THE MONEY SUPPLY FUNCTION IN NEPAL

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1. INTRODUCTION

The study of money supply is important as far as it helps us understand the factors affecting the money supply and the use of appropriate monetary policy instruments to control it. The data for money supply in Nepal are available from 1957 onwards. The analysis of available monetary statistics shows that, over the years, there has been a rapid expansion of monetary aggregates in Nepal. The objective of this article is to throw light on the behaviour of money supply during the study period. It is also attempted to analyse the determinants of money supply and estimate the money supply function.

2. MEASURES OF MONEY SUPPLY

Before analysing the money supply behaviour, it is necessary to explain briefly the available measures of money supply in Nepal. There are three monetary aggregates compiled in Nepal. These are : reserve money (RM); narrow money (M_1), and broad money (M_2).

Reserve money is the monetary base on which the entire monetary superstructure is built. RM includes currency held by the public (CC), cash held by commercial banks in their vault (CIV), commercial banks' balances (DB) with the Nepal Rastra Bank (NRB) and other deposit (OD) held at the NRB. Symbolically,

$$RM = CC + CIV + DB + OD \quad\quad\quad (1)$$

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Generally, CIV and DB are clubbed together as reserves (R) of commercial banks. Then we can write equation (1) as

$$RM=CC+R+OD \quad\text{... (2)}$$

Narrow money (M_1) consists of (CC) currency held by the public, demand deposits (DDC) held at commercial banks and OD (other deposits) held at the NRB. Symbolically,

$$M_1=CC+DDC+OD \quad\text{... (3)}$$

However, for the compilation of the monetary survey, DDC and OD are taken together as demand deposits (DD) held at the banking sector. But there is a distinction between the demand deposits held at commercial banks and other deposits held at the NRB in the sense that while the former helps manufacture money in terms of potential secondary deposit creation from such deposits, the latter does not. The latter is the mere balances held at the NRB by other than commercial banks. This is the reason why OD is also treated as a part of RM (reserve money). Following this aggregation of DDC and OD, we can rewrite equation (3) as:

$$M_1=CC+DD \quad\text{.. (4)}$$

M_2 is the broader monetary aggregate compiled in Nepal. Besides M_1, it includes time deposits (TD) held at commercial banks. TD, on the other hand, consists of savings deposits, fixed deposits and margin deposits with commercial banks. Symbolically, M_2 can be written as:

$$M_2= M_1+TD \quad\text{.. (5)}$$

3. HISTORICAL BEHAVIOUR OF MONETARY AGGREGATES

As the monetary data are available since 1957, the log-transformed growth rate of 9.7 percent for M_1 was observed in 1958. In subsequent years, there was a rapid expansion in all monetary aggregates. As clear from Table 1, the highest growth rates of monetary aggregates were recorded in 1960. For example, both M_1 and M_2 had shown about 40.0 percent growth rate in that year. Nearly the same growth rate was observed in time deposits, the other component of M_2. Among the monetary aggregates, the highest growth rate of 48.8 percent was witnessed in RM in the said year. On the other hand, in the

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monetary history of Nepal, M_1 had registered the lowest growth rate of 3.9 percent in 1971 (not shown in the table). RM had recorded a decline of nearly 1.0 percent in the same year.
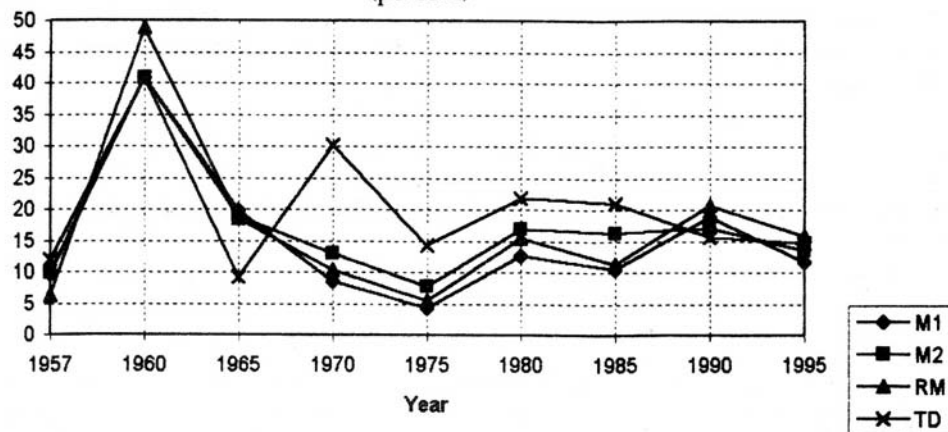
Table 1: Growth Rates of Monetary Aggregates

(log-transformed, in percent)

Year	M_1	M_2	RM	TD
1958	9.7	9.9	6.2	11.9
1960	40.9	40.9	48.8	40.9
1965	19.9	18.9	18.6	9.1
1970	8.6	12.9	10.3	30.2
1975	4.3	7.7	5.4	14.3
1980	12.7	16.9	15.4	21.8
1985	10.5	16.2	11.3	21.0
1990	18.9	17.1	20.6	15.6
1995	11.7	13.4	15.8	14.6

Source: Quarterly Economic Bulletin, 1995, NRB

Graph 1: Growth Rates of Monetary Aggregates
(percent)

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Another bout of the lowest growth rates of monetary aggregates was in 1975. In that year, M_1, M_2, and RM recorded 4.3 percent, 7.7 percent and 5.4 percent increase respectively. There was a surge in all monetary aggregates in later part of 1980s and in early 1990s.

