ESTIMATING THE DEMAND FOR MONEY IN NEPAL: SOME EMPIRICAL ISSUES

Dr. Yuba Raj Khatiwada [*]

1. INTRODUCTION

The demand for money is one of the critical variables affecting the level of aggregate economic activities in the economy. This has a decisive role in the process of transmission mechanism of monetary policy and hence the effectiveness of monetary variables on the real and external sectors of the economy. The Keynesian type of transmission mechanism which posits an indirect role of money on income depends upon the interest elasticities of the money demand and investment. The higher the interest elasticity of the demand for money, the smaller would be the change in the rate of interest required for restoring monetary equilibrium and, given the interest elasticity of investment, the lower the effect of changes in money supply on income. But if the demand for money is less sensitive to interest rate, then a small change in money supply leads to higher change in the rate of interest needed to restore monetary equilibrium; and, given the investment function, the higher would be the effect on the level of income. At the extreme case of liquidity trap where money demand is perfectly elastic with the rate of interest, no change in interest rate with respect to any change in money supply is required to restore monetary equilibrium and hence no effect on investment and income. Thus, given the interest elasticity of investment demand, the strength of the Keynesian transmission mechanism is derived from the demand for money function explaining the elasticity of demand for money with respect to the rate of interest (Dennis, 1981).

In the Monetarists' type of transmission mechanism, stability of the demand for money function has decisive role for the effect of money supply on income and prices. If the

[*] Economic Advisor, Research Department, NRB.

demand for money is stable, any change in money supply has a direct effect on aggregate expenditure. Whether this change will affect real income or price, or both, depends on whether the economy is at full employment or less than full employment. If the demand for money is not stable (i.e. velocity of money circulation is fluctuating), any change in money supply can just be off-set by equal and opposite change in velocity (through idle hoarding/dishoarding of cash balance) having no effect on income or prices. So, whether we analyse Keynesian or Monetarists type of transmission mechanism of monetary policy, the specification of the demand for money function, test of its stability and estimation of the elasticities of money demand with its specified determinants is highly essential. In fact, the entire debate between Keynesians and Monetarists regarding the role of money in determining economic activity and the relative effectiveness of monetary versus fiscal policy can be considered in the framework of the relative stability of the demand for money function and the expenditure function over time (Laidler, 1971). Although the demand for money function does not provide the whole transmission mechanism whereby money supply changes lead to changes in income or prices, it provides a vital link in that process. Moreover, if the demand for money is a predictable function of a few variables, then the required change in the stock of money which ensures equilibrium in the money market can be easily worked out. This is what we need for stability (internal and, in the case of open economies, external stability as well) in the economy. So planning for neutral money or setting socially-desirable rate of growth of the stock of money also requires specification of the demand for money function and the test of its predictability along with the capacity to control actual changes in the stock of money (Gupta, 1979). In this context, assessment of the effectiveness of monetary policy in Nepal would also require test for the stability of the money demand function. This has been all the more necessary in the context of financial liberalization taking place since mid 1980's; because with such liberalizations, there would be a fast evolution of financial instruments which are close substitutes for money. When money substitutes are available in an extensive scale, demand for money fluctuates frequently with change in interest rate structure, exchange rate, and stock prices. In this paper, the objectives of estimating the demand for money would be the following:

(i)   to estimate the income and interest elasticities of the demand for money,

(ii)   to examine whether the demand for money in Nepal is 'homogeneous of degree one' in price   and population or not,

(iii) to test the complementarity versus substitution between money and physical capital,

(iv)   to test the overall stability and predictability of the money demand function, and

(v) * to test the stationarity of the time series data used in the money demand function.

2. SPECIFICATION OF THE FUNCTION

Theoretically, the demand for money is cast as a function of some measure of income or wealth, the rate of return on alternative assets, and some other variables representing the structural composition of the economy (Gupta, 1979). Numerous empirical studies have been done in this field in the context of developed countries and, to a lesser extent, in the context of developing countries. However, the choice of variables in the empirical analysis and the methodology opted for estimating the demand for money have come out as the most controversial issues in empirical economic research. The most often debated issues in the specification of money demand function are the choice of scale variable, the interest rate, the price variable, definition of money, appropriate deflator, and in the context of developing countries, the choice of variable that represents the rate of monetization and economic development. Along with this, the complementary or substitutional role of money with respect to other financial as well as real assets is also highly debated. Regarding methods of estimations, the controversy lies in-the use of single-equation estimation or the simultaneous-equation estimation method,[1] the use of stock-adjustment lag approach, the estimation of unobserved explanatory variables such as expected income, interest rate and the rate of inflation, and the use of price and population as deflators or explanatory variables in the estimating equation.[2] So it becomes worthwhile to make a brief account of these issues before specifying the appropriate demand for money function for Nepal.

(i)   Scale Variable

The key issue in the specification of money demand function is whether income or some measure of wealth should be chosen as the scale variable. Those economists who emphasize on the 'transaction' motive of holding money hold the view that volume of transactions and hence the level of income would be the appropriate scale variable. But those who give emphasis to the 'assets' motive of holding money prefer wealth or permanent income as the scale variable. Following Friedman's (1959) study on the demand

---

[1]   Teigen (1964) argues that a logical way to eliminate the simultaneous equation bias of the single equation demand coefficients is to formulate a supply function of money and to estimate the coefficients of the demand for money and money supply jointly. His findings on the U.S. data show that bias in the coefficients exist if money demand is estimated independent of supply function. Bhattacharya (1974), examining the Indian case, also comes to the same conclusion. But overwhelming studies (except Brunner & Meltzer, 1964 and a few others) have estimated the demand for money equation by single-equation estimation method.

[2]   See Chow (1966), Feige (1967), Shapiro (1967), and White (1978).

for money, money was regarded as a durable consumer good held for the services it renders and the quantity of money demanded, like the quantity of consumption services in general, was adapted to permanent income rather than the measured income. Demand for money studies done subsequently relating the U.S. economy were mostly specified in terms of permanent income as the scale variable (Brunner and Meltzer, 1964; Chow, 1966; Laidler 1966a; 1966b; Lee, 1967; Laidler, 1971; Khan, 1974 b). But, with the introduction of wealth as a constraint on money demand by Meltzer (1963), various empirical studies were done taking wealth as a scale variable (Meltzer, 1963b; Brunner and Meltzer, 1963; Chow, 1966; Hamberger, 1966; etc.). On the other hand, use of measured income rather than permanent income or wealth was also found appropriate in many studies (Latene, 1954; 1960; Bronfenbrenner and Mayer, 1960; Courchene and Shapiro, 1964; Teigen, 1964; Heller, 1965; Khan, 1974b). In the case of some other developed countries like U.K. and Canada also, experiments have been done with permanent income (Fisher, 1968; Laidler and Parkin, 1970; Laidler, 1971) as well as measured income (Shapiro, 1967; Courchene and Kelly, 1971). In the context of developing countries, most of the empirical studies have taken measured income rather than wealth or permanent income as the scale variable for one reason or the other. As data on wealth are not available in most of the developing countries and computation of permanent income is either not possible due to very short time series of data or has no 'meaningfulness' of permanent income in a man's consumption or spending decisions (Fan and Liu, 1971), choice of measured income as the scale variable has been popular. Further, such a variable has been found to have stable and significant relationship with the demand for money. Studies on demand for money done by Rangarajan (1965), Gujarati (1968), G. S. Gupta (1970), Mammen (1971), Lahiri (1977), Pandit (1978), Gupta (1979), and Sampath and Hussain (1981) in the Indian context have chosen some measure of the current income as the explanatory scale variable and found evidence of significant influence of this variable on the demand for money. Similarly, studies relating to other developing countries have also chosen measured income in the money demand function (Fan and Liu, 1971; Akhtar, 1974; Wong 1977; etc.)

