FINANCIAL LIBERALIZATION AND THE STABILITY OF MONEY DEMAND IN NEPAL

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RECOMMENDATION LETTER

This thesis entitled **FINANCIAL LIBERALIZATION AND THE STABILITY OF MONEY DEMAND IN NEPAL** is submitted by Nirmal Tiwari under my supervision for partial fulfillment of the requirements for the degree of Master of Arts in Economics. I forward it with recommendation for approval.

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APPROVAL LETTER

This thesis **FINANCIAL LIBERALIZATION AND THE STABILITY OF MONEY DEMAND IN NEPAL** submitted by Mr. Nirmal Tiwari has been evaluated and accepted as partial fulfillment of the requirement for the MASTER OF ARTS in ECONOMICS by evaluation committee comprised of :

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ABBREVIATIONS/ACRONYMS

ADF	:	Augmented Dickey Fuller Test
AIC	:	Akaike Information Criterion
CPI	:	Consumer Price Index
CUSOM	:	Cumulative Sum
CUSUMQ	:	Cumulative Sum of Square
DW	:	Darwin Watson
FLI	:	Financial Liberalization Index
FY	:	Fiscal Year
GNP	:	Gross National Product
GOP	:	Gross Domestic Product
IMF	:	International Monetary Fund
JB	:	Jarque Berra Test
MoF	:	Ministry of Finance
NRB	:	Nepal Rastra Bank
OLS	:	Ordinary Leant Squares
QTM	:	Quantity Theory of Money
RGDP	:	Real Gross Domestic Product
SAP	:	Structural Adjustment Program
SBC	:	Schward Bayesian Criterion
SLR	:	Statutory Liquidity Ratio
UK	:	United Kingdom
USA	:	United States of America

CHAPTER I
INTRODUCTION

1.1 Background

The study of the behavior of the money demand has intrigued many researchers. The increasing research works on the behavior of money demand is as a result of its importance in setting credible monetary policy programmes. The volume of money supply and its speed of circulation link money to the economic activity in a country. Therefore, the money demand function is very crucial in the design and implementation of monetary policy. Although the demand for money function does not provide the whole transmission mechanism whereby money supply changes lead to changes in income or prices, it provides a vital link in that process. So to analyze the transmission mechanism of monetary policy, the specification of the demand for money function, test of its stability and estimation of its elasticities is highly essential (Laidler, 1966).

If the demand for money is not stable (i.e. velocity of money circulation is fluctuating), any change in money supply can just be off-set by equal and opposite change in velocity (through idle hoarding/dishoarding of cash balance) having no effect on income or prices (Khatiwada, 1997). Moreover, whether the monetary authority should make the monetary targeting strategy or inflationary targeting strategy depends upon whether the money demand is stable or not. If the choice of monetary policy instrument is inappropriate, then monetary policy will increase the costs of stabilization (Poole, 1970). Hence, a good understanding of the determinants of the demand for real money balances in the economy by investigating the behavior of the money demand function is crucial for the formulation and implementation of an effective monetary policy.

In the mid 1980s, Nepal embarked on far reaching financial reforms. The basic objectives of these reforms are to enhance the efficiency of the financial sector and promote the development of the economy as a whole. However, the introduction of the financial reforms and innovation would have implications for instability or stability of the money demand . Financial reforms could alter or cause shifts in money velocity, and in particular, where the velocity is variable, the relationship between

money and income becomes uncertain and less predictable. The instability in the money demand function due to financial innovation breaks the rigid link between money and income, since changes in money supply, however induced, may fluctuate the velocity of money circulation than produce the desire effects on spending and income. With growth in financial transactions, advancement in loan distribution techniques, financial innovation and service automation, and other structural changes, significant psychological, social and institutional change in the lending- borrowing behaviours of individual and business have taken place in the economy. It is, therefore, expected that velocity of money would undergo changes in response to the changing lending- borrowing behavior of the people (Akhtaruzzaman, 2008). Hence the demand for money function in Nepal may not be stable which gives the gives the serious implication for the central monetary authority.

So the use of monetary policy as a tool for macro-economic stabilization depends on money or real cash balances in the hands of economic agents. This brings in the demand for money function which expresses a mathematical relationship between the quantity of money demanded and it's various determinants; interest rate, income, price level, credit availability, frequency of payments etc. the stability of these relationship is vital for determining the appropriateness and effictiveness of the tools or instruments of monetary policy.

With the economic reforms of 1980's, the government of Nepal also initiated financial Liberalization process. The government allowed joint venture commercial banks to operate in the private sector and also allowed finance companies to function. Interest rate has been completely deregulated. Commercial banks are now free to determine their deposit as well as lending rates on the basis of market forces. The government began to restrain budget deficits and discontinued guaranteeing bank credit to the public enterprises. Most importantly, the government abolished the mandatory Statutory Liquidity Ratio(SLR) imposed for commercial banks but again imposed in 2009/10 (NRB).

Following the financial sector liberalization, the Nepalese financial sector observed a quantam expansion in terms of the number of new financial institutions and financial instruments in comparision to that of the 1980's. New financial instruments have been introduced and payment system has also improved reasonably. In this background,

financial expansion and innovations, integration with international financial market and external sector liberalization are the factors that can alter the equilibrium relationship between the variables that determine the demand for money. There should be appropriate level of money stock in the economy to perform monetary functions like medium of exchange and store of value. Maintaining the desired level of money supply requires among others a close analysis of money demand function in the economy, and conduct of monetary policy.

With the expansion of financial institutions and new innovations in the financial market, such as Credit Card, Automated Teller Machines (ATM), Internet Banking, Mobile Banking which reduces the transaction cost, causes the change in the demand for money. So, along with the expansion of financial institutions and new innovations in the financial market, the demand for money has no longer been a stable function with the real variables in many countries (Friedman,1988; Bofinger,2001). Hence it is imperative to explore money demand function in Nepal in the context of financial liberalization.

So, the stability issue of the money demand function is one of the most important guiding policy issues that helps to decide whether to use the monetary targeting strategy or inflation targeting strategy in the monetary policy in bringing the desire changes in the economy. This issue has been triggered further by the abandonment of monetary targeting strategy by many developed countries such as Canada, Newsland, Brazil etc as they switched to inflation targeting strategy.

In this light, an implementation of the monetary policy of Nepal requires first to test the stability of money demand function. The central bank of Nepal has been using both the narrow money stock and broad money stock as the intermediate targets of the monetary policy. Especially after the adoption of financial liberalization in the 1980's, there may have been the forces that might have caused the instability in money demand and rendered the monetary policy effective. That is why, this study mainly focuses on the stability of money demand function in Nepal.

1.2 Statement of the problem

The financial liberalization process in Nepal started since 1984. Since then various liberalization measures have been implemented in order to widen and deepen the

financial system. Some policy instrument were aimed at increasing the competition and efficiency in the financial market, which included removal of entry barriers to commercial banks, finance companies and development banks, and restructuring of two state owned banks. In order to improve the deficiency of money and capital markets, measures such as auctioning of Treasury Bills and floor trading of securities were introduced. The policy instrument such as interest rate deregulation, reduction in reserve requirement and change in the monetary policy stance from direct to indirect were implemented. Similarly, Credit Information Bureau, amendment of Nepal Rastra Bank Act, and enactment of Debt Recovery Act were aimed at ensuring the integrity of banks and maintenance of the stability of the financial system of Nepal. All these reforms have a significant role in the instability of money demand function in Nepal and as such, alter the relationship between money, income, prices and other key economic variables.

Financial market development through reform measures may lead to financial assets with attractive yield. This may shift the wealth portfolio of people. Moreover, transaction costs often go down due to competition among financial institutions and hence money demand may respond more rapidly to interest rate changes. The holding of monetary aggregates may be affected by the development of rural banking through shifting fund from informal sector to the banking sector. Thus the financial reforms have implications for the stability of the money demand function and hence the conduct of monetary policy (Khan and Wadud,2003).

If money demand is not stable , the central bank cannot conduct monetary policy effectively for attaining its ultimate objectives based on money-growth targeting framework. Many countries after finding instability in money demand function have abandoned money-growth targeting framework and swithched over to other strategies such as inflation targeting. The experiences of many countries show that money demand became unstable after following a set of liberalization policies.

It is the known fact that the nepalese financial sector witnessed a substantial expansion both in number, products and size of financial assets in comparision to that of the 1980's. The Nepalese economy has been gradually monetizing with the expansion of financial sector. The monetization , which is measure as a ratio of broad money(M2) to GDP, increased to 88.56 percent from 29.8 percent in mid- July 1990

and 8.7 percent in mid -July 1965. These phenomena could have had a significant effect on the money demand function and in its stability.

In thus context, this study has tried to achieve the following questions:

1) Is the money demand function stable ?
2) Is there any significant relationship between the real money demand and its determinants in the long run?

1.3 Objectives of the Study

The general objective of the study is to find out whether the money demand function is stable or unstable after the post liberalization period. The specific objective are :

1) To construct the Financial Liberalization Index and to examine the impact of financial liberalization on money demand
2) To investigate empirically the determinants of money demand
3) To check the stability of money demand function which has important implications for the effectiveness of the monetary policy
4) To make policy recommendations for conducting the effective monetary policy

1.4 Significance of the study

A stable money demand function forms the core in the conduct of monetary policy as it enables a policy-driven change in monetary aggregates to have predictable influences on output, interest rate and ultimately price. Because of its importance, many studies have been carried out worldwide in the last several decades (Sriram, 1999). The development of financial institutions could be a stronger source of instability of money demand function which can make the monetary policy ineffective (Bordo and Jonung, 1987). The monetary sector of Nepal has undergone structural changes through the financial sector reforms since the mid 1980's .This study aims to study the impact of these change on the behavior of money demand function in Nepal. Secondly, like many other countries, Nepal conducts monetary policy by targeting the growth of broad money supply with a predetermined value. Implicit in such monetary targeting approach is the pre-assumption that money demand is stable. We shall

examine the degree of stability of money demand function through using econometrically identified determinants of money demand. Thirdly, estimates of the demand for money are useful to understand the limits to non-inflationary seignorage revenue. Finally, by fulfilling the aforementioned objectives, it will try to give some policy recommendations of whether the monetary aggregates as the intermediate targets of monetary policy are useful for the effective monetary transmission mechanism of Nepal Rastra Bank.

1.5 Limitation of the Study

This study has the following limitation:

1) The study just covers the time series data from FY 1974/75 to FY 2014/15 only.
2) It will be based on annual data as there is no availability of quarterly data figure on GDP in Nepal

1.6 Organization of the Study

The study will be organized in five chapters. The first chapter will be an introductory part of the study covering the background of the study, statement of the problem, objectives of the study , significance of the study and limitation of the study. The second chapter covers the review of some of the theories relating to the demand for money and some empirical studies done in national and international levels. The third chapter incorporates the methodology used in the study. The forth chapter will cover the analysis part and finally the fifth chapter will present the summary ,conclusions and recommendations.

CHAPTER II
REVIEW OF LITERATURE

This chapter provides a summary of theoretical and previous empirical studies on the behavior and determination of money demand done in national and international level with special attention to the role of financial development. Many attempts have been made to examine the behavior and determinants of money demand in different countries.

2.1 Theoretical Review

Theoretical Review covers economic theories that deal with the money demand function. Theoretical literature related to the money demand can be classified broadly as (a) Classical Money Demand Theory, (b) Keynesian Money Demand Theory, (c) Boumol-Tobin Money Demand Theory ,(d) Friedman's Money Demand Theory and (e) Mckinnon and Shaw's Hypothisis on Money Demand.

2.1.1 Classical Theory of Money Demand

It was based on the view that money is simply the medium of exchange. No one desired to hold money because money has no intrinsic utility. People hold it only for transaction , lack of synchronization between income receipt and payments causes them to hold money.

Classical economists, particularly Fischer concerned with QTM which can be stated as follow:

$MV = PT$

Where, M= stock of money

V=velocity of money

P= general price level

T= volume of transactions

Here V and T are assumed to be constant

Though the QTM explicitly used to determine the general price level by the equation $P=MV/T$, it implicitly explains the motive for holding money. That is

$$M^d = \frac{1}{V(PT)} \quad \ldots\ldots\ldots (2.1)$$

This implies that a constant fraction of total value of transcations is demanded to keep in the form of money for transaction purpose. However, equation (2.1) can further be modified into

$$M=(1/V)PY$$

Since V is constant, (1/V) can be replaced with some constant, k, and when the money market is in equilibrium, money demand (M^d) becomes equal to Money supply (M^s) i.e, $M^d = M^s$. Hence, the equation can be written as:

$$M^d = k(PY)\ldots\ldots(2.2)$$
$$M^d/P = k.Y\ldots\ldots.(2.3)$$

Equation (3) is nothing but just the Cambridge cash balance equation. This implies a constant fraction of nominal income (PY) is demanded as demand for money.

2.1.2 Keynesian Theory of Money Demand

Keynes formulated his theory of money demand in his well-known book, "The General Theory of Employment, Interest and Money" in 1936. In the Keynesian view, the desire for money is a demand for liquidity preference. He presented three motives for holding money: Transaction motive, Precautionary motive and Speculative motive. The first motive arises because money is needed to finance daily purchase of goods and services or money is required to bridge the gap between the receipt of income and expenditure and to meet the time interval between incurring business costs and receipts of sales. The amount of money demanded for this purpose is expected to vary directly with the level of income.

The precautionary motive arises to provide for future contingencies like accident, sickness and other unforeseen events. The money balance for this purpose is also expected to vary with the level of income.

Keynes has lumped together the transaction and precautionary demand on the ground that both are fairly stable functions of income which can be written as:

$M_1 = f_1 (Y)$ ……..(2.4)

Where,

M_1= amount of money demanded for transaction and precautionary purpose and ,

Y= level of income

The most significant contribution made by Keynes is his analysis of money demand is the speculative demand for money. To him, people demand some amount of money for speculation, i.e., for making profit due to rise/fall in the rate of interest. Considering two financial asset- world, he concluded that in deciding whether to hold money or bonds, investors would take account of the prospective capital gain or loss in holding bonds and interest rate as well. If the investors feel that the interest is too low and they expect it to rise, the value of the bond is expected to fall and the investors hold cash to avoid capital losses. Similarly, if investors feel that interest rate is too high so that it cannot rise further and the only expectation is a fall in the interest rate, in such case investors hold bonds because with the fall in the interest rate, bond price will rise and accordingly there will be capital gains. Thus, the speculative demand for money demands inversely on interest rate which can be written as:

$M_2 = f_2(r); \partial M_2/\partial r, 0$ …… (2.5)

Where,

M_2 = speculative balance

r = interest rate

Combining (2.4) and (2.5)

$M = M_1 + M_2 = f_1(y) + f_2 (r)$ …….. (2.6)

Where,

$\partial M/\partial y > 0, \partial M/\partial r < 0$

M = total demand from money balances.

However the Keynes' micro theory of the speculative demand for money has been called into question by Tobin(1956). For an individual, Keynes' explanation leads to a

pure asset portfolio of either money or bonds. But in actual life mixed asset portfolios are the rule.

2.1.3 The Inventary – Theoretic Approach

Baumol (1952) has argued that the cash held by people for transaction is like an inventory or stock of capital and thus until otherwise needed, it can be invested in short term bonds. Thus transaction demand for money is interest rate sensitive but only at a higher rate of interest. The goal in holding money balance is to minimize the total cost of holding money which comprises of brokerage fee and interest cost. The money demand function as argued by Baumol can be written as:

$$\frac{M}{2} = \sqrt{\frac{bY}{2i}} \qquad \text{………………………………………………………….. (2.7)}$$

Where, M/2 is the average demand for money balance for transaction purpose,
b = brokerage fee per conversion while converting bonds into cash
Y = total nominal income
i = market rate of interest

Equation (2.7) shows the average demand for money to make the transaction expenditure. The average demand for money is positively related with square root of national income and inversely related with square root of market rate of interest. M/2 is thus the optimum balance held for transaction purpose.

Money demand fuction of equation (2.7) shows that

a) Transaction demand for money is inversely related with the rate of interest and thus interest rate sensitive but only at a higher rate of interest
b) Transaction demand is non-proportionately related to income as against the proportional relationship established by earlier theories
c) Elasticity of money demand with respect to interest rate is less than unity
d) Income elasticity of demand for money is less than unity

2.1.4 The Portfolio Balance Approach

Tobin(1956) has analyzed the speculative demand for money incorporating the uncertainty and risk and concluded that individual hold a combination of cash and

bonds so as to optimize the return on bonds and minimize risk. With this portfolio optimization theory, he reaches the conclusion that the risk factors and uncertainty also play important role in speculative demand for money.