In this context, it would be appropriate to highlight the determinants of money supply in Nepal. Before this issue is taken up, it is imperative to shed light on the available theory of money supply.

4. THEORY OF MONEY SUPPLY

The available theory of money supply is the money-multiplier theory or the theory of high powered money. The said theory of money supply is expounded in terms of the initial creation of reserve money which is the liabilities of the central bank to the public and the banking sector, and the secondary expansion of money supply by commercial banks. The money multiplier theory of money supply, in other words, states that money supply is the function of reserve money and money multiplier. Thus, it is clear that, according to this theory, there are two proximate determinants of money supply: reserve money and the secondary creation of deposits by commercial banks which, in fact, determines the value for the money multiplier. The indirect monetary policy stance is also based on the money-multiplier theory of money supply. It is stated that if the value for money multiplier is stable, the control of money supply can be accomplished through the control of reserve money. It is argued in the literature that it is easy to control reserve money because it is the liabilities of the central bank. However, in practice, this may not be that easy as it is said.

The money multiplier theory of money supply can be explained symbolically for available measures of money supply.

$$M_1 = m_1 \ RM \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \ (6)$$

Where, m_1 is the money multiplier for narrow money (M_1).

Equation (6) states that M_1 is the function of m_1 and RM. If the value for m_1 is given, the movement in M_1 can be traced on the movement in RM. Equation (6) has also the policy implication. If the authorities think that the actual M_1 is aberrating from the desired level, changes in M_1 can be effected by bringing about changes in RM. The theory

states that monetary authorities can bring about desired changes in RM because it is the creation of the central bank.

In accounting sense, m_1 is the ratio of M_1 to RM. This can be written as:

$$m_1 = M_1/RM \quad .... \quad (7)$$

As M_1 and RM are already defined in equation (4) and equation (2) respectively, equation (7) can be written as:

$$m_1 = M_1/RM = (CC + DD)/(CC + R + OD) .... \quad (8)$$

Dividing the right hand side equation by DD, we obtain

$$m_1 = (CC/DD + DD/DD)/(CC/DD + R/DD + OD/DD) .... \quad (9)$$

Equation (9) can be written as:

$$m_1 = (c + 1)/(c + r + d) \quad .... \quad (10)$$

Rearranging equation (10)

$$m_1 = (1 + c)/(c + r + d) \quad .... \quad (11)$$

where, c, r, and d represent currency, reserve and other deposits to demand deposit ratios respectively.

Substituting equation (11) for m_1 in equation (6) we obtain

$$M_1 = [(1 + c)/(c + r + d)] \, RM \quad .... \quad (12)$$

Similarly, we can write behavioural money multiplier equations for broad money, M_2 as:

$$M_2 = m_2 \, RM \quad .... \quad (13)$$

Where m_2 is the money multiplier for broad money, M_2.

Value for m_2 is derived as:

$$m_2 = M_2/RM = (CC + DD + TD)/(CC + R + OD) .... \quad (14)$$

Where, TD is time deposits

Dividing the right hand side of equation (14) by DD, we obtain

$$m_2 = (CC/DD + DD/DD + TD/DD)/(CC/DD + R/DD + OD/DD)$$

Equation (14) can be written in lower case letters indicating respective ratios:

$$m_2 = (c + 1 + t)/(c + r + d) \dots\dots\dots\dots (15)$$

Rearranging equation (15), we get

$$m_2 = (1 + c + t)/(c + r + d) \dots\dots\dots\dots (16)$$

Substituting equation (16) for m_2 in equation (13) we obtain

$$M_2 = [(1 + c + t)/(c + r + d)] RM \dots\dots\dots (17)$$

5. DETERMINANTS OF MONEY SUPPLY

If we are to take the theory of money supply discussed in the preceding section as a basis, following factors can be considered as the main determinants of the stock of money in the economy.

5.1   The size of the monetary base,

5.2   People's choice regarding cash and deposit proportions,

5.3   The extent of the cash reserve ratio, and

5.4   Time deposit ratio.

5.1   The Monetary Base

One of the major determinants of money stock in Nepal has been the magnitude of monetary base. Monetary base, which is the reserve money as defined above, refers to the supply of funds available for use either as cash or as the commercial banks' reserves with the central bank. Money stock varies directly in relation to the changes in this base. The importance of monetary base in affecting money stocks in Nepal is clear from Table 2. The Table shows the historical shares of reserve money in M_1 and M_2. Although, there are
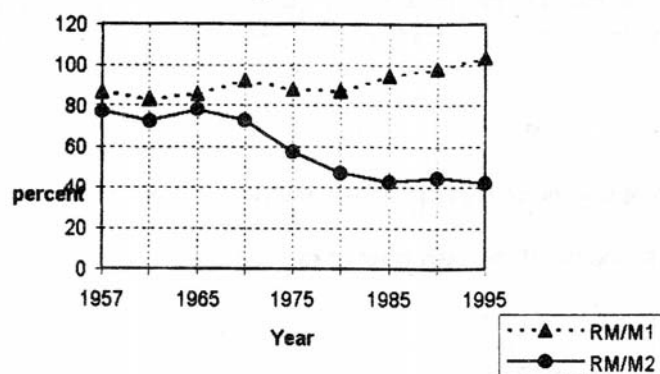
Table 2: Share of RM in Money Stocks (in percent)*

