

An Empirical Analysis of Money Supply Process in Nepal

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Abstract

This paper examines the money supply process in Nepal empirically on the basis of mainstream and Post-Keynesian theoretical perspectives for both pre and post-liberalization period covering the sample period of 1965/66-2009/10. The relative contribution of different components of money supply has been computed and the money supply as well as money multiplier function has been estimated. Empirical results show that disposable high powered money is found to be a major contributor to the change in monetary aggregates without any significant structural break. However, the degree of controllability of high powered money is not strong, and neither CRR nor Bank Rate has been effective monetary policy tools so far. Open market operation is found statistically significant only at 10 percent level of significance to influence disposable high powered money. On the other hand, money multipliers are affected by currency ratio, time deposits ratio and excess reserve ratio, but not by CRR. On the other hand, Granger causality based test of Post-Keynesian hypothesis reveals that money supply endogeneity cannot be ruled out. Hence, monetary policy framework needs to be changed accordingly and OMO should be strengthened further.

Key Words: Money Supply, Monetary Policy, High-powered Money, Money Multiplier

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I. INTRODUCTION

Money supply represents the stock of money at a certain point of time. It is obtained by summing up financial assets that can perform functions of money such as medium of exchange and store of value. Money supply process explains the creation of such a money stock in the economy. Understanding of money supply process is necessary for effective conduct of monetary policy to attain its prescribed goals. An analysis of money supply will give us a clear picture of money generating process, particularly the degree of control by the central bank, which is important for monetary management. Baghestani and Mott (1997) state that the ways the central bank, the banking system and the public interact to create the monetary aggregates are important for monetary policy. The knowledge of money supply is particularly important when monetary policy considers monetary aggregates as an intermediate target.

There is a great debate on the issue of exogeneity and endogeneity of money supply, which has great bearing on the conduct of monetary policy. It is the matter of degree of control by central bank on money supply mechanism. Monetary policy can be effective only if the central bank has a high degree of control over money supply (or interest rates). More importantly, money supply process does not remain constant, but changes with the time, more effectively with the expansion and development of financial system. As in many other countries, the financial system and the policy tools have been undergoing changes over time in Nepal, which has been adopting financial liberalization policy since the mid-eighties with the introduction of IMF-sponsored Structural Adjustment Program. Nepal has further introduced many reforms in banking and financial sectors, more deeply after 1990. To name a few, they are interest rate deregulation, liberal policy for opening banks and financial institutions, full convertibility in current account, freedom to open bank account in convertible currency, and the use of indirect monetary policy instruments like open market operation (NRB, 1996). As a result of financial liberalisation policy, there has been a tremendous expansion of financial sector and financial assets in Nepal.

Moreover, Nepal Rastra Bank (NRB) implemented financial sector reforms in the 2000s. The reform program included restructuring of state-owned banks, reengineering of NRB and capacity building of financial sector. This has incorporated new banking law and other regulatory reforms, the liberalization of the foreign exchange and money markets, and ongoing strengthening the supervision of banks. In addition, as per the new NRB Act 2002, NRB has started announcing monetary policy in the beginning of each fiscal year since 2002/03. The NRB Act 2002 has imposed the limitation on government borrowing from the NRB which cannot exceed 5 percent of the previous year's revenue. Similarly, the NRB cannot hold government securities of more than 10 percent of the previous year's revenue. Further, to make the conduct of monetary policy effective, the NRB introduced instruments like sale auctions, purchase auctions, repo and reverse repo auctions for Open Market Operation (OMO) and started using Liquidity Monitoring and Forecasting Framework (LMFF) to guide the OMO in 2004/05. Since then, the monetary policy explicitly introduced the monetary policy framework with excess reserve of commercial banks as an operating target and broad money as an intermediate target to

achieve twin goals of price stability and reasonable BOP surplus by maintaining pegged exchange rate with Indian currency (NRB, 2004).

Considering the changing environment and since there are no recent studies on it, it is pertinent to review and examine the money supply process in Nepal. Hence, this paper analyzes the determinants of money supply, degree of control by NRB and the question of endogeneity or exogeneity of money supply in Nepal. The paper is organized as follow. Section 2 presents a brief literature review followed by the contrasting theoretical aspects of money supply process in section 3. Data and methodology are presented in section 4. The fifth section analyses empirical findings and the final section 6 concludes the discussion.

II. BRIEF LITERATURE REVIEW

There are some studies on money supply and money multiplier both in developed and developing countries. For example, Zaki (1995) investigates whether monetary authorities in Egypt can control money supply and finds the impossibility of such a procedure for the sample period of 1950 to 1990. In Bangladesh, Islam (2008) finds that currency-deposit ratio component in the multiplier model, and net government borrowing and movement of net foreign asset components in reserve money (RM)¹ are the major contributors to changes in money supply. Sanusi (2010) examines the major drivers of money supply from asset side in Ghana for the period of 1983-2006 using the money multiplier approach. He finds that until the mid-nineties, fiscal deficit financing was the major driver of the money supply process, while in the later years, changes in the net foreign assets of the Bank of Ghana, driven largely by foreign aid and remittances inflows, appear to be the major cause of monetary expansion (Sanusi, 2010). Some earlier studies in this area include Roberts and Margolis (1976), Khatkhate et. al. (1980), Johannes and Rasche (1981), and Gauger (1998).

In the context of Nepal, there are two published studies on money supply process in our knowledge. First, Khatiwada (1994) examined the money supply function for the period of 1965/66 through 1989/90. He found that four-fifth of the change in high-powered money was policy controlled, and about 93 per cent of the change in narrow money stock could be attributed to high-powered money. Credit to the government was found to be a major factor explaining three-fourth change in high-powered money, followed by credit to the government enterprises (20 per cent) and net foreign assets (14 percent). This study, however, does not take broad money into consideration, and covers just the pre-liberalization period.

Second, by extending the sample period to 1995, Thapa (1997) also concludes that RM is the main determinant of money supply for both narrow and broad money, but shows that

¹ Reserve money (RM) and high-powered money and monetary base are used interchangeably to represent the same thing.

monetary authorities do not have full control of RM of foreign origin and of government budgetary operation. At that time, NRB did not have enough instruments for monetary policy and OMO was not in use. Hence, Thapa (1997) argues for the relevancy of cash reserve requirement (CRR) for managing money supply in Nepal. However, since then, the conduct of monetary policy has undergone significant changes - the OMO has been strengthened with more instruments and conducted at a higher frequency. Hence, these earlier studies on money supply cannot reflect the changing financial landscape in Nepal. In this context, this paper aims to fill the gap and contribute to explore the money supply process by extending the sample period and by applying new approach.

III. THEORETICAL FRAMEWORK OF MONEY SUPPLY PROCESS

There is a great theoretical debate on the process of money supply: whether it is exogenous or endogenous. The neoclassical school of thought including monetarism considers money supply is exogenous, generated not by market forces but by central banks. Financial institutions and the role of historical change in the financial system have no importance in determining money supply (Pollin, 1996). Keynesians, like monetarists, also take the money supply as exogenous and subject to control by the central bank. In contrast, Post-Keynesians view the money supply as an endogenous matter², arguing that in money demand creates its own supply automatically through the accommodation by the central bank. More importantly, institutional innovation continues to create an array of financial assets with different degree of liquidity.

Mainstream economists, particularly monetarists believe in *the portfolio change process* of generating money supply. In this process, the central bank initiates the change in money supply by buying existing liquid assets from the portfolios of the banking system and / or general public. Hence, a change in the money supply is an explicit policy decision of the monetary authorities to shift the supply function of money at any given rate of interest. This process involves an exogenous change in the money supply function taking it under the exogenous control of the monetary authorities via the base-reserve or money multiplier. The money supply is hence supposed to bear an empirically stable relationship to monetary base, which is directly controllable by OMO.

