

# **The Monetary Transmission Mechanism in Bangladesh: Bank Lending and Exchange Rate Channels**

*by*

SHAMIM AHMED\*  
MD EZAZUL ISLAM

In view of changes in legal, institutional and policy frameworks in the financial system of Bangladesh under the Financial Sector Reform Programme initiated in the early 1990s, the paper attempted to empirically investigate whether *bank lending* and *exchange rate channels* exist in the economy through which monetary policy changes can influence aggregate output and prices. An assessment of the empirical evidence has been established through the unrestricted vector autoregressions (VARs) approach using quarterly data for the period of July-September 1979 to April-June 2005. The results of the empirical analysis suggest *weak* existence of both *bank lending* and *exchange rate channels* in the Bangladesh economy for the full-sample period as well as in the sub-sample period (i.e., January-March 1990 to April-June 2005). These findings have important implications with respect to the operation of monetary policy. Specifically, knowing the distinct active channels of monetary transmission in the economy would guide the monetary authority in formulating and conducting monetary policy pursuant to its objectives under the current regime, i.e., floating exchange rate and market based monetary policy instruments.

## **I. INTRODUCTION**

The monetary transmission mechanism, a complex but interesting area, has drawn considerable attention of macroeconomists and central bankers all over the world in the last few decades. In particular, the determination of different channels through which money supply changes affect aggregate output and prices still remains a *black box* due to continuous monetary innovations as well as financial market integrations

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\* Research Economists, Policy Analysis Unit, Research Department, Bangladesh Bank. The authors would like to thank World Bank Institute Resident Economic Adviser at the Bangladesh Bank Professor Syed M. Ahsan for his helpful suggestions and comments. All the errors and views expressed in this paper are authors' own.

(Bernanke and Gertler 1995).<sup>1</sup> In a well-functioning economy, generally the transmission process begins either with open market operations (OMOs) or interest rates engineered through the demand-supply interactions of money, and finally, transmission proceeds through any of the several active channels (Kuttner and Mosser 2002). In this connection, it is important to mention that any model or theory of transmission mechanism assumes the existence of some degree of friction in the economy so that nominal prices cannot adjust immediately and proportionally following changes in the monetary base of the economy (Ireland 2005). Besides, the channels of monetary transmission are not mutually exclusive, i.e., the overall response of the economy to a monetary policy action integrates the influence of a variety of channels (Kuttner and Mosser 2002).

To date, extensive empirical research has been conducted in the search for the presence of various channels of monetary transmission through which monetary policy changes are propagated in an economy both in the context of developed (e.g. Mishkin (1977), Ramey (1993), Bernanke and Blinder (1988,1992), Bernanke and Gertler (1995), Meltzer (1995), and Taylor (1995)) and developing (e.g. Montiel (1991) and Disyatat and Vongsinsirikul (2003)) economies. But there have been very few empirical studies that attempted to investigate the existence of one or more channels of monetary transmission in Bangladesh. Younus (2004) has attempted to explore whether *bank lending channel* exists in the economy. Using quarterly data for the period between January-March 1975 and October-December 2000 and employing vector autoregressions (VARs) approaches (i.e., structural and recursive VARs), the paper finds that the *bank lending channel* is non-existent in Bangladesh.

Following the work of Younus (2004), the objective of the paper is to empirically investigate whether *bank lending* and *exchange rate channels* exist in Bangladesh.<sup>2</sup> This is timely and important due to several reasons. First, although a considerable number of years have elapsed since independence, the distinct channels of monetary transmission through which aggregate output and prices could be influenced in the

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<sup>1</sup> The different channels include the traditional (i.e., *Keynesian*) interest rate channel, the credit channel (i.e., bank lending, balance sheet, cash flow, unanticipated price level, and household balance sheet channels), the exchange rate channel, and the asset price channel (i.e., equity price, wealth, housing and land price channels). For an elaboration, see Mishkin (1995, 1996, and 2004, pp. 617-625).

<sup>2</sup> Apart from the period of data coverage, the empirical estimation of the present paper regarding the existence of *bank lending channel* differs from Younus (2004) since the paper has used quarterly data on real GDP instead of quantum industrial production index. Besides, the paper only explores the existence of *bank lending* and *exchange rate channels* in Bangladesh due to non-availability of appropriate data for other channels (if any exists) of monetary transmission.

economy are still not well-identified. Second, there have been significant changes in the legal, institutional and policy frameworks of the financial system of Bangladesh under the Financial Sector Reform Programme (FSRP) of the 1990s. These changes enable Bangladesh Bank (BB) to conduct monetary policy on the basis of market based instruments along with direct instruments in order to achieve price stability and smooth financial intermediation. Therefore, knowing the distinct active channels of monetary transmission in the Bangladesh economy would guide the monetary authority in formulating and conducting monetary policy.

The empirical analysis in the paper has been conducted by unrestricted vector autoregressions (VARs) approach using quarterly data for the period of July-September 1979 to April-June 2005. In particular, the paper examines the existence of *bank lending* and *exchange rate channels* separately for two periods: (i) July-September 1979 to April-June 2005 (i.e., full-sample period) and (ii) January-March 1990 to April-June 2005 (i.e., sub-sample period). The latter estimation is of interest since the FSRP began in the early 1990s and most of the reforms were fully in effect only from the late 1990s and the early 2000s. The results of the empirical analysis suggest *weak* existence of both *bank lending* and *exchange rate channels* in the economy for the full-sample period. Alongside, both of these channels also exist *weakly* in the sub-sample period even though the country adopted the FSRP in the 1990s. These results have important implications for the conduct of monetary policy in the economy.

The remainder of the paper is organised as follows: Section II briefly discusses the financial system, the monetary policy framework, and the behaviour of selected economic indicators in Bangladesh. Section III discusses the theory of *bank lending* and *exchange rate channels*, the respective unrestricted VAR models, and methodology used for empirical analysis presented in the paper. Section IV provides data specification and estimated results, and finally, section V presents a summary of the main conclusions and policy implications.

## II. FINANCIAL SYSTEM, MONETARY POLICY FRAMEWORK, AND MOVEMENTS IN MACROECONOMIC INDICATORS IN BANGLADESH

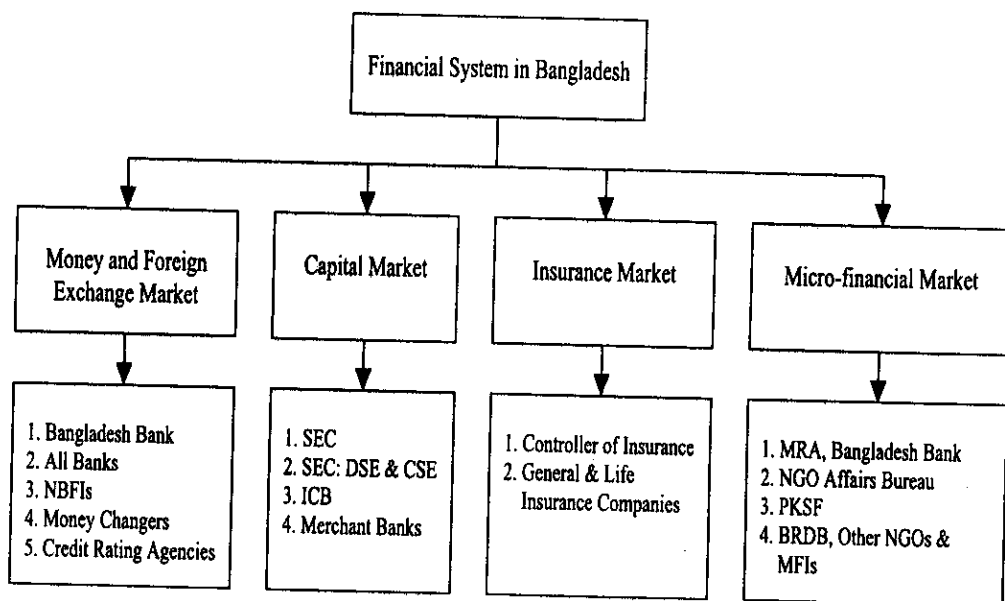
### II.1 The Financial System in Bangladesh<sup>3</sup>

In Bangladesh, the financial system comprises of BB as the central bank, 4 nationalised commercial banks (NCBs), 5 government owned specialised banks (SBs), 30 domestic private commercial banks (PCBs) including 6 Islamic banks (IBs), 9 foreign banks (FCBs), 28 non-bank financial institutions (NBFIs), and a large number of micro-finance institutions (e.g. Bangladesh Rural Advancement Committee (BRAC), *Grameen Bank*, *Proshika*, and *Association of Social Advancement (ASA)*) and 62 insurance companies (e.g. *Jiban Bima Corporation*, *Shadharan Bima Corporation*, and *American Life Insurance Company (Alico)*). In addition, the financial system also includes 2 stock exchanges (i.e., Dhaka and Chittagong Stock Exchanges (DSE & CSE)) under the Securities and Exchange Commission (SEC) and a number of co-operative banks as well as credit rating agencies. Out of the 5 SBs, *Bangladesh Krishi Bank (BKB)* and *Rajshahi Krishi Unnayan Bank (RAKUB)* have been launched in order to meet the credit demands of the agricultural sector, while *Bangladesh Shilpa Bank (BSB)* and *Bangladesh Shilpa Rin Sangtha (BSRS)* extend term loans to the industrial sector. Finally, *Bangladesh Small Industries and Commerce (BASIS)* Bank Limited provides loans to the small-scale and cottage industries of the economy. Figure 1 presents these financial market participants in a schematic way.

In the financial system, money market still plays a dominant role since the lion's share in credit demand by borrowers/entrepreneurs in the economy is being met by this market. For instance, industrial term loans disbursed by scheduled banks and NBFIs stood at BDT 96.5 billion in FY2006. Along with a dominant money market, the capital market is also growing over time, although still narrow based compared to many South East Asian countries (e.g. South Korea, Malaysia, Indonesia, Thailand, and India). But the bond market is virtually absent in the financial system of the country. On the other hand, a large number of unregulated micro-finance institutions are actively providing credit and related services to small and medium enterprises (SMEs). These major features of the financial system support the possible existence of the *bank lending channel* of monetary transmission in Bangladesh.

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<sup>3</sup> This section draws heavily from Ahmed and Islam (2004). Besides, all the information provided in this section regarding the number of institutions in the financial system are as of 31<sup>st</sup> December 2005.

Figure 1: The Financial System in Bangladesh<sup>4</sup>

**Note:** BRDB: Bangladesh Rural Development Board, ICB: Investment Corporation of Bangladesh, MRA: Micro-finance Regulatory Authority, NGO: Non-Government Organisation, MFI: Micro-finance Institution, and PKSf: Palli Karma-Sahayak Foundation.

Table I reveals that PCBs (including IBs) dominate the banking system in terms of total deposits by holding 46.47 per cent at the end of December 2005.<sup>5</sup> Although NCBs' share in total deposits has been dominant since the 1970s, it has been declining continuously in recent years. Even as late as December 2002, NCBs held 50.32 per cent of total deposits. Moreover, if credit (i.e., sum of advances and bills) of individual bank groups as a share of total credit is considered, it can be observed that PCBs (including IBs) have the highest share, 54.11 per cent, at the end of December 2005. Again, it is notable that although NCBs' share of total credit has declined in recent years, it had the highest share of more than 40 per cent at the end of September 2003. This demonstrates increasing domination of PCBs (including IBs) in the financial market of Bangladesh.

<sup>4</sup> Adapted from *Financial Sector Review* (May 2006, p.1)

<sup>5</sup> The scheduled banking system governed by BB is a major segment of the financial system which comprises of NCBs, SBs, PCBs (including IBs), and FCBs.

TABLE 1  
POSITION OF DEPOSITS AND CREDITS IN THE BANKING SYSTEM

Bank Groups	Deposits	% of Total Deposits	Credits (Advances & Bills)	% of Total Credits	Credit-Deposit Ratio
NCBs	627.74	40.52	493.67	32.91	0.79
SBs	92.41	5.97	111.55	7.44	1.21
PCBs	719.83	46.47	811.79	54.11	1.13
FCBs	109.09	7.04	83.15	5.54	0.76
Total	1549.06	100.00	1500.16	100.00	0.97

**Notes:** 1. All figures regarding deposits and credits are in billion BDT (outstanding amounts at the end of December 2005).

2. PCBs also include IBs.

**Source:** Banking Statistics Division, Statistics Department, BB and authors' calculation.

## II.2 The Monetary Policy Framework in Bangladesh

### II.2.1 Background

After independence, BB, the central bank of the country, was established by the Bangladesh Bank Order of 1972 (Presidential Order No. 127 of 1972) with effect from 16<sup>th</sup> December of 1971. The founding charter identified price, exchange rate and financial system stability as the main objectives of BB as the monetary authority. Since then, to achieve these objectives, among others, BB conducted monetary policy under a fixed exchange rate regime on the basis of direct instruments (i.e., bank rate, cash reserve requirement (CRR), and statutory liquidity ratio (SLR)) as well as quantitative monetary control to some extent (i.e., the volume of credit, margin on letters of credit (L/C), and refinancing facility). Besides, BB also determined interest rates, particularly lending and deposit rates offered by scheduled banks to both depositors and borrowers in the economy.

<sup>6</sup> According to the original charter of 1972, the broad objectives of BB were: (i) to regulate the issue of the currency and keeping of reserves; (ii) to manage the monetary and credit system of Bangladesh with a view to stabilising domestic monetary value; (iii) to preserve the par value of the Bangladesh Taka (BDT); (d) to promote and maintain a high level of production, employment and real income in Bangladesh; and (e) to foster growth and development of the country's productive resources for the national interest.

Starting in the early 1990s, there have been significant changes in legal, institutional and policy frameworks under the FSRP. In particular, there have been major changes regarding interest rate liberalisations (i.e., lending and deposit rates have been gradually freed from restrictions), development of money market instruments (i.e., introduction of *repo* in 2002 and *reverse repo* in 2003), OMO by various government treasury bills (TBs) auction (e.g. 28-day, 91-day, 182-day, 364-day, 2-year, and 5-year), adoption of floating exchange rate (on 31<sup>st</sup> May 2003), etc.<sup>7</sup> Consequently, these changes allow BB to conduct monetary policy relying on market based instruments along with direct instruments. It is important to mention that although BB is currently conducting monetary policy under the floating exchange rate, the amended Bangladesh Bank Order of 2003 allows room for BB to bring about any necessary adjustment in the foreign exchange market in an orderly fashion.<sup>8</sup>

## II.2.2 The Monetary Programming<sup>9</sup>

The framework of monetary programming followed by BB is quite intuitive and simplistic. The programming exercise involves the estimation of the *required limit* (also known as *safe limit*) of monetary expansion (i.e., broad money) on the demand side based on the growth estimates of GDP, consumer price index (CPI) and income velocity of money demand.<sup>10</sup> In particular, BB Programmes the *safe limit* of monetary expansion, broad money (M2), derived from the classical quantity equation of money demand, i.e.,  $\hat{M} = \hat{Y} + \hat{P} - \hat{V}$ , where  $\hat{M}$ ,  $\hat{Y}$ ,  $\hat{P}$ , and  $\hat{V}$  are the growth rates of money demand, anticipated real output, expected inflation rate and income velocity of money respectively.

<sup>7</sup> In addition to different government treasury bills for OMOs, BB on 21<sup>st</sup> September 2006 re-introduced its own 30-day and 91-day bills.

<sup>8</sup> The amended charter of 2003 mandates BB to: (i) formulate and implement monetary policy; (ii) formulate and implement intervention policies in the foreign exchange market; (iii) give advice to the Government on the interaction of monetary policy with fiscal and exchange rate policy, on the impact of various policy measures on the economy and to propose legislative measures it considers necessary or appropriate to attain its objectives and perform its functions; (iv) to hold and manage the official foreign reserves of Bangladesh; (v) promote, regulate and ensure a secure and efficient payment system including the issue of bank notes; and (vi) to regulate and supervise banking companies and financial institutions.

<sup>9</sup> This section draws heavily from *Monetary Policy Review* (October 2005, pp. 20-21).

<sup>10</sup> Previously, BB used income elasticity of demand for money approach to estimate the *safe limit* of monetary expansion. In particular, BB used the relationship  $\epsilon = \hat{M} / \hat{Y}$  for deriving the point estimates of  $\epsilon$  where  $\hat{M}$  and  $\hat{Y}$  are the growth rates of nominal money demand and nominal income respectively (Taslim 2001).

