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Determinants of Demand for and Supply of Money in Bangladesh

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DETERMINANTS OF DEMAND FOR AND SUPPLY OF MONEY IN BANGLADESH

A dissertation submitted to the University of Rajshahi
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in Economics

By

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Declaration

I hereby declare that the work submitted here as a dissertation entitled, **"Determinants of Demand for and Supply of Money in Bangladesh"** for the degree of Doctor of Philosophy in the Department of Economics, Rajshahi University is the result of my original research work and it has not been submitted in part or full for any diploma or degree to any other university. My indebtedness to other works/publications has been duly acknowledged at the relevant places.

Mahmuda

Mst. Hadikatul Jannat Al Mahmuda

Certificate

This is to certify that the dissertation, **"Determinants of Demand for and Supply of Money in Bangladesh"** is an original research work done by Mst. Hadikatul Jannat Al Mahmuda for the degree of Doctor of Philosophy in the Department of Economics, Rajshahi University under my supervision. The thesis has not been submitted elsewhere for any other degree. The references cited in it have been duly acknowledged.

21.06.2011

Professor Md. Abdul Quayum

Supervisor

Dedicated

To

My Parents

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Mst. Hadikatul Jannat Al Mahmuda

Abstract

This is an empirical study of demand for and supply of money in Bangladesh. The study covers the period 1976 to 2008. Estimates were obtained for the whole period as well as for the two sub-periods, 1976 to 1990 and 1991 to 2008. Of these two periods, the first period is known as the pre-liberalisation period characterised by highly regimented interest rate, while the second period is known as the post-liberalisation period that saw greater flexibility in interest rate. While the estimates of the first period showed income as the most dominant variable, the estimates for the second period revealed increasing role of the interest rate, which implied that the money demand function was converging towards the Keynesian specification with the passage of time. Simultaneous estimation of the money demand and money supply function showed that although money supply function was not found to be very significant, it strengthened the demand function and raised the significance of the interest rate. This work specifically studied the issue of structural break using the Chow test, which revealed that there was indeed a structural break between the two periods. The problem of autocorrelation, widely prevalent in time series studies like this, was formally investigated and autocorrelation corrected estimates were presented. The stability of the money demand function was looked into using the techniques of time series econometrics and results showed that although there was short-run instability, stability existed in the long-run. The causality study showed that income Granger caused money supply, which was consistent with growing money supply of the Bangladesh Bank. This study thus provides a comprehensive picture of money demand and money supply in Bangladesh for the period 1976 to 2008.

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Chapter 1

INTRODUCTION

This is an empirical study of demand for and supply of money in Bangladesh. It covers the period from 1976 to 2008. It is divided into two parts—the pre-liberalisation period (1976–1990) and the post-liberalisation period (1991–2008). The first period is characterised by highly regimented interest rate policy while the second period is marked by greater flexibility of interest rate.

This empirical study on demand for money deals with two aspects. The first aspect is concerned with **determinants** of demand for money and other issues related to it, while the second aspect is concerned with **stability** of the money demand function.

Since money supply is controlled by the central bank of a country, there are very few works on money supply function. One such supply function is estimated on the econometric software EViews, which gave it in the way of an example and not as a theoretical justification of a money supply function. Also, it is used for simultaneous estimation of demand and supply functions of money using the two-stage least squares method.

In recent time, a great deal of work has been done on causality between money supply and other relevant variables. In this thesis, two such relationships are examined. These are between money supply and income and money supply and price level. For this purpose, Granger's causality analysis is applied.

1.1 Rationale

It is necessary to know, especially for the implementation of monetary policy, the relative importance of determinants of money demand function. Also, stability of the money demand function is regarded as very important for monetary policy. Hence, there is need for a fresh look at both these aspects of money demand in Bangladesh.

Since supply of money is controlled by the central bank, research on money supply has not concentrated much on supply function. Rather, modern research has focused on causality analysis to asses the impact of money supply on other relevant variables such as income and price level. Since the knowledge of causality is essential, this thesis has focused on this aspect and results pertaining to the causality analysis have been obtained and reported.

1.2 Objectives

The main objective of this study is to examine various aspects of demand for and supply of money in Bangladesh using long and latest time series data. To attain this, the following objectives are specified:

1. Estimation of money demand functions using the standard determinants of **income** and **interest rate** as well as some other determinants like inflation, exchange rate, remittance, and foreign direct investment. A dummy variable has also been used to see whether there is any effect of monetary liberalisation.

2. Estimation of the money demand functions for the pre- and the post-liberalisation, that is, 1976–1990 and 1991–2008 period separately.

3. Tackling the problem of autocorrelation using the **Cochrane-Orcutt** method.

4. Formally studying whether there has been any structural break between the two sub-periods that have been considered using the well-known **Chow test**.

5. Examining the short-run stability of the money demand function using the technique of time series econometrics such as the unit root test. Examination of the long-run stability of money demand function using the cointegration test.

6. Estimation of the money supply function and simultaneous estimation of demand for and supply of money using the two-stage least square method.

7. Examination of the causal relationship between money supply and income and money supply and price level.

1.3 Methodology

The main method of studying demand for money consists in estimating demand functions of various types using time series data and testing the stability of the money demand function using appropriate techniques. These are stated below.

1.3.1 The Standard Money Demand Function

The standard money demand function shows money as a function of income and interest rate and can be generally written as:

$$M^d = f(y,i) \tag{1.1}$$

where M^d refers to real money demand, y refers to real income (GDP), and i refers to the rate of interest. Specifically, (1.1) can be written as:

$$M^d = a + by + ci \tag{1.2}$$

For empirical work, (1.2) is written in logarithmic form, where the estimated coefficients show the elasticity values

$$\log M^d = a + b\log y + c\log i \tag{1.3}$$

If only income is found to be significant, then that will imply that a classical situation prevails and only transaction demand for money is important.

If, however, empirical estimates show that both y and i are significant, then that would imply prevalence of the Keynesian situation and both transaction and speculative demand for money are important.

These observations have policy implications that have important bearing on the relevance of monetary and fiscal policy. These will be elaborately discussed when empirical results are reported and analysed.

1.3.2 The Broad and the Narrow Money Demand Function

In this study, money demand function has been separately estimated for narrow and broad money. Such estimations are of interest for monetary policy targeting by the central bank as these estimates will show whether the right definition of money was used for policy purpose.

It may be mentioned here that the Bangladesh Bank uses broad money (M2) for policy targeting. It will be interesting to see whether this study supports this or not.

1.3.3 The Money Demand Function with Some other Variables

Besides income and interest rate, which are regarded as the core variables of money demand in macroeconomic theory, researchers have also included other variables in their studies. These are regarded as useful as they can shed some additional light on the factors that can affect

money demand. In this thesis, estimates of money demand function using some of these variables have been obtained, presented, and discussed.

1.3.4 The Stability of the Money Demand Function

Monetary policy is an important instrument that is used by the central bank in Bangladesh. A key assumption behind monetary targeting is the existence of stable money demand functions.

Before 1970, the stability of money demand function was taken for granted. It was in the mid 1970s that stability of money demand function began to be questioned. A formal method for studying stability became available with the development of time series econometrics. Methods taken from this development have been used to study stability of money demand function in Bangladesh.

The monetary authority in Bangladesh assumes a stable money demand function in using monetary policy. Also, Bangladesh Bank usually uses broad money rather than narrow money for policy targeting (Rahim and Sohrabuddin, 1988; Hossain, 1992). The present study may be able to throw light on these issues.

As mentioned above in this study, stability of the money demand function is examined using the methodology of time series econometrics. The main idea behind this detailed exercise is to show that although there may be short-run instability, stability may he achieved in the long-run.

1.3.5 The Analysis of Money Supply

The study of money supply is mainly divided into two categories, one is involved in estimating the money supply function while the second part of the money supply analysis examines the causal relationship between the money supply, income and inflation. Both these aspects are dealt with in this thesis.

1.3.6 Simultaneous Analysis of Money Demand and Money Supply

In this thesis, simultaneous estimation of money demand and money supply is carried out using the two-stage least squares method taking appropriate care of the identification problem.

1.4 Data

The variables that are mainly needed for different estimations of this thesis are narrow money (M1), which equals currency and demand

deposits, broad money (M2), which equals M1 plus time (fixed) deposit, nominal interest rate on time deposits, and income (shown by gross domestic product – GDP). Some additional variables that have been used are exchange rate, rate of inflation, remittance, foreign direct investment, foreign exchange reserve, and expected inflation.

Data on the variables mentioned above have been collected from various issues of the *Bangladesh Economic Review* published by the Ministry of Finance, Government of Bangladesh, *Statistical Yearbook of Bangladesh* published by the Bangladesh Bureau of Statistics, *Economic Trends* published by the Bangladesh Bank, and *World Development Indicators*, an electronic publication of the World Bank.

1.5 Econometric Estimation

In this study, money demand functions of various types are estimated using the ordinary least squares methods and applying technique for correction of autocorrelation. The tests of stability of money demand are also done by methods available in time series econometrics. These are explained in the relevant places.

In the analysis of money supply, a supply function is estimated first and then causal relationship between money supply with income and inflation is studied. The causality analysis uses the Granger causality analysis methodology. Finally, demand for and supply of money function is simultaneously estimated using the two-stage least squares method.

The estimations can be done using the well-known econometric softwares like Shazam, EViews and MicroFit. In this thesis, EViews is used because of its familiarity and availability.

1.6 Organisation of the Study

This study is divided into seven chapters.

This is Chapter 1 and it provides an introduction to the study. It states the topic of research, the time covered, methodology, data used and their sources.

The demand for and supply of money are linked with the monetary sector of the economy and the macroeconomic situation. A description of various aspects of the monetary sector and macroeconomic situation in Bangladesh is presented in Chapter 2.

There is a large literature on demand for and supply of money. A selected review of these works is given in Chapter 3. The review is divided into two parts. The first part contains the general works on money demand and money supply while the second part provides a review of the works on money demand and supply on Bangladesh.

The theoretical models, empirical specification and estimation techniques used in this study are described and explained in Chapter 4.

Chapter 5 contains necessary data that have been used as inputs for econometric estimation.

The empirical results of this study on both money demand and money supply are presented and analysed in Chapter 6.

The summary, conclusion, and policy implications of this study are given in Chapter 7.

A comprehensive bibliography on money demand and supply appears at the end of the thesis.

Chapter 2

BACKGROUND

The monetary sector and the prevailing macroeconomic situation form the background to this study of demand for and supply of money in Bangladesh. In this chapter, various aspects of the monetary sector and macroeconomic conditions of the economy of Bangladesh in recent years are described and discussed.

The important sources of description and analysis of the economy of Bangladesh are *Bangladesh Economic Review,* an annual publication of the Ministry of Finance, Government of Bangladesh, *Monetary Policy Statement,* Monetary Policy Department of Bangladesh Bank, and *Statistical Yearbook of Bangladesh* of the Bangladesh Bureau of Statistics. This chapter is based on the materials drawn from these publications.

2.1 The Financial System

Bangladesh has a developed financial system. It consists of the Bangladesh Bank (BB) as the central bank, 4 state-owned commercial banks (SCB), 4 government-owned specialised banks, 30 domestic

private banks, 9 foreign banks and 29 non-bank financial institutions. Moreover, Microcredit Regulatory Authority (MRA) has given license to 298 microcredit organisations. The financial system also includes insurance companies, stock exchanges and co-operative banks. The financial system of Bangladesh is described below

2.1.1 Creation of Banks

The Bangladesh Bank, the central bank of Bangladesh, is empowered by the Bank Company Act, 1991, to issue licenses to carry out banking business in Bangladesh. Pursuant to section 31 of the Act, before granting a license, BB needs to be satisfied that the following conditions are fulfilled: "that the company is or will be in a position to pay its present or future depositors in full as their claims accrue; that the affairs of the company are not being or are not likely to be conducted in a manner detrimental to the interest of its present and future depositors; that, in the case of a company incorporated outside Bangladesh, the Government or law of the country in which it is incorporated Bangladesh as the Government or law of Bangladesh grants to banking companies incorporated outside Bangladesh and that the company complies with all applicable provisions of Bank Companies Act, 1991." Licenses may be cancelled if the bank fails to comply with these provisions or ceases to carry on banking business in Bangladesh.

2.1.2 Commercial Banks

In Bangladesh, as in other economies, the commercial banking system dominates the financial sector with limited role of non-bank financial institutions and the capital market. The banking sector alone accounts for a substantial share of assets of the financial system. The banking system is dominated by the 4 state-owned commercial banks, which together control more than 30% of deposits and operates 3383 branches (50% of the total) as of June 30, 2008.

2.1.3 Specialised Banks

There are several specialised banks in Bangladesh. Out of the 4 specialised banks, 2 (Bangladesh Krishi Bank and Rajshahi Krishi Unnayan Bank) were created to meet the credit need of the agricultural sector while the Bangladesh Shilpa Bank (BSB) and Bangladesh Shilpa Rin Sangtha (BSRS) are for extending term loans to the industrial sector of Bangladesh.

2.1.4 Financial Institutions (FIs)

There are several financial institutions in Bangladesh. Twenty-nine financial institutions are now operating in Bangladesh. Of these institutions, 1(one) is government owned, 15 (fifteen) are local (private)

and the other 13 (thirteen) are established under joint venture with foreign participation.

Bangladesh Bank has introduced a policy for loan and lease classification and provisioning for FIs from December 2000 on half-yearly basis. To enable the financial institutions to mobilise medium and long-term resources, Government of Bangladesh (GOB) signed a project loan with IDA, and a project known as "Financial Institutions Development Project (FIDP)" has started its operation from February 2000. Bangladesh Bank is administering the project. The project has established "Credit, Bridge and Standby Facility (CBSF)" to implement the financing program with a cost of US$ 57.00 million.

2.1.5 The Capital Market

A description of capital market in Bangladesh is given here. The capital market, an important ingredient of the financial system, plays a significant role in the economy of the country.

2.1.5.1 Regulatory Bodies

The Securities and Exchange Commission (SEC) exercises powers under the Securities and Exchange Commission Act 1993. It regulates

institutions engaged in capital market activities. Bangladesh Bank exercises powers under the Financial Institutions Act 1993 and regulates institutions engaged in financing activities including leasing companies and venture capital companies.

2.1.5.2 Participants in the Capital Market

The Security Exchange Commission (SEC) has issued licenses to 27 institutions to act in the capital market. Of these, 19 institutions are merchant banker and portfolio manager while 7 are issue managers and 1(one) acts as issue manager and underwriter.

2.1.5.3 The Stock Exchanges

Bangladesh has two stock exchanges, the Dhaka Stock Exchange (DSE) and the Chittagong Stock Exchange (CSE), which deal in the secondary capital market. DSE was established as a public Limited Company in April 1954 while CSE in April 1995. As of 30 June 2000 the total number of enlisted securities with DSE and CSE were 239 and 169 respectively. Out of 239 listed securities with the DSE, 219 were listed companies, 10 were mutual funds and 10 were debentures.

2.1.5.4 Investment Corporation of Bangladesh (ICB)

The Investment Corporation of Bangladesh was established in 1976 with the objective of encouraging and broadening the base of industrial investment. ICB underwrites issues of securities, provides substantial bridge financing programmes, and maintains investment accounts, floats and manages closed-end and open-end mutual funds and closed-end unit funds to ensure supply of securities as well as generate demand for securities. ICB also operates in the DSE and CSE as dealers.

2.2 Insurance

The insurance sector of Bangladesh is quite developed. The insurance sector is regulated by the Insurance Act, 1938 with regulatory oversight provided by the controller of insurance on authority under the ministry of commerce. General insurance is provided by 21 companies and life insurance is provided by 6 companies. The industry is dominated by the two large, state-owned companies – the Sadharan Bima Corporation (SBC) for general insurance and the Jiban Bima Corporation (JBC) for life insurance – which together command most of the total assets of the insurance sector.

2.3 The Central Bank and its Policies

Bangladesh Bank, as the central bank, has legal authority to supervise and regulate all banks and non-bank financial institutions. It performs the traditional central banking roles of note issuance and of being the banker to the government and banks. Given some broad policy goals and objectives, it formulates and implements monetary policy, manages foreign exchange reserves and lays down prudential regulations and conduct monitoring thereof as they apply to the entire banking system. Its prudential regulations include, among others: minimum capital requirements, limits on loan concentration and insider borrowing and guidelines for asset classification and income recognition.

The Bangladesh Bank has the power to impose penalties for non-compliance and also to intervene in the management of a bank if serious problem arise. It also has the delegated authority of issuing policy directives regarding the foreign exchange regime.

2.3.1 Interest Rate Policy

Under the financial sector reform program, banks are free to charge or fix their deposit other than export credit. At present, loans at reduced rates (7%) are provided for all sorts of export credit since January 2004.

With a view to controlling the price hike and ensuring adequate supply of essential commodities, the rate of interest on loan for import financing of rice, wheat, sugar, edible oil (crude and refined), chickpeas, beans, lentils, onions, spices, dates, and powder milk has been temporarily fixed to a maximum of 12%.

Now, banks can differentiate interest rate up to 3% considering comparative risk elements involved among borrowers in same lending category. With progressive deregulation of interest rates, banks have been advised to announce the mid-rate of the limit (if any) for different sectors and the banks may change interest 1.5% more or less than the announced mid-rate on the basis of comparative credit risk. Recently, banks have been advised to upload their deposit and lending interest rate in their respective website.

2.3.2 Loan Classification and Provisioning

Bangladesh Bank endeavors to strengthen credit discipline and bring classification and provisioning regulation in line with international standard, Bangladesh Bank issued a master circular on loan classification and provisioning through BRPD (Banking Regulations and Policy Department) circular number 5 dated June 5, 2006. The revised policy

covers an independent assessment of each loan on the basis of objective criteria and qualitative factors.

In case of fixed term loans, which are repayable in more than five years of time and if the amount of 'defaulted installment' is equal to or more than the amount of installment(s) due within 12 (twelve) months, the entire loan will be classified as 'Sub-standard'. If the amount is due within 18 (eighteen) months, the entire loan will be classified as 'Doubtful' and if the amount is due within 24 (twenty four) months, the entire loan will be classified as 'Bad/Loss'.

The short-term agricultural and microcredit is considered irregular if not repaid within the due date as stipulated in the loan agreement. If the said irregular status continues, the credit will be classified as 'Substandard' after a period of 12 months, as 'Doubtful' after a period of 36 months and as 'Bad/Loss' after a period of 60 months from the stipulated due date as per loan agreement.

Besides, if any situational changes occur in the stipulations in terms of which the loan was extended or if the capital of the borrower is impaired due to adverse conditions or if the value of the securities decreases or if the recovery of the loan becomes uncertain due to any

other unfavourable situation, the loan will have to be classified on the basis of qualitative judgment.

Banks are required to maintain a general provision against all categories of loans along with off-balance sheet items. Other instructions such as eligible securities in determining base for provision along with a revised format for submitting the report on classification of loans and advances are also provided in the respective circulars.

2.4 The Foreign Exchange System

Considerable changes have occurred in the exchange rate system of Bangladesh over time. On March 24, 1994 Bangladesh taka (domestic currency) was declared convertible for current transactions in terms of Article VIII of the International Monetary Fund (IMF) Articles of Agreement. Consequent to this, current external settlements for trade in goods and services and for amortisation payments on foreign borrowings can be made through banks authorised to deal in foreign exchange, without prior central bank authorisation. However, because resident owned capital is not freely transferable abroad (taka is not yet convertible on capital account), some current settlements beyond certain indicative limits are subject to proper checks.

Direct investments of non-residents in the industrial sector and portfolio investments of non-residents through stock exchanges are repatriable abroad, as also are capital gains and profits/dividends thereon. Investment abroad of resident-owned capital is subject to prior Bangladesh Bank approval, which is allowed only sparingly.

2.4.1 The Exchange Rate Policy

The exchange rate policy of Bangladesh Bank aims at maintaining the competitiveness of Bangladeshi products in the international markets, encouraging inflow of wage earners' remittances, maintaining internal price stability, and maintaining a viable external account position. Prior to the inception of floating exchange rate regime, adjustments in exchange rates were made while keeping in view the trends of Real Effective Exchange Rate (REER) index based on a trade weighted basket of currencies of major trading partners of Bangladesh and the trends of other important internal and external sector indicators.

Under the existing floating exchange rate regime (that started from 31/05/2003), the inter-bank foreign exchange market sets the exchange rates for customer transactions and inter-bank transactions based on demand-supply interplay; while the exchange rates for the Bangladesh

Bank's spot purchase and sales transactions of US Dollars with ADs is decided on a case to case basis.

2.5 The Microfinance Institutions (MFIs)

Bangladesh has well-developed microfinance institutions. After Professor Yunus and his Grameen Bank won the Nobel Peace Prize in 2006, Bangladesh has come to be regarded as a leader in this area.

The member-based Microfinance Institutions (MFIs) constitute a rapidly growing segment of the Rural Financial Market (RFM) in Bangladesh. Microcredit programs (MCP) in Bangladesh are implemented by various formal financial institutions (nationalised commercial banks and specialised banks), specialised government organisations and Non-Government Organisations (NGOs).

The growth in the MFI sector, in terms of the number of MFI as well as total membership, was phenomenal during the 1990s and continues till today. Over the period of June 2003 to June 2006 the growth rate was over 70% in terms of horizontal expansion of microcredit borrower. The total coverage of MCP in Bangladesh is approximately 30.09 million borrowers without considering overlapping figures.

It is estimated that after considering the overlapping problem, which is expected to be over 40%, the effective coverage would be around 18.05 million borrowers. Out of 18.05 million borrowers covered by microcredit program, about 62% are below poverty line and so over 11.19 million poor borrowers are covered by microcredit program by 2006.

Microcredit programs of NGOs (known as NGO-Microfinance Institutions or NGO-MFIs) and Grameen Bank play dominant role in this financial market, NGO-MFIs serve more than 61 percent and Grameen Bank alone serves 24 percent of the total borrowers. Among NGO-MFIs, more than 80 percent of the outstanding loan is disbursed by the top 20 NGOs, three of them are very large and have coverage all over the country.

Service charge on credit varies from 10% to 20% at flat method of collection, all partners of Palli Karma-Sahayak Foundation (PKSF) charge 12.5%. Average interest offered by NGO-MFIs on savings to the members is 5%. Near about 90% of the clients of this sector are female. Loan recovery rate is generally very high compare to the banking sector, which is over 90%. Average loan size of NGO-MFIs was found around taka 4,000.

2.5.1 Microcredit Regulatory Authority

The ever-increasing microcredit activity is controlled by the Microcredit Regulatory Authority. Microfinance is now a nation-wide activity in Bangladesh. The issue of a regulatory framework has come to the forefront because NGO-MFIs, the major provider of this service, are providing financial services to the poor outside the formal banking system. The government of Bangladesh enacted 'Microcredit Regulatory Authority Act 2006' (act number 32 of the year 2006) on July 16, 2006 with effect from August 27, 2006 with a view to ensuring transparency and accountability of microcredit activities of the microfinance institutions (MFIs) in the country.

The Microcredit Regulatory Authority (MRA) has been established under the act, which is now empowered and responsible to implement the said act and to bring the microcredit sector of the country under a full-fledged regulatory framework. According to the Act, no MFI can carry out microcredit activities without obtaining license from MRA. Section 15(2) of 'Microcredit Regulatory Authority Act 2006' has made it mandatory for MFIs who had microcredit activities before the effective date (August 27, 2006) of the act to apply for license to MRA within six months (February 26, 2007) from the effective date of the act.

Accordingly 4236 NGO-MFIs have applied to MRA for license by February 26, 2007. It was decided by the authority that among these organisations, only those organisations will be considered for license that can fulfill minimum criteria (have equal to or more than 1000 borrowers or equal to or more than taka 40 lakhs loan outstanding). Rest of the organisations already applied to the authority will be allowed time till June 2009 to reach the above mentioned minimum criteria. If they are unable to meet those criteria within specified time they will have to close their microcredit operation after that given time.

MRA is also working to prepare detail rules and policies to monitor and supervise licensed NGO-MFIs that will cover governance issues, financial transparency, mode of operations and other related issues to ensure transparency and accountability in operation.

2.6 Bangladesh Bank's Monetary Policy Approaches and Tools

BB's monetary policies aim at maintaining price stability while permitting monetary expansion needed to support output growth at sustained high rate. The money stock growth-CPI (Consumer Price Index) inflation correlation holds fairly well in Bangladesh economy characterised by significant extent of restrictions on capital transactions with the rest of the world.

Based on this correlation, BB employs monetary targeting to influence CPI, drawing up monetary programs each financial year with target growth path for broad money (M2: currency in circulation plus bank deposits) that accommodates monetary expansion commensurate with the projected real GDP growth, inflation, and the likely change in income velocity of money (change in GDP/M2 ratio).

Besides the banks, Non-Bank Financial Institutions (NBFIs), Microfinance Institutions (MFIs) and Credit Co-operatives now have a significant aggregate of deposit balances. Recent studies at BB's Policy Analysis Unit (PAU) reveal that an M3 comprising M2 and the deposits in NBFIs, MFIs and Co-operatives has better correlation with the CPI than M2 at 9–15 month time lag for both.

There is need for caution about the quality of MFI and Co-operatives data before their routine inclusion in M3 for monetary policy purposes. Monetary programming exercises are gross approximations rather than precise derivations; the differences resulting from use of M2 rather than M3 are not yet large enough to matter significantly for policy conclusions.

Ceilings on interest rates on loans for some priority productive purposes, imposed earlier in the context of global economic downturn remain in place, as downward stickiness of lending interest rates of banks in Bangladesh keep their intermediation margins substantially higher than in the neighboring countries.