Year	in M_1	in M_2
1957	86.7	77.4
1960	83.1	72.1
1965	85.7	78.1
1970	92.6	72.5
1975	88.1	57.1
1980	87.2	46.7
1985	94.4	42.1
1990	97.9	44.1
1995	103.7	41.7

* *Calculations are based on figures drawn from Quarterly Economic Bulletin, 1995, NRB.*

Graph 2: Share of RM in Money Stocks
(in percent)

intermittent changes, the contribution of RM to money stock, M_1 has increased over the years. For example, the share of RM in M_1 was 86.7 percent in 1957 which increased to 94.4 percent in 1985. The RM to M_1 ratio increased further to 97.9 percent in 1990 and 103.7 percent in 1995. The lowest share of RM in M_1 was 83.1 percent in 1960. This ratio analysis shows that reserve money has been the dominant determinant of narrow money stock, M_1.

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In fact, the gap between M_1 and RM is too narrow in Nepal which is evident from Graph 3. As the graph shows, the gap is narrowing in recent years. On the face of it, the 103.7 percent share of RM in M_1 in 1995 is puzzling. This shows that in that particular year the

Graph 3: The Gap Between M_1 and RM
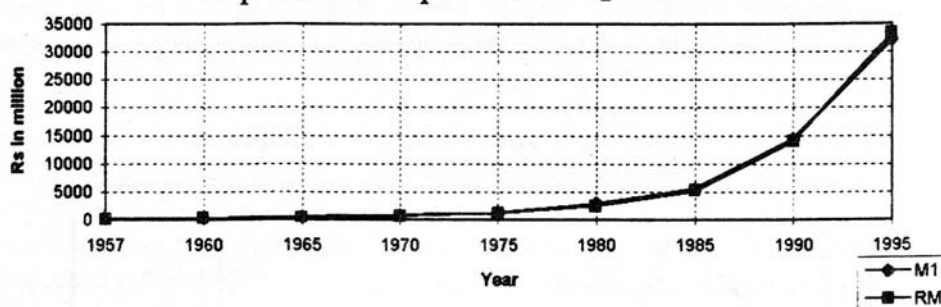
total money stock, M_1 not only was wholly accounted for by reserve money stock, but reserve money stock appeared larger than narrow money stock leaving no positive role for money multiplier i.e. the theoretical secondary creation of deposits of commercial banks. The more than 100 percent share of reserve money in money stock M_1 implies the higher reserves (R) position of commercial banks than the demand deposits(DD) with them. This fact is evident from Table 3. Demand deposits to total reserves (R) ratio of commercial

Table 3: Demand Deposits and Cash Reserves of Commercial Banks

Rs. in Million

	1985	1990	1995
DD with Commercial Banks	1434.7	3628.4	8406.9
Reserves of Commercial Banks	1132.0	3330.2	9644.5
RR of Commercial Banks*	858.2	2626.2	7325.5
ER of Commercial Banks	273.8	704.0	2319.0
DD/R	1.267	1.090	0.872

*Source: Quarterly Economic Bulletin, 1995, NRB.*

* *Calculated as the then 9 percent and 12 percent of total deposits of commercial banks for 1985, and 1990 and 1995 respectively.*

Where, RR and ER are the required reserves and excess reserves respectively.

banks is the crucial summary of the secondary expansion of money supply (see, Graph 4). This ratio can be termed as the deposit money multiplier. It speaks the state of such expansion of money supply in an economy. At first, Table 3 shows the excess liquidity with commercial banks. For example, excess reserves with commercial banks stood at Rs 273.8 million in 1985. In 1990 and 1995, such reserves increased to Rs 704.0 million and Rs 2319.0 million respectively. However, the higher reserves than the demand deposits with the commercial banks is also due to the practice of imposing the statutory reserves on the total deposits rather than on demand deposits only.

