Volume-7, Issue-1, January-June, 2018
PP. 117-134

Estimating Monetary Policy Reaction Function for Bangladesh: AVAR Model Analysis

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Abstract

Monetary policy maker adjusts its policy instruments to reach the policy objectives under the guideline of a monetary policy rule. In this context, monetary policy rule could be better described by monetary policy reaction function.The purpose of this study is to examine Bangladesh Bank's monetary policy reaction function applying VAR model over the period of 2004m1 to 2017m11. The results show that the call money rate has positive and significant response to a shock to the inflation gap, the exchange rate gap or the lagged call money rate, while it responds negatively to a shock of output gap. Similar results have been found when we re-estimate the model using Treasury bill rate. These outcomes suggests that we can apply and extend the Taylor rule using inflation gap, output gap, exchange rate and lagged interest rate in case of Bangladesh. The study has also an important policy implication of choosing the treasury bill rate as the policy instrument in implementing the monetary policy.

Keywords: Monetary Policy Reaction Function, Taylor Rule, VAR model, Impulse Response Function, Variance Decomposition.

JEL Classification: E4, E5.

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Views expressed in this paper are author's own and not necessarily reflect the views of Bangladesh Bank.

Introduction:

The analysis of monetary authority's reaction in response to economic development and the impact of their actions on the economy are the key area of discussions in the monetary economics. In the Aftermath of the globalization and financial liberalization monetary policy has started focusing on output stabilization instead of promoting economic growth, hence, rule-based monetary policy are getting popular over discretionary monetary policy. Purely discretionary policy setting leads to higher inflation, while, rule based monetary policy may be the best strategy to reduce inflation and minimizing the output and inflation variability. Under rule-based regime, central bank set explicit values as intermediate target which are strongly related to output and inflation stabilization.

Bangladesh does not follow inflation targeting or any rule-guided monetary policy strategy rather it follows the monetary policy framework with substantial discretion which is time-inconsistent (Islam and Uddin, 2011). Monetary policy reaction function which critically examines the behavior of monetary policy in response to the deviation of output and inflation is considered as very important for Bangladesh, as Bangladesh with its evolving monetary regimes is on the path of modernizing its monetary policy framework and considering to move away from monetary targeting to inflation targeting policy strategy. Under the monetary targeting framework Bangladesh bank's policy actions changes reserve money, which also changes broad money and ultimately the final objective, price stability is achieved. Though monetary targeting enables a central bank to adjust its monetary policy to cope with domestic consideration, controlling inflation is subject to long and uncertain lags and also money demand function may not be stable in monetary targeting; while, inflation targeting is better than monetary targeting to control inflation. Before going to inflation targeting it is crucial to examine how interest rate works to stabilize output and inflation and what is the relationship between interest rate and the macroeconomic variables.

Many argue that Inflation targeting is implemented through the Taylor rule in which interest rates are adjusted to the stabilization of inflation and output. Therefore, the paper attempts to examine Bangladesh Bank's monetary policy reaction based on Taylor rule. For this aim the Central Bank's monetary policy reaction function have been estimated to measure the performance of monetary policy and evaluate the relationship between monetary policy and macroeconomic variables. VAR model is employed in this

paper taking into consideration of possible simultaneous relationships among the variables and to avoid the simultaneity bias problem. The impulse response function and variance decomposition of the interest rate are estimated to determine how interest rate responds to the shock of inflation gap, output gap and exchange rate and to determine the factors that explain the variance of the interest rate. In this case, we have used both the call money rate and the treasury bill rate as the interest rate to examine which one more pronouncedly responds to the shock of endogenous variables that will also help us in choosing the appropriate policy instrument which works better to stabilize inflation in case of Bangladesh. The paper consists of six sections; section 2 describes theoretical aspects of Taylor rule and Section 3 presents review of literature. Section 4 analyses theoretical model, section 5 documents empirical result sand section 6 concludes.

