Relative Effectiveness of Monetary and Fiscal Policies on Output Growth in Bangladesh: A VAR Approach

Md. Habibur Rahman*

Abstract

This paper investigates the relative importance of monetary and fiscal policies in altering real output of Bangladesh. An unrestricted vector autoregressions (VARs) framework, based on the St. Louis equation, is used to compute variance decompositions (VDCs) and impulse response functions (IRFs) through 1000 Monte Carlo simulations. A 'Monetary—Fiscal Game' under oligopolistic framework is also used to justify the co-ordination and co-operation between the monetary and fiscal authorities. The results derived from the VDCs and IRFs imply that monetary policy alone has a significantly positive impact on real output growth in Bangladesh. The impact of fiscal policy on real output growth remains completely insignificant. The outcome of this study, thus, supports the views of the proponents of St. Louis Model that asserts monetary policy is relatively more effective than fiscal policy in stimulating real economic activity. The results also confirm the presence of interactions between monetary and fiscal policies. The outcome of the 'Monetary—Fiscal Game' substantiates the necessity for cooperation between the monetary and fiscal authorities.

1.0 Introduction

Sustainable output growth with relatively stable inflation and exchange rates is one of the important components of any macroeconomic stabilization policy. In order to accomplish this policy objective, there are two main alternative policy

* The author of this paper is a Joint Director of the Research Department of Bangladesh Bank. The views expressed in this paper are the author's own and do not necessarily reflect the views of the Bangladesh Bank. The author would like to thank Prof. Mark Wheeler of Western Michigan University, Prof. Akhtar Hossain of the University of Newcastle, Australia and Prof. Habibullah Khan of Singapore National University for their helpful suggestions and comments. However, any remaining error belongs to the author alone.

options — monetary and fiscal policy actions. The intention of this paper is to examine the relative effectiveness of these two policy actions in altering output using time series econometric technique based on St. Louis equation developed by the Federal Reserve Bank of St. Louis of the USA.

Economists are divided mainly into two groups regarding the effectiveness of macroeconomic stabilization policy. The group that believes in monetary actions argues that monetary policy is more powerful than fiscal policy in achieving various economic goals. In many cases, they (e.g., Milton Friedman and Meiselman, 1963; Anderson and Jordan, 1968; Carlson, 1978) use the St. Louis equation to provide empirical evidence in favor of their stand. The other group led by Keynes (1964) inclines to believe in fiscal actions.

Some economists, such as Stein (1980) and Ahmed et al. (1984), criticize the validity of using the St. Louis equation on various grounds. Stein (1980) and Ahmed et al. (1984) list some of the commonly used criticisms against the St. Louis equation. Among them the following are important: (i) the St. Louis equation is a reduced form equation. The policy variables (such as, money and government expenditure) included in this equation are not statistically exogenous; (ii) the St. Louis equation suffers from specification error because it omits some other relevant regressors (e.g., interest rate); and (iii) the St. Louis equation is based on constrained Almon lag procedure. They argue that because of the above limitations, the results obtained by the St. Louis equation could be biased and inconsistent.

The current study uses Sims's (1980) vector autoregressions (VARs) approach to address the above criticisms. The VAR model addresses the problem of endogeneity because it assumes all the variables in the system are endogenous. Inclusion of interest rate addresses, to some extent, the problem of omitted variables. Besides, the VAR model takes care of constrained Almon lag problem in the sense that it allows selecting lag length optimally such that estimated residuals are White Noise.

2.0 Hypothesis

The objective of this study is to investigate the relative impact of monetary and fiscal policy actions on output growth in Bangladesh. The hypothesis of this paper, therefore, is monetary policy is relatively more effective than fiscal policy in altering real output of Bangladesh. Variance decompositions (VDCs) and impulse response functions (IRFs) derived from the unrestricted VARs are used to evaluate the hypothesis of the study.

3.0 Policy Stances: Monetary vs. Fiscal

As an integral part of the national macroeconomic stabilization policy, monetary and fiscal policies are designed to fine-tune the fluctuations of the economy—in particular, fluctuations in economic growth, inflation and unemployment rates. In line with the national macroeconomic policy framework, the monetary policy is conducted with a view to achieing multiple objectives, such as maintaining price stability with a low inflation rate and fostering higher economic growth. Monetary policy is seen as a central government policy with respect to the quantity of money, interest and exchange rates which has a dominant role on aggregate demand, inflation and output. This owes much to the rise of the doctrine of monetarism and to the defeat of the popular interpretation of Keynesian fiscal policy.

The fiscal policy deals with the revenue and expenditure of the government. The government is responsible for providing all the major public goods and services through its administrative, development and welfare oriented programs which is not feasible for private sector to supply. An excess of expenditure over revenue creates fiscal deficit while excess of revenue over expenditure creates fiscal surplus. The equality between expenditure and revenue produces a balanced budget situation. The income-expenditure management of the government is very crucial in that it has far reaching impact on various macroeconomic activities.