2.7 The Recent Monetary Policy

The half yearly Monetary Policy Statement (MPS) outlines the monetary policy stance to be followed in H2 FY10 (second half of 2010) in support of pursuits of attaining sustained high broad-based economic growth in the unfolding internal and global context, while containing inflation within tolerable moderate levels.

In departure from earlier practice, BB has held much more extensive stakeholder consultations before drawing up this issue of MPS; eliciting views and suggestions from past finance ministers, advisers, governors, specialist think tanks, and trade bodies representing commerce and industry sectors including the banking sector; besides the usual co-ordination council consultations with the government. In campaign field visits for wider financial inclusion, BB Governor and his senior management team members have interacted at grass roots

level with people engaged in farming and in Small and Medium-scale Enterprises (SMEs).

The broad consensus emerging out of the stakeholder consultations is that supportive monetary stance and stimulatory fiscal stance need to continue till fuller restoration of investment confidence in the domestic economy with firmer demand recovery in export markets emerging out of the global recession; with exercise of due caution about inflation risks on the path ahead.

Successful triggering of broad-based growth in real output with supportive monetary and fiscal stances will alleviate risks of build up of inflationary pressures, creating benign conditions on the supply side. Credit resources from the supportive stance ending up instead largely in uses for speculation and conspicuous consumption will create inflationary pressure fueled by excess demand; which is why the support elements beyond some extent of general easing need to be selectively targeted with care.

BB's MPS for H1 FY10 announced in July 2009 projected real GDP growth of 5.5–6.0 percent for FY10, based on the BBS estimate of 5.9 percent growth in FY09, assuming that the then

incipient recovery of world economy from the downturn triggered by the global financial crisis will hold pace or strengthen further. Broad-based global recovery has proceeded faster than initial forecasts. Led by China and India, Asia is projected to register strong growth but recovery in North America and Europe have remained slower and less surefooted, with some concern in USA even about likelihood of a double dip recession.

In Bangladesh economy, domestic demand remains robust, well supported by growing workers' remittance inflows and budgetary stimulus outlays including higher social safety net spending. Up to date data on quantum index of manufacturing are unavailable, but the index was on positive trend in August 09, and rising trend in opening of LCs (Letters of Credit) for imports by the industrial sector in H1 FY10 indicate growing trend in manufacturing output in response to domestic demand.

Recovery in export demand in the traditional markets in North America and Europe has been somewhat slower than initially hoped for. Extra-cautious consumption behavior of post-crisis consumers in developed countries in the west is indeed a matter of some concern for Bangladeshi exporters. The export growth slowdown of H2 FY09

continued in H1 FY10, bottoming out at 11.7 percent decline in Q1 FY10 but turning around thereafter, with decline narrowing to 6.9 percent in July–November 09.

Order books of apparels and textiles exporters (more than three fourth of total exports) are reportedly full, against which LC opening for imports of apparels and textiles sector inputs increased in H1 FY10. There are anecdotal reports that due to slower demand recovery in the west, globally active retail chains are requesting deliveries in Japan and China against some of their orders for western markets; this bodes well for geographical diversification of exports of Bangladesh.

The taka 10 billion support package declared by the government in October 09 for this export sector includes time-bound temporary support measures like waiver of license fee costs of off grid captive power generation and incentive for exports to non traditional destinations. Shrimp exports to western markets, on hold for some months now for producers to sort out quality control issues, will resume in Q3 FY10. With these trends and initiatives, exports in the coming months are expected to regain enough momentum for FY10 export growth to be in double digits, as in FY09, contributing to manufacturing output growth in the industry sector.

Output activities in the construction sub sector of industry have remained strong in FY10. Activities of developers in residential and commercial building construction have spread into other urban centers and tourist sites besides the capital city, with the growing workers' remittance inflows strongly fuelling demand and creating bubble-like price pressures in the real estate markets.

Following a strong 4.63 percent agriculture sector output growth in FY09, output of the (small) Aus rice crop in FY10 suffered some decline (1.71 million metric ton, against 1.89 million metric ton in FY09) but the 13.10 million metric ton FY10 Aman rice output has been substantially higher, against 11.61 million ton of FY09.

Instead of the usual price decline following harvest seasons, market prices of rice in the local market have held firm and are on upward bias, presumably due to the much higher prices prevailing in neighboring countries and elsewhere. This has acted as a strong incentive spurring farmers to expand acreage of their Boro rice crop, reportedly being sown even in the shallower riverbeds and canal beds seasonally drying up in the winter, with extensive use of higher yield hybrid seeds.

The government and BB have maintained alert watch on timely availability of necessary inputs and financing for the growers. Already 49 percent of the disbursement target of agricultural credit for the current fiscal year has been achieved during H1 FY10. Subject to weather conditions not turning adverse, the 19.00 million metric ton output target set by agriculture ministry for FY10 (against 17.81 million metric ton of FY09) looks likely to be attained. FY10 growth in potato output is understood to be good, with growers responding to higher market prices of the preceding harvest.

There are no reports of major climatic or other difficulties for output activities in other food and non food agricultural crops, dairy and poultry. The resumption of shrimp exports in Q3 FY10 will surely stimulate its increased output. Overall, barring unforeseen adversities, it will not be unrealistic to expect agriculture sector output growth to match or come close to the strong FY09 performance.

FY10 output growth in the services sector will be supported by the above mentioned trends of activities and initiatives in industry and agriculture. Private sector led activities in the education and health sub-sectors are quite brisk, and new retailing and catering outlets are seen mushrooming countrywide, aided partly by the recent thrust on SME

financing. In the financial services sub sector, bank lending growth has been slower in H1 FY10 but capital market activities have remained buoyant.

Overall, the present outlook for FY10 real GDP is much the same as the 5.5–6.0 percent growth projected earlier in the July 09 MPS which could be brighter with full and timely use of budgetary outlays for projects in the Annual Development Program (ADP).

2.8 Macroeconomic Outcome and Outlook

The foregoing discussion has reviewed trends of available indicators of growth performance, in the nature of informed guesses, to find that after a slower first quarter, manufacturing output and investment activities have picked up from Q2 FY10 onwards with domestic demand holding up well and exports gradually coming out from declining trend, agriculture sector output activities are responding robustly to market price incentives and the support measures provided by GOB and BB, and output activities in the services sector are also correspondingly vibrant; with the higher end of the 5.5–6.0 percent real GDP growth for FY10 projected in the July 09 MPS looking well within attainability.

The dynamism now seen in growth initiatives is largely in the private sector promptly utilising the stimulus package and facilitation measures provided by GOB (subsidies and incentives to sectors affected by global slowdown) and by BB (easier loan rescheduling, increased export development fund, known as EDF, lending for input import by manufacturer-exporters, agricultural and SME loans supported by refinance, etc.). GOB's own utilisation of expenditure for development projects, while somewhat better than in previous year (28.2 percent of ADP allocations spent in H1 FY10 against 23.0 percent in H1 FY09), is hardly a robust response in upholding domestic output and demand amidst global downturn.

Real GDP growth outlook could have been brighter with government's timelier and fuller utilisation of development expenditure allocations. Unless capacity constraints in this area are addressed urgently, benefits from the expected PPP (Public–Private Partnership) initiatives and the infrastructure development assistance announced under agreements signed with India during Honorable Prime Minister's state visit will be slow to come by, with adverse implications for growth in the near and medium term.

2.8.1 Inflation

Point-to-point and 12-month average CPI inflation in Bangladesh were both on declining trend in FY09 from Q2 onward, driven by decline in global prices of oil and other commodities, helped also by bumper domestic output of the *Boro* rice crop. In H1 FY10, the point-to-point inflation was on fluctuating trend with upward bias both in food and non-food inflation.

Prices of food and non-food commodities have firmed up in international markets, with many of these on uptrend. Domestic prices of rice are holding firm even in the post Aman harvest season, presumably because of much higher prices prevailing in neighboring India and Thailand (this may prove beneficial for price stability over the medium term eliciting good output response from growers of the ensuing Boro rice crop). Given the current trends of internal and external prices, both food and non-food point-to-point CPI inflation in Bangladesh looks set to continue over the coming months on a fluctuating trend with some upward bias; the 12-month average CPI inflation accordingly ceasing decline, and creeping upward in H2 FY10 but remaining within the 6.5 percent ceiling projected earlier in the MPS for H1 FY10.

The 6.71 percent point-to-point and 5.11 percent 12-month average CPI (Consumer Price Index) inflation in Bangladesh as of October, 2009 are both moderate compared to double digit inflation levels in neighboring India and Pakistan. Demand recovery in the advanced North American and European markets not yet being very firm, global commodity prices should be broadly stable but there is always the risk of supply shortages or disruptions causing rise in prices of specific commodities, heightened further by speculators in case of major commodities.

There is a case for curbing speculation in global prices by debarring position taking in commodity futures by financial institutions including hedge funds and by non financial entities with no actual involvement in the supply chains from producers to users; but populist administrative overreactions obstructing price movements reflecting scarcities or cost increases typically seen in South Asia are self defeating, and harm by obstructing the needed supply response, thereby prolonging the shortages and higher prices. It may be worthwhile to attempt creating and strengthening consumer awareness on this issue.

2.8.2 Fiscal Developments

The taka 301.5 billion revenue earnings during July–November 09 were 14.1 percent higher than earnings during same period of FY09; apparently on course for attaining the taka 794.61 billion FY10 revenue growth, with high growth in income tax and other NBR tax receipts offsetting the low growth in custom duty receipts.

Total government expenditure during July–November 09 is estimated at taka 342.1 billion. The estimated taka 86.0 billion utilisation of ADP allocations during H1 FY10 is 28.2 percent of the annual allocation of taka 305.0 billion; better than the 23.0 percent utilisation during the same period of FY09. As usual, the expenditure estimates for FY10 will be revised on the basis of actual utilisation trends in H1 FY10; the ADP allocation is likely to be revised to taka 275.0 billion from the initial taka 305.0 billion, with overall expenditure revised to taka 1108.19 billion from the initial estimate of taka 1138.19 billion.

Budget deficit for July–November 09 stood at taka 111.2 billion, the estimated deficit for full FY10 will stand revised at taka 313.58 billion (4.57 percent of GDP) against initial estimate of taka 343.58 billion. Foreign financing of the deficit has been estimated at taka 154.83 billion (against initial lower estimate of taka 138.03 billion, due to receipt

of USD 740 million financing from ADB), non-bank domestic financing will also be higher because the high interest rates on National Savings Scheme deposit instruments are attracting high net sales. The estimates for FY10 domestic budget financing, revised accordingly, are (i) taka 75.99 billion from bank sources against initial estimate of taka 167.55 billion, and (ii) taka 82.76 billion from non-bank sources against initial estimate of taka 38.0 billion.

The recently declared government decision to revise interest rates on National Savings Scheme deposits in line with market rates, when implemented, may to some extent alter the estimated relative shares of bank and non-bank budget financing. Lower dependence on banks for domestic financing of budget can be expected to benefit the private sector by way of more affordable access to bank credit.

2.8.3 External Sector Trends

Despite gradual growth slowdown from Q2 FY09 onward, exports of Bangladesh registered 10.3 percent growth in FY09 while those of regional neighbors were on decline. The slowdown continued in FY10, bottoming out at 11.7 percent decline in Q1 FY10, commencing slow recovery thereafter with a lower (6.9 percent) decline for July–November 09. Recent increasing trends of opening input import LCs by

manufacturer-exporters indicate that exports will soon be back on growth path, hopefully matching in FY10 the FY09 feat of double digit growth.

Following 4.1 percent growth in FY09, imports declined by 12.5 percent during July–November 2009. Trade deficit narrowed, the decline in import payments being higher than the decline in export receipts in absolute terms. The narrower trade deficit and continuing strong growth in workers' remittances (22.9 percent during July–December 09, the inflows presumably including transfers of savings besides transfers from current income for family subsistence) swelled the balance of payment (BoP) current account surplus (USD 1692 million surplus during July–November 09, against USD 79 million deficit during the same period of FY09). Foreign exchange reserves increased correspondingly, crossing a new milestone of USD 10 billion in November 09, aided further by USD 740 million budget support for GOB from ADB and by positive net foreign investment inflow.

Opening of new import LCs for consumption, output and investment activities have resumed robust increase from Q2 FY10 onward, with 22.63 percent growth in H1 FY10. Import payments trends will consequently be on increasing trend in the coming months, leading to

lower surpluses in the current account and slower growth in foreign exchange reserves in H2 FY10.

Market interventions by BB (net purchase of USD 1.57 billion from the inter bank market in FY10 up to mid January 2010) have kept exchange rate of taka broadly stable with moderate undervaluation bias; with weighted average nominal exchange rate at taka 69.27 per USD as of end December 09, against taka 69.15 as of end June 09. The REER based exchange rate changed to taka 68.31 from 63.69 per USD over the same period, indicating significant erosion of the competitiveness cushion in the nominal exchange rate of taka in H1 FY10.

2.8.4 Developments in Money and Credit

High growth in foreign assets at the expense of growth in domestic assets characterises monetary developments in H1 FY10 for reasons already discussed in the foregoing sections. Slow off-take of bank credit from deposits and soaring workers' remittance inflows led banks to leave large excess balances in their taka and foreign currency accounts with the BB, causing surge in reserve money growth.

Inter-bank call money rates plunged to near zero levels in Q1 FY10. To engage with the market towards limiting the liquidity growth, BB resumed auction of 30 and 90 day BB bills, and from October 2009 resumed reverse repo auctions after lowering the repo and reverse repo rates by 200 basis points respectively to 4.5 and 2.5 percent levels, closer to the then current call money rates.

Economic activities including LC opening for capital machinery imports are picking up steam from Q2 FY10, with gradual increase in private sector led growth of domestic credit. Growth of foreign assets of the banking system will slow down as payments against increasing new import LCs commence. Liquidity conditions in the market are no longer lax, evidenced by primary dealers requesting liquidity support in fulfilling their obligation of taking up devolvement in treasury bill/bond auctions.

The targets for key monetary aggregates in the monetary program for FY10 of the July 09 MPS has been revised in light of subsequent developments. Thus far, developments of monetary aggregates are broadly on course, higher broad money and private sector credit growth in November 09 was in part due to the Eid festivities.

Inflows having been stronger and outflows for imports substantially weaker than initially expected, net foreign asset growth at the end of FY10 is projected to be positive in the revised program (instead of the initial slightly negative projection based on presumption of somewhat sharper rebound in economic activities in FY10), also taking account of government's revised lower target of bank borrowing.

2.9 The Recent Monetary Policy Statement

The very latest monetary policy statement was made on July 19, 2010 by the Bangladesh Bank Governor. Rashid (2010) described the main feature of the policy statement in an article published in a leading paper, the *Daily Star* thus:

> "Bangladesh's Monetary Policy Statement (MPS) for July–December 2010, released by Bangladesh bank, is focusing on continuous watch towards locating and neutralising likely inflationary pressures from the growth supportive monetary and credit policies, to the extent feasible, targeted to selected priority productive sectors."

It appears from the above description that the objective of our monetary policy is to encourage growth without allowing much inflation. In short, it is a growth without much inflation strategy.

2.10 Chapter Summary

A summary of this chapter is given below.

(a) The materials of this chapter are drawn from *Bangladesh Economic Review,* an annual publication of the Ministry of Finance, Government of Bangladesh, *Monetary Policy Statement,* Monetary Policy Department of Bangladesh Bank, and *Statistical Yearbook of Bangladesh* of the Bangladesh Bureau of Statistics.

(b) This chapter provides a comprehensive description of the monetary sector and the prevailing macroeconomic situation in Bangladesh, which can be regarded as the background to the study of money demand and money supply in Bangladesh.

(c) Financial system consists of the Bangladesh Bank (BB) as the central bank, 4 state-owned commercial banks (SCB), 4 government-owned

specialised banks, 30 domestic private banks, 9 foreign banks and 29 non-bank financial institutions.

(d) In Bangladesh, as in other economies, the commercial banking system dominates the financial sector with limited role of non-bank financial institutions and the capital market. The banking sector alone accounts for a substantial share of assets of the financial system. The banking system is dominated by the 4 state-owned commercial banks, which together control more than 30% of deposits and operates 3383 branches (50% of the total) as of June 30, 2008.

(e) A description of capital market in Bangladesh is given here. The capital market, an important ingredient of the financial system, plays a significant role in the economy of the country.

(f) The insurance sector of Bangladesh is quite developed. The insurance sector is regulated by the Insurance Act, 1938 with regulatory oversight provided by the controller of insurance on authority under the ministry of commerce. General insurance is provided by 21 companies and life insurance is provided by 6 companies.

(g) Bangladesh Bank, as the central bank, has legal authority to supervise and regulate all banks and non-bank financial institutions. It performs the traditional central banking roles of note issuance and of being the banker to the government and other banks.

(h) The half yearly Monetary Policy Statement (MPS) outlines the monetary policy stance to be followed in H2 FY10 in support of pursuits of attaining sustained high broad-based economic growth in the unfolding internal and global context, while containing inflation within tolerable moderate levels.

(i) The latest monetary policy statement declared on July 19, 2010 by the Governor of the Bangladesh Bank appears to be one that encourages growth and restrains inflation at the same time.

Chapter 3

LITERATURE SURVEY

This chapter contains a survey of works on both money demand and money supply function. Although there is a huge literature on money demand functions, there is only a small body of works on money supply function.

The survey is divided into two parts. The first part contains a general survey of works on money demand and money supply, while the second part consists of the survey of works done on Bangladesh.

3.1 Works on Demand for and Supply of Money

Baumol (1952) was the first to formally study the demand for money using an inventory theoretic approach. This approach earned considerable popularity and still forms the starting point of discussion on money demand in macroeconomic textbooks.

Friedman (1956) advanced the study of money demand both theoretically and empirically. His enormous work and huge body of

empirical results led to further works and debate. He held firm to his belief that his results supported monetary policy.

Mundell (1963) argued that in addition to the interest rates and the level of real income, the demand for money should be augmented by the exchange rate. His research influenced subsequent works, which included several other variables such as inflation and remittance in the money demand function.

Goldfeld (1976) studied demand for money using the adjustment mechanism, which became quite well known. Use of the adjustment mechanism became very popular as many researchers used it.

Hendry (1979) estimated the UK demand for the narrow money aggregate, M1, using data for 1961 to 1977. According to this model, the long-run demand for real balances was independent of the price level.

Luckett (1984) estimated the narrow money demand function for Fiji for the period 1978–1985. The income elasticity according to his estimate was 0.13 while the interest elasticity was –0.13. Both income and interest rate elasticity were significant. It can be observed that his estimated income elasticity was far below unity.

Fair (1987) examined the adjustment of actual to desired money holdings in nominal and real terms. He used a simple method to test the nominal against the real hypothesis. He used data for 27 countries in his study to see structural stability. His results strongly favoured the nominal adjustment hypothesis. But there was some evidence of moderate structural instability before and after 1973.

Arize (1989) studied the demand for money in four Asian countries. These were Pakistan, The Philippines, South Korea, and Thailand. According to his study, foreign interest rate, exchange rate depreciation, and technological change were found to be important determinants of the Asian money demand functions.

Yoshida and Rasche (1990) studied the Japanese money demand function using quarterly data for the period 1956/I–1989/II. They used a vector error correction model and found that the equilibrium real income elasticity was about 1.2 for the period 1956/I–1985/II. They investigated whether the equilibrium income elasticities had changed after the deregulation of interest rate that started in the middle of 1985. For this, they added a time dummy variable that took on the value of one after 1985/III and zero before 1985/III. The result showed that time dummy absorbed all the effect of deregulation of interest rates. So the rest of the

parameters of the function were unchanged from the parameters estimated from the data for the period of 1956/I–1985/II. This implied that income elasticity was stable even after deregulation of interest rates in the Japanese money market.

Bahmani-Oskooee and Malixi (1991) estimated the demand for money function in 13 developing countries as a function of inflation, real income, and the real effective exchange rate. They concluded that, ceteris paribus, depreciation in real effective exchange rate resulted in a fall in the demand for domestic currency. However, they did not include the interest rate spread to capture the general process of financial asset substitution.

Boughton (1991) examined the nature of long-run demand for money in five large industrial countries. The countries were USA, UK, Japan, Germany, and France. He used price, income, and interest rate as the dependent variables. Boughton found that price elasticity was less than unity and income elasticities exceeded unity for USA for narrow and UK for broad money. The estimated price elasticities were contrary to the theory but no evidence of instability was found in the UK money model. He also found that short term interest variable had a positive coefficient, indicating that it acted as the own rate of interest on money.

de Haan and Zelhorst (1991) found the long-run relationship between money and income in Australia using both real M3 and M1 (deflated by the CPI) as dependent variable. The explanatory variables included real GDP (deflated by the CPI) and 3-year Treasury bond yield. They estimated the function for the period 1960:1 to 1989:2 using quarterly data. Variables apart from the bond yield were seasonally adjusted and were in natural logarithms. They used the Engle-Granger (1987) estimation procedure. They found long-run relationship between GDP velocity of M3 and 3-year bond yield only for the period of 1960:1 to 1983:4.

Juselius and Hargreaves (1991) studied the long-run relationship between money and income in Australia where they used the nominal M1 and M3 as the dependent variable using GDP and GNE implicit price deflator alternatively. Nominal 90-day bill rate and nominal 10-year bond yield were used as the explanatory variables in their study. Quarterly data from 1975:3 to 1991:1 were used. All the variables were seasonally unadjusted and, apart from interest rate, were in natural logarithms. Seasonal dummies were included. They used the Johansen (1988) procedure and found two cointegrating vectors.

Lim and Dixon (1991) estimated the long-run relationship between money and income in Australia using real currency (GNE deflator) as a dependent variable and real GNE and three-month average of 90-day bill rate as the explanatory variable. Quarterly data for the period of 1977:1 to 1989:2 were used in their study. Because the variables were seasonally adjusted, seasonal dummy were included in their analysis. They used the OLS technique followed by the Engle-Granger procedure. The results showed that long-run relationship between real currency and real GNE existed.

Baba, Hendry and Starr (1992) estimated the demand for money function for USA using M1. Their findings showed that short-term interest rate had a positive sign. Moreover, the long tem income elasticity and long-run price elasticity were respectively 0.5 and unity.

Moosa (1992) found that the money balance had co-integrating relationship with output and interest rates for all the three types of money supply and argues that as greater numbers of cointegrating vectors were detected for cash and M1 than for M2, narrower definitions of money supply are better for pursuing monetary policy. A negative and significant error correction term, estimated using error correction model (ECM) based on Johansen's cointegration test showed that long-term interest

rates were more sensitive to money demand than short-term interest rates, which suggested that money demand in India was stable over the long term only when money supply was narrowly defined.

Simmons (1992) employed an error correction model to estimate the demand for money in five African economies. This study emphasises the role of opportunity cost variables including the domestic interest rate and expected exchange-rate depreciation. His empirical results indicate that the domestic interest rate is an important determinant of the demand for money functions for three of the five countries, whereas external opportunity cost variables are significant for only one of the others. He also found that in four out of five cases, inflation plays an extremely important role in determining the demand for money. The review of literature on the demand for money also reveals a growing consensus among economists that M2 should be considered as an appropriate indicator of monetary aggregate.

de Brouwer, Ng and Subbaraman (1993) estimated the long-run relationship between the money stock, activity and interest rate for Australia using the technique of cointegration. Firstly, they reviewed some basics of money demand theory. Then they summarised the results of earlier papers on cointegrating relationships. Finally, they tested for the

existence of cointegration between a number of definitions of money aggregates, activity and interest rates.

Orden and Fisher (1993) tested the long-run relationship between income and money demand in Australia using nominal M3 as dependent variable. They used real GDP, nominal 13-week Treasury note rate and GDP deflator as the independent variable. They studied the money demand using quarterly data for the period 1965:2 to 1989:3. They defined variables alternatively in seasonally adjusted terms and seasonally unadjusted term, with seasonal dummies included in the latter case. Except interest rate, all variables were taken in natural logarithms. The Johansen procedure of cointegration was used in their study. They found one cointegrating vector between M3, real GDP and prices only in the pre-deregulation sub period 1965:2 to 1982:4. Their findings were for seasonal adjustment approach.

Klacek and Smidkova (1995) conducted research for the period 1992–1995 using the error correction model and measured the money demand function in the long-run for the Czech Economy. The real narrow (M1) and broad money (M2) were used as the real demand money indicators. They found that in this period the demand for money mostly

depended on the economic activity (proxied by the level of consumption) and the inflation rate.

Agenor and Khan (1996) used a dynamic currency substitution model that incorporated forward-looking relation expectations to study the demand for money for a group of ten developing countries. They also referred to the view that foreign rate of interest at the expected rate of depreciation of the parallel market exchange rate were crucial determinants of the demand for money.

Fujiki and Mulligan (1996) estimated the parameters of a money demand function for Japan. The cross-sectional estimates of the elasticity of the income were in range of 1.2 to 1.4 and they were found stable over time.

Pradhan and Subramanian (1997) suggested that money demand function was stable not only with M1 but also with M3 and the error correction term for both M1 and M3 money supply definitions were found out to be negative and significant.

Ewing and Payne (1999) have investigated the role of the exchange rate on the demand for narrow money in several developed countries.

They utilise a standard cointegration technique to examine the relevance of the inclusion of the effective exchange rate in the money demand function. They suggest that income and interest rate are sufficient for the formulation of a long-run stable demand for money in Australia, Austria, Finland, Italy, UK, and USA. However, for Canada, Germany, and Switzerland, the effective exchange rate should be incorporated.