Having determined the *safe limit* of monetary expansion, BB attempts to clear the money market by changing the nominal stock of money (M2) in the economy by an equivalent amount on the supply side (Taslim 2001). The simple relationship between broad money (M2) and reserve money (RM) allows the latter to be used as an *operating target* to reach the *intermediate target*, i.e., broad money (M2) via the money multiplier (MM). This is done on the basis of the equation,

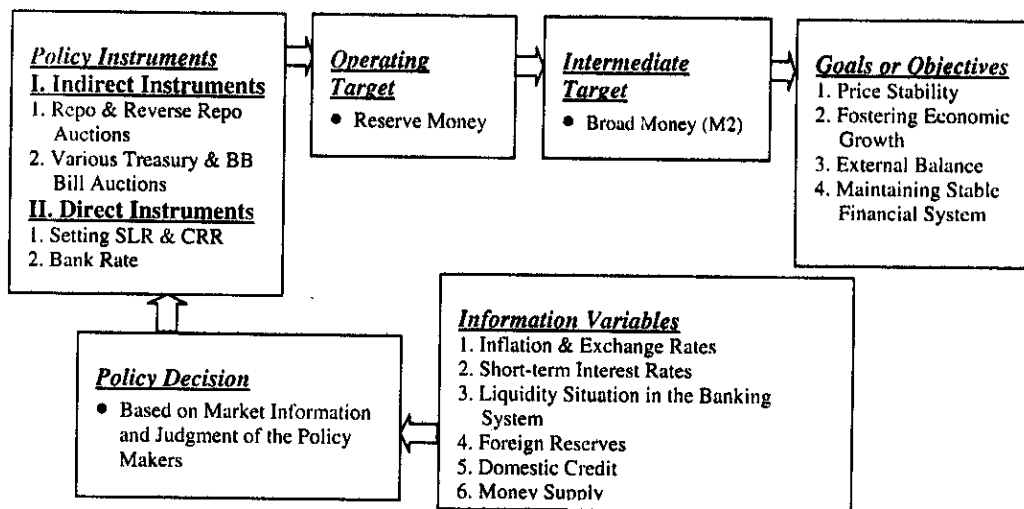
$M^s = \beta H$  where  $M^s$ ,  $H$ , and  $\beta$  are the nominal stock of money, monetary liabilities of BB or high powered money, and the money multiplier, i.e., M2, RM and MM respectively in the case of Bangladesh.<sup>11</sup> Figure 2 provides a simple schematic illustration of the monetary policy framework of BB.

Since BB does not have direct control over money supply, in order to reach its estimated *intermediate target* M2, it influences money supply by using a set of both direct and indirect instruments. In particular, M2 is influenced indirectly by changes in direct and indirect policy instruments that target and monitor RM via MM. The primary mechanism engaged in this purpose is the direct control of liquidity on a day-to-day basis achieved by the *repo* (repurchase agreement), *reverse repo* and the weekly TBs auctions. These indirect instruments would in turn have an impact on the inter-bank call money rate for overnight money market transactions.<sup>12</sup> While adjusting the excess liquidity in the banking system, BB also asserts its monetary policy stance by simultaneously re-setting the *repo* and *reverse repo* rates on a regular basis. Besides, BB also infrequently uses CRR and SLR to influence money supply. Conversely, in recent years, the traditional bank rate, i.e., the rate at which BB stands ready to lend to the scheduled banks, has not been effective in signalling the monetary stance via the adjustment of the deposit and borrowing rates in the banking system.

<sup>11</sup> The MM can be defined as  $\beta = [(1 + c) / \{c + d(rr + er)\}]$  where  $c$ ,  $d$ ,  $rr$ , and  $er$  are currency-money, deposit-money, required reserve, and excess reserve ratios, respectively. An estimate of MM determines the change in RM necessary to clear the money market (Taslim 2001).

<sup>12</sup> Through *repo* operation, a bank or financial institution is able to borrow funds from BB by selling its securities for an agreed time period and after that it will re-purchase those securities from BB. Conversely, the *reverse repo* facility enables participating institutions to purchase government securities from BB with a pre-commitment of selling those back to BB upon maturity. Therefore, *repo* injects money in the monetary system, while *reverse repo* does the opposite. Besides, auctioning off new TBs leads to withdrawal of liquidity, while maturity of TBs leads to injection of liquidity in the system.



Figure 2: Monetary Policy Framework of Bangladesh Bank<sup>13</sup>

### II.3 Behaviour of Selected Economic Indicators

The Bangladesh economy experienced robust economic growth in the beginning of the early 1990s marking a departure from the *weak* macro-economic performance of the 1970s as well as the early 1980s. The country has experienced steady economic growth of 5.44 per cent on average during the first-half of the 2000s in comparison to 2.82 per cent in the 1970s, and 3.72 per cent and 4.26 per cent during the first and second halves of the 1980s, respectively (Table II). Alongside, there was a modest rate of inflation throughout the 1990s compared to both 1980s and 1970s, indicating price stability in the economy. In the first-half of the 1990s, inflation was on average 5.55 per cent, although the rate during the second-half was a bit higher at 5.7 per cent. This modest trend of inflation was also sustained during the first-half of the 2000s with an average of 4.28 per cent, the lowest half-decade average since independence. However, inflation in the very recent year, i.e., FY2006 demonstrates an upward trend; the rate has gradually increased to around 7 per cent from 1.94 per cent in FY2001.

Apart from economic growth and inflation, in the external sector, export performance in the 1990s was also impressive compared to previous periods. The

<sup>13</sup> Adapted and modified from *Monetary Policy Review* (October 2005, p. 20).

average growth rate of exports (measured in USD) during the first-half of the 1990s was 18.34 per cent, while the average for the second-half declined to 10.72 per cent. During the first-half of the 2000s, growth remained robust although there was a setback in export performance in FY2002 with a negative growth of 7.74 per cent.<sup>14</sup> Conversely, import growth during the first-half of the 1980s was very modest with an average of 3.42 per cent (also measured in USD) and the period average for the second-half increased to 7.7 per cent. Throughout the first five years of the 1990s, imports registered an average growth of 10.36 per cent due to faster trade liberalisations as well as surge in input flow for export-oriented domestic industries, mainly readymade garment (RMG). However, in the second-half of the 1990s, imports registered a lower average growth of 5.63 per cent compared to the previous period. The import growth in FY2005 has been 20.63 per cent, the highest in the first-half of the new decade after the 1990s. This recent higher growth of imports stems mainly from increased prices of major imported commodities (e.g. petroleum, food grain and capital machinery) in the international market (Ahmed 2006).

TABLE II  
MOVEMENTS IN REAL AND EXTERNAL SECTOR INDICATORS

Fiscal Year	Inflation	GDP Growth	Export Growth	Import Growth	Nominal Exchange Rate (Revaluation/Devaluation)
1980-81	12.54	3.80	-2.26	17.38	-19.44
1981-82	16.29	2.38	-11.83	-3.91	-15.67
1982-83	9.93	4.02	9.70	-10.26	-10.76
1983-84	9.67	5.18	18.12	3.67	-2.78
1984-85	10.94	3.22	15.22	10.20	-6.67
Average (1980-81 to 1984-85)	11.87	3.72	5.79	3.42	-11.05
1985-86	9.95	4.25	-12.33	-10.69	-10.89
1986-87	10.35	3.73	31.07	10.83	-2.18
1987-88	11.42	2.16	14.75	13.97	-1.67
1988-89	8.00	2.61	4.77	13.03	-2.39
1989-90	9.30	5.94	18.02	11.38	-7.54
Average (1985-86 to 1989-90)	9.80	4.26	11.26	7.70	-4.93

(Contd. TABLE II)

<sup>14</sup> Since the beginning of the 1990s, RMG exports have contributed the lion's share of about 75 per cent in total exports and the periods before that jute and jute goods exports contributed the major share of about 70 per cent.

Fiscal Year	Inflation	GDP Growth	Export Growth	Import Growth	Nominal Exchange Rate (Revaluation/Devaluation)
1990-91	8.31	3.34	12.72	-7.69	-2.49
1991-92	4.56	5.04	16.09	-0.20	-8.23
1992-93	2.73	4.57	19.51	17.56	-2.01
1993-94	3.28	4.08	6.34	2.95	-1.12
1994-95	8.87	4.92	37.04	39.20	0.63
Average (1990-91 to 1994-95)	5.55	4.39	18.34	10.36	-2.64
1995-96	6.65	4.62	11.80	19.08	-4.19
1996-97	2.52	5.39	13.80	3.09	-4.35
1997-98	6.99	5.23	16.81	-5.45	-5.72
1998-99	8.91	4.87	2.94	6.50	-4.54
1999-00	3.41	5.94	8.27	4.91	-4.90
Average (1995-96 to 1999-00)	5.70	5.21	10.72	5.63	-4.74
2000-01	1.94	5.27	12.43	11.42	-10.53
2001-02	2.79	4.42	-7.44	-8.70	-1.55
2002-03	4.38	5.26	9.39	13.12	0.00
2003-04	5.83	6.27	16.10	13.01	-4.41
2004-05	6.48	5.96	13.83	20.63	-4.86
Average (2000-01 to 2004-05)	4.28	5.44	8.86	9.90	-4.27

- Notes:**
1. All figures are percentage changes over end of the last June.
  2. Inflation figures are based on 12-month moving average.
  3. Growth figures for 'GDP' are on the basis of GDP in constant BDT (base: 1995-96).
  4. Percentage changes in 'Exports' and 'Imports' are based on USD values.
  5. Negative and positive signs for percentage changes in the 'Exchange Rate (i.e., BDT/USD)' denote devaluation and revaluation up to 2002-03 respectively and figures beyond that denote depreciation and appreciation respectively. Besides, all calculations have been done on the basis of mid-value of buying and selling rates of commercial banks.

- Sources:**
1. Bangladesh Bank Annual Report (various issues), BB.
  2. Annual Report (various issues), Export Promotion Bureau of Bangladesh.
  3. Economic Trends (various issues), BB.
  4. BBS (2000, 2001, and 2005) and authors' calculation.

In recent years, the level of financial development also signals prospects for future economic growth in Bangladesh.<sup>15</sup> During the first five years of the 1980s, *financial deepening* i.e., M2 as per cent of GDP was 15.04 per cent on average which grew over time and stood at about 38 per cent during FY2001 to FY2005 (Table III).<sup>16</sup> On the other hand, private sector advances as per cent of GDP have increased continuously from 8.52 per cent on average to 26.39 per cent over the same time period.<sup>17</sup> Besides, income velocity of money measured by GDP/M2 has declined gradually from 6.84 on average during the first-half of the 1980s to 2.67 during the first-half of the 2000s. These patterns suggest higher level of monetisation of the economy and increasing financial intermediation of economic activities, thus increasing the level of financial development in Bangladesh.

On the other hand, investment-GDP ratio in Bangladesh compares poorly with that of the faster growing countries of South East Asia (e.g. Singapore, Malaysia, Hong Kong, and South Korea) where investment as a percentage of GDP has remained within the range of 35 to 40 per cent per year (Islam and Begum 2005). Investment-GDP ratio in current prices in Bangladesh has steadily risen to 24.43 per cent in FY2005 as compared to 16.9 per cent in FY1991 (Table IV). Besides, *public sector investment* as a percentage of GDP remained within the range of 5 to 7 per cent since the 1970s.<sup>18</sup> Conversely, *private sector investment* at current prices has increased gradually to 18.53 per cent in FY2005 from 10.26 per cent in FY1991. It would thus appear that the private sector has taken the lead following the FSRP of the 1990s.<sup>19</sup> Even though current investment spending in Bangladesh is considerably

<sup>15</sup> Levine (1997) mentions that the level of financial development is a good predictor of future economic development of a country since there is a strong and positive link between them.

<sup>16</sup> The two most important concepts of measuring the financial sector development are: (i) M2-GDP ratio also known as *financial deepening* and (ii) private sector credit-GDP ratio.

<sup>17</sup> As private sector advances comprise the major share of private sector credit (i.e., sum of advances and bills) by scheduled banks, private sector advances as per cent of GDP has been used as a proxy for private sector credit-GDP ratio in the analysis (Annex Table A.2).

<sup>18</sup> Mahmud (2004) mentions that a short-lived episode of investment boom existed in the country from the late 1970s to the beginning of the 1980s where investment in both public and private sector grew at nearly 15 per cent annually in real terms. He also added that it was made possible by depending on increased foreign aid and adopting privatisation policy based on lavish dispensation of *directed cheap credit* and provision of other incentives such as highly protected markets for domestic industries.

<sup>19</sup> To enhance overall investment, the government offers generous opportunities under its liberalised Industrial Policy and export-oriented private sector-led growth strategy. In particular, all but four sectors: (i) arms and ammunition and other defence equipment and machinery; (ii) forest plantation and mechanised extraction within the bounds of reserved forests; (iii) production of nuclear energy; and (iv) security printing and mining are open for

higher than earlier, it is not enough to attain and maintain an economic growth of 8 to 9 per cent per year as would be consistent with the goals of poverty reduction.<sup>20</sup> Therefore, the major challenge for Bangladesh is to raise investment to at least 30 per cent of GDP.<sup>21</sup>

TABLE III  
FINANCIAL DEEPENING AND INCOME VELOCITY

Fiscal Year	Financial Deepening (M2 as % of GDP)	Private Sector Advances as % of GDP	Income Velocity (GDP/M2)
1980-81	12.83	5.97	7.79
1981-82	12.29	6.59	8.14
1982-83	13.91	7.69	7.19
1983-84	17.41	9.98	5.75
1984-85	18.75	12.36	5.33
Average (1980-81 to 1984-85)	15.04	8.52	6.84
1985-86	19.50	13.52	5.13
1986-87	19.72	13.18	5.07
1987-88	20.50	13.90	4.88
1988-89	21.42	15.35	4.67
1989-90	22.22	15.83	4.50
Average (1985-86 to 1989-90)	20.67	14.36	4.85

(TABLE III Contd.)

private (both domestic and foreign) investment in Bangladesh. The Board of Investment provides institutional support services to potential investors. The general facilities/incentives include: (i) tax holiday for 5 or 7 years depending on the location of the industrial enterprise; (ii) tax exemption on royalties, technical know-how fees received by any foreign collaborator, firm, company and expert; (iii) exemption of income tax up to 3 years for foreign technicians employed in industries specified in the relevant schedule of the income tax ordinance; (iv) tax exemption on income of the private sector power generation company for 15 years from the date of commercial production; (v) tax exemption on capital gains from the transfer of shares of public limited companies listed with a stock exchange; and (vi) concessionary duty on imported capital machinery. For an elaboration, visit [www.bangladeshbank.org.bd](http://www.bangladeshbank.org.bd).

<sup>20</sup> According to the Poverty Reduction Strategy Paper document, an enhanced economic growth rate of 8 to 9 per cent per year is required to achieve the poverty reduction targets set by the Millennium Development Goals in Bangladesh (GOB, 2005).

<sup>21</sup> The figure is based on the authors' own estimation by the well known capital-output ( $K/Y$ ) ratio in the Harrod-Domar framework (Perkins *et al.* 2001, pp. 45-46).

Fiscal Year	Financial Deepening (M2 as % of GDP)	Private Sector Advances as % of GDP	Income Velocity (GDP/M2)
1990-91	21.27	15.40	4.70
1991-92	23.86	15.78	4.19
1992-93	25.15	17.26	3.98
1993-94	26.88	17.78	3.72
1994-95	22.70	18.57	4.40
Average (1990-91 to 1994-95)	23.97	16.96	4.20
1995-96	27.47	20.02	3.64
1996-97	28.02	20.49	3.57
1997-98	27.91	21.69	3.58
1998-99	28.69	22.07	3.49
1999-00	31.53	22.64	3.17
Average (1995-96 to 1999-00)	28.72	21.38	3.50
2000-01	34.38	24.83	2.91
2001-02	36.10	25.55	2.77
2002-03	37.92	25.99	2.64
2003-04	38.95	27.31	2.57
2004-05	40.89	28.28	2.45
Average (2000-01 to 2004-05)	37.65	26.39	2.67

Sources: 1. Banking Statistics Division, Statistics Department, BB.  
 2. Economic Trends (various issues), BB.  
 3. BBS (2000, 2001, and 2005) and authors' calculation.

