THE PHILIPPINE REVIEW OF ECONOMICS
VOL. XLI NO. 1 JUNE 2004

The impact of fiscal and monetary policies on nominal income in Bangladesh

*A.F.M. Kamrul Hassan**

Abstract

The impact of the growth of fiscal and monetary policy variables on nominal GDP growth is examined. Two measures on the fiscal policy side, government expenditure and total tax revenue, and on the monetary policy side, monetary aggregate measures *M1* and *M2,* are selected as explanatory variables. Growth rate of *M1* is found to have a statistically significant impact on nominal GDP growth. On the fiscal policy side, the growth rate of the tax revenue is found to have some lagged effect on nominal income. Government expenditure and *M2* growth do not have any statistically significant impact on nominal GDP growth. With respect to the cumulative effect, *M1* is found to be a statistically significant variable affecting nominal GDP growth. Co-integration analysis shows that there is a long-run equilibrium relationship between *M1* and nominal GDP growth. The findings of the study support the monetarists' claim that growth in money supply has a statistically significant impact on nominal income growth.

JEL classification: E52, E62
Keywords: Fiscal policy, monetary policy, cointegration analysis

1. Introduction

There seems to be no disagreement over attaining both economic growth and price stability, but little agreement over how to achieve these goals. Regarding key macroeconomic issues such as budget deficit, monetary policy or inflation, economists seem to agree on little beyond the definition of GDP (Samuelson and Nordhaus [1995]). Thus it is said that even if you lay all the economists end to end, they still wouldn't reach a conclusion.

The differing views on macroeconomic policy have given rise to a host of schools of thought—classical, Keynesian, monetarist, neo-classical, rational expectation, ultra-classical—and maybe a lot more to come. However, the most influential schools of thought in the history of modern macroeconomics have been Keynesian economics and monetarism.

* Assistant Professor, Department of Finance and Banking, University of Rajshahi in Bangladesh. E-mail: afmkamrulru@yahoo.com

Fiscal policy measures, such as government expenditure and tax, play important roles in determining national income in the Keynesian framework, whereas money supply, given the income velocity of money, determines the national income and price in the monetarists' view. Therefore, it is not an exaggeration to say that the study of the relative impact of fiscal and monetary policy is tantamount to the study of the relative impact of Keynesian economics and monetarism, provided monetary policy uses monetary aggregate as target.

The path-breaking work in this field of study is that of Anderson and Jordan [1968], which applied the "St. Louis Equation". They found that monetary actions have significant, permanent effect on nominal GDP growth, while fiscal actions exert no statistically significant, lasting influence. Subsequently, numerous studies have been done on this area of interest, among them Leeuw and Kalehbrenner [1969], Davis [1969], Anderson and Carlson [1970], Gramlich [1971], Friedman [1977], Carlson [1978], Hafer [1982], and Batten and Hafer [1983]. All these studies were conducted in the context of developed market economies, which operate at nearly full employment level of output. Most of these studies came to the same conclusion, i.e., monetary actions dominate fiscal actions in determining the pace of economic activities. It would be interesting to examine whether this type of analysis is applicable to a developing country like Bangladesh whose economy functions substantially below its potential output.

In Bangladesh, a considerable amount of work has been done in the field of fiscal and monetary policy. However, those works analyze these two policies in isolation. For example, Ahmed [1996] and Taslim [2001] analyzed monetary policy in terms of its objectives, monetary programming and current practice in Bangladesh. Khan [2001] examined the evolution of the monetary policy in Bangladesh before and after the financial sector reform. Parikh and Stamer [1990] and Das [2000] looked into the effects of monetary policy actions on the balance of payments. Hossain and Chowdhury [1994a] analyzed the key issues related to the design and conduct of the monetary policy in Bangladesh.

Similarly, a number of studies have attempted to analyze the fiscal policy measures in Bangladesh. Hossain and Chowdhury [1994b] studied the tax structure, pattern, growth and composition of government expenditure during the 1973-88 period and also discussed fiscal developments in Bangladesh since independence. Islam [1994] empirically analyzed the fiscal policy of Bangladesh. Sarker and Kitamura [2002] investigated the impact of technical assistance on the structure and efficiency of tax administration in Bangladesh. But none of the studies has analyzed the relative impact of these two policy measures on nominal income. The present study is an attempt to examine the relative effectiveness of fiscal and monetary policy in determining the nominal GDP of Bangladesh.