Taylor Rule:

The Taylor rule can be described as the special reaction function where interest rate acts as a function of current inflation, output gap and the difference between current inflation and targeted inflation. Tailor rule is a linear algebraic rule described by the following equation:

$$\iota_t = r^* + \pi_t + a_\pi(\pi_t - \pi^*) + a_y (y_t - y_t)$$

Where

ι_t= Central Bank Policy rate (nominal interest rate)

r^* = equilibrium real interest rate

π_t= Average inflation rate

π^*= Inflation target of the central bank

y_t = logarithm of real GDP

y_t= logarithm of potential output

$(y_t - y_t)$ = Output Gap

According to Taylor rule, central bank raises its policy rate when actual output is greater than potential output which signifies that an economy is operating beyond the potential level and it is required to back to its potential level by accelerating policy rate. The coefficient of inflation gap is positive when actual inflation is above the targeted level,

then it is suggested that central bank should raise its policy rate to back its inflation to its potential path.

Taylor couldn't estimate the equation econometrically. Taylor assumed that the weights central bank (Federal Reserve Bank) gave to deviation of inflation and output were both equal to 0.5; thus, for example, if inflation were 1 percentage point above its target, the central bank would set the real fund rate 50 basis point above its equilibrium value (Redebusch,1998)

Review of Literature

Fed's monetary policy reaction function indicates how Fed alters its monetary policy in response to economic development. Mehra (1999) has estimated a forward looking monetary policy reaction function that exhibits how policy responds to the long term inflationary expectations as reflected by the behavior of the bond rate. The GMM estimates of the two short-run monetary policy reaction function for the two sample periods of 1960Q2 to 1979Q2 and 1979Q3 to 1998Q2 indicates that the fund rate rises if actual inflation rises, if future inflation is expected to increase, if output is expected to be above trend, or if current bond rate moves relative to expected future inflation rate. The study finds that real funds rate target was very responsive to inflation in the post-1979 period (Volcker-Greenspan period) than in the pre-1979 period. The study has recommended that there was macroeconomic stability in the U.S. economy because interest rate policy pursued in Volcker-Greenspan period was very responsive to expected inflation and the real fund rate increased in response to inflation in this period.

Galbraith et. al (2007) have used VAR model for the American economy which also aims to investigate whether Fed responds to inflation signals during the period of 1983-2003. The study finds only one causal variable, term structure which indicates the importance of term structure as an economic indicator. The finding of the paper is that term structure is influenced by unemployment and is not affected by inflation. Using simple but powerful dummy regression the author wants to show the behavior of central bank in response to the deviation of inflation and unemployment from the target through Taylor's rule for the two distinct periods of 1969-1883 and 1984-2006 where monetary policy stance has been represented by yield curve. The study also finds that term structure of interest rate doesn't respond to inflation after 1983 unless unemployment is giving the same signal as inflation. Earnings inequality in manufacturing sector has been found to be responsive to term structure in Federal Reserve System. Therefore, the study

has recommended that Fed's policy influences the inequality and more specifically, the term structure of interest rate prevailing in the Federal Reserve System contains the information regarding the measure of inequality in earnings besides information on inflation and unemployment.

Using annual data for the period of 1973-2008 Malik, W. and Ahmed, A. have estimated Taylor- type reaction function and its slight modified version defined over inflation and real GDP growth in order to see whether or not Central Bank of Pakistan(SBP) has been focusing on two objectives: price stability along with output stabilization. Conducting recursive estimation of reaction function the study has found SBP's policy inconsistency in response to inflation and output deviation from their respective targets, while policy consistency improved after the year of 2002. The study has recommended that SBP has got autonomy in setting monetary policy instrument due to financial sector reform.

Employing both backward and forward looking policy rules Rotich, H. Kathanje, M and Manna, I (2007) have examined whether central bank of Kenya reacts to changes in inflation, GDP growth and the exchange rate in a consistent and predictable fashion as predicted by standard Taylor rule. CBK has responded in reducing money supply when inflation is high and output is positive. The study has concluded that CBK would respond by increasing repo rate during the period of high inflation. Including lagged inflation to the baseline reaction function the study has also found that a backward looking specification is important for Kenya and CBK takes into account past inflation in implementing monetary policy.