According to Tobin, the speculative demand for money is not only explained by expected change in rate of interest but also explained by the risk and return in holding bonds because of uncertainty in bond prices due to uncertain interest rate in the future. So people diversify their portfolio so as to minimize risk and maximize return.

Algebraically,

Return from bond consists of face value of bond and capital gain. Thus,

$$R = (r + g\square)\, B \;\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \;(2.8)$$

Where,

R = Total return from bond

r = Market rate of interest

$g\square$ = Average expected capital gain from bond

B = Price of bond.

On the other hand, risk (J) consists of loss from the change in the value of bond (B). It is written as :

$$J = jB \;\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.. \;(2.9)$$

Where,

J = Total risk

j = Risk or standard deviation of capital gain (σg).

Thus, $B = J/j = J/\sigma g$ ……………………………………. (2.10)

From equation (2.8) and (2.10)

$$R = (r + g\square)\frac{J}{\sigma g} = \left(\frac{r + g\square}{\sigma g}\right) J \;\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.. \;(2.11)$$

Equation (2.11) represents budget line with slope $\frac{r + g\square}{\sigma g}$

To find the optimization of risk and return, Tobin introduces risk return indifference curves which are upward sloping snowing higher return associated with higher risk. The optimization of risk and return is obtained at a point where IC is target to the budget line with the help of this, the optimum asset portfolio can be determined.

Tobin's theory is superior to Keynesian theory in at least two respects.

i) It assumes a more rational and realist behaviour on the part of wealth holders hold some safe wealth in the form of money even if it gives no return.
ii) It explains why wealth holders hold some safe wealth in the form of money even if it gives no return.

2.1.5 Modern Approach

In line with this portfolio balance approach, Friedman (1959) formulated the modern approach of demand for money. It is partly Keynesian and partly non-keynesian. It is non- Keynesian in the sense that Friedman neglects completely Keynes' classification of the motives for holding money and the corresponding component demands for money. To him, money is one kind of asset in the whole portfolio of assets, a capital good, and a source of productive services. He attempted to clear the conceptual framework of the quantity theory with the assertion that the demand for money does not become infinitely interest elastic but it is relatively interest inelastic(Patinkin:1972)

His money demand function can be written as:

$$M^d = f(Y, h, P, R, \pi, \mu) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (2.8)$$

Where,

M^d = money demand,

Y = permanent income,

h = ratio of human to non-human wealth,

P = price level,

R = vector of interest rates,

π = inflation and

μ = a variable incorporating tastes and preferences.

The restrictions to this demand functions are :

$$f_R < 0,\ f_h > 0,\ f_\pi < 0, \text{ and } f_y > 0$$

To Friedman the money demand function represented by equation (2.8) is homogeneous of degree one in price showing the demand for real balance i e

$$M^d/p = f(Y/P, h, R, \pi, \mu) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (2\ 9)$$

The major issue raised by Friedman is the stability of the money demand function. To him, money demand function is highly stable which implies the stability of the velocity of money.

2.1.6 McKinnon Approach

McKinnon (1973) has opined that due to the underdevelopment of capital and financial markets and the poor performance in the underdeveloped countries, the theories for the demand for money in developed countries do not fit the scenario of underdeveloped countries. He thus has argued that due to underdevelopment of capital market, there exists complementary relationship between the demand for money and the demand for physical capital. In such case, the demand for money function can be represented as:

$$(M/P)^d = f(y, I/y, d - \dot{P}^*)$$

Where,

$$f_y' > 0,\ f_I'/y > 0 \text{ and } f'_{d\text{-}\dot{P}^*} > 0$$

M/P = real money demand

y = real income

I/y = investment income ratio

d- = real rate of return from money

d- $\dot{P}^*$ = nominal rate of return from money

$\dot{P}^*$ = expected rate of inflation

2.1.7 Implication of the Theories for Nepal

Income is the most significant determinant of money demand in the developing countries like Nepal. The higher the income of an individual , the higher will be the individual's demand for cash and vice versa. The relative underdeveloped financial system means that individuals cannot finance their deficits from funds derived form the financial market and hence the need to keep large proportion of their income in cash. The relative absence of financial assets means that even if the people want to buy them, they will not get them hence holds more cash balances. So, the demand for money is positively related with level of income.

Similarly , regarding the interest rate (r), in the less developed countries like Nepal, the financial sector is underdeveloped , hence limited financial assets supplied by the market. Most individuals do not have easy access to financial institutions and with the high transaction cost, the attractiveness of financial assets decline. Furthermore, with the negative influence of asymmetric information, the interest of individuals in financial markets diminish as the implicit cost of transactions increase, hence, they keep more of their wealth in the form of cash (the higher the demand for money balances). The low level of income means people hardly satisfy their basic needs hence limited speculative demand which reduces the influence of interest rate in the demand function for money in developing countries like Nepal. Similarly, regarding the another determinants of money demand, i.e, inflation, due the unstable prices of goods and services in developing countries , price is an important determinant of the demand for money because when the people expect general price level to rise, there is a mad rush to purchase commodities and hence less demand for money balances. The uncertainty and instability in the level of prices reduces people desire to hold more of cash by increasing panic demand for good and services and hence lesser demand for money.

2.2 Review of International Empirical Studies

The conventional money demand equation has been one of the most widely studied relationship in macro economics. It generally features real money balances being affected by contemporaneous levels of real income as a proxy for transactions and a nominal interest rate that describes the opportunity cost of holding money. The

variables that enter the demand function for money , and the definition of the quantity of money appropriate for the demand function, has received substantial attention in economic literature.

The empirical works on estimating the demand behaviour for money have received an increasing attention because of its significant to policymakers and researchers when designing monetary policies.

2.2.1 Determinants of Money Demand

Empirical results in the literature provide mixed evidence regarding determinants of the demand for money. There is support for both the inclusion and exclusion of wealth as well as controversy surrounding the inclusion of income or wealth or both. Some theoretical and empirical studies such as [Blinder and Solow (1973), Tanner(1970)] suggest that wealth is an important determinant of money demand and that crowding out may be a substantial result of the wealth effect of government debt. Other studies, such as Friedman (1978) and Goldfeld (1973), however, present empirical evidence that wealth is an unimportant variable in money demand and that crowding in of investment from bond-financial fiscal policy may result if there are no wealth effects.

Marothia and Phillips(1982) estimate the demand and supply functions for money in Canada using simultaneous equation model in which the supply of money is considered endogenous. The resultant determinants of the demand for money are income and short-term real cash balance variables. Wealth is an unimportant explanatory variable in money demand thus rejecting the hypothesis that an increase outside wealth increases the demand for money.

Bronfenbrenner and Mayr (1960) estimated the separate effects of wealth and interest rates along with income and lagged money balances. Their result show that interest rate, income, and lagged money balances are statistically significant by the usual tests, but the wealth variable is non-significant.

Several recent studies by ECB staff have concluded that it is possible to model broad money demand in the euro area as a stable function of prices, GDP and interest rates (Calzo and Sausa,2003).

Similarly, Kannapiran (2001) finds that the determinants of money demand are real GDP, nominal interest rate, nominal inflation rate in Papua New Guinea.

2.2.2 Impact of Financial Liberalization

McKinnon(1973) and Shaw (1973) approach on the role of finance in development, postulates that financial repression, which consists of interest ceilings, high reserve requirements and directed credit policies, reduced domestic investment thereby negatively affecting productivity. They have argued that government intervention in the pricing and allocation of loanable funds, inhibits financial deepening by depressing real interest rate(McKinnon, 1973; Shaw, 1973; Kapur, 1976; Fry, 1998). It is also postulated that low or even negative real rates of interest impede economic growth through their productivity of investment.

This school of thought hence provided a theoretical basis for the financial liberalization movement in developing countries. McKinnon(1973) and Shaw (1973) emphasized the removal of interest rate ceilings as the key measure of financial liberalization. They were of the view that removal of such ceiling would increase real interest rate and would ultimately stimulate savings, hence contributing to the economic growth. A higher rate of interest will increase the allocative efficiency of credit by shifting funds from inefficient investments to more efficient ones through organized sectors. On the other hand, the higher saving rates would finance a higher level of investment. Hence the McKinnon-Shaw school argued that financial liberalization would lead to higher economic growth (Cho 1990, p.479).

The major thrust of both Mckinnon and Shaw is therefore the deregulation of interest rate. A high positive real rate of interest shifts the portfolio of private savings from non productive assets to financial savings. Financial savings can be allocated to high yield investments. Therefore the major goal of the monetary and financial policy is the development of domestic financial market so that savings could be attracted to the financial system.

The main objective of financial liberalization is to improve the allocation of funds from unproductive to more productive sectors. Obviously, such a financial liberalization process would impact the money demand function in the economy. Hence, in recent years, research studies have focused on the impact of financial

liberalization on money demand; among others. Two strands of studies are particularly notable:

The first strand of studies examines the contention of Gurley and Shaw (1960) that financial innovations, by increasing the number of money substitutes, increase the interest elasticity of money demand. The second strand of studies focuses on observed rapid growth of equity markets and its effects on the money demand behavior. The stock market development exerts a positive or negative effect on money demand which depends on the strength of different opposing effects. The advancement in stock market has three positive effects on the money demand, i.e, wealth effect, transaction effect and risk-spreading effect and it has the negative substitution effect on the real cash balances(Friedman, 1998, pp. 222-223).

The presence of these possible influences of financial developments on the demand for money has important implications for monetary policies. In particular, if the Gurley and Shaw's contention is right, then monetary policies are rendered less effective for stabilization purposes. Additionally, failures to incorporate the stock market activities in the demand function will resell in model misspecification. Consequently, the monetary policies may faultily be tighter or easier than is appropriate for economic stability.

However, the contradiction is shown in the empirical evidence done by Cagan and Schwartz (1975) and Hein (1984) for the United States that the proliferation of money substitutes decreases the interest elasticity of money demand, contradicting Gurley and Shaw's thesis.

Meanwhile, the empirical studies on the roles of financial market activities in the money demand function largely indicate the significant influences of the stock prices on the demand for money. Choudhry (1960) and Thornton (1998) apply recent econometric techniques of cointegration and error correction modeling to estimate the relationship between stock prices and the long-run money demand function respectively for the cases of Canada and the USA and Germany. Both studies document significant role of the stock prices in the behaviour of money demand in these countries.

Similarly, the study of Odularu and Okunrinboye (2009) in Nigeria discovers that though the income has positive relationship and the interest rate has negative relationship with the demand for money, it was also discovered that the financial innovations introduced into the financial system have not significantly affected the demand for money.

Hafer and Kuntan (2003) examined whether financial innovation in the Philippines distorted the long run relationship between monetary aggregates, income and interest rates for the period 1980-1998. They could not reject the hypothesis that there does not exist a standard money demand relation between M1 and M3, real income and interest rates. However, estimates of ECM models for these measures also show that financial innovations impacted real money balances for M1, but not M3.

2.2.3 Stability of Money demand Function

A stable demand for money plays an integral role in any macroeconomic model. The existence of a stable relationship between money and prices is generally regarded as a prerequisite for the use of monetary aggregates in the formulation of monetary policy. The question of whether the demand for money function is stable is one of the most important recurring issues in the theory and application of macroeconomic policy. What is being sought in a stable demand function is a set of necessary conditions for money to exert a predictable influence on the economy so that the central bank's control of the money supply can be a useful instrument of economic that is monetary policy. A money demand equation expresses money as a function of prices and other macroeconomic variables such as real income and interest rates.

As stated by Hamori and Tokihisa (2001,p.305), stability of the money demand function is an important premise behind the hypothesis that monetary policy matters, that is, that the money supply will have a certain amount of expected influence on real variables and that money supply control by the central bank is an effective macroeconomic policy. According to Judd and Scadding (1982), a stable demand function for money means that the quantity of money is predictably related to a small set of key variables linking money to the real sector of the economy.

Since the 1979's, money demand is found to be unstable in many developed countries (Hetzel,1984). The existence of a stable money demand relationship has been

questioned in the United states where, for instance, Friedman and Kuttner (1992) found cointegrating relationships among monetary aggregates, income and interest for the period 1960-1979 but once data from the 1980s are added, the relationships break down.

Ghumro and Karim (2016) examines the financial liberalization and the stability of money demand in Pakistan. The ADRL Bounds Approach has been employed with annual time series data from the period 1972-2014. The variables included in the study are Broad money supply, GDP, Discount rate, Inflation rate, Exchange rate, Financial Liberalization. The result provide evidence that financial liberalization provide effects on broad money demand in both the long run and short run.

Ericsson and Sharma (1996) examines the broad money demand and financial liberalization in Greece. Employing Error-Correction model and ADRL model, it provides the result that in spite if large fluctuations in the inflation rate, introduction of new financial instruments and liberalization of the financial system, the estimated model OLS remarkably stable. The dynamics of money demand are important with price and income elasticities being much smaller in the short run than in the long run.

Maghyerh (2003) examines that the stability of money demand function in Jordan over the period 1976-2002. The variable included in the study are Nominal Money Balance, Domestic Interest Rate, Foreign Interest rate, Inflation Rate, Depreciation of Exchange Rate. This study shows that despite the substantial financial market liberalization in the late of 1988, the co-integration and error collection methodology shows that the quaterly time series data confirms that the broad demand formoney in Jordan was stable during the period under investigation. This reuslt also show that the inflation rate is the most important variable that explains the demand for money in the Jordaninan economy.

Hasani and et al (2013) examines the stability of money demand in Iran. By using quaterly data between 2002-2011 and ADRL model, demand function has been estimated and the effects of electronic banking on stability of the money demand function have been surveyed. According to result of CUSUM and CUSUMQ tests, this function is unstable during period. Also, correlation between electronic banking and money demand is positive.

Short (1973) study for West Malaysia and place country-region Singapore showed that the negative impact of per capita income on velocity was overpowered by the changes in monetary habits. This study revealed that a rise in either interest rate or anticipated rate of change of prices led to a rising velocity and vice versa. The study equally showed that an increase in the number of bank branches caused the velocity of money to increase.

Mukisa (1998) study empirically investigated the determinants and behavior of income velocity of money for Uganda over the period 1980-1997, incorporating financial innovation. The results revealed that both currency in circulation and narrow money showed insignificant influence by financial innovation and had unstable function.

The study by Kharadia (1988) examined the behavior of income velocity of money in place country- region India. The study revealed that the various measures of changing financial condition including currency-demand deposit ratio, bank assets-national income ratio, and the household financial assets-national income ratio were all significant in the estimated model.

Bordo and Jonung (1987) studied the behavior of money demand for a number of countries. According to them, the observed secular pattern of velocity can be interpreted more effectively in terms of the evolutionary technical progress taking place in the financial sector of the economy over the long run rather than a few episodic changes on which others have focused.

Bahamani-Oskooee (2001) has tested the stability of money demand in Japan using ARDL modeling to cointegration analysis by using the quarterly data from 1964 to 1996 and found that demand for broad money is stable. The included variables are M2, real income and interest rate. With the help of CUSUM and CUSUMSQ test, he has found a stable relationship in the money demand function.

Khan and Hye (2011) examines the effect of financial liberalization on the demand for money in Pakistan. They employ JJ cointegration and ADRL model to estimate the long run equilibrium relationship between broad money M2 and composite financial liberalization index along with other determinants of demand for money like GDP, real deposit rate and exchange rate. In order to access the stability of the model,

the parameter constancy tests, i.e, Recrusive Residuals, CUSUM and CUSUMSQ tests have been applied. The empirical results indicated that for broad money, there exists long-run money demand function. The financial liberalization, gross domestic product and real deposit rate positively affect the demand for money in the long run as well as in short run.

Paudel (2007) examines the role of financial liberalization on money demand and economic growth employing ARDL model approach of cointegration in Sri Lanka of data for the period of 1963 to 2006. The variables included in the study are Real Broad Money Demand, Real Lending Rate, RGDP, Financial Depth (represented by the bank deposit liabilities divided by nominal GDP), Real Interest Rate and Financial Liberazation Index. It provides the conclusion that the finacial liberalization has a significant negative impact on narrow and broad money demand in the long run, while such impact is found to be positive in the short run but not significant ; and significant positive impact in the short-run on broad money.

Mutluer and Barlas (2002) analyze broad money demand in turkey between 1987 and 2001, a period characterized by a process of financial sector liberalization, implemented using various structural reforms and deregulations. It show the long run relationship is established using real income, interest rate on deposits, interest rate on government securities, inflation rate and real exchange rate.

