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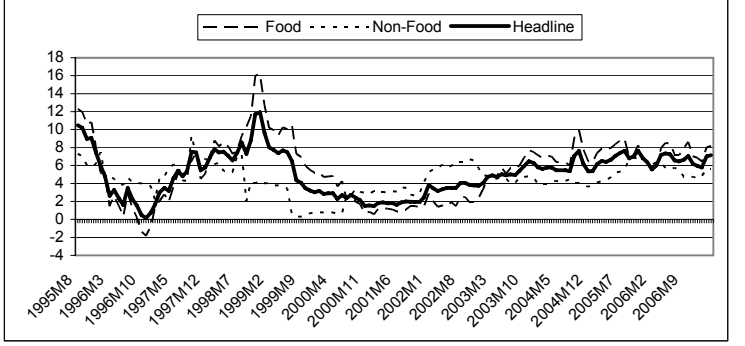
II. Inflation Dynamics in Bangladesh[1]

A. Introduction

1. **Inflation in Bangladesh has been contained at moderate levels during the past eight years, but has been on an increasing trend since 2001.** From the late-1990s, the inflation rate (as defined by y-o-y percentage change in the CPI) has been at single digit levels, reaching a low of 1.5 percent in January 2001. Since then, Bangladesh has experienced an increase in inflationary pressures. The inflation rate increased from 1.9 percent in 2001 to 5.4 percent in 2003 and was 7.2 percent as of March 2007. Since abandoning the peg of the taka to the U.S. dollar and adopting a managed float exchange rate regime in 2003, food prices (which are heavily influenced by international prices and have a weight of 54 percent in the overall CPI in Bangladesh) have increased moderately, and nonfood price inflation has been consistently lower than food price inflation (Figure 1).

Figure 1. Bangladesh: Main Components of Inflation, August 1996–March 2007, (Y-O-Y percentage change in CPI) 1/



Source: Fund staff estimates.
1/ Monthly data

2. **Inflation inertia and monetary factors, as well as the exchange rate, are important determinants of inflation in Bangladesh.** Some observers have emphasized supply-side shocks, such as shortages of domestic food production, and global external shocks (mainly higher oil prices) as the major causes of inflation in Bangladesh. However, this paper will show that monetary factors and inflation inertia have also played important roles. Among supply-side factors, only the exchange rate is found to be significant in explaining inflation in Bangladesh.

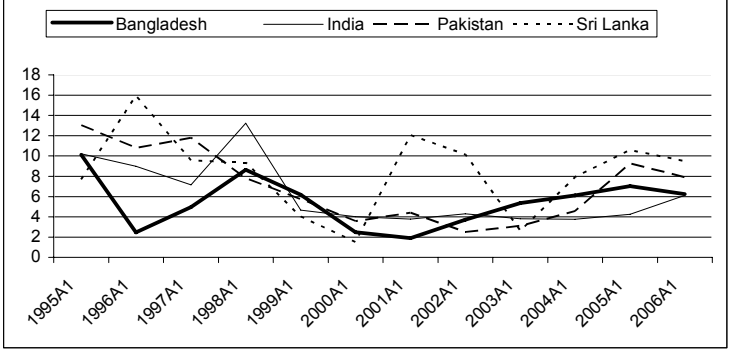
3. **Inflation causes unfavorable effects on poverty and growth.** Inflation is a regressive tax with an adverse impact on the poor since they do not have access to financial assets to hedge against inflation risks. Inflation can also hurt growth once it exceeds a certain threshold. Khan and Senhadji (2001) estimate this threshold to be 7–11 percent for developing countries. This is noteworthy for Bangladesh, where inflation has recently surpassed 7 percent.

[1] Prepared by Ali Alichi (FIN). Definitions and sources of the data are not reported, but are available upon request from the author.

B. Regional/Global Comparisons

4. **Inflation in Bangladesh in recent years has been higher than its main trading partners (India and the United States), but not so high by overall regional standards** (Figures 2, 3, and Table 1). The average (y-o-y) monthly inflation rate in Bangladesh during 2003–06 has been 5.3 percent. This is higher than inflation rates in India and the United States, almost the same as in Pakistan, but smaller than in Sri Lanka for the same period. Looking more broadly, inflation in Bangladesh has been more than 2 percentage points higher than the averages for the Asian region and the world.