To achieve a certain policy objective, such as stable and low inflation or higher output growth, do we need to depend heavily on monetary policy or on fiscal policy or on a coordinated combination of both is a compelling question to ask. Answer to this question definitely requires an in-depth investigation on relative effectiveness of monetary and fiscal policies. This paper makes an attempt to answer this question by investigating the issue of relative effectiveness of monetary and fiscal policies on output growth in Bangladesh.

3.1 A Monetary-Fiscal Game: Prisoners' Dilemma

The debate concerning the relationship between monetary and fiscal policies is centered on the inflationary consequences of deficit financing by the fiscal authority. In view of avoiding the inflationary consequences, the main policy recommendation has been to institute an independent monetary authority whose main mandate is the control of inflation. The harmful consequences of high inflation could also be addressed by the fiscal authority by rationalizing fiscal expenditure and by raising tax revenue (Bennett and Loayza, 2002).

The Bangladesh Bank Order, 1972 is the basis of the conduct of monetary policy in Bangladesh. It provides the Bangladesh Bank the responsibility of achieving both monetary stability with the special emphasis on domestic price stability and economic growth. Although in a broad sense these broad objectives are complementary, they could be in conflict if developmental objectives get priority over price stability. Lack of coordination between monetary and fiscal authorities is one of the very common cases that create a situation where other issues get priority over the price stability. For example, the program of monetary targeting of monetary authority could be jeopardized by fiscal dominance created by the fiscal authority with control of different policy instruments and objectives. The necessity for smooth coordination between monetary and fiscal authorities is, therefore, very crucial in achieving optimal real benefit from various policy actions. Following Bennett and Loayza (2002), a game theoretic approach after the well-known prisoners' dilemma is used to justify coordination between monetary and fiscal authorities. It can be shown that co-ordination and co-operation between the monetary and fiscal authorities is required for broader national interest.

Assume that monetary and fiscal authorities are the two players in the market under duopoly framework. Both of them want to maximize their pay-offs in terms of low inflation and high output, given that they have different preferences for both inflation and output. The monetary authority places greater value on achieving low inflation than on achieving high output. The fiscal authority, on the other hand, puts more value on achieving high output than on achieving low

Box-1
A Monetary—Fiscal Game: Prisoners' Dilemma

		Central Bank (CB)	
		Cooperation	**Non-cooperation**
Fiscal Authority (FA)	**Cooperation**	Low Inflation High Output CB=50, FA=50 Total=100	Low Inflation Low Output CB=60, FA=20 Total=80
	Non-cooperation	High Inflation High Output CB=20, FA=60 Total=80	High Inflation Low Output CB=25, FA=25 Total=50

inflation. Both of the authorities have two options: they can either cooperate with each other or may decide not to cooperate at all. The possible outcome and payoffs of their joint moves are given in Box-1.

Given the possible outcome and payoffs of the game (Box-1) between the monetary and fiscal authorities, the only Nash equilibrium is non-cooperation from both the sides with the outcome of high inflation and low output. All of the other alternatives provide opportunities for one of the players to benefit by unilaterally deviating from it. Note that the Nash equilibrium is the worst among all the alternatives in terms of the outcome and payoffs. The best outcome with low inflation and high output of this game, however, can only be achieved by co-operation from both players, which is obviously superior to Nash equilibrium. Therefore, co-ordination and co-operation between the monetary and fiscal authorities are required for low inflation and high output.

3.2 Monetary Policy Stance in Bangladesh

Monetary policy in Bangladesh aims at achieving a multitude of objectives, such as economic growth, price and exchange rate stability, equilibria in the balance of payments, and the development of money and capital markets. With ongoing economic reforms in Bangladesh since the early-1980s, monetary policy has gained some independence in achieving and maintaining price stability. The Bangladesh Bank conducts monetary policy by targeting the growth rate of the broad money supply (M2) and uses credit control and supports measures to contain the growth rate of the money supply within a predetermined target level.

The Bangladesh Bank is responsible for formulation and implementation of monetary policy. According to the Bangladesh Bank Order of 1972, the main functions of monetary policy in Bangladesh are: (1) to maintain reasonable price stability, (2) to ensure a stable balance of payment position and maintained an external competitiveness of the Bangladesh Taka, and (3) obtain sustained economic growth through increased production and employment. Recently, some changes have been brought about in the objectives of monetary policy through the Bangladesh Bank (Amendment) Act, 2003. The objectives as stated in the Act are, *"— to manage the monetary and credit system of Bangladesh with a view to stabilizing domestic currency value and maintaining a competitive external par value of the Bangladesh Take towards fostering growth and development of country's productive resources in the best national interest."* It is noteworthy to mention that Bangladesh is presently under the IMF program of PRGF where

maintaining a zero or low-level inflation is required for macroeconomic stability. In view of establishing a dynamically evolving and well functioning financial system, the monetary authority of Bangladesh has recently taken a series of major policy actions.