On the other hand, Post Keynesians believe in *the income finance process* of money creation. An increased desire to buy more reproducible goods induces economic agents to enter into debt contracts with the banking system. If these contracts are accepted by the banking system without any central bank interventions or actions, then the money supply can be elastic (Davidson, 1991). The additional debt of banks are issued and used to accept and pay for additional contracts of producers and workers. The creation of credit-money is not the result of excess reserves held by banks. In this process, hence, changes

² The concept of endogenous money supply can be traced back to the work of Thomas Tooke in the 1840s (Rist, 1940). He argues that the creation of credit by intermediaries takes place only because the non-bank public demands its creation. Subsequently, Marx in Vol.III of capital, Wicksell, Keynes in Treatise of Money also followed this approach (Pollin, 1996).

in the quantity of money supply are always endogenous. Moreover, the central bank's function of lender of last resort further supports this process.

In this context, this section further describes these two contrasting theories of money supply found in economic literature in a greater detail as follow.

3.1 Money Multiplier Theory

The money multiplier theory (also called high-powered money theory), developed by Brunner (1961), is the widely used theory in mainstream economics to explain the mechanism of money supply in the economy. This theory, highly applicable in case of fractional reserve banking system, establishes a link between reserve money and the money supply, where money multiplier acts as a linking factor. As per this theory, money stock is a product of joint interaction of demand for and supply of reserve money. The demand for reserve money constitutes the money multiplier part of the theory. Hence, the determinants of money supply are different from those of money demand. According to this theory, there are two proximate determinants of money supply: money multiplier and reserve money. The former is the ratio of the change in money to change in bank reserves³.

As per the money multiplier theory, money supply is written as,

$$M = m RM \quad \dots\dots\dots (1)$$

where, M is the money stock, m is the value of money multiplier and RM is the reserve money or monetary base. In order to be specific, we can consider narrow money M1 as an example.

$$M1 = C + DD \quad \dots\dots\dots (2)$$

$$RM = C + CIV + BBNRB + OD \quad \dots\dots\dots (3)$$

where, C = currency in circulation in public, DD = demand deposits, CIV = cash in vault of commercial banks, BBNRB = commercial banks' reserves with NRB, OD = other deposit held at NRB (mainly of government enterprises and other financial institutions). For simplicity, $R = CIV + BBNRB$, equation (3), in simple form, can be rewritten as:

$$\begin{aligned}
 RM &= C + R + OD \quad \dots\dots\dots (4) \\
 R &= RR + ER, \quad RR = r(DD + TD) \\
 R &= r(DD + TD) + ER
 \end{aligned}$$

³ It indicates the magnified change in money that results from an injection of additional reserve into the banking system. In other words, it measures the change in money resulting from a given change in bank reserve.

$$\begin{aligned}
 \text{So,} & \quad RM = C + r(DD+TD) + ER + OD \\
 \text{Or,} & \quad RM = cDD + r(DD+t.DD) + eD + d.DD \\
 & \quad RM = cDD + r(DD+t.DD) + e(DD+TD) + d.DD \\
 & \quad RM = cDD + r(DD+t.DD) + e(1+t)DD + d.DD \quad \dots\dots\dots (5) \\
 \text{Or,} & \quad RM = \{c+r(1+t)+e(1+t)+d\} * DD \quad \dots\dots\dots (6)
 \end{aligned}$$

where, RR = required reserve, ER = Excess reserve, r = cash reserve ratio, c = currency-demand deposits ratio, t = time deposit to demand deposit ratio, d = other deposit –demand deposit ratio, e = excess reserve to total deposit ratio.

From equation (1), money multiplier is defined as the ratio of the stock of money to the stock of high-powered money. Hence, it can be obtained as:

$$\begin{aligned}
 \text{mm}_1 \text{ (money multiplier for M1)} &= M_1/RM = (C + DD+OD)/(C + R) \quad \dots\dots\dots (7) \\
 \text{or,} \quad \text{mm1} &= (C/DD+DD/DD+OD/DD)/\{c+r(1+t)+e(1+t)+d\} * DD \\
 \text{or,} \quad \text{mm1} &= (c+1+d)/\{c+r(1+t)+e(1+t)+d\} \quad \dots\dots\dots (8)
 \end{aligned}$$

$$\begin{aligned}
 \text{For M2,} & \quad M2 = M1+TD = C+DD+OD+TD \quad \dots\dots\dots (9) \\
 \text{or,} \quad M2 &= (c+1+t+d)*DD \quad \dots\dots\dots (10)
 \end{aligned}$$

$$\begin{aligned}
 \text{Then,} & \quad \text{mm2} = M2/RM = (c+1+t+d)*DD / \{c+r(1+t)+e(1+t)+d\} * DD \\
 & \quad \text{mm2} = 1+c+t+d / \{c+r(1+t)+e(1+t)+d\} \quad \dots\dots\dots (11)
 \end{aligned}$$

Hence, factors affecting money multiplier can be grouped into currency ratio (c), excess reserve ratio (e), required reserve (r) and time deposit to demand deposit ratio (t).

If the public desire to hold more currency relative to demand deposit, the reserve base will be low and it lowers the credit creation capacity of the commercial banks. Currency ratio (c) is affected by the factors such as payment habit, interest rate on deposit, income levels – higher income higher deposits, inter-sectoral distribution of income (higher the agricultural income, higher will be the currency holding), availability of and confidence in the banking system, illegal activities (tends to hold more cash), urbanization (less cash), bank service charge and risk of bank failure (more cash). The public decision concerning ‘c’ is the function of the costs and benefits of holding money in alternative forms (Thornton, Ekelund, & DeLorme, 1991). Individuals form expectation about the factors affecting currency ratio and determine their desired holdings of currency relative to deposits.

Moreover, the desired excess reserve ratio, which has contractionary impact on multiplier, is affected by the market rate of interest on loans and bonds, risk of deposit withdrawal, interest rate on borrowed reserve (bank rate) and the expected economic conditions (Thornton, Ekelund, & DeLorme, 1991). As banks lend out excess reserves, they create checkable deposits. This ratio, hence, is determined by the depository institutions with the objective of profit maximization. On the other hand, an increase or

decrease in CRR (r) lowers or raises the money multiplier and increase in time deposit relative to DD (t) causes M2 to rise. Obviously, interest rates influence the deposit shift from demand to fixed deposits. In addition to interest rate, factor like income, banking service, financial innovation and inflationary expectation affect the 't' ratio.

In this money multiplier theory, reserve money is another major component of money supply. Generally assuming stable money multiplier, change in money supply is considered to be proportional to change in reserve money, i.e. monetary base is orthogonal to money multiplier. It means central bank's ability to control the money stock depends directly on the predictability of the multiplier. The multiplier model implies that deposit expansion is quantity constrained through the central bank's control over the source of bank reserves (Lombra, 1992). This mechanism of changing money supply by changing reserve money is based on the assumption of liquid and developed securities market in the economy.

Monetary base, in fact, changes with the change in assets and liabilities of the central bank. When the central bank acquires an asset, the monetary base is increased, because the payment will either increase the amount of currency in circulation or increase the reserves of depository institutions (Yi, 1992). Assets include government security, loan to depository institutions, foreign currency or gold. On the liabilities side, any increase of those liabilities that are not in the monetary base such government deposits, central bank's various reserves will lower the monetary base. Succinctly, monetary base is the sum of net foreign assets and net domestic assets of the central bank. If money multiplier is constant, the central bank can control money supply by manipulating monetary base. Central bank can change monetary base by using monetary policy instruments.