Hayo (2000) estimated the demand for money in Austria for the period 1965 to 1996. Here the demand for money was defined as demand for real money M1, M2, and M3. He constructed two-equation error correction models to estimate the demand for money. The model contained the short-run dynamics and the long-run economic equilibrium. The results suggested that a stable money demand existed for all monetary aggregates. The results also showed long-run equilibrium of M1, after accounting for a structural break in 1979, and can be characterised as a classical type of money demand, with no interest rate effects and an elasticity of one for real GDP. The estimates of M2 and M3 showed a unit coefficient on income and a significantly negative influence of a long-term interest rate.

Jayaraman and Ward (2000) estimated the broad money demand function for the economy of Fiji using quarterly data for the period

1979:Q1 to 1996:Q4. They used income and real interest rate as the explanatory variables and found that the elasticity of income was 0.99. However, the income elasticity was found to be insignificant. The elasticity of real interest rate, measuring the return on time deposits, was also found to be positive with the value 0.02 and it was found to be significant. They found positive relationship of demand for money with both income and interest rate.

Hussain and Abbas (2001) examined the causal relationship between money and income and between money and prices for Pakistan using the annual data set from 1949–50 to 1998–99. They used the Granger causality and error correction models. They also investigated the causal relationships through trivariate approach. They found long-run relationship among money, income, and prices. Their findings showed one-way causation from income to money implying that probably real factors rather than money supply has played a major role in increasing Pakistan's national income. They also found a bi-directional causality between money and prices. This implies that monetary expansion increases, and is also increased by, inflation in Pakistan.

Katafono (2001) applied time series econometric techniques and estimated the demand functions for both narrow and broad money in Fiji

for the period 1975 to 1999 using annual data. The explanatory variables in the study included price level, nominal rate of interest on saving deposits, nominal treasury bill rate and real effective exchange rate. All the variables were found to be positively related with the money demand. In her study, the demand for narrow money (M1), received relatively more attention. She used unit root, cointegration and causality tests in her study.

Andoh and Chappell (2002) estimated the demand for money (M2) in Ghana for the period 1960 to 1996. They studied whether privatisation and removal of foreign exchange controls policies had altered the demand for money function. The results of the study showed a structural break in the demand for money function in 1983.

Bahmani-Oskooee and Ng (2002) examined the long-run demand for money of Hong Kong using quarterly data over the period 1985:Q1–1999:Q4. They used the autoregressive distributed lag (ARDL) cointegration procedure in their study. They found that broad money demand in Hong Kong was cointegrated with its explanatory variables. Moreover, they used the CUSUM and CUSUMSQ tests that also confirmed the stability of the money demand function.

Miyao (2002) analysed the stability of an equilibrium money demand relationship in Japan in an attempted to see whether Japanese economy really trapped at the zero interest rate bound. He performed a formal analysis on the presence of stability using cointegration test in narrow money demand in Japan. He used double-log specifications. The results suggested existence of a cointegrating relationship and no break in the interest elasticity. This meant that even after nominal rates were lowered to virtually zero percent, the money demand was still stable.

Lazea and Cozmanca (2003) empirically estimated the demand for money in Romania for the period June 1997–March 2003. They showed that the main money demand determinants had been the industrial output index used in the analysis as the GDP approximation, rate of inflation, and the national currency depreciation rate. The long-run model coefficient attached to the industrial output index was found to be statistically significant and considerably above the level of one, which spoke in favour of this indicator as the best approximation of economic activity.

Maghyereh (2003) looked into various aspects of financial liberalisation and stability of demand for money in Jordan. He

empirically tested whether there was a stable function of demand for broad money in Jordan over the period 1976–2000. Despite the substantial financial market liberalisation in the late 1988, the cointegration and error correction methodology showed that the quarterly time series data confirmed that the broad demand for money in Jordan was stable during the period under investigation. The results also showed that the inflation rate was the most important variable that explained the demand for money in the Jordanian economy.

Nell (2003) empirically tested whether stable long-run demand for money function existed over the period 1965–1997. The empirical result suggested that their existed stable long-run demand for money function for M3 in South Africa, which meant that the M3 money stock could serve as an indicator for monetary policy.

Valadkhan and Alauddin (2003) examined the major determinants of the demand for real money balances in eight developing countries for which consistent annual time series data were available. Pooling cross-country and time series data for the 1979–1999 periods and employing the seemingly unrelated regression (SUR) estimation technique, they modeled a standard money demand function. Various country-specific coefficients were allowed to capture inter-country heterogeneities.

Consistent with theoretical postulates, they found that the demand for money positively responded to an increase in real income and negatively to a rise in the interest rate spread, the rate of inflation and the US long-term interest rate. This study supports the hypothesis that disequilibrium in the money market could exacerbate inflation and widen the output gap.

Choi and Oxley (2004) estimated long and short-run demand for money function for New Zealand for the period 1990–2000 using cointegration and error correction based models. They used quarterly data in their study. The independent variables in this study were price, real income and interest rate. Using Phillips and Hansen fully modified estimation method, they found existence of a long-run relationship among price, real income, and interest rate.

Rao and Singh (2004) estimated demand for narrow money in Fiji and evaluated its stability for the period 1971 to 2002 using the cointegration and error correction models. Income and interest rate elasticities were found to be significant by them.

Golinelli and Rovelli (2005) analysed the effect of interest rate used as the transmission mechanism tool on the inflation and money demand in three countries. These were the Czech Republic, Poland, and

Hungary. They measured the effect of interest rates in the real money demand and prices in the domestic market for the period 1991–2000. They also studied the effect of exchange rate on inflation that appeared to be most significant in the Czech Republic. The effects of both interest rates and the exchange rate were found to be significant for policies aimed at controlling and suppressing inflation, with the exception of the Czech Republic where the effect of interest rates on money demand was significant only after a larger number of lags had been included in the model. Using stability test, it was found that the early stage of transition had been marked by the instable money demand while stability was achieved at a later stage.

Serletis and Shahmoradi (2005) used the sampling theoretic as well as Bayesian inference to study the demand for money in the USA. They did their study in the context of the basic translog flexible functional form. In their study, they imposed local curvature, and argued that a breakthrough from the current state of using locally flexible specification that violate theoretical regularity to the use of such specifications that are more consistent with the theory will be through the use of Bayesian inference. They also showed that the basic translog did not perform well describing USA money demand in a manner that satisfied the restrictions

imposed by microeconomic theory and gave rise to stable elasticity estimates.

Stability of the money demand function was analysed by Maravic and Palic (2005) for Serbia to see the factors that influenced narrow money demand in both short and long-run for the period January 1996–March 2005. They found instability of money demand for the period under study. Empirical results showed that the money demand was unstable throughout the observed period. The cointegration analysis showed strong cointegration between the real money, overall economic activity, inflation, and interest rates. The long-term earning elasticity was found to be close to one and the opportunity cost variables had the expected designations. The short-term ECM model showed that the money demand was mostly affected by the expected inflation while the interest rate payable on short-term highly liquid transaction deposits did not play a very significant role. The instability of the demand for money function showed that Serbia's economy was sensitive to external shocks. The unstable demand for money function also meant that it may not be used for the monetary aggregate targeting.

The dynamic demand for money (M2) for Pakistan was estimated by Qayyum (2005). He employed cointegration analysis and error correction mechanism. The analysis revealed that the rates of interest,

market rate, and bond yield were important for the long-run money demand behavior. It was also found that the rate of inflation was also an important determinant of money demand in Pakistan.

Bahmani-Oskooee and Rehman (2005) analysed the money demand functions for seven Asian countries including India and found that for India, co-integrating relationships were detected only for M1 as money supply and not for M2 and therefore, concluded that M1 is the appropriate money supply definition to use in setting monetary policy.

Schabert (2005) analysed the relation between interest rate targets and money supply in (bubble-free) rational expectations equilibrium of a standard cash-in-advance model. We examine contingent monetary injections aimed to implement interest rate sequences that satisfy interest rate target rules. An interest rate target with a positive inflation feedback in general corresponds to money growth rates rising with inflation. When prices are not completely flexible, this implies that a non-destabilising money supply cannot implement a forward-looking and active interest rate rule. This principle also applies for an alternative model version with an interest elastic money demand. The implementation of a Taylor-rule then requires a money supply that leads to explosive or oscillatory equilibrium sequences. In contrast, an inertial interest rate target can be

implemented by a non-destabilising money supply, even if the inflation feedback exceeds one, which is often found in interest rate rule regressions.

Carstensen (2006) examined the stability of money demand in Europe. He analysed whether money demand in the Euro area had undergone a structural change in recent time when M3 money growth had considerably grown more than the reference value set by the European Central Bank (ECB). He found that conventional specifications of money demand had become unstable but specifications that were augmented with real stock prices and volatility remain stable. He used an augmented specification to examine the claim that the excessive M3 growth rates were due to adverse stock market developments. He found that this growth rate to revert in the near future was unexpected unless one was willing to assume a quick recovery of the European stock markets.

Knell and Stix (2006) analysed almost 1000 money demand estimations to summarise the disperse findings of this literature. They used both descriptive statistics and regressions to derive several **stylized facts** about the two most prominent determinants of money demand – **income and interest rate elasticities.** They found that the size and signs of average elasticities are systematically related to the choice of included

variables (e.g., M1 or M3, short-run or long-run interest rates), the country grouping (e.g., USA vs. Germany) and the empirical specification (e.g., the inclusion of one or two interest rates).

Bahmani-Oskooee and Wang (2007) applied the CUSUM and CUSUMSQ tests in conjunction with cointegration analysis to see whether the narrow and broad money were cointegrated with their determinants. According to the results of stability tests, they found that narrow money demand in China was stable, but there was some doubt about stability of broad money demand.

According to Dreger, Reimers and Roffia (2007), money demand models represent a natural benchmark against which monetary developments can be assessed. In particular, the existence of a well-specified and stable relationship between money and prices can be perceived as a pre-requisite for the use of monetary aggregates in the conduct of monetary policy. In this study a money demand analysis in the new member states of the European Union (EU) is conducted using panel cointegration methods. A well-behaved long-run money demand relationship can be identified only if the exchange rate as part of the opportunity cost is included. In the long-run cointegrating vector the income elasticity exceeds unity. Moreover, over the whole sample period

the exchange rates opposite to the US dollar turn out to be significant and a more appropriate variable in the money demand than the euro exchange rate. This analysis is of importance for the new EU Member States as they are expected to join in the future years the euro area, where money is deemed to be highly relevant – within the two-pillar monetary strategy of the European Central Bank (ECB) – in order to detect risks to price stability over the medium term.

The recent empirical results of Inoue and Shigeyuki (2008) indicate that an equilibrium relation in money demand exists, only when money supply was defined as M1 and M2, not for M3. Cointegration test result indicates that a co-integrating vector is detected among real money balance, interest rates, and output when money supply is represented by M1 and M2 but no long-run equilibrium relationship is found for M3. Moreover, they claim that when the money demand function was estimated using dynamic OLS, the sign conditions of the coefficients of output and interest rates were found consistent with theoretical rationale, and statistical significance was confirmed when money supply was represented by either M1 or M2. Consequently, they suggested that India's central bank should focus on M1 or M2, rather than M3, in managing monetary policy.

Singh and Pandey (2009) attempted to take a meticulous look on stability of money demand in India using annual data for period 1953–2007. They used the Hansen (1992) and Gregory–Hansen (1996) cointegration approaches with structural break. Results of the Gregory–Hansen cointegration analysis show the presence of cointegration in demand for money, real GDP, and nominal interest rate with structural break at 1965. Further, the study also suggests for downward shift of about 0.33% around 1965 in the demand for money function and put forward that demand for money is stable except for the period of 1975–1998.

Delatte and Fouquau (2010) used linearity tests proposed by Choi and Saikkonen (2004) and found the evidence of multiple equilibria in the money demand in China during the 1987–2008 period and identified potential explanations for non-linearity.

Chimobi and Uche (2010) examined the relationship between money, inflation and output in Nigeria. They employed the cointegration and Granger causality test analysis. They found that money supply Granger caused both output and inflation. They suggested that monetary stability can contribute towards price stability in the Nigerian economy since the variation in price level is mainly caused by money supply.

According to their study, M2 appeared to have a strong causal effect on the real output as well as on prices.

3.2 Studies on Demand for and Supply of Money on Bangladesh

Bhattacharya (1974) studied demand for money in Bangladesh. He used income and interest rate as the independent variables. He found the coefficient of income to be insignificant which implied that there was no relationship between demand for money and income for this period in Bangladesh. The coefficient of interest rate was found to be negative and it was also found to be insignificant.

Ahmed (1977) studied the demand for money in Bangladesh for the period 1960 to 1976. He estimated the demand for money function with a gap of two years, 1971 and 1972. In this study, he used price, rate of interest, and income as the independent variables. The results indicate that the rate of change of price was insignificant which meant that price change did not affect the demand for money. It was also found that the rate of interest was statistically significant and negatively related to the demand for money. Here, the elasticity of interest rate was found to be less than one. Regarding the relationship between income and money demand, it was seen that the income elasticity of demand for money was positive and greater than one.

Rahim and Uddin (1978) also estimated the demand for money in Bangladesh. They used only eight annual observations. Moreover, years 1970 and 1971 were included which were the years of liberation war. The dependent variables in the study were rate of interest and income. Results showed that both the regression coefficients of income and interest rate were statistically significant. It was found that the rate of interest was negatively related to the demand for money while the income elasticity of demand for money was positively related with the demand for money. Though authors did not conduct any test for stability, they concluded that there was stable money demand relationship.

The money demand function for Bangladesh for the period 1961 to 1976 was estimated by Murty and Murty (1978). They used a generalised money demand function (GMDF) based on Box-Cox parametric transformation. Annual data were used for this study. They also used income and interest rate as the independent variables. The authors incorporated different transformations and considered both equilibrium and disequilibrium versions. The estimates of GMDF were compared with those obtained from restrictive models. To choose the appropriate functional form, likelihood ratio test was carried out. They found that the linear model was found appropriate for an equilibrium version while none

of the restrictive models was appropriate for a disequilibrium version. Moreover, when behavioural properties of alternative models were examined, GMDF model was found to be superior to other models. Their findings were also similar to the previous works of Ahmed (1977) and Rahim and Uddin (1978), that is, the coefficient of the rate of interest was negative while that of income was positive.

The money demand function for Bangladesh was estimated by Taslim (1984). In this model, the explanatory variables, among others, also included foreign aid. He argued that Bangladesh maintained perpetual trade deficit. So the development programmes of the country relied on economic forces to restore external balance. Foreign aid played a very important role to meet the deficit. In such a situation, there was an excess of goods and reserves in the market for which there was no corresponding income. In this way, foreign aid increased the volume of transactions in the economy and increased the demand for real balances. Other explanatory variables in the demand function he used were income and inflation rate. He used a partial adjustment model for the period of 1960 to 1982. Annual data were used in this study. He found that the sign of the rate of interest was not only wrong but also insignificant.

Taslim used a variety of regression models involving different combinations of variables to find the variables that were important in determining the demand for money in Bangladesh and the way they affect it. When rate of interest was dropped, a better fit was found. According to the study, the public's desired cash holdings were found to be positively related to the level of income and foreign aid while it was negatively related to the inflation rate. He also suggested that the actual real balances adjusted to their desired level through a partial adjustment process.

Hossain (1996) also studied the money demand function for Bangladesh. The same independent variables were used in his study. According to this study, the rate of interest was negatively related to demand for money while income was positively related with the money demand. The results also showed that elasticity is less than one for the interest rate while it is greater than one for income.

Ahmed's (2000) causality tests suggest that interest rate, though controversial in developing countries, deserves to be a good policy variable in Bangladesh and Pakistan while money deserves to be a good policy variable in India. A bi-directional causality exists between money and prices in Bangladesh and Pakistan. The policy implication of such a result is that an increase in money stock fuels prices in Bangladesh and

Pakistan, which in turn leads to an increase in money stock. It supports the view of real business cycle theorists who postulate that monetary changes only affect prices. Multivariate causality tests suggest that interest rate and money do cause output in Bangladesh at the 6% and 7% levels of significance. So, monetary policy plays a role in output determination in Bangladesh. But this is not the case in the other two countries. Block causality tests for Bangladesh also indicate that non-policy variables do get feedback from policy variables. Interest rate and money as a block cause output and price but output and price do not cause interest rate and money. The situation, however, is reversed for India and Pakistan. The summary of the causality tests shows that the role of monetary policy is more obvious in Bangladesh compared to Pakistan and India. This study used quarterly time series data, which may mask some important dynamic aspects of the short-run behavior of output and prices. An analysis based on monthly data should certainly be more enriching. But availability of monthly data for these countries would continue to be a major stumbling block at least in the foreseeable future.

Siddiki (2000) estimated the demand for real broad money (M2) from 1975 to 1995 for Bangladesh using cointegration analyses. The results show that there was a stable long-run relationship among real per capita broad money demand, real per capita income, domestic interest

rates, and unofficial exchange rate (UM) premiums, which acted as a surrogate for foreign interest rates. It was found that income and interest elasticities were positive while the UM premium elasticity was negative. These results suggested that the demand for money in Bangladesh was stable despite financial and exchange rate policy changes during the period.

Ahmed (2001) investigated the existence of a long-run money demand function for Bangladesh during the period 1975–1997. He used the cointegration and error correction modelling approach and examined the parameter stability of the money demand function. He found that there exists a unique long-run relationship between real broad money balance, real GDP, and the real exchange rate. By estimating an error correction model, the short-term dynamic behaviour of money demand had been investigated. He found real GDP and the real exchange rate as important determinants of the demand for money in Bangladesh.

Wadud (2004) used a cointegration approach to study money demand function and effectiveness of monetary policy in Bangladesh. He not only studied the determinants of money but also the stability of the money demand function.

Quayum and Keya (2005) studied various determinants of money demand. They analysed the determinants of demand for money in Bangladesh for the period 1976 to 2003. Apart from normal variables, they included the foreign sector where the crucial variables were foreign remittance, foreign aid and loan, and exchange rate. They also included a dummy variable representing the financial liberalisation programme to see its impact on Bangladesh economy. They found that real GDP had significant positive effect on both M1 and M2 but interest rate had significant negative impact on M2 only. Their findings appeared to indicate that Keynesian view was pertinent in Bangladesh.

Hossain and Younus (2006) examined the sensitivity of money demand to interest rates on treasury bills in Bangladesh for the period 1997 to 2006. They used quarterly data for the period and specified a standard demand for money function with real output and a representative interest rate on treasury bills as key determinants. They used the ADF and the KPSS (named after Kwiatkowski, Phillips, Schmidt, and Shin) tests to see stationarity problem and found that real money balances (narrow or broad) and real output appear to have a unit root, while the interest rates on treasury bills are stationary. They then estimated the long-run demand for money relationship sequentially with a representative interest rate on treasury bills of a particular maturity by using both the ordinary least

squares and dynamic ordinary least squares methods. The results show that there was a well-behaved and stable money demand function.

Hossain and Younus also found that the demand for money was related to interest rate. For the long-run, income elasticity of the demand for narrow money was about 1.15 while the corresponding value for broad money was about 1.7. It was also found that the long-run interest elasticity of the demand for money was about (–) 0.2. They also incorporated the term-structure of interest rates in the money demand function. The empirical results were not very satisfactory because the coefficients on the pre-estimated parameters of a quadratic yield curve were insignificant and not consistent with a priori theoretical expectations.

Hossain (2006) estimated demand for narrow and broad money for Bangladesh using a partial adjustment method (PAM) for the period 1973–2003. The study provides some new results and since it is a very recent one, it may have substantial impact on the works that will be done in the future.

Rao and Kumar (2007) estimated the stability of demand for money for Bangladesh. They allowed for endogenous structural breaks in

the cointegration equation and then investigated the stability of money demand. They used the Gregory and Hansen framework and found that there was an intercept shift and a well-determined and stable demand for money exists in Bangladesh.

Ahmed and Islam (2007) examined the long-run equilibrium money demand relationship as well as short-run dynamics in the context of Bangladesh. They had done it for both the broad money (M2) and the narrow money (M1 and M0) categories. They used both Johansen (1988) and Johansen and Juselius (1990) multivariate cointegration techniques. They used the quarterly data in their study. The results showed that a single cointegrating vector described the long-run equilibrium money demand relationship for both the broad money and narrow money categories for Bangladesh. Moreover, there existed a statistically significant long-run equilibrium demand relationship among real money balances of various types, real income, and respective nominal interest rates. The study showed that the long-run demands for broad money and narrow money (M1 and M0) depend positively on real income and negatively on treasury bill (28-day), fixed deposit, and short-term deposit rates, respectively. Another important thing that was found in their study was that the demand for real balances in the economy was strongly dominated by the transactions motive for holding money. The results on

short-run dynamics suggested stability of the short-run money demand function for all categories of monetary aggregates was quite reasonable. The same thing was found for the case of speed of adjustment to the respective long-run equilibrium path.

Ali and Islam (2010) empirically estimated what can be called a money supply function for Bangladesh using annual time series data. They found that high-powered money played a very significant role in the money supply process of Bangladesh, particularly with respect to the narrow money supply M1, thus providing some support for the monetarist model. But additional variables in the light of the Keynesian and structuralist analysis, such as bank rate, external resources, and financial liberalisation should to be taken into account in understanding the money supply process of the country. These variables were also found to exert some influence on the broad money supply in Bangladesh. According to them, the estimated results needed to be interpret with caution because of the poor performance of the narrow money model and the existence of multicollinearity problem in both models.

3.3 Lessons for this Study

A study of the works mentioned above show that there are several aspects of money demand and money supply that need to be looked at. These are:

(a) An up-to-date study of money demand and money supply in Bangladesh. The present study will cover the period 1976 to 2008, making it the most up-to-date work on Bangladesh to date.

(b) There is no formal study of structural break between the two sub-periods, the pre- and the post-liberalisation period. In this study, structural break will be formally examined using the well-known Chow test.

(c) The autocorrelation problem is widely prevalent but usually overlooked needs to be duly tackled otherwise the OLS estimates will no longer have minimum variance which means that they will not give efficient estimates relative to other linear and unbiased estimators. To avoid this problem, autocorrelation corrected estimates will be provided in this study using the Cochrane-Orcutt method.

(d) The money demand function in Bangladesh is changing from the classical specification to the Keynesian specification as the economy is witnessing greater interest flexibility and monetary activity. It is necessary to capture this which will be done in this thesis.

(e) There is hardly any work that provides a simultaneous study of money demand and money supply. An attempt will be made in this thesis to do so using the 2SLS method.

All the above things will be done in addition to the standard money demand and money supply function estimates, test of stability of the money demand function and causality test between money supply with income and price level.

3.4 Chapter Summary

A summary of topics covered in this chapter are given below.

(a) This chapter contains a fairly comprehensive survey of works on money demand and supply. The survey has two parts – a general survey of all works as well as a survey of works on Bangladesh.

(b) Since money supply is controlled by the central bank, there are very few works on the money supply function. However, there are an increasing number of works on causality between money supply and other variables such as GDP and price level.

(c) A large number of works reported that income and interest rate were the most important determinant of money demand. In a mammoth survey of 1000 works, Knell and Stix (2006) confirmed this.

(d) There were works that reported inclusion of variables other than income and interest rate. Some of these variables were inflation rate, exchange rate and foreign remittance.

(e) Excellent availability of data in both developed and developing countries including Bangladesh have led to increasing number of works on money demand and money supply.

Chapter 4

THEORY AND RESEARCH METHODOLOGY

This chapter contains a description of the theories of demand for money and the methodology of analysis of supply of money. The theoretical discussion of these aspects is followed by a description of the empirical methodology of analysis of money demand and money supply that will be followed in this thesis.

4.1 Theories of Demand for Money

The economic theory advances a great number of money demand theories that share a common stance: the major function of money is it being a medium of exchange; hence these theories treat the quantity of money in demand as dependent on the volume of transactions in the economy.

There are several theories related to demand for money such as the Fisherian quantity theory of money, the demand for money analysis by the Cambridge economists, the Keynes liquidity preference theory, the Tobin model, the Friedman modern quantity theory of money, and the

Baumol–Tobin money demand model. A brief description of these theories is given below.

4.1.1 The Fisherian Quantity Theory of Money

Fisher ranks among the developers of the classical quantity theory of money. His theory explains the relation between the quantity of money in circulation and the volume of transactions in the economy. As measuring the volume of transactions is complicated, the Fisherian theory has been modified to link the quantity of money with the amount of spending on goods and services produced in the economy.

The quantity of money is dependent on both the total amount of spending and the intensity of using money in settlements. In the Fisher theory, this dependence is expressed by the velocity of money V, which measures the average number of times per year a unit of money is used to settle up for goods and services:

$$V = \frac{PY}{M} \tag{4.1}$$

where

M is the quantity of money;

P is the price level;

Y is the output.

The Fisher equation expressing the relation between the quantity of money in circulation and nominal income of the economy is obtained from the definition of the money velocity. The Fisher equation, without any additional assumption on the velocity of money, is an identity, a relation that always holds by definition. Therefore the Fisher quantity theory of money is based on the analysis of factors affecting the velocity of money.

The velocity of money is affected by institutional and technological factors that determine the type of payment (cash, settlement accounts). According to Fisher's stance, effects of institutional factors change slowly over time, and the velocity of money is relatively constant. Hence in the shorter run, the quantity of money depends only on the nominal income level. Where the money market is in equilibrium, the quantity of money in the economy is equal to the demanded amount of money, M^d.

Assuming that the velocity of money is constant, the equation of the demand for money is obtained from the Fisher equation:

$$M^d = k.P.Y \qquad (4.2)$$

where the constant k is inversely proportional to the velocity of money. As this theory builds on the assumption that money functions only as a medium of exchange and is held in the amount needed for settlements, the Fisher theory rejects the dependence of the demand for money on interest rates.