The Bangladesh Bank has pursued a series of legal, policy and institutional reforms to improve the process of financial intermediation and ensure efficient allocation of financial resources and in the ultimate analysis improve the competitiveness of the private sector and thereby promote investment and growth in the real sector. The thrust of the reform program is to improve the environment for, and the ability of bank owners, bank management, bank regulators and the markets to, provide for better governance and regulation. The reform program focuses on: (i) greater autonomy to the Bangladesh Bank; (ii) strengthening of the Bangladesh Bank's capabilities and technical skills to perform its enhanced responsibilities; (iii) strengthening prudential regulation and supervision; (iv) restructuring the management and internal processes of Nationalized Commercial Banks (NCBs) and ultimately privatization of selected NCBs and Development Financial Institutions (DFIs), (v) strengthening the legal and judicial processes, and (vi) improving the money and debt markets.

In line with the structural adjustment program, the financial sector underwent through a pragmatic reform program with view to developing a sound and well-functioning financial system. Since the inception of the Financial Sector Reforms Program (FSRP) in the early 1990s, Bangladesh has achieved a considerable success in several spheres of financial as well as real sector. The floating of exchange rate in May 2003, the introduction of Repo and reverse Repo in July 2002 and in April 2003, respectively, and the initiation of secondary market for government bonds/bills are some of them. Poverty reduction and the growth performance are also showing signs of improvement since then.

3.3 Fiscal Policy Stance in Bangladesh

In pursuance of reconstructing the war-ravaged economy, Bangladesh had been following an expansionary fiscal policy during the decade of 1970s producing a substantial amount of fiscal deficits since then. Besides, the centrally planned economic framework of the early 1970s also contributed significantly to large fiscal deficits overtime. Because of the centrally planned economic framework, Bangladesh economy started with a huge size of public sector where most of the enterprises were nationalized. Financial losses in these state-owned enterprises (SOEs) have since then been the root cause of consolidated fiscal deficits.

The structural adjustment program of the early 1980s was the first initiative in the direction of reducing the size of the public sector. It is well cited in the literature (Habibullah, 1991) that the share of public sector enterprises in Bangladesh is still high, and in all the public sector enterprises, nationalized banks and autonomous bodies, there has been a persistent waste of resources and unscrupulous expenditure.

In line with the objectives of the IMF Poverty Reduction and Growth Facility (PRGF) program, the Government of Bangladesh has recently undertaken substantial policy measures to maintain fiscal discipline. To consolidate the fiscal sector, the government has initiated a four-year program to phase out the loss making SOEs. In addition to the Adamjee Jute Mills, another 24 SOEs were closed in 2003 (Hossain, 2004). Table 1 reports the data for government revenue, expenditure and fiscal deficit during 1973-2003.

Table 1 : Government Revenue, Expenditure and Fiscal Deficit in Bangladesh

(As percent of GDP)

Year (End June)	Revenue	Expenditure	Fiscal Deficit
1973-1980	7.2	14.8	-7.6
1981-1990	8.5	15.5	-6.9
1991-2000	9.1	13.7	-4.6
2001	9.6	14.8	-5.1
2002	10.2	14.9	-4.7
2003	10.3	14.5	-4.2
2001-2003	10.0	14.7	-4.7

Sources:

1. The data from 1973 to 1989 has been taken from Hossain (1996).
2. Ministry of Finance, Government of Bangladesh: The Economic Review, 2003.
3. Bangladesh Bank, Annual Report (various issues) and author's own calculation.

It is observed from Table-1 that the Government of Bangladesh witnessed a relatively high fiscal deficit of 7.6 percent of GDP during 1973-1980. During the period of 1981-1990, the practice of expansionary fiscal policy was still in place. Despite the expansionary fiscal policy stance, the fiscal deficit was slightly moderated at 6.9 percent of GDP during 1981-1990. The fiscal deficit was maintained well below 5.0 percent of GDP during the late 1990s. The amount of fiscal deficits as a percent of GDP stood at 4.6 during the period 1991-2000. From 5.1 percent of GDP in FY2001, the deficit came down further to 4.2 percent in FY2003.

4.0 Literature Review

The debate on the comparative effectiveness of monetary and fiscal policy actions as discretionary stabilization tools is very old and extensive. Right after the end of Great Depression, there was a widespread credence that fiscal policy was more effective. Keynes's *General Theory* followed by some noteworthy works, such as Leeuw et al. (1969), Schmidt and Waud (1973), Blinder and Solow (1974) provide basic theoretical and practical ground for active fiscal policy. Starting from the late sixties, as noted by Gramlich (1971), the failure of 1968-surtax policy introduced a new ground for monetarist attack claiming that fiscal policy has very little effect on aggregate demand, and that monetary policy is more important than most people had thought it to be.