Following Khatiwada (1994), the above model has been modified considering disposable high powered money (DH) by deducting required reserves from the reported monetary base because the required reserves do not serve the credit creation purpose. In addition, demand for excess reserves (ER) is assumed to be determined by total deposits of the commercial banks instead of demand deposits as a first approximation because it is demanded to meet currency and clearing demand, and required reserve is imposed on total domestic currency deposits in Nepal (Khatiwada, 1994).

$$C = c.DD \quad \dots\dots\dots (19)$$

$$ER = e.D \quad \dots\dots\dots (20)$$

$$TD = t.DD \quad \dots\dots\dots (21)$$

$$ER = e.D = e(DD + TD) = e(1 + t)DD \quad \dots\dots\dots (22)$$

$$\text{Other deposits in central bank: } OD = d.DD \quad \dots\dots\dots (23)$$

Since $DH = C + ER + OD$, $DH = c.DD + e(1 + t)DD + d.DD = [c + e(1 + t) + d]DD$.

$$\text{Hence, in equilibrium, } DH = [c + e(1 + t) + d]DD \quad \dots\dots\dots (24)$$

$$\text{Or,} \quad DD = \frac{1}{[c+e(1+t)+d]} DH \quad \dots\dots\dots (25)$$

$$M1 = C + DD + OD$$

$$\text{So,} \quad M1 = \frac{1+c+d}{c+e(1+t)+d} DH \quad \dots\dots\dots (26)$$

$$\text{For} \quad M2 = C + DD + OD + TD,$$

$$M2 = \frac{1+c+d+t}{c+e(1+t)+d} DH \quad \dots\dots\dots (27)$$

3.2 Alternative Theories on Money Supply Process

There are two alternative theoretical views that challenge the money multiplier theory from the Post Keynesian School of thought⁴. First, Kaldor and Trevuthick (1981), Kaldor (1982), and Moore (1988, 1989) present the accommodative view of money supply on the ground that commercial banks are in the business of selling credit, being price setters and quantity takers in their retail lending and deposit markets. Loans make deposits and loans are determined by bank borrowers (Nell, 2000). Central banks supply currency and reserves on demand to preserve system liquidity acting as a “lender of last resort”. When banks and other intermediaries hold insufficient reserves and are at financial risk, central banks have to accommodate their needs, either through OMO or through discount window, to preserve the financial stability in the economy (Minisky, 1991). Because central banks are obligated to accommodate reserve demand, no effective quantity constraint exists on banks' reserve need.

Second, structuralist view accepts the endogenous nature of the money supply process, but they argue that the demand for credit is to some extent quantity constrained by the central bank and the commercial banks (Nell, 2000). In this line, Palley (1994) and Pollin (1991) argue that accommodation depends on the stance of monetary policy, and through OMO, central bank have the option to place significant quantity constraint on reserve availability (Pollin, 1996). Discount window borrowing is not a close substitute for non-borrowed funds provided by OMO. Structuralists stress that the marginal cost of borrowing from the discount window rise with increasing borrowed funds (Palley, 1994). Hence money supply function is not horizontal, but positively sloped with the interest rate- a rising mark-up on loans when bank lending increases, in contrast to the accommodation view.

The structuralist endogeneity approach emphasizes on liability management practice, which allows banks to partly overcome reserve constraints imposed by the central bank. Financial system can generate additional reserves through innovative liability management practices such as interbank borrowing, Eurodollar and certificate of deposits

⁴ Monetarists view the money multiplier as stable and predictable. Moreover, considering exogeneity has two meanings: one is to define money as a simple multiple of a monetary base, which in turn is controlled by the central bank, and another is that financial markets and institutions do not seek profit (Minisky, 1991)

(Pollin, 1996). This route is related to financial innovation. Bankers and other players in financial markets as entrepreneurs seek profits by innovating and by developing new ways to finance positions in existing assets and investment (Minisky, 1991). Minisky (1991) further argues that profit seeking activities of banks and financial institutions make the money endogenously generated in the economy. He further mentions that securitization process in the modern financial system reinforces the endogenous money creation in the economy⁵.

The structuralist view incorporates some ideas of monetarists and accommodationist. Hence, there can be bidirectional causality between total bank credit and monetary base (and money supply) (Nell, 2000). Increased lending causes liability transformations so that credit causes an increase in the money multiplier. The accommodationist approach views that central bank can set short-term interest rates, which influences other market rates. However, the structural approach considers interest rate determination is interactive process (Pollin, 1996).

On explaining money supply endogeneity in line with accommodative approach, Lavoie (2006) asserts that money supply is determined by the demand for bank credit and the public's preferences. There is no need for banks to have excess reserves in order to extend loans. The creation of credit-money is not the result of excess reserves held by private banks. Even high-powered money, just like bank money (money deposit) is endogenous and demand determined. It cannot be imposed arbitrarily by the central bank. In fact, the volume of high-powered money is directly related to the supply of bank loans and bank money through the credit divisor. Bank money is not a multiple of high powered money; rather high powered money is a quotient of the quantity of bank money (Lavoie, 2006). Lavoie (2006) further highlights the relevant institutional context for analyzing money supply process. There are some important differences between Anglo-Saxon financial systems found in advanced countries and those of the rest of the world⁶. In overdraft economies of advanced economies, money could be endogenous, and commercial banks are indebted towards the central bank. In case of asset-based economies, mainly found in developing countries, however, it is often argued that money supply is exogenous and under the control of the central bank. In overdraft economy, commercial banks face no constraints in borrowing banknotes or reserves from the central bank, as needs arise.

Some economists view that the concept of endogenous and exogenous is just the matter of economic conditions and institutional development. Moore (1996) argues that two opposing views are accurate portrayals of the money supply process in different economic situation. During period of deflation, when the loan market is weak, the mainstream view is correct. However, during the period of inflation, when loan demand is

⁵ However, financial systems in the developing countries are not developed as in the advanced countries.

⁶ Some of these differences are vanishing with the advent of globalization.

strong, the Post Keynesian view is correct. Borrower demand for bank credit determines the rate at which deposit expands (Moore, 1996). He even argues that endogeneity of the money supply does not imply the inability of the authorities to increase or decrease the money supply.

IV. DATA AND METHODOLOGY

4.1 Source of Data and Sample Period

This paper has used secondary data. Data sources are the publications of NRB and IMF. The sample period ranges from 1965/66 through 2009/10 based on the availability of data and the implementation of monetary policy started from the mid-1960s⁷. Data on money stock and its components, reserve money and other monetary variables are annual average of the end of the month figure for annual data. Moreover, disposable high powered money, which is also annual data, has been computed by deducting required reserves from the measured reserve money since the required reserves does not serve as a base for the multiple creations of credit (or deposits) as in Khatiwada (1994).

As regards the monetary aggregates, this study has used both narrow money (M1) and broad money (M2), computed and published by the NRB. The former includes the currency in circulation outside the central bank and commercial banks, deposits in current accounts of commercial banks and other deposits in NRB (deposits of government non-financial enterprises and other financial institutions), and the latter includes the narrow money and saving, fixed, call and margin deposits in commercial banks. The NRB has recently started publishing monetary aggregates by incorporating the deposits of development banks and finance companies since 2011. Hence, the paper has included the data up to mid-July 2010. The fiscal year 1989/90 is taken as a break point for post-liberalisation period.

For examining the effectiveness of OMO⁸ and the Post Keynesian hypothesis of money supply endogeneity, the paper uses the monthly data of sample period 2004/05 to 2009/10, and 1994/95 to 2009/10 respectively based on the availability of data and relevancy of the time period. These monthly data were obtained from the Monetary Division of Research Department, NRB.

⁷ Prior to that, during the first decade of the establishment, the NRB specially focused on the responsibility of circulating Nepalese currency and ensuring exchange rate stability of the Nepalese currency with Indian currency (NRB, 1996).

⁸ The NRB has started conducting outright sale auction, purchase auction, repo auction and reverse repo auction for OMO on a weekly basis guided by Liquidity Monitoring and Forecasting Framework since 2004/05.

