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Fiscal Deficits and Inflation: the case of Bangladesh

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Fiscal deficits and inflation: the case of Bangladesh

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Abstract

Maintaining price stability is an important macroeconomic goal for sustainability of economic growth. To control inflation, it is important to know what factors are working behind price fluctuations. The fiscal theory of price level suggests that persistent budget deficits can result in inflation and various empirical works show that the deficit-inflation relationship is positive and significant in many countries. The validity of this relationship has important implications for understanding the effects of fiscal and monetary policy on inflation rate. This paper analyses the fiscal deficit-CPI inflation relationship in the context of Bangladesh using the ARDL cointegration approach suggested by Pesaran and Shin (1995) based on annual data for the period 1974-2010. The study finds that fiscal deficits have inflationary effects in the long run and together with this factor, real GDP, inflation expectations and the current floating exchange rate regime also affect the inflation dynamics of Bangladesh. So, both demand side and supply side management policies are important for maintaining price stability in Bangladesh.

Key words: fiscal deficits, CPI inflation, ARDL cointegration techinique, Bounds test.

JEL Classification: E62, E31, C22.

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Fiscal deficits and inflation: the case of Bangladesh

1 Introduction

A fundamental macroeconomic objective for a country is to achieve price stability and, the monetary authority sets policies accordingly to prevent any persistent rise in the general price level. Although inflation is undesirable, we see it because of policymaker's efforts to achieve other goals such as maintaining high employment and managing fiscal deficits. Persistent fiscal deficits create inflation, when deficits are financed by either borrowing money from a central bank through printing money or issuing a large number of government debt instruments and those instruments end up in the hands of the central bank through open market purchase (Mishkin 2010). This monetization of debt, instead of increasing tax revenue, can be a significant source of inflation in many countries. A similar line of reasoning works behind the theory named, the Fiscal Theory of Price Level (FTPL), proposed by Woodford (1995). The FTPL identifies the wealth effect of government debt as an additional channel of fiscal influence on inflation where increased government debt adds to household wealth and thereby to demand for goods and services, creating pressure on the price level (Kwon et al. 2006).

Developing countries, aiming to achieve high economic growth, often sacrifice price stability in the short run. After independence in 1971, Bangladesh was under persistent inflationary pressure due to the high money supply (Hossain 1995). In later years, the government was cautious in controlling inflation and registered well inflation performance during the 1990's relative to the neighbouring countries. However a lower level of financial deepening (measured by M2/GDP) could explain the lower inflation during this time (Mortaza 2007). In recent years, rising price levels have posed a challenge to policy makers since a continuous rise in inflation can erode long run growth prospects of an economy. The general government budget balance in Bangladesh is always negative, and because of the narrow tax base and underdeveloped bond market the government relies on bank borrowing to finance a significant portion of the deficit each year.

In this situation it is important to investigate whether government budget deficits are inflationary in Bangladesh. Many empirical works have found that deficits can be inflationary particularly in those countries where the government securities market and tax system are not well developed. Identifying the active factors behind persistently rising price levels is important because inflation decreases the purchasing power of money and erodes living standards thereby adding to uncertainties in life (Lipsey et al. 1982) and making economic planning difficult. If inflation is unanticipated then it redistributes income and wealth, which ultimately affects economic activity and resource allocation of the country (Taslim & Chowdhury 1995). Inflation decreases market efficiency by providing a wrong signals about the relative scarcity of goods in the market, thereby making the market environment cloudy and transactions inefficient (Bank of Canada 2011).

The financing of budget deficits and their impact on the economy are important issues to investigate for analysing the monetary policy effects and fiscal policy effects on an economy. Much of the inflation literature investigates the inflation-budget deficit relationship using time series and panel data analysis and the outcomes have been mixed. In a comprehensive data analysis of the US and 12 other countries, King and Plosser (1985) find no significant relationship between inflation and budget deficits. Haan and Zelhorst (1990), using a nonparametric approach in developing country data, suggest seignorage is weakly related to budget deficits except in periods of high inflation. Catao and Terrones (2005) show that equilibrium inflation is directly related to budget deficits scaled by narrow money, using a simple inter temporal optimization model. Some other studies analysing inflation sources do not include the government budget balance in their model. For example, Mortaza (2006), Mujeri et al. (2009), Begum (1991) and many other empirical works on Bangladesh's inflation do not consider budget deficit as a separate control variable in their model.

Literature Review

It has been a matter of debate among economists for a long period about what actually causes inflation. This macroeconomic debate arises mainly because of the disparity between developing and developed countries internal situations and the different

conventional views about measures to control inflation. The two main schools of thoughts about inflation are the Keynsians or structuralists and the monetarists or reduced form thoughts.

The Keynsians or structuralists explain inflation as a result of an increase in fiscal expenditures which shift aggregate demand positively and thus increase the price level. High money growth to achieve the government's high employment target may result in cost push or demand pull inflation. However, a one shot increase in government expenditure will result in a one shot increase in price level, not a persistent increase. Monetarists, on the other hand, explain inflation solely as a result of money growth, that is, an increase in money supply by the central bank causes inflation. In this view, the central bank can control inflation by controlling the money supply.

Sargent and Wallace (1981) in their seminal paper 'some unpleasant monetarist arithmetic' demonstrate that under certain circumstances, the monetary authority has very little control over inflation even though the monetary base and inflation remains closely connected, according to monetarist's hypothesis. They show this is true when monetary and fiscal policies are coordinated in a particular way and the public's demand for interest bearing government debt instruments has a certain form. Being limited to divide government debt only between the bond and base money and with no possibility of budget surplus, the monetary authority that wants to control inflation tries to do so by reducing base money growth and letting public bond holdings increase. But eventually, the public bond holding will reach its limit and then to finance due interest and principal payments, the only resort available will be seignorage (revenue from money creation). So, governments running persistent budget deficits have to finance those deficits sooner or later by money creation (seignorage) and thus a central bank's efforts to control inflation through controlling the base money will result in additional inflation. Hence, when fiscal policy dominates monetary policy then money supply becomes endogenous. .