In respect of the relationship between money and output, the classic study by Milton Friedman and Schwartz (1963) is still very important and influential. Their study, as mentioned by Walsh (1998), indicates that variation in the rate of money growth causes variations in real economic activity. However, some economists e.g., Benjamin Friedman and Kuttner (1992), and Tobin (1970) have challenged the prediction of Milton Friedman and Schwartz (1963). They argue that the causation from money to output, as claimed by Milton Friedman and Schwartz, might not be the case.

Benjamin Friedman and Kuttner (1992) re-examines the postwar evidence of significant relationship between money and income using time-series approach on extended data through the 1980s for the U.S. economy. The empirical findings do not indicate a close or credible relationship between money and income. Their paper, however, has one strong finding that the spread between the commercial paper and Treasury bill rate has very significant information about the movements in real income. In the concluding section of their paper, they express their concern about the difficulty of using this spread as an intermediate policy target of the Federal Reserve System because of the continuously changing relationship between policy target and its outcome.

Gramlich (1971) summarizes some of the important papers on monetary-fiscal debate. He points out that a paper by Friedman and Meiselman (1963) predicts more stable and statistically significant relationship between output and money than that of output and autonomous spending. Anderson and Jordan (1968) uses various measures of monetary and fiscal policy actions and shows that monetary policy has greater, faster and more predictable impact on economic activity. Gramlich (1971) also reports the findings of some other papers from the opposite

side, such as, Ando and Modigliani (1965), DePrano and Mayer (1965) against the monetarist claim. His own study, however, indicates that both monetary and fiscal policy have impact on real economic activity with the indication that money matters greatly.

Benjamin Friedman (1977) uses the St. Louis equation in his paper and claims that the St. Louis equation now *believes in* fiscal policy. In response to Benjamin Friedman's (1977) claim, Carlson (1978) re-estimates the St. Louis equation and argues that Benjamin Friedman's equation was suffering from the heteroscedasticity problem. The evidence from new and corrected estimation does not support Benjamin Friedman's claim that fiscal policy is more important than monetary policy. His findings suggest that only monetary policy has significant impact on economic activity, and fiscal policy does not have any impact on real output. As in developed countries, the empirical evidence for developing countries regarding the relative effectiveness of monetary and fiscal policies on economic activitly is also mixed. Studies of Jayaraman (2002) for the South Pacific Island countries, Masood and Ahmed (1980) for Pakistan, Saqib and Yesmin (1987) for Pakistan, and Upadhyaya (1991) for developing countries support the monetarists' view that monetary policy is important for economic activity. Some other studies on developing countries, such as Hussain (1982) for Pakistan, and Darrat (1984) for five Latin American countries find that fiscal policy is more effective than monetary policy in altering real output.

Using modified version of St. Louis equation, the study of Latif and Chowdhury (1998) for Bangladesh finds that fiscal policy is more effective over monetary policy in Bangladesh. This study is based on the OLS technique using the nominal data during 1974-1993 that suffers from all of the limitations indicated by Stein (1980) and Ahmed et al. (1984). They estimate six different equations of which 4 have only a single explanatory variable. One recent study on Bangladesh by Hasan (2001) based on the modified version of St. Louis equation predicts that both monetary as well as fiscal policies are important for economic growth. This study uses various econometric techniques based on nominal data during 1974-1996. The prediction of this paper, however, alters if real variable for income is used instead.

In contrast to other studies, the approach in the current paper is methodologically and significantly different from previous studies on Bangladesh economy. Firstly, the data used in this paper are more recent and cover a wider span of time producing more degrees of freedom and power that helps to get more efficient parameter estimates. Secondly, the data used in this paper are real, enabling us to

investigate the real effect of the policy actions. Thirdly, this paper uses sophisticated econometric techniques, such as cointegration and vector autoregressions with simulated standard errors and confidence bands that address most of the criticisms associated with the St. Louis equation.

5.0 Methodology and Cholesky Ordering

Structural macroeconometric models, such as Klein interwar model, the Brooking model, the BEA model, the St. Louis macroeconomic model and the Taylor model are based on hundreds of equations and variables. In addition to the estimation difficulties, the problems of identification and endogeneity are commonly associated with these giant structural macroeconomic models. Sims's (1980) seminal work introduces unrestricted vector autoregressions (VARs) that allows feedback and dynamic interrelationship across all the variables in the system and appears to be highly competitive with the large-scale macroeconometric models in forecasting and policy analysis. The unrestricted VARs model assumes that each and every variable in the system is endogenous and does not impose any a *priori* restrictions.