Busari(2004) using cointegration and error correction approach on annual data for the period 1970 -2002 to examine Nigerian money demand function. In this study, he observed that demand for money in Nigeria this period was stable and that reforms measures to have significantly altered the demand function for money in Nigeria.

2.3 Review of National Empirical Studies

Some of the studies relating to money demand function and test of its stability in Nepalese context are as follows:

Budha (2012) investigates the demand for money in Nepal using the Autoregressive Distributed Lag (ARDL) approach for the period of 1975-2011. The results based on the Bound Testing procedure reveal that ther exist the cointegration among the real money aggregates (M1 and M2) , real income , inflation and interest rate. The real

income coefficient is found to be positive and the inflation coefficient is negative. The interest rate coefficient is negative for both of the real monetary aggregates supporting the theoretical explanation. In addition, the error correction models suggest that the deviations from the long run equilibrium are short-lived real M1 and real M2. Finally, the CUSUM and CUSUMSQ test reveal that the real M1 demand function is stable , but real M2 demand function is not stable implying that the monetary policy should pay attention to real M1 than real M2.

Poudel (1987) has estimated the money demand function of Nepal using the data sample 1974/1975 to 1986/87. In his study it is found that the demand for money M1 is highly stable. Aggregate real income is the most statistically significant determinant for M1 and M2 defined in real terms. The income elasticity of the demand for M1 is substantially greater than unity, lying within the range of 2.31 to 2.47. Hence money appears to be luxurious commodity. The interest rate on non-monetary assets (rate of interest on saving deposits) has insignificant effect on M1 implies savings deposits are not a substitute for M1. The income elasticity of the demand for time deposits is 3.77. The broad money has also more than unitary income elasticity whose magnitude is 2.72.

Kathiwada (1997) has analyzed money demand function in Nepal using the annual data of 21 years from 1975/76 . He has concluded that demand for real money balance in Nepal is a stable and predictable function of a few variables(real income and interest rate). He has concluded that the financial reforms have not significantly affected the money demand function. He has found the income elasticity of M1 and M2 is 1.25 and 1.45 respectively. The unit root test show that most of the time series in natural logarithmic form of the levels of the data used in the money demand function are time trended or integrated of order zero (I0) and order one (I1) implying they are stationary in level form and first difference. Only GDP defaltor is integrated of order three implying the higher degree of non-stationarity in time series. The Engle-Granger(EG) cointegration test reveals that real narrow money demand, real income and interest rate represented by 12-months fixed deposit rate are cointegrated when the time trend variable is included in the cointegration test. However, the EG test shows that the cointegrating relationship does not seem significant for broad money definitions of real money balances.

Koirala (2010) has employed the cointegration technique developed by Johansen (1988) and Johansen and Juselius (1990) that money demand function for both narrow and broad money is a stable and predictable function of real income and interest rate. The disequilibrium, according to the study, corrects more rapidly in narrow money than the broad money.

Pandey (1998) by using an error correction dynamic specification has found that demand for narrow money (M1) is highly stable and this has been confirmed by all the statistical tests that were employed. He also has found that the rate of interest on savings deposits does not have a significant effect on the demand for m1 balances. This study has also established the fact that money is luxurious item for the Nepalese people and the expected rate of inflation does not seem to have a significant inflence on the demand for M1 in Nepal. However, he has not tested the stability of the demand for broad money.

Gaudel (2003) has used chow test to investigate the stability for the three alternative definitions of money in the demand function using OLS estimation and found that a stable relationship is maintained in all definitions of money. His major findings in his study are:

The demand for money in Nepal over the sample period is best explained as a function of income as a scale variable and rate of inflation and interest bearing assets as opportunity cost variables. Form the result of the chow test, it is found that a stable relationship is maintained in all the three definitions of money. The overall result of the linear models conclude that narrow definitions of money is superior to broad definition of money. It seems to indicate that narrow definition of money is more appropriate than broad definition providing the evidence of non-monetized economy.

The income elasticity of the demand for money is positive and less than unity in all log linear models implying that money is not a luxury asset in Nepal. It also supports the view of Baumol and Tobin that there is a significant economy of scale in holding money balances. Money and physical assets in Nepal are more complementary rather than substitutes. The long run demand function in comparison to the short run demand function has performed better. The interest elasticities in log linear models are found to be low and statistically insignificant.

Pandey (2011) examines the impact of financial liberalization on the demand for money using the data of period 1974/75 to 2007/2009. The major findings in his study can be summarized as follows:

Income is a more important variable determining money demand than interest rate. Based on different models, Income elasticity of narrow money ranges from 0.18 to 1.2 while that of broad money ranges from 1.4 to 2.8. Real money balance, real GDP and interest rate are cointegrated so that they have a long run relationship; and financial innovations introduced into the financial system have not significantly affected the demand for money. CUSUM tests show signs of structural break in the mid-1990s , although CUSUMSQ test show stability in money demand function.

Bhatta (2011) has investigated the money demand relationship in Nepal empirically using the data of period 1975 to 2009 and examine the stability of the money demand function by using the recently developed tools of ARDL modeling to cointegration and error correction modeling developed by Pesaran and Shin (1999). He concluded that in both cases of monetary aggregates M1 and M2, demand for real money balance has been found to have a long run equilibrium relationship with real GDP and interest rate(opportunity cost of holding money in which he takes the interest rate on savings deposit in narrow money demand and interest rate on one year fixed deposit in case of broad money demand). Moreover, the most significant determinants of money demand in Nepal is the scale variable (i.e, real GDP). Also, he has concluded that interest rate is statistically insignificant implying that money balance is independent of interest rate in the long run in Nepal. It further implies that Nepal should continue the financial liberalization process developing the money and capital market to make the interest rate as significant variable as suggested by theoretical theories. Notwithstanding the major policy reforms in the financial sector, the money demand functions in case of both monetary aggregates are stable in their parameter, hence the central bank of Nepal can continue the monetary targeting strategy as a policy in achieving the major macroeconomic policy goals.

2.4 Conclusion

By reviewing various literatures, it can be concluded that real GDP, interest rate, inflation rate and exchange rate are the most common determinants of money

demand. In the absence of developed financial market in developing countries, the real income determinants has always been significant scale variable in the demand for money function. For instance, in India the studies by Singh (1984,1990), Chakraborty and Kulkarni (1991) and Barari (1996) and in Nepal, Paudal (1989), Khatiwada (1997), Budha (1012), Bhatta (2011) have shown that the income is one of the major determinants of the demand for money. However, interest rate is found to be insignificant factor affecting the demand for money. It may be attributed to the less developed money and capital market in the economy. Also, lack of speculative motive also seems to be responsible for the insignificant effect of the rate of interest on money demand. Moreover, the real income elasticity coefficient is expected to be positive and that of the interest rate is expected to be negative. Similarly, the Price level (relative to the real value of physical assets) exerts negative effects on money demand as the increase in expected inflation lead to substitution away from money to real assets.

Regarding the exchange rate, the external monetary and financial factors affect the money demand significantly in an open economy through the exchange rate and expected rate of return on the money (Lestano et al., 2009). The capital account in Nepal's balance of payments is partially liberalized including the restrictions on portfolio investment. Capital outflow by Nepalese residents has been completely restricted expect few purposes (Foreign Investment and Technology Transfer Act, 1992). So, the exchange rate and the foreign interest rate have insignificant effect on the real money balances in case of Nepal. Also, it is found that due to reforms in the financial sector, there is no unique relationship between the real money demand and its determinants. Reviewing various literature, it is evidenced that in many developed countries (USA, Germany, Canada etc.) and in many less developed and developing countries (Nigeria, Uganda, Singapore, Pakistan, Jordan etc.), the reforms in financial market and the resultant increase in the new financial instruments have positively financial liberalization and to access its impact on the money demand function is must and hence becomes the one of the most important determinant of money demand.

2.5 Research Gap

Several studies have done the estimation of money demand function in Nepal. But they are not included the financial liberalization by developing the Financial

Liberalization Index. Pandey (2011) has estimated the money demand including the index, but he has analysed the impact of financial liberalization upto only 2009. But the fact is that due to financial crisis of 2007-2008 that occurred in USA may have the spill over effect beyond the period 2008/09. So this study helps to show the real picture of the money demand function in Nepal till now.

CHAPTER III
RESEARCH METHODOLOGY

This chapter discusses the research methodology adopted in the study. It elaborates the issues in money demand estimation, model specification, data selection, sample period and econometric technique applied in the estimation of money demand.

3.1 The General Model

In the literature of money demand function, the basic model of money demand begins with the following relationship:

$$M/P = f(S,OC)$$

Where,
M/P = demand for real money balances
S = Scale variable to represent the economic activity
OC = Opportunity Cost variable

3.2 Selection of Determinants of Money Demand Function

3.2.1 Scale variable

There is a wide controversy among the researchers on the selection of appropriate scale variable. Some of the economists emphasizing on the transaction motive of holding money prefers montetized income (monetized ratio times income) while the other economists emphasized on the asset motive of holding money prefer wealth or permanent income as scale variable.

In the developed countries like USA and UK, there is a general [Metlzer (1963), Walter (1965), Laidler and Parkin (1970), Chow (1966)] that the use of permanent income or wealth rather than the use of current income is an appropriate determinant. However, Latane (1960), Courchene and Shapiro (1964) have applied measure income in the place of permanent income.

In the context of developing countries, most of the empirical studies have found taking measured income as the major determinant of the demand for money instead of

wealth or permanent income. One of the main reasons for not including wealth is the absence of data in the non-monetized economy. Several studies in India [Gujrati (1968), Bhattacharya (1974)] have chosen current as the major determinant.

Despite these, the use of gross national product (GNP) as a scale variable might not be applicable in developing countries (Mookerjee, 1984:50). This is because, the developing economies are characterized by a dual economic structure composed of large non-monetized sector and a small –monetized sector.

Thus the general agreement observed from the various studies shows that some measure of income or wealth must be incorporated as a major determinant. But the inclusion of both income and wealth variables may be problematic due to multicollinearity.

In the Nepalese context regarding the scale variable, the studies by Poudyal (1989), Sharma (1987), Khatiwada (1997), Bhatta (2011) have found significant and stable relationship between the gross domestic product (GDP) and the stock of money holding. For all types of money, GDP has emerged as the principal determinant of the money demand. Regarding GDP, it is also stated that in a predominantly agricultural country like Nepal, the share of non-monetized income is supposed to be higher owing to the existence of a subsistence level of farming and the prevalence of barter system in factor payments. Besides, the lack of adequate data on wealth or permanent income and monetized income precludes employing ideal scale variable in the money demand function. So, real GDP is taken as a scale variable in the present study.

3.2.2 The Interest Rate

The interest rate is considered as the second major determinant of the demand for money. The role of interest rate variable in the demand for money function has remained in dispute. Some of the economist prescribed for the long term interest rate variable for the money demand function while the other economist prescribed for interest rate on short term bond instruments.

Regarding the choice of rate of interest, it is believed that time deposit rather than other deposits is more responsive. As pointed out by Saravene (1971) and Subrahmanyan (1977), an attractive rate of interest paid on time deposits would be an

effective tool to change the saving habits of those people who do not come to deposit in banks and channel their savings in the unorganized sectors of the economy.

In the context of Nepal, there exist varying degree of the unorganized market rate of interest and the financial market is almost in a rudimentary stage. So, in such circumstances the choice of particular rate of interest as an appropriate determinant is really difficult. So the hypothesis of Saravene and Subrahmanyan may not be applied in the case of Nepal because a large proportion of population remains at subsistence level. An increase in income of the people can be held in the form of cash for the fulfillment of their basic needs. Holding their income on saving and time deposits for interest earning purposes would be luxury (Thapa, 1997:56). The use of Treasury Bill or government bond is also irrelevant because of its inefficiency to change public asset portfolio. Thus, it is evident that in the absence of alternative financial assets, the interest rate on time deposit may be taken as a relevant determinant for the estimation of the demand for money in Nepal. Under this study, saving deposit rate is taken to estimate the narrow money demand function and the 1 year fixed deposit rate is taken to estimate the broad money demand function.

3.2.3 Price level

The relationship between money and price has remained a matter of debate among economists of the different era. According to classical theory, there is a direct and proportional relationship between the money and price. Keynesian underemployment equilibrium structure has emphasized the partial effect of money on price level. Similarly the monetarists hypothesis is that the rate of change in price level or Inflation is purely a monetary phenomenon and has significant effect on money demand. Moreover the monetarist version holds the view that the demand for money like other assets depends upon its own return in terms of the rate of interest and return on its substitutes in the form of price of physical assets. If these assets serve as alternative to holding money, an increase in their prices would cause a shift from money or bonds to real assets. Thus, there is an inverse relationship between money demand and price change. In view of this, the inclusion of the price level as a separate determinant seems reasonable in the demand for money function.

Prior to the derivation of the demand for money, it is to be decided on the use of appropriate price level in order to deflate the stock of nominal money balances. To that extent, the relevant price index as suggested by Barrow (1970) would be the consumer price index if the aggregate demand for money were dominated by household's behaviour. In this regard a number of researchers adopted different techniques for measuring the price variable. Cagan (1956) and Khan (1985) used WPI, Hamburger (1966) and Friedman (1992) applied GNP deflator and so on.

It is argued that in developing countries, substitution between money and real assets is more important than money and financial assets. The relevant opportunity cost of holding money would be the expected rate of inflation rather than interest rate (Khan, 1982). In the case of Nepal, the series on wholesale price index are not available for a relatively longer period. Further, it may not be possible to generate expected rate of inflation as weighted average of the past rates. Thus, in such a situation, inflationary expectation may be replaced by the rate of change in consumer price index.

Moreover, in the Nepalese context, contradictory result is shown on the behaviour of prices in Nepal on various empirical studies. The studies by Pant (1978) and Sharma (1987) have exhibited a weak association between prices and money but the studies of Khatiwada (1994) have revealed a good relation. Furthermore, in our economy there is no availability of statistics about general price index and the wholesale price index so far the choice of the appropriate price index has been confined to the consumer price index or the GDP deflator. Besides, the GDP deflator as the most general measure of prices may be inappropriate due to its limited area of covering domestic output only. That is why, CPI is preferable as a measure of opportunity cost of holding money .

3.2.4 Effect of financial liberalization

With financial liberalization process, financial deepening and widening increase in the economy, so is the monetization and access to financial services. As a result, people can have monetary assets in their portfolio balance. Moreover, financial innovation, which follows the financial liberalization, provides different financial instruments to the public so that traditional definition of money might be questionable. Because of this, money demand functions in many advance countries are now unstable and it is

difficult to estimate money demand in the economy because of rising income velocity with financial innovation.

Nepal has also been adopting financial liberalization policy since the mid-1995. Along with this liberalization process, we have seen change in financial landscape with the expansion of financial sector. It has increased the access of financial services to the people and increased the monetization process. To access the impact of financial liberalization on money demand, financial liberalization index has been included in the money demand function. It is also assumed that the level of financial liberalization will tend to capture the level of economic development as well. The procedure and compilation of financial liberalization index in Nepal has been discussed in the latter chapter.

3.3 Monetary Aggregates

In money demand function, with the assumption of money market clear (money demand = money supply), empirical studies used the money supply data, generally provided by the central banks or monetary authorities.

In Nepal, the NRB has been releasing two types of monetary aggregates so far: narrow money (M1) and broad money (M2). The former includes the currency in circulation and demand deposits in commercial banks while the latter incorporates time deposits of commercial banks plus narrow money (M1). The present study only incorporates the narrow money (M1) to estimate the money demand function in Nepal.

3.4 Source of Data

Econometric research work in our country is seriously inhibited by wide range of data shortcoming. As there are no quarterly time series on GDP available, annual data have been used, the study is based on secondary data. Data source are the publications of NRB, the Ministry of Finance, the Central Bureau of Statistics, IMF and the WB. Nominal stock of narrow money (M1), Broad money supply (M2), rate of interest on saving deposit (r_{st}) rate of interest on 1 year fixed deposit (r_{fd}), consumer price index (CPI), inflation rate were taken from the Quaterly Economic Bulletin, Nepal Rastra Bank.

3.5 The Empirical Model

In this study, the following model has been considered.

Ln $m_t = a_0 + b_1 \ln y_t + b_2 r_t + b_3 Z_t + e_t$ ……(3.1)Where, m_t is a monetary aggregate in real term, y_t = the real GDP, Z_t is the financial liberalization index and e_t is a white noise error term. Based on conventional economic theory, the income elasticity coefficient, b_1 is expected to be positive and the interest elasticity coefficient, r, is expected to be negative.