In the fiscal view of inflation, fiscal imbalance remains the most important factor behind inflation. Woodford (1995) argues in the Fiscal Theory of Price Level (FTPL) that a government's decision about how to finance its debt plays a crucial role in determining the time path of inflation rate if the government can behave fundamentally

differently from households. Households must satisfy an inter-temporal budget constraint but the government can follow a non Ricardian policy under which the inter temporal budget constraint is satisfied for only some, not all price paths.

In the monetarists view, government can control inflation by simply controlling money supply. If output grows at ɣ per cent per year and money supply grows at μ per cent per year, then over a long period of time, price level will grow by (μ-ɣ) per cent per year. So, inflation here is determined by the relative scarcity of money and goods. Kocherlakota and Phelan (1999) show, following Obstfeld and Rogoff (1983), that inflation cannot be determined in this simple fashion because the agent's current money demand depends on its future inflation expectations. Therefore, a large number of equilibrium paths of inflation can exist beside the one equilibrium growth rate of (μ-ɣ) per cent. Thus, controlling only money supply is not sufficient to pin down the time path of inflation rate.

In an empirical work, De Haan and Zelhorst (1999) analyse the relationship between the budget deficit and money growth among 17 countries from Asia, Europe and Latin America, using VAR approach over the period 1961-1985. They find that the fiscal deficit has a significant positive temporary impact on reserve money growth for seven countries. They also find a long run influence of government budget deficits on the money growth of Greece, India, Korea and the Philippines. They conclude that the evidence for a positive relation between government budget deficits and money growth exists only for a few countries and during a period of acute inflation.

In countries which do not have a well functioning tax system and developed bond market (both government and corporate), governments face difficulties in raising revenue for expenditures. In addition, central bank independence is an important factor in controlling inflation because political pressure may force the central bank to monetize government debt continuously if the central bank does not have autonomy. Using the panel data technique, Cottarelli et al. (1998) analyse the inflation performance of 47 industrialised and transition economies over the period 1993-1996 by examining the policy maker's incentives to inflate the economy. The estimated results suggest budget deficits have a significant effect on inflation, particularly in those countries where government securities markets are not well developed. In addition, other factors that

have significant inflationary effects are relative price changes, central bank autonomy, the degree of price liberalization and exchange rate regime. Sikken and De Haan (1998) in a study of 30 countries find that if turnover rate of central bank governors or political vulnerability index is used as a proxy for central bank independence then monetization of deficit is negatively related with central bank independence. In Bangladesh, the focus of this study, the bond market (especially secondary market) is not well developed and the government faces many constraints in raising tax revenue for fiscal expenditure.

Fischer et al. (2002) show, using fixed effects in a panel of 94 developed and developing countries that a one percentage point improvement in the budget balance to GDP ratio leads to around a 4.25 per cent decrease in inflation, holding all other variables constant. They also find that the effect of changes in the budget balance is not significant in low inflation countries or in the low inflation episodes of high inflation countries.

In a recent work, Catao and Terrones (2005) investigate the budget deficit-inflation relationship using a broad cross country data set (107 countries over the period 1960-2001) and find that inflation is directly related to the budget deficit scaled by narrow money. This model scales budget deficit by narrow money (M1) rather than the standard approach of scaling by GDP, allowing nonlinearity in the relationship of inflation with deficit in the inflation tax base (M1). They model the deficit-inflation relationship as dynamic and find that fiscal deficits are inflationary in most countries. Their findings are stronger support for the FTPL than some earlier studies which had different model specifications of the deficit-inflation relation than Catao and Terrones (2005). The relationship is stronger in the case of developing countries; however, they conclude fiscal deficits have no significant positive impact on long run inflation in some countries with a long history of low single digit inflation.

There are a number of empirical studies on inflation in the context of Bangladesh that try to identify the factors behind inflation but very few are recent. In an earlier study Taslim (1982) analyses the factors contributing to inflation in Bangladesh in light of the structuralist-monetarist controversy, using data over the period 1960-1980. He tests both views separately and a hybrid model which stays in the middle of the two views and finds that any devaluation of the domestic currency leads to an equal proportionate

increase in inflation. During the period of this study, Bangladesh had fixed exchange rate regime[1] and the study does not consider the effect of fiscal balance on inflation directly.

However, Begum (1991) formulates the inflation model in Bangladesh's context considering both demand and supply side factors and identifies significant contributing factors to inflation including agriculture and import bottlenecks, fiscal expenditure, interest rate, bank loans and expected inflation. The significance of factors such as import bottlenecks, fiscal expenditure and expected inflation demonstrate the importance of the demand side on inflation in Bangladesh. However these analyses are based on data when the Bangladesh economy was not liberalised and the exchange rate was the nominal anchor for monetary policy. Using unrestricted vector auto regression (VAR), Mortaza (2006) finds inflation sources based on data from 1990 to 2006 and concludes that demand management policy is important for the price stability of Bangladesh.

The IMF selected issues paper (2007) on Bangladesh show the most important factors for Bangladesh inflation are money creation and inflation inertia rather than supply side shocks, such as shortages of domestic food production or rise in international oil price that some other studies emphasise. Among the supply side factors this study finds only exchange rate has some significance on the inflation process in Bangladesh. This gives some indication that budget deficits may be inflationary if the deficits are monetized continuously since this paper finds that monetary factors are important determinants of inflation in Bangladesh.

Akhtaruzzaman (2005) analyses the factors which are believed to generate inflation in Bangladesh, using the co-integration and Vector Error Correction approach over the period 1973-2002. The author admits that fiscal and monetary policies are closely related in Bangladesh because fiscal deficits are mainly financed by increasing the money supply. Thus, government borrowing from the central bank is viewed as

[1] From1972-1999 the exchange rate was pegged to the pound sterling and then to a basket of currencies, 2000-2002 crawling band and from May 2003 floating exchange rate regime (Hossain & Ahmed 2009).

inflationary but this study does not include budget balance as a separate control variable in the model.