The VARs approach solves the endogeneity problem associated with the St. Louis equation by assuming that all the variables in the system are endogenous. To address the problem of omitted variable, interest rate is added along with the three existing variables in the St. Louis equation, namely, real government expenditure as proxy for fiscal policy, real money supply (M2) as proxy for monetary policy, and real output. The vector of the VAR model, therefore, contains the following variables:

1. Real Government Expenditure (g),
2. Real Money (m),
3. Real Interest Rate (r) and
4. Real GDP (y).

Variance decompositions (VDCs) and impulse response functions (IRFs) derived from vector autoregressions (VARs) approach are used to examine the relative impact of monetary and fiscal policy on real output growth. The VDCs show the portion of the variance in the forecast error for each variable due to innovations to all variables in the system. The IRFs show the response of each variable in the system to shock from system variables. By analyzing respective orthogonalized variance decompositions (VDCs) and impulse response functions (IRFs) the relative strength of monetary and fiscal policies could easily be determined. For

example, if the response of real output growth due to monetary innovations is relatively higher and dissipate at a relatively slower rate than that of fiscal innovations, we could conclude that monetary policy is more effective than fiscal policy.

A Cholesky decomposition requires the variables to be ordered in a particular fashion, where variables placed higher in the ordering have contemporaneous impact on the variables which are lower in the ordering, but the variables lower in the ordering do not have contemporaneous impact on the variables those are higher in the ordering. As the objective of this study of to examine the relative impact of monetary and fiscal policies on output growth, this variable has been put in the last position. Since interest rate is influenced by the monetary and fiscal policy actions, the interest rate variable has been put in the third position in the ordering of the 4-variable VAR model. And finally, two policy variables have been put in the first two places. To check the robustness of the outcome, first two places are being interchanged between the two policy variables. Two models of VARs using log differenced as well as log levels are also attempted.

6.0 Data

Annual data for real government consumption, real money supply, real interest rate and real output during 1975-2003 are used in the investigation. All of the series are in growth form except the real interest rate. The sources of data are the World Bank 2003 CD-ROM and Annual Report (various issues) of Bangladesh Bank. The definitions of all of the variables are given below:

Consumer Price Index (1995 = 100): Consumer price index reflects changes in the cost to the average consumer of acquiring a fixed basket of goods and services that may be fixed or changed at specified intervals, such as yearly.

Real Government Expenditure (g): Real government expenditure is CPI adjusted general government final consumption expenditure that includes all government current expenditures for purchases of goods and services (including compensation of employees). It also includes most expenditure on national defense and security, but excludes government military expenditures that are part of government capital formation.

Real Money (m): Real money is CPI adjusted broad money that comprises the sum of currency outside banks, demand deposits other than those of the central government, and the time, savings, and foreign currency deposits of resident sectors other than the central government.

Real Interest Rate (r): Real interest rate is calculated from the average of lending and deposit rates minus expected inflation. Lending interest rate is the rate charged by banks on loans to prime customers. Deposit interest rate is the rate paid by commercial or similar banks for demand, time, or savings deposits. Expected inflation is proxied by lagged inflation.

Real Output (y): Real output is price (CPI based) adjusted GDP that includes gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources.

7.0 Preliminary Data Analysis

Before using the data in the estimation of VAR, we need to know time series properties of all the variables. Accordingly, a series of unit root tests[2] such as Augmented Dickey-Fuller (ADF, 1981), Phillips-Perron (PP, 1988), and Kwiatkowski-Phillips-Schmidt-Shin (KPSS, 1992) are used to determine the order of integration for each series. The results of unit root tests as reported in Table 2 indicate that only the real interest rate is stationary while the rest of the variables, i.e., natural log of real government consumption, real money and real output are non-stationary and contain unit-roots I(1).

Table 2 : Results of Unit-Root Tests

Variables (in log levels)	Without Trend ADF	PP	KPSS	With Trend ADF	PP	KPSS	Decision
Real Interest Rateö (r)	I(0)	I(0)	I(1)	I(0)	I(0)	I(0)	I(0)
Real Government Consumption (g)	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)
Real Money (m)	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)
Real Output (y)	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)

Notes:
1. Lag length for ADF tests are decided based on Akaike's information criterion (AIC).
2. Maximum Bandwidth for PP and KPSS test are decided based on Newey-West (1994).
3. All the tests are performed on the basis of 5 percent significance level.
4. ö = without log

2 Note that ADF and PP tests are based on the null of unit roots while KPSS test assumes the null of stationarity.

Engle and Granger (1987) point out that a VAR model would be misspecified if all the non-stationary variables of the model are cointegrated. Therefore, estimating a VAR model with I(1) series are not appropriate if they are cointegrated. Accordingly, Johansen's (1988) cointegration test is used to identify the presence of cointegration among the integrated variables. The results[3] indicate that natural log of real government consumption, real money supply and real output are not cointegrated. Therefore, a VAR model with variables in their growth form is appropriate. As a result, a VAR estimation technique is applied to the system of all variables in growth form except the real interest rate. The estimated results of VARs in terms of VDCs and IRFs are presented in the following section.

8.0 Empirical Results

To estimate VDCs and IRFs, orthogonalization of the residuals is required. A Cholesky decomposition is used to orthogonalize the residuals. To examine the relative impact of monetary and fiscal policies on output growth, the VDCs and IRFs are generated[4] through 1000 Monte Carlo simulations from the orthogonalized residuals. Computed VDCs are reported in Tables 3-5 and IRFs are reported in Figures 1-3. Table 3 contains VDCs of output growth while Table-4 and 5 contain VDCs of money and government consumption growth, respectively. The IRFs of output growth due to policy shocks are reported at Figure 1. The IRFs of monetary policy due to fiscal policy shocks and the IRFs of fiscal policy due to monetary policy shocks are reported at Figures 2 and 3, respectively.