Muhammad et al.(2012) have investigated the monetary policy reaction function in Pakistan to identify the importance of the goals of monetary policy for central bank of Pakistan (CBP). In order to find out the main objective of monetary policy, rolling window technique has been employed and the study has found that after 2002 main focus of monetary policy for central bank of Pakistan was inflation. The findings of the paper is that the regression coefficient of inflation and exchange rate is insignificant because in case of Pakistan there was cost push inflation which could not be controlled by monetary policy and uncertainty and risk factor coefficient was also found insignificant in case of Pakistan. The study has recommended that State Bank of Pakistan did not strictly follow Taylor's rule and its monetary policy was discretionary.

Emir et al.(2000) have estimated monetary policy reaction for measuring the

performance of monetary policy and evaluating the relationship between monetary policy and macroeconomic variables. Estimation has been conducted for two sub-periods, in the pre-crisis period (1990-1993) low degree of sterilization, offset and neutralization co-efficient suggest that central bank of turkey (CBRT) implemented a relatively accommodative policy to fiscal policy by expanding domestic credit to finance budget deficit. On the other hand, in the post crisis period (1995-1999) high level of sterilization, CBRT implemented more active policy by sterilizing most of foreign assets increase and neutralizing the expansion of government credit by reducing banking sector credit. The link between high sterilization and low inflation was not observed in the post-crisis period since the pricing behavior of economic agents in the goods and factor market was dramatically changed in the post crisis period which also changed the inflationary process.

Rigobon and Sack (2001) have used identification technique based on the heteroskedasticity of stock market returns to effectively measure the magnitude of monetary policy reaction function to stock prices in USA, even though stock market is endogenously reacting to interest rate at the same time. The study found that the significant and positive reaction of monetary policy to stock market and, therefore, interest rate changes with the same direction of changes in stock prices. The finding of the paper is consistent with Alan Greenspan's view which states that policymaker should respond to the stock prices according to their influence on the outlook of output and inflation.

Fung (2010) has estimated a simple Taylor-type monetary policy reaction function for the Dominican Republic (DR) for the period of 1970-98 by using vector autoregressions in order to assess the effects of the actions of monetary authorities. Following Judd and Rudebusch, the author has estimated modified version of Taylor's rule where monetary base reacts to Erdiff (differential between black market exchange rate and official exchange rate), ygap (output gap) or both. The estimation has also been conducted for the two distinct-periods, during the period of 1970-84; authorities followed an accommodative policy and did not give importance in using the differential between the official exchange rate and the black market exchange rate as one of the main policy targets. In this paper, the implicit reaction of monetary authorities was more systematic in the period of 1985-98 than the period of 1970-84 which might be explained by the determination of monetary authorities to 'implicitly' follow the feedback rules in monetary policy making rather than extreme discretion.

Salgado et al. (2005) have estimated the reaction function for central bank of Brazil for the period of August, 1994 to December 2000. In order to empirically show whether central bank of Brazil follows non-linear monetary policy reaction function they have used threshold autoregressive model (TAR) with exogenous variable that contemplate the changes in dynamics of nominal interest rate between the period of tranquil and crises. In order to verify whether Brazilian nominal interest rate would follow the modified Taylor rule, a linear model was estimated. Except constant and output gap, all the co-efficient are statistically significant and have expected signs, still the linear model is not correctly specified, as ARCH effect is present and the hypothesis of normally distributed residual is strongly rejected. In order to show the dynamics of Brazilian nominal interest rate during the two periods-the crisis period and tranquil period, a TAR model proposed by Tsay in 1989. Comparing the linear model with the TAR, there are significant advantages of the TAR approach. In fact, there is no evidence of misspecification in the TAR approach, whereas, misspecification presents in the linear model. SBIC is smaller in the TAR model, which represents improvement to fit when considering the two regimes. Therefore, TAR model is more appropriate to represent the monetary policy reaction function in Brazil for the period of August, 1994 to December 2000.