The general consensus in the formulation of demand for money, observed from the various empirical studies in the case of developed as well as developing economies, is that some measure of wealth or income must be included in the demand for money function. Some studies have involved both of these scale variables also (Hamberger, 1966; Chow, 1966; Bhattacharya, 1974;) etc. But inclusion of both income and wealth in the function is problematic from the view point of empirical estimation as the two variables move with similar trends (wealth being the capitalized value of income) and cause multicollinearity in

estimation. So, it becomes worthwhile to select only one scale variable for the money demand function. In the Nepalese context, we chose measured income as the appropriate variable. In fact, there are convincing prima facial arguments favouring the selection of measured income as the scale variable in our study. First, the 'transaction' motive of holding money presumably dominates the 'asset' or speculative motive of holding money and the level of income would be the appropriate scale variable for such money demand. Second, data on wealth are not available, nor permanent income series can be constructed because of very short time series of national income data, and income, which is regarded as a steady stream or return on wealth, would serve as a proxy for wealth variable. Third, the demand for money studies done in the Nepalese context (Poudel, 1987 and Sharma, 1987) have found significant and stable relationship between income and the demand for money.

But, the controversy does not end here. Even if we choose income as the explanatory variable, the questions still persisting are - which measure of income (GNP, NNP, GDP, National Income or Disposable Income) is to be chosen ? Is it monetized income only or the total income to be taken under consideration ? And is it the current income or the permanent income to be chosen? Regarding the first problem, there is no hard and fast criterion for the choice of any national income aggregate; and, all the alternative measures may work well. However, if income is regarded as a proxy for wealth, NNP should be preferable to GNP because it is the net wealth not the gross wealth that matters for asset choice and hence the demand for money (Gupta, 1979).[3] But numerous studies have chosen National Income also as the scale variable (G.S. Gupta, 1970; Mammen, 1971; Gujarati, 1968; Akhatar, 1974; Jacobs, 1974; etc.). Since National income at market price is identical to NNP at factor cost, the issue culminates to the choice of NNP at factor cost or market price. As indirect taxes less subsidy which differentiates NNP at market prices from that at factor cost is regarded 'fully a part and parcel of net income as viewed by the public' (Gupta, 1979), NNP at market price (which includes this item also) is preferred to that at factor cost. But in the absence of data on NNP at market price, GNP at market price would be preferable in our context. However, GNP figures are available only for the period after 1974/75 and the empirical study covering a longer period back has to be confined to GDP figures.[4]

---

[3]   Demand for money studies by Brunner and Meltzer (1964, Feize (1967), Chow (1966), Khan (1974a), Khan (1974b), and Gupta (1979) have chosen NNP as the measure of income. But Teigen (1964), Shapiro (1967), Melitz and correa (1970), Fan and Liu (1971), Courchene and Killy (1971), Lahiri (1977), Wong (1977) use GNP as the income variable.

[4]   Experiments with three alternative definitions of income (GDP, NI, GNE) in Sampath and Hussain's study reveals GDP as the most appropriate definition of the scale variable (Sampath and Hussain, 1981).

The next issue associated with our study is the choice between monetized GDP and total GDP as the scale variable. It is stated that in developed countries, the discrepancies between physical and monetary flows of production, consumption and income are only marginal but, in developing ones, a sizable portion of these magnitudes originate through non-monetary transactions like self consumption and trade in kind. So non-monetized income presumably has a larger share in national income in developing countries than in the developed ones (Bhattacharya, 1974). In an agriculture-dominated economy like Nepal, the share of non-monetized income is supposed to be higher; for, owing to the existence of a subsistence level of farming and prevalence of barter system in factor payments, agricultural income remains mostly non-monetized. What would be the role of this non-monetized income in the money demand function ? Some economists argue that money demand is related to only monetized income and not to non-monetized income, and subsequently use monetized income as the scale variable (Prasad, 1969; Bhattacharya, 1974; and Fry, 1976). Bhattacharya (1974) argues that 'since the proportion of monetized income to national income increases with development, use of national income data leads to an underestimation of the income elasticity of money demand'. He mentions that as the transaction demand for money increases, partly because of growth of national income and partly because of growth in the degree of monetization, a correct assessment of the rate of monetization is essential for determining the money demand in a developing economy. But it is difficult to get quantitative information on the rate of monetization. And, use of monetized income only in the money demand function is equally controversial. According to Gupta (1979), there are several shortcomings in this approach. First, it links the demand for money to only the transaction demand for it to the total neglect of asset demand. Second, the assumption that non-monetized income does not generate any demand for money is not necessarily true. Third, the monetized income approach does not look consistent with the modern theory of demand for money which links demand for money not only to the value of monetary transactions, but to the total income or wealth. Lastly, he argues that if the demand for money function is to be used for designing a suitable monetary policy to affect money income, the appropriate income concept would be total income rather than monetized income. Against this background and in the wake of unavailability of data on monetized income and its rate of growth and the arguments put forward against the use of narrow definition of income, we choose total GDP, and not the monetized GDP, for the estimation of demand for money in Nepal.

(ii) Interest Rate Variable

Despite the conflicting views that interest rate is or is not an important variable in the demand for money function, the theoretical logic as well as overwhelming empirical studies agree that the money demand function should contain some rate of interest that best represents the opportunity cost of holding money. Putting aside the decision whether interest rate is a significant variable or not to the empirical findings, the problem further faced is the choice of appropriate rate of interest representing the opportunity cost of holding money. There is a wide variety of assets as alternatives to holding money and the rates of return on these assets work as the opportunity cost of money holding. There is then a controversy regarding the choice of the rate of return that best represents the opportunity cost. It is argued that long term bond rate is better choice because it is more representative of the average rate of return on capital and hence better indicator of the general opportunity cost of holding money than the yield on short term debts. The Keynesian theory also supports the long-term rate of interest as it is the interest rate that is linked with investment decision and hence the level of income. On the other hand, it is argued that short term debt instruments, because of their short maturity, are closer substitutes for money than are long term bonds, and the yield on them is the appropriate opportunity cost variable. The theory of term structure of interest rate rests on the proposition that (with suitable adjustment for risk) expected holding period yields on assets of various maturities tend to be equalized by the market. But this is possible in a perfectly competitive capital market only. In an underdeveloped monopolistic market situation, such yields are not equalized and there also exist unorganized market rates of interest which are varying in degree and unobservable also. Such a situation is more severe in a country like Nepal where organized capital market is in a rudimentary stage. So selection of a particular rate of interest that represents the average opportunity cost of holding money is more complicated.[5]

As the demand for money theory does not provide specific guidance regarding the choice of interest rate, various researchers have tried different rates depending upon the methodology adopted and the availability of suitable data. Working on the U.S. data, Latane (1954, 1960), Meltzer (1963), Chow (1966), Hamberger (1966), Khan (1974b) etc. have found significant negative relationship between money demand and the long term rate of interest. Friedman (1959), however, finds no significant relationship between long term rate

---

5   Use of more than one interest rate variable in the statistical demand function for money is neither theatrically elegant nor practically possible (as it creates the problem of multicollinearity and loss of degrees for freedom in empirical estimation of the money demand equation.

of interest and the demand for money. But his findings are refuted by laidler (1966a, 1966b). Working on both the short-term and long term rates of interest, he finds either rates significant in the determination of demand for money. Several other studies are also based on the long-term rate of interest (Gujarati, 1968; Laidler, 1971; Courchene and Kelly, 1971; Akhatar, 1974; Jacobs, 1974; Khan, 1974b). A study by Hamberger (1966) shows that both the yields on long term bonds and equities have significant influence in money demand in the U.S.A. But Lee (1967) does not find yield on corporate equities a potentially important determinant of the demand for money. In his study, the yield on non-bank financial intermediary liabilities has been found most significant. These evidence tend to support that long term rate of interest is highly appropriate for demand for money function. There are, however, sufficiently large number of studies based on short term rate of interest also. Even in the case of U.S.A., studies done by Heller (1965) and Laidler (1971), show that short term rates are more relevant for estimating money demand function. In the Indian context, Rangarajan (1965), Gupta (1970), and Bhattacharya (1974,) have used the short term interest variable and most of them have found significant relationship between this interest rate variable and money demand. But the empirical findings of Gujarati (1968), Gupta (1979) and Sampath and Hussain (1981) reveal no significant influence of any rate of interest on the demand for money.