2. Objectives of the study

The broad objective of this study is to find out which policy instrument—fiscal or monetary—is appropriate to use in order to affect long-run macroeconomic activities. To fulfill this broad objective, two specific objectives are in order, namely:

1. to examine the relative effectiveness of fiscal and monetary policy measures in influencing the nominal GDP in Bangladesh; and
2. to examine whether the relatively more effective policy has a long-run equilibrium relationship with nominal GDP, that is, whether nominal GDP is co-integrated with the more effective policy instrument.

3. Data source and limitation of the study

3.1 Data sources

Most of the studies conducted in the present area of interest use quarterly data. But in Bangladesh, only yearly data on GDP are available as published in domestic as well as international publications. Data on government expenditure are also available only on a yearly basis. Although quarterly data on money supply are available, the lack of data on other variables limited this study to the use of yearly data. GDP and government expenditure data are taken from the *International Financial Statistics* (IFS), a publication of IMF. Data on narrow money (*M1*), broad money (*M2*) and total tax revenue are sourced from the various issues of *Economic Trend*, a publication of the statistics department of the Bangladesh Bank. The period covered by the study is 1974-2002.

3.2 Limitations of the study

The first limitation of this paper is the lack of data on a monthly or quarterly basis which would have been the ideal frequency. Secondly, the number of observations is not large enough to overcome the first limitation of not having more frequent data. Since Bangladesh gained its independence only in 1971, data are available only from 1974-75, making only 29 observations.

Another limitation stems from the fact that the regression equations are estimated solely to test the relative efficacy of monetary and fiscal actions. The exclusion of certain exogenous variables affecting nominal GDP would conceptually give rise to specification bias, that could lead to autocorrelation in the residuals. Fortunately, out of three regression equations estimated, two are free from autocorrelation problems; the remaining one is corrected for auto-regressive scheme (AR(1)).

4. Methodology and empirical analysis

4.1 Methodology

The model used in this paper is derived from the 'St. Louis Equation' developed by Anderson and Jordan [1968]. The key distributed lag equation can be written as:

$$Y_t = \alpha + \sum_{i=0}^{3} \beta_i M_{t-i} + \sum_{j=0}^{3} \lambda_i E_{t-j} + e_t$$

where Y represents nominal GDP, M is the money stock and E is one of several measures of high-employment fiscal measures. Batten and Hafer [1983] modified the equation to include merchandise export to represent an 'open economy' and express the equation in growth rate form. The model used in this study is similar to that of Batten and Hafer [1983]. This study uses two fiscal and two monetary policy measures. Accordingly, the following regression equations are estimated:

$$\ln Y_t = \alpha_0 + \sum_{i=0}^{j} \beta_i \ln G_{t-i} + \sum_{i=0}^{k} \theta_i \ln T_{t-i} + \sum_{i=0}^{l} \lambda_i \ln M1_{t-i} + \mu_t \quad \beta > 0, \theta < 0, \lambda > 0 \quad (1)$$

$$\ln Y_t = \alpha_0 + \sum_{i=0}^{j} \beta_i \ln G_{t-i} + \sum_{i=0}^{k} \theta_i \ln T_{t-i} + \sum_{i=0}^{l} \lambda_i \ln M2_{t-i} + \mu_t \quad \beta > 0, \theta < 0, \lambda > 0 \quad (2)$$

where:

G = Growth rate of government expenditure,

$M2$ = Broad money growth rate,

T = Growth rate of total tax revenue of the government,

$M1$ = Narrow money growth rate, and

$j = k = l = 1$

Batten and Hafer [1983] used only high employment government expenditure as fiscal policy measure and narrow money as monetary policy measure, and included merchandise export to represent the open economy in their analysis. The present study differs from Batten and Hafer [1983] in that it uses government expenditure which does not correspond to high-employment level. As such, a priori, it is not expected to have a significant impact on nominal income. Another fiscal policy measure used, in addition to government expenditure, is the total tax revenue of the government, given that an increase in tax revenue reduces nominal disposable income. A change in the growth rate of the tax revenue will therefore have a significant impact on change in the growth rate of nominal income. Broad money ($M2$) is added on the monetary policy side, in addition to narrow money

