PN 0711: Near-Term Inflation Outlook and BB's Policy Stance [1]

Dr. Md. Habibur Rahman
Senior Research Economist
Email: habiburr@yahoo.com
and
Dr. Sayera Younus
Senior Research Economist
Email: sayera33@yahoo.com

Policy Analysis Unit (PAU)
Research Department, Bangladesh Bank

Abstract

This paper uses three alternative forecasting techniques, namely, Box-Jenkins's Auto-regressive Integrated Moving Average (ARIMA) model, unrestricted Vector Autoregression (UVAR) model and Hsiao's Final Prediction Error (FPE) criteria to forecast inflation based on quarterly data during 1990:1-2006:4. This paper also compares these forecasting techniques to see which suits better in forecasting inflation based on the lowest MSE and RMSE. It has been found that the UVAR produces best forecasted outcome for inflation in Bangladesh. According to the UVAR technique, the point estimates for inflation in Bangladesh is expected to be 7.24 percent, 7.95 percent and 7.70 percent respectively in June 2007, December 2007 and in June 2008. With a view to containing near-term inflationary pressure, the continuation of existing cautious policy stance of BB may therefore be recommended.

Keywords: Forecasting, Output, Inflation, Exchange Rate, Money and Credit

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Near-Term Inflation Outlook and BB's Policy Stance

1.   Introduction

With a view to maintaining intended rate of future inflation within the desired limits, the monetary authority of Bangladesh programs the required rate of money supply growth for a given real output growth. Current levels of inflation, however, which are themselves the result of past policies, provide insufficient information to the policy makers. As a result, policy makers need some estimation of future inflation to conduct monetary policy in an effective manner. However, the practice of forecasting inflation in Bangladesh is 'ad hoc' in nature and is not based on any fundamental macroeconomic model. Forecasting inflation based on a number of sophisticated econometric models that link future and current macroeconomic developments can play a crucial role in providing some guidelines for the existing practice of forecasting in Bangladesh. Given the importance of forecasting inflation in Bangladesh, the current paper attempts to use quite a few forecasting models to forecast inflation along with some other macroeconomic variables in Bangladesh. This paper also makes a comparison of these forecasting techniques to see which suits better in forecasting inflation in Bangladesh.

2.   Model Variables and Methodology

Quarterly data during 1990:Q1–2006:Q4 on narrow money, broad money, total domestic credit (private plus public) and domestic credit to the private sector from the banking system, consumer price index, exchange rate and industrial production index or real GDP for Bangladesh have been used in the study. Depending on the various alternative combinations of the selected variables four different models have been used in forecasting inflation. The four alternative models are as follows:

> Model 1: Narrow money (m1), exchange rate (er), consumer price index (cpi) and industrial production index (ipi) or real GDP (y).

> Model 2: Broad money (m2), exchange rate (er), consumer price index (cpi) and industrial production index (ipi) or real GDP (y).

> Model 3: Private sector credit (pc), exchange rate (er), consumer price index (cpi) and industrial production index (ipi) or real GDP (y).

> Model 4: Domestic credit (dc), exchange rate (er), consumer price index (cpi) and industrial production index (ipi) or real GDP (y).

The literature on forecasting technique is one of the fastest growing areas in econometrics in terms of both volume and sophistication. Among the broad spectrum of forecasting techniques, the current study uses three techniques, such as Box-Jenkins's ARIMA model, Unrestricted Vector Autoregressions (UVARs) model and Hsiao's Final Prediction Error (FPE) criteria to forecast inflation in Bangladesh.

3.   Empirical Results

The forecasting models, as described above, require all variables to be identified properly so that all the residuals are white noise. A series of unit root tests, such as Augmented Dickey-Fuller (DF 1981), Phillips-Perron (PP 1988) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS 1992) are used to determine the order of integration (d) for each series. In

order to decide the autoregressive parameters (*p*) and moving average parameters (*q*), autocorrelation and partial autocorrelation functions are used. The lag lengths of the unrestricted VARs are decided based on Schwarz Information Criterion (SIC) criteria that are sufficient to make all residuals white noise. The identification results of each variable are reported in Table-1.