4.2 The Model

As discussed above, based on the money multiplier theory, money stock is expressed as in equation (1). Taking natural log on both side of equation (1) by replacing RM by DH, we get

$$\ln M = \ln m + \ln DH \quad \dots\dots\dots (28)$$

By taking first difference we get

$$\dot{M} = \dot{m} + \dot{D}H \quad \dots\dots\dots(29)$$

The dot above the variable denotes the growth rate of the corresponding variable. If the multiplier is constant, any increase in monetary base will cause the money supply to go up by $m\Delta DH$, and on the other hand, if the monetary base is fixed, a change in the multiplier will cause the money supply to change by the amount $DH\Delta m$ where Δ is change.

Equation (28) can be converted into

$$\Delta \ln M = \Delta \ln m + \Delta \ln DH \quad \dots\dots\dots (30)$$

Dividing by $\Delta \ln M$ on both sides, we get

$$1 = \frac{\Delta \ln m}{\Delta \ln M} + \frac{\Delta \ln DH}{\Delta \ln M} \quad \dots\dots\dots (31)$$

The first term and the second term on right hand side represents the relative contributions of money multiplier and high-powered money to money supply. The multiplier summarizes all those factors not included in monetary base that influences the money stock.

Moreover, the sources of high-powered money are derived as⁹:

$$RM = NFA + NCG + CE + CB + CP - NNML \quad \dots\dots\dots (32)$$

- where NFA = net foreign assets,
- NCG = net claims on government
- CE = claim on government enterprises
- CB = claim on commercial banks
- CP = claims on private sector
- NNML = net, non-monetary liability

⁹ For accounting purpose, RM is used here instead of DH.

Taking change in equation (32) and dividing by change in RM, we will get the relative contribution of each component to reserve money as:

$$1 = \frac{\Delta NFA}{\Delta RM} + \frac{\Delta NCG}{\Delta RM} + \frac{\Delta CE}{\Delta RM} + \frac{\Delta CB}{\Delta RM} + \frac{\Delta CP}{\Delta RM} - \frac{\Delta NNML}{\Delta RM} \dots\dots\dots (33)$$

In addition, the following money supply function has been empirically examined on the basis of the money multiplier theory discussed above by considering major variables that likely to affect money supply function.

$$MS = f(DH, LR, BR, CRR, BB) \dots\dots\dots (34)$$

In specific form,

$$\log M = \gamma_0 + \gamma_1 \log DH + \gamma_2 CRR + \gamma_3 LR + \gamma_4 BR + \gamma_5 BB + \varepsilon_t \dots\dots\dots (35)$$

In growth rate form

$$d(\log M) = \gamma_0 + \gamma_1 d(\log DH) + \gamma_2 CRR + \gamma_3 LR + \gamma_4 BR + \gamma_5 d(BB) + \varepsilon_t \dots\dots\dots (36)$$

where DH= disposable high powered money, i = market interest rate on loans (commercial), BR = bank rate, CRR = cash reserve ratio rate, LR = average lending rate (average of minimum and maximum rate) of the commercial banks, BB= bank branch, ε= error term.

Expected signs: $\gamma_1 > 0, \gamma_2 < 0, \gamma_3 > 0, \gamma_4 < 0, \gamma_5 > 0$

Market rate of interest reflects the yield from the additional bank loan and this affects the excess reserve. At a higher loan rate, commercial banks tend to lower excess reserve, thereby increasing money supply. On the other hand, bank rate is the cost of borrowing from the central bank. At a lower bank rate, it is expected that commercial banks extend more credit in the economy, resulting in more money supply. However, its effectiveness depends on how often commercial banks resort to refinancing facilities. Moreover, a change in CRR puts a constraint in the deposits creation capacity of banks.

It is believed that an expansion of bank branch would increase banking habit of people so that they hold less currency, lowering the currency ratio and positively affecting the money supply. This variable is especially important for developing countries like Nepal. However, the expansion of bank branches in rural Nepal may have increased currency holding through monetization process.

In addition, the following equation is estimated to identify the relative importance of determinants of money multiplier.

$$\left. \begin{aligned} mm1 &= \alpha_0 + \alpha_1 c + \alpha_2 t + \alpha_3 e + \alpha_4 r + \alpha_5 d + e \\ mm2 &= \beta_0 + \beta_1 c + \beta_2 t + \beta_3 e + \beta_4 r + \beta_5 d + e \end{aligned} \right\} \dots\dots\dots (37)$$

Where 'c' is currency to demand deposit ratio, 't' is time deposit to demand deposit ratio, 'e' is excess reserves to total deposit ratio, r is required reserve for total deposits (CRR) and d is other deposits (in NRB) to demand deposit ratio. Here, time deposit rate (t) induces the change in preferences of the individuals for time deposits relative to demand deposit. With a higher 't' ratio, broad money can increase but lowers the narrow money.

4.3 Method for Testing Alternative Money Supply Process

Alternative modelling of money supply or Post Keynesian approach strongly argues that money supply is endogenous in contrast to the mainstream money multiplier theory. This hypothesis is examined through Granger Causality approach as followed by Vera (2001). Post Keynesians views bank credit determines bank deposits instead of other ways round as assumed in money multiplier theory. Instead of money supply responds to monetary base, in the Post Keynesian theory, the monetary base should response to change in money supply caused by lending process of banks. In this study, we have applied standard Granger causality test between monetary base, money multiplier, and domestic credit to ascertain whether domestic credit can Granger cause monetary base as well as money multiplier or not as in Vera (2001).

V. EMPIRICAL RESULTS

5.1 Relative Contribution of DH and Multiplier to Money Supply

Based on the formula $1 = \frac{\Delta \ln m}{\Delta \ln M} + \frac{\Delta \ln DH}{\Delta \ln M}$ as described above, the relative contribution of change in money multiplier and change in disposable high powered money to money supply, both narrow and broad money, has been computed over the whole sample period¹⁰. Table 1 shows such a relative contribution on average for different decades. It is found that change in disposable high powered money is a dominating factor affecting change in money stock, relatively more for M1 and less for M2.

Table 1
Average Relative Contribution of Money Multiplier and DH to Money Supply

	dlnDH/dlnM1	dlnmm1/dlnM1	dlnDH/dlnM2	dlnmm2/dlnM2
1966-70	0.862	0.138	0.733	0.267
1971-80	0.906	0.094	0.526	0.474
1981-90	0.994	0.006	0.851	0.149
1991-00	1.055	-0.055	0.864	0.136
2001-10	1.047	-0.047	0.984	0.016
1966-2010	0.986	0.014	0.799	0.200

¹⁰ Detail computed data are available upon request, not shown for the lack of space.

The relative contribution of change in DH and mm1 (money multiplier for M1) to change in M1 were 98.6 percent and 1.4 percent respectively on average between 1965/66 and 2009/2010. However, such an average contribution of change in DH to change in M2 remained at only 79.9 percent, while the relative contribution of change in mm2 was 20.0 percent. On the other hand, after a substantial drop in 1971-80, the relative contribution of DH to change in M2 has been in an upward trend.

In the recent last two decades: 1991-2000 and 2001-2010, the relative contribution of DH remained higher than one for M1 and increased to 98.4 percent for M2 during 2001-2010. In this way, data shows that degree of explanation of change in monetary aggregates by change in DH has increased, indicating important role of DH to explain the variation of these monetary aggregates. It seems that controlling DH can be sufficient for controlling monetary aggregates. Then, question can arise whether the NRB can control the DH itself or not, which is examined below.

5.2 Sources of Reserve Money

Reserves money is the monetary liability of the central bank, which consists of currency held by the public and commercial banks, and reserves of commercial banks and 'other deposits' at the central bank. The sources of monetary base are net foreign assets, credit to the government, credit to government enterprises, credit to the commercial banks, credit to private sectors and net non-monetary liabilities of the monetary authority.

