to test for cointegration, which is known to provide a unified framework for estimation and testing of cointegration relations in the context of VAR error correction models. It basically tells us whether or not the variables are associated in the long-run. The authors estimate an Unrestricted Vector of Autocorrelation of the following form for this purpose:

$$\Delta x_t = \alpha + \theta_1 \Delta x_{t-1} + \theta_2 \Delta x_{t-2} + \theta_3 \Delta x_{t-3} + \cdots\cdots + \theta_{k-1} \Delta x_{t-k+1} + \theta_k \Delta x_{t-k} + u_t \quad \text{---------- (ii)}$$

where Δ is the difference operator; x_t is a (n x 1) vector of non-stationary variables (in levels); and U_t is the (n x 1) vector of random errors. The matrix θ_k contains the information on long-run relationship between variables, for instance, if the rank of $\theta_k = 0$, the variables are not cointegrated. On the other hand if rank (usually denoted by r) is equal to 1, there exists one cointegrating vector and finally if $1 < r < n$, there are multiple cointegrating vectors. Johansen (1988) derive two tests for cointegration, namely the trace test and the maximum Eigenvalue test. The trace statistic test evaluates the null

hypothesis that there are at most r cointegrating vectors whereas the maximum Eigenvalue test, evaluates the null hypothesis that there are exactly r cointegrating vectors in x_t.

5.3. Granger Causality Test

According to cointegration analysis, when two variables are cointegrated then there exists at least one direction of causality. Granger causality, introduced by Granger (1969), is one of the important matters that have been much studied in empirical macroeconomics and empirical finance. The presence of non-stationarity can lead to ambiguous or misleading conclusions in the Granger causality tests (Engle and Granger 1987). Only when the variables are cointegrated, it is possible to deduce that a long-run relationship exists between the non-stationary time series. When we take y and x as the variables of interest, then the Granger causality test (Granger 1969) determines whether past values of y add to the explanation of current values of x as provided by information in past values of x itself. If previous changes in y do not help explain current changes in x, then y does not Granger cause x. In a similar way, we can examine if x Ganger causes y just be interchanging them and carrying out this process again. There could be four probable outcomes: (i) x Granger causes y (ii) y Granger causes (iii) Both x and y granger causes the other and (iv) neither of the variables Granger causes the other. In this paper, the causality tests among all the concerned variables are conducted. For this the following set of equations are estimated:

$$x_t = \alpha_0 + \alpha_1 x_{t-1} + \cdots \cdots + \alpha_l x_{t-l} + \beta_1 y_{t-1} + \cdots \cdots + \beta_l y_{t-l} + u_t \text{ -------------(iii)}$$

$$y_t = \alpha_0 + \alpha_1 y_{t-1} + \cdots \cdots + \alpha_l y_{t-l} + \beta_1 x_{t-1} + \cdots \cdots + \beta_l x_{t-l} + v_t \text{ -----------(iv)}$$

We consider the above set of equations for all possible pairs of (x, y) series in the group. The reported F-statistics are the Wald statistics for the joint hypothesis.

5.4. Vector Error-Correction Model (VECM) Approach

Engle and Granger (1987) showed that a vector error correction model (VECM) is an appropriate method to model the long-run as well as short-run dynamics among the cointegrated variables. Causality inferences in the multi-variate framework are made by estimating the parameters of the following VECM equations.

$$\Delta Y = \alpha + \sum_{i=1}^{m} \beta i \Delta Y_{t-i} + \sum_{j=1}^{n} \gamma_j \Delta X_{t-j} + \sum_{k=1}^{0} \delta \Delta M^s + \sum_{l=1}^{p} \zeta \Delta N + \theta Z_{t-1} + \varepsilon_t \qquad \text{---------------- (v)}$$

$$\Delta X = a + \sum_{i=1}^{m} b i \Delta Y + \sum_{j=1}^{n} c_j \Delta X_{t-j} + \sum_{k=1}^{0} d \Delta M^s + \sum_{l=1}^{p} e \Delta N + f Z_{t-1} + \xi_t \qquad \text{------------------(vi)}$$

z_{t-1} is the error-correction term which is the lagged residual series of the cointegrating vector. The error-correction term measures the deviations of the series from the long-run equilibrium relation. For example, from equation (v), the null hypothesis that X does not Granger-cause Y is rejected if the set of estimated coefficients on the lagged values

of X is jointly significant. Furthermore, in those instances where X appears in the cointegrating relationship, the hypothesis is also supported if the coefficient of the lagged error-correction term is significant. Changes in an independent variable may be interpreted as representing the short-run causal impact while the error-correction term provides the adjustment of Y and X toward their respective long-run equilibrium. Thus, the VECM representation allows to differentiate between the short- and long-run dynamic relationships. The Chi-Square test statistic is used to determine the short-run causalities between pairs of variables in the model.