TABLE IV  
 INVESTMENT AS PER CENT OF GDP AT CURRENT AND  
 CONSTANT PRICES (BASE: 1995-96)

Fiscal Year	Constant Prices			Current Prices		
	Total	Private	Public	Total	Private	Public
1990-91	16.62	10.12	6.5	16.90	10.26	6.63
1995-96	19.99	13.58	6.42	19.99	13.58	6.42
1999-00	23.81	16.01	7.80	23.02	15.61	7.41
2001-02	24.78	17.97	6.82	23.15	16.78	6.37
2003-04	26.09	19.11	6.98	24.02	17.83	6.19
2004-05	27.04	20.22	6.82	24.43	18.53	5.90

Note: Figures for constant prices are constructed using sectoral implicit deflators: 1995-96 base (e.g. construction material price index, machinery equipment, transport equipment, and other capital goods).

Source: BBS (2005).

The growth rate of broad money, i.e., M2 has remained about 15 per cent on average in the first five years of the 2000s which is considerably lower than the period average of the first-half of the 1980s (Table V). Besides, the average growth rate in time deposits during the first-half of the 1980s was about 32 per cent which is much higher than the average growth of about 9 per cent in the first-half of the 1990s. This again gradually increased to 16.18 per cent in the first-half of the 2000s partly reflecting the higher opportunity cost of holding money due to attractive returns on different term deposits. An analysis of the RM growth shows after the first half of the 1990s, RM started to increase from FY1996 at an annual rate of less than 5 per cent, reaching close to 25 per cent growth in FY2002. Although it significantly fell to 3.31 per cent in FY2003, the figure in FY2005 was about 13 per cent.

Overnight money market has undergone significant changes in the last few years; in particular, BB has introduced several new instruments to reinforce indirect monetary operation and to manage the day-to-day liquidity position in the market. Table VI presents the yearly trend of various direct and indirect policy instruments rates. It is observed that all the nominal rates of indirect policy instruments have increased starting FY2005 which continued also in FY2006 due to tighter monetary policy pursued by the BB as well as a higher credit demand in the economy. For instance, the high *repo* rate observed in FY2005 originated from the tight liquidity situation that prevailed in last quarter of the fiscal year. Simultaneously, as in the case of previous years, the BB had withdrawn excess liquidity through higher *reverse repo* rates starting FY2005. The SLR for the scheduled banks excluding IBs and SBs has been raised from 16 per cent of their demand and time liabilities excluding inter-bank items to 18 per cent in October 2005.<sup>22</sup> While the SLR for the IBs remained unchanged at 10 per cent, SBs continued to remain exempt from maintaining the SLR.

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<sup>22</sup> Effective from October 2005, CRR has also been set at 5 per cent on average on a fortnightly basis but not less than 4 per cent on any working day.

**TABLE V**  
**GROWTH IN MONETARY SECTOR INDICATORS**

Fiscal Year	M2	Excess Reserve	Time Deposits	Demand Deposits	Total Deposits	Reserve Money
1980-81	29.86	-33.08	29.63	27.96	29.04	27.91
1981-82	7.54	-15.08	14.55	3.56	10.67	-4.11
1982-83	27.75	-46.61	34.85	15.56	28.49	26.87
1983-84	50.11	300.07	52.64	50.71	52.07	37.64
1984-85	23.56	-37.84	29.35	23.61	27.66	19.66
Average (1980-81 to 1984-85)	27.76	33.49	32.20	24.28	29.59	21.59
1985-86	17.12	179.95	17.58	18.57	17.86	22.28
1986-87	16.33	175.66	22.67	7.16	18.23	14.38
1987-88	14.27	6.35	24.97	-17.42	13.97	35.16
1988-89	16.32	-25.30	19.87	8.07	17.65	8.13
1989-90	16.88	-30.87	16.97	11.79	16.08	15.52
Average (1985-86 to 1989-90)	16.18	61.16	20.41	5.63	16.76	19.10
1990-91	5.44	161.04	-1.42	7.01	-0.01	3.31
1991-92	21.34	46.60	29.07	22.95	27.98	5.90
1992-93	10.55	270.09	10.88	9.51	10.64	30.13
1993-94	15.43	35.16	12.29	25.50	14.53	25.72
1994-95	15.96	-43.36	-6.15	-13.54	-7.52	-5.99
Average (1990-91 to 1994-95)	13.74	93.90	8.93	10.29	9.12	11.81
1995-96	8.24	-35.78	31.85	47.53	34.57	3.51
1996-97	10.81	48.72	13.56	3.49	11.65	12.65
1997-98	10.35	19.57	12.75	1.88	10.83	9.87
1998-99	12.81	30.43	14.50	10.70	13.88	8.26
1999-00	18.62	11.31	19.82	13.73	18.86	15.75
Average (1995-96 to 1999-00)	12.17	14.85	18.50	15.47	17.96	10.00
2000-01	16.60	12.54	18.19	11.61	17.20	10.92
2001-02	13.13	82.12	14.85	6.91	13.71	24.34
2002-03	15.59	-5.93	17.19	10.39	16.27	3.31
2003-04	13.84	-19.63	13.78	13.91	13.80	7.58
2004-05	16.79	-18.14	16.89	15.31	16.69	12.96
Average (2000-01 to 2004-05)	15.19	10.19	16.18	11.63	15.53	11.82

**Note:** All figures are percentage changes over end of the last June.

**Source:** Economic Trends (various issues), BB and authors' calculation.



TABLE VI  
MOVEMENTS IN SELECTED MONETARY POLICY INSTRUMENTS

Fiscal Year	Direct Instruments			Rates on Indirect Instruments						
	Bank Rate	CRR	SLR	28-day T-Bills	91-day T-Bills	182-day T-Bills	364-day T-Bills	Repo (1-2 day)	Reverse Repo (1-2 day)	Reverse Repo (3-9 day)
1980-81	8.00	5.00	25.00	-	-	-	-	-	-	-
1981-82	10.50	5.00	25.00	-	-	-	-	-	-	-
1982-83	10.50	5.00	25.00	-	-	-	-	-	-	-
1983-84	10.50	5.00	25.00	-	-	-	-	-	-	-
1984-85	10.50	5.00	25.00	-	-	-	-	-	-	-
1985-86	11.00	5.00	25.00	-	-	-	-	-	-	-
1986-87	11.25	5.00	20.00	-	-	-	-	-	-	-
1987-88	10.75	10.00	20.00	-	-	-	-	-	-	-
1988-89	10.75	10.00	20.00	-	-	-	-	-	-	-
1989-90	9.75	10.00	20.00	-	-	-	-	-	-	-
1990-91	9.25	7.00	20.00	-	-	-	-	-	-	-
1991-92	9.00	6.00	20.00	-	-	-	-	-	-	-
1992-93	7.00	5.00	20.00	-	-	-	-	-	-	-
1993-94	6.50	4.00	20.00	-	-	-	-	-	-	-
1994-95	5.00	4.00	20.00	-	-	-	-	-	-	-
1995-96	5.75	4.00	20.00	-	-	-	-	-	-	-
1996-97	7.00	4.00	20.00	-	-	-	-	-	-	-
1997-98	8.00	4.00	20.00	8.31	-	-	-	-	-	-
1998-99	8.00	4.00	20.00	7.51	8.46	8.87	8.87	-	-	-
1999-00	7.00	4.00	20.00	6.05	6.35	7.06	7.06	-	-	-
2000-01	7.00	4.00	20.00	6.33	6.84	7.10	7.10	-	-	-
2001-02	6.00	4.00	20.00	4.81	5.25	5.50	5.73	-	-	-
2002-03	6.00	4.00	20.00	7.00	8.82	9.27	9.90	12.18	3.83	4.00
2003-04	5.00	4.00	16.00	3.99	5.00	5.99	6.30	4.61	2.50	2.84
2004-05	5.00	4.50	16.00	6.60	5.45*	6.75	7.00	8.00	4.50	4.63
2005-06	5.00	5.00	18.00	7.10	7.43	7.75	8.30	-	6.04	6.29

**Notes:** 1. Figures regarding 'SLR' exclude IBs and SBs. 2. All figures are as of end June of respective fiscal years. 3. '-' denotes figures are not available and \* denotes as of end March.

**Sources:** 1. Bangladesh Bank Annual Report (various issues), BB. 2. Economic Trends (various issues), BB. 3. Monthly Economic Indicators: Monthly Update (various issues), Monetary Policy Department, BB.

### III. THE MODEL AND THE METHODOLOGY

#### III.1 The Theory of Bank Lending and Exchange Rate Channels

##### III.1.1 The Bank Lending Channel

The *bank lending channel*, an important implication of the *credit view* of monetary transmission, arises as a result of asymmetric information problems between lenders and borrowers in the financial market.<sup>23</sup> According to this channel, banks play a special role in the financial system as they are better capable of and well designed to deal with certain types of borrowers, mainly small and medium firms who do not have access to credit markets unless they borrow from banks (Mishkin 2004, p.621). If the supply of bank loans to borrowers is interrupted, it is likely that borrowers will face increased external finance premium due to costs associated with finding a new lender, and thus, reducing real economic activities. As a result, in this channel, monetary policy actions will have a greater impact on small and medium firms that are more dependent on bank loans than on large firms that can directly access credit through stocks and bonds along with banks. Likewise, for a developing economy with narrow based capital market and non-existent bond market, monetary policy stances through this channel are likely to have greater efficacy than in a well-functioning developed economy with stock and bond markets along with banks (Mishkin 2004, p. 622).

In the context of Bangladesh, although capital market is shallow and a developed bond market is virtually absent, there are a large number of micro-finance institutions from where small and medium firms can get credit along with banks. Besides, large firms in most cases can get credit through initial public offerings in the capital market as well as from banks and NBFIs. Thus, the effectiveness of monetary policy actions through the *bank lending channel* in Bangladesh may not be that high compared to that in a developing economy with an immatured capital market and virtually non-existent developed bond market.

Theoretically, in this channel, as long as there is no perfect substitutability between retail bank deposits and other sources of funds (e.g. stocks and certificates of deposits), a contractionary monetary policy ( $M \downarrow$ ) for instance decreases bank reserves (i.e., excess reserves) which over time simultaneously reduces bank deposits and the quantity of bank loans available to borrowers (Mishkin 2004, p. 621).<sup>24</sup> Since banks

<sup>23</sup> The idea of the *bank lending channel* was pioneered by Bernanke and Blinder (1988).

<sup>24</sup> This is an important condition for the existence of the *bank lending channel* of monetary transmission since there are doubts about the channel in economies with highly developed financial markets where full-fledged stock and bond market exists (e.g. United States). For details, see Ramey (1993), Meltzer (1995), etc.

play a special role as a lender to classes of bank borrowers, this reduction in the quantity of loans will cause investment (and possibly consumer spending) to fall which will in turn reduce aggregate output ( $Y$ ). The effect of monetary policy actions through the *bank lending channel* of monetary transmission can be shown schematically as:

$$M \downarrow \Rightarrow \text{Bank Reserves} \downarrow \Rightarrow \text{Bank Deposits \& Bank Loans} \downarrow \Rightarrow I \downarrow \Rightarrow Y \downarrow$$

### III.1.2 The Exchange Rate Channel

In an open economy, the *exchange rate channel* plays a pivotal role owing to the increased internalisation of economies all over the world (Mishkin 2004, p. 618). In particular, this channel is concerned with the interrelationships between net private capital inflows and monetary policy following liberalisations in the financial market which is evident in literature (e.g. Bryant *et al.* 1993 and Taylor 1993). The transmission process operates from the domestic real interest rates to the exchange rate through the uncovered interest rate parity condition involving the differentials in real interest rate and subsequent exchange rate movements (Kuttner and Mosser 2002).

Under a flexible exchange rate regime and perfect capital mobility, a contractionary monetary policy ( $M \downarrow$ ) raises the domestic real interest rate ( $i_r$ ) and this leads to an inflow of capital (i.e., deposits denominated in domestic currency become more attractive compared to deposits denominated in foreign currencies).<sup>25</sup> As a result, domestic currency appreciates ( $E \uparrow$ ) and this appreciation of domestic currency makes domestic goods more expensive for foreigners, therefore exports fall. Simultaneously, imports become cheaper and thus domestic imports increase. Overall, a contractionary monetary policy leads to a fall in net exports ( $NX$ ) and aggregate output ( $Y$ ). The schematic illustration of the *exchange rate channel* of monetary transmission is given below.

$$M \downarrow \Rightarrow i_r \uparrow \Rightarrow E \uparrow \Rightarrow NX \downarrow \Rightarrow Y \downarrow$$

On the other hand, under a fixed exchange rate regime, a contractionary monetary policy primarily increases the domestic real interest rate and lowers income. This leads to an inflow of capital as well as a current account surplus position. As a result, the attempt to contract money supply becomes ineffective since the withdrawal of domestic bonds by the monetary authority through OMOs is balanced by its gains of having additional foreign exchange reserves.

<sup>25</sup> Inflow of capital requires that the domestic real interest rate must rise above its foreign counterpart.

However, the theory of *exchange rate channel* relevant to Bangladesh deviates from the standard theory described above. There are several reasons behind this. First, since independence, the monetary authority followed a fixed exchange rate with a narrow band and subsequently a wider band of buying and selling rates for commercial banks, and finally, a floating exchange rate system in May 2003. Second, although current account is convertible since 1994, capital account is still not convertible in Bangladesh. Third, foreign exchange market is limitedly open in terms of volume transactions. Last, interest rates in the economy were administratively set (i.e., not market based) till the initiation of the FSRP at the beginning of 1990. Therefore, with imperfect capital mobility, a contractionary monetary policy ( $M \downarrow$ ) leads to a fall in price levels, i.e.,  $CPI$ . Consequently, domestic currency appreciates ( $E \uparrow$ ) and this causes exports to fall and imports to increase. On the whole, a contractionary monetary policy leads to a fall in  $NX$  and  $Y$ . The *exchange rate channel* of monetary transmission relevant to Bangladesh can be illustrated schematically as:

$$M \downarrow \Rightarrow CPI \downarrow \Rightarrow E \uparrow \Rightarrow NX \downarrow \Rightarrow Y \downarrow$$

### III.2 The Empirical Model<sup>26</sup>

In the early 1970s, the tasks of providing macroeconomic forecasts and delivering structural inferences as well as guidance for appropriate policy prescriptions were basically performed using diverse econometric approaches. These ranged from large scale models to single-equation models focused on interactions of a few variables to simple univariate time series models. Following the ground breaking *Lucas critique* (1976), almost all of these approaches appeared to be less reliable, especially in making forecasts with large non-structural models.<sup>27</sup> In this connection, Sims (1972, 1980) developed a new macro-econometric framework, known as vector autoregressions (VARs), which provides a simple and systematic way to capture the rich dynamics that exist in the univariate or multivariate time series models engaged in forecasting and policy analysis. In general, an  $n$ -equation VAR is an  $n$ -variable linear system in which each variable is in turn explained by its own lagged values and past values of the remaining  $n-1$  variables. Besides, in an  $n$ -variable unrestricted VAR,

<sup>26</sup> This section draws heavily from Ahmed and Islam (2004).

<sup>27</sup> The *Lucas critique* points out not only that conventional econometric models cannot be used for policy evaluation, but also that the public's expectations about a policy will influence the response to that policy (Miskin 2004, p. 660).

each and every concerned variable in the system is assumed to be endogenous and *no a priori* restrictions are imposed (Enders 1995).

Considering advantages of the VAR approach, the paper employs unrestricted VARs to investigate whether *bank lending* and *exchange rate channels* exist in Bangladesh. Basically, the paper examines the existence of both of these channels separately using quarterly data for the period: (i) July-September 1979 to April-June 2005 (i.e., full-sample period) and (ii) January-March 1990 to April-June 2005 (i.e., sub-sample period). The existence of other channels (if any) of monetary transmission in the country has not been empirically explored in the paper because of non-availability of relevant data.