Following equation (33), an overview of the source of change in RM¹¹ during 1966-2010 reveals that net foreign asset has remained the major source contributing, on average, around 60 percent of the change in RM, followed by credit to the government (47 percent), credit to the government enterprises (12 percent) (Table 2). Credit to commercial banks contributed to 4.0 percent and credit to private sector to 3.0 percent of the change in RM on average during the sample period. Net non-monetary liabilities exerted a contractionary effect of 25.0 percent.

If we compare the pre (1966-1989) and post liberalization period (1990-2010), the relative contribution of various components to RM has changed remarkably. For example, the contribution of NFA to RM increased from 13.0 percent in pre-liberalization period (1966-89) to 116.0 percent (more than hundred percent) in the post-liberalization (1990-2010), but the relative contribution of net credit to government has declined from almost 72 percent in pre-liberalization period to 17.0 percent in the post liberalization period. NFA has been driven largely by the elevated level of remittance and decline in contribution of net credit to government is due to fiscal austerity measures adopted by the government with the adoption of a series of structural adjustment programs. More importantly, new NRB Act 2002 has imposed a limit on government borrowing from the NRB.

¹¹ Because of balance sheet identity, RM instead of DH is used in this section to identify the sources.

The relative contribution of credit to government enterprise to reserve money also dropped substantially in the post-liberalization period from 21.1 percent to almost zero percent (Table 2). After the initiation of privatization process and economic liberalization, the government stopped providing guarantee to public enterprises to obtain loans from the NRB. Similar trend has been observed in case of relative contribution of credit to banks in change in reserve money. However, the relative contribution of credit to private sector remained stable at around 3.0 percent. Moreover, negative contribution of net non-monetary liabilities increased from 14.5 percent in the pre-liberalization to 37.0 percent in the post liberalization period, which is due to rise in capital fund and reserve funds of the NRB.

After adding credit to the government, government enterprises, credit to commercial banks and credit to private sector together as a policy controlled credit supply through coordinated fiscal and monetary policies, it is observed that just 40 percent change in reserve money on average is policy controlled. With the growing contribution of change in NFA in the post-liberalization period, the policy controlled portion has been declining. In this context, a full sterilization through OMO requires adequate availability of securities, which is still difficult because of fledgling government securities market.

Table 2: Average Relative Contribution of Components of RM to RM

	dNFA/ dRM	dNCG/ dRM	dCE/ dRM	dCB/ dRM	dCP/ dRM	dNNML/ dRM
1966-70	-0.57	0.34	0.13	0.00	0.05	-1.04
1971-80	0.43	0.75	0.36	0.09	0.01	0.65
1981-90	0.20	0.91	0.07	0.04	0.02	0.24
1991-00	1.17	0.31	0.02	0.01	0.03	0.54
2001-10	1.25	-0.10	-0.01	0.02	0.04	0.21
1966-2010	0.60	0.47	0.12	0.04	0.03	0.25
1966-89	0.13	0.72	0.21	0.06	0.03	0.14
1990-2010	1.16	0.17	0.00	0.01	0.03	0.37

Source: Author's calculation

Table 3 further shows the volatility of the relative contribution of the components of reserve money over the sample period. Comparatively, it is found that relative contribution of NFA has remained relatively the most volatile component followed by net monetary liabilities and net claims on government. The claims on private sector remained the least volatile component of RM, followed by claim on government enterprises. Compared to the pre-liberalization period, the volatility of NFA has declined from 2.33 to 0.74 (Table 3). Similarly, the volatilities of other components, except claims on private sector also fell in the post-liberalization. Moreover, despite declining in the post-liberalization period, the volatility of NFA remained the highest among others.

**Table 3: Volatility of Relative Contribution of Components of RM to RM
(Measured by Standard Deviation)**

	dNFA/ dRM	dNCG/ dRM	dCE/ dRM	dCB/ dRM	dCP/dR M	dNNML/ dRM
1966-70	5.04	2.05	0.21	0.12	0.11	2.90
1971-80	1.28	1.27	0.32	0.63	0.03	1.95
1981-90	0.77	0.68	0.07	0.23	0.03	0.26
1991-00	0.79	0.46	0.05	0.06	0.03	0.45
2001-10	0.71	0.89	0.01	0.10	0.08	0.55
1966-2010	1.83	1.07	0.22	0.31	0.06	1.38
1966-1989	2.33	1.26	0.26	0.42	0.06	1.84
1990-2010	0.74	0.72	0.04	0.09	0.06	0.51

Source: Author's calculation

5.3 Estimating Money Supply Function

This section presents an empirical estimate of equation (36) and (37) to examine the money supply function. Before doing estimation, unit root tests are done for the variables under consideration to identify the degree of integration.

5.3.1 Unit Root Tests

Table 4 presents unit root tests by computing ADF statistics for the variables under consideration. Log(DH), Log(M1), Log(M2), BR, LR and BB are stationary in first difference, while CRR is stationary in level. Hence, the following model is estimated.

**Table 4: Unit Root Test (1966-2010)
(Automatic lag length selected based on AIC except dlog(M1))**

Variables	ADF (intercept)	Lag length	Variables	ADF (intercept)	Lag length
Log(DH)	-0.44	6	dlog(DH)	-6.41*	0
Log(M1)	-0.58	5	dlog(M1)	-5.13*	0
Log(M2)	-0.62	2	dlog(M2)	-3.71*	1
CRR	-3.24**	0			
BR	-2.53	0	dBR	-6.25*	0
LR	-0.92	1	dLR	-5.91*	0
Log(BB)	-1.06	1	Dlog(BB)	-3.27**	0

*1 % significant level, ** 5 % significant level, ***10 % significant level

$$d(\log M) = \gamma_0 + \gamma_1 d(\log DH) + \gamma_2 CRR + \gamma_3 dLR + \gamma_4 dBR + \gamma_5 d(\log BB) + \gamma_6 D + \varepsilon_t \dots (38)$$

where D is a dummy variable for the post- liberalization period (after 1990) to capture the structural break.

Table 5 presents the estimates of this equation using OLS. The DH is the only important and robust variable to control both money aggregates. It is the dominating variable for both M1 and M2. However, the explanatory power of the model is low in case of M2 compared to M1. It implies that M1 is explained more by DH than M2. Moreover, bank branch expansion is found significant to explain growth rate of M2. No any monetary policy instruments like CRR and BR are found significant to explain the money supply for both M1 and M2. Since the dummy variable (D) to represent the post-liberalization period is statistically insignificant, it seems that there is no significant structural break in money supply process in Nepal with financial liberalization process as per this model. DW Stat, which is close to 2, indicates that there is no problem of serial correlation in the model.

Table 5
OLS Estimates of Money Supply Function

	<i>d(logM1)</i>	<i>d(logM2)</i>
Constant	0.03 (1.16)	0.05 (2.05)**
logDH	0.76 (10.19)*	0.55 (7.22)*
CRR	0.001 (0.43)	.004 (1.69)
d(LR)	-0.01 (-1.83)***	-0.005 (-0.85)
d(BR)	.002 (0.63)	-0.002(-0.49)
d(logBB)	0.02(0.30)	0.12 (2.02)**
D	-0.006(-0.65)	-0.01(-1.32)
<i>AdjR</i> ²	0.71	0.58
DW Stat	2.18	1.71

*1 % significant level, ** 5 % significant level, ***10 % significant level

5.4 Determinants of Reserve Money

Now, a question may arise whether OMO has controlled monetary base or not. To examine this question, the following equation (39) of determinants of reserves money has been examined. As before, disposable high-powered money is used since required reserve is affected by CRR.

$$D(DH) = \delta_0 + \delta_1 NOMO + \delta_2 NFX + \delta_3 D(NCG) + \varepsilon_1 \dots (39)$$

As a systematic way of conducting OMO based on LMFF has been started since 2004/05 (NRB, 2004), the monthly data for the sample period 2004/05 through 2009/10 are used for estimating equation (39). There were no regular OMOs for liquidity management purpose on weekly basis before that period. Since the sample comprises of 72 observations, the empirical estimates must be reliable and robust.