Hence, the validity of the relationship between budget balance and inflation in the case of Bangladesh has not been established in the existing empirical works. So, these studies might have missed an important contributory factor in the inflation dynamics of Bangladesh. This paper attempts to fill this gap by analysing the effects of budget balance on Bangladesh inflation for the period 1974-2010. The principal research question of this study is, whether fiscal theory of price level works in Bangladesh or, equivalently, whether there exists a significant positive relationship between the budget deficits and inflation under the current deficit financing system in Bangladesh. The results indicate that budget deficits along with supply side factors are important determinants of inflation in Bangladesh.

This study contributes to the existing empirical works by testing the theoretically and empirically important relationship between fiscal deficits and inflation in the case of Bangladesh, based on the inter-temporal optimization model developed by Catao and Terrones (2005) for the first time. Although Habibullah et al. (2011) analyse this relation, using Engle-Granger two step co-integration techniques for 13 Asian developing countries, this test has low power and the model specification is not appealing. Second, this paper uses a more sophisticated econometric technique and empirically appealing model than previous inflation literature on Bangladesh. Third, the analysis covers data up to the most recent period (1974 – 2010) and hence, is able to explain the recent inflation dynamics. Finally, this analysis sheds light on the effectiveness of monetary policy and recent trends in government deficit financing and its impact on price level of the economy.

The rest of the paper is organised as follows: Section 2 briefly describes the background of this study by analysing CPI inflation and methods of deficit financing in Bangladesh. Section 3 includes methodological issues and data description. Section 4 presents the empirical results and Section 5 presents policy implications based on the empirical results and draws concluding remarks.

2 Background

During the 1970's, inflation in Bangladesh was very high due to the reconstruction and rehabilitation of the war torn economy. However, from the 1980's CPI inflation started to settle at a level around 10 per cent or below. In calculating Consumer Price Index (CPI), more than 58 per cent weight is given to food items of which more than 80 per cent are rice and cereal products. Weights on food items are higher in rural CPI than urban CPI and the majority people live in rural areas, so, rural inflation and food price have important impacts on the national inflation rate.

The fiscal sector of Bangladesh usually has difficulty earning sufficient tax revenues or, income from noninflationary sources in relation to its expenditure, due to weak fiscal management and tax structure. Similar to many other developing and emerging industrialized countries, Bangladesh faces budgetary challenges as areas of public expenditure are always larger than sources of income. The lower domestic savings rate constrains the government to some extent from borrowing from the public. Again, due to a lower level of monetization and skewed income distribution, the tax base has not grown as much, despite a continuous GDP growth rate of around 6 per cent since 2003. Although a well functioning banking sector and equity market exist, the bond market and nonbank financial sector of Bangladesh still have a long way to go. A well developed bond market can provide government with roll over facilities of its debts over a long time horizon. The level of financial development can influence modes of deficit financing and hence, fiscal deficit's impacts on the price level.

Although tax revenue collection has been improving recently, the revenue-GDP ratio (12 per cent) and the tax-GDP ratio of Bangladesh is still the lowest in the South Asian region (Governor of Bangladesh Bank 2011). So, fiscal deficits of Bangladesh remain persistent and the common feature of deficit financing is to borrow from abroad and domestic sources (from the central bank, the scheduled banks and the non bank sector). The government's net domestic borrowing structure is shown in Figure 1 in the Appendix. Borrowing from the banking sector is particularly harmful for the economy as the theory suggests that this is inflationary and crowds out private investment, and both effects can erode economic growth.

3 Model

Sargent and Wallace (1982) show that the relationship between inflation and fiscal deficits is dynamic since the government can allocate seigniorage inter temporally by borrowing. When fiscal policy is set independently, deficits determine the present value of seignorage to finance them but not necessarily determine the current level of seignorage and inflation. So, the current deficit is not necessarily related to current inflation. Using a small open economy version of general equilibrium models surveyed by Ljungqvist and Sargent (2000), a parsimonious and testable specification of the long run relationship between deficit and inflation is derived by Catao and Terrones (2005). In the model, households maximize lifetime utility subject to an inter-temporal budget constraint. The government, on the other hand, finances its spending by tax collection, bond issuance or by printing money. Finally, after some algebraic manipulations, the authors show, economy wide budget constraint and stationary equilibrium imply that inflation is proportional to the product of the ratio of government budget deficit to GDP and the inverse of the narrow money to GDP. Or, equivalently, inflation is directly proportional to the ratio of budget deficit over money supply which can be expressed as:

$$\pi = \alpha \frac{(G-T)}{M} \qquad (1)$$

Where, π = rate of inflation, G - T = government expenditure – tax revenue = budget deficit, M= money (narrow money) and α = semi elasticity parameter.

Following Catao and Terrones (2005), this particular specification of the relationship between inflation and budget deficit is used in this paper because this is less *ad hoc* than the previous standard practice of scaling the deficit by GDP and it also seems empirically relevant. In terms of methodology, this paper uses the more recent technique - autoregressive distributed lag (ARDL) structure (Pesaran & Shin 1995, 1999; Pesaran et al. 1996; Pesaran 1997; Pesaran et al. 1998) in which dependent and independent variables appear in the right hand side of equation with lags p and q respectively:

$$\pi_t = \alpha + \sum_{k=1}^{p} \gamma_k \pi_{t-k} + \sum_{j=1}^{m} \sum_{i=0}^{q_j} \delta_{ji} X_{j,t-i} + DER_t + \varepsilon_t \qquad (2)$$

Where, π_t is the inflation rate at time t and X_j denotes the explanatory variables such as Ln(real GDP), weighted inflation of trade partner countries, and fiscal deficits [$\frac{(G-T)}{M}$].