Before estimation of VARs, time series properties of all concerned variables have been identified by Dicky-Fuller (DF, 1979), Augmented Dickey-Fuller (ADF, 1981), Phillips-Perron (PP, 1988) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS, 1992) tests. All of these tests have been performed in the levels. The paper has estimated all of the unrestricted VAR models in levels; even though, some of the relevant time series variables in the respective models are likely to be non-stationary and contain unit roots,  $I(1)$ . This has been motivated by a considerable number of empirical literature (e.g. Christiano and Eichenbaum 1992, Eichenbaum 1992, Sims 1980, Sims *et al.* 1990, and Strongin 1992) on unrestricted VARs employed in levels. In particular, Sims (1980) argues that since the objective of VAR analysis is to explore the interrelationships that exist among the time series variables, first differencing the variables purges away relevant information concerning the comovements in the data even if the variables contain a unit root,  $I(1)$ . The following unrestricted VAR models regarding the existence of *bank lending* and *exchange rate channels* of monetary transmission in Bangladesh have been estimated in the paper with the order of given variables:

- Bank Lending Channel (1979:3–2005:2):  $RM, PSA, RGDP, CPI^{28}$

<sup>28</sup> The system of equations of the VAR model regarding the *bank lending channel* of monetary transmission can be represented as

$$RM_t = \varphi_{10} + \sum_{j=1}^s \varphi_{11j} RM_{t-j} + \sum_{i=1}^q \varphi_{12i} PSA_{t-i} + \sum_{k=1}^m \varphi_{13k} RGDP_{t-k} + \sum_{l=1}^n \varphi_{14l} CPI_{t-l} + e_{1t}$$

$$PSA_t = \varphi_{20} + \sum_{j=1}^s \varphi_{21j} RM_{t-j} + \sum_{i=1}^q \varphi_{22i} PSA_{t-i} + \sum_{k=1}^m \varphi_{23k} RGDP_{t-k} + \sum_{l=1}^n \varphi_{24l} CPI_{t-l} + e_{2t}$$

$$RGDP_t = \varphi_{30} + \sum_{j=1}^s \varphi_{31j} RM_{t-j} + \sum_{i=1}^q \varphi_{32i} PSA_{t-i} + \sum_{k=1}^m \varphi_{33k} RGDP_{t-k} + \sum_{l=1}^n \varphi_{34l} CPI_{t-l} + e_{3t}$$

$$CPI_t = \varphi_{40} + \sum_{j=1}^s \varphi_{41j} RM_{t-j} + \sum_{i=1}^q \varphi_{42i} PSA_{t-i} + \sum_{k=1}^m \varphi_{43k} RGDP_{t-k} + \sum_{l=1}^n \varphi_{44l} CPI_{t-l} + e_{4t}$$

where  $e_{1t}, e_{2t}, e_{3t}, e_{4t}$  are the random disturbance terms, and  $s, q, m$ , and  $n$  are the number of lag lengths.

$$RM, TOD, RGDP, CPI^{29}$$

- Bank Lending Channel (1990:1–2005:2):  $RM, PSA, RGDP, CPI$

$$RM, TOD, RGDP, CPI$$

- Exchange Rate Channel (1979:3–2005:2):  $RM, CPI, NEXR, EPR, IMP, RGDP$
- Exchange Rate Channel (1990:1–2005:2):  $RM, CPI, NEXR, EPR, IMP, RGDP$

where

$RM$  = reserve money

$TOD$  = total deposits (i.e., sum of time and demand deposits)

$PSA$  = private sector advance

$NEXR$  = nominal exchange rate (i.e., BDT/USD)

$EPR$  = exports

$IMP$  = imports

$CPI$  = consumer price index

$RGDP$  = real GDP

All of the VAR models have been identified using a Choleski decomposition, which isolates the structural errors by recursive orthogonalisation. A Choleski decomposition requires that the concerned variables be placed on the basis of the speed at which the variables act in response to shocks. In particular, the variables placed higher in the ordering have contemporaneous impact on the variables lower in the ordering, but the variables placed lower in the ordering do not have contemporaneous impact on the variables higher in the ordering (Rahman 2005). Since the main objective of the paper is to empirically investigate whether monetary policy changes are propagated in the economy through *bank lending* and *exchange rate channels* (i.e., whether one or both of these channels exists), policy variable, i.e., reserve money has been placed first in all the corresponding VAR models and the order of the other variables follows the theory of respective channels.

Finally, variance decompositions (VDCs) and impulse response functions (IRFs) derived from VARs estimation have been used to look at the relative impact of monetary policy actions (i.e., money supply changes) on aggregate output and

<sup>29</sup> The existence of the *bank lending channel* for both full and sub-sample periods has been examined using alternative specifications, since total deposits ( $TOD$ ) and private sector advances ( $PSA$ ) cannot be used simultaneously in the same model because of the possibility of multicollinearity.

prices.<sup>30</sup> Basically, the IRFs show the response of each concerned variable in the linear system to a shock from system variables and the VDCs show the portion of the variance in the forecast error for each variable due to innovations to all variables in the system (Enders 1995).

## IV. DATA AND EMPIRICAL EVIDENCE

### IV.1 Data Specification

The VAR models estimated in the paper have used a quarterly data on: (i) real GDP at producer prices (base year: 1995-96);<sup>31</sup> (ii) total deposits (i.e., sum of time and demand deposits of the banking system); (iii) private sector advances (by all scheduled banks); (iv) consumer price index (base year: 1995-96); (v) reserve money; (vi) nominal exchange rate (i.e., BDT/USD); (vii) exports; and (viii) imports for the period of July-September 1979 to April-June 2005. The data on total deposits (*TOD*), private sector advances (*PSA*) and reserve money (*RM*) are outstanding amounts as of the end of each quarter, while consumer price index (*CPI*) is as of the end of each quarter. Besides, nominal exchange rate (*NEXR*) is the mid-value of buying and selling rates of commercial banks at the end of each quarter and exports (*EPR*) and imports (*IMP*) are total *EPR* and *IMP* in BDT in each respective quarter. These data have been retrieved from the Bangladesh Bureau of Statistics (BBS) and various publications of BB.

In the empirical estimation, the VAR model regarding the: (i) *bank lending channel* for both full and sub-sample periods has used quarterly data set on *RM*, *TOD*, *PSA*, *RGDP*, *CPI* (with alternative specifications) and (ii) *exchange rate channel* for both full and sub-sample periods has used *RM*, *CPI*, *NEXR*, *EPR*, *IMP*, and *RGDP*. All the above mentioned time series variables have been adjusted for seasonality and used in log form.

### IV.2 Empirical Evidence

The results of the unit root tests on the relevant macroeconomic variables have been reported in Table VII. Based on these results, it can be concluded that the variables, *RM*, *TOD*, *PSA*, *NEXR*, *IMP*, *RGDP*, and *CPI* are non-stationary and contain unit roots *I*(1). Conversely, the unit root tests suggest that the variable *EPR* is stationary, *I*(0). Finally, the estimated results of all the VAR models in terms of VDCs and IRFs have been presented in the next section.

<sup>30</sup> Enders (1995) mentions that IRF analysis and VDCs together known as *innovation accounting* is a useful tool to investigate the relationships among macroeconomic variables.

<sup>31</sup> For Elaboration, see Ahmed and Islam (2004).

TABLE VII  
UNIT ROOT TESTS

Variable (in log levels)	DF		ADF		PP		KPSS		Decision
	Without trend	With trend	Without trend	With trend	Without trend	With trend	Without trend	With trend	
<i>RM</i>	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)
<i>TOD</i>	I(0)	I(1)	I(1)	I(1)	I(1)	I(0)	I(1)	I(1)	I(1)
<i>PSA</i>	I(1)	I(1)	I(0)	I(0)	I(0)	I(1)	I(1)	I(1)	I(1)
<i>NEXR</i>	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)
<i>EPR</i>	I(0)	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	I(0)	I(0)
<i>IMP</i>	I(0)	I(1)	I(1)	I(1)	I(1)	I(0)	I(1)	I(0)	I(1)
<i>RGDP</i>	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)
<i>CPI</i>	I(0)	I(0)	I(0)	I(1)	I(0)	I(1)	I(1)	I(1)	I(1)

- Notes:**
1. Lag length for DF tests have been decided on the basis of Schwartz's Information Criteria (SIC).
  2. Lag length for ADF tests have been decided on the basis of Akaike's Information Criteria (AIC).
  3. Maximum Bandwidth for PP and KPSS tests have been decided on the basis of Newey-West (1994).
  4. All tests have been performed on the basis of 5 per cent significance level using Econometric Views Package.
  5. The DF, ADF and PP tests are based on the null hypothesis of unit roots, while the KPSS test assumes the null hypothesis of stationarity.

## IV.2.1 Bank Lending Channel (1979:3–2005:2)

### IV.2.1.1 Bank Lending Channel (with Private Sector Advances)

The 4-variable VAR model regarding the existence of *bank lending channel* in Bangladesh has been estimated using quarterly data for the period between July–September 1979 and April–June 2005 (i.e., full-sample period). Alongside, 7 lags of each variable have been used in the estimation as the optimal lag length that makes all the residuals of the model white noise. The estimated VDCs and IRFs presented in Table VIII and Figure 3 have been generated through 1000 *Monte Carlo* random draws from the orthogonalised residuals. In this connection, it is important to mention that the estimates of the forecast error variance are considered to be statistically significant if the point estimate is at least twice as large as the respective standard error. Besides, each IRF has been reported with a two-standard-deviation confidence interval (i.e., 95 per cent confidence interval) level and a response is considered to be significant if it does not contain the zero line within its confidence bands (i.e.,  $\pm 2$  s. e.).



VDCs presented in Table VIII for each variable at forecast horizons of 1 quarter through 16 quarters, i.e., 4 years, give the share of fluctuations in a given variable that are caused by shocks in other relevant variables as well as itself. The columns give the percentage of forecast error variance due to each shock, with each row adding up to 100 per cent. The results indicate that the *RM* shock does not have any statistically significant explanatory power of predicting the movements in other variables (i.e., *PSA*, *RGDP*, and *CPI*) at any time horizon except for its own future path. Conversely, the shock in *PSA* has a statistically significant explanatory power of forecasting the movement in *RGDP* only at time horizon 8, i.e., year-2. In particular, *PSA* shock alone explains 16.32 per cent of the forecast error variance of *RGDP* in year-2. Besides, *PSA* shock explains about 33 per cent of the forecast error variance of *CPI* at time horizon 16, i.e., year-4. Finally, analysis of these results obtained from the VDCs for the full-sample period suggests that the existence of the overall *bank lending channel* in Bangladesh is *weak*, and therefore, not discernible in the empirical estimation of the paper.

TABLE VIII  
VARIANCE DECOMPOSITIONS-BANK LENDING CHANNEL (1979:3–2005:2)

Variance Decomposition of <i>RM</i>				
Quarter	<i>RM</i>	<i>PSA</i>	<i>RGDP</i>	<i>CPI</i>
1	100.00* (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
4	92.56* (7.19)	1.77 (3.80)	0.93 (2.51)	4.74 (5.58)
8	86.29* (11.95)	2.43 (6.96)	1.03 (3.63)	10.24 (9.89)
12	75.92* (12.45)	11.35 (9.79)	2.64 (3.77)	10.09 (9.10)
16	61.92* (12.65)	20.63 (12.17)	4.78 (4.32)	12.67 (10.19)
Variance Decomposition of <i>PSA</i>				
1	0.37 (1.89)	99.63* (1.89)	0.00 (0.00)	0.00 (0.00)
4	2.19 (4.76)	89.76* (7.22)	2.98 (3.45)	5.06 (4.89)

(TABLE VIII Contd.)

Variance Decomposition of <i>RM</i>				
Quarter	<i>RM</i>	<i>PSA</i>	<i>RGDP</i>	<i>CPI</i>
8	3.00 (7.20)	85.56* (11.45)	3.35 (4.95)	8.09 (9.32)
12	2.43 (7.54)	85.52* (12.81)	4.57 (5.87)	7.48 (10.87)
16	2.26 (7.68)	85.03* (13.23)	6.06 (6.29)	6.65 (10.94)
Variance Decomposition of <i>RGDP</i>				
1	0.32 (1.78)	4.95 (4.18)	94.73* (4.55)	0.00 (0.00)
4	2.72 (4.19)	5.19 (4.92)	88.32* (6.97)	3.76 (4.06)
8	2.68 (4.49)	16.32* (8.10)	77.59* (8.85)	3.63 (4.06)
12	2.60 (4.77)	15.42 (9.00)	78.00* (9.75)	3.98 (5.48)
16	2.51 (5.32)	13.76 (8.87)	79.15* (10.43)	4.58 (6.81)
Variance Decomposition of <i>CPI</i>				
1	0.01 (1.53)	4.62 (4.31)	1.99 (2.94)	93.38* (5.27)
4	5.57 (5.98)	8.26 (7.58)	1.48 (3.66)	84.69* (9.32)
8	11.19 (9.41)	9.88 (10.27)	3.92 (4.88)	75.02* (12.71)
12	12.86 (10.73)	18.87 (13.19)	4.10 (4.78)	64.17* (13.84)
16	12.27 (10.87)	32.89* (15.44)	4.04 (4.56)	51.41* (13.75)
Cholesky Ordering: <i>RM PSA RGDP CPI</i>				

**Notes:** 1. The first entry in each cell is the point estimate of the percentage of forecast error variance of variable 'i' as explained by shocks to variable 'j'. Monte Carlo simulated standard errors are reported in the parentheses by employing 1000 random draws.

2. \* denotes the statistical significance of point estimates at 5 per cent level assuming that the estimates are asymptotically normally distributed.

The estimated IRFs presented in Figure 3 for the full-sample period show that the shock in *RM* has no statistically significant impact on *PSA* as well as *RGDP* and *CPI* which is very much in line with the outcome of VDCs. This, in turn, indicates that the impact of reserve money shock has not been transmitted to aggregate output and

prices through the portfolio (i.e., private sector advances) of the scheduled banks in the country. The probable reasons could be excess liquidity position in the banking system which neutralises the impact of reserve money shock on credit (Annex Table 1). Besides, bank lending (i.e., sum of advances and bills) by 4 NCBs as well as 5 SBs are not fully related to the shock in reserve money rather historically dispensed as *directed credit* at a *concessional rate*, particularly to the public sector. This is important since their combined share in total credit is significant though declining in recent years (Annex Table 2). Moreover, the share of net government credit in the reserve money is significant over the years especially in the early 1980s and 2000s which causes *weak* policy response to the portfolio of the scheduled banks due to reserve money shock (Annex Table 3). Apart from these probable reasons, the active presence of a large number of micro-finance institutions in the economy could be one.

On the other hand, *PSA* shock has a positive and significant impact on *CPI* only in the 1<sup>st</sup> quarter and then dissipates over the rest of the periods, suggesting a very short-run positive influence on *CPI*. It is, therefore, noticeable that there is no *price puzzle* in the empirical model of the paper.<sup>32</sup> The response of *RGDP* to *PSA* shock is positive and significant only in the 1<sup>st</sup> quarter and then turns insignificant in the 2<sup>nd</sup> quarter, again becoming positive and significant only in the 5<sup>th</sup> quarter. Therefore, a very short-run positive relationship between *private sector investment* (as proxied by private sector advances) and aggregate output can be confirmed for the economy. Since the private sector has been growing faster due to the economic liberalisation policy adopted by the Government of Bangladesh (GOB) from the late 1980s, a positive and significant relationship between *private sector investment* and aggregate output is expected to exist in the economy.