(*M1*). Two regression equations are estimated to examine separately the effects of *M1* (see Table 1) and *M2* (see Table 2) growth on nominal GDP growth. *M1* and *M2* are not included in one regression to avoid the problem of multicollinearity. The present study also does not include merchandise export as an explanatory variable in the estimated equations, because it is believed that in a relatively closed economy like Bangladesh, merchandise export does not have any significant impact on nominal income growth.

We assume that the regression equations are linear in parameter, and are estimated through the ordinary least squares (OLS) method. As yearly data are used, a one-lag (*t-1)* period is resorted to in the analysis. The econometrics computer program SHAZAM (version 7.0) is used to estimate the regressions.

4.2 Empirical analysis and findings

From the estimated regressions, it is clear that the error term of regression 2 follows first-order autoregressive scheme, AR(1) (see Table 2). Autocorrelation is corrected through the Geary (Run) Test following the steps suggested by Gujarati [1995]; the estimated results after correction are presented in Table 3. However, regression 1 does not suffer from autocorrelation problem as evident from the Durbin-Watson (DW) statistics (Table 1). Also multicollinearity among the explanatory variables in regressions 1 and 2 is very low (see Tables 4 and 5). Therefore, the results can safely be considered free from multicollinearity.

The estimated regression equations show that the coefficient of *M2* appears to be statistically insignificant at any acceptable significance level (Table 3). That is, the growth rate of *M2* does not have any significant impact on the growth rate of nominal GDP, neither at lag nor at level. On the other hand, the lagged coefficient of *M1* growth rate is highly significant (at 0 percent) but it is insignificant at level (Table 1). It implies that the current year's nominal GDP growth rate is significantly affected by last year's *M1* growth rate but current year's *M1* growth does not have any significant impact on current year's nominal GDP. According to regression 1 (see Table 1), a 1 percent increase in last year's *M1* growth rate is associated with 0.83476 percent increase in the current year's nominal GDP.

Insofar as fiscal policy measures are concerned, only the lag coefficients of *T* are found to be statistically significant. In regression 1 the growth rate of the tax revenue is significant at 11 percent, and in regression 2 it is significant at the 4 percent level of significance (Tables 1 and 3). This finding implies that the current year's nominal GDP growth will be negatively affected by last year's total tax revenue growth, that is, the increase in tax, as is supported by economic theory, will reduce nominal GDP growth. If last year's tax revenue increases by 1 percent, the current year's nominal GDP growth will decrease by 0.58305 percent (regression 2 and Table 3) and 0.36514 percent (regression 1 and Table 1). Neither of the coefficients is significant at level and in regression 1 it is even positive, which is the wrong sign (Table 2).

Table 1. Estimation result of regression equation (1)

$$\ln Y_t = \alpha_0 + \sum_{i=0}^{j} \beta_i \ln G_{t-i} + \sum_{i=0}^{k} \theta_i \ln T_{t-i} + \sum_{i=0}^{l} \lambda_i \ln M1_{t-i} + \mu_t \quad \beta > 0, \theta < 0, \lambda > 0$$

	Coefficient	*Standard error*	*t-ratio*	*p-value*
Constant	0.316	1.177	0.268	0.791
G_t	-0.083	0.128	-0.651	0.523
G_{t-1}	0.138	0.122	1.131	0.271
T_t	0.148	0.215	0.691	0.498
T_{t-1}	-0.365	0.214	-1.709	0.103
$M1_t$	0.051	0.339	0.151	0.882
$M1_{t-1}$	0.835	0.207	4.039	0.001
R^2				0.604
Adj. R^2				0.485
DW				2.087

Table 2. Estimation result of regression equation (2)

$$\ln Y_t = \alpha_0 + \sum_{i=0}^{j} \beta_i \ln G_{t-i} + \sum_{i=0}^{k} \theta_i \ln T_{t-i} + \sum_{i=0}^{l} \lambda_i \ln M2_{t-i} + \mu_t \quad \beta > 0, \theta < 0, \lambda > 0$$