There are some studies which have chosen opportunity cost variable in a slight departure from the conventional way of chosing it. Feige (1967) uses an exponentially weighted average of past and present values of the interest rate (commercial paper rate), whereas Fry (1976) uses the expected rate of inflation as the opportunity cost variable. Interest rates offered by financial intermediaries on their liabilities are also selected by many researchers (Lee, 1967; Otani and Park, 1976; Gupta, 1979; Sharma, 1987). These researchers have chosen one particular rate or the other as the representative interest rate whereas some others have generated the simple average or weighted average of the lending or deposit rates.[6] Wong (1977), on the other hand, argues that the observable interest rates in developing countries do not, in general, reflect money market conditions (as they are institutionally pegged) and the interest rates prevailing in the unorganized markets are unobservable. Since the prevailing interest rate in this market would reflect the degree of credit restraint in an economy, the degree of credit restraint *per see* can be treated as a proxy variable for the interest rate to be specified in the money demand function. This hypothesis

---

6   Khan (1974a) uses weighted average interest rate on commercial bank loan whereas Schulz (1978) chooses the average deposit rate.

looks highly relevant in the Nepalese context where interest rate in the organized sector remained administered for a long time and the interest rates prevailing in unorganized market are not recorded.

Use of treasury bill rate or long term bond yield as the interest rate variable in the Nepalese context is irrelevant because these debt instruments are not a significant part of the public's asset portfolio and their market has remained captive, mostly within the banking system. The newly issued National Savings Certificates are somewhat held by the public. But in the absence of sufficient time series data, we can not make use of the yield on this long term debt instrument as the interest rate variable. Time deposits at banks are, on the other hand, popular and significant part of the public's financial asset portfolio. Hence interest rate on such deposit is likely to be more appropriate opportunity cost variable. Therefore, the interest rate on time deposits will be taken as the opportunity cost variable in the statistical demand for money function in Nepal.

(iii) Price Variable

The Keynesian type of money demand function postulates substitution between money and financial assets only. But the Monetarists version regards money as a form of asset in the portfolio of wealth-financial as well as physical. This version holds the view that as the demand for any asset depends, among others, upon own price and price of the substitutes, demand for money also depends upon own return (interest rate) and return on its substitute (price of the physical capital). Inflation has the effect of lowering the value of money but increasing that of other real assets. If these assets serve as the alternatives to holding money, then an increase in prices would cause a switch from money and bonds to real assets. Assuming nominal rate of return on wealth held in the form of money to be zero (at least when money is defined to include currency and demand deposits only) and that on wealth held in the form of physical assets to be equal to price changes in those assets, it is stated that money demand is inversely related to changes in price level. In a developing country like Nepal where there are very few financial assets other than money and where price rise has become a regular phenomenon, inflation appears as the opportunity cost of holding money. This is because substitution between money and physical assets is more apparent in the absence of a well-developed financial system. So considering money as an asset in the generalized portfolio of wealth and a substitute for real assets, rather than a substitute to financial assets only, the inclusion of price variable in the money demand function seems logical.

9

But a greater controversy revolves around the use of price explicitly as a separate explanatory variable or implicitly as a deflator to the nominal money stock. Many studies have cast their models in real terms excluding price as a separate explanatory variable on the assumption that demand for real money balances is invariant with respect to price level-that is, the demand for nominal money balance is proportional to price level. This statement implies that there exists no money illusion in the economy. Various studies done in the context of U.S.A. and U.K. have either found unitary price elasticity of nominal money balances (Meltzer, 1963) or taken it for granted that the elasticity is one (Laidler and Parking, 1970; Laidler, 1971; Khan, 1974b)[7] But in the context of developing economies where money illusion is supposed to exist (i.e. adjustment of money balance to price changes may not be instantaneous), we can not postulate, *a priori*, that demand for money balances is homogeneous of degree one in price level. Thus, the homogeneity assumption becomes a testable hypothesis and this can be done by introducing price as an explanatory variable in the money demand function. Further, Sampath and Hussain (1981) argue that from a strict transaction view of the demand for money, anticipated inflation has no role but it will be reflected to some extent in nominal interest rates and indirectly affects the demand for money. But in the Chicago tradition, as money serves as an alternative for physical goods, expected rate of price change is given a prominent role. So they test the linear homogeneity assumption of money demand function with respect to the price level in the Indian context and find that money demand is homogeneous of degree one in prices.[8] Nevertheless, estimating the demand for money function including price as a separate explanatory variable sounds better. If the coefficient on price of the estimated real money demand function turns out to be zero, then we can accept the homogeneity assumption and drop prices as a separate explanatory variable. Estimation of $\frac{M^d}{P} = by^{\beta_1} r^{\beta_2}$ type of equation (where $y = Y/P$) without using P as independent variable will be valid only if price elasticity

---

[7] If the price level elasticity of demand for money is indeed not equal to one, then demand for real balances will also depend upon the level of prices and the latter's omission should show some instability and poorness of fit of the equation cast in real terms.

[8] Assuming real money demand function as $M/P = A(Y/P)^{\alpha} r^{\beta}$ where M = nominal money balance, P = price level, Y = nominal income, r = interest rate and A, α, β = parameters , Sampath and Hussain (1981) derive the nominal money demand function as: $M = a (Y/P)^{\alpha} r^{\beta} P$ or $M = A Y^{\alpha} r^{\beta} P^{1-a}$. Estimating the latter equation, if the coefficient on P turns out to be equal to $1-\alpha$, then linear homogeneity argument is valid and their estimated coefficient on P is not significantly different from $1-\alpha$. That is how they validate the linear homogeneity assumption. But such a test is not possible when prices used to deflate Y and M are different.

of money demand is equal to one. Because if $M^d = b \, Y^{\beta_1} r^{\beta_2} \, P^{\beta_3}$ and $\beta_3 \neq 1$, dividing this equation by P will yield $\dfrac{M^d}{P} = b \, y^{\beta_1} r^{\beta_2} \, P^{\beta_3 - 1}$, not the usual estimating equation $\dfrac{M^d}{P} = b \, y \, \beta_1 \, r \, \beta_2$. So inclusion of P as a separate explanatory variable is necessary to find out whether β_3 is equal to one or not.

But the question still arising is the choice of appropriate price variable. Various researchers have chosen various measures of price such as NNP deflator (Meltzer, 1963; Feize, 1967; Laidler, 1971; Khan, 1974b), GNP deflator (Hamberger, 1966), GDP deflator (Laidler and Parkin, 1970), or the National Income deflator (Akhtar, 1974). Others have chosen either general price index, consumer's price index, or the wholesale price index.[9] Permanent price (Teigen 1964, Jacobs, 1974) and expected rate of inflation (generated from any price index) rather than the current rate (Otani and Park, 1976; Fry, 1976) are also specified in the money demand function.