The dummy variable DER_t is to control for exchange rate regime. The model does not include oil price as the oil price is administered by the government in Bangladesh, so, it is unlikely that the real effects of oil price fluctuations on inflation can be observed in Bangladesh. The subsidy given to oil price may already be captured by the budget deficit term. So, oil price, a commonly used variable in many inflation models is not included here. The wage rate is also not included in the model as Bangladesh has abundant cheap labour similar to many other developing countries.

The ARDL approach allows rich dynamics in the way inflation adjusts to changes in fiscal deficits and other variables and mitigates the contemporaneous causation from the dependent variable (inflation) to the independent variables which might bias the estimates (Catao &Terrones 2005; Banaerjee et al. 1993). There are several advantages of using the ARDL approach which motivate this study to adopt it.

The ARDL approach is advantageous than the conventional Johansen (1998) and the Johansen and Juselius (1990) approach because the conventional approach estimates the long run relationship within a system of equations while the ARDL estimates use a single reduced form equation (Pesaran & Shin 1995). Wickens and Breusch (1988) show that Engle and Granger two step procedure of estimating long run relationship is unnecessary. Rather, a simultaneous estimation of long run and short run parameters can give efficient long run estimation. Second, in ARDL approach, the test of the existence of any relationship among the underlying variables at levels can be done irrespective of whether the variables are purely I(0), purely I(1) or mutually cointegrated (Pesaran et al 2001). The underlying statistic in this procedure is Wald or F statistic in the generalised Dickey-Fuller regression which shows the significance of the lagged level of variables in a conditional (unrestricted) equilibrium correction model (ECM). Third, in this approach different variables can have different optimal lags, which is not possible in standard co-integration tests. Finally, the ARDL approach can be applied for small sample time series data (Duasa 2007) such as 30 to 80 observations, and critical values for small sample have been developed by Narayan (2004).

The ARDL co-integration approach (Pesaran et al. 2001) involves estimating an unrestricted (conditional) error correction version of the ARDL model which can be written as:

$$\Delta\pi_t = \alpha_0 + \sum_{i=1}^{n} \rho_i \Delta\pi_{t-i} + \sum_{i=0}^{n} \theta_i \Delta bd_{t-i} + \sum_{i=0}^{n} \varphi_i \Delta lnRGDP_{t-i} + \sum_{i=0}^{n} \lambda_i \Delta MINF_{t-i} + \delta_1 \pi_{t-1} + \delta_2 bd_{t-1} + \delta_3 lnRGDP_{t-1} + \delta_4 MINF_{t-1} + \delta_5 DER_t + \vartheta_t \quad (3)$$

Where, π_t = inflation at time t;

$bd_t = \frac{budget\ deficits}{money\ supply} = \frac{Governemnt\ expenditure - revenue}{M2}$ at time t;

$lnRGDP_t$ = ln(Real GDP) at time t; $MINF_t$= weighted foreign inflation rate (from Bangladesh' major import partners) at time t and the dummy variable DER_t is to control for exchange rate regime. Δ is the first difference operator and p is the optimal lag length. ϑ_t is the error term.

The F test is used to test for the existence of long run relationship among the variables in the model with an intercept but no trend. Here, the null hypothesis is no co-integration that is;

H_0: $\delta_1 = \delta_2 = \delta_3 = \delta_4 = 0$ (no long run relationship exists) and the alternative is, H_1: $\delta_1 \neq \delta_2 \neq \delta_3 \neq \delta_4 \neq 0$ that is, a long run relationship exists between the dependent and explanatory variables in the model.

The F test has non-standard distribution and the value depends on-

(i) whether the variables are I(0) or I(1), (ii) whether there is an intercept and/or trend included in the model and (iii) the number of regressors.

The calculated F statistic is compared with the critical values calculated by Pesaran et al. (2001). There are two types of critical values; lower bound critical values for I(0) series, and upper bound values for I(1) series. A decision can be made without knowing the orders of the series (whether I(0) or I(1)). The decision rule is:

if calculated F > upper bound critical value, reject null and conclude that cointegration exists in the model. If the F value falls within I(0) and I(1) value band, then it is inconclusive, no decision can be made about cointegration. In this situation, we need to do unit root tests to know the orders of all series.

If evidence in the first step suggests the existence of long run relationship, then we move to second step to estimate the long run and short run parameters of the inflation model. The econometric software that conveniently selects the optimal lag structure for ARDL model for each of the conventional model selection criteria, after setting maximum lags, is Microfit (Pesaran & Pesaran 1997) and this paper estimates the ARDL model, using Microfit 4. One benefit of using Microfit is, after having cointegration, Microfit calculates the long run parameters from the underlying short run model with the standard errors and t-ratios automatically.

Long run and short run model

Given that the long run relationship exists among the variables, we estimate the long run parameters of the model through estimating the following ARDL (m,n,p,q) model:

$$\pi_t = \alpha_0 + \sum_{i=1}^{m} \alpha_1 \pi_{t-i} + \sum_{i=0}^{n} \alpha_2 bd_{t-i} + \sum_{i=0}^{p} \alpha_3 lRGDP_{t-i} + \sum_{i=0}^{q} \alpha_4 MINF_{t-i} + \alpha_5 DER_t + \omega_t \quad (4)$$

Here, the variables are as previously defined. The order of the lags in the ARDL model can be selected by Akaike Information Criterion (AIC) or Schwarz Bayesian criterion (SBC) or Hannan-Quinn (HQ) criterion. SBC is known as more parsimonious than AIC and here, we choose SBC criterion to decide the lag structure of the ARDL model. Pesaran and Shin (1999) recommend 2 as the maximum lags to choose for annual data. From this, lag length that minimizes the SBC is selected.