To model the money demand function for both narrow and broad monetary aggregate equation (3.1) can be written in the form of two different models. Model I for Narrow money demand function and Model II for broad money demand function.

Model I: $\ln m_{1t} = a_0 + b_1 \ln y_t + b_2 r_{sdt} + b_3 Z_t + e_t$ ……(3.2)
Model II: $\ln m_{2t} = a_0 + b_1 \ln y_t + b_2 r_{fdt} + b_3 Z_t + e_t$ …….(3.3)

The details of all the variables used in the formulation of equation (3.2) and (3.3) and used in this study have been presented in table 3.1.

Table 3.1

Variable Details

Variables	**Variable Details**
Narrow Money Stock (M_1)	Currency held by public plus demand deposits of the commercial banks (CC+ DD)
Broad Money Stock (M_2)	Narrow Money Stock plus time deposit (M_2= CC+DD+TD)
m_{1t}	Real narrow money stock defined by the Narrow Money Stock divided by CPI (FY 2014/15=100)
m_{2t}	Real broad money stock defined by the Broad Money Stock divided by CPI (FY 2014/15=100)
$\ln m_{1t}$	Natural logarithm of real narrow money stock
$\ln m_{2t}$	Natural logarithm of real broad money stock
y_t	Real GDP defined by nominal GDP deflated by the implicit GDP deflator (FY 2014/15 = 100)
$\ln y_t$	Natural logarithm of real GDP(y_t)
r_{sdt}	Rate of interest on saving deposit
r_{fdt}	Rate of interest on 1 year fixed deposit
CPI	Consumer price index (FY 2014/15=100)
FLI	Financial Liberalization Index

3.6 Estimation Methodology

We have used the single equation estimation method thereby implicitly assuming that the independent variables are exogenously determined in the sense of being independent of the error term in the demand for money equation, and the reverse connection from money to income and interest variables. The results were obtained with ordinary least square method.

3.6.1 Coefficient of Determination

Coefficient of determination, R^2 is a statistical number, computed from the sample data, which exhibits the percentage of the total variation of the dependent variable being explained by the changes on the independent variables. The coefficient of determination is calculated in order to test the explanatory power of the model. The coefficient of determination is calculated in terms of the following formula:

$$R^2 = 1 - \frac{\sum e_i^2}{\sum (Y_t - Y)^2}$$

Where,

$$e = Y_t - \hat{Y}_t$$

When the coefficient of determination is adjusted to the degrees of freedom, the adjusted coefficient of determination, R^2 s computed and the formula is:

$$\bar{R}^2 = 1 - \frac{\sum e_t^2/(N-K)}{\sum (Y_t - Y)^2/(N-1)} = 1 - (1 - R^2)\frac{(N - 1)}{(N - K)}$$

Where,
N = Number of observations
K Number of parameters.

3.6.2 t-Test

The t- test used to find out the statistical significance of the individual parameters at the given level of statistical significance. It determines the degree of confidence in the

validity of the estimates. This test helps us to decide whether the estimated parameters b_1, b_2 and b_3 are significantly different from zero or not, t-test is performed as follows:

Null Hypothesis : $H_0 : b^{\perp}$, i.e. the regression parameter is not significant.
Alternative Hypothesis: $H_1 : b_1 \neq 0$ i.e. the regression parameter is significant.

T-test statistic is computed by the formula,

$$t = \frac{b^{\perp}}{SE\ (b^{\perp})}$$

Where,

$$SE(b^{\perp}) = \sqrt{\frac{\hat{\sigma}_u^2}{\sum (X - X)^2}} \text{ and } \hat{\sigma}_u^2 = \frac{\Sigma e^2}{N - K}$$

Here, $\hat{\sigma}_u^2$ is an unbrased estimator of true σ_u^2.

When computed t-statistic is greater than tabulated t-statistic at a certain degree of freedom and level of significance, the null hypothesis is rejected and the regression parameters are significant and vice versa.

3.6.3 F- test

F-test is used to test the overall significance of the regression model at a given level of statistical significance. It attempts to show whether the movement in the dependent variable is significantly is computed as follows:

F-test is. used to test the overall significance of the regression model at a given level of statistical significance. It attempts to show whether the movement in the dependent variable is significantly explained or not with the change in all independent variables. F-test statistic is computed as follows:

Null Hypothesis : H_0 : all b's are zero, i.e. no linear relationship exists between dependent and explanatory variables.

Alternative Hypothesis : H_0: all b's are not equal to zero, i.e. there exists linear relationship between dependent and explanatory variables.

The F-test statistic is computed the formula,

$$F = \frac{R^2 (K - 1)}{(1 - R^2) (N - K)}$$

Where,

R^2 = Coefficient of determination

K = Number of Estimated Parameters

N = Number of observations-

When computed F-statistic is greater than tabulated F-statistic at a certain degree of freedom and level of significance the null hypothesis is rejected and we can conclude that there significant linear relationship between dependent variable and the explanatory variables and vice versa.

When computed F- statistic is greater than tabulated F-statistic at a certain degree of freedom and level of significance , the null hypothesis is rejected and we can conclude that there is significant linear relationship between dependent variable and the explanatory variables and vice versa.

3.7 Diagnostic Tests and Other Tests

i) JB Test for Normality

Jarque Bera (JB) Test of Normality is an asymptotic large sample test based on the OLS residuals. The test statistic is defined by :

$$JB = n\left(\frac{S^2}{6} + \frac{(K - 3)^2}{24}\right)$$

Where n = sample size, S = skewness coefficient, K kurtosis coefficient. For a normally distributed variable, S = 0 and K = 3. Therefore, the JB test for normality is a test of joint hypothesis that S and K are 0 and 3 respectively. In that case, the value of the JB statistic is expected to be zero. Under the null hypothesis that the residuals are normally distributed, Jarque and Bera showed that asymptotically the JB statistic

follows the chi-square distribution with 2 degree of freedom. If the computed p-value of the JB statistic is sufficiently low or the value of the statistic itself is very different from zero, the null hypothesis that the residuals are normally distributed is rejected. On the contrary, if the p-value is reasonably high or the value of the statistic is close to zero, the normality hypothesis is not rejected (Gujarati and Sangeetha, 2007).

ii) LM Test for Serial Correlation

In the models which contain lagged values of the regressand, the Durbin-Watson d-statistic is often around 2 implying that there is no first order autocorrelation. Thus, there is a bias against discovering first order autocorrelation in such models. This does not mean that autoregressive models do not suffer from autocorrelation problem. To solve this problem, Durbin has developed Durbin h-test but it is less powerful in statistical sense than the Breusch-Godfrey test popularly known as the LM test for serial correlation. The LM test allows for the lagged values of the regressand, higher order autoregressive scheme and simple or higher order moving averages• of the white noise error term.

The null hypothesis under this test is:

$H_0 : \rho_1 = \rho_2 = \rho_3 = 0$ i.e. there is no serial correlation of any order.

Where u_t follows the p^{th} order autoregressive, AR (p), scheme as follows:

$$u_t = \rho_1 u_{t-1} + \rho_2 u_{t-2} + \ldots\ldots\ldots + \rho_p u_{t-p} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3.7)$$

Test statistic is given by

$$(n - p)R^2 \sim x^{2}{}^{p}$$

Where the R^2 is calculated from the auxiliary regression equation given by

$$u\perp_t = \alpha_0 + \alpha_0\ X_t + \rho\perp_1\ u\perp_{t-1} + \rho\perp_2\ u\perp_{t-2} + \ldots\ldots\ldots + \rho\perp_p\ u\perp_{t-p} + \varepsilon_t$$

Where X_{ti} are explanatory variables

For large sample, this statistics follows the chi-square distribution with p df. If (n-p)R^2 exceeds the chi-square critical value at the chosen level of significance in which

case null hypothesis is rejected that is to say there is the presence of serial correlation of some order (Gujarati and Sangeetha, 2007).

iii) Hetereoscedasticty

When the variance of the unobserved error, *u*, conditional on the explanatory variables, is constant in the OLS is called Homoscedasticity. Homoscedasticity fails whenever the variance of the unobserved factors changes across different segments of the population is called heteroscedaticity.it is arises when there is the segments are determined by the different values of the explanatory variables. For example, in a savings equation, heteroscedasticity is present if the variance of the unobserved factors affecting savings increases with income.

Homoscedasticity is needed to justify the usual *t* tests, *F* tests, and confidence intervals for OLS estimation of the linear regression model, even with large sample sizes. Heteroscedasticity does not cause bias or inconsistency in the OLS estimators of the beta coefficients. Whereas something like omitting an important variable would have this effect. Heteroscedasticity does not affect the goodness of fit – R^2 and adjusted R^2 (Wooldridge, 2012). But in case of presence of the heteroscedasticty there is the problem of incorrect OLS coefficients, estimates will be inefficient etc. The test of the presence of the heteroscedasticty can be deducted by different method but here it is tested by various methods e.g. Park Test, Glejser Test, Breuch-Pagan Godfrey Test etc. Let see Breuch- Pagan Godfery Test in detail: In statistics, the Breusch–Pagan test, developed in 1979 by Trevor Breusch and Adrian Pagan, is used to test for heteroskedasticity in a linear regression model. It was independently suggested with some extension by R. Dennis Cook and Sanford Weisberg in 1983.https://en.wikipedia.org/wiki/Breusch%E2%80%93Pagan_test - cite_note-2 It tests whether the variance of the errors from a regression is dependent on the values of the independent variables. In that case, heteroskedasticity is present. Suppose that following regression model is estimated: $y = \beta_0 + \beta_1 x + u$ and obtain from this fitted model a set of values for $u\Downarrow$, the residuals. Ordinary least squares constrains these so that their mean is 0 and so, given the assumption that their variance does not depend on the independent variables, an estimate of this variance can be obtained from the average of the squared values of the residuals. If the assumption is not held to be true, a simple model might be that the variance is linearly related to independent variable.

$$u^2 = y_0 + y_1 x + v$$

This is the basis of the Breusch–Pagan test. It is a chi-squared test: the test statistic is distributed $n\chi^2$ with *k* degrees of freedom. If the test statistic has a p-value below an appropriate threshold (e.g. $p<0.05$) then the null hypothesis of homoscedasticity is rejected and heteroscedasticity assumed (WikiVisually).

iv) Stability Test: CUSUM Test and CUSUMSQ Test

The CUSUM test was introduced by Brown et al. (1975) for the study of structural change and the original test statistic was constructed based on cumulated sums of recursive residuals. Ploberger and Kramer (1992) extended the CUSUM test to OLS residuals. Nowadays, these tests are widely used in econometrics and statistics, and have become especially popular because they draw attention to structural change and breakpoints in the data (Xiao & Phllips, 2002). The CUSUM test (Brown, Durbin, & Evans, 1975) is based on the cumulative sum of the recursive residuals. This option plots the cumulative sum together with the 5% critical lines. The test finds parameter instability if the cumulative sum goes outside the area between the two critical lines. The CUSUM test is based on the statistic:

$$W_t = \sum_{r=k+1}^{t} w_t / S_t \qquad t = k+1,\ldots\ldots,T$$

Where *w* is the recursive residual defined above, and S is the standard error of the regression fitted to all *T* sample points. If the b vector remains constant from period to period, $E[W_t] = 0$, but if β changes, W_t will tend to diverge from the zero mean value line. The significance of any departure from the zero line is assessed by reference to a pair of 5% significance lines, the distance between which increases with *t*. The 5% significance lines are found by connecting the points:

$$[k, \pm 0.948(T-k)^{1/2}] \quad \text{and} \quad [T, \pm 3*0.948(T-k)^{1/2}]$$

Movement of W_t outside the critical lines is suggestive of coefficient instability The CUSUM of squares test (Brown, Durbin, and Evans, 1975) is based on the test statistic.

$$S_t = \sum_{r=k+1}^{t} wr^2 / \sum_{r=k+1}^{t} wr^2$$

The expected value of *S* under the hypothesis of parameter constancy is $E[S_t] = (t-k)/(T-k)$ which goes from zero at $t=k$ to unity at $t=T$. The significance of the departure of *S* from its expected value is assessed by reference to a pair of parallel straight lines around the expected value. The CUSUM of squares test provides a plot of against *t* and the pair of 5 percent critical lines. As with the CUSUM test, movement outside the critical lines is suggestive of parameter or variance instability.

v) Chow Test

If we use linear regression models to represent an economic relationship, the question often arises as to whether the relationship remains stable in various periods of time or not. Here, the whole study period has been separated into two sub-sample periods viz. 1975-1989 and 1990-2002. The former represents the less liberalized economy and the latter, the liberalized economy. The basis for such separation of the whole period is on the postulation that the liberalization policy started during mid 1980s and intensified at the beginning of 1990s, following the policy changes such as deregulation in interest rates, establishment of joint venture banks, initiation on full convertibility in current account, etc. In this regard, we realized the necessity of stability test to know the effectiveness of liberalization policy. Several statistical tests are available for the stability test of the regression equation and of the parameters. One of the popular methods of testing the stability of the parameters can be performed with the help of Chow-test statistics. The null of the coefficients of two sub-sample periods do not differ significantly is given by;

$H_0: a_1 = a_2$

To test this hypothesis, the calculated F-ratio is given by,

$$F^* = \frac{[\sum e_0^2 - (\sum e_1^2 + \sum e_2^2)]/K}{[\sum e_1^2 + \sum e_2^2]/(n_1 + n_2 - 2K)}$$

Where,

$\sum e_0^2$ = Residual sum of squares of the regression estimates

n = Number of observations

K = Number of estimated parameters

Subscripts 1 and 2 stand for sample 1 and sample 2 periods respectively (Koutsoyiannis, 1977).

vi) Recursive Coefficient Estimates

This traces the evolution of estimates for any coefficient as more and more of the sample data are used in the estimation. It will provide a plot of selected coefficients in the equation for all feasible recursive estimations. If the coefficient displays significant variation as more data is added to the estimating equation, it is a strong indication of instability. Coefficient plots will sometimes show dramatic jumps as the postulated equation tries to digest a structural break. Eviews software program easily estimates such recursive coefficients.

vii) Augmented Dickey-Fuller (ADF)Test

ADF test statistic is used to examine the stationarity of the time series variable. The following regression is run in Augmented Dickey-Fuller (ADF) test to check for unit root of the variables or to check the order of integration:

$$\Delta x_t = \eta + \gamma_t + \alpha x_{t-1} + \sum_{j=1}^{k} \delta_j \Delta x_{t-j} + \varepsilon_{1t} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3.13)$$

Where x_t is any variable used in this study, that is, ln m_{1t}, ln m_{2t}, ln y_t,r_{sdt}, and r_{fdt}, Δ indicates the first difference operator and k is the length of lag which ensures residuals to have white noise empirically. The ADF statistic is simply the t-value of the coefficient α in equation (13). The null hypothesis is that x has a unit root, that is, H_0: $\alpha = 0$ and is rejected if the calculated ADF statistic is above the critical value implying that x_t has no unit root or x is stationary (Gujarati and Sangeetha, 2007).

3.8 Financial Liberalization in Nepal

The financial liberalization process in Nepal started in 1984. Since then, various liberalization measures have been implemented in order to widen and deepen the financial system. Some policy instruments were aimed at increasing the competition and efficiency in the financial market, which included removal of entry barriers to commercial banks, finance companies and development banks, and restructuring of two state- owned banks. In order to improve the efficiency of money and capital markets, measures such as auctioning of Treasury Bills and floor trading of securities were introduced. The policy instruments such as interest rate deregulation, reduction in reserve requirement and change in the monetary policy stance from direct to indirect were implemented. Similarly, introduction of prudential norms, establishment of Credit Information Bureau, revision of Nepal Rastra Bank Act, and enactment of Debt Recovery Act were aimed at ensuring the integrity of banks and maintenance of the stability of the financial system of Nepal. All of these policy instruments were expected to complement each other in achieving the overall objectives of competition and efficiency, smooth functioning of money and capital markets, and attainment of stability in the financial sector of Nepal. These policy measures are discussed below.

- **Removal of Entry Barriers (1984)**

financial liberalization in Nepal started evidently with the removal of entry barriers in the banking system. Until 1984, only two government-owned commercial banks operating in the market. With the objective of promoting healthy competition among banks, the commercial Bank Act 1974 was amended in 1984, which removed the entry barriers to the private sector in the commercial banking industry. This was done mainly to attract private joint venture banks would bring in much foreign collaboration with the hope that such banks would bring in much needed foreign capital and technical know-how, infuse modern banking skills to the domestic banks, and, widen as well as deepen the national financial structure (Acharya et al. 1998). Following the amendment of the Act , joint venture banks started to enter the financial system. In 1985, the Finance Companies Act was enacted in order to allow finance companies to enter the financial system. This was done with the objective of serving small borrowers and meeting the demand for consumer credit. The Act was amended

in 1992. Following this amendment, there has been a very fast growth in the establishment of finance companies.