Table 6 presents the unit root tests of the variables used for estimating equation (39). DH and Net Claims on government (NCG) are stationary in first difference and net injection through OMOs (NOMO) and net foreign exchange interventions (NFX)¹² are stationary in level. Hence, we can estimate the equation (39) by OLS.

Table 6
Unit Root Tests of D(RM), NOMO, NFX, NCG and D(FX)

Variables	ADF (intercept)	Lag Length	Based on
D(DH)	-10.79*	0	SIC
NOMO#	-2.20**	3	AIC
NFX	-3.50**	9	AIC
D(NCG)	-10.19*	0	SIC

without intercept

*1 % significant level, ** 5 % significant level, ***10 % significant level

where DH = disposable high-powered money, NOMO = net OMOs (net injection through OMOs), NFX = net foreign exchange intervention, NCG = net claims on government

OLS estimates of the equation (39) is as follow.

$$D(DH) = \frac{1169.5}{(2.91)*} + \frac{0.11}{(1.73)***} NOMO + \frac{0.36}{(3.72)*} NFX + \frac{0.64}{(10.26)*} D(NCG)$$

$$AdjR^2 = 0.66, DW = 2.11, F = 46.3 *$$

Over the sample period, NOMO is found to affect the change in disposable high-powered money only at 10 percent level of significance, while the coefficients of net foreign exchange operations and change in net claims on government are significant at 1 percent level of significance. It shows that the NRB has not effectively sterilized the inflow of liquidity. Such a situation may arise due to insufficient instruments on OMOs or it has not been conducted effectively to influence the monetary base. Coefficients of NFX and D(NCG) are significant at 1 percent level of significance. These variables are not under control of NRB.

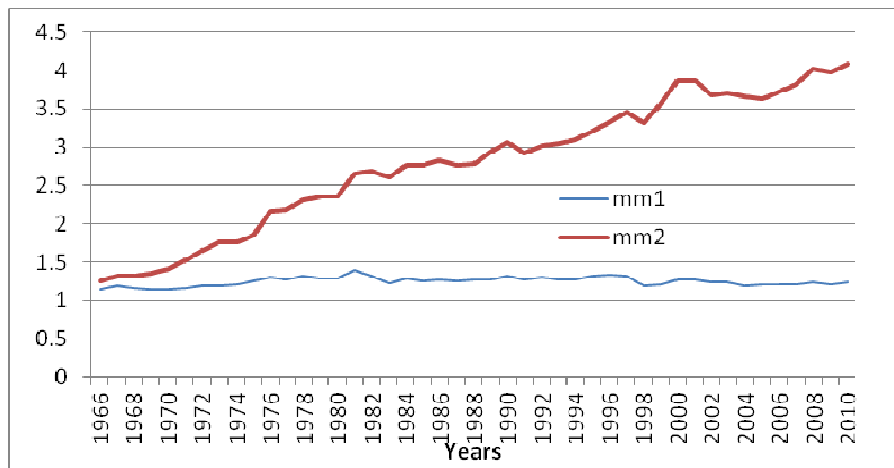
¹² Purchases of Indian currency have also been accommodated in NFX.

5.5 Determinants of Money Multiplier

Now after analysis of determinants of reserve money, this section deals with an examination of money multiplier, another component of theory of money multiplier. Multiplier is a variable rather than a constant, jointly determined by the interaction of the central bank, commercial banks and the public. Although it is predictable to a certain degree, there is a lot of uncertainty and endogeneity involved in determining the multiplier. Further, a small error in estimating the multiplier could lead to a large error in the money supply prediction (Yi, 1992).

Figure 1 shows the value of money multiplier in Nepal between 1966 and 2010. Narrow money multiplier is about 1 which means RM almost explains M1. Money multiplier for M2 is about 3. Money multiplier for M2 witnesses a steady increasing trend while money multiplier for narrow money remained almost stable.

Figure 1: Money Multiplier for M1 and M2



According to money multiplier theory as discussed above, the money multiplier is defined as follow for M1 and M2, taking disposable high power money.

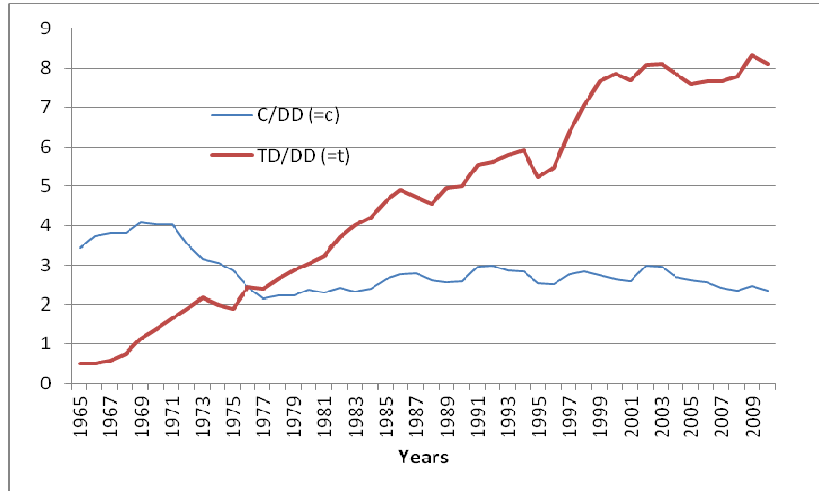
For M1 money multiplier
$$mm1 = \frac{1+c+d}{c+r(1+t)+e(1+t)+d}$$

For M2 money multiplier,
$$mm2 = \frac{1+c+t+d}{c+r(1+t)+e(1+t)+d}$$

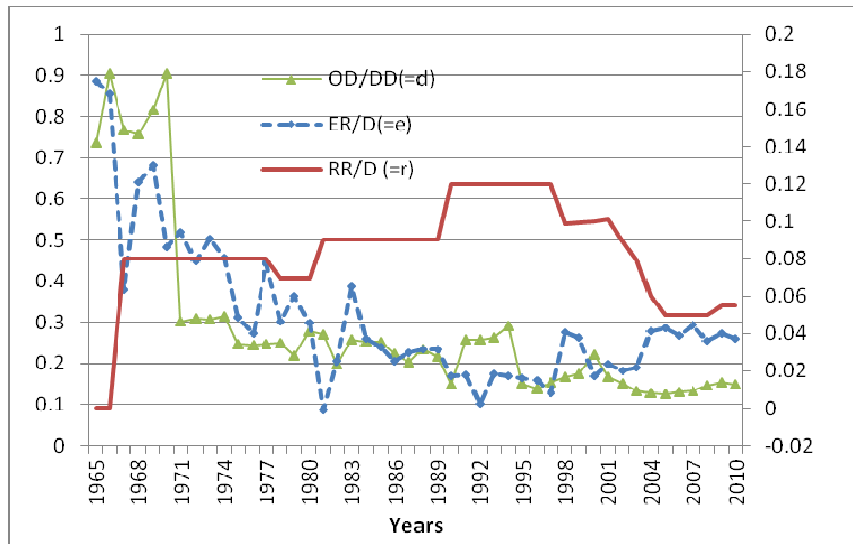
where ‘c’ is currency ratio (c), ‘e’ is excess reserve ratio, ‘r’ is cash reserve ratio in terms of total deposits and ‘t’ is time deposit to demand deposit ratio (t). Movement of these ratios jointly determines the value of money multiplier. The ‘c’ and ‘t’ are related to the

behavior of public, 'e' is related to the behavior of commercial banks and 'r' depends on monetary policy decision.

Figure 2: "c" and "t" Ratios



**Figure 3: "e", "d", and "r" Ratios
('e' and 'r' in right axis)**



Decomposition of movement of components of money multiplier shows that a rise in money multiplier of broad money was due to constantly increasing 't' ratio over the period (Figure 2). It was due to increase in savings deposits with its flexibility and

interest earnings feature. On the other hand, 'c' ratio after substantially declined in the beginning of 1970s, remained almost stable then after. Moreover, 'd' has declined substantially in 1971, remained low since then with the shift of banking operation of government enterprises outside the NRB.