Chang (2005) has estimated the monetary policy reaction function for Taiwan by extending the Taylor rule and considering whether central bank of Taiwan reacts in response to exchange rate gap and stock price gap in addition to inflation gap and output gap. The impulse response function and variance decomposition model for the interest rate have been estimated to find the possible responses of discount rate and collateral loan rate to a shock of one of the endogenous variables and to identify the explanatory power of each of variables on the variance of interest rate. The study has found that discount rate and collateral loan rate respond positively and significantly to a shock to inflation gap, stock price gap or the lagged interest rate, but doesn't respond significantly to a shock to the output gap or exchange rate gap.

Inoue T. and Hamori S. (2009) have estimated India's monetary policy reaction function by applying the simple Taylor rule and also have augmented the simple Taylor rule by including exchange rates. The analyses uses monthly data for the period of April 1998 to December 2007. They have employed the dynamic OLS method instead of ordinary least squares and found that output gap coefficient was statistically significant and the

sign of its coefficient was rational with the theory; however, inflation coefficient had been found insignificant. Including exchange rate in the base line, coefficient of output gap and exchange rate gap had the statistical significance with the expected signs, while, inflation coefficient still remained insignificant. The result of the study indicates that short-term interest rate is not effective instrument to control inflation in India. Based on empirical results the study concludes that inflation doesn't play significant role in conducting monetary policy in India and, therefore, India should not follow inflation targeting policy framework.

The Model

The Taylor rule linearly maps inflation gap and output gap with targeted interest rate. The Taylor's equation presents a simple relationship, yet it is found to be a very powerful rule in analyzing monetary policy. Apart from equating inflation gap and output gap in interest rate modeling, it was felt necessary to include other economic variables that are likely influence interest rate. Ball (1999) found that adding the exchange rate to the benchmark policy rule could improve macroeconomic performance in a small open economy model. The exchange rate was included to the policy rule in two ways in Ball's analysis. First the central bank uses a monetary conditions index in place of the interest rate as its instrument. Second, the lagged exchange rate is added as a variable to the policy rule. The net effect of these two changes is to add the current and lagged exchange rate to the right hand side of the policy rule. Ball found that, for the same amount of inflation variability, output variability could be reduced by 17 percent by adding the exchange rate to the policy rule in this way.

Taylor rule is developed for closed economy where central banks can concentrate on the interest rate only. In real world this phenomenon is absent in monetary policy. In closed economy condition Taylor rule may provide an efficient result in measurement of short term interest rate but in open economy Taylor rule should be modified or extended.

We want to estimate monetary policy reaction function for Bangladesh where we have extendedthe Taylor rule using exchange rate. In implementing monetary policy we consider exchange rate as a policy variable because it affects both international trade as well as economic growth. Our empirical model is specified as follows.

Original Taylor rule:

$i = f(YGAP, PGAP)$

Where,

i= short term interest rate

YGAP= the output gap $(Y-Y^*)$

PGAP= inflation gap $(\pi-\pi^*)$

Extended Taylor rule includes exchange rate

$i = f(YGAP, PGAP, E)$

where,

E= exchange rate in term of BDT

Replacing short term interest rate with Call Money Rate(CMR), the equationcan be estimated by the following VAR (Vector Auto Regression) model,

$X_t = ß_1X_{t-1}+\ldots\ldots+ß_mX_{t-m}+\theta Z_t+ \varepsilon_t$

Where,

X_t = Vector of the endogenous variables (CMR, YGAP, PGAP, E)

Z_t = Vector of exogenous variable

ß and θ = Parameter matrices

ε_t = White noise error term

As the Taylor rule indicates that short term interest rate (CMR) would response positively to a shock to YGAP or PGAP. But now at extended Taylor rule we also expect that exchange rate and short term interest rate (CMR) are positively related that is when BDT becomes stronger or the exchange rate rises, central bank of Bangladesh (Bangladesh Bank) would attempt to stabilize weak BDT by conducting tight monetary policy or raising the short term interest rate (CMR) so that demand of BDT would increase. So in our analysis we included exchange rate data as an explanatory variable in determining BB's policy rate.