The variance decompositions of output growth, as reported in Table 3, indicate that most of the forecast error variance of output growth is explained by the monetary policy shocks. The growth rate in money supply alone explains more than 50 percent of the forecast error variances of output growth during all time horizons with the exception of year 4 where it explains about 49.0 percent of the forecast error variances of output growth. None of the other variables, such as fiscal policy and interest rate has any significant influence in predicting the movement in output growth. The output growth itself explains only about 28.0

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4 The standard errors of VDCs and the confidence bands of IRFs are generated through 1000 Monte Carlo simulations.

3 The results (not reported here but available from the author on request) are based on the assumptions of a constant and a linear trend in the data with optimal lag length 3. Akaike's Information Criteria (AIC), and Likelihood Ratio (LR) test are used to decide the optimal lag length that makes all the residuals White Noise.

Table 3 : Variance Decompositions of Output Growth

Time Horizon (Years Ahead)	Explained by Shocks in the Growth of Fiscal Policy	Monetary Policy	Interest Rate	Output
1	2.47	66.51**	3.29	27.73**
	(8.78)	(12.50)	(4.86)	(9.60)
4	28.29	48.70**	3.83	19.18
	(19.18)	(19.26)	(5.50)	(10.93)
8	20.22	56.08**	5.60	18.09
	(19.64)	(21.64)	(7.39)	(11.49)
12	17.11	51.00**	11.77	20.12
	(20.40)	(22.48)	(7.99)	(12.20)

Notes:

1. First entry in each cell is the point estimates of the percentage of forecast error variance of variable *i* as explained by shocks to variable *j*. Monte Carlo (1000) simulated standard errors are reported in the parenthesis.
2. ** Indicate point estimates are statistically significant at 5 percent level assuming that the estimates are asymptotically normally distributed.

percent of its own forecast error variance at the very first year. In the rest of the period it does not have any statistically significant explanatory power of dictating its own future path. Therefore, monetary policy alone is the most important factor for the prediction of future output growth of Bangladesh.

Table 4 : Variance Decompositions of Money Growth

Time Horizon (Years Ahead)	Explained by Shocks in the Growth of Fiscal Policy	Monetary Policy	Interest Rate	Output
1	2.00	98.00**	0.00	(0.00)
	(8.70)	(8.70)	(0.00)	(0.00)
4	29.74	58.59**	4.65	7.01
	(17.54)	(19.13)	(5.64)	(7.97)
8	32.52	47.59**	7.63	12.25
	(18.03)	(21.38)	(7.56)	(10.65)
12	23.92	30.36	17.54**	28.18**
	(19.32)	(22.90)	(8.23)	(11.56)

Notes:

1. First entry in each cell is the point estimates of the percentage of forecast error variance of variable *i* as explained by shocks to variable *j*. Monte Carlo (1000) simulated standard errors are reported in the parenthesis.
2. ** Indicate point estimates are statistically significant at 5 percent level assuming that the estimates are asymptotically normally distributed.

The VDCs of money growth as reported at Table 4 indicate that most of the variations in the money growth are explained by money growth itself indicating that money is growing independent and exogenously. The fiscal policy variable does not contain any information about money growth as the portions of forecast error variance of money growth at various time horizons explained by fiscal policy variable are not statistically significant. Likewise, the forecast error variances of money growth during 1-8 time horizons explained by real interest rate and output growth are not statistically significant. At time horizon 12, however, the real interest rate and output growth explain, respectively, 17.54 percent and 28.18 percent of the forecast error variance of money growth.

The VDCs of fiscal policy variable as reported at Table 5 indicate that at the very first time horizon, 100 percent of its own forecast error variance is explained by itself. The fiscal policy variable becomes totally irrelevant in explaining its own future path as the portions of forecast error variance of this variable explained by itself after the initial time horizons are not statistically significant. During the time horizons 2-12, the forecast error variances of the fiscal policy variable are mostly explained by money growth indicating that money growth is important in forecasting future path of fiscal policy variable. Movement in the real interest rate, however, does not contain any information about the movement of the fiscal policy variable as none of the portions explained by the real interest rate is

Table 5 Variance Decompositions of Government Expenditure Growth

Time Horizon (Years Ahead)	Explained by Shocks in the Growth of			
	Fiscal Policy	Monetary Policy	Interest Rate	Output
1	100.00**	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
4	23.75	50.03**	4.14	22.08**
	(16.67)	(19.10)	(5.57)	(10.70)
8	9.67	64.86**	9.63	15.84
	(18.50)	(21.27)	(7.45)	(10.79)
12	7.28	52.86**	15.68	24.18**
	(19.93)	(22.44)	(8.38)	(11.90)