Table 1
The Results of Identification

Name of the Variable (all in natural logarithmic form)	Identified as ARIMA (*p, d, q*)
1. Narrow money (lm1)	lm1 = ARIMA(4,1,1)
2. Broad money (lm2)	lm2 = ARIMA(1,1,0)
3. Domestic credit to the private sector (lpc)	lpc = ARIMA(1,1,1)
4. Total domestic credit (private plus public) (ldc)	ldc = ARIMA(1,1,1)
5. Exchange rate (ler)	ler = ARIMA(1,1,0)
6. Consumer price index (lcpi)	lcpi = ARIMA(6,1,0)
7. Industrial production index (lipi)	lipi = ARIMA(3,1,0)
8. Real GDP (ly)	ly = ARIMA(3,1,3)

The Time Series Forecasting System (TSFS) provides a variety of tools for identifying potential forecasting models and for choosing the best fitting model. As a standard practice, in making the forecasting outcomes comparable among the various techniques, mean square error (MSE) as well as root mean square error (RMSE) are used as model selection criteria to identify the best performing technique in forecasting inflation and some other macroeconomic variables in Bangladesh. As reported in Table 2, various forecasting techniques are assigned to forecast various variables based on the lowest MSE and RMSE. It has been observed that the FPE produces best outcome for narrow money, domestic credit, industrial production index and for real GDP growth. While BJ technique generates best outcome for broad money and private sector credit, UVAR model produces best outcome for exchange rate and inflation.

Table 2
Best Technique Based on Minimum Means
Square Error (MSE) and Root Means Square Error (RMSE) for All Variables

Name of the Variable (all in natural logarithmic form)	Selected Technique	Reported Minimum	
		MSE	RMSE
1. Narrow money (lm1)	FPE with real GDP	0.0020	0.0445
2. Broad money (lm2)	BJ	0.0003	0.0177
3. Domestic private sector credit (lpc)	BJ	0.0006	0.0251
4. Total domestic credit (ldc)	FPE with real GDP	0.0001	0.0081
5. Exchange rate (ler)	UVAR with real GDP	0.0003	0.0172
6. Consumer price index (lcpi)	UVAR with real GDP	0.0001	0.0102
7. Industrial production index (lipi)	FPE with IPI	0.0027	0.0517
8. Real GDP (ly)	FPE with real GDP	0.0001	0.0010

It is worthwhile to discuss briefly the recent development of the selected macroeconomic variables before presenting the forecasted outcome. The uncertain political environment and the accompanying transport and other logistical disruptions during the first half of FY07 impacted on the overall economic activities. Given the lower-than-expected production in agriculture and normal growth in industry and services sectors, the overall output growth is likely be close to the bottom of the range of the earlier prediction of 6.6-7.1 percent by the PAU in FY07 as against 6.7 percent growth in FY06.[2] Monetary and price developments early in FY06 as well as pressure in the foreign exchange market in the latter half of FY06 prompted BB to continue with the tightening bias which had started in Q2 of FY05. Despite the cautious monetary policy stance, narrow money, broad money, total domestic credit and private sector credit registered an increase of 22 percent, 19.9 percent, 18.7 percent and 17.3 percent respectively in February 2007 over February 2006. Due to some supply side bottlenecks, recent adjustment in the oil prices and price hike in the international commodity market the rate of inflation on point to point basis increased to 7.28 percent in February from 5.94 percent in January 2007 reflecting an increase of 12 basis points in the annual average inflation (6.84 percent February 2007 from 6.72 percent in January 2007) during the period. In the backdrop of a healthy inflow of workers' remittances and exports earnings the exchange rate of Taka per US dollar declined to Tk. 68.81 at the end of March 2007 from Tk. 69.67 at the end of June 2006 indicating about 1.25 percent appreciation of Taka during the period.