With the presence of cointegration, we estimate the short run dynamics of the model by constructing an error correction model in the form:

$$\Delta\pi_t = \beta_0 + \sum_{i=1}^{n} \beta_1 \Delta\pi_{t-i} + \sum_{i=0}^{n} \beta_2 \Delta bd_{t-i} + \sum_{i=0}^{n} \beta_3 \Delta lRGDP_{t-i} + \sum_{i=0}^{n} \beta_4 \Delta MINF_{t-i} + \beta_5 DER_t + \psi ECM_{t-1} + \varepsilon_t \quad (5)$$

Where, ECM_{t-1} is the error correction term, defined as:

$$ECM_t = \pi_t - \alpha_0 - \sum_{i=1}^{m} \alpha_1 \pi_{t-i} - \sum_{i=0}^{n} \alpha_2 bd_{t-i} - \sum_{i=0}^{p} \alpha_3 lRGDP_{t-i} - \sum_{i=0}^{q} \alpha_4 MINF_{t-i}$$

Here, Δ is the first difference operator and β parameters are to describe the short run dynamics of the model. The error correction coefficient ψ, lying between (-1< ψ < 0) , measures the speed of adjustment.

Data

The model is analysed using annual data from period 1974-2010. GDP is an important series for the proposed model but quarterly GDP data for Bangladesh is not available. The quarterly budget deficit data is also not available over all the years of our study. Consequently, this study uses annual data for its analysis. The variable inflation rate (π_t) in this model is the annual percentage change in Consumer Price Index (CPI) :

$$\pi_t = \frac{CPI_t - CPI_{t-1}}{CPI_{t-1}} * 100$$

Inflation data is taken from World Economic Outlook (WEO) database. The variable bd_t is calculated as $\frac{G-T}{M2}$ where G is the general government expenditure and T is the general government revenue, hence the difference is the budget deficit which is scaled by M2 money. Here, budget deficit data from 1980 -2010 is collected from World Economic Outlook database which follows the definition of budget deficits given in the IMF Government Finance Statistics Manual (GFSM). The deficit data from 1974-1979 is taken from publications of the Ministry of Finance, Bangladesh. The M2 data is collected from the World Development Indicators (WDI) database. The definition of M2 in case of Bangladesh is:

M2 = M1+ time deposits = (Currency outside banks + deposit of financial institutions with Bangladesh Bank + demand deposits) + time deposits.

The lRGDP is ln(Real GDP) (GDP at constant 2000 price measured in local currency, Taka) and MINF is the CPI inflation rate of Bangladesh's major import partners. Inflation in import partner countries can influence Bangladesh's inflation through imports from these countries. Annual data for these two variables have been taken from WDI, International Financial Statistics (IFS), and Direction of Trade Statistics (DOTS) databases. The variable MINF is calculated as:

$$MINF_t = \sum_{j=1}^{5} inflation_j \left(\frac{import\ from\ country\ j}{total\ imports}\right)$$

Here, annual inflation rates of five countries (India, China, Singapore, Hong Kong and Japan) from where Bangladesh imported most during the period of the study are considered. Weights $\left(\frac{\text{import from country j}}{\text{total imports}}\right)$ have been calculated using import volume from these countries. Hence, MINF is an import weighted foreign inflation rate.

The dummy variable DER is included in the model to control for exchange rate regime. Bangladesh adopted the floating exchange rate system in 2003 abandoning earlier fixed pegged system to make monetary policy more effective in the context of growing economic liberalization. Hence, DER= 0 for 1974-2002 (fixed exchange rate) and DER=1 for 2003-2010 (floating exchange rate regime).

4 Empirical results and discussion

In the first step we carried out the cointegration test by estimating equation (3) for the period 1974-2010 whilst ensuring that there was no evidence of serial correlation as emphasized by Pesaran et al. (2001). The lag length was chosen by minimizing the Schwarz Bayesian criterion. Since we have annual data with 37 initial observations, we chose 2 as the maximum lags. Here we find, lag 1 minimizes the SBC, and hence, is chosen as the optimal lag. Result of the F test is presented in Table 1 along with the corresponding critical values. The critical values calculated by Pesaran et al. (2001) are

Table 1 **Cointegration test (F-test)**

(Lag length selected by SBC)				Bound critical values (restricted intercept & no trend)	
Test statistics	value	lag	Significance level	I(0)	I(1)
F-statistics	8.54	1	1% [a] (Pesaran et al. 2001)	3.56	4.66
			1% [b] (Narayan 2004)	4.522	5.792
			5% [a]	2.79	3.67
			5% [b]	3.160	4.218

based on 1,000 observations with 40,000 replications. So these critical values are not suitable for a small sample study like this.

However, critical values for small sample F test are calculated by Narayan (2004) from 30 to 80 observations based on the same GAUSS code used by Pesaran et al. (2000) which are also reported in Table 1. The calculated F statistic (8.54) is greater than upper bound critical value (5.792) at 1% level. So we reject the null hypothesis and conclude that a long run relationship (cointegration) between the dependent variable and independent variables exists in the model, tested at 1% level.

Since we have evidence of cointegration in the first step, we move to the next step of estimating the ARDL model to get the long run and short run dynamics of inflation-budget deficit relationship. The calculated long run parameters and corresponding standard errors (in parentheses) are reported in Table 2. Here, inpt is the intercept term.

The ARDL lag structure (2, 0, 0, 0) is automatically selected based on Schwarz Bayesian criteria, after setting 2 as the maximum lags to be used. However, the lag structures selected by the AIC and Hannan- Quinn criterion appear the same as those selected by the SBC in this study. From Table 2 we see that, budget deficits scaled by M2 money and the log of real GDP affect the long run inflation rate significantly.