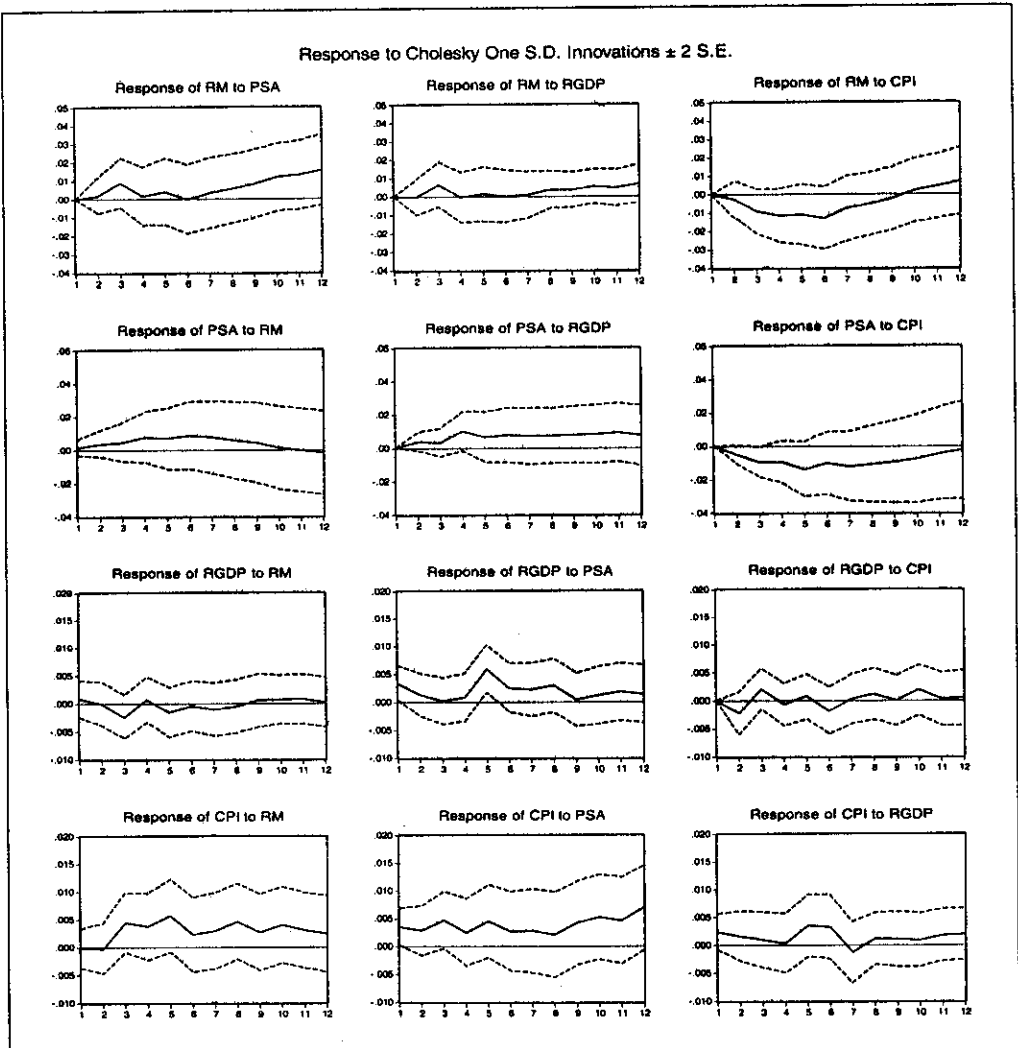
In conclusion, the results derived from the IRFs for the full-sample period suggest that the existence of the overall *bank lending channel* in the economy is *weak* due to reasons already explained before.<sup>33</sup> Besides, although most of the financial data (i.e., reserve money, private sector advances, etc.) are well structured in time frequency (e.g. monthly, quarterly, and yearly) but real sector data (i.e., aggregate output, *CPI* inflation) are not well structured in time frequency, which may have caused a *weak* existence of the overall *bank lending channel* in Bangladesh. These results have some

<sup>32</sup> *Price puzzle* arises when a contractionary/tight monetary policy shock is followed by a rise in the price level where the effect is small and temporary but still puzzling (Walsh 2003, p. 29).

<sup>33</sup> The results regarding the existence of *bank lending channel* for the full-sample period remain the same as those of alternative ordering of the relevant variables including some radical ones such as reversing the order.

important policy implications with respect to the restrained or accommodative policy stance in controlling inflation, the prime objective of the BB. Tight monetary policy generally shrinks the volume of private sector credit, though credit demand has been found to be *weakly* responsive to respective real rates from the lenders' point of view in the short-run (Ahmed and Islam 2004).

**Figure 3: Impulse Responses: Bank Lending Channel (1979:3–2005:2)**



#### IV.2.1.2 Bank Lending Channel (with Total Deposits)

To investigate the existence of *bank lending channel* in Bangladesh, the model has been estimated using quarterly data for the full-sample period (i.e., July-September 1979 to April-June 2005) with alternative specification (i.e., using total deposits instead of private sector advances).<sup>34</sup> The estimated VDCs and IRFs presented in Table IX and Figure 4 have been generated through 1000 *Monte Carlo* random draws from the orthogonalised residuals. The results in Table IX indicate that the *RM* shock does not have any statistically significant explanatory power of predicting the movements in other variables (i.e., *TOD*, *RGDP*, and *CPI*) at any time horizon except for its own future path. On the other hand, only *TOD* shock explains about 44 per cent of the forecast error variance of *CPI* at time horizon 16, i.e., year-4. These results for the full-sample period suggest that the overall *bank lending channel* in Bangladesh is *weak*. It is also noticeable that the use of *TOD* instead of *PSA* in the model specification does not alter the main conclusion regarding the existence of the overall *bank lending channel* in the economy.

TABLE IX  
VARIANCE DECOMPOSITIONS-BANK LENDING CHANNEL (1979:3-2005:2)

Variance Decomposition of <i>RM</i>				
Quarter	<i>RM</i>	<i>TOD</i>	<i>RGDP</i>	<i>CPI</i>
1	100.00* (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
4	92.01* (6.22)	2.91 (3.61)	1.48 (2.58)	3.61 (4.47)
8	82.03* (11.85)	9.15 (9.53)	1.33 (3.40)	7.48 (8.16)
12	69.95* (12.80)	17.38 (12.67)	2.48 (3.49)	10.19 (7.79)
16	57.74* (12.71)	19.97 (13.89)	4.17 (4.25)	18.12 (10.19)
Variance Decomposition of <i>TOD</i>				
1	2.93 (3.60)	97.07* (3.60)	0.00 (0.00)	0.00 (0.00)
4	12.87 (8.38)	83.96* (8.55)	1.07 (2.89)	2.10 (2.86)
8	10.14 (9.21)	86.56* (10.27)	1.62 (3.76)	1.67 (4.14)

(Contd. TABLE IX)

<sup>34</sup> 7 lags have been considered that make the residuals of the VAR model white noise.

Variance Decomposition of <i>RM</i>				
Quarter	<i>RM</i>	<i>TOD</i>	<i>RGDP</i>	<i>CPI</i>
12	8.30 (9.29)	83.27* (12.43)	3.97 (4.98)	4.45 (6.85)
16	7.31 (9.36)	78.61* (14.20)	6.57 (6.02)	7.51 (9.06)
Variance Decomposition of <i>RGDP</i>				
1	0.00 (0.00)	3.79 (3.59)	96.21* (3.76)	0.00 (0.00)
4	2.77 (4.24)	10.63 (6.74)	81.69* (8.07)	4.91 (4.20)
8	2.86 (4.44)	9.21 (6.11)	82.82* (7.99)	5.09 (4.26)
12	3.73 (5.13)	9.45 (6.05)	82.27* (8.30)	4.54 (4.71)
16	4.18 (5.98)	10.54 (7.18)	81.30* (9.48)	3.97 (5.24)
Variance Decomposition of <i>CPI</i>				
1	0.13 (1.71)	1.40 (2.81)	2.28 (3.27)	96.18* (4.47)
4	6.18 (6.27)	2.00 (4.49)	2.39 (4.05)	89.42* (8.09)
8	8.74 (8.96)	9.92 (9.83)	4.39 (4.84)	76.95* (11.91)
12	8.66 (9.98)	28.10 (15.09)	3.61 (4.63)	59.63* (14.28)
16	8.09 (10.38)	43.95* (17.52)	2.88 (4.49)	45.07* (14.79)
Cholesky Ordering: <i>RM TOD RGDP CPI</i>				

**Notes:** 1. The first entry in each cell is the point estimate of the percentage of forecast error variance of variable 'i' as explained by shocks to variable 'j'. Monte Carlo simulated standard errors are reported in the parentheses by employing 1000 random draws.

2. \* denotes the statistical significance of point estimates at 5 per cent level assuming that the estimates are asymptotically normally distributed.

The IRFs presented in Figure 4 for the full-sample period with alternative specification (i.e., using total deposits instead of private sector advances) show that the shock in *RM* has no statistically significant impact on *RGDP* and *CPI* except for *TOD* for a short while. In particular, *RM* shock has a significant and positive impact

on *TOD* only in the 2<sup>nd</sup> quarter and then dissipates over the rest of the periods, indicating a very short-run positive influence on *TOD*. This again indicates that the impact of reserve money shock has not been transmitted to aggregate output and prices through the portfolio (i.e., total deposits) of the scheduled banks.

Conversely, the shock in *TOD* has a significant and positive impact on *CPI* only in the 12<sup>th</sup> quarter, indicating a positive influence (i.e., lag effect) on the price level. This again confirms that there is no *price puzzle* in the empirical model. Finally, analysis of the results for the full-sample period suggests that the existence of the overall *bank lending channel* in Bangladesh is *weak* due to reasons already explained earlier.<sup>35</sup> It is important to mention that the use of alternative VAR specification does not change the conclusion regarding the existence of the overall *bank lending channel* in the economy.

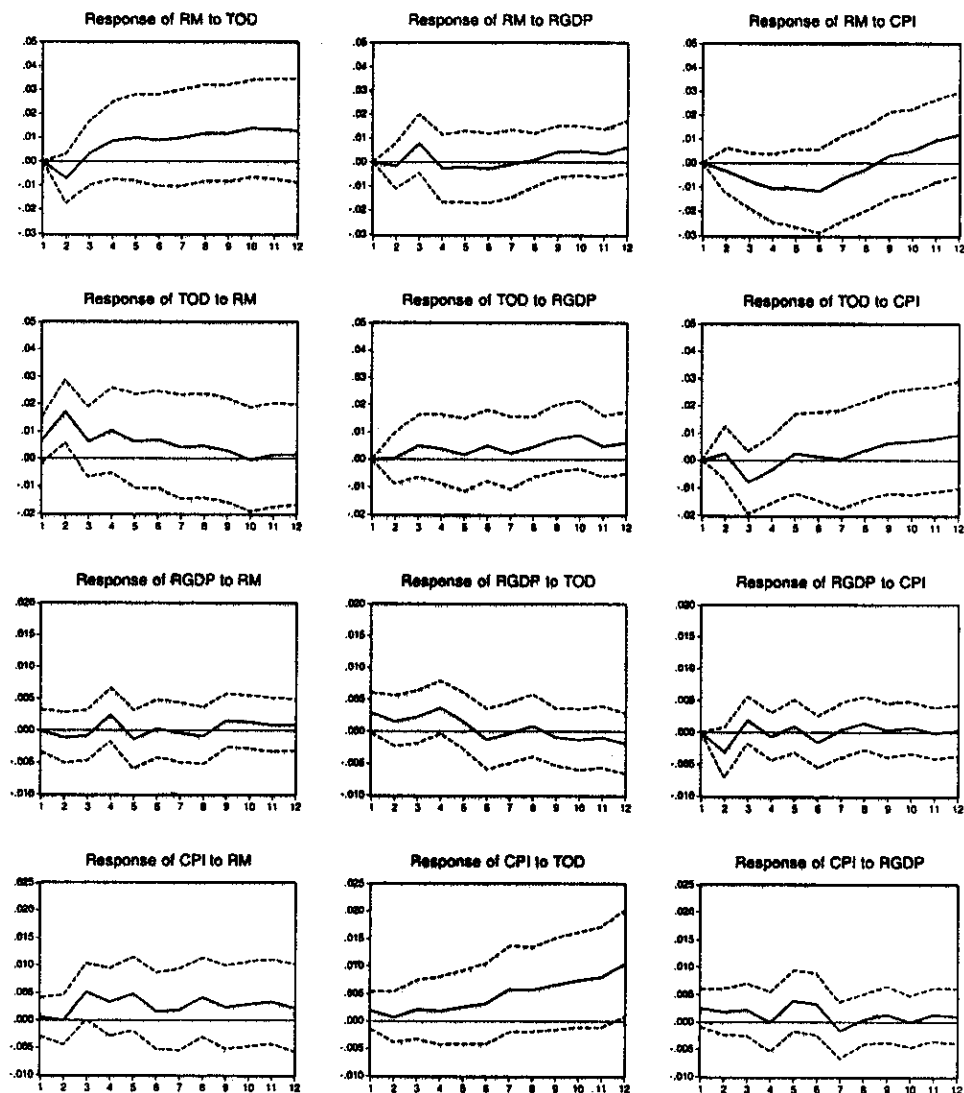
## IV.2.2 Bank Lending Channel (1990:1–2005:2)

### IV.2.2.1 Bank Lending Channel (with Private Sector Advances)

To further examine the presence of *bank lending channel* in the Bangladesh economy, the 4-variable VAR model has also been estimated using quarterly data for the period between January-March 1990 and April-June 2005 (i.e., the sub-sample period).<sup>36</sup> Estimated VDCs (i.e., for each variable at forecast horizons of 1 through 16 quarters) and IRFs presented in Table X and Figure 5 respectively have been generated through 1000 *Monte Carlo* random draws from the orthogonalised residuals. The results of the empirical analysis for the sub-sample period again suggest that the movement in *RM* does not contain any information about the movements in other variables (i.e., *PSA*, *RGDP*, and *CPI*) at any time horizon except for its own future path. Conversely, *PSA* shock has a statistically significant influence over predicting the movement in *RGDP* starting at time horizon 12, i.e., from year 3 to 4. In particular, *PSA* shock alone explains about 25 per cent of the forecast error variance of aggregate output in year-4. These results derived from the VDCs for the sub-sample period again confirm that the overall *bank lending channel* in Bangladesh is *weak*.

<sup>35</sup> The results for the full-sample period remain the same as those of alternative ordering.

<sup>36</sup> 5 lags have been considered in the estimation that makes the residuals of the model white noise.

**Figure 4: Impulse Responses: Bank Lending Channel (1979:3–2005:2)**Response to Cholesky One S.D. Innovations  $\pm 2$  S.E.



**TABLE X**  
**VARIANCE DECOMPOSITIONS-BANK LENDING CHANNEL (1990:1-2005:2)**

Variance Decomposition of <i>RM</i>				
Quarter	<i>RM</i>	<i>PSA</i>	<i>RGDP</i>	<i>CPI</i>
1	100.00* (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
4	92.19* (8.07)	0.69 (3.79)	2.17 (3.92)	4.95 (6.17)
8	87.66 (12.29)	5.72 (9.41)	2.13 (4.53)	4.48 (7.58)
12	79.71* (14.19)	7.21 (11.02)	2.04 (4.73)	11.05 (10.55)
16	75.52* (15.27)	6.96 (11.37)	2.51 (5.15)	15.01 (12.44)
Variance Decomposition of <i>PSA</i>				
1	1.055 (3.29)	98.95* (3.29)	0.00 (0.00)	0.00 (0.00)
4	6.21 (8.61)	85.82* (10.34)	2.41 (4.17)	5.54 (6.84)
8	15.03 (13.93)	75.38* (14.64)	5.02 (6.72)	4.55 (8.92)
12	30.67 (17.65)	59.64* (17.41)	6.49 (8.12)	3.18 (9.18)
16	36.02 (18.85)	52.95* (18.67)	7.41 (9.25)	2.63 (9.53)
Variance Decomposition of <i>RGDP</i>				
1	5.95 (6.01)	8.43 (6.29)	85.61* (8.23)	0.00 (0.00)
4	10.12 (7.81)	13.63 (7.54)	71.50* (9.78)	4.74 (5.73)
8	10.54 (8.60)	18.71 (8.73)	62.87* (10.52)	7.86 (6.85)
12	11.26 (9.93)	21.02* (10.41)	59.69* (11.86)	8.01 (7.81)
16	12.17 (11.27)	24.66* (12.11)	56.01* (13.02)	7.14 (8.49)

(Contd. TABLE X)

Variance Decomposition of *RM*

Quarter	<i>RM</i>	<i>PSA</i>	<i>RGDP</i>	<i>CPI</i>
Variance Decomposition of <i>CPI</i>				
1	0.74 (2.99)	1.71 (3.33)	0.02 (2.13)	97.51* (4.79)
4	0.72 (5.10)	5.90 (7.49)	0.70 (3.86)	92.65* (9.43)
8	2.41 (8.33)	5.56 (8.21)	4.37 (5.22)	87.63* (11.51)
12	6.57 (10.91)	10.69 (9.75)	6.34 (5.80)	76.37* (12.51)
16	7.10 (11.89)	14.51 (10.86)	7.45 (6.35)	70.92* (12.88)