Having considered all of the forecasting outcomes, it may noteworthy to mention that Hsiao's Final Prediction Error (FPE) Criteria is the best technique followed by Box-Jenkins's ARIMA model (BJ) and unrestricted VAR model in forecasting selected macroeconomic variables in Bangladesh. Based on the best outcome of all of the three forecasting techniques an attempt has been made to forecast inflation & exchange rate as well as annualized growth in real output, M1, M2, private sector credit, total domestic credit and industrial production index for FY07-FY08. Forecasted points estimates by making necessary adjustments based on the latest available information for the selected macroeconomic variables are reported in Table 3.

4.   Near-Term Outlook

The growth momentum evidenced over the last several years is expected to continue during FY07-FY08. While agricultural growth is expected to be slower, available data for manufacturing production and service sector indicators including financial, telecommunication, computer and internet, education and health care segments all point to robust overall growth for the economy in FY07. The sectoral output projections carried out in the latest *Monetary Policy Review* (Bangladesh Bank, October 2006) lead to an estimated GDP growth of 6.6 to 7.1 percent for FY07. In view of the slower growth of agriculture and a more modest decline in manufacturing, the overall real output growth for FY07 is predicted to be close to 6.5 percent, the bottom of the range predicted earlier. Overall GDP growth forecast for FY08, however, is expected to regain its momentum and expected grow at about 7.0 percent per annum. The industrial production index, on the other hand, is expected to grow at 12.48 percent, 11.76 percent and 11.92 percent respectively in June 2007, December 2007 and June 2008 as against actual growth of 15.70 percent in June 2006.

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[2] A 6.5 percent GDP growth for FY07 is also predicted by the BBS

Table 3

**Forecasted Point Estimates under Various
Techniques Based on Minimum MSE and RMSE**

| Name of the Variable	Selected Technique	Actual	Forecast		
		FY06	FY07	FY08	
		Q4	Q4	Q2	Q4
1. Real GDP Growth	FPE with real GDP	6.70	6.50	--	7.00
2. Exchange rate	UVAR with real GDP	69.67	69.90	72.14	74.26
3. Inflation	UVAR with real GDP	7.54	7.24	7.95	7.70
Annual Growth (in percent):					
4. Narrow money (m1)	FPE	21.32	16.62	17.98	19.33
5. Broad money (m2)	BJ	19.51	17.82	17.82	17.82
6. Private sector credit	BJ	18.27	16.11	16.11	16.11
7. Domestic credit	FPE with real GDP	20.45	16.79	16.77	17.06
8. Industrial production index	FPE with IPI	15.70	12.48	11.76	11.92

Notes
1. *All the point estimates are of end-of-period and adjusted based on the deviation from the last available actual data except real GDP growth.*
2. *The forecasted outcome as reported in the above table is a baseline scenario which is produced by various forecasting models given the fact that the tight monetary policy stance during FY05-FY06 will continue and there would be no policy changes in near future.*
3. *All of the above figures are generated through RATS Programming. Please consult RATS 'Programming Manual, 2003' by Walter Enders for more details.*