- **Deregulation of Interest Rate (1984)**

Interest rate deregulation started in November 1984 with partial freedom provided to the commercial banks to fix the interest rates from 1.0 percentage points to 1.5 percentage points above the minimum administered rates for different types of term deposits. In May 1986, this range was eliminated, allowing the banks to offer higher interest rates to any level above the fixed minimum level. In August 1989, the interest rate to any level above the fixed minimum level. Since then, commercial banks and financial institutions are free to set both the deposits and loans rates. The objective of interest rate deregulation was to let the market decide the true cost of capital, keep real deposit rates positive, thereby, stimulating savings and creating a competitive environment in the financial system so as to benefit both the depositors and borrowers (Khatiwada 1999).

- **Reforms in Treasury Bills Issuance (1988)**

Treasury bills carried a coupon rate, which used to be generally low. Commercial banks were not interested in investing in such low yielding bills. As a result, Nepal Rastra Bank used to hold a large chunk of treasury bills, exacerbating the excess liquidity in the economy (Khatiwada, 1999). To rectify this anomaly, NRB commenced auctioning of treasury bills since November 1988. Initially, the acutioning was done on a monthly basis. As the market matured, auctioning frequency was increased to every fortnight, and then to weekly from December 1991 (Acharya et al. 1998). After the introduction of auctioning, commercial banks began to hold increasing shares of such bills.

- **Introduction of Prudential Norms (1988)**

With the objective of helping in the sustainable development of the financial sector through creating a healthy banking environment, a set of prudential norms was introduced in 1988. Such norms put in place by NRB included capital adequacy requirement, loan classification, loan loss provisioning, interest income recognition, single borrower limit, and account disclosure norms. Most of these norms were

revised in 1991. The requirements, ratios, limits, types, and formats set in these norms have been changed from time to time.

Commercial banks initially were directed to classify their loans into four categories namely pass, substandard, doubtful, and loss. After the re-categorization of loans in 1991, the banks were required to classify their loans into six categories based on the overdue period. Since 2002, the loans are categories again into four categories, viz, pass, substandard, doubtful, and loss. Along with the introduction of loan classification norms, commercial and development banks were directed to set aside certain funds as loans loss provisioning.

- **Establishment of Credit Information Bureau (1989)**

With a view to check the possible fraud and irregularities in banking transactions, the Credit Information Bureau was established in 1989. Every commercial bank has to supply necessary credit information to the Bureau and the Bureau in turn supplies credit information to all other banks. On the basis of credit information received from the banks, the Bureau prepares a defaulters list and a black list.

- **Shift in Monetary policy Stance (1989)**

The way monetary policy is conducted has a direct impact on the financial sector. After the full liberalization of the interest rate and elimination of credit ceilings, the monetary policy stance has been changed from direct to indirect. Under the indirect monetary policy stance, there is no direct control on the price or interest as well as on the volume of loans of commercial banks. Market behavior is aligned through the use of indirect monetary policy instruments such as bank rate, cash reserve requirement, and open market operations.

- **Reform in Capital Market (1992)**

The Securities Marketing Centre was established in 1977 with the objective of developing markets for the government securities. In 1984, it was converted into the Security Exchange Centre. The reform in capital market started with the amendment in the Security Exchange Act in 1992.

- **Reduction in the Reserve Requirement (1993)**

The banks were required to meet the high reserve requirement in the form of the cash reserve ratio (CRR) introduced in 1966 and statutory liquidity ratio (SLR) introduced in 1974. CRR was imposed for monetary control and prudential norms, whereas SLR was imposed to provide a captive market for government securities. The SLR was completely abolished in August 1993. After the complete liberalization of the interest rate in 1989, the CRR however, was revised upward from 9 percent to 12% of the domestic deposits.

- **Introduction of Floor Trading of Securities (1994)**

In January 1994, floor trading of the stocks was introduced under the Nepal Stock Exchange Centre. Due to this new arrangement, trading in stocks started to boom, and the number of listed companies as well as the market capitalization increased gradually.

- **Enactment of Development Bank Act (1996)**

Nepal Industrial Development Corporation, established in 1959, and the Agricultural Development Bank established in 1968 were the two development banks operating in the market to meet the long term credits. To allow new development banks in the market, the Development Bank Act was enacted in 1996. Till 2016, 87 development banks are functioning in Nepal.

- **Revision of Nepal Rastra Bank Act (2001)**

Thee Nepal Rastra Bank Act 1955 was revised in 2001. This act has made NRB an autonomous institution. It is expected that the revised Act will serve the requirements of a modern central bank as part of the government's overall financial sector development and modernization program (Pyakuryal 2002)

- **Restructuring the Government Owned Commercial Banks (2002)**

The financial health of Rastriya Banijya Bank and Nepal Bank Limited was reported to be gradually deteriorating for quite some time. To improve the financial health of these two banks, the restructuring process started with the technical and financial

assistance of the World Bank. In this process, NRB has handed over the management of Nepal Bank Limited to the ICC Consulting Group of Scotland in July 2002. Another professional group- Deloitte Touche Tohmatsu was selected for managing Rastriya Banijya Bank hired Mr. Burce F. Henderson, an American bank professional, as the Chief Executive Officer of Rastra Banijya Bank in December 2002. Under the new management, restructuring activities are being carried out in these banks (Nepal Rastra Bank 2003).

3.8.1 Construction of Financial Liberalization Index

We construct the FLI in order to study the level of FL process over the time in Nepal. FL is a process that includes various changes, amendments on existing policies and introduction of some new policies as per the requirements to support the liberal economy in the nation, and these efforts have been considered. FLI is constructed including major components following the method proposed by Bandiera, Caprio et al. (2000) and Shrestha (2005).

This study uses 8 major policy components of financial liberalization to construct the FLI for Nepal which are as follows:

a. Interest Rate Deregulation (IRD)
b. Removal of Entry Barriers (REB)
c. Reduction in Reserve Requirement (RRR)
d. Easing in Credit Control (ECC)
e. Implementation of Prudential Rules (IPR)
f. Stock Market Reform (SMR)
g. Privatization of State-owned Banks (PSB)
h. External Account Liberalization (EAL)

Financial liberalization is a process that involves the implementation of a number of policies. In order to show the degree or the level of financial liberalization at a particular time, a Financial Liberalization Index (FLI) for Nepal is constructed based on Principal Component Method following Bandiera, Capiro et al. (2000), Laeven (2003) and Shrestha (2005).

Bandiera, Capiro et al. (2000) construct a financial liberalization index for eight developing countries by including eight main components of financial liberalization in their index, which are (1) interest rates, (2) procompetition measures, (3) reserve requirements, (4) directed credit, (5) banks' ownership, (6) prudential regulation, (7) stock markets, and (8) international financial liberalization. Laeven (2003) constructs a similar index for 13 developing countries. He includes six measures of financial liberalization but excludes the measures related to stock markets and external sector in his index. Previously, Dematriades and Luintel (1997) constructed a financial repression index for India using the Principal Components Method. They included nine different repressionist policies in their index. Following the same method, Laurenceson and Chai (2003) construct a similar financial repression index for China.

Similarly, Paudel (2009) has used 13 major policy components including Interest Rate Derugulation, Stock Market Reform, among others, to construct FLI for Srilanka following the method proposed by Bandiera, Capiro et. al (2000), Laeven (2003), Shrestha (2005) and has used the FLI to know the impact of Financial Liberalization on Money Demand in Srilanka.

In this study, eight major policy components of financial liberalization have been used to construct the financial liberalization index for Nepal. The policy components include (1) Interest Rate Deregulation, (2) Removal of Entry Barriers, (3) Reduction in Reserve Requirement, (4) Easing in Credit Controls, (5) Introduction of Prudential Regulations, (6) Stock Market Reform, (7) Privatization of State Owned Banks, and (8) External Account Liberalization.

The description of the policy variables and their implementation data are presented below:

IRD (Interest Rate Deregulation)- Interest rate deregulation with ceilings in 1984, ceilings removed in 1986, and completely deregulated in 1989.

REB (Removal of Entry Barriers) – 1984

RRR (Reduction in Reserve Requirements) -1993

ECC (Easing in Credit Controls)- 1991. Some control still exists, as commercial banks are required to channel certain portions of their loan portfolio to a productive sector and rural sector.

IPR (Implementation of Prudential Rules)- A set of prudential rules implemented in 1998. But the Central Bank became independent only in 2001.

SMR (Stock Market Reform)- Floor trading of stocks started in 1994.

PSB (Privatisation of State- Owned Banks)- At the initial phase, the managements of two ailing state-owned banks were given to foreign parties on contract in August 2002; and it has been planned to privatise the ownership of these banks after their financial health becomes better under the new management.

EAL(External Account Liberalization) The current account became fully convertible in 1993, but the capital account by and large still remains inconvertible.

In order to construct the Financial Liberalization Index (FLI), some arbitrary value is assigned to each of the selected policy components. If a sector is fully liberalized in a single phase, the value assigned in this case is 1, and if regulated it is assigned as 0. But if it is fully liberalized in two phases, then 0.5 is assigned for the first phase and 1 for the second. Similarly if the liberalization takes place in three phases, then the number assigned is 0.33, 0.66 and 1 for first second and third phase respectively (Appendix c). On the basis of financial liberalization policy variables shown in Appendix c, the financial liberalization index for Nepal is derived. To this end, the weight of each of the components is calculated by employing the Principal Component Analysis method.

CHAPTER IV
ANALYSIS OF DATA

In this chapter, general money demand function is estimated to find out income and interest elasticity. Ordinary Least Square method has been applied to know the relationship between the variables. Moreover, the result of ADF test to test the order of integration of the variables. And the result of CUSUM and CUSUMSQ test to show the stability of the model are presented in this chapter. Besides it, the financial liberalization index has been developed on the basis of the explanation of section 3.8.1.

4.1 Time Series properties of the Variables

Augmented Dickey- Fuller (ADF) unit-root test has been applied to test the order of integration of the variables. Before conducting the ADF test, an attempt is made on whether to include the trend as a variable in the ADF regression or not. To confirm this, the time series plot of the variables has been presented in Fig. 4.1, Fig. 4.2 and Fig. 4.3.

The time series plot in Fig 1 shows that ln m_{1t}, ln m_{2t} and ln y_t are trended variables. So, a trend is included in the ADF test for them. On the other hand, r_{sdt}, r_{fdt} have no trend as such intercept only is included while testing their order of integration. Similarly, FLI is a trended variable, so a trend is included in the ADF test.

Fig. 4.1

Time series plot of ln m_{1t},ln m_{2t} and ln y_t

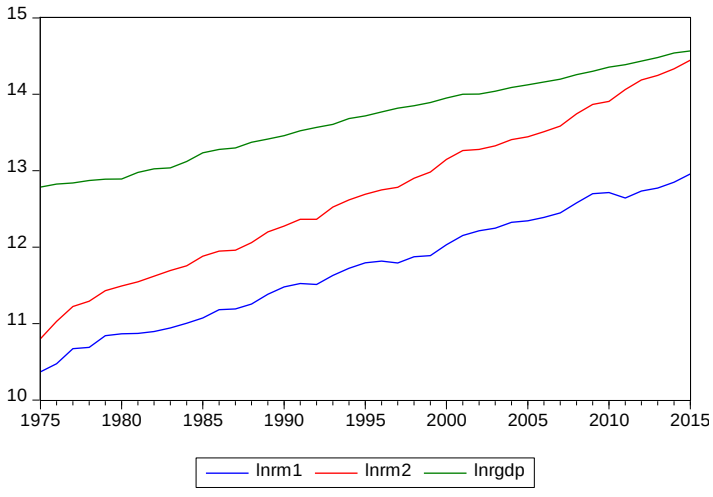


Fig.4. 2

Time series plot of r_{sdt} and r_{fdt}

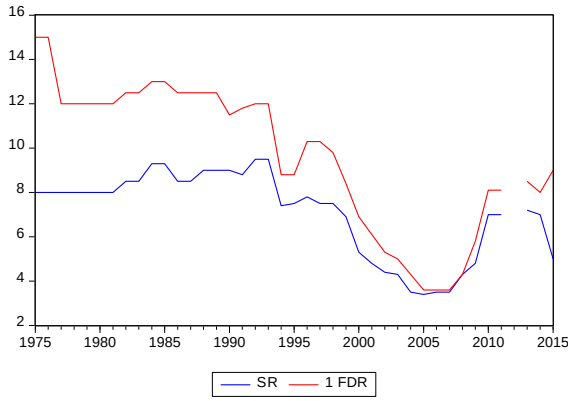


Fig. 4.3

Time series plot of FLI

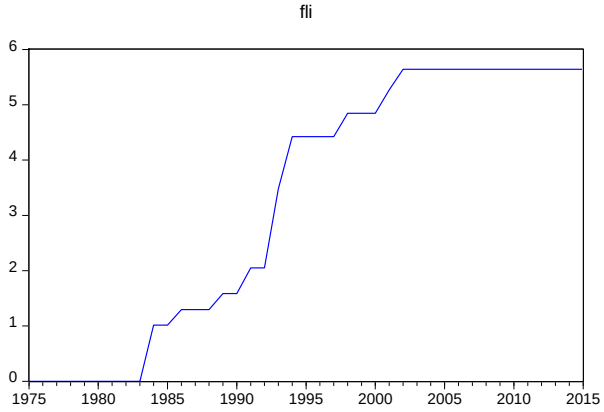


Table 4.1 presents the results of the ADF test.

Table 4.1

ADF Test Results

Variable	**Level**		**First Difference**		**Remark**
	Intercept	Intercept and Trend	Intercept	Intercept and Trend	
ln m1	-0.9225 [0.7707]	-4.768 [0.0023]	-5.3617*** [0.0001]	-5.1638*** [0.0008]	I(1)
ln m2	-0.8564 [0.7916]	-4.3005 [0.0078]	-6.1117*** [0.0000]	-5.9823*** [0.0001]	I(1)
ln y_t	-0.4268 [0.8943]	-1.2706 [0.8801]	-6.0589*** [0.0000]	-5.8366*** [0.0001]	I(1)
r_{sdt}	-0.9632 [0.7564]	-1.8971 [0.6364]	-4.2257*** [0.0021]	-4.1595** [0.0120]	I(1)
r_{fdt}	-1.7875 [0.3805]	-1.2878 [0.8750]	-4.5781*** [0.0008]	-4.7666*** [0.0026]	I(1)
FLI	-0.9460 0.7629	-0.7863 [0.9585]	-5.1157*** [0.0001]	-5.1418*** [0.0008]	I(1)

Note: Asterisk **and *** show 5% and 1% level of significance respectively , and numeric value between [….] express corresponding p- values.

From the results of table 4.1, it becomes clear that none of the variables are integrated of higher than order one. All the variables are integrated of order one.

From the above ADF test result, it is clearly expressed that the null hypothesis of the variables ln m_1, ln m_2, ln y_t, r_{sdt}, r_{fdt} and FLI are rejecting at the significance levels. The variable ln m_1 and ln m_2 ,ln y_t, r_{sdt}, r_{fdt} and FLI rejecting the null hypothesis at first difference. Since the variables are stationary at I(1), it is prudent to employ the Engle Granger cointegration test. However, in order to employ the Granger cointegration, the residuals obtained from the estimated model of OLS must be stationary.

The test of Granger cointegration is shown in table 4.2. This is two step procedures. At first regression equation is estimated and residual is derived. In the second step, residual is tested for stationarity. If the residuals are stationary, the variables are cointegrated and if the variables are cointegrated, then can go for error correction mechanism. Cointegration test is reported in Table 4.2.

Table 4.2

Granger Cointegration Test

Dependent Variable	ADF Test for Residual at lags	
	1	2
lnrm1	-2.7936	-2.6148
lnrm2	-2.7324	-2.5207

Table 4.2 shows that the residuals are not stationary in case of both monetary aggregates . The unit root test of residuals at level form with intercept at lag 1 and lag 2 have a unit root i.e., they are not stationary. This shows that the variables are not cointegrated in the long run or there is no long run equilibrium relationship among the variables. Since there is no any evidence of cointegration between the variables, we can not go for ECM in Granger test.