Table 2 **Long run model**

ARDL(2,0,0,0) selected based on Schwarz Bayesian Criterion

Dependent variable is Π_t (inflation rate)		
Regressors	Coefficients	P-value
bd	5.99* (3.384)	.087
lRGDP	-7.47** (1.414)	.000
MINF	0.24 (.181)	.196
DER	5.85** (1.363)	.000
inpt	59.76** (10.574)	.000

** & * denote significant at 1% and 10% respectively.

The coefficient of the ratio (G-T)/M2 is positive and significant at 10 per cent level which implies that fiscal theory of price level works in Bangladesh in the long run. A one unit increase in the ratio budget deficit over M2 increases inflation by 6 percentage points in the long run, holding the effects of all other variables constant. So, the fiscal deficit is an important determinant of Bangladesh's inflation. As fiscal theory argues, an increase in the budget deficit, with no possibility of revenue surplus, will lead the government to borrow more either from the central bank or from the private sector by issuing debt instruments. Seignorage as well as other public debt instruments have inflationary effects on the economy. So, the result is similar to the theory. The result of this study is consistent with Habibullah et al. (2011) who investigate the budget deficit-inflation relationship among 13 Asian countries; including Bangladesh and find that budget deficit granger causes inflation in Bangladesh both in the long and short run. The conclusion of Catao and Terrones (2005), who find the deficit-inflation relationship as positive and significant, and particularly strong for developing countries, is also in line with this study.

The coefficient of ln(RGDP) is negative and significant at 1 per cent level. The study finds that if real GDP or output increases by 1 per cent then inflation decreases by 7.5 percentage points approximately in the long run, holding all other effects on inflation constant. It is typical in the non FTPL literature to consider budget deficit as a per cent of GDP (budget deficit/GDP). The approach taken in this paper models the effect of budget defcit/M2 (= bd) which is the core of the FTPL literature in addition to GDP. Hence, this is a generalization of the existing literature.

The significant negative effect of real GDP indicates the important role of the supply side in the determining inflation dynamics of Bangladesh. This result is similar to Akhtaruzzaman (2005) who also finds a strong deflationary effect of real output in Bangladesh economy. The increase in GDP, especially the high growth in agricultural output significantly reduces the upward pressure on general price level of the economy. For industrialized countries, the relation between inflation and output gap is expected to be positive following expectation augmented Phillips curve but the relation is expected to be reversed in the case of Bangladesh, a predominantly agricultural economy[2]. An increase in agricultural output due to favourable weather can reduce agricultural prices. Hence industrial output is also expected to increase as raw material costs and urban wage demand should decrease (Akhtaruzzaman 2005).

Rising inflation in Bangladesh is largely dominated by food price inflation (Shahiduzzaman 2009). As Akhtaruzzaman (2005) explains, an increase in real output or income increases the demand for real money balances for transactions which in turn decreases the price level. The highly significant negative effect of real output on long run inflation implies a concave upward sloping aggregate supply curve as shown in Figure 2 in the Appendix , indicating strong supply side effects. Figure 2 depicts that as real output increases, the change in price level decreases. Since real GDP has significant impact on inflation, the hypothesis – inflation is a purely monetary phenomenon, is not very robust in the case of Bangladesh.

Inflation rate in the countries from which Bangladesh imports most is expected to have some positive impacts on Bangladesh's inflation through imports from those countries.

[2] The sectoral contribution of agriculture to GDP in FY 2008-2009 was approximately 21 per cent and 48 per cent of total labour force is engaged in agriculture (Bangladesh Economic Review 2010).

Here the coefficient of foreign inflation has the positive sign as expected and indicates that a one percentage point increase in foreign inflation will increase domestic inflation by 0.24 percentage points but this coefficient appears insignificant. The World Bank (2008) points out that rising global price may not increase domestic price level to the same extent for several reasons such as the weakening dollar, domestic infrastructure and price stabilization policies. In this study we see that the effect of import partner countries' inflation on domestic inflation rate is insignificant. This indicates that Bangladesh has variable tariffs on food imports in order to stabilize the domestic price level. So the transmission of foreign inflation to domestic inflation is less or insignificant in the case of Bangladesh. Petroleum and petroleum products are important import items for Bangladesh, but they are given small weights in CPI (4 per cent) (Akhtaruzzaman 2005). So, even when the petroleum price fluctuates in the international market, the domestic price of petroleum remains stable. The result of this paper is consistent with the inflation study by Akhtaruzzamn (2005) which finds no cointegration between domestic inflation and foreign price level.

Error correction model

The short run inflation dynamics and speed of adjustment are presented in Table 3 with the results of a number of diagnostic tests applied to the error correction (short run) model. The values in parentheses are standard errors of the short run parameters and the values inside the square brackets in the diagnostic test part are p-values of the respective tests.

In contrast to the long run model, the effect of budget deficits on inflation is insignificant or less significant in the short run. The coefficient of the ratio of budget deficit over M2 is still positive but insignificant, implying that fiscal theory of price level works in Bangladesh's case only in the long run, not in the short run. The government is able to shift its debt inter temporally. As Sargent and Wallace (1981) stress, a persistent budget deficit is inflationary in the long run, not necessarily in the short run. Instead of seignorage, the government can rely more on debt instruments (domestic and foreign) in the short run to finance persistent budget deficits.

Table 3 **Short run model (Error correction model)**
ARDL(2,0,0,0) selected based on Schwarz Bayesian Criterion

Dependent variable $d\Pi_t$		
Regressor	Coefficient	P-value
$d\Pi_{t-1}$	0.32**(.05996)	.000
dbd_t	5.9 (3.7027)	.123
$dlRGDP_t$	-7.33** (1.385)	.000
$dMINF_t$	0.235 (.168)	.172
$dDER_t$	5.74** (1.4)	.000
$dinpt_t$	58.63 (10.59)	.000
ecm_{t-1}	- 0.981** (.125)	.000
Diagnostic tests		
R-bar squared	0.74	
DW statistics	1.825	
Breusch-Godfrey LM test for serial correlation $\chi 2(1)$	0.138 [0.711]	
Functional form (Ramsey's RESET test) $\chi 2(1)$	0.217 [0.641]	
Normality $\chi 2(2)$	3.8795 [0.144]	
Heteroscedasticity $\chi 2(1)$	0.106 [0.745]	

** indicates significant at 1% level.

Eventually it will reach the borrowing limit when all the repayments are due after a sufficiently long time. Then government has no alternative but to create money to meet its debt obligations. Thus the persistent budget deficit is inflationary in the long run, but may not be so in the short run.