Figure 1: Real GDP Growth
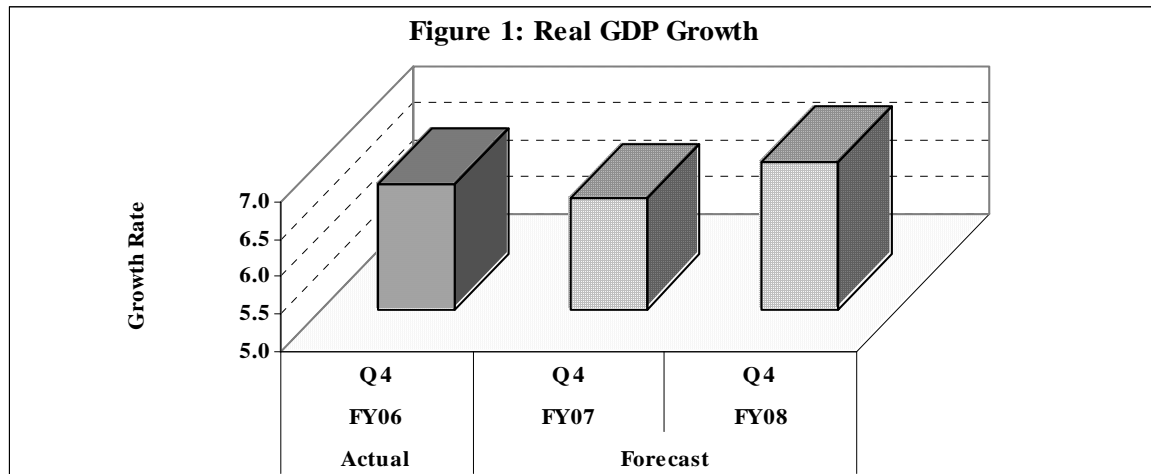
Because of the recent energy price adjustment, supply side bottlenecks and international commodity price hike the issue of projected inflation in Bangladesh for FY07 and FY08 is passing under active debate. The forecasted outcome for inflation of the current study indicate that the rate of inflation will be about 7.24 percent, 7.95 percent and 7.70 percent respectively in June 2007, December 2007 and June 2008 as against 7.54 percent in June 2006 which are substantially higher than the predicted inflation as shown in the medium term macroeconomic framework (Ministry of Finance, 2007). The predicted exchange

rate, on the other hand, will experience a depreciating pressure during forecast horizon (FY07-08) as the Taka-dollar exchange rates appear to be Taka 69.90 in June 2007, Taka 72.14 in December 2007 and Taka 74.26 percent in June 2008 respectively indicating about 6.2 percent depreciation over June 2006-June 2008.

Figure 2: Inflation

Figure 3: Exchange Rate
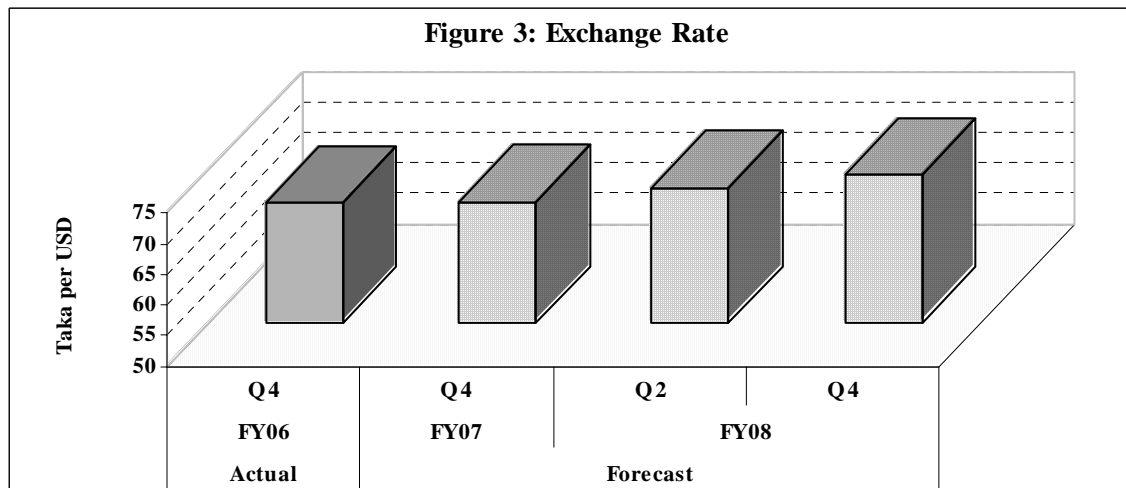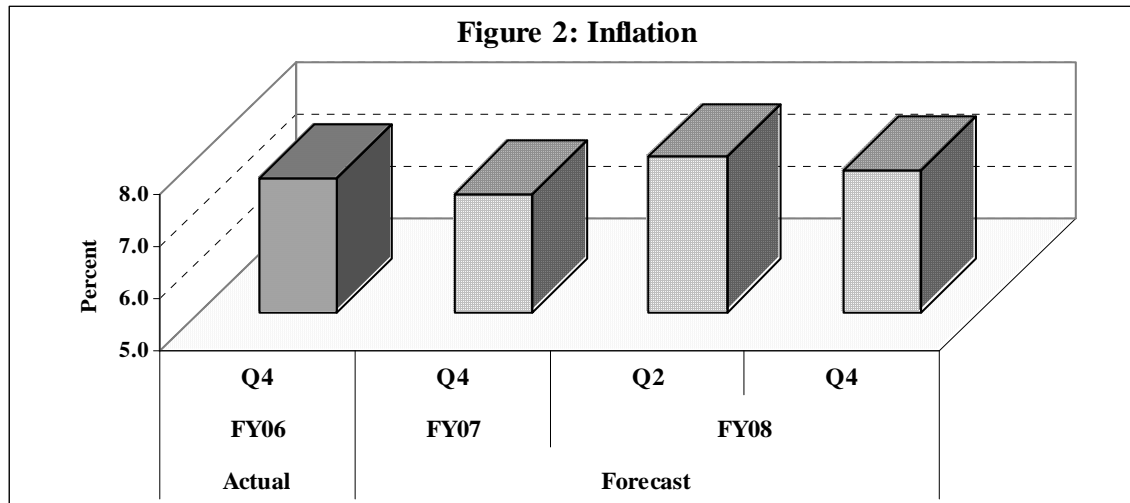
Monetary policy pursued by the BB aims at supporting the highest sustainable output growth while maintaining price stability, adjusting smoothly to the internal and external shocks faced by the economy from time to time. Repo, reverse repo rates, among others, are the routinely employed policy instruments for influencing financial and real sector prices towards the targeted path for inflation. Cash Reserve Ratio (CRR) and Statutory Liquidity Ratio (SLR) for banks are less frequently used instruments that directly influence available volumes of credit. Annual monetary programs based on the projected real GDP growth and targeted inflation rate employ Reserve Money (RM) and Broad Money (M2) as intermediate targets, while also tracking other asset and liability side sub-aggregates. On year-on-year basis, disbursements of total domestic credit as well as credit to private sector from the banking system also registered an increase of around 20 percent which reflected high credit demand from the public as well as private sectors. Given the tightened policy stance of the monetary authority, narrow money, broad money, total domestic credit and credit to the private sector are projected to grow by 16.62 percent,