Graph 4: Deposit Money Multiplier
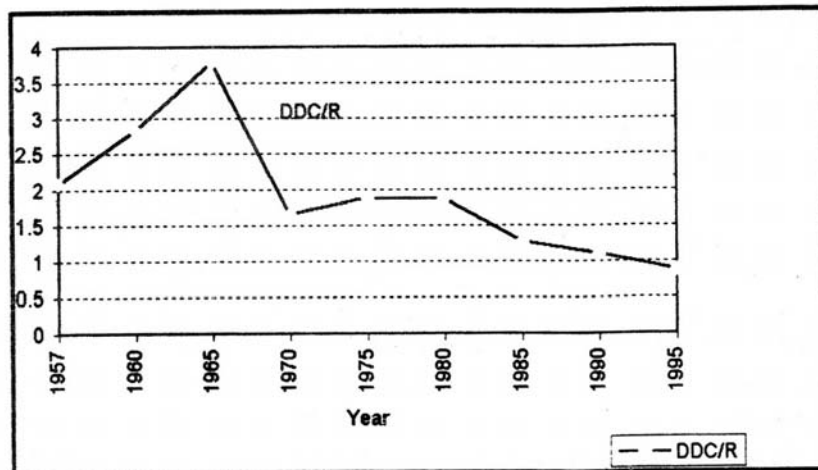
The anomalies between the practice of imposing reserve requirement and M_1 in terms of accounting sense which is evident from the above discussion cast shadow in choosing M_1 as an intermediate monetary target.

Although there are intermittent ups and downs in reserve money to M_2 ratio, the same has declined from 77.4 percent (Table 2) in 1957 to 41.7 percent in 1995. The decline in the RM to M_2 ratio underlines the strong growth in time deposits during the sample period. However, as clear from Table 2, RM has also been the major determinant of broad money stock, M_2.

5.1.1 Determinants of Monetary Base

The above analysis shows that reserve money has been the dominant determinant of both M_1 and M_2. This very fact makes it imperative for the indepth analysis of the determinants of reserve money itself. While analysing the same, it is found that the net foreign assets (NFA) of the NRB has been one of the two principal determinants of reserve money growth in Nepal. However, there are intermittently ups and downs in the contribution of NFA (see, Graph 4) of the NRB to the RM growth during the study period. For example, the share of NFA in RM was 64.5 percent in 1957 which increased to 95.4 percent in 1960, to 112.7 percent in 1965 and 130.7 percent in 1970. The share of the same came down to 70.8 percent in 1980 and further down to 17.2 percent in 1985. In subsequent years, the share of NFA in RM began to rise. It reached 96.4 percent in 1995. The ups and downs of the share of NFA in RM as discussed above reflect the movement in the overall balance of payments of the country.

Graph 5: Percentage Share of NFA and IDA of the NRB in RM
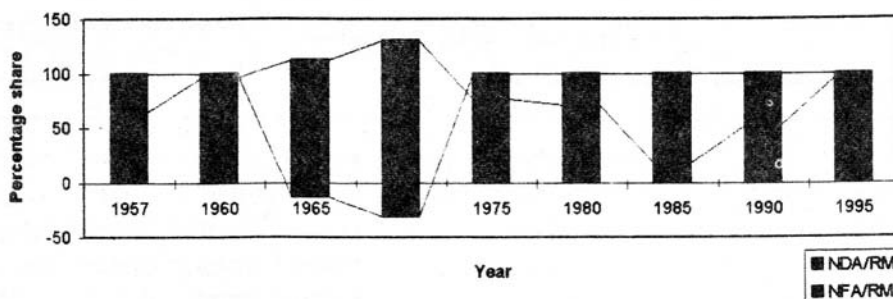
The other dominant source of RM is the net domestic assets (NDA) of the NRB. The movement in the percentage contribution of the NDA to RM is just the converse to that of NFA as discussed above. Since RM, in the accounting sense, is the summation of NFA and NDA of the NRB, the relative share of NDA is not reported here as it can be understood (see, Graph 5) from the share of NFA as analysed above.

NDA, in turn, is the positive summation of the NRB credit to government, government enterprises, commercial banks and private sector, and the negative summation

of other items, net. The analysis of major sources of NDA reveals that the NRB credit to government has played a dominant role during the study period. The role of other items, net is also equally important in as much as it helps to boost and dampen the movement in NDA. It must be noted that, to some extent, the movements in other items net are corroborated by the movements in NFA of the NRB.

5.2 People's Choice Regarding Cash and Deposit Proportions

Although, the size of reserve money is an important determinant of money supply, there is no constant relationship between the two. The monetary base that supports monetary superstructure may vary greatly in size. Therefore, the relative amounts of cash and demand deposits, which the public chooses to hold, has great significance in this respect. For example, if the community decides to effect payments by cheques rather than by cash in a significant proportion, then the larger will be the total stock of money that will be supported by a given monetary base. This is precisely because of the fact that, one rupee in the hands of the public supports only itself, i.e., one rupee of money only; while one rupee with a commercial bank in its reserves can support several rupees of money in the form of derivative demand deposits.