	Coefficient	*Standard error*	*t-ratio*	*p-value*
Constant	2.844	1.069	2.661	0.015
G_t	0.028	0.167	0.166	0.870
G_{t-1}	0.212	0.165	1.287	0.213
T_t	-0.069	0.299	-0.229	0.821
T_{t-1}	-0.624	0.285	-2.187	0.041
$M2_t$	0.060	0.205	0.293	0.773
$M2_{t-1}$	0.191	0.205	0.932	0.363
R^2				0.269
Adj. R^2				0.049
DW				1.055

Table 3. Autocorrelation corrected estimation result of regression equation (2)

$$\ln Y_t = \alpha_0 + \sum_{i=0}^{j} \beta_i \ln G_{t-i} + \sum_{i=0}^{k} \theta_i \ln T_{t-i} + \sum_{i=0}^{l} \lambda_i \ln M1_{t-i} + \mu_t \quad \beta > 0, \theta < 0, \lambda > 0$$

(Corrected for correlation)

	Coefficient	*Standard error*	*t-ratio*	*p-value*
Constant	2.896	1.228	2.358	0.029
G_t	-0.012	0.145	-0.081	0.937
G_{t-1}	0.173	0.171	1.230	0.233
T_t	-0.149	0.255	-0.584	0.565
T_{t-1}	-0.583	0.265	-2.199	0.040
$M2_t$	0.105	0.185	0.567	0.577
$M2_{t-1}$	0.225	0.180	1.255	0.224
R^2				0.403
Adj. R^2				0.224
DW				1.601
No. of Runs				12
Positive runs				16
Negative runs				11

Table 4. Correlation matrix (regression1)

	G	*T*	*M1*
G	1.000		
T	0.012	1.000	
M1	0.004	0.008	1.000

Table 5. Correlation matrix (regression2)

	G	*T*	*M1*
G	1.000		
T	0.012	1.000	
M2	0.114	-0.140	1.000

The growth of government expenditure does not show any significant impact on nominal GDP growth. Level and lag coefficients of G in regressions 1 and 2 are not statistically significant at any acceptable level of significance; it even has the wrong sign at level in both regressions (Tables 1 and 3). This finding is consistent with what we predicted and also confirms the fact that below the full employment level of output, an economy operates in the Keynesian range of aggregate supply curve where a change in aggregate demand simply changes the real output without putting any pressure on price.

Analysis of the regression estimations yielded the following conclusions:

1. No variable has any significant impact on nominal GDP at level.
2. Neither G nor $M2$ has any impact on nominal GDP either at level or lag.
3. Only lagged values of T and $M1$ have statistically significant impact on nominal GDP.

Now we have found two measures—one fiscal policy measure (T) and one monetary policy measure ($M1$)—that have important effects on nominal GDP growth with one-year lag. At this point, we raise this question: which one is relatively more effective in influencing nominal GDP growth? To answer this question, the following regression is run:

$$\ln Y_t = \alpha_0 + \sum_{i=0}^{j} \theta_i \ln T_{t-1} + \sum_{i=0}^{k} \lambda_i \ln M1_{t-i} + \mu_t \qquad \theta < 0, \lambda > 0 \tag{3}$$

The results are presented in Table 6. The coefficients of T and $M1$ are more statistically significant than the coefficients obtained in previous regressions and the model can explain a substantial amount of variation in nominal GDP growth as indicated by the R^2 value. The result shows that neither coefficient has the right sign at level and both the coefficients are statistically significant at lag.

From the results of the foregoing estimated regressions, it is evident that both monetary and fiscal policy have some lagged effect on the change in nominal GDP growth. The monetary policy measure ($M1$) shows greater lagged effect than the fiscal policy measure (T) (see regression 3 and Table 6.) However, if we consider the cumulative effect of a unit change in T and $M1$ in regression 3, we obtain $\Sigma_{i=0}^{l}\theta_i = -0.16308$ and $\Sigma_{i=0}^{l}\lambda_i = 0.81338$ respectively; the former is not statistically significant (t = -0.59798), but the latter is (t = 2.5919). This comparison tends to support the monetarists' claim that money supply has a very significant impact on the changes in nominal GDP. Therefore, as a policy tool, so far as nominal income is concerned, monetary policy is more effective than fiscal policy and M1 is a more effective monetary policy instrument than $M2$. However, the estimated coefficient of individual lagged terms in regression (3) suggest that fiscal policy measure (T) can also be used to stabilize nominal income growth if we want to influence the GDP within a one-year lag.