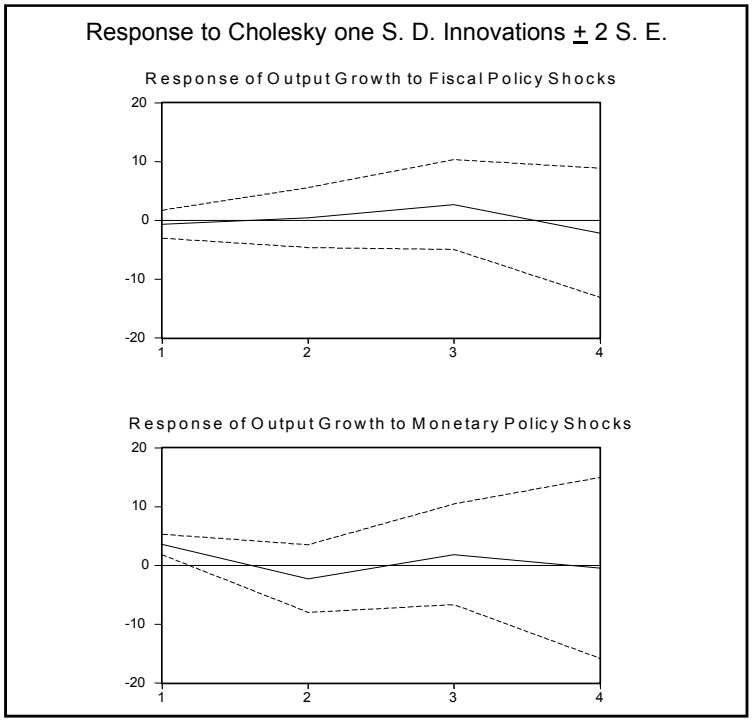
Notes:

1. First entry in each cell is the point estimates of the percentage of forecast error variance of variable *i* as explained by shocks to variable *j*. Monte Carlo (1000) simulated standard errors are reported in the parenthesis.
2. ** Indicate point estimates are statistically significant at 5 percent level assuming that the estimates are asymptotically normally distributed.

statistically significant at any time horizon. The output growth, on the hand, significantly explains 22.08 percent and 24.18 percent of forecast error variance of the fiscal policy variable at time horizons 4 and 12, respectively.

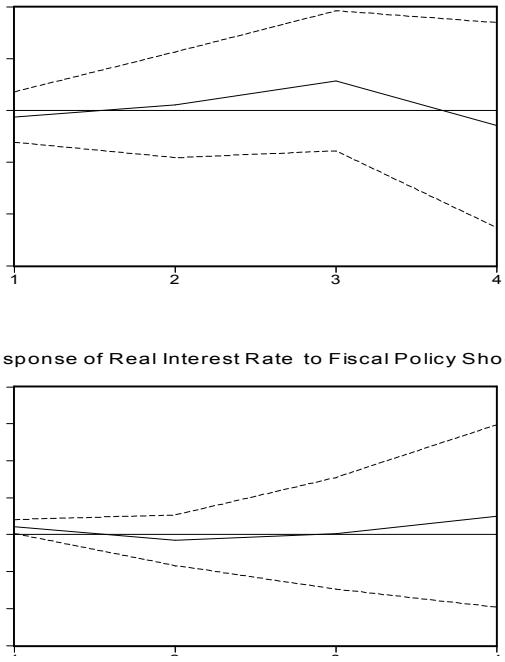
The estimated IRFs along with 95 percent confidence interval of output growth due to fiscal as well as monetary policy shocks are reported in Figure-1[5]. The top part of this figure represents the IRFs of output growth to fiscal policy shocks and the bottom part represents the response of output growth due to monetary shocks. Figure-1 indicates that only monetary policy shocks have significant and positive impact on output growth, which is very much in line with outcome of VDCs. Real output growth responds positively to the monetary policy shocks at the initial period and becomes insignificant for rest of the period indicating a short-run positive impact of monetary policy on real output growth. The response of output growth to the fiscal policy shocks, however, is always insignificant indicating no real impact of fiscal policy on real output growth.

Figure 1 Impulse Response of Output Growth to Fiscal and Monetary Policy Shocks



5 A response is considered as significant if it does not contain the zero line within its confidence bands. Confidence bands (+ 2 S.D.) are generated through 1000 Monte Carlo simulations.