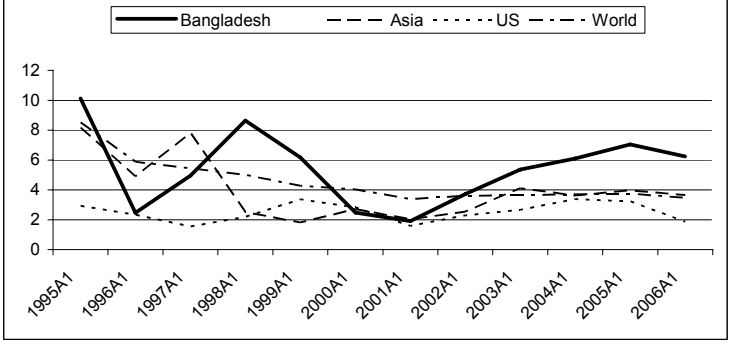
Figure 2. Bangladesh and Neighbors: Inflation, 1995–2006, (In percentage change in CPI) 1/



Source: WEO.
1/ Annual data.

5. **Volatility and persistence of inflation in Bangladesh have been higher than in India, but lower than in Sri Lanka, while Bangladesh and Pakistan on average have similar inflation dynamics** (Table 1). This is consistent with findings in the literature that as inflation increases, its volatility (standard deviation) also increases.

Figure 3. Bangladesh, Asia and United States: Inflation, 1995–2006, (In percentage change in CPI) 1/



Source: WEO.
1/ Annual data.

Table 1. Bangladesh and Neighbors: Inflation Statistics, January 2003–February 2007 1/

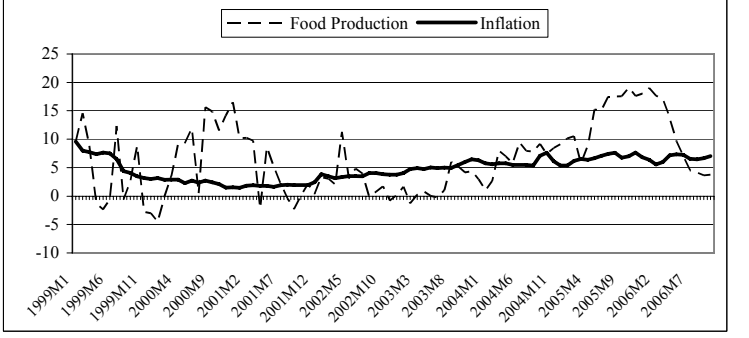
Country	Mean	Median	Maximum	Minimum	Standard Deviation
Bangladesh	5.3	5.6	10.1	1.1	2.5
India	4.4	4.2	7.3	2.2	1.1
Pakistan	5.3	4.7	11.1	1.4	2.8
Sri Lanka	9.5	10.7	19.8	0.5	4.3

Source: *IFS*.
1/ Inflation is calculated as y-o-y monthly percentage change in CPI.

C. Supply Shocks and Inflation

6. **Fluctuations in food production, including those due to natural disasters, have not heavily influenced inflation in Bangladesh** (Figure 4). A likely explanation for this finding is that domestic food production always falls considerably short of demand in Bangladesh. Therefore, food prices are determined mostly by international prices, rather than domestic production.

Figure 4. Bangladesh: Food Prod. and Inflation, January 1999–December 2006, (y-o-y percentage change in food prod. and CPI) 1/



7. **There is a close association between exchange rate fluctuations and inflation, but little short-term impact of changes in oil prices on inflation** (Figures 5–6). Since the adoption of a managed float exchange rate regime in 2003, any depreciation (appreciation) of the exchange rate has been associated with a pickup (decrease) in inflation. However, inflation has changed in line with oil price changes only over the medium term presumably because the government has not always passed through international oil price changes to the domestic economy in a timely fashion, as was the case over the last two years.

Figure 5. Bangladesh: Inflation and International Oil Price, January 1999– January 2007
(y-o-y percentage change in oil price and CPI) 1/