4.1.2 The Demand for Theories of Money by the Cambridge Economists

Independently of Fisher, Cambridge economists Marshall and Pigou presented an identical relation between money and the volume of transactions. Consistency of the two equations notwithstanding, the analyses conducted by Fisher and the Cambridge economists differ noticeably.

First, the theories developed by Fisher and the Cambridge economists use distinctive approaches to the problem. The focus of the Cambridge quantity theory of money is not on the analysis of market equilibrium but on the choice of individual economic agents. In contrast to the Fisher theory concerning factors that affect the quantity of money needed for conducting transactions, the Cambridge theory focuses on the

quantity of money that economic agents would like to hold under certain circumstances.

Second, in addition to an argument in the Fisher theory that money serves as a medium of exchange, the Cambridge economists view money also as a store of value; hence the volume of transactions is a significant yet not the only factor having an impact on the demand for money. The Cambridge theory deals also with the role of wealth and interest rates. With wealth of economic agents increasing, the volume of financial assets (including money) held for storing wealth should have grown. Assuming that wealth, the volume of transactions and the level of income are proportional, the demand for money is also proportional to the nominal income.

Emphasising the significance of the transaction volume for the formation of the demand for money, the Cambridge economists treated the coefficient k as constant; however, the values of this coefficient may be subject to short-term fluctuations, as the choice of economic agents to use money as a store of value will be influenced by interest rates and the expected return on other assets.

4.1.3 The Liquidity Preference Theory of Keynes

Until the Great Depression, economists shared the view that in the longer run the velocity of money is affected by technological changes, and in the shorter run instability is not typical for it. Following the notable fall in the velocity of money during the Great Depression, other determinants of the demand for money were sought to explain variability of the velocity of money. Keynes scrapped the view that the velocity of money was constant and developed a theory in which he placed a particular emphasis on the role of interest rates. However, his theory not only deals with the factors influencing the money demand but provides also a deeper insight into causes for holding money. Proceeding from the analysis of these causes, Keynes arrived at three motives: the transaction, precautionary and speculative motive.

Pointing out that the need for money is determined by its function as a medium of exchange, the Keynes theory argues that the demand for money basically depends on the volume of transactions. Assuming that the volume of transactions is proportional to income, this component of the money demand should also be proportional to income.

Acknowledging that money functions as a store of value, Keynes proposed that in addition to using money for making planned payments there is a need to use money to cover unforeseen expenses. According to Keynes, the quantity of money held for the precautionary motive is mainly affected by the level of planned costs in proportion to the income level. Consequently, this component of the money demand is proportional to income.

Keynes adopted the stance of the classics of the economic theory that money is a medium of storing value. This function of money gives rise to the so-called speculative motive for holding money. In addition to the argument about the close relation between the stored wealth and the income level, Keynes emphasised the importance of interest rates for economic agents to make decisions on the amount of money to be allocated for storing wealth. When changes in interest rates are anticipated and when resulting from such changes does not ensure the largest possible return, economic agents would act reasonably and move their capital to such financial assets that yield the largest return. In Keynes' view, the assets that can be used to store wealth are money and bonds. Regarding the financial assets to be used for storing value, the

Keynes theory assumes that economic agents anticipate a move of interest rates toward some 'normal' level.

The interest rates that are above such a 'normal' level are expected to fall; the return expected on current investment in bonds could be a good reason to use bonds, not money for storing value. When, in turn, a rise in interest rates is expected, the demand for money would increase, as due to higher interest rates the former investment in bonds would bring about losses.

The value of money is in its purchasing power; hence the money demand is the demand for its real value. It follows from Keynes' analysis that the real demand for money M^d/P should be positively related to the real income Y and negatively related to the interest rate i, with the following general money demand function:

$$\frac{M^d}{P} = f(Y, i) \tag{4.3}$$

The speculative money demand model of the Keynes theory produces two explanations for fluctuations in the velocity of money. Using the definition of money velocity and the Keynes money demand function, it is possible to show that under money market equilibrium the velocity of money increases due to rising interest rates. The Keynes

model implies that money demand depends on the normal level of interest rates that cannot be directly observed. Changes in this level may figure as a second cause for unstable velocity of money.

4.1.4 The Tobin Model

Criticism of Keynes' analysis of the speculative money demand most often focuses on more straightforward assumptions, as the condition regarding the individual choice to either place capital in bonds or hold it as monetary assets *does* not foresee a portfolio diversification possibility. Eliminating this shortcoming, Tobin created a speculative money demand model in which, along the expected return on assets, he incorporated risk of return on assets as an additional portfolio-formation factor.

According to this model, economic agents are not willing to assume risk. A constant expected return is a significant feature of monetary assets (Tobin considered a case of a zero expected return). Bond prices, in turn, may be subject to fluctuations, the return on them comprises risk, and a negative return is also possible. Hence risk-averse economic agents may still wish to use monetary assets also for storing value, because in this way the portfolio volatility would be limited.

Tobin's analysis shows that portfolio diversification is possible by involving monetary assets, and hence, despite the zero return, money may serve as a medium for storing value.

4.1.5 The Baumol–Tobin Model

Baumol (1952) and Tobin (1958) independently of each other advanced similar money demand models, which showed that monetary assets held for conducting transactions might be affected by interest rates. This model deals with an economy where two types of financial assets are available – monetary assets that do not yield interest, and one other type of interest bearing liquid assets, e.g. bonds that cannot be used for settlements. Only money can be used in transactions, while bond trading is associated with transaction costs. In such circumstances, two types of costs are possible – costs related to holding money and a brokerage fee, offsetting the shortage of monetary assets with the income from trading bonds.

Economic agents face the problem how to minimise effects of the lost interest and reduce the amount of brokerage fees. If the total value of transactions made in a particular period is Y, the brokerage fee related to

trading bonds is b and the interest rate is i, the minimisation of total expenses leads to the amount of money required for transaction purposes:

$$M = \sqrt{\frac{b.Y}{2.i}} \tag{4.4}$$

4.1.6 The Modern Quantity Theory of Money of Friedman

Friedman developed a theory in 1956 in which he defined the function of the demand for money on the basis of the theory of demand for assets. According to this theory, the demand for monetary assets should be related to resources at the disposal of an economic agent, i.e. the total amount of assets and the expected return on alternative-to-money assets in comparison with the return on monetary assets. The demand for assets is positively related to wealth; hence the same relation exists also between the demand for money and the indicator of permanent wealth, a measure of accumulated wealth introduced by Friedman. Permanent income is calculated as the present value of the expected average future income, and, in contrast to income, this indicator shows less pronounced short-term volatility.

Next to money, also bonds, shares and goods can be used for storing value. The reason behind using other alternative-to-money assets for storing value is the expected return on such other assets against the

expected return on money deposits; hence an increase in return on alternative assets relative to monetary assets would result in a diminishing demand for money.

These considerations lead to an assumption that the function of the real demand for money is as follows:

$$\frac{M^d}{P} = f(Y_p, r_b - r_m, r_e - r_m, \pi^e) \qquad (4.5)$$

where

Y_p is the permanent income;

r_m is the expected return on monetary assets;

r_b is the expected return on bonds;

r_e is the expected return on shares;

π^e is the expected inflation.

In contrast to Keynes, Friedman considered that goods and money are substitutes, and his theory does not treat the expected return on money deposits as a constant variable. With interest rates rising in the economy, banks' income from lending also increases; in such circumstances, banks, aiming to attract new funds, push up interest rates on deposits. Competition in the banking sector is the factor driving up deposit interest rates until there is no excess profit. Under the impact of

these processes, the difference is rather stable. Due to it, interest rates are likely to have little impact on the demand for money.

4.2 Analysis of Money Supply

Determinants of money, M are often described by the theory advanced by Tiegen, a compact description of which is given in Branson's well-known macroeconomics book (Branson, 1989). Following him, a description of the model is given below.

Money supply, M is divided into two parts—that part which is held by the public, Cp and that part which is held by the banking system, Dp. Hence,

$$M = Cp + Dp \qquad (4.6.1)$$

Of this, public holds h percent in currency and the rest, (1-h) is held in checking account in deposits. So, we have

$$cp = hM \qquad (4.6.2)$$

and

$$Dp = (1-h)\,M \qquad (4.6.3)$$

The required reserve ratio, z, which is the fraction of demand deposit, Dp that must be held as a required reserve, RR is given by

$$RR = z.Dp = z\,(1\text{-}h)\,M \qquad (4.6.4)$$

Total reserve can be divided into *sources* of reserves and *uses* of reserves. The central bank provides unborrowed reserve, RU and borrowed reserve, RB, which are then allocated to three uses—to required reserve, RB or to excess reserve, RE. Also, some reserve may also end up as currency in the hands of the public, Cp. This gives us the basic reserve identity

$$RU + RB = R = RR + RE + Cp \qquad (4.6.5)$$

The equation (4.6.5) also leads to an expression for the policy instrument which the central bank controls through open market operations:

$$RU = RR + RE - RB\ Cp = RR + RF + Cp \qquad (4.6.6)$$

where *net free reserve,* RF is equal to RE + RB.

In order to get an equation for money supply, equation (4.6.2) and (4.6.4) can be combined, which will generate an equation showing money supply as a function of unborrowed reserves, controlled by the central bank and free reserves controlled by the commercial banks. After making proper substitution, an expression for RU can be obtained:

$$RU = z\,(1-h)\,M + hM \qquad (4.6.7)$$

Solving for M, the following money supply equation is obtained:

$$M = (RU - RF) / (h + z(1-h)) = (RU - RF) / (z + (1 - z)) \qquad (4.6.8)$$

Equation (8) implies that money supply rises as the central bank provides more unborrowed reserves and falls as free reserves increase, public preference for currency rises, or as the central bank increases the reserve ratio.

Unlike empirical estimation of the demand for money function, money supply functions are rarely estimated. This is primarily because money supply is controlled by the central bank and is not endogenously determined. However, money supply has wide impact on various aspects

of the economy and these constitute the main subject of research on money supply.

In modern empirical research, these are essentially studied through the causality analysis advanced by Granger (1969) and enriched by the works of others. The topics covered by such studies include the relationship between money supply and the price level (Hussain and Abbas, 2001), and money supply and GDP growth (Chimobi and Uche, 2010).

4.3 Empirical Methodology of Studying Money Demand

In an early work, Goldfeld (1973) advanced four essential properties of money demand that have been confirmed in subsequent studies. The properties can be summarised thus:

(a) The demand for real money depends negatively on the rate of interest.

(b) The demand for money is positively influenced by real income.

(c) The long-run responsiveness of money demand to changes in interest rate and income is greater than the short-run response.

In this thesis, these properties will be empirically examined.

The empirical method of studying demand for money proceeds along estimation of the money demand function to obtain income and interest elasticity and to examine the stability of the money demand function. Dornbusch and Fischer (1995) and other textbook writers have asserted that the demand for money plays an important role in determining the effectiveness of monetary and fiscal policies. They have explained the theoretical reasons for which the demand for real balances should depend on the rate of interest and why this relationship should be negative. According to the theory of money demand, the demand for money should also depend on the level of income. This can be measured by estimating the income elasticity of money demand. In this thesis, both interest and income elasticities are carefully estimated and analysed.

The empirical study of the money demand function also deals with structural breaks over different periods characterised by distinct economic features or policy. The empirical methodology of doing these are described below.

4.3.1 Empirical Study of Money Demand Function

Monetary economists postulate that the demand for money depends on a small number of economic variables. Following the literature, it is assumed that the demand for real money, M, depends positively on the real income, y, and negatively on the nominal interest rate, i.

Thus the money demand function is:

$$lnM_t = \alpha_0 + \alpha_1 \ln y_t + \alpha_2 i_t + u_t \qquad (4.7)$$

where u_t is the stochastic disturbance term.

The basic issues for the money demand specification have been about the appropriate monetary aggregate, interest rate, and the scale variable measures. Therefore, this thesis considers two alternatives for monetary aggregate, M1 and M2, and one alternative for interest rate and GDP.

Estimation of elasticity of money demand with respect to income and interest rate is a key objective in empirical study of demand for money. The income elasticity demand can be written as:

$$\frac{\frac{\Delta(M/P)}{M/P}}{\frac{\Delta Y}{Y}} \qquad (4.8)$$

where M refers to nominal money, P refers to price level and Y refers to income.

Similarly, interest elasticity of money can be written as:

$$\frac{\frac{\Delta(M/P)}{M/P}}{\frac{\Delta i}{i}} \tag{4.9}$$

where M refers to nominal money, P refers to price level and i refers to interest.

For empirical estimation, when demand for money is written as a function of income and interest rate, the double-log form is used. This means that log of dependent and independent variables are taken so that the coefficient of income and interest rate show elasticity of money demand with respect to these variables. If the money demand function is written thus:

$$\log M = a + b \log Y - c \log i \tag{4.10}$$

then can be generalised to include more than two variables in the right hand side.

Now if *log M* is differentiated with respect to Y, it can be written as:

$$\frac{d\log M}{d\log Y} = \frac{\frac{\Delta(M/P)}{M/P}}{\frac{\Delta Y}{Y}} = b \qquad (4.11)$$

Similar expression can be obtained for elasticity of money demand with respect to other variables. This justifies application of the double-log from used by many, in fact most, researchers working in this area.

4.3.2 Correction for Autocorrelation: The Cochrane-Orcutt Method

The problem of autocorrelation is quite common in time series studies of the money demand functions like the ones used in this thesis. Usually, researchers leave the problem unattended, which make the estimates questionable. In this thesis, having presented the estimates and observing the presence of autocorrelation through the D-W statistics, due steps are taken to correct autocorrelation. For this, the well-known Cochrane-Orcutt method is used.

4.3.3 Breakpoint Test: The Chow Test

The idea of the breakpoint Chow test is to fit the equation separately for each sub-sample and to see whether there are significant differences in the estimated equations. A significant difference indicates a structural change in the relationship. For example, the test can be used to examine whether the demand function for energy was the same before

and after the oil shock. In this study, there are two sub-periods – pre- and post- liberalisation period, which are very fit for application of the Chow test.

To carry out the test, the data are partitioned into two or more sub-samples. Each sub-sample must contain more observations than the number of coefficients in the equation so that the equation can be estimated. The Chow breakpoint test compares the sum of squared residuals obtained by fitting a single equation to the entire sample with the sum of squared residuals obtained when separate equations are fit to each sub-sample of the data.

EViews reports two test statistics for the Chow breakpoint test. The F-statistic is based on the comparison of the restricted and unrestricted sum of squared residuals and in the simplest case involving a single breakpoint, is computed as:

$$F = \frac{(\hat{u}'\hat{u} - (u_1' u_1 + u_2' u_2))/k}{(u_1' u_1 + u_2' u_2)/(T-2k)} \qquad (4.12)$$

where $\hat{u}'\hat{u}$ is the restricted sum of squared residuals, $u_i' u_i$ is the sum of squared residuals from subsample i, T is the total number of observations, and k is the number of parameters in the equation. This

formula can be generalised naturally to more than one breakpoint. The F-statistic has an exact finite sample F-distribution if the errors are independent and identically distributed normal random variables.

4.3.4 Stability of Money Demand Function

The stability of the money demand function can be examined by employing the tests of stationarity and cointegration. These are described below in the following pages.

4.3.4.1 Test of Stationarity

If a variable whose values are given for a long time series is found to be non-stationary, then this reflects instability in the short-run. To test stationarity of a variable, the Dickey-Fuller (DF) test is widely applied. However, this test assumes that error terms are uncorrelated. If the error terms are correlated, as quite frequently is the case, then the DF test is not appropriate. Another test, also advanced by Dicky and Fuller, is known as the Augmented Dickey-Fuller (ADF) test. This test takes into consideration the problem of autocorrelation, that is, possible relation between the error terms. The ADF test requires estimation of an equation like the following:

$$\Delta y_t = \beta_1 + \beta_2 t + \delta y_{t-1} + \alpha \sum_{i=1}^{m} \Delta y_{t-1} + \varepsilon_t \qquad (4.13)$$

where ε_t is the error term and where $\Delta Y_{t-1} = (Y_{t-1} - Y_{t-2})$. The ADF test has the same critical values as the DF test. Inclusion of the lagged difference term and their number is empirically determined. The main objective is to have enough terms so that the error term is serially uncorrelated.

4.3.4.2 Test of Cointegration

A test of cointegration between variables of the same order of integration can be made. Cointegration can be between any two variables or between the dependent variable and all other independent variables. The latter is known as multiple cointegration. The foremost among the cointegration tests is the Johansen and Juselius test, which will be used for empirical testing in this thesis. The econometric software EViews will be used in this study.

4.4 Methodology of Studying Money Supply

As mentioned above, the study of money supply rarely contain estimation of money supply function, there being very few studies since money supply is exogenous and is controlled by the central bank. Recent research has focused on causal relationship between money supply and

other economic variables such as the price level and income (Hussain and Abbas, 2001; Chimobi and Uche, 2010).

There has been a long debate in economics regarding the role of money in an economy particularly in the determination of income and prices. The monetarists claim that money plays an active role and leads to changes in income and prices. In other words, changes in income and prices in an economy are mainly caused by the changes in money stocks. Hence, the direction of causation runs from money to income and prices without any feedback, i.e., unidirectional causation.

The Keynesians, on the other hand, argue that money does not play an active role in changing income and prices. In fact, changes in income cause changes in money stocks via demand for money implying that the direction of causation runs from income to money without any feedback. Similarly, changes in prices are mainly caused by structural factors.

4.4.1 Empirical Study of Money Supply

It has been already mentioned that money supply is controlled by the central bank and, as a result, there is hardly any work on money supply function.

4.4.2 Causality Analysis

The causality study of money supply with other variables can be examined by employing the stationarity, cointegration, and Granger causality tests. These are described below in the following sections.

A necessary condition for testing a long-run relationship among variables is that the relevant variables are integrated of the same order. The classical unit root test, namely, the Augmented Dickey-Fuller (ADF) test will be used to see whether unit root exists in the time series. After that long-run relationship between the series will be tested with the help of cointegration techniques devised by Johansen and Juselius. Then the Granger causality test will be applied to see the direction of causality.

In the discussion on the stability of money demand function above, the first two steps, that is, the unit root test and the test of cointegration, have been already discussed. So in this section, only the methodology of the Granger causality test is described.

4.4.2.1 Granger Causality Test

The Granger causality test involves the following equations between the two set of variables with the right hand side always consisting of lagged values of the dependent variables:

$$Y_t = \Sigma \alpha_i X_{t-i} + \Sigma \beta_j Y_{t-j} + U_{1t} \qquad (4.14)$$

$$X_t = \Sigma \lambda_i X_{t-i} + \Sigma \delta_j Y_{t-j} + U_{2t} \qquad (4.15)$$

Here, the interest lies in the dependence of variable Y at time t on previous values of X and vice-versa, that is, the focus on the terms α and δ in equations 4.14 and 4.15, respectively. If the α_i coefficients as a set are statistically different from zero i.e. $\sum_i \alpha_i \neq 0$, then it may be concluded that Y depends on past values of X, hence changes in Y are *caused* by changes in X variable. The same is applicable for variable Y causing X when $\sum_i \delta_i \neq 0$. This test is used in this thesis to determine causal relationship between money supply with economic growth and moey supply and price.

4.5 Chapter Summary

Following is a summary of key issues of chapter 4.

(a) This chapter contains a description of the theories of demand for money and the methodology of analysis of supply of money.

(b) The theoretical discussion of these aspects is followed by a description of the empirical methodology of analysis of money demand and money supply that will be followed in this thesis.

(c) The theories that have been described are the Fisherian quantity theory of money, the demand for money theories by the Cambridge economists, the liquidity preference theory of Keynes, the Tobin model, the Baumol–Tobin model, the modern quantity theory of money of Friedman, and analysis of money supply are described in this chapter.

(d) Methodology of empirical study of demand for and supply of money are discussed here. This includes specification of money demand and supply function, study of stability, breakpoint test, simultaneous estimation of money demand and supply function, and the Granger causality analysis.

Chapter 5

DATA FOR THE RESEARCH

This chapter contains data that will be used for various empirical estimations on demand for and supply of money. A description of these data and the changes that have taken place over time are also given.

The discussion starts with demand for money and its components. Money in narrow sense is the sum of the money outside banks as well as the current deposits. Broad money (M2) includes both narrow money (M1) and the time deposits.

5.1 Narrow Money and its Components in Current Term

The trend of narrow money demand and its components for the period 1976 to 2008 are described in the following pages with the help of both table and figure. Data of these variables have been collected from various issues of Bangladesh Economic Review.

Money outside bank in current term has gone through a steady growth during the period of 1976 to 2008. It was 3.30 billion taka in 1976, and then gradually increased to 19.50 billion taka in 1986. In 1996,

Table 5.1: Money outside bank, current deposit and narrow money (M1) for the period 1976 to 2008 in current billion taka

(in current billion taka)

Year	Money outside bank	Current deposit	Narrow money (M1)
1976	3.3	5.5	8.8
1977	3.6	6.2	9.7
1978	5.0	7.2	12.2
1979	6.1	9.1	15.2
1980	6.9	10.4	17.3
1981	9.2	10.7	19.9
1982	8.8	11.4	20.1
1983	11.4	15.0	26.3
1984	15.6	19.9	35.5
1985	17.2	25.1	42.3
1986	19.5	29.8	49.3
1987	20.8	31.9	52.6
1988	24.2	26.3	50.5
1989	26.2	28.5	54.6
1990	31.9	31.8	63.7
1991	36.1	35.9	72.0
1992	40.7	41.9	82.6
1993	44.8	45.8	90.6
1994	54.2	57.5	111.7
1995	65.7	66.1	131.8
1996	71.2	73.4	144.6
1997	75.8	75.9	151.7
1998	81.5	77.4	158.9
1999	86.9	85.6	172.5
2000	101.8	97.1	198.8
2001	114.8	108.7	223.5
2002	125.3	116.3	241.6
2003	139.0	128.4	267.4
2004	158.1	146.9	305.0
2005	185.2	170.3	355.5
2006	228.6	202.7	431.3
2007	266.4	240.1	506.5
2008	326.9	266.2	593.1

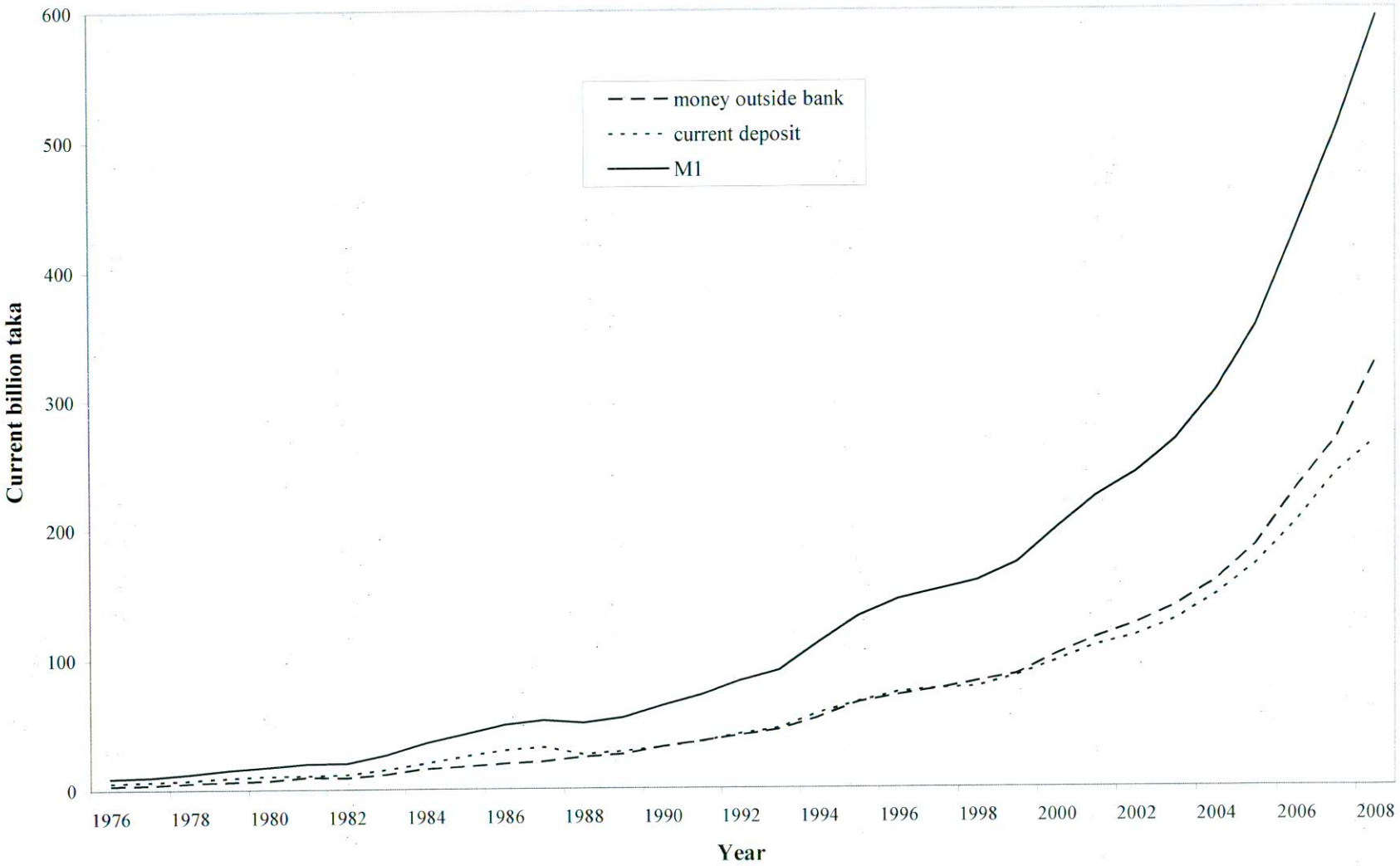
Sources: Government of Bangladesh, *Bangladesh Economic Review,* various issues.

its growth was rather fast and it increased to 71.20. Finally, it became 326.90 billion taka in 2008.