The authors resorted tousing the EViews 7.1 software for carrying out all econometric tests in this study.

6. Results and Discussion

The results from the ADF test confirm that all the variables are stationary both at their levels, I (0) and at their first differenced forms, I(1). Thus, the possibility of the regression being spurious is nullified following the absence of unit roots in the data set. Results from the ADF test are provided in Table 1.

Table 1: Augmented Dickey-Fuller (ADF) Test Results (Lag=8)

Variable	ADF Statistic[a]	Critical Value (95% level)	ADF Statistic[b]	Critical Value (95% level)	Decision on Stationarity
			First Difference I (1)		
INF	-9.111	-2.854	-8.984	-3.553	Stationary considering both constant and constant and trend
BD	-0.294	-2.960	-3.624	-3.558	Non-Stationary considering constant and Stationary considering constant and trend
M2	6.556	-2.954	-0.053	-3.553	Stationary considering constant and Non-Stationary considering constant and trend

Notes: a. ADF statistic considering only constant; b. ADF statistic considering constant and trend. Optimal lag selection is based on the Schwarz Information Criterion (SIC).

The Johansen Cointegration test results show that there is a presence of at least one cointegrating equation in the model. However, only in the context of the trace test, a cointegrating relationship was found which was not the case under the maximum Eigenvalue test of Johansen cointegration. Asthe variables are found to be associated in the long-run it fulfills the prerequisite for proceeding to the Granger causality tests. Results from the Johansen cointegration test are given in Table 2.

Table 2: Johansen Cointegration Test Results (Lag = 2)

Johansen Test of Cointegration (Trace Test)				
Null	**Alternative**	**Trace Statistic**	**95% Critical Value**	**Conclusion**
r = 0	**r = 1**	33.171	29.797	
r<=1	**r = 2**	14.920	15.495	1 cointegrating equation
r<=2	**r = 3**	1.712	3.841	
Johansen Test of Cointegration (Maximum Eigen Value Test)				
Null	**Alternative**	**Max-Eigen Statistic**	**95% Critical Value**	**Conclusion**
r = 0	**r = 1**	18.251	21.132	
r<=1	**r = 2**	13.207	14.265	No cointegrating equation
r<=2	**r = 3**	1.712	3.841	

Notes: Selection of the lag is based on Schwartz Information Criterion (SIC

According to the Granger causality test results, provided in table 3, there were no causalities found to running between the concerned variables in the long-run as all the F-Statistics are found to be statistically insignificant at 10% level of significance. The fact that M2 and INF are found to be unassociated corroborates with the economic conjecture of monetary policies being ineffective in controlling INF in the long-run. Thus, these findings contradict with the opinion put forward by Oladipo and Akinbobola (2011) for Nigeria which advocated in favor or a long-run unidirectional causal association running from BD to INF.

Table 3: Granger Causality Test Results (Lag=2)

Null Hypothesis	F Statistic	P-Value	Conclusions
BD does not Granger cause INF	0.006	0.994	No Causality
INF does not Granger cause BD	0.269	0.766	
M2 does not Granger cause INF	0.069	0.933	No Causality
INF does not Granger cause M2	0.139	0.871	
M2 does not Granger cause BD	1.720	0.198	No Causality
BD does not Granger cause M2	1.241	0.304	

Notes: Selection of the lag is based on Schwartz Information Criterion (SIC)

The results of VECM approach suggests that BD is effective in influencing the domestic rate of INF in Bangladesh which is confirmed by the presence of a unidirectional causality running from BD to INF only in the short-run. Thus, this finding corroborates with the findings by Abel *et al.* (2012). However, no short-run causalities are found neither between M2 and INF nor between M2 and BD. This implies that INF in Bangladesh could well be influenced by other factors like real exchange misalignments, etc. The results therefore provide statistical support to the *a priori* hypothesis of monetary expansion being effective in explaining movements in the domestic INF.Table 4 provides the details of the findings from the VECM approach showing possible short-run causal associations between the variables considered in the model.

Table 4: VECM Test Results (Lag = 2)

Dependent Variable	Null Hypothesis	Chi-Square Statistic	Prob. Value	Conclusions
	Causality Test Statistics between INF and BD			
INF	BD does not cause INF	4.539	0.0834	Unidirectional Causality
BD	INF does not cause BD	2.313	0.315	running from BD to INF
	Causality Test Statistics between INF and M2			
INF	M2 does not cause INF	0.506	0.776	No Causality
M2	INF does not cause M2	0.583	0.747	
	Causality Test Statistics between BD and M2			
BD	M2 does not cause BD	3.511	0.173	No Causality
M2	BD does not cause M2	2.697	0.260	

Notes: Selection of the lag is based on Schwartz Information Criterion (SIC). EViews 7.1 software automatically selects the most significant lag length based on this criterion.