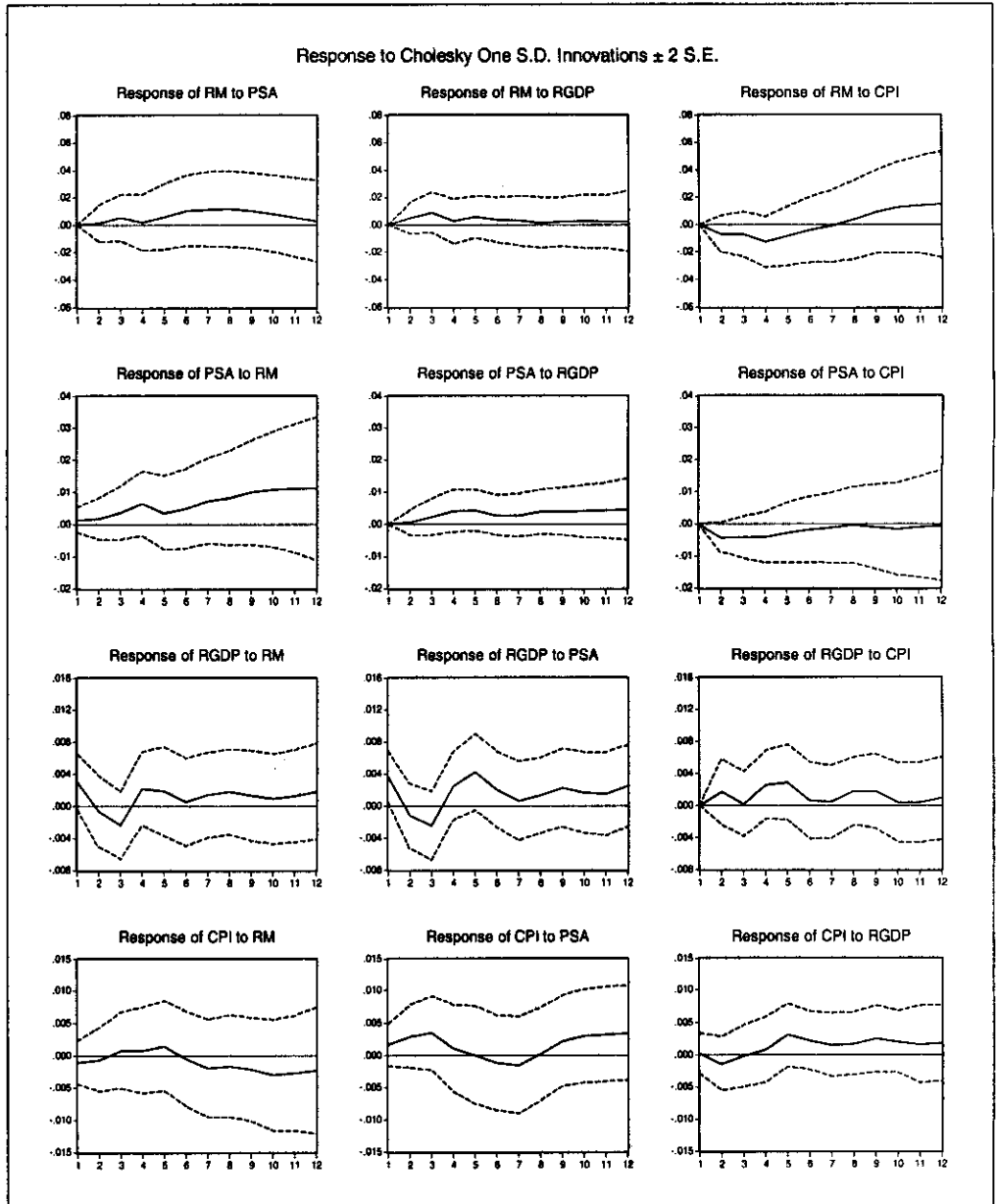
Cholesky Ordering: *RM PSA RGDP CPI*

- Notes:** 1. The first entry in each cell is the point estimate of the percentage of forecast error variance of variable 'i' as explained by shocks to variable 'j'. Monte Carlo simulated standard errors are reported in the parentheses by employing 1000 random draws.
2. \* denotes the statistical significance of point estimates at 5 per cent level assuming that the estimates are asymptotically normally distributed.

Estimated IRFs for the sub-sample period (i.e., January-March 1990 to April-June 2005) presented in Figure 5 show that the *RM* shock has no statistically significant impact on *PSA*, *RGDP*, and finally *CPI*. This again suggests that the reserve money shock has no influence on aggregate output and prices through the portfolio of the scheduled banks due to reasons already explained for the full-sample period in the preceding section. Besides, the shock in *PSA* has a significant and positive impact on *RGDP* only in the 1<sup>st</sup> quarter and then dissipates over the rest of the periods. Hence, a very short-run positive relationship between *private sector investment* as proxied by private sector advances and aggregate output exists in the economy. Lastly, these results derived from the IRFs for the sub-sample period also suggest that the existence of the overall *bank lending channel* in the economy is *weak*.<sup>37</sup>

<sup>37</sup> The results for the sub-sample period remain the same as those of alternative ordering.

**Figure 5: Impulse Responses: Bank Lending Channel (1990:1–2005:2)**



#### IV.2.2.2 Bank Lending Channel (with Total Deposits)

The 4-variable VAR model has also been estimated using total deposits instead of private sector advances for the period between January-March 1990 and April-June 2005 (i.e., the sub-sample period).<sup>38</sup> Estimated VDCs and IRFs presented in Table XI and Figure 6 respectively have been generated through 1000 *Monte Carlo* random draws from the orthogonalised residuals. The results of the empirical analysis for the sub-sample period again suggest that the movement in *RM* does not contain any information about the movements in other variables (i.e., *TOD*, *RGDP*, and *CPI*) at any time horizon except for its own future path. On the other hand, the shock in *RGDP* has a statistically significant explanatory power of predicting the movement in *CPI* starting with time horizon 12, i.e., year-3. In particular, *RGDP* shock alone explains about 28 per cent of the forecast error variance of price level in year-4. Therefore, the overall *bank lending channel* in the country is *weak* even for the sub-sample period.

TABLE XI  
VARIANCE DECOMPOSITIONS-BANK LENDING CHANNEL (1990:1-2005:2)

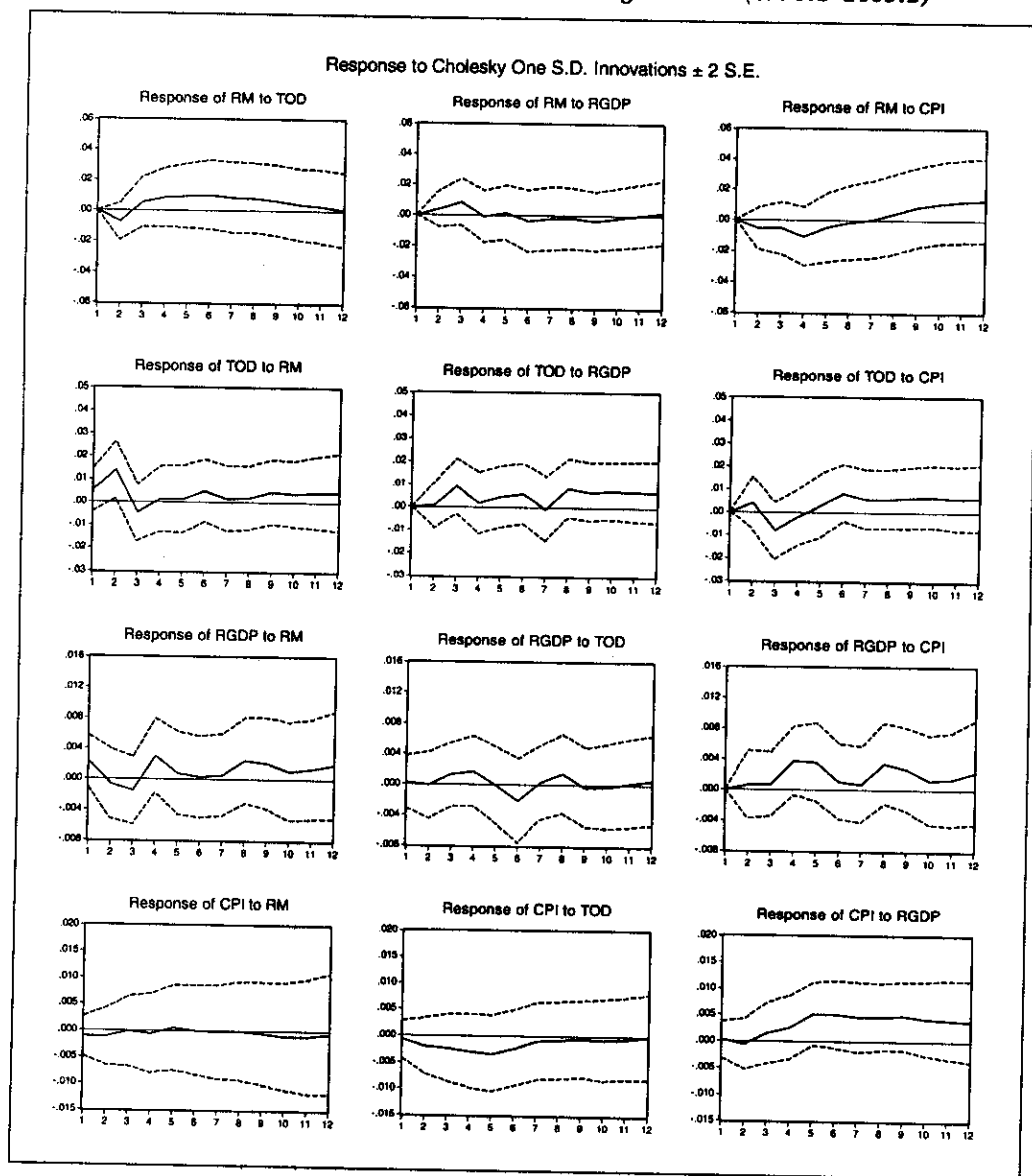
Variance Decomposition of <i>RM</i>				
Quarter	<i>RM</i>	<i>TOD</i>	<i>RGDP</i>	<i>CPI</i>
1	100.00* (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
4	91.35* (7.92)	3.25 (4.37)	1.96 (3.59)	3.42 (5.81)
8	88.27* (11.82)	7.13 (8.27)	1.64 (4.53)	2.93 (7.54)
12	81.27* (13.49)	7.44 (9.02)	1.76 (5.40)	9.51 (10.39)
16	74.84* (14.34)	6.90 (8.97)	3.50 (6.40)	14.75 (11.84)
Variance Decomposition of <i>TOD</i>				
1	2.38 (4.33)	97.61* (4.33)	0.00 (0.00)	0.00 (0.00)
4	14.95 (8.31)	74.59* (9.71)	5.31 (5.52)	5.13 (6.17)
8	13.90 (8.08)	63.72* (9.90)	10.81 (6.87)	11.55 (7.01)

(Contd. TABLE XI)

<sup>38</sup> 5 lags have been considered in the estimation that makes the residuals of the model white noise.

Variance Decomposition of <i>RM</i>				
Quarter	<i>RM</i>	<i>TOD</i>	<i>RGDP</i>	<i>CPI</i>
12	14.45 (9.19)	52.35* (10.58)	16.95 (8.07)	16.24 (9.01)
16	14.06 (10.44)	43.79* (11.23)	23.90 (9.80)	18.24 (10.26)
Variance Decomposition of <i>RGDP</i>				
1	3.15 (4.53)	0.03 (2.37)	96.80* (4.95)	0.00 (0.00)
4	8.10 (7.30)	2.18 (5.21)	82.83* (9.13)	6.87 (6.40)
8	8.14 (7.89)	3.740 (6.48)	74.41* (10.37)	13.69 (8.55)
12	9.51 (9.88)	3.18 (6.81)	71.93* (12.09)	15.36 (10.28)
16	9.92 (11.32)	2.81 (7.27)	70.05* (13.43)	17.21 (11.69)
Variance Decomposition of <i>CPI</i>				
1	0.73 (2.86)	0.26 (2.44)	0.06 (2.35)	98.92* (4.41)
4	0.62 (5.56)	3.70 (7.41)	1.956 (5.22)	93.72* (10.24)
8	0.50 (8.43)	5.21 (8.64)	15.34 (9.94)	78.93* (14.43)
12	0.79 (10.55)	4.73 (8.70)	23.26* (11.64)	71.20* (15.38)
16	0.85 (11.85)	4.42 (8.80)	27.85* (12.41)	66.86* (15.98)
Cholesky Ordering: <i>RM TOD RGDP CPI</i>				

- Notes:** 1. The first entry in each cell is the point estimate of the percentage of forecast error variance of variable 'i' as explained by shocks to variable 'j'. Monte Carlo simulated standard errors are reported in the parentheses by employing 1000 random draws.
2. \* denotes the statistical significance of point estimates at 5 per cent level assuming that the estimates are asymptotically normally distributed.

**Figure 6: Impulse Responses: Bank Lending Channel (1990:1–2005:2)**

The estimated IRFs with alternative specification (i.e., using total deposits instead of private sector advances) for the sub-sample period (i.e., January-March 1990 to

April-June 2005) presented in Figure 6 show that the *RM* shock has no statistically significant impact on *RGDP* and *CPI* except for *TOD* for a very short period. In particular, *RM* shock has a significant and positive impact on *TOD* only in the 2<sup>nd</sup> quarter and then dissipates over the rest of the periods, indicating a very short-run positive influence on *TOD*. This is in line with the full-sample period that is the impact of reserve money shock has not been transmitted to aggregate output and prices through the portfolio of the scheduled banks. These results derived from the IRFs for the sub-sample period also suggest that the existence of the overall *bank lending channel* in the economy is weak.<sup>39</sup>

#### IV.3.1 Exchange Rate Channel (1979:3–2005:2)

In order to investigate the existence of *exchange rate channel* in Bangladesh, the 6-variable VAR model has been estimated using quarterly data for the period between July-September 1979 and April-June 2005 (i.e., full-sample period) with an optimal lag of 6 for each variable in the model.<sup>40</sup> The estimated VDCs and IRFs reported in Table XII and Figure 7 have been generated through 1000 *Monte Carlo* simulations from the orthogonalised residuals. The empirical results for the full-sample period suggest that the shock in *RM* has no statistically significant influence over predicting the movements in other variables (i.e., *CPI*, *NEXR*, *EPR*, *IMP*, and *RGDP*) at any time horizon except for its own future path.

However, the shock in *CPI* has a statistically significant explanatory power of forecasting the movement in *NEXR* (i.e., BDT/USD) starting time horizon 12, i.e., year-3. In particular, *CPI* shock alone explains about 37 per cent of the forecast error variance of nominal exchange rate in year-4. Conversely, the shock in *EPR* has a statistically significant influence over predicting the movement in *IMP* over all time horizons though not vice versa. For instance, the *EPR* shock alone explains about 30 per cent of the forecast error variance of imports in year-2 with the magnitude remaining stable between the 4 quarters on. Analysis of the results derived from the VDCs for the full-sample period suggests that the existence of the overall *exchange rate channel* in the country is weak, and thus, not captured in the empirical estimation of the paper.

<sup>39</sup> The results remain the same as those of alternative ordering.

<sup>40</sup> 6 lags have been considered that makes the residuals of the 6-variable VAR model white noise.