The excess reserve 'e' (ER/D) remained quite high before the implementation of monetary policy instruments. With the start of monetary management, this ratio declined substantially until 1981, then increased slightly for two years before declined again and remained low until the NRB began to lower the reserve requirement ratio in 1998. As regards the CRR, the NRB increased, except during 1978-80, gradually until 1990 and made it as high as 12 percent, which was kept unchanged until 1997. In 1998, the NRB lowered the CRR and kept it unchanged for next four years, However, after then the NRB further reduced the CRR gradually to as low as 5 percent in 2004/05, which was kept intact for next four years. Then, it was revised upward to 5.5 percent in 2008/09 and kept unchanged until 2009/10.

Of the determinants of money multiplier, which one is most significant over the period statistically and how much is the marginal contribution of them to bring change in the money multiplier? For this, the following simple linear regression equation is estimated.

$$mm1 = \alpha_0 + \alpha_1c + \alpha_2t + \alpha_3e + \alpha_4r + \alpha_5d + e$$

$$mm2 = \beta_0 + \beta_1c + \beta_2t + \beta_3e + \beta_4r + \beta_5d + e$$

5.6 Unit Root Tests

Table 5 presents the unit root tests of the variables used for money multiplier equations. Except 'r', which is CRR, all variables under consideration are non-stationary in level and stationary in first difference. Hence, the following model is estimated to identify the determinants of money multipliers.

**Table 7: Unit Root Tests
(Automatic lag length selected based on AIC except dlog(M1))**

Variables	ADF (intercept)	Lag length	Variables	ADF (intercept)	Lag length
mm1	-2.76***	0	Δ mm1	-6.91*	1
mm2	-1.13	2	Δ mm2	-6.18*	1
C	-2.11	1	Δ c	-4.33*	1
T	-1.09	0	Δ t	-5.30*	0
e	-2.5	6	Δ e	-3.47**	4
r	-3.24**	0			
d	-2.32	0	Δ d	-2.92***	3

*1 % significant level, ** 5 % significant level, ***10 % significant level

The estimated regression equations for the sample period (1966-2010) are

$$\Delta mm1 = \frac{-0.01}{(-0.72)} - \frac{0.06}{(-2.55)**} \Delta c - \frac{0.03}{(-1.73)**} \Delta t - \frac{1.13}{(-7.28)*} \Delta e + \frac{0.12}{(0.76)} r - \frac{0.02}{(-0.60)} \Delta d$$

$AdjR^2 = 0.60, DW = 2.66, F = 14.1 *$

$$\Delta mm2 = \frac{0.01}{(0.74)} - \frac{0.35}{(-4.84)**} \Delta c + \frac{0.13}{(2.78)*} \Delta t - \frac{1.99}{(-3.99)*} \Delta e + \frac{0.11}{(0.20)} r - \frac{0.06}{(-0.52)} \Delta d$$

$AdjR^2 = 0.42, DW = 2.31, F = 7.4 *$

*Significant at 1 percent level, **Significant at 5 percent level and *** significant at 10 percent level.

In case of money multiplier for M1, 'c', 't' and 'e' are found to be statistically significant with the theoretically expected signs. However, the impact of CRR has been found statistically insignificant with inconsistent sign with theory. It shows the monetary policy, by changing CRR, does not have any significant impact on money multiplier. As regards the M2 money multiplier, empirical results are same as for M1 multiplier. The 'c', 't' and 'e' have statistically significant impact on multiplier with expected signs. Hence, from these empirical results, it can be inferred that the NRB has not been able to influence the value of multiplier by changing the reserve requirement significantly, which is one of the important monetary policy instruments. Since money multipliers are affected by 'c', 't' and 'e', these are beyond the control of central bank. In fact, controllability of money supply will be low when money multipliers are not constant and not affected by policy instrument (Garfinkel and Thornton, 2001).

5.7 Examining Post Keynesian Money Supply Endogeneity Hypothesis

One major contention of Post Keynesian economics is that the money supply is endogenous. According to them when economic units borrow from their banks, deposits

and thereby bank money are created, and when economic units repay their loans, deposits are destroyed (Vera, 2001). Hence, the interest rate charged on bank loans and paid on deposits, as a mark up over the short-term interest rate set by the central bank, play a central role in governing the rate of expansion of the money stock. As per the Post Keynesian views monetary endogeneity implies that the causality runs from bank lending to bank deposit.

Given the data availability, the sample period of 1994/95:1 – 2009/10:12 is taken and Granger causality test is applied. The procedure has two stages: first, since stationarity is a requirement for the implementation of Granger causality tests, all series are checked for stationarity through unit root test; second, Granger causality tests were run using four different lag lengths for the autoregressive distributed lag relations. The unit root tests of concerned variables are reported in Table 8. Following variables are included LDH = log of disposable high-powered money (DH), mm1 = M1 money multiplier (M1/RM), mm2 = M2 money multiplier (M2/RM), LDC = log of domestic credit (DC) and D = difference operator. As per the ADF tests, mm1, D(mm2), DLDH, DLPVTC, and DLDC are found stationary.

Table 8
Unit Root Tests of Money Multiplier, Reserve Money and Credit Flows

Variables	ADF-value (lag length)	Lag Length	Lag based on
mm1	-3.79* (1)	1	SIC
D(mm2)	-5.42* (11)	11	AIC
D(LDH)	-4.41* (11)	11	AIC
D(LDC)	-12.02*(1)	1	SIC

*1 percent significant level,

The results from the Granger causality tests between disposable high-powered money and domestic credit as well as money multipliers and domestic credits are shown in Table 9. Granger causality test results are presented for 4 different lags. The numbers in parentheses correspond to the probability that the null hypothesis is true. Results indicate that the null hypothesis of D(LDC) does not Granger Cause D(LDH) is rejected at all four different lags. It implies that change in domestic credit does Granger cause change in disposable high-powered money. However, the null hypothesis of D(LDH) does not Granger Cause D(LDC) is also rejected in 6 months and 9 months lag, but cannot be rejected in 3 months and 12 months lag. Hence, the result is somewhat mixed type. Similar is the situation in case of money multipliers and domestic credit. Although there seems to be two-way causality, the null hypothesis of D(LDC) does not Granger Cause money multiplier (for both M1 and M2) is rejected in all selected lags. So endogeneity hypothesis seems to be strong although other way round also cannot be rejected fully.

Table 9
Granger Causality tests for Examining Monetary Endogeneity

Null Hypothesis	Lags			
	12 months	9 months	6 months	3 months
D(LDC) does not Granger Cause D(LDH)	1.96 (0.03)**	2.19 (0.02)**	3.00 (0.00)*	3.25 (0.02)**
D(LDH) does not Granger Cause D(LDC)	1.24 (0.26)	2.02 (0.04)**	2.68 (0.02)**	1.48 (0.22)
D(LDC) does not Granger Cause mm1	2.24 (0.01)*	2.59 (0.01)*	3.97 (0.00)*	4.85 (0.00)*
mm1 does not Granger Cause D(LDC)	1.09 (0.38)	2.33 (0.02)**	2.39 (0.03)**	0.49 (0.69)
D(LDC) does not Granger Cause D(mm2)	1.76 (0.06)***	2.40 (0.01)*	2.67 (0.02)**	3.82 (0.01)*
D(MM2) does not Granger Cause D(LDC)	1.35 (0.19)	2.76 (0.00)*	3.28 (0.00)*	1.56 (0.20)

VI. CONCLUDING REMARKS

Money supply is a result of complex interactions of central banks, banks and financial institutions and public. This paper has analyzed the money supply process in Nepal from two different perspectives – mainstream and Post-Keynesian. Accordingly, the paper has identified the relative contributions of different components of money stock, estimated money supply and money multiplier function, and examined the Post-Keynesian hypothesis. The impact of different monetary instruments on money supply has also been analyzed. Empirical findings show that disposable high-powered money is a major contributor to the change in both monetary aggregates and there is no significant structural break even after post-liberalization period. However, controllability of high-powered money is not strong. Only two-fifth of change in reserve money seems to be policy-controlled in recent years in contrast to four-fifth found by Khatiwada (1994). The contribution of NFA to RM increased from 13.0 percent in pre-liberalization period to 116.0 percent in the post-liberalization period, while the relative contribution of net credit to government has declined from almost 72 percent to 17.0 percent during the same period. Moreover, growing contribution of NFA on account of the elevated level of remittance inflows in the post-liberalization period has further weakened the controllability of money supply. Our findings are almost similar to findings of Sanusi (2010) in Ghana. In addition, neither CRR nor bank rate has been effective monetary policy tools so far. However, OMO is found to affect change in (disposable) high-powered money to some extent.