Various studies done in the case of European and Latin American countries provide strong evidence of the role of expected rate of inflation in the demand for money (Cagan, 1956; Lerner, 1956; Harberger, 1963). But studies in the case of U.S.A. have found no evidence of any role of such variable (Friedman, 1959). This is attributed to the near stable price level in the U.S.A., not a tendency of U.S. economy to form expectations; and this does not preclude researchers from using expected rate of inflation as the explanatory variable in the statistical money demand function even in the U.S.A. In Nepal, however, there has been a persistent rise in the level of prices during the last decade or so and the rate of inflation is mostly recorded in two digits. It is anticipated that the incessant inflationary trend has switched asset holdings from financial to physical ones such as gold and silver, real estate and consumer durables. But the measurement of return on such assets is constrained by the unavailability of appropriate price index. There are no general price and wholesale price indices. The choice of appropriate price variable is limited to consumer's price index or the GDP deflator (as GNP deflator also is unavailable). Keeping in view the excessive weight given to food items in the consumer's price index and very little weight to other goods and services, it is apparently better to select GDP deflator as the price variable in our equation.

---

9   Melitz and Correa (1971) use general price index whereas Chow (1966), and Courchene and Kelly (1971) use consumer's price index.

(iv) Choice of Other Explanatory Variables

(a)   *Distribution variable:* When wealth is included as the scale variable in the money demand function, then its distribution between human and non-human portions is also crucial. For, the higher the ratio of non-human wealth in total wealth, the lower would be the liquid asset requirement of the wealth owner, the former itself being a liquid asset compared to human wealth. Hence, the lower would be the demand for money balances. When income is regarded as the scale variable, its distribution between agricultural and non-agricultural income also counts for the specification of money demand function. The theoretical basis for involving such distribution variable in the money demand function is that marginal propensity to hold money is supposed to be less for agricultural income compared to non-agricultural income. Empirically, this has been found true also[10]. So, with the growing ratio of non-agricultural income to total income, demand for money is supposed to increase. This variable may also work as a proxy for economic development variable which some researchers have advocated for in estimating demand for money function. Though the distribution variable is usually defined as the ratio of agricultural income at current prices to net national income at current price we have to choose the ratio of agricultural GDP to total GDP for want of data on NNP and its sectorial components. But the inclusion of this variable in the statistical demand for money function which includes some measure of income as the separate explanatory variable is not out of controversy.

(b)   *Rate of monetization:* In developing economies where non-monetized income comprises a sizable chunk of the total income, additional amount of money may be demanded in the process of gradual transformation of non-monetized income into money-income. That is why, income, inflation or the rate of interest, the conventional determinants of the demand for money are said to be insufficient or unapplicable for all economies. So to capture the institutional and behavioral differences among different economies, degree of monetization is one of the variables chosen for money demand function. (Chandavarkar, 1975; Melitz and Correa, 1970). But the rate of monetization is not readily observable and various proxy measures have to be included in the estimating equation.[11] In our context, it is plausible to use bank offices per million of population as the proxy for monetization

---

10   In a study, Sharma (1987) has found marginal propensity to hold money of the non-agricultural income four times higher than that of agricultural income in Nepal.

11   Ratio of taxes to GNP, urbanization ratio, size of non-agricultural output, number of population per bank branch are some of them. Some have followed the Goldsmith (1966) criterion for estimating the degree of monetization while some others have chosen the velocity of money for this purpose.

variable. But it is also viewed that growths of monetization and financial intermediation are more concurrent than sequential (Chandavarkar, 1975); so both variables need to be included in the equation. Hence money demand function can be specified taking income velocity of money as the indicator of monetization (as the velocity is expected to decline with the growth of monetary sector) and bank offices as the indicator of financial intermediation (as financial intermediaries are supposed to affect public's money holding behavior also).

(c)   *Level of economic Development:* Level of economic development is also supposed to affect money demand to some extent. So to capture the effect of this structural variable, per capita income, per capita energy consumption, index of industrial production etc. have been used in the money demand function. But as the process of monetization and economic development are concurrent, use of both of these variables simultaneously in the estimating equation may create problem of multicollinearity.[12] So it becomes practicable to select one variable that represents both the degree of monetization and the level of economic development. Index of industrial production can be a probable candidate for this purpose.

(v)   Definition of Money

There is no unanimity among economists regarding the empirical definition of money for specifying money demand function. Economists who emphasize medium of exchange function of money prefer money to be defined as currency held by the public plus demand deposits at the banking system (M1). Many others who recognize money functioning as a store of value include time deposits also in the definition of money. The view that time deposits should only be included in the definition money and not the liabilities of other financial institutions, stems from the judgement that time deposits are cheaper assets to use as a "temporary abode of purchasing power" than are the liabilities of other financial institutions (Laidler, 1969). Notwithstanding this, selecting appropriate definition of money

---

[12]   Melitz and correa's study (1970) shows currency ratio, interest rate and monetization as significant variables in money demand function. But it was only after excluding monetization variable that the economic development variable was significant in explaining money demand. Hence, they come to the conclusion that any effect of the level of economic development in money demand (and velocity) derives primarily from the positive association of economic development with monetization.

in the demand for money studies is regarded fundamentally an empirical issue.[13] Any definition of money that has a more stable relationship with the specified explanatory variables can be preferable for monetary planning purposes. But the evidence has remained somewhat mixed. Demand for money studies done by some researchers show M1 and M2 both equally stable functions (Khan, 1974b; Sampath and Hussain, 1981) while others have shown either M_1 or M_2 the preferable definitions from the viewpoint of either stability of the money demand function or basic function money is supposed to perform. There is also a view that a choice can not be made on the appropriate definition of money stock by appealing to the stability criterion (Khan, 1974b). In the Nepalese context, fixed deposits, a major chunk of time deposits, though supposed to be close substitutes for money, are not readily available for spending due to prior notice required for its withdrawal. However, saving deposits in recent years have been more liquid from the growing facility of withdrawals. So it becomes worthwhile to test either definition of money for empirical purposes. The appropriate variable can the chosen only after empirical results.

(vi) Nominal Versus Real

Another issue that needs our attention is whether money demand function should be defined in nominal or real terms. It is argued that the demand for money should be viewed as demand for real cash balances because money is demanded not for its own sake but for the real services it yields to its holders. Given the stock of nominal balance, its real service (i.e. the purchasing power) declines with the increase in prices. So public would desire to maintain this level of real service (real cash balance) by increasing the nominal stock of cash balance if they have to get command over the given values of real income or wealth. Assuming that demand for money balance is proportional to the price level (a doubling of price level requiring also a doubling of nominal money balances to maintain the real balance intact), money demand functions are generally cast in real terms. In fact, the theory of demand for money mostly involves the proposition that real money balances is invariant with the price level and specification of money demand function in real terms (deflating nominal stock of money by the price level) is consistent with the theory. Various demand for money studies done in the context of U.S.A. are thus cast in real terms (Friedman, 1959; Chow, 1966, Laidler, 1966a; 1966b; Khan, 1974b; etc.). In the Indian context, while Gujarati

---

[13] In the empirical studies, Brunner and Meltzer (1963), Chow (1966), Motley (1967), Adekunle (1968), Gupta (1970), Gujarati (1968), Akhtar (1974) and Gupta (1979) have used narrow (M_1) definition of money whereas Friedman (1959), Laidler (1966a) Laidler (1966b), Laidler (1971), Jacobs (1974), Otani and Park (1976), and Fry (1976) have chosen broader (M_2) definition of money.