Current currency deposits had almost a similar pattern of increase during the period of study. It was 5.50 billion taka in 1976, increased to 29.80 in 1986. The trend continued even after the post-liberalisation period. In 1996, the current currency deposit rose to 73.40 billion taka. The growth was continuous and by the year 2008, the amount reached 266.20 billion taka.

The current narrow money (M1) is the combination of the above two components. So it followed a quite similar path for this period. Of the two components, currency deposit was bigger in the early part of this study but money outside bank increased at a faster rate and gradually became the bigger component of current M1 from the year 1998. Current narrow money demand was 8.80 billion taka in 1976, increased to 49.30 in 1986. The trend continued even after the post-liberalisation period. In 1996, the current currency deposit rose to 144.60 billion taka. The growth was continuous and by the year 2008, the amount reached 593.10 billion taka. The trend of these variables during the period of 1976 to 2008 can be seen more clearly with the following figure.

Figure 5.1: Money outside bank, current deposit and narrow money (M1) for the period 1976 to 2008 in current billion taka



5.2 Narrow Money, Time Deposit and Broad Money in Current Term

The trend of broad money demand and its components are described in the following pages with the help of both table and figure. The data of narrow money, time deposit and broad money are given for the period 1976 to 2008. Data of these variables have been also collected from various issues of Bangladesh Economic Review.

As the trend of narrow money discussed above, only the trends of time deposit and broad money in current terms are discussed below. Current time deposits continuously increased during the period of study but the growth was very fast during the second half of the period. It was 5.20 billion taka in 1976, increased to 74.10 in 1986. The increase continued at a greater amount and reached 312.30 in the year 1996. By 2008, the amount reached a mammoth 1894.80 billion taka.

The current broad money (M2) is the sum of the above two components. The trend followed the pattern of time deposit because it formed the larger part of broad money. Current broad money demand was 14.00 billion taka in 1976, increased to 123.40 in 1986. In 1996, the current currency deposit rose to 457.60 billion taka. The growth was continuous and in 2008, the amount reached 2487.90 billion taka.

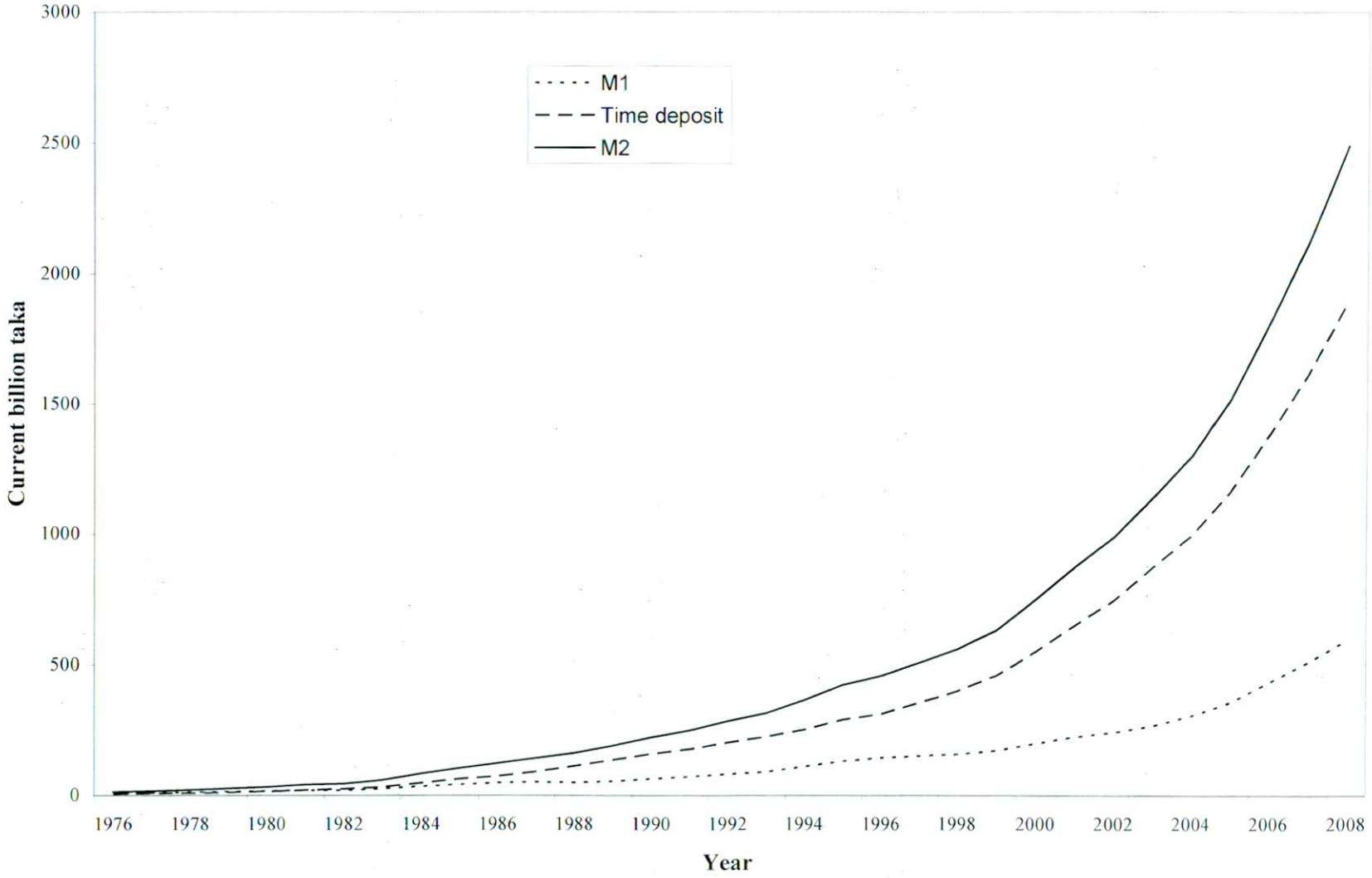
Table 5.2: Narrow money (M1), time deposit and broad money (M2) for the period 1976 to 2008

(in current billion taka)

Year	Narrow money (M1)	Time deposit	Broad money (M2)
1976	8.8	5.2	14.0
1977	9.7	7.7	17.4
1978	12.2	9.2	21.4
1979	15.2	12.4	27.6
1980	17.3	15.1	32.4
1981	19.9	21.5	41.4
1982	20.1	25.4	45.5
1983	26.3	32.6	59.0
1984	35.5	48.4	83.9
1985	42.3	63.0	105.3
1986	49.3	74.1	123.4
1987	52.6	90.9	143.5
1988	50.5	113.6	164.1
1989	54.6	136.2	190.8
1990	63.7	159.3	223.0
1991	72.0	178.0	250.1
1992	82.6	202.7	285.3
1993	90.6	224.7	315.4
1994	111.7	252.4	364.0
1995	131.8	290.3	422.7
1996	144.6	312.3	457.6
1997	151.7	354.6	507.1
1998	158.9	399.8	558.7
1999	172.5	457.8	630.3
2000	198.8	548.8	747.6
2001	223.5	648.3	871.7
2002	241.6	744.5	986.2
2003	267.4	872.5	1140.0
2004	305.0	992.7	1297.7
2005	355.5	1160.4	1515.9
2006	431.3	1380.2	1811.6
2007	506.5	1613.4	2119.9
2008	593.1	1894.8	2487.9

Sources: Government of Bangladesh, *Bangladesh Economic Review,* various issues.

Figure 5.2: Narrow money (M1), time deposit and broad money (M2) for the period 1976 to 2008



5.3 GDP Deflator Series

When M1 and M2 are stated in nominal term, these refer to supply of money. Since demand for money refers to demand for real balance, it has to be stated in real terms. Practically, this means that when the price level divides M1 and M2, demand for money is obtained, which can be written as M1/P and M2/P.

The basic data of the GDP deflator series has been obtained from various issues of World Development Indicators. The remaining part of the series has been constructed on the basis of the series with the help of inflation data. The base year for the study is 1990. Choosing 1990 as the base year has the following two advantages. Firstly, it falls almost in the middle part of our study. Secondly, from this time the liberalisation process started.

From the GDP deflator series, it can be seen that it is 100.0 in 1990 because this is the base year. It was 27.9 at the starting year of the study, which is 1976. In 1986, it became 74.1. After another ten years, it was 127.1 in the year 1996. After another twelve years in 2008 which is the end year of our study, it reached 232.9.

Table 5.3: GDP deflator series, Base = 1990.

Year	GDP deflator
1976	27.9
1977	27.4
1978	34.4
1979	38.1
1980	43.2
1981	45.8
1982	49.2
1983	53.0
1984	60.7
1985	67.5
1986	74.1
1987	82.2
1988	88.5
1989	95.4
1990	100.0
1991	106.8
1992	110.3
1993	110.9
1994	114.7
1995	122.4
1996	127.1
1997	133.2
1998	140.1
1999	146.7
2000	149.4
2001	151.8
2002	156.7
2003	163.6
2004	173.1
2005	184.3
2006	197.6
2007	211.9
2008	232.9

Sources: Bangladesh Bureau of Statistics, *Statistical Yearbook of Bangladesh*, various issues.
Government of Bangladesh, *Bangladesh Economic Review,* various issues.
World Bank, *World Development Indicators,* various issues.

5.4 Narrow Money and its Components in Real Term

The trend of narrow money demand and its components are described in the following pages with the help of both table and figure. The demand for narrow money can be defined as the narrow money demand in real terms. This is derived by deflating the current narrow money by the GDP deflator. The same thing is done for the components of narrow money demand, which are money outside banks and current deposits.

Data of these variables in nominal term have been collected from various issues of Bangladesh Economic Review. Then they are deflated by the GDP deflator series to have these series in real term.

Money outside bank in real term has gone through a steady growth during the period of 1976 to 2008. It was 11.83 billion taka in 1976 and then gradually increased to 26.32 billion taka in 1986. In 1996, its growth was quite similar and it increased to 56.20. Finally, it became 140.36 billion taka in 2008.

Real currency deposits increased during the period of study with some fluctuations in some years. It was 19.71 billion taka in 1976, increased to 40.22 in 1986. The trend continued even after the post-

liberalisation period. In 1996, the real currency deposit rose to 57.75 billion taka. The growth gained speed and by the year 2008, the amount reached 114.30 billion taka. Although the growth was steady from decade to decade, it decreased in some years within the decades.

The real narrow money (M1) is the combination of the above two components. So in this period, it had characteristics of both the components. It had quite a steady growth as well as it also experienced some decrease in some years. Of the two components, currency deposit was bigger in the early part of this study but money outside bank increased at a faster rate and gradually became the bigger component of real M1 from the year 1998. Real narrow money demand was 31.54 billion taka in 1976, increased to 66.53 in 1986. The trend continued even after the post-liberalisation period. In 1996, the real currency deposit rose to 113.77 billion taka. The growth experienced marginal decrease in 1998 but otherwise its increase was continuous and by the year 2008, the amount reached 254.66 billion taka.

The trend of these variables during the period of 1976 to 2008 can be seen more clearly with the following table and figure.

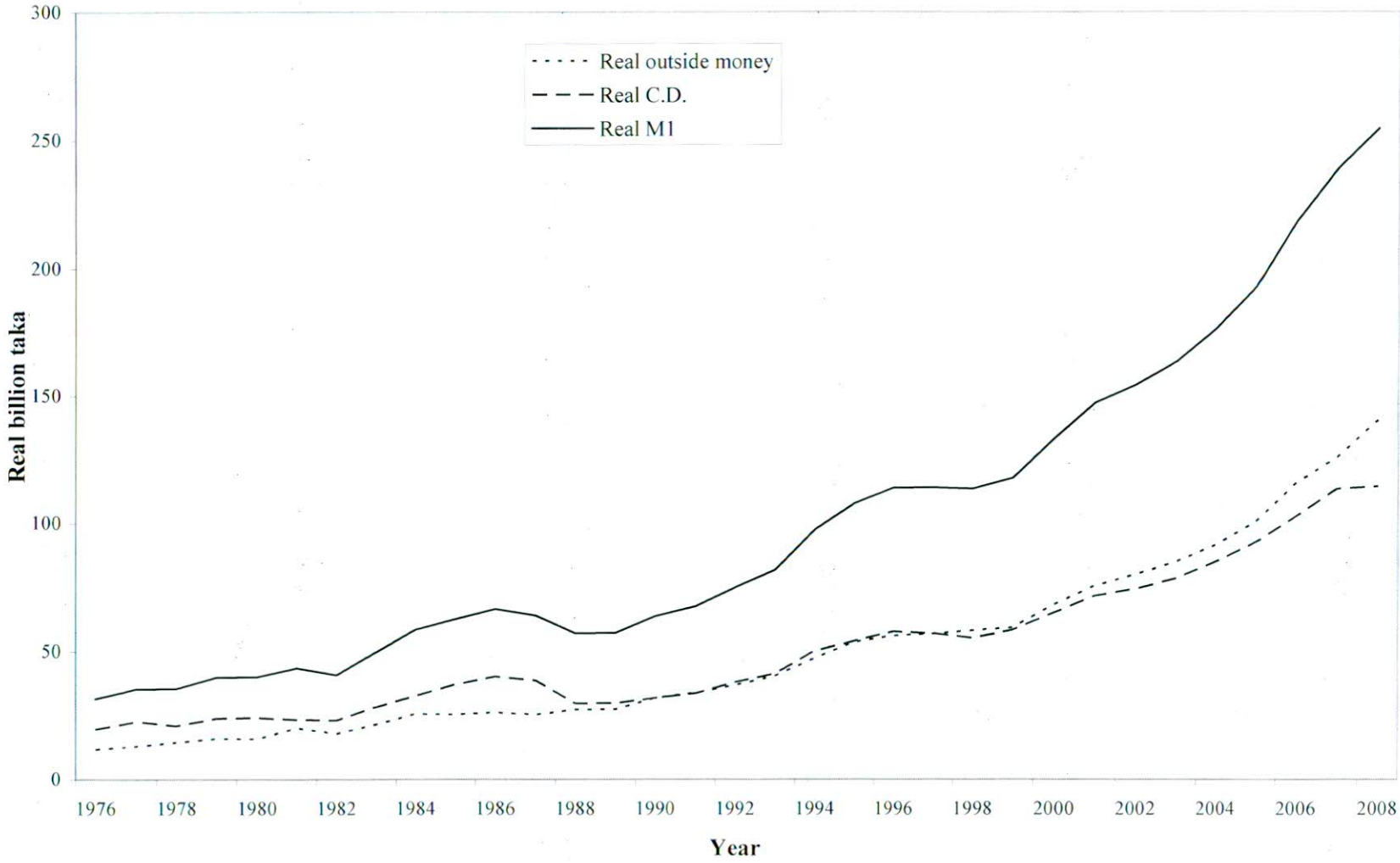
Table 5.4: Money outside bank, current deposit and narrow money (M1) for the period 1976 to 2008 in real billion taka

(in real billion taka)

Year	Money outside bank	Current deposit	Narrow money (M1)
1976	11.83	19.71	31.54
1977	13.14	22.63	35.77
1978	14.53	20.93	35.47
1979	16.01	23.88	39.90
1980	15.97	24.07	40.05
1981	20.09	23.36	43.45
1982	17.89	23.17	41.06
1983	21.51	28.30	49.81
1984	25.70	32.78	58.48
1985	25.48	37.19	62.67
1986	26.32	40.22	66.53
1987	25.30	38.81	64.11
1988	27.34	29.72	57.06
1989	27.46	29.87	57.34
1990	31.90	31.80	63.70
1991	33.80	33.61	67.42
1992	36.90	37.99	74.89
1993	40.40	41.30	81.70
1994	47.25	50.13	97.38
1995	53.68	54.00	107.68
1996	56.02	57.75	113.77
1997	56.91	56.98	113.89
1998	58.17	55.25	113.42
1999	59.24	58.35	117.59
2000	68.14	64.99	133.13
2001	75.63	71.61	147.23
2002	79.96	74.22	154.18
2003	84.96	78.48	163.45
2004	91.34	84.86	176.20
2005	100.48	92.40	192.89
2006	115.69	102.58	218.27
2007	125.72	113.31	239.03
2008	140.36	114.30	254.66

Sources: Bangladesh Bureau of Statistics, *Statistical Yearbook of Bangladesh*, various issues.
Government of Bangladesh, *Bangladesh Economic Review*, various issues.
World Bank, *World Development Indicators*, various issues.

Figure 5.3: Money outside bank, current deposit and narrow money for the period 1976 to 2008 in real billion taka



5.5 Narrow Money, Time Deposit and Broad Money in Real Term

The demand for broad money can be defined as the broad money demand in real terms. This is derived by deflating the real narrow money demand by the GDP deflator. The same thing is done for the components of broad money demand, which are narrow money and time deposits. These are described below with the help of table and figure. Data of these variables in nominal term have been collected from various issues of Bangladesh Economic Review. Then they were deflated by the GDP deflator series to have these series in real term.

Trend of real narrow money have been discussed earlier. So this discussion starts with trend of real time deposits. Real time deposit followed a quite steady increase with some early fluctuations. It was 18.64 billion taka in 1976. It then gradually increased to 100.00 billion taka in 1986. In 1996, its growth was quite similar and it increased to 245.71. Finally, it became 813.57 billion taka in 2008.

The real broad money (M2) increased during this period with the exception of 1978. Real broad money demand was 50.18 billion taka in 1976, increased to 166.53 in 1986. In 1996, it rose to 359.48 billion taka. The growth gained speed and reached 1068.23 billion taka in 2008. These trends can be seen more clearly with the following table and figure.

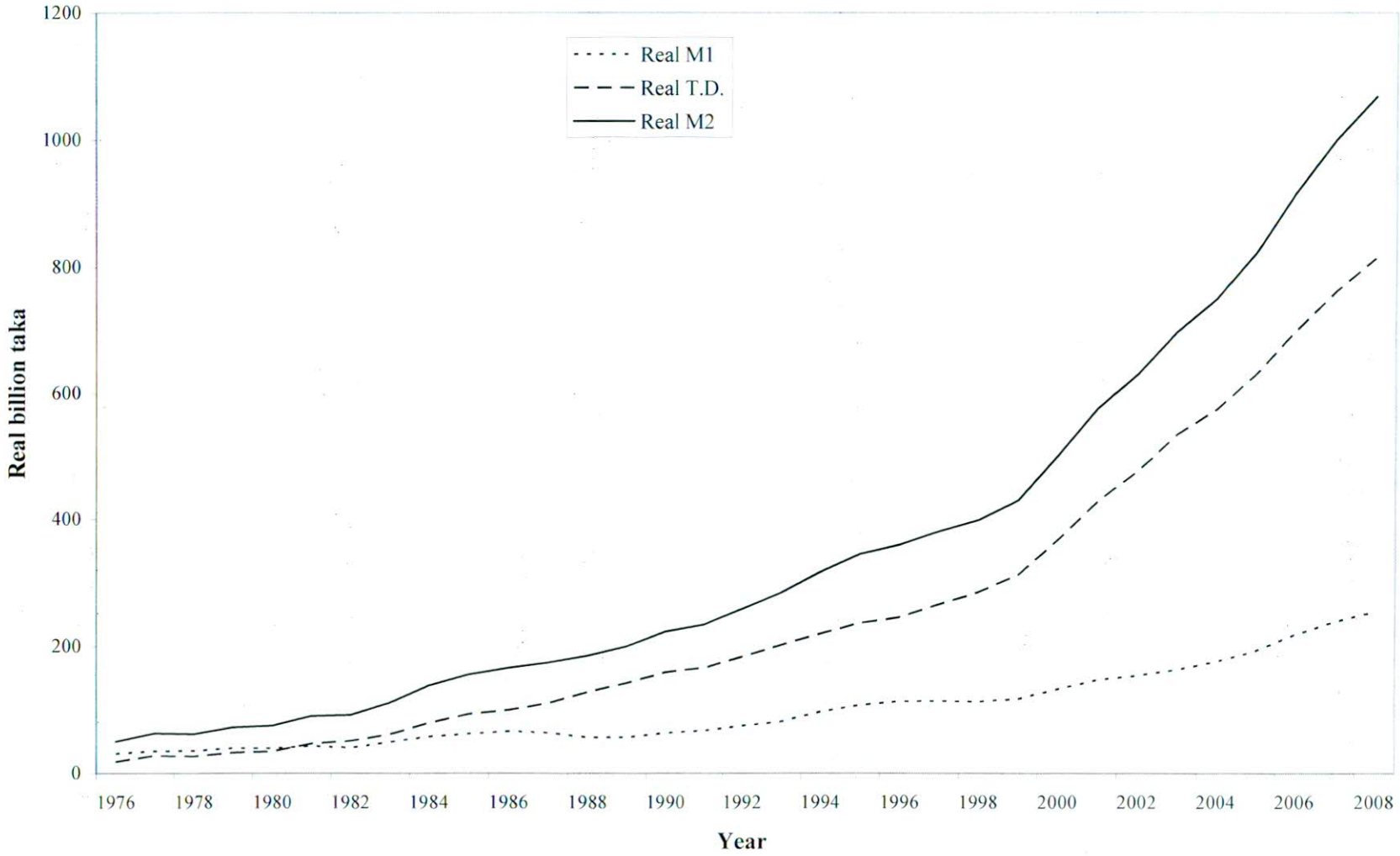
Table 5.5: Narrow money (M1), time deposit and broad money (M2) for the period 1976 to 2008 in real billion taka

(in real billion taka)

Year	Narrow money (M1)	Time deposit	Broad money (M2)
1976	31.54	18.64	50.18
1977	35.77	28.10	63.87
1978	35.47	26.74	62.21
1979	39.90	32.55	72.44
1980	40.05	34.95	75.00
1981	43.45	46.94	90.39
1982	41.06	51.63	92.68
1983	49.81	61.51	111.32
1984	58.48	79.74	138.22
1985	62.67	93.33	156.00
1986	66.53	100.00	166.53
1987	64.11	110.58	174.70
1988	57.06	128.36	185.42
1989	57.34	142.77	200.10
1990	63.70	159.30	223.00
1991	67.42	166.67	234.08
1992	74.89	183.77	258.66
1993	81.70	202.61	284.31
1994	97.38	220.05	317.44
1995	107.68	237.17	344.85
1996	113.77	245.71	359.48
1997	113.89	266.22	380.11
1998	113.42	285.37	398.79
1999	117.59	312.07	429.65
2000	133.13	367.34	500.47
2001	147.23	427.08	574.31
2002	154.18	475.11	629.29
2003	163.45	533.31	696.76
2004	176.20	573.48	749.68
2005	192.89	629.63	822.52
2006	218.27	698.48	916.80
2007	239.03	761.40	1000.42
2008	254.66	813.57	1068.23

Sources: Bangladesh Bureau of Statistics, *Statistical Yearbook of Bangladesh*, various issues.
Government of Bangladesh, *Bangladesh Economic Review*, various issues.
World Bank, *World Development Indicators*, various issues.

Figure 5.4: Narrow money, time deposit and broad money for the period 1976 to 2008 in real billion taka



5.6 Percentage Share of Money Outside Bank, Current Deposit and Time Deposit in Broad Money in Real Term

The percentage shares of the three components of broad money in real term are discussed below. Data for these shares are calculated using the real value of the three components.

In the early part of our study, the shares of these components were quite close although the share of money outside bank was a bit behind. Later on, shares of both money outside banks and currency deposit decreased even though their amount in both nominal and real terms increased. On the other hand, the share of time deposit in real term more than doubled during this period.

The above trends indicate the changes in the saving pattern of the people of Bangladesh. This may also indicate the improvement in the economic condition of the country. These trends are now individually described below.

The trend of percentage share of money outside bank in real term has gone through a steady decline during the period of 1976 to 2008. Its share was 23.57 percent in 1976, and then gradually decreased to 15.80 percent in 1986. In the next ten years it hovered around 15 percent and

stood at 15.58 percent in 1996. After that, it continuously decreased again except in the last couple of years and the share was 13.14 percent in 2008.

The trend of percentage share of current deposit in real term has also gone through a steady decline during the period of 1976 to 2008. Its share was 39.29 percent in 1976, and then gradually decreased to 24.15 percent in 1986. This trend continued and stood at 16.06 percent in 1996. It continuously decreased again for the last twelve years except the year of 2004 and the share became 10.70 percent in 2008.

The trend of percentage share of time deposit followed a completely different pattern. Although its share experienced some fluctuations in some individual years as well as in the early part of 1990s, the share increased overtime. Its share was 37.14 percent in 1976, and then gradually increased to 60.05 percent in 1986. In the next two years it increased dramatically to almost 70 percent but then it hovered around it and stood at 68.35 percent in 1996. After that, it continuously increased again except for the year 2004 and the share reached a staggering 76.16 percent in 2008. The trend of these variables during the period of 1976 to 2008 can be seen more clearly with the following table and figure.