Table 4 : Money Multiplier*

FY	m_1	m_2	c	r	d	t
1957	1.1531	1.2923	2.7975	0.4669	0.0289	0.4587
1960	1.2040	1.3873	1.6950	0.2442	0.2941	0.4102
1965	1.1665	1.2799	1.9753	0.1520	0.4240	0.2893
1970	1.0793	1.3791	2.2915	0.3721	0.3859	0.9142
1975	1.1347	1.7511	2.1759	0.4311	0.1918	1.7253
1980	1.1466	2.1410	1.7450	0.4035	0.2457	2.3809
1985	1.0585	2.3751	2.1445	0.6496	0.1767	3.9115
1990	1.0214	2.2659	2.1573	0.7393	0.1945	3.8469
1995	0.9628	2.3981	2.3573	1.0104	0.1193	5.0049

* *Calculations are based on figures drawn from 'Quarterly Economic Bulletin', 1995, NRB.*

Graph 6: M_1 and M_2 Money Multiplier, and Currency (c) Ratio
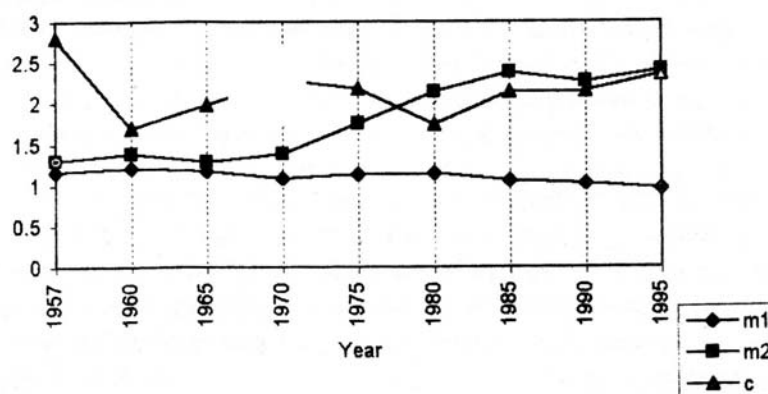
Community's choice between cash and demand deposits can be represented by currency (held by the public) to demand deposit (c) ratio. As clear from Table 4 and Graph 6, the currency ratio does not exhibit a definite trend. If we take two points, beginning and the last period of the sample, the ratio has nonetheless come down from 2.7975 in 1957 to 2.3573 in 1995. However, there are noticeable ups and downs in the ratio during the study period. The ratio was the lowest at 1.6950 in 1960, but it increased intermittently in subsequent years until 1975. With the financial development, currency ratio is expected to decline. As this is clear from Table 4, this did not happen for Nepal. One of the reasons for a high and discreet jump in currency ratio may be due to the discreet monetisation process that is taking place in Nepal.

5.2.1 Determinants of the Currency Ratio

Other things remaining the same, the currency ratio increases when the nonbank public's preference for currency relative to demand deposits increases. If this happens, it tantamount to an additional leakage of reserves to currency from the secondary money creation process. In the event of increasing currency ratio, the base for the secondary creation of money becomes smaller, and this, in turn, lowers the total money stock in the economy. The determinants of currency ratio are: interest rate on interest bearing assets; the availability of bank services; the degree of public confidence in banking system etc.

Public holds currency and demand deposits as assets. Both of these assets are positively related to income. But it is believed and hypothesised that demand deposits is more responsive to changes in income than currency. This is so because as income increases the public makes larger uses of demand deposits rather than currency. From this analysis, it is clear that the currency ratio is inversely related to income. The decline in currency ratio increases the money supply through its impact on the deposit money multiplier (i.e., DD/R, where, DD is the demand deposits and R is the cash reserves of commercial banks).

The interest rate on interest bearing assets can act as an opportunity cost for both currency and demand deposits. Such interest rates can adversely affect both currency holdings and demand deposits. However, it is believed that demand deposits rather than currency holding is more responsive to changes in the interest rate. This implies that with the increase in interest rates, currency ratio increases which , in turn, leads to the contraction of money supply.

The availability (i.e., the expansion) of bank branches can also lead to a decline in currency ratio. That is, people holding cash in the absence of banks shift the same to demand deposits in the event of availability of bank branches.

In the context of Nepal, the results of above arguments can be at best ambiguous. For instance, we can take the case of rising income. Suppose incomes rise. What impact will it have on currency holdings and demand deposits? On the face of it, one would promptly argue that demand deposits would increase more than currency holdings. But this may not be the case with Nepal where a large number of people live a subsistence life. Any increase in income can be held in the form of currency for the immediate spending on basic consumption. Holding of their income in demand deposits becomes luxury for such people which they hardly can afford. However, demand deposits vis-a-vis currency increases only when income distribution is highly skewed and is largely pocketed by a few people of modern sector of the economy. Even if a rise in income of people living below a subsistence level leads to a shift of additional cash income to bank deposits rather than cash holdings, it is not the demand deposits but the savings deposits which increases. For low income people, savings deposits are more popular as they provide both returns and liquidity to their holders. Ambiguous is the impact of the changes in interest rate on interest bearing assets. As Nepal has low level of financial development, alternative financial assets other than the currency are the savings deposits and fixed deposits. Such interest rate changes is likely to bring about a shift from demand deposits to savings

deposits. And if there are people holding a large cash, they also might shift to savings deposits from their cash holdings.