14

(1968), Gupta (1979), etc. have cast their studies in real terms, Gupta (1970), Bhattacharya (1974) etc. have chosen the function in nominal terms. Bhattacharya states that if appropriate price deflators for many predetermined variables are not available and if elasticities of nominal money with real income and prices are not significantly different from unity, then specifying the equation in the form of nominal money balance and nominal income variables would not only take care of deflation problem of other variables but also abide by the homogeneity assumption. But unitary income-elasticity is a particular case and this should not be taken as a general rule for casting money demand function in nominal term rather than in real term. Further, if the deflators used for deriving real magnitudes of the variables are different, switch-over from real to nominal magnitudes as stated by Bhattacharya is not practicable.[14] Contradicting to Fisher's study (1968) which estimates demand for money in nominal terms, Laidler and Parking (1970) explain how nominal variables in the equation lead to overstate the relationship between variables (particularly between money balance and income) in the U.K. economy. Such a problem can be more severe in the Nepalese situation where prices have been increasing significantly and affecting many of the variables (such as nominal income, nominal rate of interest, nominal stock of money etc.) in the same direction, thereby causing a case of spurious correlation between variables. This sort of problem can be removed by casting the function in real terms. Further, if we want to make use of the money demand function in monetary planning for price stability, purposes it is the real demand for money, not the nominal one, that guides us to attain monetary equilibrium with price stability.[15]

But what would be the appropriate deflator ? It is stated that the deflator for money should be the GNP deflator as far as the real transaction demand for money is concerned (Wong, 1977). In its absence, wholesale price index is preferred rather than consumer's price index on the logic that the former does not contain the prices of services which are not relevant in considering the substitution between money and real assets. In Nepal, data on either GNP deflator or wholesale prices are not available. So GDP deflator has to be used to derive real magnitudes for the statistical demand for money function.

---

[14] For deflating nominal money, the use of consumer's price index number is popular while use of appropriate implicit price deflator is popular for deflating nominal income.

[15] However, Chow (1966) is of the opinion that money demand function should be estimated in real terms if money illusion is absent and in nominal terms if money illusion is assumed.

(vii) Aggregate or Per Capita

It is argued that the correct specification of money demand function should use per capita real money holding and real income rather than aggregate values.[16] This is warranted not only because this has stronger theoretical foundation but also because it reduces the problem of heteroscedasticity and spurious association due to time trend movement in the money and income variables. Deflation by population to aggregate money balance is deemed necessary where the growth of population is rapid. But again the assumption of homogeneity should be accepted while using population as a deflator; that is, the demand for aggregate money is homogeneous of degree one in population. But empirical studies have hardly been successful to defend the assumption (Akhtar, 1974). Meltzer's study (1963) shows that the per capita demand for real money balance is not homogeneous of degree zero in population. This implies that the money demand function should be estimated in aggregate terms, since estimation in per capita terms would overstate the income elasticity. But Jacob's study (1974) could not substantiate it. After alternative specifications of the money demand function - deflating the aggregate data by population and prices deflating by price only, and using nominal data (undeflated by price or population) he comes to the conclusion that all the three specifications are mathematically equivalent when the data are dominated by time trend. When data are not purely time trended, then money demand function can be estimated using population and prices as separate independent variables. But just as the ability of a society to save depends on per capita income rather than aggregate income, demand for cash balances is also likely to depend on the amount of income per capita or per family. So deflation by population can be ignored only in the special case in which real income elasticity of demand for money is around unity (white, 1978). Since theoretically it sounds better, it is the empirical study which will determine whether deflation by population to aggregate money stock and income is desirous or not. As one of our objectives is to test the stability of the money demand function, that model (real aggregate or real per capita) which gives the best result will be accepted for further consideration.

3. EMPIRICAL EQUATIONS

As a first approximation, the demand for money function in aggregate real terms is specified as:

---

[16]   Accordingly, various demand for money functions are cast in real per capita terms (Friedman, 1959; Laidler, 1966a; 1966b; Khan, 1974d; and Melitz and correa, 1970).

Estimating the Demand for Money in Nepal : Some Empirical Issues

$$\ln RM^* = \ln a_0 + a_1 \ln y + a_2 r + u \dots\dots\dots\dots\dots\dots(i)$$

Where RM^* = desired real money demand (M/P), y = real GDP (Y/P), Y = nominal GDP,

P = implicit price (GDP) deflator, r = interest rate on 12-month fixed deposits, u = error term,

The expected signs of the coefficients are: $a_0 > < 0$, $a_1 > 0$ and $a_2 < 0$.

Estimating equation for the test of whether demand for real money balance is homogeneous of degree zero (whether demand for nominal money balance is homogeneous of degree one) in prices or not can be specified as:

$$\ln R M^* = \ln a_0 + a_1 \ln y \, a_2 r + a_3 \ln P + u \dots\dots\dots\dots\dots\dots (ii)$$

The expected values of the coefficients are: $a_0 > < 0$, $a_1 > 0$, $a_2 < 0$, $a_3 = 0$

Alternately, the function in real per capita terms is specified as

$$\ln RM^*/N = \ln a_0 + a_1 \ln y/N + a_2 r + a_3 \ln P + a_4 \ln N + u \dots\dots\dots\dots (iii)$$

Where N= population, and the expected value of $a_4 = 0$

In fact a_3 and a_4 are hypothesized to have zero value on the assumption that the demand for nominal money is homogeneous of degree one in prices and population. The equations specified above imply that there is 'instantaneous' (i.e. within the unit period) adjustment of actual stock of money balance to its desired level. In reality, because of the time and cost involved in making portfolio adjustment, the presence of various obstacles and money illusion, the complete adjustment of real money balances to the desired level within a defined period (say a month, quarter or year) is not possible. It is argued that when empirical studies are done on the basis of annual data, there is no need of any stock adjustment process in estimation, as one year is quite sufficient for adjusting actual real balances to the desired level. Moreover, it is conventional not to use lagged variables in annual models (Sampath and Hussain, 1981). But this argument seems valid in the case of developed economies only. In developing countries, empirical studies have revealed that full adjustment of desired and actual level of real balances is not possible even in a year. So standard adjustment process is needed for deriving short term or actual demand for money function from the long run or desired demand for money functions stated above. A

17

convenient method for examining the adjustment of actual stock of money balances to its desired level is Nerlov's partial adjustment mechanism (Kutsoyiannis, 1972). This postulates that actual changes in money balances (M) at any time period is some fraction of the desired change for that period. That is :

$$M_t - M_{t-1} = \lambda \, (M_t^* - M_{t-1}) \text{ .... (iv)}$$

Where $M_t - M_{t-1}$ is the actual change in the demand for money balances, $M_t^* - M_{t-1}$ is the desired change and λ is the adjustment coefficient, $1 > \lambda > 0$

Equation (iii) can be rewritten in real terms as well as in the exponential form as follows:

$$(\frac{M}{P})_t / (\frac{M}{P})_{t-1} = \lambda \left[(\frac{M}{P})^*{}_t / (\frac{M}{P})_{t-1} \right]$$

Logarithmic transformation and rearrangement of equation (iv) results in:

$$\ln(\frac{M}{P})_t = \lambda \ln(\frac{M}{P})^*{}_t + (1-\lambda)\ln(\frac{M}{P})_{t-1} \text{ ....(v)}$$

Substituting equation (i) in equation (v), the short run demand function for money can be derived as

$$\ln(\frac{M}{P})_t = \lambda \, [\ln a_0 + a_1 \ln(Y/P) + a_2 r + a_3 \ln P + U] + (1-\lambda) \ln(\frac{M}{P})_{t-1} \text{ ..... (vi)}$$

or $$\ln(\frac{M}{P})_t = \lambda \ln a_0 + \lambda \, a_1 \ln(Y/P) + \lambda \, a_2 r + \lambda \, a_3 \ln P + (1-\lambda) \ln(\frac{M}{P})_{t-1} + V \text{ ... (vi)'}$$

or $$\ln RM_t = \ln a_0 + \lambda \, a_1 \ln y_t + \lambda \, a_2 \, r_t + \lambda \, a_3 \ln P_t + (1-\lambda) \ln RM_{t-1} + V \text{ ..... (vi)''}$$

Where $V = \lambda u$, and RM_{t-1} = one year lagged RM.