Table 6. Estimation result of regression equation (3)

$$3.\ \ln Y_t = \alpha_0 + \sum_{i=0}^{j} \theta_i \ln T_{t-i} + \sum_{i=0}^{k} \lambda_i \ln M1_{t-i} + \mu_t \quad \theta < 0, \lambda > 0$$

	Coefficient	*Standard error*	*t-ratio*	*p-value*
Constant	0.528	1.149	0.460	0.650
T_t	0.203	0.200	1.017	0.320
T_{t-1}	-0.366	0.194	-1.891	0.072
$M1_t$	-0.041	0.325	-0.126	0.901
$M1_{t-1}$	0.854	0.204	4.182	0.000
R^2				0.565
Adj. R^2				0.486
DW				2.116

4.3 Co-integration analysis

For long-run policy formulation, it is essential to maintain a long-run equilibrium relationship between *M1* and nominal GDP growth. In time series econometrics, two series must be co-integrated, despite not being individually stationary, in order to draw any meaningful conclusion from their relationship. To find out whether *M1* and nominal GDP growth are co-integrated, the Augmented Engle-Granger (*AEG*) methodology is employed. The test results are presented in Table 7. Since in absolute terms the estimated τ value of 5.998 exceeds any of the Engle-Granger critical values at the 1 percent, 5 percent and 10 percent significance level presented in Table 7, the conclusion would be that the estimated u_t is stationary, i.e. it does not have a unit root and therefore, *M1* and nominal GDP growth are co-integrated.

5. Conclusion

Monetary authorities set money supply growth or short-term interest rates as their target variable. Setting short-term interest rate targets needs a deep and efficient money market so that the economy can benefit from the effect of a change in interest rate.

Much of the existing evidence suggests that the interest rate is a redundant variable in Bangladesh and many other developing countries. However, there has been no formal explanation of the monetary policy from the monetary authority of Bangladesh. Bangladesh Bank (Central Bank) does not make public the theoretical framework utilized for monetary programming. As Taslim [2001] has observed: "The lack of transparency is a hindrance to a critical study of monetary policy." Bangladesh Bank uses money supply as monetary target, but it does not specify which monetary aggregate—*M1* or *M2*—it uses as target.

Table 7. Augmented Engle-Ganger (AEG) test

$$\Delta\hat{u}_t = \tau\hat{u}_{t-1} + e_t$$

	Coefficient	*τ ratio*
$\hat{u}_{t-1}$	-1.1528	-5.998

Engle-Granger critical τ values at*

1% s.l.	*5% s.l.*	*10% s.l.*
-2.5899	-1.9439	-1.6177

Note: s.l. stands for significance level.
* From Basic Econometrics, 3rd ed, Gujarati, N. Damodar, p.727.

The findings of this paper indicated that *M1* performed better than *M2*. The findings also supported the monetarists' view that increasing the growth rate of money stock leads to an increase in the growth rate of nominal income. The foregoing analysis makes one point clear: The growth rate of narrow money (*M1*) supply has a very significant impact on nominal income growth in Bangladesh economy; this is the key notion of the quantity theory of money, which is the building block of monetarism. The co-integrated relationship between these two implies that the monetary authority can use the monetary aggregate *M1* to achieve long-run price stability. The monetary policy can thus be used successfully to handle the problem of inflationary and deflationary pressure on the economy. Monetary authorities should target to control *M1* supply to steer the economy on the right track. Another implication of this long-run equilibrium relationship between narrow money supply (*M1*) and nominal GDP growth is that a stable income velocity of money is essential to derive a stable money demand function for monetary programming. Therefore, in the light of evidence presented in this study, it can safely be concluded that money matters in the conduct of monetary policy in Bangladesh.

References

Ahmed, Faruquddin [1996] "Monetary policy: objectives and current practice in Bangladesh". *Bank Parikrama* **XXIII**(3&4):1-10.