Before estimating the narrow and broad money demand function incorporating FLI as another explanatory variable along with real GDP and interest rate, it is must to compute the financial liberalization index prior to estimate the given model of equation (3.2) and (3.3).

On the basis of section 3.8.1, the composition of the FLI can be expressed in the following equation:

$$FLI_t = w_1IRD_t + w_2REB_t + w_3RRR_t + w_4ECC_t + w_5IPR_t + w_6SMR_t + w_7PSB_t + w_8EAL_t \quad \ldots\ldots\ldots\ldots (4.1)$$

Where, FLI_t = Financial Liberalization Index at respective year

W_i = weight of the component given by the respective Eigenvector of the selected component. The Eigenvalues and Eigenvectors of the correlation matrix of financial liberalization policy variables are shown below:

Table 4.3

Eigenvalues of the Correlation Matrix of the Policy variables:

	F1	F2	F3	F4	F5	F6	F7
Eigenvalue	6.123	1.011	0.563	0.139	0.073	0.052	0.038
Variability (%)	76.532	12.641	7.039	1.738	0.918	0.651	0.480
Cumulative %	76.532	89.173	96.213	97.951	98.869	99.520	100.000

Table 4.4

Eigenvectors of the Correlation Matrix of the Policy Variables

	F1	F2	F3	F4	F5	F6	F7
IRD	0.347	0.448	0.239	0.175	0.076	0.101	0.758
REB	0.296	0.559	0.462	-0.326	-0.072	-0.078	-0.518
RRR	0.386	-0.031	-0.356	-0.168	-0.282	-0.334	0.065
ECC	0.375	0.129	-0.234	0.785	0.147	0.076	-0.380
IPR	0.341	-0.437	0.303	-0.079	0.659	-0.401	0.012
SMR	0.380	-0.103	-0.292	-0.397	0.264	0.728	-0.052
PSB	0.303	-0.516	0.494	0.163	-0.552	0.255	-0.007
EAL	0.386	-0.031	-0.356	-0.168	-0.282	-0.334	0.065

Taking the first principal component (F1) which accounts for 76.5 % of the total variance in the eight policy variables and substituting the respective eigenvalues for w_i's in equation (4.1),

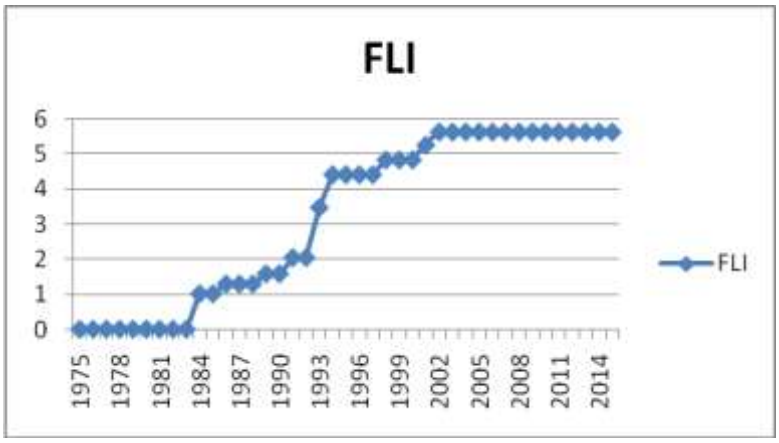
$$FLI_t = 0.347*IRD_t + 0.296*REB_t + 0.386*RRR_t + 0.375*ECC_t + 0.341*IPR_t + 0.380*SMR_t + 0.303*PSB_t + 0.386*EAL_t \quad \ldots\ldots.(4.2)$$

The index for the individual components of the financial liberalization policy is calculated by substituting the value of IRD, REB,RRR,ECC,IPR,SMR,PSB and EAL in equation (4.2) [see Appendix D]. The index of financial liberalization for each year is calculated by adding the calculated value of all elements of the policy variable for the year concerned [see Appendix D].

The following figure shows the figure of the financial liberalization index (FLI) on the basis of Appendix D:

Fig. 4.4

Financial Liberalization Index for Nepal



The above figure reveals that the decade of 1984 to 2002 was the main period of the implementation of financial liberalization measure in Nepal. Speculating the trend of FLI from the above figure, it can be concluded that the liberalization process begins from 1984 and it gets momentum in 1987. From this fact, there is no doubt that the financial liberalization in Nepal gets the momentum when the Bretton Woods institutions WB and IMF makes the attempt in the member developing countries to adopt the Stabilization program and Structural Adjustment Policy in 1986. The index is initially constant, it moves in upward trend and again constant from 2002 till 2015. It also shows that there is a **Structural Break** in the policy implemented by NRB. However it should not be concluded that NRB has done nothing in the financial sector since 2002. It is so because it only considers the major policy changes made by NRB and Nepal government in the area of financial sector. Besides it, most of the past studies considered only full liberalization level or non liberalization. But it will misguide when evaluating the impact of financial liberalization on macroeconomic aggregates. Therefore, this study has presented the real picture of financial liberalization process in Nepal. This index would make it easy to further studies on financial liberalization in Nepal.

4.2 OLS Estimation at Level

On the basis of Appendix E and Appendix G, the estimated coefficient under the ordinary least square method for both monetary aggregates are presented in table 4.5 below:

Table 4.5

OLS Estimation Result

Independent Variables	Dependent Variables			
	Narrow Monetary Aggregate		Broad Monetary Aggregate	
	lnm1	T ratio[Prob]	lnm2	T ratio[prob]
ln y_t	0.5752	3.6997[0.0008]***	0.6154	3.1351[0.0035]***
r_{sdt}	-0.01	-2.5749[0.0146]**		
r_{fdt}			-0.0032	-0.6325[0.5313]
lnm1(-1)	0.5486	5.7797[0.0000]		
lnm2(-1)			0.6991	7.8304[0.0000]
FLI	-0.0176	-1.29151[0.2052]	-0.0248	-1.4708[0.1506]
C	-2.7835	-2.7023[0.0107]**	-4.4233	-2.8404[0.0076]***

The Astirick *** and ** shows the 1 percent and 5 percent level of significance .

The estimated long run narrow and broad money demand function can be written as follows:

$$lnm_{1t} = -2.7835^{**} + 0.5752^{***} lny_t - 0.01^{**} r_{sdt} - 0.017FLI \ldots\ldots (4.3)$$

$$lnm_{2t} = -4.4233^{***} + 0.6154^{***} lny_t - 0.0032\, r_{fdt} - 0.0176FLI \ldots.. (4.4)$$

From the above table 4.5 and 4.6, it is shown that the income elasticity coefficient bears the correct positive sign which are statistically significant at 1 percent level of significance in case of both monetary aggregates. As shown in table, 1 percent increase in income leads to 0.57 percent increase in demand for narrow money balances and 0.62 percent increase in the demand for broad money balances. Similarly, though the intrest rate elasticity coefficient bears the correct negative sign in case of both monetary aggregates, they are found insignificant in case of broad monetary aggregates. This implies the underdeveloped capital market in Nepal. The coefficient of the financial liberalization index is also found insigniciant in case of both monetary aggregates implies the financial liberalization in Nepal have not profound effect on the money demand function in Nepal. In order to avoid the presence the autocorrelation in the model, one lag of dependent variable is taken as an explanator variable in the model. Similarly, the demand for money of the previous

period have positively effected the demand for money of the current year period as show by the coefficient of lnm1(-1) and lnm2(-1). The constant term in case of both moentary aggregates is negative which is statistically significant implies there are also the other factors which have affected the demand for money negatively.

4.3 Diagnostic Test

The diagnostic test of the overall model of both monetary aggregates are explained below on the basis of appendix F and H are summarized in table 4.6 below:

Table 4.6

Diagnostic Test Result

Diagnostic Tests	**Narrow Money Demand**	**Broad Money Demand**
R-squared	0.9963	0.9980
Adjusted R- squared	0.9958	0.9978
F- statistics	2268.225[p-value 0.0000]	4219.45[p-value 0.0000]
AIC value(least among 20 models)	-3.2018	-3.2218
D-W test	1.9831	1.6797
χ^2 (Autocorrelation)	0.7780	0.6360 (p-value)
χ^2 (Normality)/JB test	0.6834(p-value 0.7107)	0.4088 (p-value)
χ^2 (Heteroscedasticity)/ BP test	0.9365 (p- value)	0.3458 (p-value)

The above both model diagnostic result show that overall both models are good because the F statistics is statistically significant at less than 1 percent level of significance. R-squared is more than 99 percent for both models and the adjusted R squared are also more than 99 percent in both models. For the efficient estimation, model should be free from serial correlation. Basically the serial correlation of LM test shows that the condition of the acceptance of the null hypothesis means these models are free from serial correlation.

4.4 Short Run Dynamics of the Model

The short run relationship between the variables by taking first difference of the variables are shown in following table:

Table 4.7

Short Run Coefficients of the Model

Independent Variables	Dependent Variables			
	Narrow Monetary Aggregate		Broad Monetary Aggregate	
	Δlnm1	T ratio[Prob]	Δlnm2	T ratio[prob]
$\Delta \ln y_t$	-0.15725	-0.3949[0.6953]	0.1195	0.3163[0.7537]
Δr_{sdt}	-0.0171	-1.4008[0.1703]		
Δr_{fdt}			-0.00983	-1.1533[0.2568]
ΔFLI	0.06514	3.3356[0.2292]	0.0107	0.4003[0.6915]

The short run dynamics of the model shows that all the variables such as $\ln y_t$, r_{sdt}, r_{fdt}, and FLI are found insignificant in case of both monetary aggregates in the short run.

4.5 Chow Breakpoint Test

The Chow break point test is performed to identify the structural change by taking 1990 as a break point. Two test statistics are reported for the Chow Breakpoint test: F-statistics and Log Likelihood Ratio statistics. The following table gives the F-statitstics and Log Likehood Ratio statistics of both monetary aggregates.

Table 4.8

Chow Breakpoint Test Result

Chow Breakpoint Test	F-statistics	Log Likelihood ratio
lnm1	0.2322 (p-value 0.9453)	1.5309 (0.9095)
lnm2	3.5958 (p-value 0.0119)	18.8139 (0.0021)

The Chow breakpoint test shows that the null hypothesis of no structural break for narrow money demand taking 1990 as a break point can not be rejected, since F-statistics and Log Likelihood ratio are statistically insignificant. Similarly, the Chow breakpoint test for broad monetary aggregate shows that the null hypothesis of no structural break for broad money demand taking 1990 as a break point has been rejected, since F-statistics is statistically significant in 5 percent level of significance and Log-Likelihood Ratio test is statistically significant at 1 percent level of significance.

4.6 CUSUM and CUSUMSQ Tests

The CUSUM and CUSUMSQ tests as proposed by Brown, Durbin and Evans (1975) have been applied. Specially the CUSUM test makes use of the cumulative sum of recursive residuals based on the first set of n observations and is updated recursively and plotted against break points. If the plot of CUSUM statistics stays within the critical bounds of 5 percent significance level represented by a pair of straight lines drawn at the 5 percent level of significance whose equations are given in Brown, Durbin, and Evans (1975), the null hypothesis of coefficient constancy can be rejected at the 5 percent level of significance. A similar procedure is used to carry out the CUSUMSQ test, which is based on the squared recursive residuals. Figure 4.5 and figure 4.6, and figure 4.7 and figure 4.8 show the graphical representation of the CUSUM and CUSUMQ plots applied to the money demand models selected by the SBC criterion.

Fig . 4.5

Plot of CUSUM statistics (M1 Aggregate)

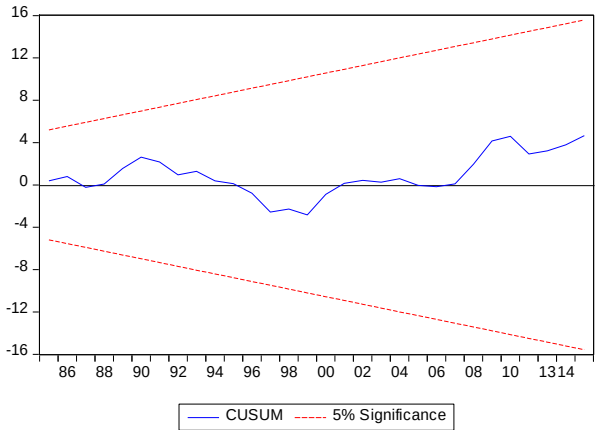


Fig. 4.6

Plot of CUSUMSQ statistics (M1 Aggregate)

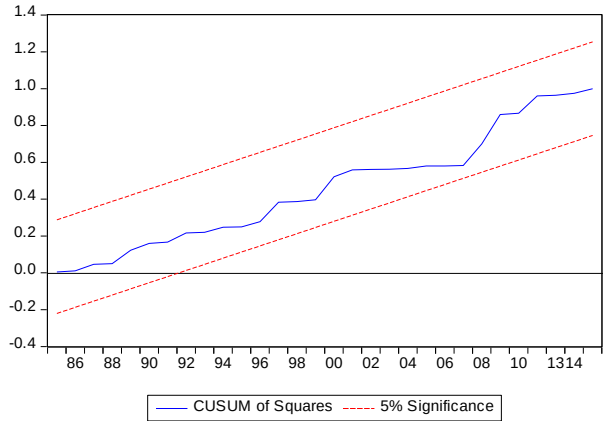


Fig. 4.7

Plot of CUSUM statistics (M2 Agggregate)

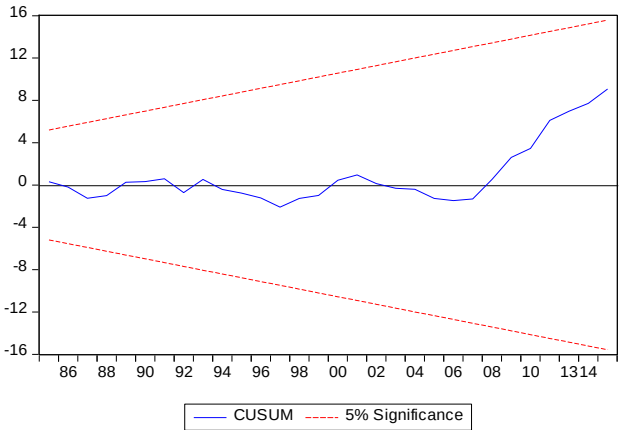
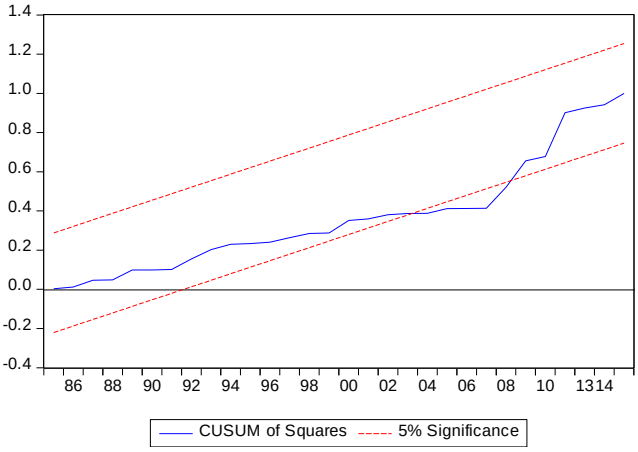


Fig. 4.8

Plot of CUSUMSQ statistics (M2 Aggregate)



Neither CUSUM nor CUSUMSQ plot cross the critical bounds, in case of narrow money demand indicating no evidence of any significant structural instability. However, the plot of CUSUMSQ statistics for M_1 crosses the critical value line indicating some instability in broad monetary aggregate. However, since it is returning back towards the critical bands, the deviation is only transitory. This may be impact of global financial crisis, resulting in liquidity shortage. However, this finding could be an indication of the fact that M_1 is a better monetary aggregate in terms of formulating monetary policy and central banks control.

4.7 Recursive Coefficient Estimates

This enables us to trace the evolution of estimates for any coefficients as more and more of the sample data are used in the estimation. If the coefficient displays significant variation as more data is added to the estimating equation, it is strong indication of instability. The following figures show the movement coefficient over time with increase in sample data.

As seen in the graphs below, since all the coefficients lies within the critical bound as more and more sample are added, there is no indication of instability.