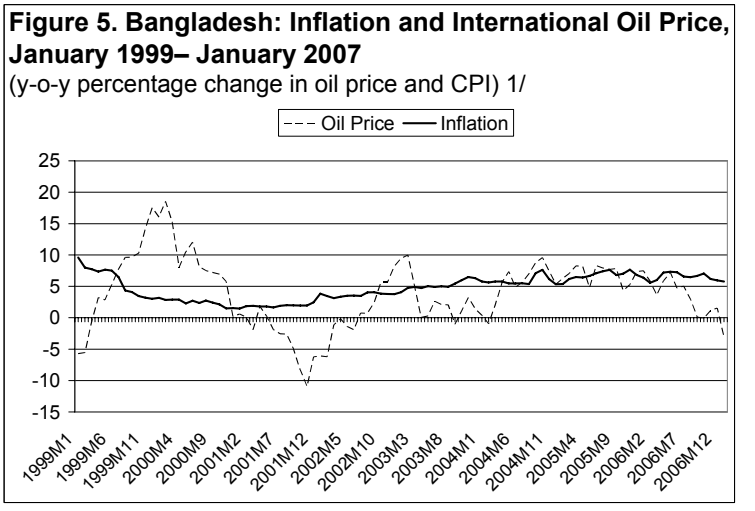
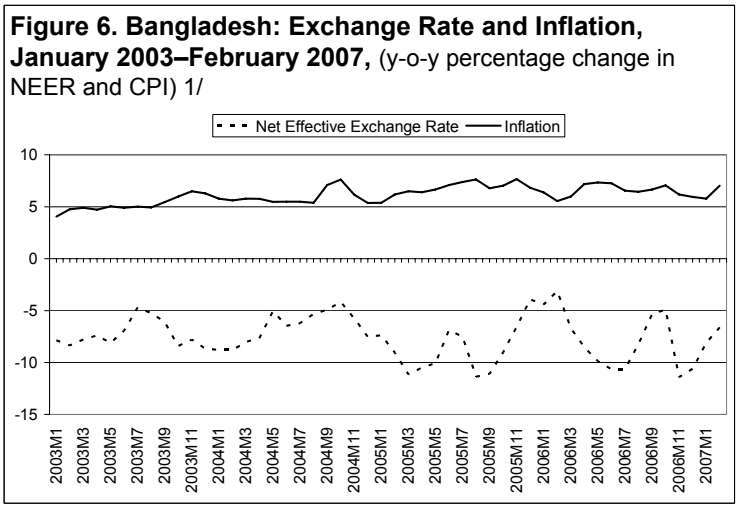
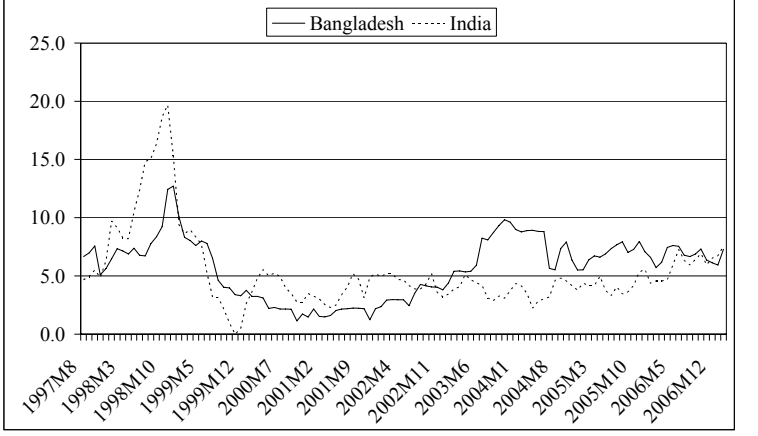


Figure 6. Bangladesh: Exchange Rate and Inflation, January 2003–February 2007, (y-o-y percentage change in NEER and CPI) 1/



8. **India's inflation can influence Bangladesh's inflation through trade and financial transactions.** The past episodes of rising inflation in India have usually been followed by periods of rising inflation in Bangladesh with a lag of one–two months (Figure 7). India had a stable inflation rate of around 4 percent during much of the past few years. However, inflation in India has increased, with the current rate above 6 percent.

Figure 7. Bangladesh and India: Inflation, August 1998–February 2007 (y-o-y percentage change in CPI) 1/



D. Data, Model, and Estimation Methodology

9. **Table 2 shows the correlation matrix for the Bangladesh data used in this paper.** Monthly data are used to capture variations of inflation more accurately. As expected, private sector credit and the oil price are positively, and NEER negatively, correlated with the CPI. However, inflation and broad money growth (surprisingly) appear to be negatively correlated. This negative correlation only occurs prior to 2001 during the fixed exchange rate regime. The January 2001 to December 2006 subsample of inflation and broad money are positively correlated.

Table 2. Bangladesh: Correlation Matrix: Inflation and Selected Variables, January 1999–December 2006 1/

	Inflation (CPI)	Private Sector Credit 1/	Broad Money 1/	NEER	Food Production	Oil Price
Inflation (CPI)	1					
Private sector credit 2/	0.32	1				
Broad money 2/	-0.27	0.12	1			
Broad money 2/ 3/	0.32	0.57	1	-0.11	0.27	0.19
NEER	-0.75	-0.23	0.28	1		
Food production	0.41	-0.22	-0.33	-0.12	1	
Oil price	0.29	-0.11	-0.68	-0.12	0.43	1

Sources: Data sources are explained in the appendix.
1/ All variables are in y-o-y monthly percentage change.
2/ Lagged 12 months.
3/ January 2001–December 2006.

10. **The model estimated is, essentially, the quantity equation of money in differences, assuming constant velocity**, as follows:

$$\dot{P} = \dot{M} - \dot{Y}$$

Where, $\dot{P}$ is the inflation rate, $\dot{M}$ is the growth rate of money, and $\dot{Y}$ is the output growth.[2] Assume output growth is only due to supply and demand shocks in the short run:

$$\dot{Y} = \alpha_1 \dot{M} + \alpha_2 \dot{S}$$

Where, $\dot{S}$ is the growth rate of supply-side factors (including the exchange rate), and α_1 and α_2 are the (vector) coefficients. The model will be derived by plugging output growth into the quantity equation above, and taking lagged-inflation to the right hand side:

$$\dot{P}_t = \beta_1 \dot{M} + \beta_2 \dot{S} + \beta_3 \dot{P}_{t-1}$$

Where, $\dot{P}_{t-1}$ is lagged inflation and β_1, β_2, and β_3 are the coefficients to be estimated.