Anderson, Leonall C. and Jordan I. Jerry [1968] "Monetary and fiscal actions: a test of their relative importance in economic stabilization", *Review*, Federal Reserve Bank of St. Louis (November):11-24.

Anderson, Leonall C. and Carlson M. Keith [1970] "A monetarist model for economic stabilization", *Review*, Federal Reserve Bank of St. Louis (April):7-25.

Anderson, Richard G. [2002] "Interpreting monetary growth", *Review*, Federal Reserve Bank of St. Louis (February).

Batten, Dallas S. and Hafer R.W. [1983] "The relative impact of monetary and fiscal actions on economic activity: a cross-country comparison", *Review*, Federal Reserve Bank of St. Louis (January):5-12.

Carlson, Keith M. [1978]"Does St. Louis equation now believe in fiscal policy?", *Review*, Federal Reserve Bank of St. Louis (February):13-19.

Das Kanti Sujit [2000] "The monetary theory of balance of payments: an empirical study of Bangladesh", *Bank Parikrama* **XXV**(1):5-18.

Davis, Richard G. [1969] "How much does money matter a look at some recent evidence", *Monthly Review*, Federal Reserve Bank of New York (June):119-31.

Dotsey, Michael, Lantz D. Carl and Santucci Lawrence [2002] "Is money useful in the conduct of monetary policy", *Economic Quarterly* **86**(4):23-48, Federal Reserve Bank of Richmond.

Friedman, Benjamin M. [1977] "Even the St. Louis model now believes in fiscal policy", *Journal of Money, Credit and Banking* **May**:365-67.

Friedman, Milton [1970] "A theoretical framework for monetary analysis". *The Journal of Political Economy* **78**(2):193-238.

Friedman, Milton [1971] "A monetary theory of national income". *The Journal of Political Economy*,**79**(2):323-337.

Gramlich, Edward M. [1971] "The usefulness of monetary and fiscal policy as discretionary stabilization tools", *Journal of Money, Credit and Banking* **May**:506-32.

Gujarati, Damodar N. [1995] *Basic econometrics.* Third Edition. New Delhi: McGraw-Hill

Hafer, R.W. [1982] "The role of fiscal policy in the St. Louis equation", *Review*, Federal Reserve Bank of St. Louis (January):17-22.

Hafer, R.W. [2001] "What remains of monetarism?" *Economic Review* **86**(4):13-33, Federal Reserve Bank of Atlanta

Hossain, A. and A. Chowdhury [1994a] "Monetary policy", in Habib Zafarullah, M.A. Taslim and Anis Chowdhury, eds. *Policy Issues in Bangladesh*, Dhaka: University Press Limited:68-96.

Hossain, A. and A. Chowdhury [1994b] "Fiscal policy", in Habib Zafarullah, M.A. Taslim and Anis Chowdhury (eds.), *Policy Issues in Bangladesh*, Dhaka: University Press Limited:38-67.

Khan, Ahmed Syed [2001] "An evaluation of monetary policy before and after financial sector reform", *Journal of the Institute of Bankers Bangladesh* **48**:48-70.

Leeuw, De Frank and Kalehbremer [1969] "Monetary and fiscal actions: a test of their relative importance in economic stabilization-comment", *Review*, Federal Reserve Bank of St. Louis (April):6-11.

Parikh, A. and C.Stamer [1990] "A note on monetary policy and the balance of payments in Bangladesh". *The Bangladesh Development Studies* **XVIII**(4):67-75.

Samuelson, Paul A. and Nordhaus William D. [1995] *Economics.* Fifteenth Edition. Singapore: McGraw-Hill.

Sarker, Tapan K. and Kitamura Yokinobu [2002] "Technical assistance in fiscal policy and tax administration in a developing country: The State of Bangladesh", *Asia-Pacific Tax Bulletin* **September**:278-288.

Steindel, Charles [2000] "The effect of tax change on consumer spending", *Current Issues*,**7**(11), Federal Reserve Bank of New York

Taslim, M.A.[2001] "Monetary policy and monetary programming in Bangladesh", *The Bangladesh Development Studies* **XXVII**(4):81-99.