Fig 4.9

Recursive Coefficients Estimate for Narrow Money Demand

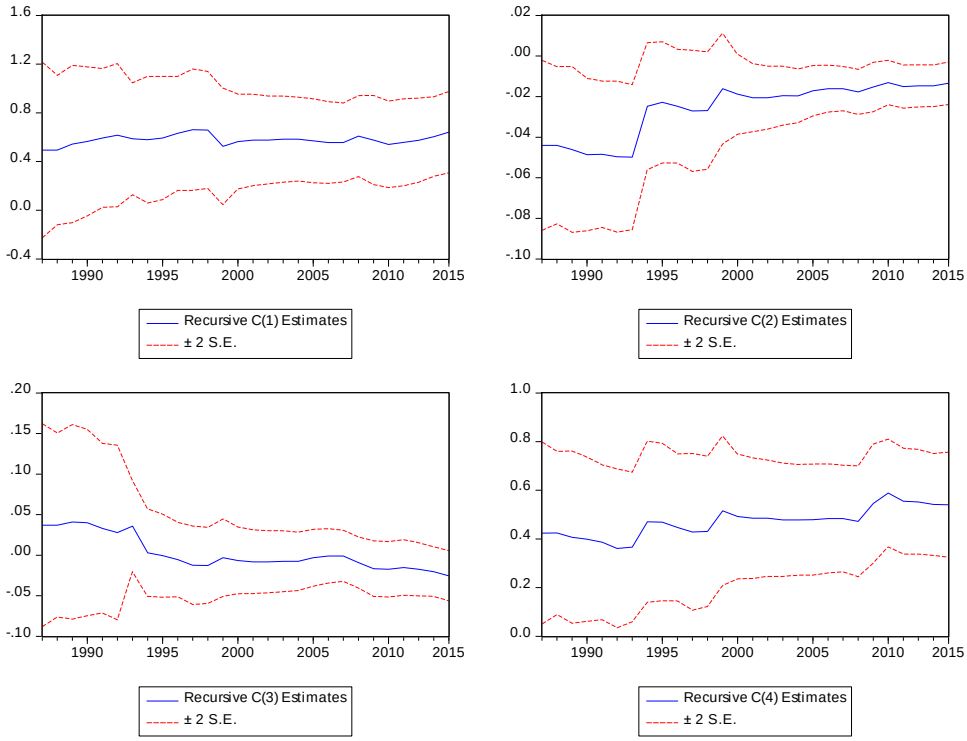
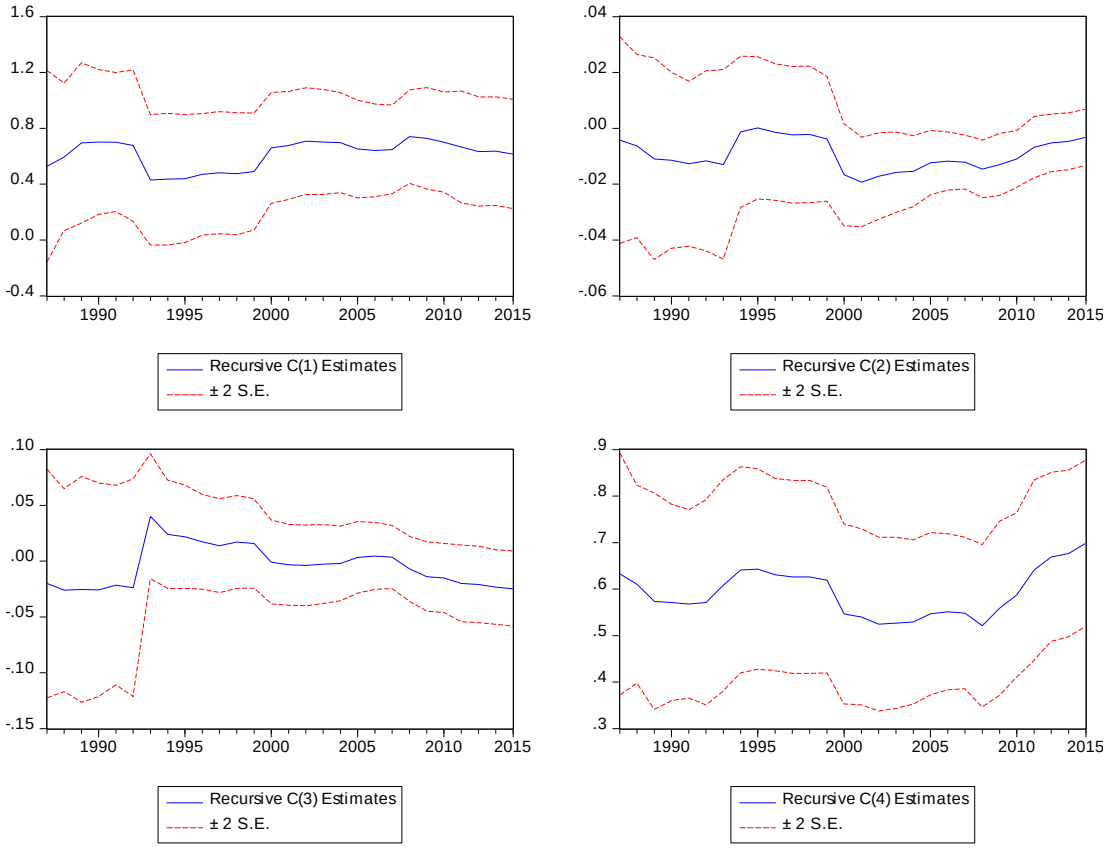


Fig 4.10

Recursive Coefficient Estimates for Broad Money Demand Function



CHAPTER V
FINDINGS, CONCLUSION AND RECOMMENDATION

A stable money demand function is generally considered essential for the formulation and conduct of efficient monetary policy. However, in the mid 1980's, Nepal embarked on far reaching financial reforms in order to exchange the efficiency of the financial sector and to promote the development of the economy as a whole. In the process, the Nepalese financial sector has observed a substantial expansion both in number of financial institutions and in financial assets in comparison to that of the 1980's. The financial liberalization and the resultant increase in the number of FIs and the new financial instruments may have been the forces that might have caused the instability in money demand and thus rendered the monetary policy ineffective. In this light, the present study aims to investigate the stability of money demand in Nepal.

5.1 Major Findings and Conclusions

The major findings and conclusion from this study are:

1. The most significant determinant for both narrow and broad money demand function in case of Nepal is the scale variable or the real GDP as shown by the correct sign of long run income elasticity which is highly significant in both cases.

2. In the long run, the rate of interest on saving deposit is found statistically significant in case of narrow monetary aggregate and the interest rate on 1 year fixed deposit is found insignificant in case of broad monetary aggregate. This implies the underdeveloped capital market in Nepal. This supports the view of Pandey (1998) that due to the financial assets consists a negligible part in the asset portfolio in Nepal, saving are mostly held in the form of physical assets and thus the interest rate has a poor performance in modeling the demand for money.

3. The income elasticity in case of narrow money demand is 0.5752 and in case of broad money demand is 0.6154. Since the income elasticity is less than unity in both cases, money balances not appear to be a luxury in Nepal. This

supports the view of Gaudel (2003). It also supports the approach of Baumol and Tobin implying that there is a significant economy of scale in holding money balances.

4. The coefficient of financial liberalization is found insignificant in case of both monetary aggregates in the short run and long run. It implies that the financial liberalization has not much impact on the demand function in case of Nepal.

5. Neither CUSUM nor CUSUMSQ plot cross the critical bounds, in case of narrow money demand indicating no evidence of any significant structural instability. However, the plot of CUSUMSQ statistics for M_2 crosses the critical value line indicating some instability in narrow monetary aggregate. However, since it is returning back towards the critical bands, the deviation is only transitory. However, this finding could be an indication of the fact that M_1 is a better monetary aggregate in terms of formulating monetary policy and central banks control.

6. Since the coefficient of constant is negative and significant for both monetary aggregates, it can be concluded that there are other important explanatory variables except GDP, r and fli which have negatively affected the money demand.

5.2 Recommendations

On the basis of these conclusion, following recommendations are put forward:

1. Since the money demand function in case of broad monetary aggregate is unstable despite it is transitory and the narrow monetary aggregate is stable in parameter, the Central Bank of Nepal should focus on narrow monetary aggregate rather than on broad monetary aggregate as a policy in achieving the major macro economic policy goals.

2. Since the interest rate is insignificant in case of broad monetary aggregate, it implies the under developed capital market. So Nepal should focus on the development of capital market to make the interest rate as an effective opportunity cost variable for the broad money demand function.

3. Financial liberalization has not made enough financial innovation to bring about the changes in money demand function. However, the experience of other countries shows that money demand function can gradually become unstable with the development of financial sector. This implies that this sector still has scope to move forward. So NRB should closely monitor the development of financial sector.

APPENDICES

Appendix A

Raw Data

Rs. in millions

Year	M1	M2	ncpi	GDP*	gdp deflator	r_{sdt}	r_{fdt}	rgdp
1975	1337.7	2064.4	4.2	16601	11.41	8	15	145495.2
1976	1452.5	2524	4.1	17394	11.47	8	15	151647.8
1977	1852.9	3223	4.3	17280	11.07	8	12	156097.6
1978	2060.6	3772.1	4.7	19727	12.1	8	12	163033.1
1979	2504.9	4511.4	4.9	26128	13.31	8	12	196303.5
1980	2830.4	5285.3	5.4	23351	14.32	8	12	163065.6
1981	3207.8	6307.7	6.1	27307	15.46	8	12	176630
1982	3611.5	7458	6.7	30988	16.9	8.5	12.5	183360.9
1983	4348.9	9222.4	7.7	33821	18.98	8.5	12.5	178192.8
1984	4931.5	10455.2	8.2	39290	20.19	9.3	13	194601.3
1985	5480	12296.6	8.5	46587	22.5	9.3	13	207053.3
1986	7029.3	15159	9.8	55734	25.74	8.5	12.5	216526.8
1987	8120.2	17498.2	11.2	63864	29	8.5	12.5	220220.7
1988	9596.6	21422.6	12.4	76906	32.43	9	12.5	237144.6
1989	11775.4	26605.1	13.4	89270	36.08	9	12.5	247422.4
1990	14223	31552.4	14.7	103416	39.95	9	11.5	258863.6
1991	16283.6	37712.5	16.1	120370	44.96	8.8	11.8	267726.9
1992	19457.7	45670.5	19.5	149487	53.27	9.5	12	280621.4
1993	23833	58322.5	21.2	171474	59.01	9.5	12	290584.6
1994	28510.4	69777.1	23.1	199272	61.86	7.4	8.8	322133.9
1995	32985.4	80984.7	24.9	219175	65.75	7.5	8.8	333346
1996	36498	92652.2	26.9	248913	70.9	7.8	10.3	351076.2
1997	38460.3	103720.6	29.1	280513	76.06	7.5	10.3	368804.9
1998	45163.8	126462.6	31.5	300845	79.18	7.5	9.8	379950.7
1999	51062.5	152800.2	35.1	342036	86.22	6.9	8.4	396701.5
2000	60979.7	186120.8	36.3	379488	90.08	5.3	6.9	421278.9
2001	70577	214454.2	37.2	441518.5	100	4.8	6.1	441518.5

2002	77156.2	223988.3	38.3	459422.6	103.93	4.4	5.3	442050
2003	83754.1	245911.2	40.1	492230.8	107.13	4.3	5	459470.5
2004	93973.7	277310.1	41.7	536749.1	111.59	3.5	4.3	481001.1
2005	100205.8	300440	43.6	589411.7	118.42	3.4	3.6	497729.9
2006	113060.8	346824.1	47.1	654084.1	127.13	3.5	3.6	514500.2
2007	126888	395518.2	49.8	727827	136.8	3.5	3.6	532037.3
2008	154343.9	495377.1	53.2	815658.2	144.49	4.3	4.3	564508.4
2009	196459.4	630521.2	59.9	988272	167.47	4.8	5.8	590118.8
2010	218159	719599.1	65.6	1192774	192.84	7	8.1	618530.4
2011	222351.3	921320.1	71.9	1366953	213.69	7	8.1	639689.7
2012	263705.7	1130302	77.8	1527344	227.87			670269.9
2013	301590.2	1315376	85.5	1694540	242.85	7.2	8.5	697772.3
2014	354830	1565967	93.3	1964540	263.98	7	8	744200.3
2015	424744.6	1877802	100	2120470	279.5	5	9	758665.5

*GDP at producers price

Source : Economic Survey, Various Issues, MoF.

Quarterly Economic Bulletin, NRB.

Appendix B

Processed Data

Year	rm1	rm2	lnrm1	lnrm2	Rgdp	lnrgdp
1975	31850	49152.38	10.36879	10.80268	145495.2	11.8879
1976	35426.83	61560.98	10.47522	11.02778	151647.8	11.92932
1977	43090.7	74953.49	10.67106	11.22462	156097.6	11.95824
1978	43842.55	80257.45	10.68836	11.29299	163033.1	12.00171
1979	51120.41	92069.39	10.84194	11.4303	196303.5	12.18742
1980	52414.81	97875.93	10.86694	11.49146	163065.6	12.00191
1981	52586.89	103404.9	10.87022	11.54641	176630	12.08181
1982	53902.99	111313.4	10.89494	11.62011	183360.9	12.11921
1983	56479.22	119771.4	10.94163	11.69334	178192.8	12.09062
1984	60140.24	127502.4	11.00443	11.75589	194601.3	12.17871
1985	64470.59	144665.9	11.07396	11.88218	207053.3	12.24073
1986	71727.55	154683.7	11.18063	11.94914	216526.8	12.28547
1987	72501.79	156233.9	11.19137	11.95911	220220.7	12.30239
1988	77391.94	172762.9	11.25664	12.05968	237144.6	12.37643
1989	87876.12	198545.5	11.38368	12.19877	247422.4	12.41885
1990	96755.1	214642.2	11.47994	12.27673	258863.6	12.46406
1991	101140.4	234239.1	11.52426	12.3641	267726.9	12.49772
1992	99783.08	234207.7	11.51075	12.36396	280621.4	12.54476
1993	112419.8	275106.1	11.63	12.52491	290584.6	12.57965
1994	123421.6	302065.4	11.72336	12.6184	322133.9	12.68272
1995	132471.5	325239.8	11.79412	12.69232	333346	12.71694
1996	135680.3	344432	11.81806	12.74965	351076.2	12.76876
1997	132166	356428.2	11.79181	12.78389	368804.9	12.81802
1998	143377.1	401468.6	11.87323	12.90288	379950.7	12.8478
1999	145477.2	435328.2	11.88777	12.98386	396701.5	12.89094
2000	167988.2	512729.5	12.03165	13.1475	421278.9	12.95105
2001	189723.1	576489.8	12.15332	13.26471	441518.5	12.99798
2002	201452.2	584825.8	12.21331	13.27907	442050	12.99918

2003	208863.1	613244.9	12.24943	13.32652	459470.5	13.03783
2004	225356.6	665012.2	12.32544	13.40756	481001.1	13.08362
2005	229829.8	689082.6	12.34509	13.44312	497729.9	13.11781
2006	240044.2	736356.9	12.38858	13.50947	514500.2	13.15095
2007	254795.2	794213.3	12.44822	13.58511	532037.3	13.18447
2008	290120.1	931160	12.57805	13.74419	564508.4	13.24371
2009	327979	1052623	12.7007	13.8668	590118.8	13.28808
2010	332559.5	1096950	12.71457	13.90804	618530.4	13.3351
2011	309250.8	1281391	12.64191	14.06346	639689.7	13.36874
2012	338953.3	1452831	12.73362	14.18902	670269.9	13.41544
2013	352737.1	1538452	12.77348	14.24629	697772.3	13.45565
2014	380310.8	1678421	12.84874	14.33336	744200.3	13.52007
2015	424744.6	1877802	12.95924	14.44561	758665.5	13.53932

Appendix C

Finacial Liberalization Policy Variables

Year	IRD	REB	RRR	ECC	IPR	SMR	PSB	EAL
1975	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0
1984	0.33	1	0	0	0	0	0	0
1985	0.33	1	0	0	0	0	0	0
1986	0.66	1	0	0	0	0	0	0
1987	0.66	1	0	0	0	0	0	0
1988	0.66	1	0	0	0	0	0	0
1989	1	1	0	0	0	0	0	0
1990	1	1	0	0	0	0	0	0
1991	1	1	0	0.5	0	0	0	0
1992	1	1	0	0.5	0	0	0	0
1993	1	1	1	0.5	0	0	0	0.5
1994	1	1	1	0.5	0	1	0	0.5
1995	1	1	1	0.5	0	1	0	0.5
1996	1	1	1	0.5	0	1	0	0.5
1997	1	1	1	0.5	0	1	0	0.5
1998	1	1	1	0.5	0.5	1	0	0.5
1999	1	1	1	0.5	0.5	1	0	0.5
2000	**1**	**1**	**1**	**0.5**	**0.5**	**1**	**0**	**0.5**
2001	1	1	1	0.5	1	1	0	0.5
2002	1	1	1	0.5	1	1	0.5	0.5
2003	1	1	1	0.5	1	1	0.5	0.5

2004	1	1	1	0.5	1	1	0.5	0.5
2005	1	1	1	0.5	1	1	0.5	0.5
2006	1	1	1	0.5	1	1	0.5	0.5
2007	1	1	1	0.5	1	1	0.5	0.5
2008	1	1	1	0.5	1	1	0.5	0.5
2009	1	1	1	0.5	1	1	0.5	0.5
2010	1	1	1	0.5	1	1	0.5	0.5
2011	1	1	1	0.5	1	1	0.5	0.5
2012	1	1	1	0.5	1	1	0.5	0.5
2013	1	1	1	0.5	1	1	0.5	0.5
2014	1	1	1	0.5	1	1	0.5	0.5
2015	1	1	1	0.5	1	1	0.5	0.5

Source : Various Publications of NRB.