Equation (vi) is the short run estimating regression equation where lagged value of the dependent variable (RM_{t-1}) also exists as one of the explanatory variables.

This form of lagged variable model can be extended to the equation having additional explanatory variables (such as rate of monetization, the industrial production index or the distributional variable represented by the ratio of agricultural income to total income) which

we have not specified above. The inclusion or exclusion of these variables will be decided after various alternative specifications and empirical evidence.

4. DEFINITION OF THE VARIABLES AND DERIVATION

M_1 definition of money includes currency held by the public plus demand deposits (net of interbank and government deposits) with banking system. Money stock figures are annual averages of month end money stock figures. M2 definition is M1 plus time deposits at commercial banks (inclusive of saving and margin deposits). Income variable is measured by GDP at factor cost and real magnitude derived at 1984/85 prices. In fact, the GDP deflator which we regard as a price variable is also based at 1984/85 prices. The interest rate variable is the 12- month fixed deposit rate. Expected rate of inflation is proximated by one year lagged rate of inflation. Real interest rate is nominal interest rate adjusted for the current rate of inflation. The empirical study is based on annual data covering a period of 21 years (1975/76 through 1995/96).

5. EMPIRICAL EVIDENCE

5.1 General Model

To start with, a simple OLS equation for real money demand is estimated taking narrow definition of money as the dependent variable, real income (as the scale variable) and 12- month deposit rate (as the opportunity cost variable). The estimated result is:

$$\ln RM1 = -4.44 + 1.25 \ln y - .034\ r$$
$$\quad\quad (-5.4)^* \quad (17.2)^* \quad (-3.4)^*$$

$$\overline{R}^2 = .988, \quad F = 584.8, \quad DW = 2.81 \quad \text{Period: } 1976 - 96$$

Where $\ln RM_1$ = natural logarithm of real narrow money (M_1/P), $\ln y$ = natural logarithm of real income (GDP at factor cost at 1984/85 prices), r = 12 - month fixed deposit rate offered by the commercial banks. Figures in the parentheses are t- values of the respective coefficients. (*) and (**) indicate significance at 5 percent and 10 percent level respectively.

The above equation shows very satisfactory result in that the signs of the estimated coefficients are as per the expectation and they are statistically significant at 5 percent level of significance. The adjusted coefficient of determination is highly significant (as the F-

19

statistic exhibits), and Durbin - watson (DW) statistics is also within a tolerable range.[17] The predicted (or fitted) value of real money demand based on this equation are close to actual values indicating a highly predictable behavior money demand in Nepal (Graph 1)

In the above equation, income elasticity of narrow money is greater than unity (1.25) implying that each one percent increase in real income causes 1.25 percent increase in real money demand. This is in contrast to the results derived in case of many developed countries where income elasticity is more or less unity. The underlying factors for greater than unitary income elasticity of money in Nepal may be either due to omission of some of the explanatory variables from the equation as the statistically significant constant term also indicates, or due to non-stationarity of the data representing the variables in the money demand equation. Regarding omission of the explanatory variables, two possibilities exist. First, rate of monetization which is a crucial factor affecting the demand for money does not exist in the list of explanatory variables in this estimation. So the coefficient on real income might have absorbed also the effect of rate of monetization on money demand, and hence higher income elasticity. In fact, in many developing countries with monetization taking place, the income elasticity of the demand for money is found to be greater than unity. This is because in such economies money is demanded not only for bringing output into monetary transactions or exchange but also for replacing barter or commodity transactions by monetary transactions. And, the latter type of demand makes income elasticity of money demand greater than unity. Second, the omission of the price variable from the estimating equation and estimating real money demand as a function real income implies that demand for money is 'homogeneous of degree one' in prices. In other words, it assumes unitary price elasticity of demand for money. If the price elasticity is different from unity, the estimated income elasticity of real money demand gives biased result. In the next section, this issue will be taken care of.

Regarding the possibility of spurious correlation among the variables in the estimating equation, statistical tests (Unit Root Test and Cointegration Test) can be applied. This is likely to examine the nonstationary nature of the variables included in the estimating equation and the relationship between the variables in a stationary situation of the time series. Section 6 is devoted for this purposes.

---

[17]   The original estimated equation exhibited serial correlation in the error terms. So Cochrane - Orcutt reiterative process was adopted to correct the auto correlation. Convergence was achieved after 4 iterations and the estimated autocorrelation coefficient was .471.

Alternative specification of the money demand function using broader definition of money produced the following result:

$$\ln RM_2 = -5.87 + 1.45 \ln y - .021r$$
$$(9.4)^* \quad (-3.5)^* \quad (-2.1)^*$$

$$\overline{R}^2 = .99 \quad F = 819.1 \qquad DW = 2.72 \qquad \text{period: } 1976 - 96$$

Where $\ln RM_2$ = natural log of real broad money balance. In the above equation, the income elasticity of broad money is found higher than that of narrow money whereas interest rate elasticity is observed lower than that of narrow money. This implies income elasticity of time deposits higher than that of narrow money; and, a portion of broad money (time deposits) positively related with interest rate. In Nepal where time deposits exist as important instrument for holding financial savings, interest rate is supposed to have a crucial positive effect on it. That is why in the above broad money definition of money demand function, the negative impact of interest rate on narrow money demand has been diluted by the positive impact of interest rate on time deposits.

The above equation is a pointer to the choice of appropriate definition of monetary variable in the specification of money demand function. As the interest rate variable has contradictory impact on broad money, having negative impact on narrow money and positive impact on quasi - money (time deposits), estimation of the money demand equation where bank deposit rate enters as a significant explanatory variables seems more appropriate in narrow money specification. So far as the stability of the money demand equation is concerned, the proximate indicators (high R^2 and significant t-statistics) exhibit that both narrow and broad money can be predicted as a function of few variables, and thus no critical problem exists in choosing either M_1 or M_2 as the policy variable.

5.2 Stability Test

It is argued that with financial liberalization taking place, the demand for money becomes unstable. This is substantiated by the frequently changing velocity of money in the economies undergoing financial reforms. Nepal also initiated financial deregulation and liberalization since mid 1980's and more deeply since early 1990's. A noteworthy step in this regard was interest rate liberalization, abolishion of statutory liquidity requirement, full convertibility of the Nepalese rupee in current account followed by freedom to open bank account in convertible currencies and banks' discretion to choose their assets port-folio in

foreign or local currencies, deregulation of interbank rate and sales of securities (treasury bills and Nepal Rastra Bank Bonds) at market determined interest rate through the system of weekly auctions. There have been sweeping developments in the capital market with new financial institutions coming up, new securities being issued and stock exchange resuming full-fledged primary and secondary market activities. Such type of financial liberalization is likely to affect demand for money in the following manner.

First, liberalized interest rate structure reflects the opportunity cost of capital and riskiness of financial instruments prompting shift in financial assets port-folio of the public and the financial system. For instance, if the yield on treasury bills or NRB bonds goes up with liberalization of the interest rate structure, then public might choose to hold bills rather than time deposits at banks. Or, if return on stocks are lucrative, then a rational behavior would be to shift savings in the form of bank deposits to share participation. These shifts imply a downward shift in the demand for broad money. Second, financial market development induces income and interest rate sensitivity of money demand. In this context, frequently changing interest rate structure would have corresponding impact on money demand as well. Third, liberalization of the financial sector along with the foreign exchange regime would allow a free port-folio choice between domestic currency denominated and foreign currency denominated financial assets. This holds true for money as well. Currency substitution (between domestic and foreign) is a major consequence of such liberalization. With higher degree of currency substitution in practice, the demand for domestic currency (money demand) becomes unstable. Growing tendency for opening foreign currency denominated deposit accounts in Nepal is an example in this regard.