17.82 percent, 16.79 percent and 16.11 percent respectively in June 2007 and respectively 19.33 percent, 17.82 percent, 17.06 percent and 16.11 percent in June 2008 as against the actual growth of 21.32 percent, 19.51 percent, 20.45 percent and 18.27 percent respectively in June 2006 (Table 5).

5.   Concluding Remarks

Econometric forecasting models usually comprise systems of relationships between variables of interest where the relations are estimated from available data, mainly aggregate time-series. In practice, it has been observed, however, that reasonably good forecasts can be made with simple rules of thumb that are extrapolations of a single data series. Including too many variables makes a model unwieldy, while not including enough can increase forecast error. Keeping this in mind the current paper has attempted to use quite a few forecasting models namely Box-Jenkins's ARIMA model, unrestricted Vector Autoregression (VAR) model and Hsiao's Final Prediction Error (FPE) criteria to inflation along with some other related macroeconomic variables in Bangladesh using quarterly data during 1990:1-2006:4. While UVAR produces best forecasted outcome for inflation and exchange rate, ARIMA (BJ) model produces best forecast for broad money and private sector credit based on the lowest MSE and RMSE. Among the three forecasting techniques, the FPE criteria appears to be appropriate for real GDP, industrial production index, narrow money and domestic credit forecasting. Based on the best technique, the point estimates for selected variables indicate that real GDP growth will be 6.5 percent and 7.0 percent respectively in FY07 and FY08. According to the forecasted estimates of the current study, on the other hand, inflation is expected to be 7.24 percent, 7.95 percent and 7.70 percent respectively in June 2007, December 2007 and in June 2008. Given the current and expected international as well as domestic inflationary pressure BB's current tight monetary policy stance needs to be continued.

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