Figure 2 : Impulse Response of Monetary Policy to Fiscal Policy Shocks

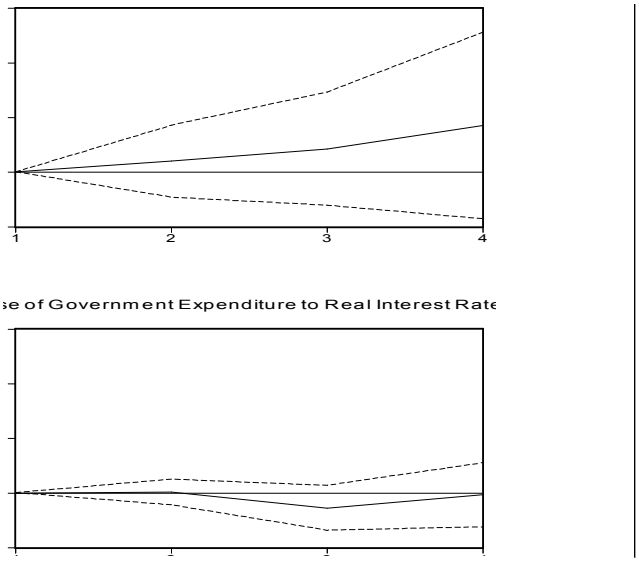


The IRFs of monetary policy due to fiscal policy shocks as shown at Figure2 indicate that money growth does not respond to any fiscal policy shocks but real interest rate responds positively at the initial period. That is, an increase in government expenditure will lead to an increase in the real interest rate. The IRFs as depicted at Figures 3 indicate that government expenditure, the proxy for fiscal policy, does not respond at all to any positive shock to money growth or real interest rate.

Concerning the inter-relationship between monetary and fiscal policy actions, the findings of this paper imply that there is some degree of relationship between them. Therefore, coordinated policy actions are required to extract expected outcome in terms of low inflation and high output growth from the long-run macroeconomic policy in Bangladesh.

The absence of cointegration among the natural log of real government consumption, real money supply and real output supports the finding that none of the policy variables has long run impact on real output and there is no long-run

Figure 3 : Impulse Response of Fiscal Policy to Monetary Policy Shocks



equilibrium relationship among them. In order to check the robustness of this finding, a VAR model is estimated by interchanging the ordering of two policy variables and another VAR model is estimated in natural log levels of all variables[6]. The outcome regarding the relative impact of fiscal and monetary policies on real output growth remains the same regardless of the ordering of the two policy variables and a VAR model in log levels.

9.0 Summary and Concluding Remarks

This study investigates whether the monetary policy action or fiscal policy action has a greater impact on real output growth using unrestricted VARs based on St. Louis equation. The result from the VDCs implies that monetary policy variable explains most of the forecast error variance of real output growth where fiscal policy remains completely insignificant in explaining the forecast error variance of output growth. In line with the prediction of VDCs, the outcome of IRFs also suggests that monetary policy alone has significant impact on real output growth in Bangladesh. The result of cointegration test, however, does not provide any evidence of long-run equilibrium relationship among the two policy variables and real output. A '*Monetary—Fiscal Game*' under oligopolistic framework is used to justify the co-ordination and co-operation between the monetary and fiscal

6 The results are not reported here but available from the author on request.

authorities. The prediction of the duopoly game warrants proper co-ordination and co-operation between the monetary and fiscal authorities.

The results as evident from Tables 4-5 and Figures 2-3 indicate that there is some degree of inter-relationship between the two policy actions that support the prediction of the duopoly game shown in Box-1. The outcome of VDCs (Tables 4-5) indicates that money growth is an important variable for the prediction of future government spending. The outcome of IRFs (Figures 2-3), on the other hand, implies that an increase in the government expenditure will lead to an immediate increase in the real interest rate that could be detrimental for the private investment and hence for economic growth. In order to achieve long-run macroeconomic policy objectives, therefore, some sort of co-operation between monetary and fiscal authorities is required.

The prediction of this study in terms of the relative impact of monetary and fiscal policies on real output growth is in sharp contrast with the findings of Latif and Chowdhury (1998). Their study finds that fiscal policy is more effective over monetary policy in Bangladesh. This is mainly because their study is based on the OLS technique, which suffers from the problems of endogeneity and omitted variables associated with the St. Louis equation as indicated by Stein (1980) and Ahmed et al. (1984). They estimate six different equations of which 4 have only a single explanatory variable. Their study uses nominal variables during 1974-1993 that are mostly limited to the pre-reform era. Some or all of these limitations associated with their study may be responsible for the contrasting results. The current study, on the other hand, uses sophisticated econometric technique based on real variables with extended data during 1975-2003 that include a substantial time period since the initiation of financial sector reform program in the early 1990s.

The outcome of the current study is very much in line with the predictions of the classic study by Milton Friedman and Schwartz (1963) and other advocates of the St. Louis equation where variation in the rate of money growth causes variation in real economic activity. The findings of this paper, thus, suggest that only monetary policy is effective in altering real output of Bangladesh where fiscal policy remains totally ineffective. In order to achieve higher output growth, we should rely heavily on monetary policy rather than fiscal policy. An independent monetary authority and continuous effort to bring discipline in the financial as well as public sector is recommended. Any policy recommendation based on the outcome of a single study, however, may not be appropriate. Further studies on this issue are, therefore, required for making any appropriate policy recommendation.

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