The data set:

To use the extended tailor rule the data set must be prepared first. The sample consists of monthly data for the period of 2004m1 to 2017m11. Industrial production index has

been taken as proxy variable of real output. Industrial production index (Y), the CPI, the call money rate and the exchange rates have been taken from the International Financial Statistics published by IMF; while, the 91-day treasury bill rates have been taken from Monetary Policy Department. Inflation rate is derived from the CPI. Potential output is estimated based on the Hodrick-Prescott filtering process. Output gap (ygap), is calcluted based on difference between real GDP and its Hodrick-Prescott filtered values. Inflation gap is measured calculating the gap between the actual inflation and the target value of inflation. Target value of inflation has taken from the various publications of annual reports and monetary policy statements (MPS).

Empirical Results:

The empirical analysis of monetary policy reaction function for Bangladesh based extended Taylor rule and using the VAR model over the period of 2004m1 to 2017m11 have been shown in this section. In the VAR estimation, based on final prediction error(FPE) and Akaike information criteria (AIC) optimum lag order has been selected at 3. Augmented Dickey-Fuller(ADF) tests are conducted to test for the presence of unit roots in levels, ygap, pgap, exr and cmr. The test statistics and the critical values are given in table-1.

Table-1.Unit root test:

Variable	ADF Test Statistics	99% Critical Value	Conclusion
cmr	-1.505	-2.57	unit root at level
exr	-1.659	-3.47	unit root at level
ygap	-2.93	-3.47	unit root at level
pgap	-2.78	-3.47	unit root at level
tbill	-1.66	-3.47	unit root at level
∆cmr	-11.934	-2.58	Stationary at 1
∆exr	-11.01	-3.47	Stationary at 1
∆pgap	-11.21	-3.47	Stationary at 1
∆ygap	-7.54	-3.47	Stationary at 1
∆tbill	-8.696	-3.47	Stationary at 1

The test statistics for the stationary of the levels of ygap, pgap, exr and cmr indicate the presence of a unit root for 1% level of significance. The test statistics for the first differences of all those variables at 1% level lead to rejection of null hypothesis of a unit root indicating all of the variables are integrated of order 1.

Whether the variables are co-integrated or not has been tested by Johansen co-integration test (table- 2). Comparison of the likelihood ratio test statistics with the 95% critical values indicate that cointegration hypothesis is rejected at 5% level and hypothesis of at most 3 cointegrating vector cannot be rejected at 5% level. Therefore, it is concluded that there is a long run stable relationship among the variables.

Table-2. Johansen Cointegration test:

Eigen Value	Trace statistics	95% critical value	Hypothesized number of CE's
0.398075	119.4260	47.85613	None *
0.142763	39.72928	29.79707	At most 1 *
0.082170	15.54482	15.49471	At most 2 *
0.013181	2.083125	3.841466	At most 3

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

Graph 1 (in appendix) presents the impulse response function of the call money rate (cmr) with a 95% confidence interval. Call money rate (cmr) responds positively to a shock to the inflation gap, the exchange rate and the lagged call money rate during some period of months, while cmr responds negatively with the output gap. These findings suggest that Bangladesh Bank (BB) pursues tight monetary policy and raises its policy instrument when inflation gap widen sand exchange rate gets depreciated. When exchange rate rises meaning that taka becomes weaker against the dollar, in response to this phenomena BB pursues tight monetary policy, therefore, interest rate increases and demand for domestic currency rises which contributes exchange rate to decrease.

However, Call money rate (cmr) negatively responds with the output gap which is not unusual in case of Bangladesh, as Bangladesh Bank doesn't put emphasis on growth stabilization rather it works on promoting economic growth. Another interesting finding is that the exchange rate (Taka-dollar exchange rate) responds positively to shock to the

output gap. It suggests that when actual output is above the potential level partly due to rise in export or FDI inflows, then Bangladeshi Taka becomes stronger against the dollar. From the above analysis it can be said that call money rate could be used as policy instrument to stabilize inflation, as it is positively responds to inflation gap. Similar result has been found from the analysis of variance decomposition of the call money rate. From table-1 (in appendix), it can be said that lagged call money rate is the most influential variable in explaining the variation of call money rate for all of the period. However, inflation gap is the second most influential variable, as it explains up to 12.55% variation of call money rate.