The estimation method is Ordinary Least Squares (OLS) in differences. The dependent variable is the inflation rate (percentage change in CPI), and explanatory variables include growth rates of monetary factors (broad money and private sector credit), the exchange rate, domestic food production, and international oil prices.

E. Results

11. **Regression results (Table 3) suggest that inertia, demand shocks, and exchange rate changes are determinants of inflation in Bangladesh.**[3] Similar to other countries, inflation inertia is found to be a significant component. Regression coefficients for the other factors (e.g., 0.02 for private sector credit in Model 1) are smaller than those of inertia. However, they have compounded effects on inflation by influencing expectations.

- **Models 1 and 3 represent the best specification.** They show that the current month's inflation rate is the most powerful determinant of the next month's (coefficient = 0.87). A month's inflation contains the influence of all previous months' shocks, which form inertia for the following month. They also show that a depreciation of the exchange rate increases the inflation rate, and that money and credit aggregates are found to be a significant determinant of inflation.

[2] A variable without time index is a vector, which includes a scalar variable, as well as its relevant lags—for example, $\dot{P}$ is the vector of inflation that includes inflation ($\dot{P}_t$) and lagged inflation ($\dot{P}_{t-1}$).

[3] In the previous section, Pakistan was found to be a close inflation comparator for Bangladesh. Recently, Khan and Schimmelpfennig (2006) have found that monetary factors have been the dominant driving force of inflation in Pakistan.

Table 3. Bangladesh: Inflation Determinants 1/

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Inflation 2/	0.87 *		0.87 *		0.87 *	0.85 *	0.86 *
	-0.04		-0.04		-0.04	-0.04	-0.04
Private sector credit 2/	0.02 *				0.02 *	0.02 *	0.016
	-0.01				-0.01	-0.01	-0.011
Private sector credit 3/		0.15 *					
		-0.02					
Broad money 2/			0.02 *				
			-0.01				
Broad money 3/				0.11 *			
				-0.02			
NEER	-0.06 *	-0.46 *	-0.07 *	-0.53 *	-0.06 *	-0.06 *	-0.06 *
	-0.03	-0.05	-0.03	-0.05	-0.03	-0.03	-0.03
Food production /2						0.02 *	0.02 *
						-0.01	-0.01
Oil price					-0.001		-0.002
					-0.002		-0.002
Adjusted R-squared	0.99	0.94	0.99	0.93	0.99	0.99	0.99
Durbin-Watson Statistic	1.49	0.41	1.49	0.44	1.49	1.52	1.54
Observations	93	82	93	82	93	93	93

1/ The dependent variable is inflation. All variables are in y-o-y monthly percentage change for January 1999 to December 2006. Values under each coefficient are standard deviations. Signifance at 95 percent confidence interval is indicated with *.
2/ Lagged one month.
3/ Lagged 12 months.

- **Models 2 and 4 are provided for comparison with some other contributions in the literature.** Specification of these models has two differences with Models 1 and 3. First, the inflation lag is among the explanatory variables in Models 1 and 3, but not in Models 2 and 4. Second, monetary factors are with a lag of one month in Models 1 and 3, but with a lag of 12 months in Models 1 and 4. As evidenced by the Durbin-Watson statistics, Models 2 and 4 suffer from nonstationarity, and are, therefore, mis-specified.

- **Models 5, 6, and 7 add domestic food production and international oil price shocks to the list of explanatory variables**. However, none of these variables turn out to be explaining inflation. Food production coefficients have the wrong sign (positive). This is perhaps because Bangladesh is an open economy that relies on food imports, which implies food prices in Bangladesh are determined internationally, rather than by domestic demand and supply. Oil price coefficients are not significant.

F. Conclusion

12. **The empirical results presented in this paper show that inflation inertia, monetary factors, and exchange rate fluctuations are the main determinants of inflation in Bangladesh.** Broad money growth and private sector credit growth explain inflation with a lag of up to 12 months. Exchange rate changes also impact inflation. In contrast, domestic food production and international oil price changes are not shown to have a significant impact.

13. **Given that inflation has increased already to above 7 percent, these results point to the need for the central bank to employ a more contractionary monetary policy**. Broad money and private sector credit have grown by more than 16 percent, annually, since 2006. The model's results indicate that tightening broad money or private credit in one month will cause lower inflation starting the next month, and up to 12 months later.