TABLE XII  
VARIANCE DECOMPOSITIONS—EXCHANGE RATE CHANNEL (1979:3–2005:2)

Variance Decomposition of <i>RM</i>						
Quarter	<i>RM</i>	<i>CPI</i>	<i>NEXR</i>	<i>EPR</i>	<i>IMP</i>	<i>RGDP</i>
1	100.00*	0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
4	92.82*	1.42	2.48	1.74	1.03	0.51
	(7.18)	(3.49)	(4.10)	(3.70)	(2.67)	(2.30)
8	88.54*	3.49	2.27	3.69	1.48	0.53
	(11.55)	(6.99)	(5.19)	(7.32)	(4.95)	(2.73)
12	79.83*	3.78	9.79	3.51	2.09	1.00
	(12.19)	(7.69)	(7.44)	(8.26)	(5.63)	(2.76)
16	67.87*	11.69	12.86	3.32	3.12	1.14
	(11.77)	(9.89)	(7.99)	(8.69)	(5.77)	(2.68)
Variance Decomposition of <i>CPI</i>						
1	0.03	99.97*	0.00	0.00	0.00	0.00
	(1.45)	(1.45)	(0.00)	(0.00)	(0.00)	(0.00)
4	2.79	84.64*	9.66	0.99	1.34	0.58
	(4.00)	(8.39)	(6.45)	(2.62)	(2.26)	(2.35)
8	6.16	79.65*	9.46	1.05	2.74	0.94
	(7.12)	(11.93)	(7.85)	(5.41)	(4.13)	(2.58)
12	7.81	75.91*	10.58	1.54	3.27	0.89
	(8.31)	(14.37)	(9.52)	(8.29)	(6.08)	(2.80)
16	9.39	70.67*	12.23	2.31	4.54	0.86
	(8.94)	(15.39)	(10.52)	(10.57)	(7.29)	(2.95)
Variance Decomposition of <i>NEXR</i>						
1	5.33	0.89	93.78*	0.00	0.00	0.00
	(4.41)	(2.27)	(4.89)	(0.00)	(0.00)	(0.00)
4	9.93	2.96	79.09*	4.25	3.39	0.38
	(7.98)	(3.51)	(9.83)	(4.95)	(3.63)	(1.99)
8	9.10	13.29	59.33*	3.48	14.34	0.46
	(8.17)	(9.39)	(12.69)	(5.78)	(9.61)	(2.40)
12	6.71	31.39*	43.04*	2.97	14.33	1.56
	(7.34)	(13.61)	(12.43)	(7.11)	(9.94)	(2.88)
16	5.94	36.69*	37.57*	2.65	13.72	3.43
	(7.19)	(14.32)	(12.03)	(8.87)	(9.52)	(3.66)

(Contd. TABLE XII)

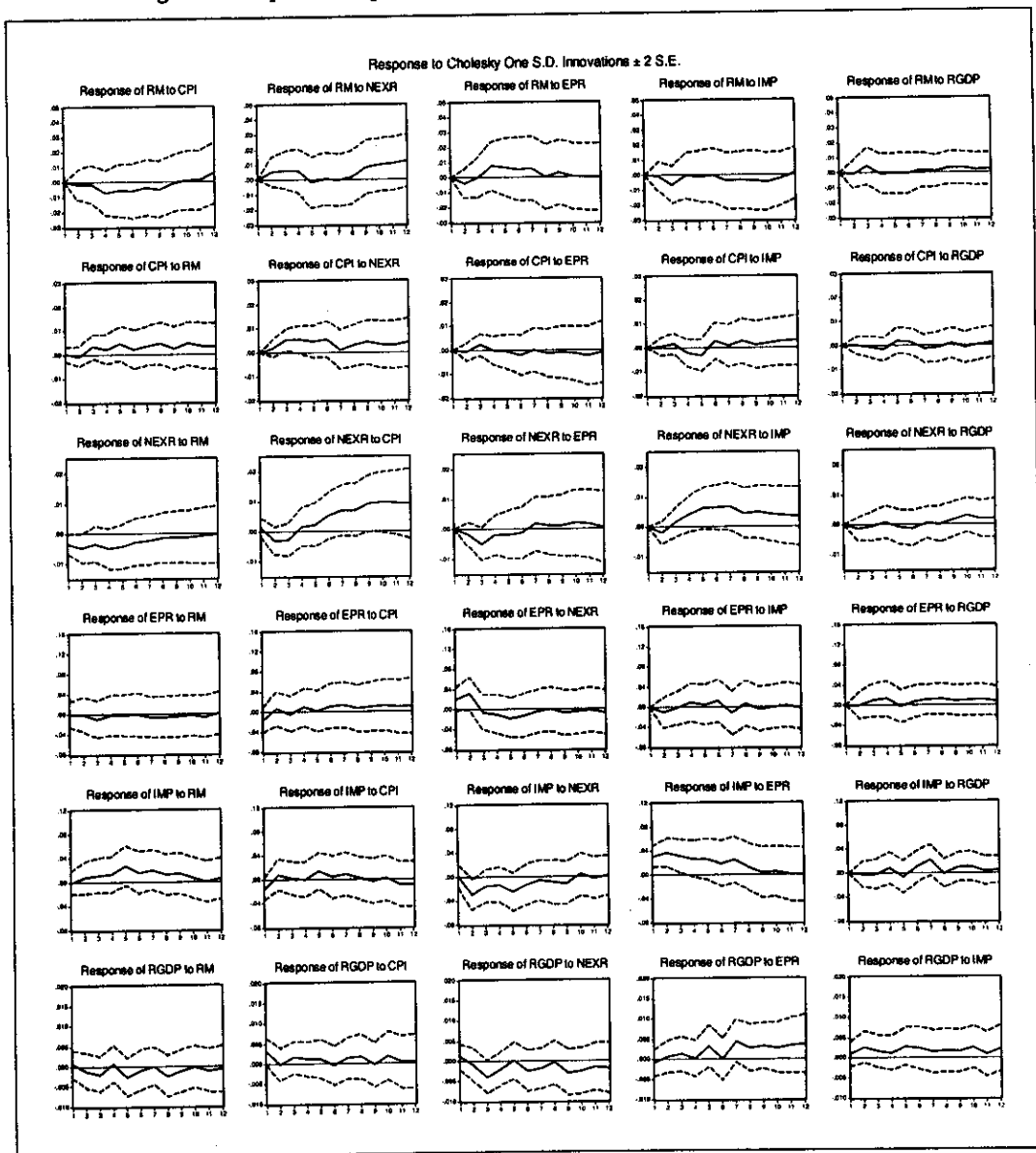


Variance Decomposition of <i>RM</i>						
Quarter	<i>RM</i>	<i>CPI</i>	<i>NEXR</i>	<i>EPR</i>	<i>IMP</i>	<i>RGDP</i>
Variance Decomposition of <i>EPR</i>						
1	0.01 (1.50)	1.958 (2.93)	3.09 (3.87)	94.92* (4.89)	0.00 (0.00)	0.00 (0.00)
4	0.54 (3.68)	1.74 (3.45)	6.77 (4.91)	88.97* (7.61)	0.91 (3.02)	1.07 (3.31)
8	0.73 (4.74)	2.39 (5.24)	6.95 (5.30)	86.25* (9.67)	1.86 (4.39)	1.82 (3.40)
12	0.94 (5.44)	3.51 (7.54)	6.89 (5.99)	84.25* (11.47)	1.84 (5.05)	2.57 (3.81)
16	0.91 (5.69)	4.20 (8.74)	6.68 (6.35)	82.86* (12.50)	2.06 (5.43)	3.29 (4.17)
Variance Decomposition of <i>IMP</i>						
1	0.02 (1.39)	3.10 (3.69)	0.00 (1.48)	12.11* (5.71)	84.77* (6.76)	0.00 (0.00)
4	2.35 (4.39)	2.22 (3.49)	9.58 (6.81)	28.95* (9.63)	56.35* (9.04)	0.55 (2.49)
8	9.46 (7.55)	3.11 (4.99)	11.87 (7.74)	30.05* (10.51)	41.95* (8.17)	3.56 (3.24)
12	9.97 (7.47)	3.73 (5.86)	11.67 (7.45)	27.97* (10.36)	42.15* (8.35)	4.51 (3.67)
16	9.99 (7.15)	4.22 (6.78)	12.29 (7.23)	27.47* (10.58)	41.14* (8.37)	4.89 (3.87)
Variance Decomposition of <i>RGDP</i>						
1	0.14 (1.63)	4.14 (4.03)	0.49 (1.90)	0.32 (1.77)	0.42 (1.73)	94.49* (5.05)
4	1.92 (3.88)	4.53 (4.35)	7.24 (5.69)	0.93 (3.45)	3.90 (4.42)	81.48* (8.05)
8	4.29 (4.99)	4.24 (4.86)	6.73 (5.60)	8.68 (6.72)	6.48 (5.77)	69.58* (9.18)
12	3.84 (5.39)	3.86 (5.59)	8.50 (6.95)	14.10 (9.94)	7.55 (6.67)	62.15* (10.56)
16	3.50 (5.78)	3.21 (6.48)	10.15 (8.12)	19.26 (12.79)	6.92 (7.07)	56.96* (11.99)

Cholesky Ordering: *RM CPI NEXR EPR IMP RGDP*

- Notes:** 1. The first entry in each cell is the point estimate of the percentage of forecast error variance of variable 'i' as explained by shocks to variable 'j'. Monte Carlo simulated standard errors are reported in the parentheses by employing 1000 random draws.
2. \* denotes the statistical significance of point estimates at 5 per cent level assuming that the estimates are asymptotically normally distributed.

**Figure 7: Impulse Responses: Exchange Rate Channel (1979:3–2005:2)**



The estimated IRFs presented in Figure 7 for the full-sample period (i.e., July–September 1979 to April–June 2005) show that the shock in RM has no statistically

significant impact on *CPI* as well as *EPR*, *IMP*, and *RGDP* except for *NEXR*. This, in turn, suggests that prices and aggregate output in the economy have not been influenced by the reserve money shock. The contributing reason behind these results would appear that the monetary policy framework under the fixed exchange rate regime for a considerable length of time in the full-sample period (i.e., up to 31 May, 2003) where reserve money as a policy variable has been unable to explain the monetary transmission mechanism through the *exchange rate channel* in Bangladesh. However, *RM* shock has a negative and significant impact on *NEXR* (i.e., BDT/USD) only in the 1<sup>st</sup> quarter and then dissipates over the rest of the periods. This is an interesting finding since it partly confirms the claims by many economists as well as policymakers regarding the overvalued exchange rate under the fixed exchange rate regime in Bangladesh (Ahmed, 2006).<sup>41</sup>

On the other hand, the shock in *NEXR* has a significant and positive impact on *CPI* only in the 3<sup>rd</sup> quarter, indicating a very short-run positive influence on *CPI*. Besides, the response of *IMP* to *NEXR* shock is insignificant in the 1<sup>st</sup> quarter and then turns negative and significant in the 2<sup>nd</sup> quarter and then becomes insignificant over the rest of the periods. This confirms the existence of the general relationship between the appreciation/depreciation of nominal exchange rates and imports in Bangladesh. It is also observable that the shock in *EPR* has a significant and positive impact on *IMP* from 1<sup>st</sup> to 3<sup>rd</sup> quarter and then dissipates suggesting a short-run positive influence on *IMP*. It matches the actual export-import structure of Bangladesh where exports mostly depend on imported capital machineries, raw materials, etc. In conclusion, the IRFs obtained for the full-sample period (i.e., July-September 1979 to April-June 2005) suggest that the existence of the overall *exchange rate channel* in Bangladesh is *weak* due to reasons already explained above.<sup>42</sup> However, following the move from a fixed exchange rate to floating regime, the recent experience of volatility in the foreign exchange market perhaps indicates the working of the overall *exchange rate channel* in the economy under the monetary policy framework pursued by the BB.<sup>43</sup>

#### IV.3.2 Exchange Rate Channel (1990:1–2005:2)

The above 6-variable VAR model regarding the overall *exchange rate channel* in the country has also been re-examined using quarterly data for the period between

<sup>41</sup> Overvalued exchange rate of domestic currency in a small open economy hurts exports and tends to increase imports (Ahmed 2006).

<sup>42</sup> The results for the full-sample period remain the same as those of alternative ordering.

<sup>43</sup> The existence of the overall *exchange rate channel* in an economy mainly depends on the degree of openness, the responsiveness of the exchange rate to monetary policy shocks, and the sensitivity of net exports to exchange rate fluctuations.

January-March 1990 and April-June 2005 (i.e., the sub-sample period) with an optimal lag of 5 for each variable.<sup>44</sup> The computed VDCs and IRFs presented in Table XIII and Figure 8 have been generated through *Monte Carlo* simulations from the orthogonalised residuals. The results obtained for the sub-sample period again indicate that the *RM* shock does not have any statistically significant explanatory power of predicting the movements in *CPI*, *EPR*, and *RGDP* at any time horizon. However, the shock in *RM* has a significant influence over predicting the movement in *NEXR* (i.e., BDT/USD) only at time horizon 8 and *IMP* starting time horizon 8 as well as its own future path starting the very first quarter. For instance, *RM* shock alone explains about 35 per cent and more than 50 per cent of the forecast error variances of nominal exchange rates in year-2 and of imports in year-3 respectively.

The movement in *RGDP*, on the other hand, has a statistically significant explanatory power of forecasting the future path of *CPI* starting time horizon 8 as well as *NEXR* starting time horizon 12. Specifically, the shock in *RGDP* explains about 16 per cent and 14 per cent of the forecast error variances of price level and nominal exchange rate in year-4 respectively. Besides, the movement in *CPI* alone significantly explains 26.06 per cent of the forecast error variance of *NEXR* only in year-4. Analysis of these results obtained from the VDCs for the sub-sample period again implies that the existence of the overall *exchange rate channel* in Bangladesh is *weak*.

The computed IRFs presented in Figure 8 for the sub-sample period (i.e., January-March 1990 to April-June 2005) show that the shock in *RM* has no statistically significant impact on *CPI*, *EPR*, *IMP* as well as *NEXR* except for *RGDP*. In particular, the response of aggregate output to reserve money shock is positive and significant only in the 1<sup>st</sup> quarter and then turns insignificant over the rest of the periods. Thus, aggregate output in the economy has been influenced by the reserve money shock (i.e., monetary policy shock) for a short while. However, the price level remains independent of the reserve money shock partially due to supply side bottlenecks other than monetary phenomenon in the empirical estimation.

The shock in *RGDP* has a significant and positive impact on *CPI* only in the 5<sup>th</sup> quarter, indicating a very short-run positive influence (with lag effect) on *CPI*. Besides, the response of *CPI* to *IMP* shock is negative and significant in the 1<sup>st</sup> quarter and then becomes insignificant over the rest of the periods. It is also noticeable that the shock in *NEXR* has a significant and positive impact on *EPR* only in the 2<sup>nd</sup> quarter suggesting a very short-run positive impact on *EPR*. This supports the

<sup>44</sup> 5 lags have been considered in the estimation that makes the residuals of the VAR model white noise.

existence of the general relationship between the appreciation/depreciation of nominal exchange rates and export competitiveness in the economy. Finally, the IRFs for the sub-sample period again confirm that the existence of the overall *exchange rate channel* in Bangladesh is *weak* mainly due to reasons already explained for the full-sample period in the preceding section.<sup>45</sup>

TABLE XIII  
VARIANCE DECOMPOSITIONS—EXCHANGE RATE CHANNEL (1990:1–2005:2)

Variance Decomposition of <i>RM</i>						
Quarter	<i>RM</i>	<i>CPI</i>	<i>NEXR</i>	<i>EPR</i>	<i>IMP</i>	<i>RGDP</i>
1	100.00*	0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
4	89.87*	4.79	2.14	0.47	0.74	1.99
	(11.13)	(7.93)	(5.24)	(4.14)	(3.85)	(3.31)
8	80.35*	7.38	3.75	2.96	3.87	1.69
	(15.20)	(10.71)	(7.16)	(8.97)	(6.89)	(3.58)
12	75.71*	7.63	5.16	5.69	3.88	1.93
	(15.29)	(10.86)	(7.54)	(11.52)	(6.99)	(3.78)
16	67.08*	10.58	4.99	10.04	4.29	3.02
	(15.58)	(11.65)	(7.24)	(13.18)	(7.25)	(4.22)
Variance Decomposition of <i>CPI</i>						
1	1.02	98.98*	0.00	0.00	0.00	0.00
	(3.18)	(3.18)	(0.00)	(0.00)	(0.00)	(0.00)
4	0.97	74.46*	5.42	2.77	11.99	4.39
	(5.79)	(11.46)	(6.99)	(4.21)	(8.38)	(4.19)
8	3.49	57.91*	2.95	5.66	16.85	13.14*
	(9.99)	(14.84)	(6.37)	(8.92)	(10.33)	(6.42)
12	3.19	55.39*	2.68	8.35	15.19	15.20*
	(11.56)	(14.87)	(6.49)	(12.16)	(9.14)	(6.62)
16	4.48	53.94*	2.57	8.14	14.99	15.88*
	(13.29)	(14.59)	(7.01)	(13.16)	(8.99)	(6.49)
Variance Decomposition of <i>NEXR</i>						
1	4.76	3.83	91.41*	0.00	0.00	0.00
	(5.50)	(5.07)	(7.14)	(0.00)	(0.00)	(0.00)
4	16.62	8.04	59.31*	1.98	3.80	10.25
	(11.96)	(8.70)	(13.14)	(4.79)	(5.54)	(5.90)
8	34.51*	8.99	39.28*	3.43	3.84	9.95
	(16.32)	(8.78)	(11.82)	(7.26)	(5.74)	(5.67)
12	29.86	20.46	28.30*	3.18	5.69	12.51*
	(16.13)	(12.53)	(9.60)	(9.30)	(6.85)	(5.93)