Since banks borrow less frequently and volume of borrowing is not high, the effectiveness of bank rate is low. Similarly, maintaining excess reserves most of the time has undermined the effectiveness of CRR. Although OMO has emerged as a dynamic and

market based policy tool for monetary management, it is yet to have strong impact on change in reserve money. Foreign exchange interventions and claims on government are found more powerful to influence the reserve money. Money multipliers are also not constant and affected by 'c', 't' and 'e' ratio but not by CRR. Hence, control of money supply through changing monetary base and money multiplier is not strong. Moreover, Granger causality based testing of Post Keynesian money supply endogeneity hypothesis reveals that there is a bi-directional causality between reserve money and domestic credit. Hence, some degree of money supply endogeneity cannot be rejected. This also implies that money supply is not fully under control of NRB.

Several policy implications can be drawn from this study. First, with the opening up of the economy and flow of remittance as well as expansion of financial system, NRB may not be able to control money supply effectively as required for monetary management. Second, NRB should put more focus on the OMO which is relatively more effective monetary policy tool. Third, since the net claim on government is found significantly affecting reserve money, high fluctuation of government balance with NRB should be avoided through sound public expenditure management. Fourth, with loosening degree of control on money supply, NRB needs to think about changing monetary policy framework, currently based on monetary aggregate to interest rate targeting framework.

REFERENCES

- Baghestani, H. and T. Mott. 1997. "A Cointegration Analysis of the US Money Supply Process", *Journal of Macroeconomics*, 19 (2): 269-283.
- Brunner, K. 1961. "A Schema for the Supply Theory of Money." *International Economic Review*, 2: 79-109
- Davidson, P. 1991. "Money: Cause or Effect? Exogenous or Endogenous". In E. Nell, & W. Semmler (eds), *Nicholas Kaldor and Mainstream Economics: Confrontation or Convergence* : 243-258, New York: St. Martin's Press.
- Garfinkel, M. and D.L. Thornton. 1991. The Multiplier Approach to the Money Supply Process: A Precautionary Note, *Review*, Federal Reserve Bank of St. Louis, 47-64, Available at http://research.stlouisfed.org/publications/review/91/07/Multiplier_Jul_Aug1991.pdf
- Gauger, J. 1998. "Economic Impacts on the Money Supply Process", *Journal of Macroeconomics*, 20(3): 553-577.
- Islam, M.E. 2008. "Money Supply Process in Bangladesh: An Empirical Analysis", *Bangladesh Bank's Working Paper Series 0805*, Retrieved from www.bangladeshbank.org.bd
- Johannes, J.M. and R.H. Rasche. 1981. "Can the Reserve Approach to Monetary Control really work?", *Journal of Money, Credit and Banking*, 13(3): 298:313.
- Kaldor, N. 1982. *The Scourge of Monetarism*. Oxford: Oxford University Press.
- Kaldor, N. and J. Trevuthick. 1981. "A Keynesian Perspective on Money", *Lloyds Bank Review*, 139:1-19.
- Khatiwada, Y. R. 1994. *Some Aspects of Monetary Policy in Nepal*. New Delhi: South Asian Publishers.

- Khatkhate, D.R, V.G Galbis and D.D Villanueva. 1980. "A Money Multiplier Model for Developing Economies: The Venezuelan Case", in W. L. Coats, Jr and D. R. Khatkhate (eds.), *Money and Monetary Policy in Less Developed Countries*, Pergaman Press Ltd, London.
- Lavoie, M. 2006. *Introduction to Post Keynesian Economics*. Macmillan: Palgrave.
- Lombra, R. E. 1992. "Understanding the Remarkable Survival of Multiplier Model of Money Stock Determination", *Eastern Economic Journal* , 18 (3):305-315.
- Minisky, H.P. 1991. "The Endogeniety of Money", In E. Nell, & W. Semmler (eds), *Nicholas Kaldor and Mainstream Economics: Confrontation or Convergence*, New York: St. Martin's Press: 207-220.
- Moore, B. J.1996. "The Money Supply Process: A Historical Reinterpretation", In E. Nell, and G. Deleplace (eds), *Money in Motion: The Post Keynesian and Circulation Approaches*. New York: St. Martin's Press.
- Moore, B.1988. *Horizontalists and Verticalists*. Cambridge: Cambridge University Press.
- Moore, B.1989. "A Simple Model of Bank Intermediation", *Journal of Post Keynesian Economics*, 12 (1), 10-28.
- Nell, K. S. 2000. "The Endogenous/Exogenous Nature of South Africa's Money Supply under Direct and Indirect Monetary Control Measures. *Journal of Post Keynesian Economics* , 23 (2), 313-329.
- NRB. 1996. *40 Years of the Nepal Rastra Bank*, Nepal Rastra Bank, Kathmandu.
- NRB. 2004. *Monetary Policy Statement for 2004/05*. Kathmandu: Nepal Rastra Bank.
- Palley, T. 1994. "Competing Views of Money Supply Process", *Journal of Post Keynesian Economics* , 45(1):397-403.
- Pollin, R. 1996. "Money Supply Endogeneity: What are the Questions and What do they Matter?" In E. Nell, & G. Deleplace (eds), *Money in Motion: The Post Keynesian and Circulation Approaches*. New York: St. Martin's Press Inc.
- Pollin, R. 1991. "Two Theories of Money Supply of Endogeneity", *Journal of Post Keynesian Economics* , 13(3):366-96.
- Rist, C. 1940. *History of Money and Credit Theory: From John Law to Present Day*, Augustus M. Kelly, New York
- Roberts, S.M. and M.S. Margolis, 1978. "Control of Money Stock with a Reserve Aggregate", *Journal of Money, Credit and Banking*, 8(4): 457:476.
- Sanusi, A. R. 2010. An Empirical Analysis of the Money Supply Process in Ghana: 1983-2006, *Abuja Journal of Banking and Finance*, 2(1): 115-128, Available at http://mpira.ub.uni-muenchen.de/29494/1/MPRA_paper_29494.pdf
- Thapa, N. B. 1997. "The Money Supply Function in Nepal", *Economic Review*, 9:44-65.
- Thornton, M., R.B. Ekelund, and C.D. DeLorme .1991. "The Money Creation Model: An Alternative Pedagogy", *Journal of Economic Education* , 22(4):317-325.
- Vera, A. P. 2001. "The Endogenous Money Hypothesis: Some Evidence from Spain (1987-1998)", *Journal of Post Keynesian Economics* , 23(3):509-526.
- Yi, G. 1992. "The Money Supply Mechanism and Monetary Policy in China", *Journal of Asian Economics* , 3(2): 217-238.
- Zaki, M. Y. 1995. "Forecasting the Money Multiplier and the Control of Money Supply in Egypt", *Journal of Development Studies*, 32(1): 97-111.