We re-estimated the VAR model using treasury bill rate (tbill-rate) instead of using call money rate (cmr) to show the response of tbill rate because the weighted average call money rate sometimes does not reflect the actual market interest rate due to outlier effects in the transaction value as well as in the rates. Like before, from graph-2 (in appendix), it can be said that tbill-rate responds positively to a shock to inflation gap and the response is more pronounced in case of tbill-rate than that of call money rate (cmr). However, the response of treasury bill rate to the shock of output gap is very negligible, though most of the period it reacts negatively which suggests that interest rate doesn't work to stabilize output. From the variance decomposition (table-2 in appendix) of treasury bill rate it can be said that up to 98.08% and 26.43% variation in treasury bill rate can be attributed to the lagged treasury bill rate and inflation gap which indicate that lagged treasury bill rate and inflation gap are the determining factors in explaining the variation of treasury bill rate. The findings suggests that interest rate works as an instrument to stabilize inflation in Bangladesh, indicating that Bangladesh Bank (BB) may take inflation targeting monetary policy strategy if the necessary pre-conditions of inflation targeting policy strategy are full-filled.

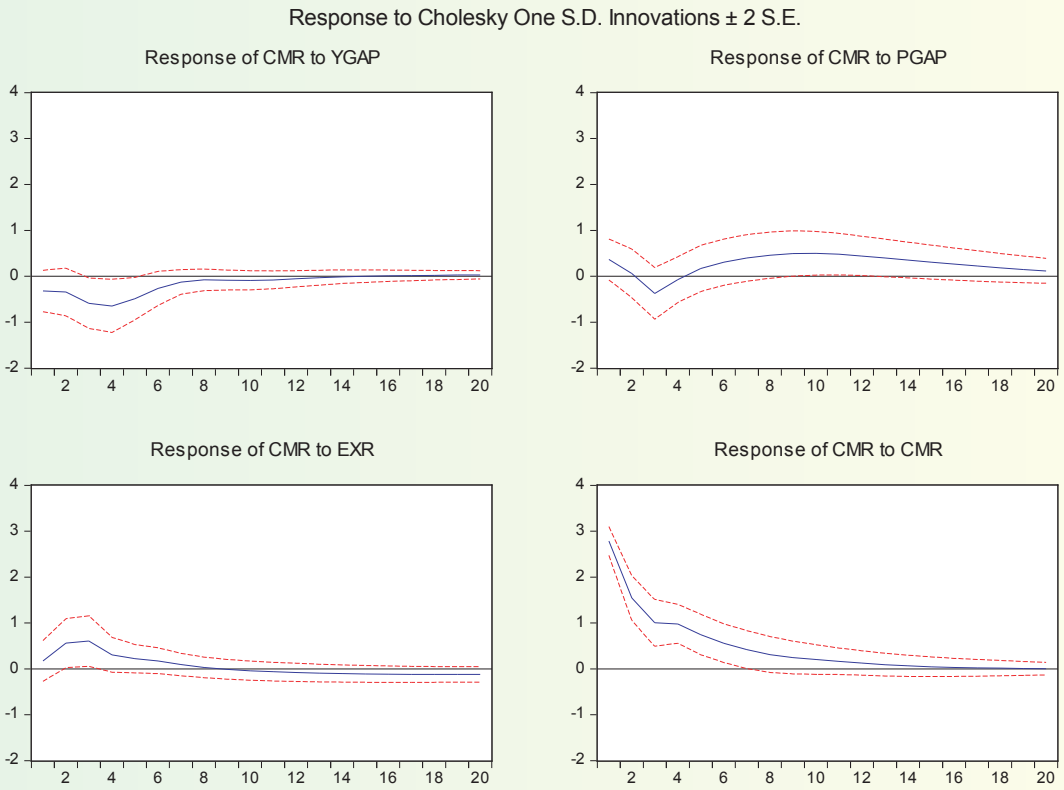
Conclusion:

In this study, we have estimated monetary policy reaction function for Bangladesh Bank by extending the Taylor rule and applying the VAR model. Finding of the paper is that both call money rate and Treasury bill rate respond positively to a shock of the inflation gap, exchange rate gap and the lagged interest rate (call money rate and Treasury bill rate). Another interesting finding is that Treasury bill rate responds positively and more pronouncedly in response to inflation gap than the response of call money rate. On the other hand, both call money rate and Treasury bill rate responds negatively to a shock of

output gap and the response is very much small for most of the months. There are several policy implications which are also worth mentioning. Finding of the paper suggests that the Taylor rule can be applied in case of Bangladesh and can be extended by adding exchange rate and using lagged interest rate. The lagged call money rate is the most contributing factor in explaining the variation of call money rate when we have estimated the model using call money rate. Similarly, in case of using treasury bill rate, the lagged treasury bill rate is the most important factor to explain the variation of treasury bill rate, since up to 98.02% variation of treasury bill rate can be attributed to the lagged treasury bill rate. From the analysis it can be said that whether we take call money rate or Treasury bill rate as the policy rate, we should include lagged interest rate in the Taylor Rule, otherwise, an omission of the lagged interest rate would cause specification error. Similarly, both call money rate and Treasury bill rate responds positively and significantly to exchange rate for some periods indicating that interest rate works to stabilize the currency, therefore, Taylor rule can be applied and extended using exchange rate. Interest rate negatively responds with the output gap as Bangladesh Bank does not put emphasis on output stabilization. Since the Treasury bill rate responds significantly and highly with the inflation gap it should be regarded as the more appropriate policy instrument to control inflation, therefore, it is better to use Treasury bill rate as an interest rate in developing monetary policy reaction function applying Taylor rule in case of Bangladesh.