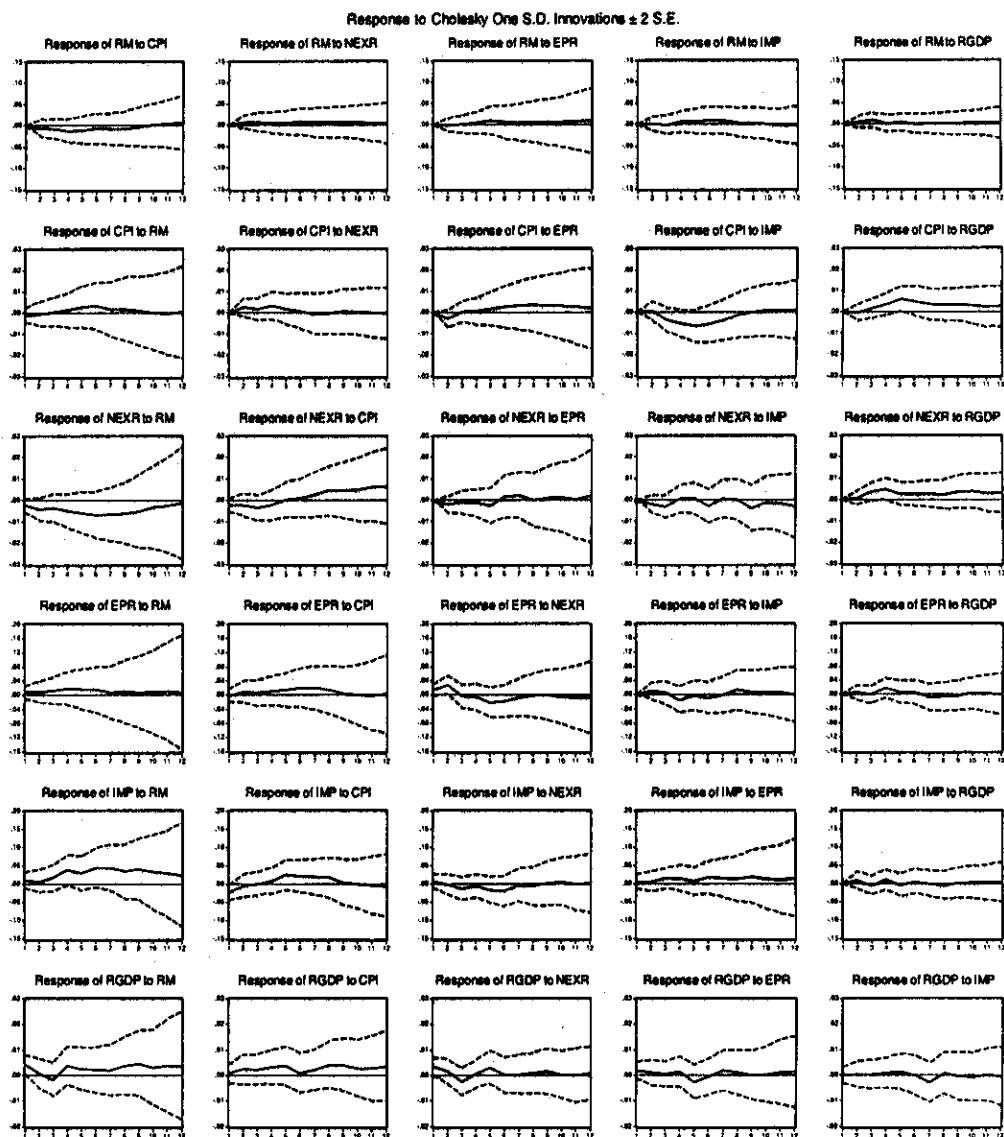
(Contd. TABLE XIII)

<sup>45</sup> The results for the sub-sample period remain the same as those of alternative ordering of the relevant variables.

Variance Decomposition of <i>RM</i>						
Quarter	<i>RM</i>	<i>CPI</i>	<i>NEXR</i>	<i>EPR</i>	<i>IMP</i>	<i>RGDP</i>
16	27.52 (15.44)	26.06* (13.02)	24.18* (8.98)	3.52 (11.39)	4.88 (6.96)	13.84* (5.86)
Variance Decomposition of <i>EPR</i>						
1	1.98 (4.43)	0.16 (2.45)	4.82 (5.28)	93.04* (6.93)	0.00 (0.00)	0.00 (0.00)
4	5.86 (8.98)	2.24 (6.17)	9.36 (6.53)	76.27* (12.29)	3.18 (4.67)	3.09 (4.39)
8	5.67 (11.02)	6.65 (9.81)	8.11 (6.45)	74.59* (14.68)	2.69 (5.50)	2.29 (3.76)
12	5.53 (13.06)	5.47 (10.55)	7.07 (7.02)	77.34* (16.36)	2.62 (6.45)	1.97 (4.33)
16	5.69 (14.65)	4.67 (11.43)	6.02 (7.44)	78.74* (17.59)	3.04 (7.04)	1.82 (4.94)
Variance Decomposition of <i>IMP</i>						
1	1.67 (3.82)	9.37 (6.96)	1.19 (3.19)	0.57 (2.63)	87.22* (8.09)	0.00 (0.00)
4	20.99 (10.66)	7.01 (6.39)	3.07 (5.04)	6.27 (6.83)	60.17* (10.20)	2.49 (4.32)
8	42.36* (14.18)	12.68 (8.62)	5.32 (6.16)	7.19 (8.03)	30.77* (8.77)	1.68 (3.66)
12	50.03* (15.89)	10.07 (9.04)	4.34 (6.39)	9.91 (10.65)	24.10* (8.87)	1.55 (4.18)
16	48.46* (15.89)	9.55 (10.19)	4.45 (6.94)	12.95 (12.93)	23.15* (9.49)	1.44 (4.71)
Variance Decomposition of <i>RGDP</i>						
1	10.00 (6.97)	0.31 (2.53)	6.74 (5.90)	2.02 (3.71)	0.04 (1.85)	80.89* (8.60)
4	14.81 (8.95)	9.22 (8.05)	8.65 (6.22)	3.02 (4.69)	0.61 (4.73)	63.69* (9.32)
8	17.13 (10.23)	15.72 (9.30)	8.26 (6.62)	5.00 (5.88)	3.16 (5.72)	50.73* (8.66)
12	23.15 (13.08)	19.88 (10.69)	6.62 (7.08)	4.24 (7.89)	2.47 (6.23)	43.64* (9.35)
16	26.49 (14.59)	21.49 (11.65)	5.73 (7.59)	4.26 (10.38)	2.04 (7.06)	39.99* (9.97)
Cholesky Ordering: <i>RM CPI NEXR EPR IMP RGDP</i>						

**Notes:** 1. The first entry in each cell is the point estimate of the percentage of forecast error variance of variable 'i' as explained by shocks to variable 'j'. Monte Carlo simulated standard errors are reported in the parentheses by employing 1000 random draws.

2. \* denotes the statistical significance of point estimates at 5 per cent level assuming that the estimates are asymptotically normally distributed.

**Figure 8: Impulse Responses: Exchange Rate Channel (1990:1–2005:2)**

## V. CONCLUSION

In view of changes in legal, institutional and policy frameworks in the financial system of Bangladesh under the FSRP initiated in the early 1990s, the paper attempted to empirically investigate whether *bank lending* and *exchange rate channels* exist in the economy through which monetary policy changes can influence aggregate output and prices. An assessment of the empirical evidence has been performed through the unrestricted VARs approach using a quarterly data in the relevant time series variables. Major findings are summarised as follows:

- *Bank Lending Channel (1979:3–2005:2)*
  - *Bank Lending Channel (with Private Sector Advances)*: VDCs indicate that reserve money has no explanatory power of forecasting the movements in other variables while private sector advances is an important variable for predicting the movements in real output as well as prices only in year 2-and year-4 respectively. On the other hand, IRFs show that private sector advances, aggregate output and prices are non-responsive to reserve money which is very much in line with the outcome of VDCs. Besides, prices respond positively to private sector advances only in the 1<sup>st</sup> quarter and then dissipate. The response of aggregate output to private sector advances is positive in the 1<sup>st</sup> and 5<sup>th</sup> quarters.
  - *Bank Lending Channel (with Total Deposits)*: The estimated VDCs indicate that reserve money has no explanatory power of predicting the movements in other variables except for total deposits. Conversely, total deposits are vital for forecasting the movements in prices in year-4. The IRFs show that except for total deposits, aggregate output and prices are non-responsive to reserve money. Besides, prices respond positively to total deposits only in the 12<sup>th</sup> quarter (i.e., lag effect).
- *Bank Lending Channel (1990:1–2005:2)*
  - *Bank Lending Channel (with Private Sector Advances)*: VDCs again suggest that the movement in reserve money does not contain any information about the movements in other variables. Conversely, private sector advances have significant explanatory power of predicting the movement in aggregate output starting year-3. IRFs show that private sector advances, aggregate output and prices are non-responsive to reserve money and aggregate output responds positively to private sector advances only in the 1<sup>st</sup> quarter.
  - *Bank Lending Channel (with Total Deposits)*: The results from VDCs again indicate that the movement in reserve money does not contain any information



about the movements in other variables. Besides, real output has a significant explanatory power of predicting the movement in prices starting year-3. The IRFs show that except for total deposits, aggregate output and prices are non-responsive to reserve money. On the other hand, total deposits respond positively to prices in the 3<sup>rd</sup> quarter and private sector advances respond positively to aggregate output only in the 1<sup>st</sup> quarter.

- *Exchange Rate Channel (1979:3–2005:2)*: Estimated VDCs suggest that reserve money has no influence in predicting the movements in other variables. However, price level has a significant explanatory power of forecasting the movement in nominal exchange rate (i.e., BDT/USD) starting year-3. Besides, exports have a significant influence in predicting the movement in imports over all time periods. On the other hand, IRFs show that nominal exchange rate reacts negatively to reserve money only in the 1<sup>st</sup> quarter and prices respond positively to nominal exchange rate in the 3<sup>rd</sup> quarter. Imports respond negatively to nominal exchange rate in the 2<sup>nd</sup> quarter and positively to exports from 1<sup>st</sup> to 3<sup>rd</sup> quarters.
- *Exchange Rate Channel (1990:1–2005:2)*: VDCs indicate that reserve money has a significant explanatory power of predicting the movements in nominal exchange rate only in year-2 and imports starting year-2. The movement in aggregate output, on the other hand has a significant explanatory power of forecasting the future path of prices starting year-2 as well as nominal exchange rate starting year-3. Besides, the movement in prices explains the future path of nominal exchange rate only in year-4. Conversely, IRFs show that aggregate output responds positively to reserve money in the 1<sup>st</sup> quarter and prices react positively to aggregate output in the 5<sup>th</sup> quarter. The response of prices to imports is negative and significant in the 1<sup>st</sup> quarter and exports respond positively to nominal exchange rate only in the 2<sup>nd</sup> quarter.

The results of the empirical analysis suggest *weak* existence of both *bank lending* and *exchange rate channels* in the economy for the full-sample period (i.e., July-September 1979 to April-June 2005) as well as in the sub-sample period (i.e., January-March 1990 to April-June 2005). Recall that the country adopted the FSRP in the early 1990s. Therefore, the observation regarding the existence of *bank lending channel* is partly consistent with the empirical evidence of Younus (2004), that is, the channel is non-existent in Bangladesh. But the analysis of historical data presented in Tables I and V indicate discernible success of monetary policy in the long-run in terms of the growth-money-inflation nexus. Economic growth picked up, actual monetary expansion was more or less within the *safe limit* and inflation converged to a moderate level over time.

Several explanations may be put forward to support the findings obtained of the paper. First, though the data set includes observations for the period July-September 1979 to April-June 2005, most of the reforms under the FSRP were fully in effect only from the late 1990s (e.g., interest rate liberalisation of 1997). Second, monetary policy framework in the sample period was mainly under the fixed exchange rate and fiscal dominance. Third, although less relevant in recent years, the existence and continuation of *directed credits* at *concessional rates* by NCBs as well as SBs and the consequent high non-performing loans (NPLs) of these banks partially distort the channels of monetary transmission in the economy. Fourth, the excess liquidity position in the banking system as well as a significant share of net government borrowing in reserve money in most years partly neutralise the efficacy of monetary policy actions. Finally, a large number of unregulated micro-finance institutions are actively present in the economy.

The empirical findings of the paper have important implications with respect to the operation of monetary policy. Specifically, knowing the distinct active channels of monetary transmission in the economy would guide the monetary authority in formulating and conducting monetary policy pursuant to its objectives under the current regime, i.e., floating exchange rate and market based monetary policy instruments.

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## Annexes

TABLE A.1  
LIQUIDITY POSITION IN THE BANKING SYSTEM

Fiscal Year	Total Liquid Assets	Required Liquid Assets	Excess Liquidity	Excess Liquidity as % of Required Level
1986-87	33.60	25.00	8.60	34.40
1987-88	42.20	37.44	4.75	12.69
1988-89	46.03	43.67	2.36	5.40
1989-90	49.57	48.49	1.08	2.23
Average (1986-87 to 1989-90)	42.85	38.65	4.20	13.68
1990-91	54.57	51.07	3.50	6.85
1991-92	59.76	51.33	8.43	16.42
1992-93	64.24	57.23	7.01	12.25
1993-94	88.60	64.67	23.93	37.00
1994-95	86.77	69.54	17.23	24.78
Average (1990-91 to 1994-95)	70.79	58.77	12.02	19.46
1995-96	93.40	80.08	13.32	16.63
1996-97	105.90	88.81	17.09	19.24
1997-98	117.19	97.46	19.73	20.24
1998-99	138.10	104.74	33.35	31.84
1999-00	178.39	124.96	53.44	42.77
Average (1995-96 to 1999-00)	126.60	99.21	27.39	26.14
2000-01	188.75	144.13	44.62	30.96
2001-02	228.28	162.41	65.87	40.56
2002-03	266.56	186.85	79.71	42.66
2003-04	286.90	169.36	117.54	69.40
2004-05	305.71	196.29	109.42	55.74
Average (2000-01 to 2004-05)	255.24	171.80	83.43	47.86
2005-06	351.47	255.56	95.91	37.53

**Note:** All figures are in billion BDT (outstanding amounts) as of end June of respective fiscal years.

**Source:** Department of Off-site Supervision, BB and authors' calculation.

TABLE A.2  
SCHEDULED BANK CREDIT PATTERN

Year	NCBs		SBs		FCBs		PCBs (including IBs)		IBs		All Banks	NCB & SB as % of All Banks
	Advance	Bills	Advance	Bills	Advance	Bills	Advance	Bills	Advance	Bills		
1999	278.66	8.22	97.37	0.54	30.27	2.85	157.69	8.76	32.85	2.28	584.35	65.85
2000	297.95	14.00	102.06	0.69	35.03	1.70	196.68	12.50	42.97	1.76	660.61	62.78
2001	327.73	13.65	108.28	0.77	37.77	3.36	253.72	14.79	56.24	1.54	760.05	59.26
2002	355.86	20.85	109.22	0.74	50.92	2.10	314.31	15.18	73.19	2.45	869.17	55.99
2003	361.68	22.94	99.63	0.54	61.64	2.20	372.42	20.27	92.04	4.19	941.31	51.50
2004	381.09	23.61	107.95	1.40	69.05	2.44	466.27	26.17	137.32	7.71	1077.99	47.69
2005	423.86	69.81	110.41	1.14	78.80	4.36	589.41	42.61	171.41	8.37	1500.17	40.34

Note: Figures for advances and bills are in billion BDT (outstanding amounts) at the period end.

Source: Banking Statistics Division, Statistics Department, BB.



**TABLE A.3**  
**RESERVE MONEY AND NET GOVERNMENT CREDIT FROM THE BANGLADESH BANK**

Fiscal Year	Reserve Money	Net Government Borrowing from BB	Net Government Credit as % of Reserve Money
1980-81	13.35	14.77	110.64
1981-82	12.80	15.81	123.52
1982-83	16.23	18.20	112.14
1983-84	22.35	13.51	60.45
1984-85	26.75	14.24	53.23
Average (1980-81 to 1984-85)	18.30	15.31	91.99
1985-86	32.71	17.89	54.69
1986-87	37.41	19.63	52.47
1987-88	50.57	22.45	44.39
1988-89	54.68	9.86	18.03
1989-90	63.17	16.78	26.56
Average (1985-86 to 1989-90)	47.71	17.32	39.23
1990-91	65.00	16.77	25.80
1991-92	68.20	12.00	17.60
1992-93	89.50	14.50	16.20
1993-94	113.10	10.10	8.93
1994-95	106.30	12.50	11.76
Average (1990-91 to 1994-95)	88.42	13.17	16.06
1995-96	110.00	30.40	27.64
1996-97	124.00	44.90	36.21
1997-98	136.20	53.00	38.91
1998-99	147.40	63.60	43.15
1999-00	170.70	81.00	47.45
Average (1995-96 to 1999-00)	137.66	54.58	38.67
2000-01	189.30	101.10	53.41
2001-02	235.30	128.30	54.53
2002-03	243.10	102.50	42.16
2003-04	262.60	119.00	45.32
2004-05	295.50	157.20	53.20
Average (2000-01 to 2004-05)	245.16	121.62	49.72
2005-06	378.63	246.62	65.13

**Note:** Figures for 'Reserve Money' and 'Net Government Credit from BB' are in billion BDT (outstanding amounts) as of end June of respective fiscal years.

**Sources:** 1. Bangladesh Bank Annual Report (various issues), BB.  
 2. Economic Trends (various issues), BB.  
 3. Authors' calculation.