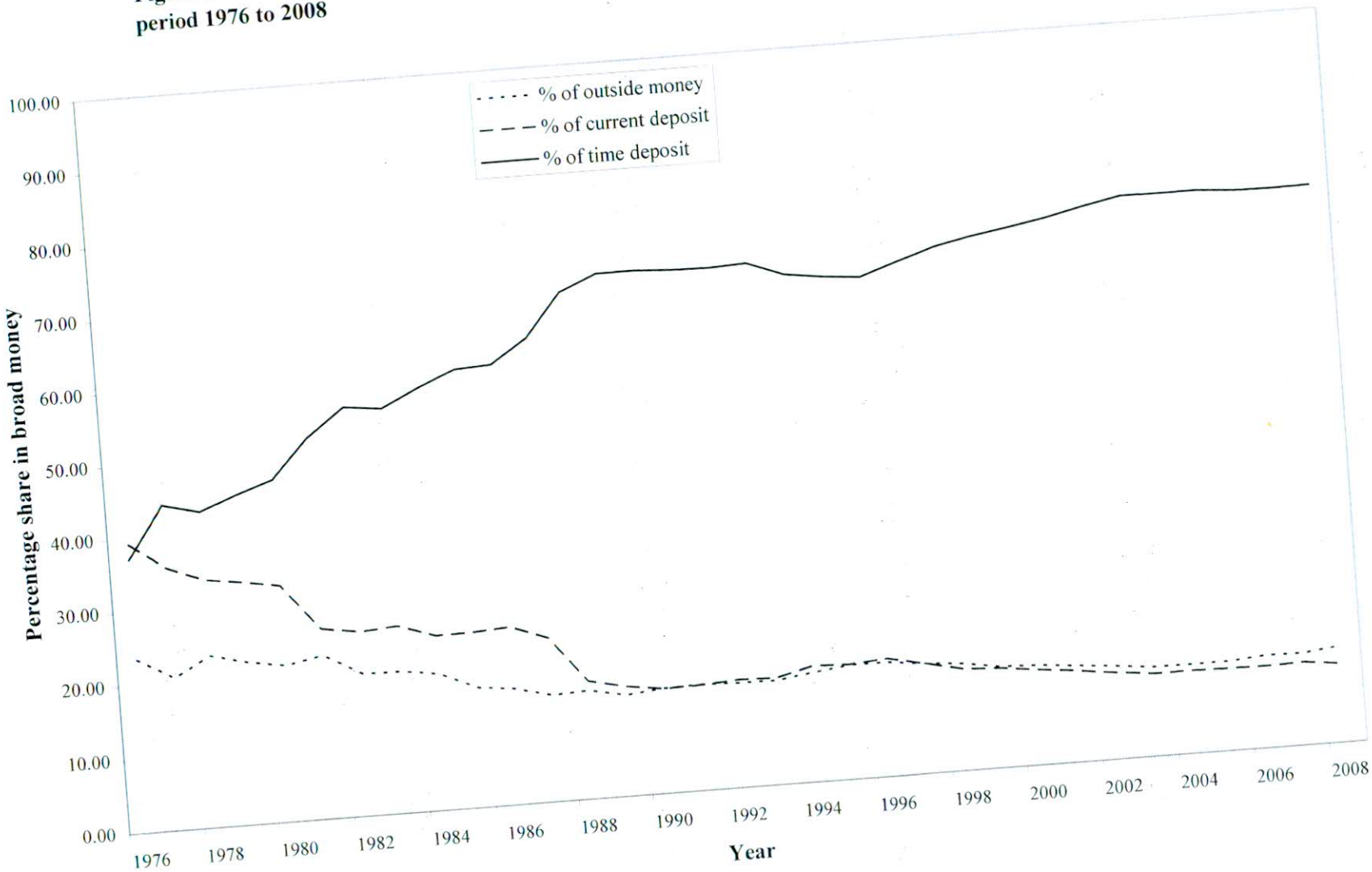
Table 5.6: Percentage share of money outside bank, current deposit and time deposit in broad money (M2) for the period 1976 to 2008

(in real term)

Year	Share of money outside bank in M2 (%)	Share of current deposit in M2 (%)	Share of time deposit in M2 (%)
1976	23.57	39.29	37.14
1977	20.57	35.43	44.00
1978	23.36	33.64	42.99
1979	22.10	32.97	44.93
1980	21.30	32.10	46.60
1981	22.22	25.85	51.93
1982	19.30	25.00	55.70
1983	19.32	25.42	55.25
1984	18.59	23.72	57.69
1985	16.33	23.84	59.83
1986	15.80	24.15	60.05
1987	14.48	22.21	63.30
1988	14.75	16.03	69.23
1989	13.72	14.93	71.35
1990	14.30	14.26	71.43
1991	14.44	14.36	71.20
1992	14.27	14.69	71.05
1993	14.21	14.53	71.27
1994	14.89	15.79	69.32
1995	15.57	15.66	68.78
1996	15.58	16.06	68.35
1997	14.97	14.99	70.04
1998	14.59	13.85	71.56
1999	13.79	13.58	72.63
2000	13.62	12.99	73.40
2001	13.17	12.47	74.36
2002	12.71	11.79	75.50
2003	12.19	11.26	76.54
2004	12.18	11.32	76.50
2005	12.22	11.23	76.55
2006	12.62	11.19	76.19
2007	12.57	11.32	76.11
2008	13.14	10.70	76.16

Sources: Bangladesh Bureau of Statistics, *Statistical Yearbook of Bangladesh*, various issues.
Government of Bangladesh, *Bangladesh Economic Review*, various issues.
World Bank, *World Development Indicators*, various issues.

Figure 5.5: Percentage share of money outside bank, current deposit and time deposit in broad money for the period 1976 to 2008



5.7 Real GDP, Interest Rate, Exchange Rate and Inflation Rate

The trend of nominal GDP, real GDP, nominal interest rate, exchange rate and inflation rate are described in the following pages. The relationship of demand for both narrow and broad money with income is seen with the income in real terms. But the GDP series is given below in both nominal and real terms. The nominal interest rate, exchange rate, and the inflation rate are also described in the following pages with the help of both table and figure.

As data of these variables are different in nature, data have been collected from various sources. These include various issues of *Bangladesh Economic Review, Statistical Yearbook of Bangladesh, Economic Trends,* and *World Development Indicators.*

Nominal GDP of Bangladesh has gone through a steady increase during 1976 to 2008 except the year 1977. Nominal GDP was 148.90 billion taka in 1976, and then gradually increased to 628.40 billion taka in 1986. In 1996, its growth was quite similar and it increased to 1648.40. Finally, it became 5458.20 billion taka in 2008.

Real GDP of Bangladesh has also gone through a steady increase during 1976 to 2008 except the year 1977. Real GDP was 533.69 billion

taka in 1976, and then gradually increased to 848.04 billion taka in 1986. In 1996, its growth was quite similar and it increased to 1296.93. Finally, it became 2343.58 billion taka in 2008.

Nominal interest rate of Bangladesh can be divided into two phases. The first phase is the pre-liberalisation period when the interest rate was kept fixed and changed by the central bank while the second phase is the post-liberalisation period when the interest rate became flexible and were not determined by the central bank. The nominal interest rate was 9.25 percent in 1976, it was 10.25 in the following three years, and then it was fixed at 15 percent for the period 1980 to 1986. From 1987 to 1990, the rate was 14.25 percent. From 1991, the rate of interest fluctuated as there was no central control over it. It was 9.11 percent in 1991, decreased to 6.11 percent in 1996. It then gradually increased to 12.63 percent in 2008.

Rate of exchange of Bangladeshi taka against US dollar has steadily declined for this period. It was 15.05 in 1976. In the next ten years, it increased gradually and stood at 29.89 taka in 1986. In 1996, the exchange rate against US dollar for taka became 40.84 and in 2008 it reached 68.60 taka in 2008.

Table 5.7: Data of nominal and real GDP, nominal interest rate, exchange rate and rate of inflation for the period 1976 to 2008

Year	Y (GDP, in current billion Tk)	YR (GDP, in real billion Tk)	i (Nominal interest rate, %)	E (Exchange rate)	Inflation
1976	148.9	533.69	9.25	15.05	27.9
1977	148.0	540.15	10.25	15.43	27.4
1978	199.0	578.49	10.25	15.12	34.4
1979	234.8	616.27	10.25	15.22	38.1
1980	270.2	625.46	15.00	15.49	43.2
1981	315.5	688.86	15.00	16.26	45.8
1982	350.9	713.21	15.00	20.07	49.2
1983	395.5	746.23	15.00	23.80	53
1984	475.2	782.87	15.00	24.94	60.7
1985	548.5	812.59	15.00	25.96	67.5
1986	628.4	848.04	15.00	29.89	74.1
1987	726.8	884.18	14.25	30.63	82.2
1988	804.9	909.49	14.25	31.24	88.5
1989	889.1	931.97	14.25	32.14	95.4
1990	994.2	994.20	14.25	32.92	100
1991	1097.0	1027.15	9.11	35.67	106.8
1992	1188.9	1077.88	8.11	38.15	110.3
1993	1249.9	1127.05	6.51	39.14	110.9
1994	1342.4	1170.36	5.34	40.00	114.7
1995	1512.1	1235.38	4.86	40.20	122.4
1996	1648.4	1296.93	6.11	40.84	127.1
1997	1807.0	1356.61	6.67	42.70	133.2
1998	2001.8	1428.84	12.96	45.46	140.1
1999	2197.0	1497.61	13.09	48.06	146.7
2000	2370.9	1586.95	13.03	50.31	149.4
2001	2535.5	1670.29	12.62	53.95	151.8
2002	2732.0	1743.46	13.02	57.43	156.7
2003	3005.8	1837.29	12.24	57.90	163.6
2004	3329.7	1923.57	11.16	58.93	173.1
2005	3707.1	2011.45	10.52	61.39	184.3
2006	4157.3	2106.07	11.06	67.08	197.6
2007	4724.8	2229.73	12.28	69.03	211.9
2008	5458.2	2343.58	12.63	68.60	232.9

Sources: Bangladesh Bank, *Economic Trends*, various issues.
Bangladesh Bureau of Statistics, *Statistical Yearbook of Bangladesh*, various issues.
Government of Bangladesh, *Bangladesh Economic Review*, various issues.
World Bank, *World Development Indicators*, various issues.

Figure 5.6: Nominal and real GDP for the period 1976 to 2008 in billion taka

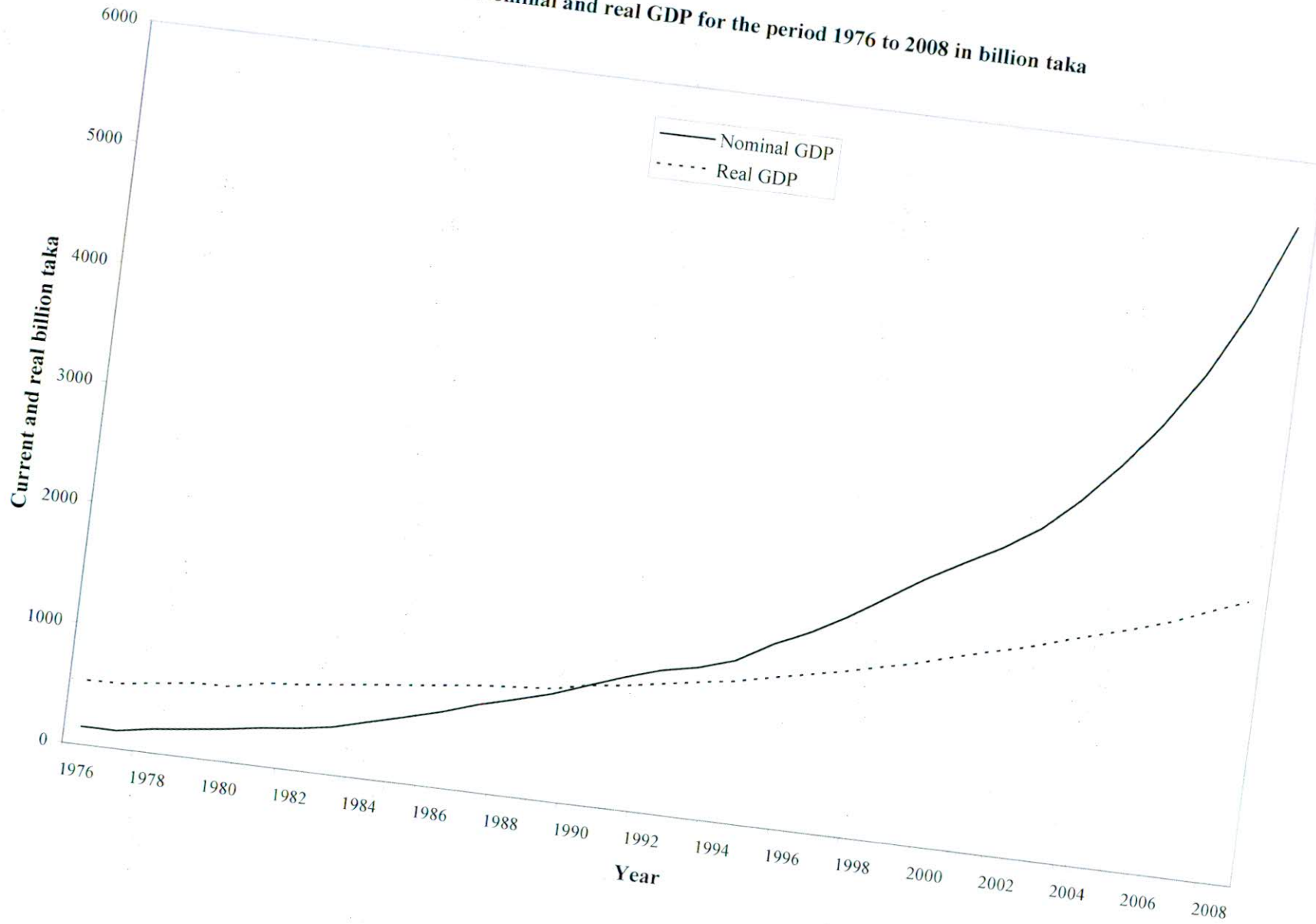
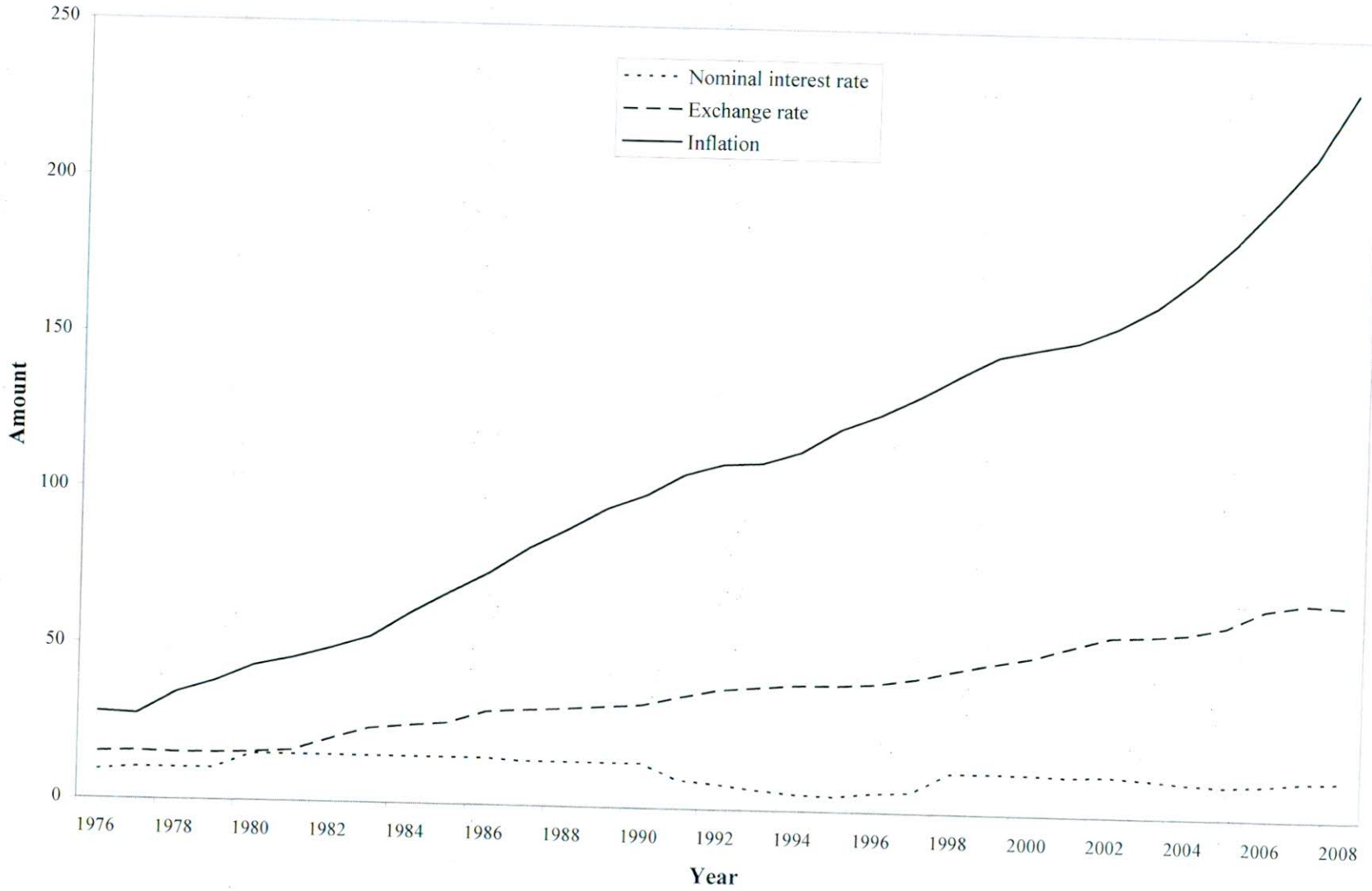


Figure 5.7: Nominal interest rate, exchange rate and rate of inflation for the period 1976 to 2008



Inflation rate in Bangladesh has steadily increased during this period. Here, GDP deflator series has been used as a proxy for the inflation rate. It was 27.90 in 1976. In the next ten years, it became almost threefold and stood at 74.10 in 1986. In the next ten years the inflation rate increased continuously and in 1996, it became 127.10. In the next twelve years, inflation rose very sharply to reach 232.90 in 2008.

5.8 Explanatory Variables in the Money Supply Function

Among the explanatory variables, real GDP and inflation have already been discussed in the discussion of the money demand. Moreover, the dependent variables of narrow and broad money in nominal form were also discussed. So, only the trends of the remaining variables – foreign exchange reserve, foreign direct investment (FDI), and remittance – are discussed here though time series data of all the explanatory variables are provided in Table 5.8.

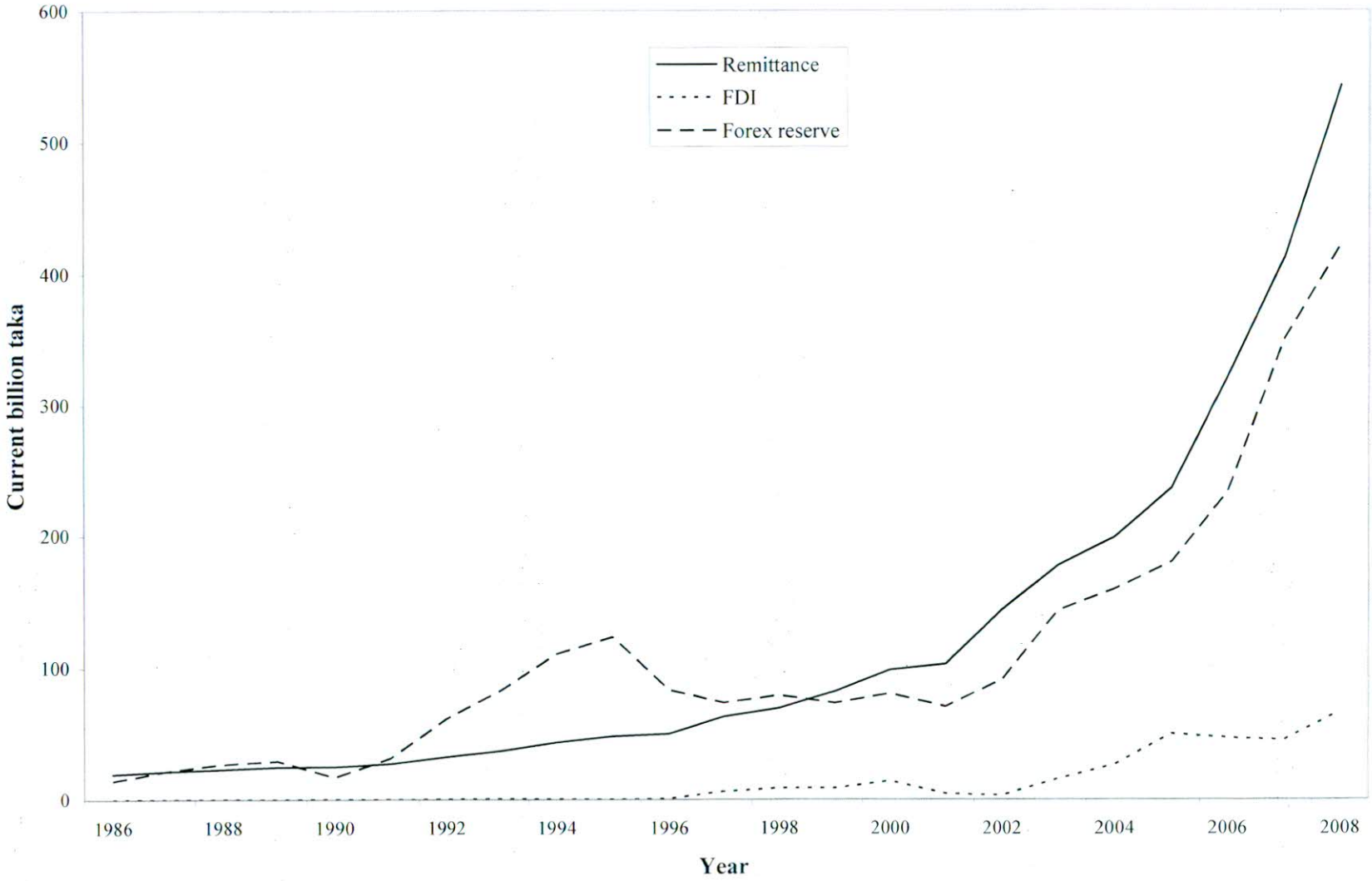
The trend of foreign exchange reserve in Bangladesh has been quite fluctuating. The foreign exchange reserve was 2.43 billion taka in 1982 and it increased to 61.35 billion taka in 1992. The trend continued for the next three years and reached 123.41 billion taka in 1995 but then started to fluctuate and stood at 90.91 billion taka in 2002. After 2002, it increased again and reached 421.82 billion taka in 2008.

Table 5.8: Data of real GDP, inflation, nominal remittance, nominal FDI and nominal forex reserve for the period 1976 to 2008

Year	YR (GDP, in real billion Tk)	Inflation	Nominal remittance in current billion tk	FDI in current billion tk	Forex reserve in current billion tk
1976	533.69	27.9	0.15	—	—
1977	540.15	27.4	0.75	—	—
1978	578.49	34.4	1.54	—	—
1979	616.27	38.1	1.89	—	—
1980	625.46	43.2	3.78	—	—
1981	688.86	45.8	6.20	—	—
1982	713.21	49.2	8.40	—	2.43
1983	746.23	53	14.74	—	8.52
1984	782.87	60.7	14.73	—	13.47
1985	812.59	67.5	11.48	—	10.25
1986	848.04	74.1	19.40	0.07	14.23
1987	884.18	82.2	21.35	0.10	21.90
1988	909.49	88.5	23.04	0.06	26.74
1989	931.97	95.4	24.77	0.01	29.34
1990	994.20	100	24.95	0.11	17.12
1991	1027.15	106.8	27.26	0.05	31.39
1992	1077.88	110.3	32.42	0.14	61.35
1993	1127.05	110.9	37.10	0.55	83.02
1994	1170.36	114.7	43.55	0.45	110.60
1995	1235.38	122.4	48.14	0.08	123.41
1996	1296.93	127.1	49.78	0.55	83.27
1997	1356.61	133.2	63.04	5.95	73.40
1998	1428.84	140.1	69.51	8.64	79.05
1999	1497.61	146.7	82.13	8.63	73.20
2000	1586.95	149.4	98.25	14.11	80.60
2001	1670.29	151.8	102.66	4.24	70.51
2002	1743.46	156.7	143.77	3.01	90.91
2003	1837.29	163.6	177.30	15.53	143.01
2004	1923.57	173.1	198.70	26.45	159.41
2005	2011.45	184.3	236.47	49.93	179.87
2006	2106.07	197.6	322.11	46.77	233.71
2007	2229.73	211.9	413.04	45.06	350.47
2008	2343.58	232.9	542.93	66.76	421.82

Sources: Bangladesh Bank, *Economic Trends*, various issues.
Bangladesh Bureau of Statistics, *Statistical Yearbook of Bangladesh*, various issues.
Government of Bangladesh, *Bangladesh Economic Review*, various issues.
World Bank, *World Development Indicators*, various issues.

Figure 5.8: Nominal remittance, nominal FDI and nominal forex reserve for the period 1976 to 2008



The trend of foreign direct investment (FDI) has not gone through a very steady path. The data of FDI is available for the period 1986 to 2008. The FDI was 0.07 billion taka in 1986. It hovered around this rate in the next five years and reached 0.05 billion taka in the year 1991. Although it showed some fluctuation in the next five years, it increased to 0.55 billion taka in 1996. In 2002, it reached the amount of 3.01 billion taka. It may be mentioned that in 2000, it reached as high as 14.11 billion taka but then fell again in the following years. In the following years, it almost continuously increased and reached a handsome 66.76 billion taka in 2008 which is the last year of this study.