However, to successfully and reliably explore the dynamic dimension of the relationship between the budget deficit and inflation, a long time series is required (Catao & Terrones 2005), but this is small sample time series study using annual observations due to unavailability of high frequency data.

The coefficient of the difference of lagged inflation ($d\Pi_{t-1}$) is positive and significant at 1 per cent level indicating that inflation expectations are important determinants of short run inflation in Bangladesh. For a one percentage point increase in expected inflation, actual inflation increases by 0.32 percentage points, holding the effects of other factors on inflation constant. This finding is consistent with the findings of Begum (1991) and Akhtaruzzaman (2005) in the context of Bangladesh. The high significance of inflation expectations in determining the short run inflation dynamics reveals that expectations-augmented Phillips curve relationship is effective for Bangladesh. If expected inflation increases, the short run Philips curve shifts upward resulting in an increase in inflation. This is also an indication that inflation is not purely a monetary phenomenon in the case of Bangladesh.

The short run effect of real GDP is significant at 1 per cent level, similar to the long run case but the magnitude of the effect is slightly lower than the long run case. The intercept term in the error correction model is also highly significant. Macroeconomic theory suggests that the exchange rate regime can have impacts in determining short run inflation. Here we find the effect of exchange rate regime on inflation is significantly positive. While fixing monetary policy, the central bank considers consumer price inflation which is a weighted average of the inflation for domestic goods and imported goods (Sorensen & Whitta-Jacobsen 2010):

$\pi_c = \gamma(\Delta e + \pi^f) + (1-\gamma)\pi$, where,$0 \leq \gamma \leq 1$.

π_c is the targeted inflation and π is the inflation from domestic goods. π^f is the foreign inflation. Any fluctuations in nominal exchange rate (hence,Δe) under the floating regime affect domestic inflation through import price as can be seen from the equation above. Even if π^f is not important for short run inflation (here, the insignificant effect of MINF in the error correction model), import price can still affect domestic inflation by devaluation of Bangladesh's currency Taka. Hossain and Ahmed (2009) find a high

pass-through coefficient for the Bangladesh Taka. So, any depreciation of Bangladesh Taka is easily translated into domestic inflation rate. Priyo (2009) shows that since the exchange rate regime change, the value of Taka has fallen by more than 20 per cent against the US dollar during the period when the US dollar itself was losing value. Thus, depreciation of the Taka during the floating exchange rate regime has significant impacts on the short run inflation dynamics of Bangladesh.

Finally, Table 3 shows the adjustment mechanism of inflation by the coefficient of error correction term (ecm_t) which is highly significant (at 1 per cent level). Here, the empirical analysis is based on annual data and the high magnitude of error correction coefficient implies that a large portion of any deviation from long run equilibrium inflation is adjusted within a year. The adjustment coefficient -0.98 means, almost 98 per cent of the deviation of inflation rate from its long run equilibrium level is corrected within a year, tested at 1 per cent level. So, the speed of adjustment is very high.

The last part of Table 3 describes a battery of diagnostic tests to understand the validity of the result of error correction model. The adjusted R square shows around 74 per cent of the variation of data is explained by the model. The Durbin-Watson (DW) statistic (1.84) is close to 2, which roughly indicates that the model is free of autocorrelation problem. The Breusch-Godfrey LM test for serial correlation is more appropriate for dynamic models and we see, this model passes this test. The model also passes the Ramsey's RESET test for functional form, indicating that the model has a correct functional form. The model also passes Jarque-Bera normality test which means the residuals are normally distributed. So, the model has correct functional form and the residuals are normally distributed. The heteroscedasticity test shows there is no heteroscedasticity problem in the model.

5 Conclusion and policy implications

The purpose of the study was to explore the fiscal deficit-inflation relationship in the case of Bangladesh and thereby, gain insights into the factors contributing to inflation in Bangladesh. The findings are more favourable to the fiscal-based inflation theory than previous inflation studies on Bangladesh. However, the overall findings imply that both

the demand and supply side management policies are important to control inflation in the long run.

The significance of the effects of budget deficits on inflation leads us to conclude that demand management policies such as government revenue and expenditure management have important roles to play in controlling inflation. It is not only monetary policy which is sufficient to maintain price stability; rather fiscal policy also has a crucial role to play in the scenario. If a significant part of fiscal deficits are continued to be financed by borrowing from banks then, new money creation will add pressure on domestic price levels and the central bank will no longer be able to maintain price stability. So, demand management policy should aim to reduce the size of government budget deficit and stop its monetization. This result points to the issue of greater central bank autonomy.

Catao and Terrones (2005) find that deficit-inflation relationship statistically significant in the case of developing and advanced countries of the middle inflation range. The theoretical relationship is violated in the case of low inflation advanced countries where central banks enjoy reasonable level of autonomy. This suggests a sufficient level of central bank autonomy can prevent the government from borrowing beyond a certain limit from the banking system. Greater central bank autonomy as well as institutional constraints that make government borrowing close to tax and spending smoothing rather than a systematic source of financing can be helpful in controlling inflation. However, the level of the Bangladesh Bank's autonomy and its relation with fiscal deficits and inflation can be an area of further research.

In addition, revenue mobilization needs to be strengthened to limit the deficits to a reasonable level. Broadening the tax base, increasing the share of direct tax with appropriate rationalization and reforms, enhancing the capacity and efficiency of monitoring potential tax payers and making effective services available to tax payers to increase tax compliance can increase government revenue collection significantly.