7. Conclusions

This paper has attempted to empirically investigate the long-run dynamic relationship between BD, M2 and INF in Bangladesh. In addition, the authors also wanted to check whether any causality exists among the aforementioned variables. The results coincide with the economics conjecture of a rise in BD leading to INF within the economy as a unidirectional causality is seen to be running from BD to domestic INF in Bangladesh only in the short-run, corroborating to the conclusion made in the study by Abel *et al.* (2012). However, the authors find evidence regarding M2 to be ineffective in influencing BD and INF neither in the short-run nor in the long-run. A possible reason behind the findings related to the M2 – INF nexus could be the fact that according to the macroeconomic theorem, monetary policy is ineffective in controlling price levels in the long-run. This conclusion is in contrast to the findings by Kesavarajah and Amirthaligam (2012) for Sri Lanka.

The implications of the findings are important in the sense that Bangladesh has always faced shortfalls in its revenue generation whereby a deficit budget was inevitable. In addition, the associated impact of this BD on the INF rate in the country has also been a great concern for the government. Thus, this paper can be useful in governing the policy-making decisions whereby the BD-induced INF in the short-run can be counteracted through appropriate measures. It is important to keep INF at a desired level since lower rates of INF can be associated with higher rates of economic growth. Thus, controlling INF is one of the utmost important policy agendas of governments in the developing world, to which Bangladesh is no exception. The significance of keeping inflationary rates in check is even more crucial in the context of Bangladesh following the nation's majority of the population living in the rural areas and having low-income levels. It is believed that the marginal impact of INF is relatively higher on the shoulders of the poor people as compared to the rich counterparts. Thus, in light of the findings, it can be asserted that it is ideal for the government of Bangladesh to adopt effective INF-targeting policies which would neutralize the inflationary pressures arising from the nation's BD.

Unavailability of relevant data acted as the main constraint in this paper which restrained the authors from adding some crucial controlled variables in the model. As part of the future scopes of research, the authors would like to the causal relationship between BD, M2 and INF in context of a panel of different countries which would provide robustness of the findings. Furthermore, cross-sectional studies can also be taken dividing the time-period into smaller sub-periods in order to capture the inter-temporal effects on the causal associates more accurately.

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Appendix

Figure 4: Domestic Money Market Equilibrium
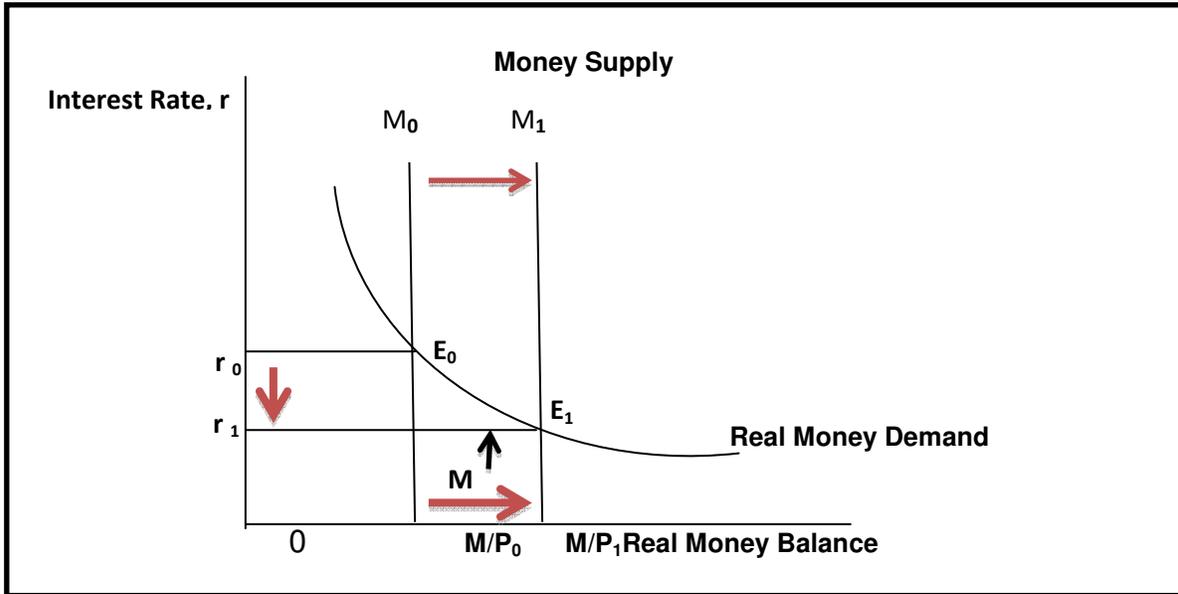
Source: Krugman and Obstfeld, 2003.