Remittance followed a somewhat different pattern than the FDI for Bangladesh. The trend of remittance has been quite straightforward as it increased almost continuously throughout the period of this study. In 1976, the amount of remittance was 0.15 billion taka. In the next ten years it increased to 19.40 billion taka though it experienced slight fall in the years 1984 and 1985. For the next ten years, it increased continuously and reached 49.78 billion taka. It may be mentioned that the remittance did not experience any decrease in these ten years and also for the rest of this study. Moreover, it became one of the major sources of foreign exchange reserve with its steady increase. By the year 2008, the amount of remittance reached a mammoth amount of 542.93 billion taka.

5.9 Chapter Summary

A summary of materials covered in this chapter is given below.

(a) Data on two components of money, that is, narrow money (M1) and broad money (M2) are presented and discussed.

(b) For money supply estimation, nominal values of M1 and M2 are used, but for money demand estimation real values of M1 and M2, that is, M1/P and M2/P, are used where P is price level. These are given in relevant tables.

(c) Among the independent variables, income (GDP) and interest rates are reported in the relevant tables.

(d) In addition, variables such as inflation rate, exchange rate, foreign remittance, foreign exchange reserve, and foreign direct investment are also reported.

(e) In short, this chapter presents a comprehensive picture of monetary data needed for the study of money demand and money supply in Bangladesh.

Chapter 6

EMPIRICAL RESULTS ON DEMAND FOR AND SUPPLY OF MONEY

Several estimates have been made on demand for and supply of money in Bangladesh. The estimates include money demand functions, money supply function, estimates of various statistical tests on autocorrelation and structural breaks. The empirical results also include tests of stability of the money demand function and Granger's causality test related to money supply. Macroeconomic implication of these results is also carefully analysed.

Several equations containing different variables have been estimated in this study. A summary of these is given below.

Equations

$\ln M1 = a + b_1 \ln y - b_2 \ln i$

$\ln M2 = c + d_1 \ln y - d_2 \ln i$

$\ln M1 = a + b_1 \ln y - b_2 \ln i - b_3 \ln er - b_4 \ln inf + b_5 \ln rem - b_6 \ln FDI + b_7 dum$

$\ln M2 = b + c_1 \ln y - c_2 \ln i + c_3 \ln er - c_4 \ln inf + c_5 \ln rem - c_6 \ln FDI - c_7 dum$

$\ln m1 = a + b'_1 \ln y + b'_2 \ln forex + b'_3 \ln FDI + b'_4 \ln inf$

$\ln m2 = b + c'_1 \ln y + c'_2 \ln forex - c'_3 \ln FDI + c'_4 \ln inf$

Two-stage Least Squares

Demand

$\ln M1 = a + b_1 \ln y + b_2 \ln nm + b_3 \ln int + b_4 \ln infl + b_5 \ln rem + b_6 \ln FDI$

$\ln M2 = a' + b_1' \ln y + b_2' \ln nm + b_3' \ln int + b_4' \ln infl + b_5' \ln rem + b_6' \ln FDI$

Supply

$\ln m1 = c + d_1 \ln y + d_2 \ln rm - d_3 \ln forex + d_4 \ln FDI + d_5 \ln inf$

$\ln m2 = c' + d_1' \ln y + d_2' \ln rm - d_3' \ln forex + d_4' \ln FDI + d_5' \ln inf$

Variables

M1 = Narrow real money
m1 = Narrow nominal money
M2 = Broad real money
m2 = Broad nominal money
y = Income
i = Rate of interest
er = Exchange rate
inf = Rate of inflation
rem = Remittance
FDI = Foreign direct investment
forex = Foreign exchange
dum = Dummy variable
ln = Natural log

A list of items on which empirical results have been obtained is given below.

1. Estimates of the standard money demand function with income and interest rate as the independent variables for the whole period, that is, 1976 to 2008;
2. Estimates of the standard money demand function for the two sub-periods, that is, the pre-liberalisation period of 1976–1990 and the post-liberalisation period of 1991–2008;
3. Separate estimates for narrow (M1) and broad money (M2) for the whole as well as for the sub-periods;
4. Estimates of the money demand function with exchange rate, inflation, remittance, foreign direct investment, and a dummy variable (to see the effect of monetary liberalisation) in addition to income and interest rate;
5. Correction for presence of autocorrelation in the money demand function using the Cochrane-Orcutt method;
6. A formal analysis of structural break for the two periods – 1976 to 1990 and 1991 to 2008 – applying the Chow test;
7. Stability of the standard money demand function for both M1 and M2;
8. Estimates of the money supply function;
9. Causal relationship between money supply and income;
10. Causal relationship between money supply and prices.

In this study, both narrow and broad money, that is M1 and M2, concepts are studied. An important question that is examined is which of these two definitions of money generates better and more sensible result. So, estimates of equations having M1 and M2 as dependent variables are provided. It may be mentioned here that the Bangladesh Bank uses broad money, which is M2, for policy targeting.

Since the main objective of this study is to obtain income and interest elasticity estimates, the double log form is used. In this case, coefficient of a particular variable stands for elasticity of money demand with respect to that variable.

Importance of elasticity of money demand with respect to income and interest rate has been widely discussed in standard texts in macroeconomics. Relevant parts of such observations made by Dornbusch and Fischer (1994: 383–384) are quoted below:

> "..... *interest elasticity* of the demand for money plays an important role in determining the effectiveness of monetary and fiscal policies. The response of the demand for money to the level of income, as measured by the *income elasticity* of money demand, is also important from a policy viewpoint. As we shall see, the income elasticity of money demand

provides a guide to the Fed (the central bank) as to how fast to increase the money supply in order to support a given rate of growth of GNP without changing the interest rate."

Knell and Stix (2006) analysed almost 1000 money demand estimations to summarise the large findings of this literature. They used both descriptive statistics and regressions to derive several stylized facts about the money demand function and found that its two most prominent determinants were **income and interest** rate.

The demand for money is regarded as a demand for real balance, that is, how much a given quantity of money can buy. Hence, in empirical studies, money is divided by the price level, P, to get the demand for real balance (M/P). This is done in this thesis, too.

This study covers the period of 1976–2008. The years 1973, 1974 and 1975 are not regarded as normal either because of economic condition or unreliability in the availability of data. So, this study covers the period of 1976 to 2008. This means that this research covers 33 years, which provides a comprehensive picture of demand for and supply of money in Bangladesh.

6.1 The Narrow Money Demand Function for the Whole Period

The estimated narrow money (M1) demand function for the whole period (1976–2008) is reported below. Figures in the parentheses are t-values of the respective coefficients:

$$\ln M1 = -4.96 + 1.36 \ln y - 0.047 \ln i \qquad (6.1)$$

$$(-18.43)\ (40.96)\quad (-1.05)$$

$$R^2 = 0.982$$

$$\text{D-W} = 0.63$$

It can be observed from the D-W value, which is found to be 0.63, that there is problem of autocorrelation in the estimate. So, the Cochrane-Orcutt method is applied to reduce the problem of autocorrelation. The estimated narrow money demand functions for the whole period (1977–2008) using the Cochrane-Orcutt method is reported below:

$$\ln M1 = -5.01 + 1.38 \ln y - 0.08 \ln i \qquad (6.2)$$

$$(-7.67)\ (15.72)\quad (-1.12)$$

$$R^2 = 0.990$$

$$\text{D-W} = 1.40$$

It is seen from equation (6.2) that the coefficient of income is 1.38, which means that demand for narrow money with respect to income is elastic. Statistically, the estimated coefficient is found to be highly

significant, the t-value being 15.72. The coefficient of interest rate has the right sign, that is, negative. The coefficient is found to be very small, which is in line with earlier studies. The estimated coefficient of interest rate is not statistically significant as indicated by the t-value, which is found to be –1.12. The value R^2 is found to be 0.990, which is quite high. This means that income and interest rate together explain 99% of the variation in narrow money demand. Economically, it can be observed that of the two explanatory variables, income is more dominant than the rate of interest. The problem of autocorrelation is now not evident as the Durbin-Watson value increased from 0.63 to 1.40.

6.2 The Broad Money Demand Function for the Whole Period

The broad money is denoted by M2 and is defined as narrow money plus long-term deposits. The estimated broad money demand function is given below:

$$\ln M2 = -8.40 + 2.01 \ln y - 0.05 \ln i \qquad (6.3)$$

$$(-32.12)\ (62.30) \qquad (-1.07)$$

$$R^2 = 0.992$$

$$\text{D-W} = 0.63$$

The problem of autocorrelation is also observed in this estimate. So, the Cochrane-Orcutt method is applied again to have an estimate that

does not have the problem of autocorrelation. The estimated broad money (M2) demand function for the whole period (1977–2008) using the Cochrane-Orcutt method is reported below:

$$\ln M2 = -7.75 + 1.92 \ln y - 0.06 \ln i \qquad (6.4)$$

$$(-15.23)\ (27.76) \quad (-1.04)$$

$$R^2 = 0.996$$

$$\text{D-W} = 1.70$$

Equation (6.4) shows that coefficient of income is 1.92, which is higher than the narrow money elasticity of demand with respect to income. Statistically, the estimated coefficient is found to be highly significant, where the t-value is 27.76. The coefficient of interest rate has the right sign, that is, negative. However, the interest elasticity of broad money demand is found to be lower than that of the narrow money. The estimated coefficient is not statistically significant as indicated by the t-value, which is found to be –1.04. The value of R^2 is slightly higher at 0.996. Application of the Cochrane-Orcutt method also removed the problem of autocorrelation as the Durbin-Watson value increased from 0.63 to 1.69.

The empirical results for narrow and broad money for the whole period show that of the two variables here, income is the dominant

explanatory variable in the money demand function. In both the cases of narrow and broad money, the value of income elasticity is higher, and that of interest rate is lower.

6.3 The Pre- and Post-liberalisation Periods

The period 1976–1990 is regarded as the pre-liberalisation period characterised by fixity of interest rate, while the period 1991–2008 is thought of as post-liberalisation period when greater reliance was placed on market mechanism that led to variation in the interest rate. In order to look into these two periods, separate estimates of the narrow and broad money demand functions are presented below.

6.3.1 The Pre-liberalisation Narrow Money Demand Function

The narrow money demand function for the pre-liberalisation period, that is, for 1976–1990 is presented below:

$$\ln M1 = -3.60 + 1.08 \ln y + 0.13 \ln i \qquad (6.5)$$

$$(-4.04)\ (5.93) \qquad (0.62)$$

$$R^2 = 0.881$$

$$\text{D-W} = 0.89$$

It can be observed here that there is problem of autocorrelation in the estimate. So, the Cochrane-Orcutt method is applied here to have an estimate that does not have the problem of autocorrelation. The estimated narrow money (M1) demand function for the 1977–1990 period using the Cochrane-Orcutt method is presented below:

$$\ln M1 = -2.69 + 0.99 \ln y + 0.03 \ln i \qquad (6.6)$$

$$(-1.26)\ (3.14) \qquad (0.11)$$

$$R^2 = 0.897$$

$$\text{D-W} = 1.46$$

The estimates above show that income elasticity of M1 is 0.99, which is lower than the value for the whole period, that is, 1.38. The coefficient is statistically significant at the 1% level. The value of interest elasticity is 0.03 which is an interesting result. It is during this pre-liberalisation period that interest rate was often deliberately held constant by the monetary authority. As a result, interest rate had a lesser impact on M1 than it had for the whole period. Statistically, the coefficient of interest rate is not significant, the t-value being only 0.11 in comparison to a much higher value (–1.12) for the whole period. The problem of autocorrelation is now not evident as the D-W value increased from 0.89 to 1.46.

6.3.2 The Post-liberalisation Narrow Money Demand Function

The narrow money demand function for the post-liberalisation period, that is, for 1991–2008 is presented below:

$$\ln M1 = -6.83 + 1.66 \ln y - 0.21 \ln i \qquad (6.7)$$

$$(-27.42)\ (42.15)\quad (-7.07)$$

$$R^2 = 0.994$$

$$\text{D-W} = 1.43$$

It can be seen from equation (6.7) that income elasticity of M1 is 1.66, which is higher than that for the pre-liberalisation period. The coefficient of income is statistically highly significant with t-value of 42.15.

The estimate of interest elasticity of narrow money demand shows nearly a seven-fold increase in the absolute value. The value is –0.21 compared to 0.03 for the pre-liberalisation period. This is perhaps due to the fact that there was lesser intervention on the interest rate, which varied to some extent daring this period. As a result, a greater impact of interest rate on M1 is found. As can be observed from the t-value, the estimated coefficient is statistically significant here. The problem of autocorrelation is not evident as indicated by the D-W value of 1.43.

6.3.3 The Pre-liberalisation Broad Money Demand Function

The broad money demand function for the pre-liberalisation period, which is for 1976–1990, is presented below:

$$\ln M2 = -11.07 + 2.43 \ln y - 0.10 \ln i \qquad (6.8)$$

$$(-15.87)\ (16.99)\quad (-0.60)$$

$$R^2 = 0.980$$

$$\text{D-W} = 1.80$$

The estimated equation shows that income elasticity of income is 2.43 and interest elasticity is –0.10. The coefficient of income, which shows income elasticity, is highly significant but that of interest is not. It may be mentioned that the Cochrane-Orcutt method is not applied here as there was no problem of autocorrelation.

6.3.4 The Post-liberalisation Broad Money Demand Function

The broad money demand function for the post-liberalisation period, that is estimates for M2, for 1991–2008 is presented below:

$$\ln M2 = -7.79 + 1.94 \ln y - 0.10 \ln i \qquad (6.9)$$

$$(-31.37)\ (49.34)\quad (-3.46)$$

$$R^2 = 0.996 \qquad \text{D-W} = 0.59$$

From the estimation of the broad money demand function for the post-liberalisation period, the problem of autocorrelation is evident again.

To remove this problem, the Cochrane-Orcutt method is applied. The broad money demand function for the post-liberalisation period using the Cochrane-Orcutt method is presented below:

$$\ln M2 = -8.08 + 1.98 \ln y - 0.10 \ln i \qquad (6.10)$$

$$(-18.26)\ (30.73)\quad (-2.61)$$

$$R^2 = 0.998$$

$$\text{D-W} = 1.44$$

The estimated equation shows that income elasticity is 1.98 and interest elasticity is –0.10. The coefficients of both income and interest rate are significant. The interest elasticity of money demand is the same as for the pre-liberalisation period. This result is somewhat disappointing since in this period the interest rate varied more than the previous period. The problem of autocorrelation is now not evident as the D-W increased from 0.59 to 1.44.

The results presented and discussed above are summarised below in Table 6.1. This will enable us to compare and analyse the results in a compact manner. It may be mentioned that in case of presence of autocorrelation problem, results are provided after the application of the Cochrane-Orcutt method. It may also be noted that the Cochrane-Orcutt

method is applied in all cases except for the post-liberalisation period for broad money in which case autocorrelation was not found.

Table 6.1: Income and interest elasticity of narrow money (M1) and broad money (M2)

Period	Narrow money (M1)		Broad money (M2)	
	Income elasticity	Interest elasticity	Income elasticity	Interest elasticity
1977–2008	1.38 (15.72)	–0.08 (–1.12)	1.92 (27.76)	–0.06 (–1.04)
1977–1990	0.99 (3.14)	0.03 (0.11)	2.43 (16.99)	–0.10 (–0.60)
1991–2008	1.66 (42.15)	–0.21 (–7.07)	1.98 (30.73)	–0.10 (–2.61)

Note: figures in the parentheses show t-values.

It can be seen from Table 6.1 that:

(a) Income elasticities of money demand are higher for M2 than for M1 for the whole as well as for the sub-periods;

(b) Income is found to be the dominant variable, as it is consistently found to be statistically significant;

(c) A very important result is obtained for interest rate, which is found to be significant for post-liberalisation period, which is marked by greater flexibility in interest rate;

(d) These results indicate that the estimated money demand function for Bangladesh resembles the classical specification where money is regarded as a function of income for the pre-liberalisation period but with greater interest rate flexibility in the post-liberalisation period and increased monetary activity, it converged towards the Keynesian specification where money is regarded as a function of both income and interest rate.

6.4 Inclusion of Inflation, Exchange Rate, Foreign Direct Investment, and Remittance in the Money Demand Function

Although income and interest rate are regarded as the key variables that affect money demand and find their place in macroeconomic texts as the main determinants of money demand, researchers have included other variables in money demand studies. Inflation and exchange rate are two such variables. New estimates, based on an augmented money demand function that includes these two variables are now reported. The estimated demand function for narrow money is reported first and is followed by the demand function for broad money. These are given below for the period 1986–2008:

$$\ln M1 = -3.62 + 2.29 \ln y - 0.13 \ln i - 0.95 \ln er - 1.19 \ln inf + 0.33 \ln rem - 0.00 \ln fdi + 0.08 dum$$

(–1.54) (3.63) (–2.09) (–1.57) (–3.67) (2.83) (–0.07) (0.78)

(6.11)

$R^2 = 0.991$ D-W = 1.31

It is seen from equation (6.11) that the coefficient of income is 2.29, which means that demand for narrow money with respect to income is elastic. Statistically, the estimated coefficient is found to be significant, the t-value being 3.63. The coefficient of interest rate has the right sign, that is, negative. The coefficient is found to be very small, which is in line with earlier studies. The estimated coefficient of interest rate is also statistically significant as indicated by the t-value, which is –2.09.

Among the other variables, coefficients of exchange rate, foreign direct investment and the dummy were not found to be statistically significant but inflation and remittance have significant relationship with inflation having negative elastic (–1.19) and remittance having positive (0.33) effect on the narrow money. The value R^2 is found to be 0.991, which is quite high. This means that the explanatory variables were able to explain more than 99% of the variation in narrow money demand. Economically, it can be observed that among all these explanatory variables, income is the most dominant one. The problem of autocorrelation is not evident as the Durbin-Watson value is 1.31.

$$\ln M2 = -6.85 + 1.55 \ln y - 0.11 \ln i + 0.68 \ln er - 0.13 \ln inf + 0.01 \ln rem - 0.01 \ln fdi - 0.11 dum$$

(–10.10) (8.51) (–6.24) (3.87) (–1.42) (0.32) (–2.89) (–3.62)

(6.12)

$R^2 = 0.999$ D-W = 1.96

From the result above, it is observed that there are some differences in the significance of the explanatory variables between the narrow and broad money demand functions. In equation (6.12), the coefficient of income is 1.55, which means that demand for broad money with respect to income is also elastic. Statistically, the estimated coefficient is found to be significant. The coefficient of interest rate is negative and like the narrow money, the coefficient is found to be very small, and is also statistically significant as indicated by the t-value, which is –6.24.

The significance of other variables changed. Among the other variables, coefficients of exchange rate, foreign direct investment and the dummy were found to be statistically significant with exchange rate having a positive inelastic (0.68) effect while foreign direct investment and the dummy variable showing the effect of monetary liberalisation have a very low negative effect (–0.01 and –0.11 respectively). But inflation and remittance do not have significant relationship with the demand for broad money. The value R^2 is found to be 0.999, which is

very high. The problem of autocorrelation is not evident as the D -W value is 1.96.

6.5 The Study of Breakpoint: The Chow Test

The objective of studying breakpoint is to see whether there are significant differences over the pre- and the post-liberalisation periods in the estimated equations. A significant difference indicates a structural change in the relationship. The Chow test can be used to see whether there is any significant difference in the estimated equations. A significant difference indicates a structural change in the relationship.

It is obvious from this study that the whole period can be divided into two sub-periods according to monetary liberalisation. These are pre-liberalisation and post-liberalisation periods. The Chow test is applied here to see whether there is any significant difference between the two periods. This test is applied for both the narrow and the broad money functions.

Since liberalisation started in 1991, the assumed year for breakpoint for both the function was taken as 1991. In this test, if the estimated F-value is greater than the critical F-value, then it can be concluded that there was a breakpoint in the assumed year and vice versa.

For the narrow money, the result of the Chow test is given in Table 6.2. From the results, it can be seen that there was a breakpoint in 1991 as the estimated F-value is greater than the critical F-value.

Table 6.2: The Chow breakpoint test for narrow money

Chow Breakpoint Test: 1991			
F-statistic	6.02	Probability	0.003

Note: The theoretical F-value is 5.42.

In the case of broad money, similar results are obtained when the Chow test is applied. From the results given in Table 6.3, it can be seen that there was a breakpoint in 1991 for the broad money as well as the estimated F-value is greater than the critical F-value.

Table 6.3: The Chow breakpoint test for broad money

Chow Breakpoint Test: 1991			
F-statistic	12.52	Probability	0.003

Note: The theoretical F-value is 5.42.

From the above discussion, it can be concluded that there was a breakpoint in the year 1991, which implies that a structural break occurred in 1991.

6.6 Stability of Money Demand Function

In this study, the list of variables other than income and interest has been kept to a minimum. This is because it has bearing on the stability of money demand, an aspect that is dealt with in some detail below. The following quotation of a well-known money demand researcher (Thomas, 1990: 346) will make the point clear:

> By "a stable demand for money function, it is normally meant a stable relationship between demand for money and just a few, typically two or three, explanatory variables. If a large number of variables seriously influence money demand than a stable function, in our sense, does not exist."

The general opinion regarding demand for money functions until the early 1970s was that these were stable. Laidler (1971:99) said:

"For the United States, the evidence is overwhelming and for Britain it is at the very least highly suggested."

At that tine stability was not studied rigorously and the conclusions were based mainly on rough comparison of income and interest elasticity estimated for various sub-periods. Such comparisons suggested fairly constant values of elasticity.

More rigorous statistical tests were applied for the study of stability of demand for money functions. Some of the better known of such studies included the works of Kahn (1974), Laumas and Mehra (1976), and Laumas (1978). These seemed to confirm the previous findings of stability of money demand function.

Doubts began to be raised on the stability of money demand functions estimated for both the UK and USA during the mid 1970s. Such results began a new era of the study of stability in the estimated money demand functions. This was reinforced by the development in the time series econometrics which, through examination of stationarity (or nonstationarity), integration, and cointegration could very formally and concretely study stability in the short- and long-run.

Monetary policy is an important instrument that is used by the central bank in Bangladesh. An important assumption behind monetary targeting is the existence of stable money demand functions. To our knowledge, the monetary authority in Bangladesh has not yet specified and estimated a money demand function and tested for its stability. Also, Bangladesh Bank's practice of targeting broad rather than narrow monetary aggregate has not been formally looked into (Rahim and Sohrabuddin, 1988; Hossain, 1992).

In this study, stability of the money demand functions is studied using the methodology of the time series econometrics. Such an exercise includes the following stages:

(a) To study the stationarity property of each of the relevant variables. If a variable is not found to be stationary, then that indicates short-run instability.

(b) If a variable is non-stationary, the first difference of the variable is taken to see if it has become stationary. If stationarity is not achieved after first difference then higher differences are taken. If a variable becomes stationary after first difference, then it is known to be

integrated of order one, if it is found to be stationary after two differences, then it is integrated of order two, and so on.

(c) The cointegration test is made to see if the dependent variable, here M1 and M2, and the independent variables are integrated of the same order. If cointegration is found to exist, then that implies long-run stability.

The main idea behind this detailed and complex exercise is to show that although there may be short-run instability, stability may be achieved in the long-run.

6.6.1 The Short-run Stability and the ADF Test

If it is assumed that the demand for real money is a function of real income and interest rate, then the following variables are to be used for unit root testing:

ln M1/P = the natural log of real narrow money (the narrow stock of money M1 deflated by the price index);

ln M2/P = the natural log of real broad money (the broad stock of money M2 deflated by the price index);

ln y = natural log of real income (GDP);

ln i = natural log of nominal interest rate on time deposit.

To examine stability of money demand function, the first step is to check whether the relevant variables – here M1, M2, income, and interest rate – suffer from non-stationarity or not. It there is non-stationarity, it is said to have the unit root problem.

The stationarity problem is tested by the use of the Dickey-Fuller (DF) and the Augmented Dickey-Fuller (ADF) test. Of these two tests, the first one does not take into consideration the problem of autocorrelation but the second one does. Since, the problem of autocorrelation was encountered in our empirical study of money demand, the Augmented Dickey-Fuller (ADF) test is used here. The Augmented Dickey-Fuller (ADF) test is done for all these variables and the results are given in Table 6.4.

Table 6.4: The ADF test on the levels of the variables

Variable	ADF Value	Result
ln M1	0.432	Non-stationary
ln M2	–0.535	Non-stationary
ln y	0.262	Non-stationary
ln i	–1.981	Non-stationary

Critical Values: –2.959 (5%), –3.658 (1%)

The results of the ADF test given in Table 6.4 show that M1, M2, income, and interest rate have all unit roots, that is, they are all non-stationary. This implies that there is short-run instability in the money demand function,

6.6.2 The Long-run Stability of the Money Demand Function

Presence of short-run instability does not mean that long-run stability cannot be achieved. In fact, present econometric methodology can examine whether long-run stability can be achieved even when there is short-run instability. The first step in this direction is to take the difference of the variables and then see if these have become stationary. If so, they are said to be integrated of order one.

Table 6.5: The ADF test on the 1st difference of the variables

Variable	ADF Value	Result
Δ ln M1	–3.26**	Stationary
Δ ln M2	–2.95*	Stationary
Δ ln y	–5.46***	Stationary
Δ ln i	–2.66*	Stationary

Critical values for first difference data: –3.67 (1%), –2.96 (5%), –2.62 (10%)

The results of the ADF test on the first differenced variables given in Table 6.5, show that all variables except broad money and interest rate became stationary at the 1% or the 5% level of significance. The interest rate and the broad money were found to be stationary at the 10% level of significance. So, all the variables can be said to be integrated of order one. Since the variables have been found integrated of the same order, the next step is to find if they are cointegrated. This is an important step, as it will indicate presence of long-run stability.