The expansion of bank branches in rural Nepal is believed to have helped boost both monetisation process and the mobilisation of bank deposits. While the former has promoted the use of currency in economic transactions, the latter has helped increase savings and fixed deposits rather than demand deposits. The empirical evidence as suggested by currency ratio and t (time deposits) ratio (Table 4) lends support to these arguments. The monetisation process- that is taking place in Nepal which is further hastened by the aggressive expansion of bank branches in rural areas and the expansion of transport facility which, in turn, has helped introduce new goods and services to rural people, has helped keep the currency ratio more or less intact. This is the one of the reasons why the value for narrow money multiplier has remained more or less constant during the study period. On the other hand, the value for broad money multiplier has increased during the study period largely due to the rise in t-ratio (Table 4).

5.3 The size of the Cash-Reserve Ratio

The cash-reserve ratio is also an important determinant of the quantity of money in an economy, for it determines the multiplier coefficient of credit creation. As said earlier, a smaller cash reserve ratio enables greater expansion in the creation of credit by the banks and vice versa. It is important to note that there are two elements in total cash reserves position of commercial banks. One is statutory cash reserves which is legally mandatory for commercial banks to maintain and the other is the reserves maintained by commercial banks in excess of statutorily required reserves. In Nepal, at present, commercial banks are required to maintain 12 percent reserves (4 percent in their vault and 8 percent balances with the NRB) of their total deposit liabilities. Table 4 also shows the total reserves to demand deposit (r) ratio. The reserves to demand deposit ratio declined from 0.4669 (see, Graph 7) in 1957 to 0.2492 in 1960 and further to 0.1520 in 1965. However, the ratio appears to be on ascending order since 1985. The ratio which was 0.6496 in 1985 increased to 0.7393 in 1990. Total reserves of commercial banks surpassed the total demand deposits held at the banking sector in 1995. This fact is evident from Table 4 as the ratio turned out to be more than one (1.0104) in 1995. It dampened the coefficient of money multiplier. For example, money multiplier (m_1) for narrow money M_1 which was 1.1531 in 1957 fell to 0.9628 in 1995.

Graph 7: Reserves (r) Ratio
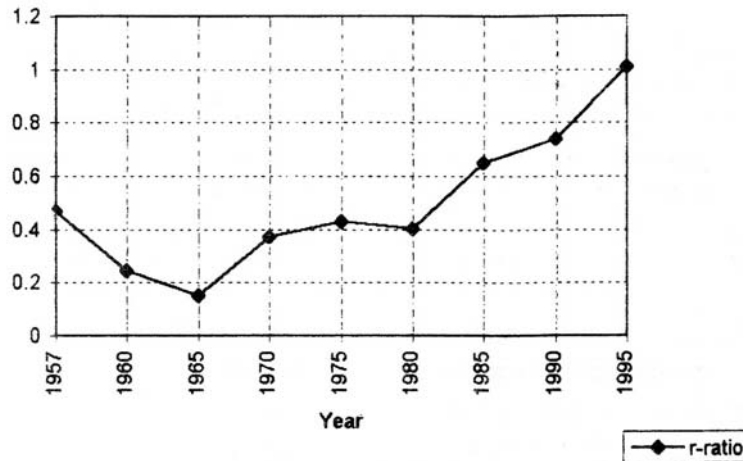
5.3.1 Determinants of the Excess Reserve Ratio

As shown in Table 3, total reserves consist of required reserves and excess reserves. So far as the required reserves are concerned they are policy determined[1] . Reserves maintained in excess of required reserves are behavioural ones of commercial banks. Nonetheless, they affect the money supply negatively. When commercial banks, due to some reasons, increase their desired holdings of excess reserves, funds to that extent are withdrawn from the money creation process. In the literature, factors such as market rate of interest, the effective discount rate and deposit variability are considered as the crucial determinants of the excess reserves. Market rate of interest is the opportunity cost for holding excess cash. As such, such holdings are sensitive to the changes in the market rate of interest. This implies that changes in the interest inversely affects the excess reserve ratio. This means a rise in the interest rate reduces the desired excess reserve ratio. As a result, when the excess reserve ratio decreases, the deposit money multiplier increases, for such reserves are utilised by the banking system to create money.

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[1]   However, given the required ratio, the levels of required reserves can also rise with a rise in constituent deposits or the total deposits as the required reserve ratio is imposed.

Consequently, the money supply increases. Converse is the result of the decrease in the interest rate.

However, in the event of commercial banks reducing their excess reserves to take advantage of rising market rate of interest, probability increases of their not being able to fulfil deposit withdrawal demands from their customers. In such a situation, they have to resort to borrowings from the central bank. This shows that it is not only market rate of interest but the market rate in conjunction with the discount rate is the crucial determinant of the excess reserve ratio. Not only is the discount rate but also the ease with which they can avail the central bank financing is important for commercial banks with regard to their decision of keeping the level of excess reserve ratio. For instance, if the discount rate is low and it is easily available, commercial banks are likely to reduce their excess reserves and thereby increase the money supply. Changes in the discount rate also works through its impact on the deposit money multiplier.

Deposit variability is the another factor influencing the excess reserves of commercial banks. If such variability rises and is uncertain, banks' holding of excess reserves increases which, in turn, decreases the deposit money multiplier and thereby the money supply.