Appendix D

Finacial Liberalization Index for Nepal

Year	w1IRD	w2REB	w3RRR	w4ECC	w5IPR	w6SMR	w7PSB	w8EAL	FLI
1975	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0
1984	0.28083	0.734	0	0	0	0	0	0	1.01483
1985	0.28083	0.734	0	0	0	0	0	0	1.01483
1986	0.56166	0.734	0	0	0	0	0	0	1.29566
1987	0.56166	0.734	0	0	0	0	0	0	1.29566
1988	0.56166	0.734	0	0	0	0	0	0	1.29566
1989	0.851	0.734	0	0	0	0	0	0	1.585
1990	0.851	0.734	0	0	0	0	0	0	1.585
1991	0.851	0.734	0	0.4635	0	0	0	0	2.0485
1992	0.851	0.734	0	0.4635	0	0	0	0	2.0485
1993	0.851	0.734	0.955	0.4635	0	0	0	0.4775	3.481
1994	0.851	0.734	0.955	0.4635	0	0.941	0	0.4775	4.422
1995	0.851	0.734	0.955	0.4635	0	0.941	0	0.4775	4.422
1996	0.851	0.734	0.955	0.4635	0	0.941	0	0.4775	4.422
1997	0.851	0.734	0.955	0.4635	0	0.941	0	0.4775	4.422
1998	0.851	0.734	0.955	0.4635	0.4225	0.941	0	0.4775	4.8445
1999	0.851	0.734	0.955	0.4635	0.4225	0.941	0	0.4775	4.8445
2000	0.851	0.734	0.955	0.4635	0.4225	0.941	0	0.4775	4.8445
2001	0.851	0.734	0.955	0.4635	0.845	0.941	0	0.4775	5.267
2002	0.851	0.734	0.955	0.4635	0.845	0.941	0.375	0.4775	5.642
2003	0.851	0.734	0.955	0.4635	0.845	0.941	0.375	0.4775	5.642

2004	0.851	0.734	0.955	0.4635	0.845	0.941	0.375	0.4775	5.642
2005	0.851	0.734	0.955	0.4635	0.845	0.941	0.375	0.4775	5.642
2006	0.851	0.734	0.955	0.4635	0.845	0.941	0.375	0.4775	5.642
2007	0.851	0.734	0.955	0.4635	0.845	0.941	0.375	0.4775	5.642
2008	0.851	0.734	0.955	0.4635	0.845	0.941	0.375	0.4775	5.642
2009	0.851	0.734	0.955	0.4635	0.845	0.941	0.375	0.4775	5.642
2010	0.851	0.734	0.955	0.4635	0.845	0.941	0.375	0.4775	5.642
2011	0.851	0.734	0.955	0.4635	0.845	0.941	0.375	0.4775	5.642
2012	0.851	0.734	0.955	0.4635	0.845	0.941	0.375	0.4775	5.642
2013	0.851	0.734	0.955	0.4635	0.845	0.941	0.375	0.4775	5.642
2014	0.851	0.734	0.955	0.4635	0.845	0.941	0.375	0.4775	5.642
2015	0.851	0.734	0.955	0.4635	0.845	0.941	0.375	0.4775	5.642

Note : w_i's are the weights.

FLI denotes Financial Liberalization Index.

APPENDIX E

OLS Estimation for Narrow Money Demand Function

variable	coefficient	Std.error	t-statistics	Prob.
lnrgdp	0.5752	0.1555	3.6997	0.0008
FLI	-0.0176	0.0136	-1.2915	0.2052
r_{sdt}	-0.0160	0.0062	-2.5749	0.0146
lnrm1(-1)	0.5846	0.1011	5.7797	0.0000
C	-2.7835	1.0300	-2.7023	0.0107

R-squared	0.9963
Adjusted R-squared	0.9958
Standard Error of Regression	0.0459
F-statistics	2268.225
Probability (F-statistics)	0.0000
Akike Information Criterion	-3.2018
Schwartz Criterion	-2.9885
Durbin-Watson Statistics	1.9831

APPENDIX F

Diagnostic Test for Narrow Money Demand Function

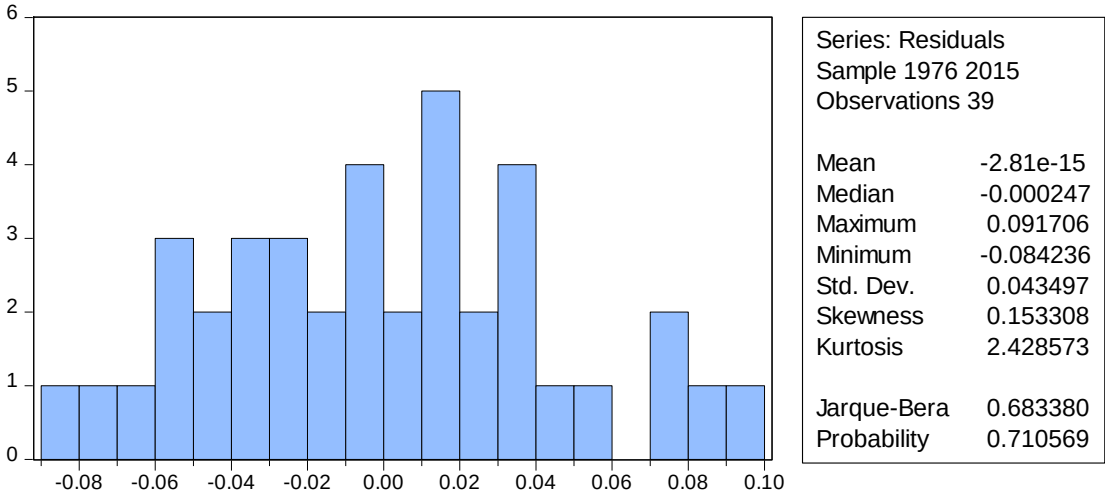
1 Breusch – Godfrey Serial Correlation LM Test

Lag order	F statistic	Observed R squared
1	0.0404 [0.8419]	0.0477 [0.8271]
2	0.2087 [0.8127]	0.5022 [0.778]

2 Heteroskedasticity Test : Breusch-Pagan- Gofrey

F statistics	Observe R-square	Scaled Explained SS
0.1812 [0.9465]	0.8142 [0.9365]	0.4420 [0.9789]

3 Normality Test: Jarque – Bera Test



Source: Author's calculation through Eviews9

Note: between the parentheses (..) is the corresponding P- value.

APPENDIX G

OLS Estimation for Broad Money Demand Function

variable	coefficient	Std.error	t-statistics	Prob.
lnrgdp	0.6154	0.1963	3.1351	0.0035
FLI	-0.0248	0.0168	-1.4707	0.1506
r_{fdt}	-0.0032	0.0050	-0.6325	0.5313
lnrm2(-1)	0.6991	0.08927	7.8304	0.0000
C	-4.4233	1.5575	-2.8400	0.0076

R-squared	0.9979
Adjusted R-squared	0.9978
Standard Error of Regression	0.0455
F-statistics	4219.45
Probability (F-statistics)	0.0000
Akike Information Criterion	-3.2218
Schwartz Criterion	-3.0085
Durbin-Watson Statistics	1.6798

APPENDIX H

Diagnostic Test for Broad Money Demand

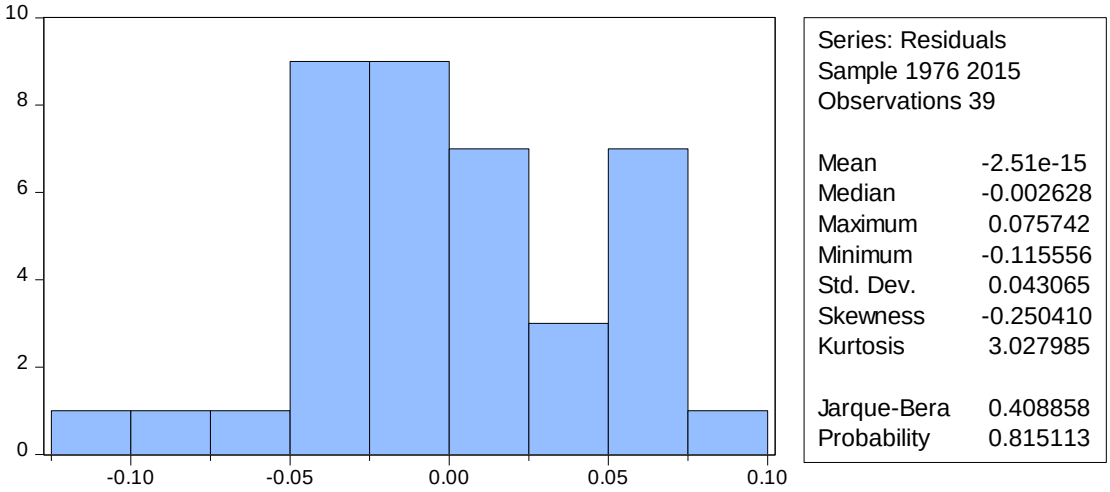
2 Breusch – Godfrey Serial Correlation LM Test

Lag	F-statistics	Observe R-square
1	0.4757 [0.4952]	0.5542 [0.4566]
2	0.3801 [0.6868]	0.9051 [0.6360]

3 Heteroskedasticity Test : Breusch-Pagan- Gofrey

F statistics	Observe R-square	Scaled Explained SS
1.1011[0.3719]	4.4728 [0.3458]	3.4469 [0.4860]

3 Normality Test: Jarque – Bera Test

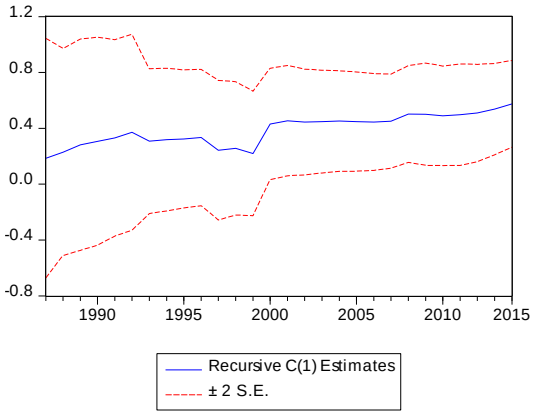


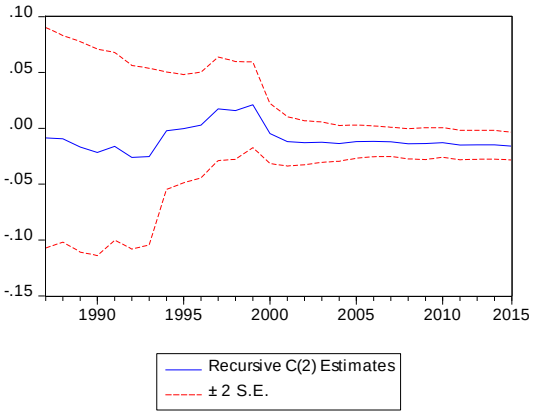
Source: Author's calculation through Eviews 9.

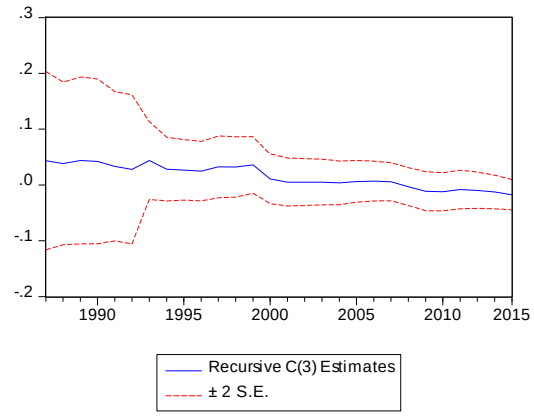
Note: between the parentheses (..) is the corresponding P- value.

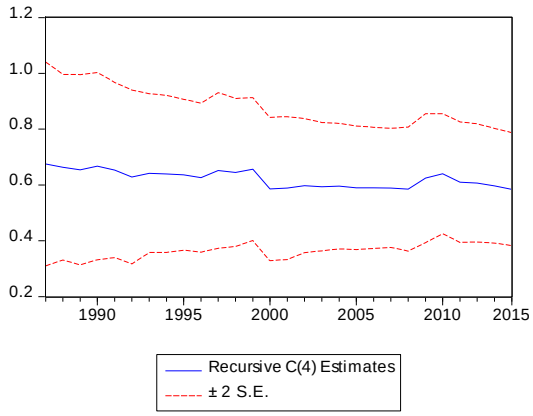
APPENDIX I

Recursive Coefficient Estimates for M1



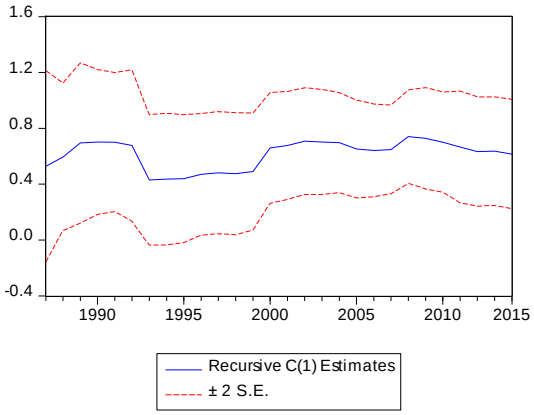


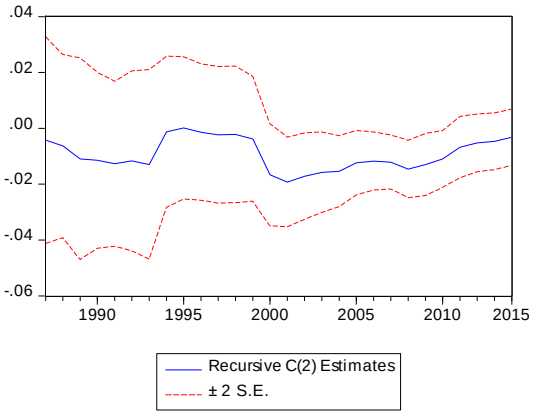


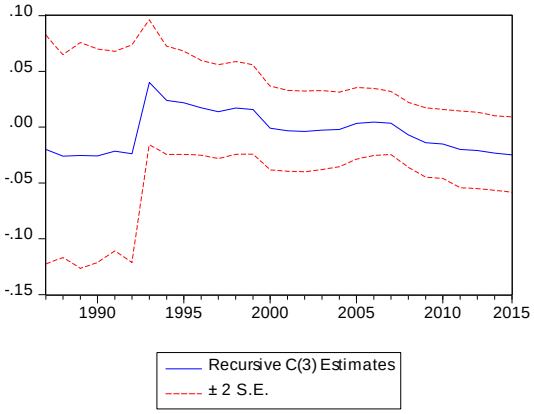


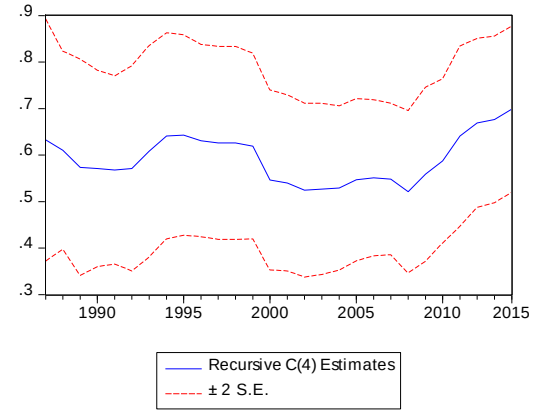
APPENDIX J

Recursive Coefficient Estimates for M2









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