6.6.3 Testing for Cointegration and Stability of Narrow Money Demand Function when only Income and Interest Rate are considered

If the estimated statistic is greater than the critical value than the relevant null hypothesis is rejected and the alternative hypothesis is

accepted. Here as in Table 6.6, when the null hypothesis is r=0 and the alternative is r =1 estimated statistic is 64.55 which is greater than the critical value of 41.07 at the 1% level of significance. This means that the null hypothesis is rejected and the alternative hypothesis (r=l) is accepted which means that there is at least one cointegrating vector.

When the null hypothesis is r≤0 and the alternative is r =2 estimated statistic is 19.96 which is smaller than the critical value of 24.60 at the 1% level of significance. This means that the null hypothesis is accepted and the alternative hypothesis (r=2) is rejected. These results imply that there is unique vector. This result shows that the variables income and interest rate are cointegrated with narrow money demand, M1. This means that the money demand function is stable in the long-run.

Table 6.6: Cointegration test for M1, GDP and interest rate

Null hypothesis	Alternative hypothesis	Statistic	1% critical value
r =0	r=1	64.55	41.07
r ≤1	r=2	19.96	24.60

6.6.4 Testing for Cointegration and Stability of Broad Money Demand Function when only Income and Interest Rate are considered

Here, as in Table 6.7, when the null hypothesis is r=0 and the alternative is r=1, the estimated statistic is 68.79 which is greater than the critical value of 41.07 at the 1% level of significance.

Table 6.7: Cointegration test for M2, GDP and interest rate

Null	Alternative	Statistic	1% critical value
r =0	r=1	68.79	41.07
r ≤1	r=2	16.76	24.60

This means that the null hypothesis is rejected and the alternative hypothesis (r=1) is accepted. When the null hypothesis is r≤0 and the alternative is r =2, the estimated statistic is 19.96 which is smaller than the critical value of 24.60 at the 1% level of significance. This means that the null hypothesis is accepted and the alternative hypothesis (r=2) is rejected. This means that there is unique vector. The results show that the variables income and interest rate are cointegrated with broad money demand, M2. This means that the money demand function is stable in the long-run.

6.7 The Study of Money Supply

The study of money supply can be divided into two sections. Firstly, estimation of a money supply function for the economy of Bangladesh is undertaken. Secondly, it will be examined whether there is any causality between money supply and income as well as between money supply and price (inflation).

6.7.1 Estimating the Money Supply Function

Money supply is controlled by the central bank. Hence, there are very few works on money supply function. In fact, only two cases of supply function of money could be traced (Ali and Islam, 2010; EViews 4.0, 2002). In this thesis, these two works were followed. In addition, some other variables that could be relevant have also been included.

The money supply function for Bangladesh has been estimated using GDP, foreign exchange rate, foreign direct investment (FDI), and expected inflation as the explanatory variables. Both definition of money, that is, narrow and broad money, is used to see whether there is any difference in the effect when there is a change in the definition of money.

The estimated narrow money (M1) supply function for the period of 1986–2008 is reported below:

$$\ln m1 = -10.44 + 2.06 \ln y + 0.12 \ln forex + 0.00 \ln fdi + 0.02 \ln exinf \quad (6.13)$$

$$(-9.28)\ (12.03)\quad (3.32)\qquad (0.29)\qquad (0.70)$$

$$R^2 = 0.994$$

D-W= 1.05

The Cochrane-Orcutt method is applied in this section since autocorrelation is found in this case. The estimated narrow money (m1) supply function for the period of 1987–2008 using the Cochrane-Orcutt method is reported below:

$$\ln m1 = -13.15 + 2.48 \ln y + 0.06 \ln forex - 0.01 \ln fdi - 0.02 \ln exinf \quad (6.14)$$

$$(-7.90)\ (10.19)\quad (1.30)\qquad (-0.81)\qquad (-0.87)$$

$$R^2 = 0.997$$

D-W= 1.22

From the results above, it can be seen that only the result of the income variable is statistically significant. All other variables are found to be statistically insignificant. The R^2 is very high at 0.997 while the D-W value is 1.22, which shows a reduction in autocorrelation.

The estimated broad money (M2) supply function for the period of 1986–2008 is reported below:

$$\ln m2 = -14.29 + 2.80 \ln y + 0.07 \ln forex - 0.02 \ln fdi + 0.01 \ln exinf \quad (6.15)$$

$$(-22.00)\ (28.39)\quad (3.23)\qquad (-2.94)\qquad (0.43)$$

$$R^2 = 0.999$$

$$\text{D-W} = 1.03$$

The Cochrane-Orcutt method is also applied here since autocorrelation is found in this case. The estimated broad money (M2) supply function for the period of 1987–2008 using the Cochrane-Orcutt method is reported below:

$$\ln m2 = -14.00 + 2.80 \ln y + 0.02 \ln forex - 0.01 \ln fdi - 0.01 \ln exinf \quad (6.16)$$

$$(-18.87)\ (25.56)\quad (0.93)\qquad (-2.48)\qquad (-0.66)$$

$$R^2 = 0.999$$

$$\text{D-W} = 1.55$$

From the results above, it can be seen that the coefficients of income and foreign direct investment are statistically significant. Other variables are found to be statistically insignificant. It is seen from equation (6.16) that the coefficient of income is 2.80, which means that broad money supply with respect to income is elastic. On the other hand, the elasticity of broad money supply with respect to foreign direct investment is very low at 0.01. The value of R^2 is found to be 0.999. The

D-W value has increased from 1.03 to 1.55 after the Cochrane-Orcutt method is used, which implies absence of autocorrelaton.

6.7.2 Examining the Causal Relationship of Money Supply with Income and Price

This analysis can be divided into three parts. In the first part of the study, the stationarity property of the relevant variables is tested. In the next stage, the cointegration test is applied to see if there is any long-run relationship between the variables. In the last stage, the Granger causality test is applied to find whether there is any causality between them and the direction of causation.

Although some of these steps are described earlier in the analysis of the stability of the money demand function, the steps are briefly described again for convenience. The steps are as follows:

(a) To study the stationarity property of each of the relevant variables. If a variable is not found to be stationary, then that indicates short-run instability.

(b) If a variable is non-stationary, the first difference of the variable is taken to see if it has become stationary. If stationarity is not achieved

after first difference then higher differences are taken. If a variable becomes stationary after first difference, then it is known to be integrated of order one, if it is found to be stationary after two differences, then it is integrated of order two, and so on.

(c) The cointegration test is made to see if the variables that are integrated of the same order, are cointegrated or not. If cointegration is found to exist, then that implies long-run relationship.

(d) If any long-run relationship is found among the variables, then the Granger causality test is applied to find the direction of causation between them. There can be either bi-directional causality or unidirectional causality among the variables.

6.7.2.1 Testing Stationarity Property of the Variables Using the ADF Test

Unlike in the analysis of demand for money, in the analysis of supply of money the money is taken in nominal rather than in real term. Here, real GDP is taken as a proxy for income and inflation rate is taken as a proxy for price. So, the following variables are used for unit root testing:

ln m1 = the natural log of nominal narrow money;

ln m2 = the natural log of nominal broad money;

ln y = natural log of real income (GDP);

ln i = natural log of rate of inflation.

The stationarity problem is tested by the use of the Dickey-Fuller (DF) and the Augmented Dickey-Fuller (ADF) test. Of these two tests, the first one does not take into consideration the problem of autocorrelation but the second one does. Since, the problem of autocorrelation was encountered in the empirical study of money demand, the Augmented Dickey-Fuller (ADF) test is used here.

The Augmented Dickey-Fuller (ADF) test is done for all these variables and the results are given in Table 6.8.

Table 6.8: The ADF test on the levels of the variables

Variable	**ADF Value**	**Result**
ln m1	–0.17	Non-stationary
ln m2	–1.42	Non-stationary
ln y	1.24	Non-stationary
ln inf	–2.53	Non-stationary

Critical Values: –3.69 (1%), –2.97 (5%), –2.62 (10%)

The results of the ADF test given in Table 6.8 show that M1, M2, income, and inflation have all unit roots, that is, they are all non-stationary. This implies that there is no short-run relationship between money, income and price.

6.7.2.2 Testing Long-run Relationship

Absence of short-run relationship does not imply that there will be no long-run relationship. Using the present econometric methodology, it can be examined whether there is any long-run relationship among the variables.

The first step in this direction is to take the difference of the variables and then see if these have become stationary.

Table 6.9: The ADF test on the 1st difference of the variables

Variable	ADF Value	Result
Δ ln m1	–3.64**	Stationary
Δ ln m2	–5.28***	Stationary
Δ ln y	–4.16***	Stationary
Δ ln i	–5.28***	Stationary

Critical values for first difference data: –3.69 (1%), –2.97 (5%), –2.62 (10%)

The results of the ADF test on the first differenced variables show that all variables became stationary at the 1% or 5% level of significance. So, all the variables can be said to be integrated of order one.

Since the variables have been found integrated of the same order, the next step is to find if they are cointegrated, that is, jointly integrated. This is an important step, as it will indicate whether there is any long-run relationship. If the estimated statistic is greater than the critical value than the relevant null hypothesis is rejected and the alternative hypothesis is accepted.

Here as in Table 6.10, when the null hypothesis is r=0 and the alternative is r =1. the estimated statistic is 18.43 which is greater than the critical value 15.41 at the 5% level of significance. This means that the null hypothesis is rejected and the alternative hypothesis (r=1) is accepted.

Table 6.10: Cointegration test for M1 and GDP (1978–2008)

Null	Alternative	Statistic	5 % critical value
r=0	r=1	18.43	15.41
r≤1	r=2	1.50	3.76

When the null hypothesis is r≤0 and the alternative hypothesis is r=2, the estimated statistic is 1.50 which is smaller than the critical value of 3.76 at the 5% level of significance. This means that the null hypothesis is accepted and the alternative hypothesis (r=2) is rejected. Here, this means that there is unique vector. This result shows that narrow money and income have long-run relationship.

The results for test of cointegration for narrow money and the price level are presented in Table 6.11. Here, when the null hypothesis is r=0 and the alternative is r =1, the estimated statistic is 8.03 which is smaller than the critical value of 15.41 at the 5% level of significance.

Table 6.11: Cointegration test for M1 and the price level (1978–2008)

Null	Alternative	Statistic	5 % critical value
r=0	r=1	8.03	15.41
r≤1	r=2	0.34	3.76

This result shows that the null hypothesis is accepted and there is no cointegrating vector. This means that the variables narrow money and the price level does not have any long-run relationship.The results of cointegration test for broad money and income are provided in Table 6.12. It can be observed here that when the null hypothesis is r=0 and the

alternative is r =1, the estimated statistic is 19.65 which is greater than the critical value of 15.41 at the 5% level of significance. This means that the null hypothesis is rejected and the alternative hypothesis (r=1) is accepted.

Table 6.12: Cointegration test for M2 and GDP (1978–2008)

Null	Alternative	Statistic	5 % critical value
r=0	r=1	19.65	15.41
r≤1	r=2	1.81	3.76

On the other hand, when the null hypothesis is r≤0 and the alternative is r =2 the estimated statistic is 1.81 which is smaller than the critical value of 3.76 at the 5% level of significance. This means that the null hypothesis is accepted and the alternative hypothesis (r=2) is rejected. The results show that the variables narrow money and income have long-run relationship.

The results for test of cointegration for broad money and the price level are presented in Table 6.13. In this case, the estimated statistic is 12.88 which is smaller than the critical value at the 5% level of significance when the null hypothesis is r=0 and the alternative is r =1.

Table 6.13: Cointegration test for M2 and the price level (1978–2008)

Null	Alternative	Statistic	5 % critical value
r=0	r=1	12.88	15.41
r≤1	r=2	2.30	3.76

The result shows that the null hypothesis is accepted and there is no cointegrating vector. This implies that there is no long-run relationship between broad money and the price level..

6.7.2.3 Causality Analysis between Money Supply and Income (GDP)

The causal relationship between the variables can be examined by the Granger causality analysis. But for causal relationship to be present there should be long-run relationship between the relevant variables. In the discussion of the previous section, it has been found that there is long-run relationship between money supply (both M1 and M2) and income but no long-run relationship is found between money supply (both M1 and M2) and the price level.

Table 6.14: Causality analysis between narrow money and income (GDP) for the period 1978 to 2008

Null hypothesis	F-statistic	Probability
lnGDP does not Granger cause ln m1	12.20	0.0002
ln m1 does not Granger cause lnGDP	0.92	0.4120

Theoretical F-value at the 1% level is 5.39.

As a result, the Granger causality analysis is applied only to variables money supply and income. These results are discussed below.

The results of the Granger causality analysis can be interpreted with the help of the F-value. If the value of the estimated F-statistic is greater than the theoretical F-value than the null hypothesis is rejected. Similarly, if the F-value is smaller than the theoretical F-value than the null hypothesis is accepted.

From Table 6.14, it can be seen that null hypothesis of no causality from income to money supply is rejected as the estimated F-value is greater than the theoretical F-value while the null hypothesis of no causality from money supply to income is accepted as estimated F-value is smaller than the theoretical F-value. This implies that there is one-way causality running from income to money supply when narrow money is considered.

It can be found from Table 6.15 that null hypothesis of no causality from income to money supply is rejected as the estimated F-value is greater than the theoretical F-value while the null hypothesis of no causality from money supply to income is accepted again as the estimated F-value is smaller than the theoretical F-value. This implies that there is

one-way causality running from income to money supply when broad money is considered.

Table 6.15: Causality analysis between broad money and income (GDP) for the period 1978 to 2008

Null hypothesis	F-statistic	Probability
lnGDP does not Granger cause ln m2	16.54	3.1E–05
ln m2 does not Granger cause lnGDP	1.25	0.30317

Theoretical F-value at the 1% level is 5.39.

6.8 Simultaneous Study of Demand for and Supply of Money

The two-stage least squares method was developed by Theil (1953) and Basmann (1957). It is a single equation method, which is applied to one equation of the system at a time. It has provided satisfactory results for the estimate of the structural parameters and has been accepted as the most important of the single equation techniques for the estimation of overidentified models (Koutsoyiannis, 1977).

The two-stage least square (TSLS) method is applied in this thesis to examine the simultaneous relationship of demand for and supply of money in Bangladesh. In the simultaneous equation model, application of the 2SLS method gives estimates of structural parameters of the equations. The two-stage least squares estimates are given in Table 6.16 and Table 6.17.

Table 6.16: Two-stage least squares estimates of demand for money

	Dependent variable: M1		**Dependent variable: M2**	
	Coefficient	**t-value**	**Coefficient**	**t-value**
Constant	4.64	22.46	3.96	4.48
GDP	-0.01	-0.17	0.06	0.41
Nominal money	1.01	31.24	0.93	12.02
Interest rate	0.01	0.27	-0.01	-0.21
Inflation	-1.00	-266.98	-0.94	-16.59
Remittance	-0.00	-0.15	0.01	0.64
FDI	-0.00	-0.49	-0.00	-1.15
F-statistic	1608226.0		113460.0	
R^2	0.999		0.999	
D-W	2.46		1.45	
Observations	23		23	

Table 6.16 contains the estimates of money demand function in terms of both narrow and broad money. For M1, nominal money supply and inflation are found to be significant and for M2, again money supply and inflation are found to be significant. The explanatory variables remittance and FDI are not found to be significant for both M1 and M2. The values of R^2 are quite high.

Table 6.17: Two-stage least squares estimates of supply of money

	Dependent variable: m1		**Dependent variable: m2**	
	Coefficient	**t-value**	**Coefficient**	**t-value**
Constant	-8.21	-6.17	-29.46	-2.32
GDP	1.55	4.84	6.43	2.11
Real money	0.26	1.78	-1.85	-1.80
Foreign exchange	0.17	2.38	0.09	1.42
Foreign direct investment	0.01	0.46	-0.06	-1.85
Inflation	0.02	1.09	-0.02	-0.61
F-statistic	876.69		683.18	
R^2	0.998		0.996	
D-W	1.34		1.28	
Number of observations	23		23	

For the money supply function, m1, real money supply, GDP and foreign exchange are found to be significant, while for m2, GDP, real money and FDI are found to be significant.

The failure of the money supply function to perform strongly shows why there is hardly any money supply function estimation in monetary research. As it has been mentioned before, this is due to the fact that money supply is controlled by the central bank and it cannot be explained in the way money demand function can be.

6.9 Chapter Summary

Several empirical results have been obtained in this chapter. These include different specification of the money demand functions, money supply function, estimates of various statistical tests on autocorrelation and structural breaks. The empirical results also include tests of stability of the money demand function, Granger's causality test related to money supply, and the simultneous estimate of demand for and supply of money. It is worthwhile to present a summary of these results, which are given below.

(a) Analysing the estimated money demand function for the whole period, that is, for the period 1976 to 2008, it is found that income elasticities of money demand are higher for M2 than M1 and interest elasticities are higher for M1 than for M2.

(b) An analysis of sub-period results show that income elasticities of money demand are higher for M2 than M1 and interest elasticities have no general trend for M1 and M2.

(c) The estimated money demand function for Bangladesh initially resembled the classical specification where money was regarded as a function of income alone for the pre-liberalisation period but with greater interest rate flexibility in the post-liberalisation period and increased monetary activity, it converged towards the Keynesian specification where money found to be a function of both income and interest rate.

(d) The inclusion of other additional variables – inflation, exchange rate, FDI, inflation rate, and a dummy variable (showing the effect of monetary liberalisation) – shows that most of the variables have some effect on the money demand but the results differ for narrow and broad money.

(e) An analysis of the statistical significance of the estimated coefficients show that income is always found to be significant while interest rate is generally not found to be significant (except for the post-liberalisation period).

(f) The estimated R^2 and Durbin-Watson values show that the R^2 values are quite high but the problem of autocorrelation was observed in most cases. Hence, results are presented after using the Cochrane-Orcutt method, which led to removal of the autocorrelation problem.

(g) Since there was monetary liberalisation from the year 1991, a formal test was applied to see whether there was any structural break in 1991. The Chow test was applied and it was found that there was a structural break in 1991.

(h) In the study of stability, the ADF test on the levels of the variables showed existence of the nonstationarity problem, this meant that there was short-run instability in the estimated money demand functions.

(i) Subsequent test of cointegration done by applying the Johansen test, which is an advanced and more general method, showed existence of

cointegration, which meant that there was long-run stability in the money demand function.

(j) The analysis of the money supply function shows that only the coefficient of GDP was statistically significant while other variables were not found to be significant.

(k) Although there was short-run instability between income and money supply, long-run relationship was found between them. Moreover, in the causality analysis, one-way causality was found between these variables running from income to money supply.

(l) In the analysis of causal relationship between money supply and price, no long-run relationship was found when the test of cointegration was used. As a result, no causal relationship could be found between them.

(m) The TSLS method is applied in this study to examine the simultaneous relationship of demand for and supply of money.

(n) The estimates of money demand function shows that for M1, nominal money supply and inflation are found to be significant and for M2, again money supply and inflation are found to be significant.

(o) For the money supply function, m1, real money supply, GDP and foreign exchange are found to be significant, while for m2, GDP, real money and FDI are found to be significant.

Chapter 7

SUMMARY AND CONCLUSION

Various aspects of the money demand and money supply function in Bangladesh were studied in this thesis. Besides studying the two key determinants of money demand, that is, income and the rate of interest, the study also included explanatory variables like exchange rate, FDI, inflation rate, and foreign remittance in demand and supply function of money.

In addition to obtaining results for the whole period of 1976 to 2008, empirical study was separately done for the pre-liberalisation period of 1976 to 1990 and the post-liberalisation period of 1991 to 2008. Estimates of the money demand function that included some other variables as mentioned above were also made and reported.

This study closely examined the stability of the money demand function. The results provided suggested that although there was short-run instability in money demand function in Bangladesh, long-run stability existed.

A summary of these results, some policy implications, and concluding remarks are given below.

7.1 Summary

A summary of the main results are given below:

(a) The results of money demand function for the whole period, that is, for the period 1976 to 2008, shows that income elasticities of money demand are higher for M2 than for M1 and interest elasticities are higher for M1 than for M2.

(b) Income elasticities of money demand are higher for M2 than for M1 and interest elasticities have no general trend for M1 and M2 when the two sub-periods are considered.

(c) There was significant change in the empirical estimation of money demand function for Bangladesh, which initially resembled the classical specification where money was found to be a function of income alone for the pre-liberalisation period but with greater interest rate flexibility in the post-liberalisation period and increased monetary activity, of both income and interest rate came to the forefront and the

estimated money demand function converged towards the Keynesian specification.

(d) Variables like exchange rate, FDI, inflation rate, remittance, and a dummy variable (showing the effect of monetary liberalisation) – were found have some effect on the money demand though these were different for narrow and broad money.

(e) Statistical significance of the estimated coefficients show that income is always found to be significant while interest rate is generally not found to be so (except for the post-liberalisation period). This means that contrary to many results obtained particularly for the developed countries where interest rate appeared as a significant variable, in the case of Bangladesh it is not found to be so, particularly in the pre-liberalisation period. But the importance of interest rate became evident during the post-liberalisation period, when greater flexibility in interest rate was observed.

(f) The explanatory power of the equation were found to be very high as indicated by the high values of the R^2. Most of the estimates were vitiated by presence of autocorrelation. These were corrected by the

Cochrane-Orcutt method, which led to removal of the autocorrelation problem.

(g) The 1991 marked the start of the period of liberalisation. Hence, a formal study of structural break was made using the Chow test, which showed that a structural break was indeed present.

(h) The ADF test on the levels of the variables showed existence of the nonstationarity problem. Short-run instability in the estimated money demand functions was implied by this result.

(i) The Johansen test, which is an advanced and more general method, showed existence of cointegration. This meant long-run stability in the money demand function.

(j) The analysis of money supply shows that only the coefficient of GDP and foreign exchange reserve were statistically significant while other variables were not.

(k) In the Granger causality analysis, one-way causality was found between these variables running from income to money supply.

(l) Money supply and price showed no long-run relationship when the test of cointegration was applied. As a result, no causal relationship between money supply and price could be established.

(m) The two-stage least square (TSLS) method was been applied in this thesis for examining simultaneous relationship of money demand and money supply in Bangldesh. Estimates for money demand show that for M1 nominal money and inflation were found to be significant, while for M2, the determinants exchange rate, inflation and nominal money were found to be significant.

(n) For the money supply function, for M1 and M2 equations, except the explanatory variable GDP, no other variable was found to be significant. This is perhaps due to the fact that money supply is controlled by the central bank and it cannot be explained in the way money demand function can be.

7.2 Policy Implications

Empirical estimation of money demand function can help policy making by identifying the relative importance of the key determinants of the money demand function, which are income and interest rate. The findings of this thesis show that although income was found to be the

most dominant explanatory variable initially, interest rate was found to have growing influence in the post-liberalisation period.

This empirical result would place the monetary policy makers in a great predicament. While interest rate is regarded as the most important policy weapon at the hand of the monetary authority, this empirical study, and other studies of this nature, have not shown it as such, especially for the pre-liberalisation period. This is because interest rate, although an important policy instrument, was not used as such. The monetary history of Bangladesh shows that from 1976 to 1990, known as the pre-liberalisation period, interest rate was kept under a tight leash by the monetary authorities. It is only since 1991 that some liberalisation in interest rate was allowed. Even now the central bank frequently intervenes in interest rate fixing though the extent of control has been relaxed to some extent since 1991 as is evident from the data of interest rate for the period after 1991.

Given the changed situation of increased interest rate liberalisation, it is expected that it will play an increasingly important role in the monetary policy of the nation. It can be observed from the results of the post-liberalisation period, where the interest rate became significant for both the case of narrow and broad money demand estimates.

The empirical results also showed that broad money (M2) performed better than narrow money (M1). The policy implication is that M2 should be used for monetary targeting rather than narrow money. The case of M2 needs no recommendation since the Bangladesh Bank already does so.

The results of causality analysis showed that GDP growth was causing money supply to grow, which means that money supply was keeping pace with GDP growth. This would imply that as GDP grows, money supply should grow as well, which perhaps explains the central bank's regular increase of money supply.

7.3 Conclusion

The study presented a host of empirical results that threw important light on various aspects of demand for and supply of money. Different estimates were obtained to have a clearer view of demand for and supply of money in Bangladesh.

In this study, it was found that income elasticity of money demand was statistically significant but its value appeared somewhat high. The

reason for this could be the fact that interest being the subject of intervention by the monetary authority, the burden of adjustment in the money demand fell on income.

An important weapon in the hand of the monetary authority is the interest rate. In the pre-liberalisation and for the whole period of this study, this did not appear so. Appearance of the interest rate as statistically insignificant was due to the interventionist policy of the monetary authorities, which did not allow the interest rate to vary much, particularly during the pre-liberalisation period of 1976 to 1990. So, the fact that the interest rate appeared not as a significant explanatory variable was not due to economic, but institutional, reason. With some measure of liberalisation that started since 1991, it became significant and the money demand function converged from the classical specification, where money is regarded as a function of income only, towards the Keynesian specification where money is regarded as a function of both income and interest rate.

The results of this thesis, which undertook a formal study of stability of money demand, showed that although there was short-run instability in money demand, it was stable in the long-run. The central bank of Bangladesh unknowingly assumed stability in money demand

without conducting a rigorous study till very recently, but escaped much difficulty since stability actually existed (Hossain, 1996; Ahmad and Islam, 2007).

This study covered long 33 years from 1976 to 2008. A fairly comprehensive picture of money demand and money supply and other related aspects has been presented in this thesis. The empirical results of this study and other materials included in it may be found to be of interest by the academicians, policy makers and future researchers of money demand and money supply in Bangladesh.

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