5.4 Time Deposit Ratio

Time deposit to demand deposit (t) ratio is one of the components of broad money multiplier, m_2. Time deposit ratio has the positive relationship with m_2 (broad money

Graph 8: Time Deposits (t) Ratio
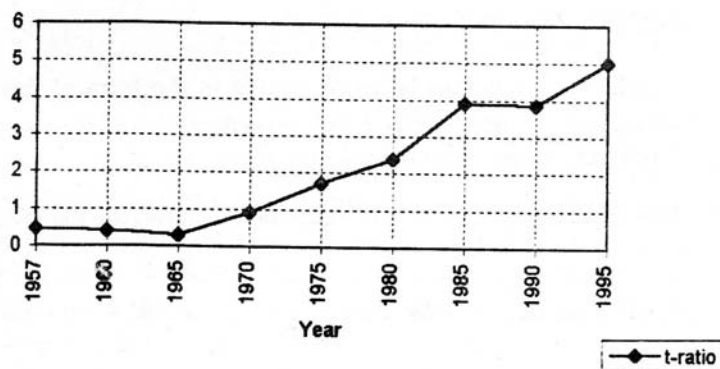
multiplier). As clear from Table 4 (see, also Graph 8). Lately, the time deposit ratio has gone up. It was 3.8469 in 1990 which went up to 5.0049 in 1995. The surge in time deposit ratio pushed broad money multiplier from 1.2923 in 1957 to 2.3981 in 1995.

5.4.1 Determinants of the Time Deposit Ratio

An increase in the nonbank public's preference for time deposits relative to demand deposits raises the time deposit ratio. This results in an additional leakage of demand deposits to time deposits from the money creation process. The factors affecting the time deposit ratio are: income; the interest rate on time deposits and the market rate of interest.

Both time and demand deposits are positively related to income. It is argued in the literature that time deposits are luxury goods and demand deposits are necessities. Therefore, time deposits are hypothesised to be more sensitive to changes in income than demand deposits. Hence, income induced increase in the time deposits ratio reduces the deposit money multiplier and thereby the money supply.

Another factor affecting the time deposit ratio is the market rate of interest. It is hypothesised to be inversely related to such interest rate, for such interest rates are taken as the opportunity cost of holding of time deposits.

On the other hand, time deposit rate is positively related to the time deposit ratio. An increase in the t-ratio decreases the deposit money multiplier and thereby the money supply. Thus, changes in the interest rate on time deposit has the inverse effect on the money supply.

6. THE MONEY SUPPLY FUNCTION

Money supply behaviour can be encapsulated in the form of the money supply function. Obviously, a money supply function expresses the functional relationship between the quantity of money supplied and its determinant variables.

Based on the theory of money supply as discussed above, the money supply function can be specified as:

$$MS = f(i, rb, rt, y, rr, RM, U) \ .... \ (18)$$

Where, MS = money supply, i = market rate of interest, rb = effective discount rate, rt = time deposit rate, y = level of income, rr = required reserve ratio, RM = reserve money and U = unknown.

Market rate of interest, i reflects the yield from the extending additional bank credit which increases the quantity of money supplied. Changes in i influences, among others, excess reserves, and time deposit ratio which in turn affect the deposit money multiplier and thereby the money supply. Discount rate, rb reflects the cost of borrowing from the central bank. i and rb play an opposite role so far as their impact on the money supply is concerned. Therefore, while estimating the money supply function, it is appropriate to take changes in i relative to changes in rb. Changes in rt also affect the deposit money multiplier by effecting changes in the preferences of the nonbank public for time relative to demand deposits. A rise in rt induces the t-ratio to rise which in turn pushes the deposit money multiplier down and thereby the money supply. Required reserve ratio, rr affects the deposit money multiplier negatively. Impact of income changes on the money supply is ambiguous, for it affects the time deposit ratio positively which in turn has the negative effect on the money supply on the one hand, it also affects currency ratio negatively which in turn leads to a rise in deposit money multiplier, resulting in an increase in the money supply. Therefore, while estimating the money supply function for Nepal income variable is removed from the equation.

Following is the specification of money supply function used for empirical testing.

$$MS = f(rd, rr, rt, RM, u) \dots\dots\dots (19)$$

where, rd is the discount rate adjusted interest rate.

A priori ; $dMS/drd > 0$; $dMS/drr < 0$; $dMS/drt < 0$ & $dMs/dRM > 0$.

In the money supply equation the factors, RM and discount rate which is the part of rd are under the control of the central bank, while the factors like i (market rate of interest)and rt are determined by the market forces. However, prior to 1989, the entire interest rate structure was controlled by the NRB. The money supply function as specified above stresses the point that money supply is the outcome of the joint interaction of the central bank, the commercial banks, and the general public. However, this is the empirical issue to pinpoint the exact role of each of the factors mentioned above in the determination of money stocks in Nepal.