The strong effect of real output in dampening inflation suggests the dominance of supply side factors in determining inflation. This is in contrast with the monetarist view that inflation is purely a monetary phenomenon everywhere. Real sector activity

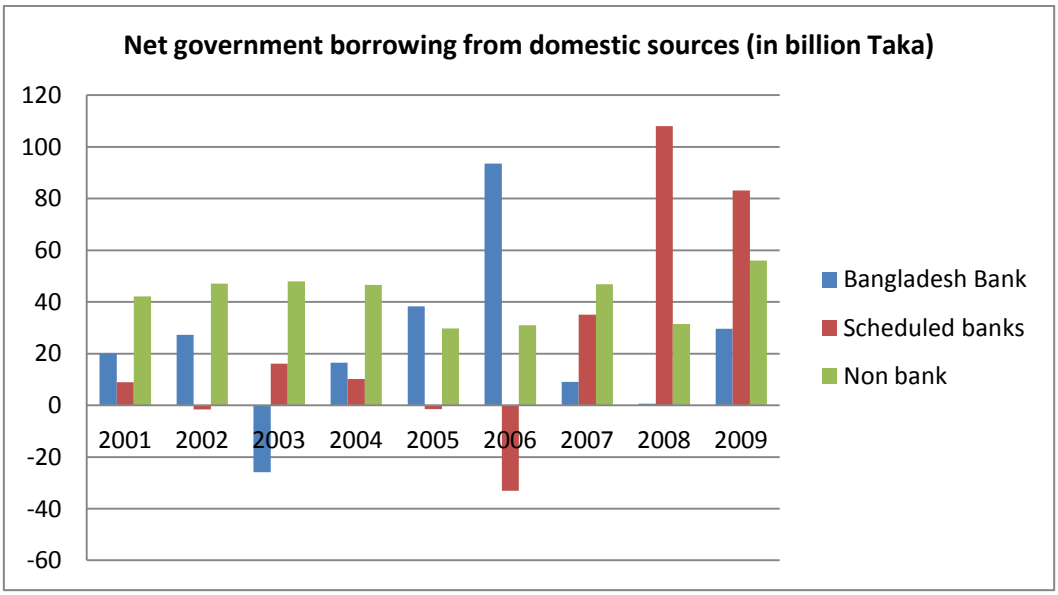
especially, high output performance in the agricultural sector, has been found to be effective in stabilising price level in Bangladesh as CPI is heavily weighted by food items (58 per cent) which mostly consist of cereals and rice (Akhtaruzzaman 2005). Food items get 56 per cent weight in new base 2005-06. So, a spectacular performance in the agriculture sector as well as in the overall real sector can reduce price fluctuations, at least in the short run in an economy like Bangladesh where agriculture has a significant share in total economic activity. However, this implication is not totally contrasting to the monetarist view as inflation is the excess of money supply growth over real output growth according to the monetarist view. So, if real sector output growth is higher than money supply growth then it is expected theoretically to reduce inflation, similar to the monetarist view.

In addition to achieving high agricultural output/food stock, the supply side inflation view also suggests that accumulating enough foreign exchange reserves can also mitigate price fluctuations through sterilization type intervention. It is evident from the empirical results of this study that that floating exchange rate regime in Bangladesh is not conducive to lowering inflation at least in the short run. If the value of the Taka falls continuously against the USD and other major currencies, then inflation will rise and this justifies the timely and appropriate intervention of Bangladesh Bank in the foreign exchange market.

Economic theory presumes a causal relationship between budget deficit and inflation but measuring the strength of this relationship is not easy because budget deficits may not be inflationary in the short run as explained above. So empirical testing of the theory requires a long time series and the appropriate econometric technique to capture the dynamic aspects of this relationship. Although this study uses small time series annual data due to unavailability of high frequency data, the deficit-inflation relationship is modelled as nonlinear in the inflation tax base (money). Here, the fiscal deficit-inflation relationship has been investigated by an ARDL framework with a more logical model specification, by scaling deficit with money (M2), rather than the traditional *ad-hoc* way to scale deficit by GDP. In sum, the evidence of this study suggests that fiscal deficits are inflationary in Bangladesh, at least in the long run and real sector output also significantly affect inflation in Bangladesh.

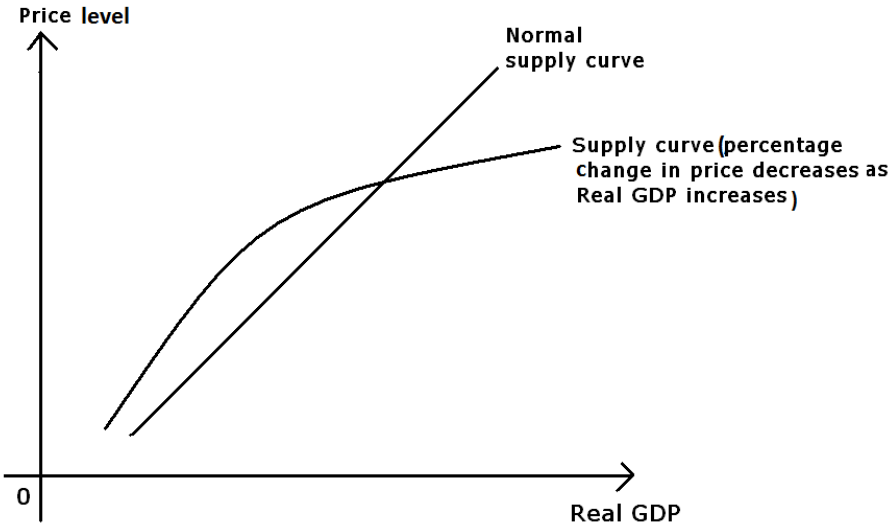
Appendix

Figure 1 **Government borrowing from domestic sources**



Data source: Ministry of Finance, Bangladesh.

Figure 2 **Aggregate supply curve**



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