The aforementioned issues provide enough room for instability in money demand in Nepal. Hence, empirical test is done to test the stability of money demand function for two sub periods: (i) 1976 - 86 when no marked financial liberalization took place, and (ii) 1987 - 96 when financial deregulation process took place along with foreign exchange liberalization.

The estimated regression equations for these two sub-sample periods are:

(i)   Period: <u>1976 - 86</u>:
      $\ln RM1 = -4.97 + 1.335 \ln y - 0.062r$
      $\quad\quad\quad (-1.3) \quad\; (3.3)^* \quad (-1.01)$
      $\overline{R}^2 = .928 \quad F = 44.2 \quad\quad\quad DW = 2.52$

(ii)   Period: <u>1987 - 96</u>

$$\ln RM_1 = -5.32 + 1.315\,y - 0.017r$$
$$(-4.7)^* \quad (14.0)^* \quad (-1.54)$$

$$\overline{R}^2 = .985, \quad F = 201.0 \quad DW = 2.1$$

These two equations reveal almost similar income elasticities of money but interest elasticities are different in the two sub-sample periods. Seemingly, the second equation shows more predicable money demand relation, as evidenced from high adjusted R^2 and it F - value, and statistically significant parameters. Even then, income elasticity of money demand is almost the same as in the first sub-sample estimation.

Several statistical tests are available for the stability test of the regression equation and of the parameters. Statistical test of the stability of the parameters can be done with Chow-test statistics or CUSUM test. Regarding Chow-test, the sample period was divided in two sub-periods taking 1986 as the break point. This was because many financial sector liberalization measures were taken in August 1986. If this financial liberalization had exerted any instability in money demand functions, then the regression coefficients should have shifted since 1986/87. The F - statistics computed for testing whether the coefficients in two sub-sample periods differed significantly or not shows that the estimated parameters are not different for two sub-sample periods implying stability of the money demand function[18].

Alternative test for stability of money demand function was done taking 1989 as the break point. As interest rate was fully liberalized in that year along with other financial reform measures, it is hypothesized that demand for money function might have shifted thereafter. However, test of the stability of regression parameters over two sub-sample

---

[18]   The hypothesis that can be set for stability test is Ho: $B_1 = B_2$, Ha: $B_1 \neq B_2$ where of B_1 and B_2 are regression parameters for two sub-sample periods. The Chow test statistics is: $F^* = \setminus f([\Sigma e \setminus s(2,p) - (\Sigma e_1^2 + \Sigma e_2^2)]/k, (\Sigma e_1^2 + \Sigma e_2^2)/(n_1 + n_2 - 2k))$ where Σe^2 = sum of squared residuals of the regression estimation, subscript p,1, & 2 stand for pooled, sample 1, and sample 2 periods respectively, k is number of estimated parameters and n = number of observations. The estimated F^* statistic was 1.19. Critical values for F_{15}^3 at 5 percent level of significant is 3.24. Since the computed F^* statistic is less than the critical F^* values, one cannot reject the hypotheses that the parameters are similar for two sub-sample periods.

periods (1975/76 to 1988/89 and 1989/90 to 1995/96) exhibited no significant difference between the regression parameters in these two periods.[19] Taking 1992/93 as the break point when massive foreign exchange liberalization took place (which had some bearings on financial market as well), it is observed that the money demand parameters are not significantly different for the period prior to 1992/93 or after that.

The Cumulative Sum of Squares (CUSUMSQ) test also exhibits that the demand for real money balance is stable over time as evidenced from the CUSUMSQ graph which shows residuals of the estimated real money balances drifting within the 5 percent range of the square graph (see Graph 2).

The Population Factor

To examine whether money demand is homogeneous of degree one in population or not, the following equation was estimated

$$\ln RM_1 = \ln a_0 + a_1 \ln y + a_2 r + a_3 \ln Pop$$

where $\ln Pop$ = natural log of population

The estimated result was :

$$\ln RM_1 = -2.15 + 0.688 \ln y - .028 r + 1.32 \ln Pop$$
$$\quad\quad (-3.3)* \quad (6.0)* \quad\quad (-4.9)* \quad (5.8)*$$
$$\overline{R}^2 = .99 \quad\quad\quad\quad F = 1127 \quad DW = 2.1 \quad\quad\quad Period: 1976-96$$

Although the coefficient on population is 1.32, the standard test statistic shows that it is not significantly different from 1.[20] This hints that estimation of money demand function either in aggregative term including the population variable or in per capita term without including this variable does not make noticeable change in the estimated parameters.

---

[19]   As the computed F^* - statistic was 1.6 against the critical value of 3.2 at 5 percent significance level for 3 df in the numerator and 15 df in the denominator, we could not reject the null hypothesis that they are similar.

[20]   Setting the hypothesis Ho: $a_{3e} = 1$ and Ha: $a_{3e} \neq 1$ (where superscript e means estimated) and going through t - test, we get $t = a_{3e} - a3/\delta b_e = \dfrac{1.32-1}{.228} = 1.4$. As this value is lower than critical value at 5% level of significance (at 16 d.f), we accept the null hypothesis that a_3 is equal to 1.

Short-run Relationship

Assuming that supply of money is not instantaneously adjusted to the demand for it, we can hypothesize that a portion of desired money stock would be met only in the subsequent time period. If this occurs, demand for money at any time 't' becomes the function money demand in the previous time (t-1). In such a situation, estimation of money demand equation taking no account of this partial adjustment process may exhibit biased result. As discussed earlier, estimation of money demand equation inclusive of lagged dependant variable as one of the explanatory variables can serve this purpose. The following is the estimated equation with lagged money demand as one of the explanatory variables.

$$\ln RM_1 = -1.28 + .40 \ln y - .021 r + .683 \ln RM_1$$
$$(-1.6) \quad (2.5)^* \quad (-2.3)^* \quad (5.7)^* (-1)$$

$$\bar{R}^2 = .993 \qquad F = 903 \qquad DW = 2.58$$

Where $\ln RM (-1)$ = one year lagged real money balance.

In the above equation, the coefficient on $\ln RM_1 (-1)$ has an value of .683 which implies that $1 - \lambda = .683$ and $\lambda = .317$. This exhibits that only 32 percent of the desired money balance is realised in the same year implying that money market may remain in disequilibrium for a longer time. The result shows short-term income elasticity of real money balance at 0.40 only whereas the long run elasticity would be 1.26 (=.40/.317). On the whole, the sizable and significant the coefficient on lagged real money balance exhibits non-instantaneous adjustment of money supply to the desired demand for it.

Role of Agricultural Versus Non-agricultural Income

The composition of GDP is also expected to exert an impact on money demand. As the share of agriculture to GDP declines demand for money should increase because of the following factors. First, as large chunk of agricultural sector is non-monetised, increase in such income in relation to non-agricultural income (which is more monetized) implies less demands for money for transaction purposes. Second, the non-agricultural sector is synonymously known as the modern sector where demand for money for assets purpose is relatively higher. In other words, most of the savings in the agricultural sector is normally held in the form of physical assets whereas savings in the non-agricultural sector is held in the form of financial assets. This implies that the demand for money should be high with

25

respect to growing share of non-agriculture in GDP. Estimating the money demand equation including one more variable to represent the share of agriculture in GDP, this hypothesis is substantiated. The estimated result is:

$$\ln RM_1 = -1.09 + 0.99 \ln y - .027\, r - 11.62\, \frac{AGDP}{GDP}$$

$$\quad\quad (-0.75)\ (8.4)^* \quad\quad (-3.2)^*\ (-2.6)^*$$

$$\overline{R}^2 = .991 \quad F = 586 \quad DW = 2. \quad \rho = .492$$

where P = auto correlation coefficient

Where AGDP/GDP = share of agricultural GDP in total GDP. In the above equation, the coefficient on the share variable (AGDP/GDP) is negative and statistically significant. This manifests that as the share of agriculture in GDP increases, demand for money declines and vice-versa. This implies that if modernization of economic activities takes place (with declining share of agriculture in national income) demand for money increases. This is, however, in contradiction with the hypothesis that with financial development taking place along with economic development, money substitutes also emerge and lead to low demand for money.