6.1 Sources of Data and the Sample period of the study

Most of the monetary data used in this study are taken from various issues of Quarterly Economic Bulletin, NRB. Some data particularly on monetary policy related variables are sourced from various issues of Annual Reports of the NRB. Time series data on discount rate of the NRB are taken both from the IFS monthly publications and the IFS Yearbooks.

Although monetary data are available from 1957 onwards, the NRB commenced monetary policy measures since 1966. This forced to shorten the sample range of the study period. On top of it, time series data on discount rate are available from 1976 onwards in the IFS publications. This further limited the sample size of the following empirical study.

6.2 Empirical Evidence

Following is the result of the estimated equation of money supply behaviour in Nepal. The sample range of the estimated equation is 1967-95.

$$\ln M_1 = 0.392 + 0.946 \ln RM + 0.011\, i - 0.001 rr \quad -0.002 rt$$
$$\quad\quad (9.7)^* \quad (67.2)^* \quad\ (1.2) \quad\ (-0.2) \quad\quad (-.30)$$

Adj. $R^2 = 0.99$ DW = Corrected.

(Figures in parentheses are respective t-ratios, and *, indicates significant at less than 5 percent.)

Where, $\ln M_1$ is the log level M_1; $\ln RM$ is the log level RM; i is the commercial lending rate; rr is the cash reserve ratio; and rt is the one year deposit rate.

The estimated regression result shows that the model has a good fit as suggested by the adjusted R^2 at 0.99. Coefficients of all variables have the correct signs. However, barring lnRM, coefficients of other variables of the model are not significant. The coefficient of reserve money (lnRM) shows that one rupee change in RM leads to a 0.95 rupee change in narrow money stock, M_1. Here, it is important to clarify why one rupee change in RM does not cause a one rupee change in M_1. The answer is simply because total reserve money rather than the disposable reserve money is taken here. The extent at which rr is imposed on deposit liabilities of commercial banks causes an impoundment of

reserves of commercial banks to that extent. The coefficient of i is not statistically significant. With the increase in the commercial bank lending rate, it is expected that commercial banks decrease their excess reserves and increase the supply of credit and thereby increase money supply in the economy. This channel of increasing money supply is not seen strong in Nepal. This might be due to the administered interest rate structure Nepal had adopted during the most of the period of the study. Although, coefficient of rr has apriori sign, it is not statistically significant. This may be due to the fact that commercial banks might not have been fully loaned up during the study period. Under the circumstances, changing rr does not affect commercial banks' activities. Similarly, the coefficient of rt (time deposit rate) is not statistically significant. First, this may be due to the fixate of interest rate structure Nepal had in the past. Secondly, this may be also due to the fact that changes effected in time deposit rates were not attractive enough to cause a shift from demand deposits to time deposits.

It is argued in the literature that while estimating the money supply function, changes in i (represented here as the commercial lending rate) alone is not appropriate. Because, of the factors affecting the excess reserves of commercial banks, changes in discount rate (rb) and loan rate are both important. However, they have opposite effects on the level of reserves of commercial banks (Hosek and Zahin, 1977). Therefore, the money supply function with Rd i.e., the loan rate adjusted for discount rate was estimated. The sample range of this estimating equation was shorten to 1977-95 due to the nonavailability of data on discount rate. The coefficient of Rd was found statistically significant at about 5 percent. However, the coefficient of rr obtained a wrong sign.

Similarly, the model is also tested for M_2. The estimated result of the model is as follows:

$$\ln M_2 = -54.655 + 0.469 \ln RM - 0.001\,i - 0.005rr + 0.003rt$$
$$\quad\;\;(-0.2)\qquad (4.0)^* \qquad\;\; (-0.1)\quad\;\; (-0.8)\qquad (0.4)$$

Adj. $R^2 = 0.99$ DW = Corrected.

Where, $\ln M_2$ is the log level M_2.

Among the variables of the model, coefficient of reserve money (lnRM) is found statistically significant. With regards other variables, barring rr, they do not have proper signs. And, moreover, they are not statistically significant. This indicates that,

except for reserve money, the effect of other variables of the model on the changes of M_2 is effectively zero

7. CONCLUDING REMARKS WITH A NOTE ON IMPLICATION FOR MONETARY POLICY IN NEPAL

Reserve money has been the dominant determinant of money supply for both M_1 and M_2. The analysis has shown that the value for M_1 multiplier has been less than one in some years of the study period. This fact itself establishes that reserve money has been more or less sole determinant of M_1. Since the gap between M_1 and RM is rather narrow, it is itself suggestive that controlling RM helps control M_1. However, the analysis of the sources of reserve money does not indicate that monetary authorities have full control of reserve money of foreign origin due to the movement in BOP nor of domestic origin arising mainly due to the government budgetary operation. Control of money supply through the control of reserve money implies the adoption of indirect monetary policy instruments such as open market operations and central bank rate. The conduct of monetary policy through open market operations may fail to control RM due to the lack of instruments and also markets for such instruments. The use of central bank rate may also fail to have an impact on reserve money in a situation of excess liquidity with commercial banks. Therefore, direct monetary policy instrument like CRR, which work through its impact on money multiplier, is still relevant for an effective reign over money supply in developing economy like Nepal.

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