Appendices

Graph:1



Graph:2

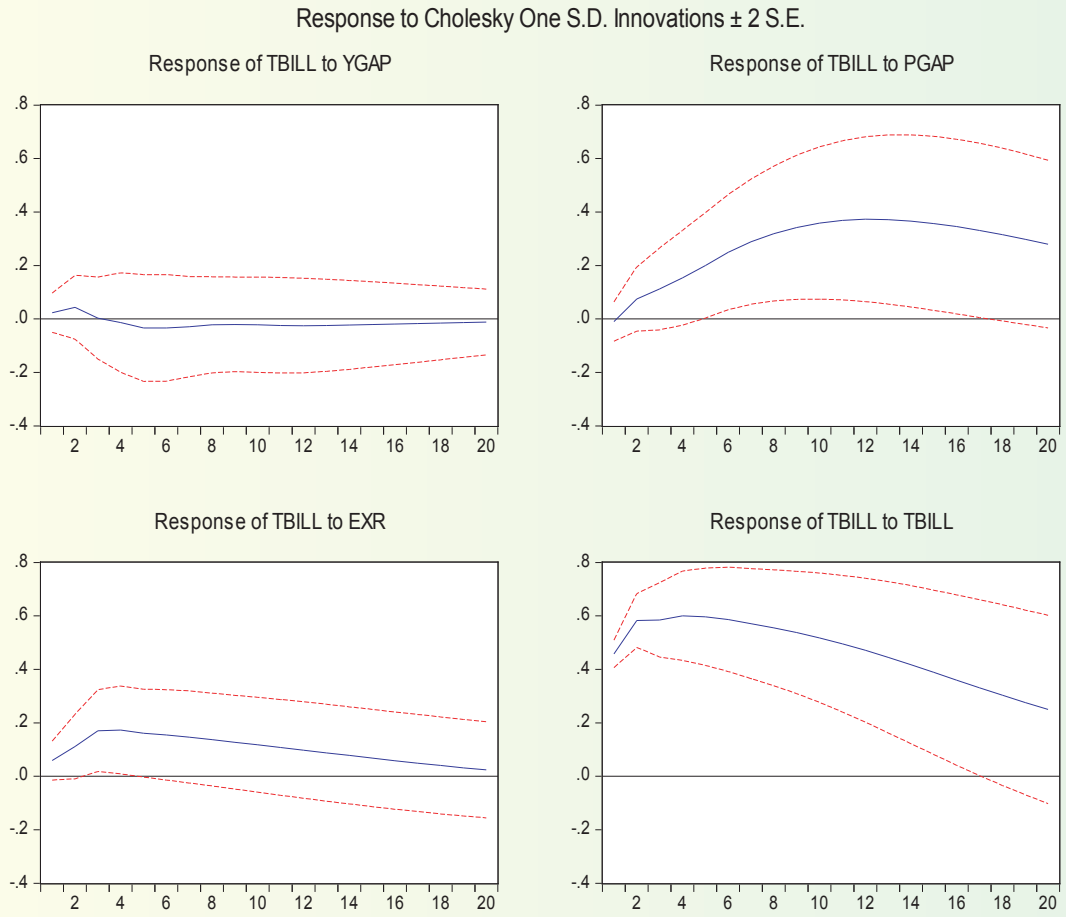

Response to Cholesky One S.D. Innovations ± 2 S.E.
Response of TBILL to YGAP
Response of TBILL to PGAP
Response of TBILL to EXR
Response of TBILL to TBILL
.8
.6
.4
.2
.0
-.2
-.4
2
4
6
8
10
12
14
16
18
20

Table : 1

Variance Decomposition of CMR					
Period	S.E.	YGAP	PGAP	EXR	CMR
1	2.833816	1.282530	1.668238	0.370498	96.67873
2	3.295214	2.040174	1.265145	3.165733	93.52895
3	3.566275	4.474152	2.179708	5.586712	87.75943
4	3.767363	6.953310	1.990815	5.663075	85.39280
5	3.881254	8.132523	2.066381	5.656173	84.14492
6	3.945378	8.316903	2.607174	5.664178	83.41174
7	3.990370	8.229642	3.545805	5.590030	82.63452
8	4.029628	8.108308	4.777207	5.487030	81.62745
9	4.068202	7.999401	6.163657	5.384300	80.45264
10	4.105112	7.904668	7.542629	5.298033	79.25467
11	4.137476	7.818570	8.769898	5.238332	78.17320
12	4.164006	7.737289	9.785454	5.208155	77.26910
13	4.185067	7.665315	10.58841	5.205762	76.54051
14	4.201634	7.605844	11.20564	5.226868	75.96165
15	4.214595	7.559136	11.66791	5.266376	75.50658
16	4.224650	7.523664	12.00383	5.319460	75.15305
17	4.232366	7.497623	12.23856	5.382024	74.88179
18	4.238248	7.479347	12.39475	5.450786	74.67512
19	4.242746	7.467305	12.49229	5.523167	74.51724
20	4.246239	7.460098	12.54793	5.597154	74.39482

Table : 2

Variance Decomposition of TBILL :					
Period	S.E.	YGAP	PGAP	EXR	TBILL
1	0.462254	0.256352	0.043323	1.620467	98.07986
2	0.756712	0.420545	0.976865	2.758206	95.84438
3	0.977962	0.252602	1.902403	4.691311	93.15368
4	1.170730	0.190720	3.053899	5.453399	91.30198
5	1.339316	0.210532	4.562800	5.611184	89.61548
6	1.491717	0.221210	6.476191	5.598187	87.70441
7	1.629948	0.217784	8.558183	5.497931	85.72610
8	1.756827	0.203400	10.66752	5.338185	83.79090
9	1.873228	0.191324	12.72176	5.154970	81.93195
10	1.979923	0.183590	14.67306	4.967066	80.17628
11	2.076990	0.180578	16.48579	4.783176	78.55046
12	2.164553	0.179753	18.14572	4.608385	77.06615
13	2.242708	0.179399	19.64954	4.446123	75.72493
14	2.311794	0.178512	21.00155	4.297689	74.52225
15	2.372315	0.177180	22.20949	4.163263	73.45007
16	2.424908	0.175644	23.28304	4.042487	72.49883
17	2.470248	0.174109	24.23205	3.934858	71.65898
18	2.509021	0.172603	25.06613	3.839800	70.92146
19	2.541893	0.171099	25.79452	3.756719	70.27767
20	2.569518	0.169573	26.42615	3.684979	69.71930

Cholesky Ordering: YGAP PGAP EXR TBILL

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