Test for Homogeneity Postulate

The 'homogeneity postulate' assumes that demand for money is 'homogeneous of degree one in price'. That is price elasticity of nominal money demand is unitary. Only if this holds true, estimation of money demand equation in real terms would give unbiased result without including price as a separate explanatory variable. If price elasticity of nominal money demand is greater than unity, the parameters of the money demand equation would be down-ward biased and vice versa. Therefore, for examining whether estimation of money demand equation in real term without including price variable as a separate explanatory variable will give unbiased result or not, the following equation was estimated:

$$\ln M_1 = b_0 + b_1 \ln y + b_2^r + b_3 \ln P$$

M_1 = nominal money balance, where Y = nominal GDP, P = implicit GDP deflator, r = nominal interest rate on 12- month deposits.

The expected signs of the coefficients are:

$$b_1 > 0, b_2 < 0, b_3 = 1.$$

If the estimated value of b_3 is not significantly different from 1, the homogeneity postulate is substantiated.

The estimated equation is as follows

$$\ln M_1 = -.344 + .469 \ln Y - .028\,r + .911 \ln P$$
$$(1.64)\quad (-3.2)^* \quad (2.2)^* \quad (-.3)$$

$$\overline{R}^2 = .998 \quad F = 4106 \quad DW = 2.2 \quad \rho = .342$$

From the above equation, it is observed that b_3 is not significantly different from 1 from the statistical point of view. Therefore, it can be concluded that estimation of money demand equation in real terms would not result in an overly biased parameters so far as GDP deflator is used for deriving real money balances. However, if CPI is used as the deflator, the estimating equation is likely to give a biased result. This is because the coefficient on prices is significantly different from unity which defies the homogeneity postulate.[21]

Test for Complementarity vs. Substitution Hypothesis

It has been said that conventional money demand equations which contain some measure of income and interest rate as independent variables (the former being the scale variable and the latter being the opportunity cost variable) do not perform satisfactorily in explaining the demand for money in developing countries. In an important book, Mckinnon (1973) states that the accepted theories of monetary and financial process (Keynesian as well as Monetarists) are not appropriate for analyzing money demand function in developing nations because of their assumption of a competitive capital market with a single interest rate or a term structure of interest rates and real money balance being treated as a substitute

---

[21]   Estimating equation with CPI as one of the explanatory variables in money demand function gives a coefficient on prices significantly difference from unity. The estimated result was as follows:

$$\ln M_1 = -1.04 + .6.75 \ln Y - 0.32\,r + 0.60 \ln CPI$$
$$(-1.2)\quad (3.4)^* \quad (-3.5)^* \quad (2.1)^*$$
$$\overline{R}^2 = .998. \qquad F = 4050 \qquad DW = 2.6 \qquad P = .34$$

for physical capital. He says that the relationship between physical capital and real money balances is one of complementarity rather than of substitution. He defends his argument by stating that in developing nations, investors must accumulate money before investment. The reasons given are that capital markets in developing countries are fragmented in which there is a large self-financed household sector and an imperfectly financed corporate sector; business sector issue a limited amount of primary securities and that is also held by financial institutions rather than by the general public; most of the savers are small savers leading to unviability of security issues in large denominations; there is lack of access to external financing; and the predominantly available financial assets are currency, demand deposits, saving and time deposits, and government bonds. In such a situation, money can be an instrument for private capital accumulation. Thus the condition that makes money holding attractive is supposed to enhance rather than inhibit the incentives to hold physical capital. In fact, it is posited that if the desired rate of capital accumulation increases at any given level of income, the average ratio of real cash balance to income will also rise. So money is regarded as an inventory which the saver/investor wants to accumulate before investment takes place or 'money is a conduit through which accumulation takes place'.

Before mentioning the complementarity role of money, let us assume that money is a form of wealth that competes with other assets in the portfolio of consumers and producers. Then the Mckinnion type of demand for money function under 'substitution hypothesis' can be specified as :

$$\frac{M}{P} = f\,(y, r, d - p_r^e)........ \text{(vii)}$$

where $\frac{M}{P}$ real money balance, y= real income, r = real rate of interest on both physical capital and non-monetary financial assets, d = average nominal rate of interest on monetary assets, P_r^e = expected rate of inflation. The expected partial derivatives are: $\partial f / \partial y > 0$, $\partial f / \partial r < 0$, $\partial f / \partial\,(d - p_r^e) > 0$. Since Mckinnon questions the rationale of the negative impact of increase in 'r' on money demand and postulates complementarity between money and physical capital, his type of money demand function under 'complementarity hypothesis' can be specified as:

28

$$\frac{M}{P} = g\ (y, \frac{i}{y}, d - p_r^e) \dots\dots\dots\dots\dots\dots\dots\dots\dots \text{(viii)}$$

Where i = real investment and $\partial g/\partial\ (i/y) > 0$. The 'complementarity hypothesis' states that money must be accumulated before investment due to 'lumpiness' of investment and hence positive relationship between M/P and i/y.

The Mckinnon type of demand for money function specified by Fry (1978) substituting national savings for domestic investment is:

$$\frac{M}{PN} = h\ [y/N, s/y, d - P_r^e, M/PN\ (-1)\ ] \dots\dots\dots\dots\dots\dots \text{(ix)}$$

where N = population, s = gross national savings and the expected sign of the partial derivatives are all positive.

If complementarity holds, then $\partial h/\partial\ (s/y)$ must be positive. In the Nepalese context, we formulate the following Mckinnon type of demand for money equation for statistical analysis:

$$\ln \frac{M}{P} = \ln b_0 + b_1 \ln y + b_2 \ln \frac{i}{y} + b_3\ (d - P_r^e) + u \dots\dots\dots\dots \text{(x)}$$

Alternately,

$$\ln \frac{M}{P} = \ln b_0 + b_1 \ln y + b_2 \ln \frac{s}{y} + b_3\ (d - P_r^e) + u \dots\dots\dots\dots \text{(xi)}$$

Where y = real income, $\frac{i}{y}$ = investment - income ratio, s/y = saving - income ratio, d = one-year fixed deposit rate, P = GDP deflator, P_r^e = expected rate of inflation (represented by current rate of inflation). The expected signs of all the coefficients are positive except for (d-P_r^e). For narrow money specification of the money demand function, real rate of interest is supposed to exert negative effect on money demand.

Estimation of Mckinnon type of money demand function where invest-income or saving-income ratio enters as one of the explanatory variables exhibited the following result.

$$\ln RM_1 = -4.62 + 1.21 \ln y + 1.36 \frac{i}{y} - .004 (d\text{-}P_r^e)$$

$$(-4.8)^* \qquad (12.7)^* \qquad (1.9)^{**} \qquad (-1.7)$$

$$\overline{R}^2 = 9.85 \quad F = 339 \quad DW = 2.55 \quad \rho = .46$$

In the above equation, the coefficient on $\frac{i}{y}$ is positive and statistically significant at 90 percent level of confidence. This substantiates the hypothesis that money balance and physical capital (assets) are complementary. That is, if the desired rate of capital accumulation increases at the given level of income, desired level money balance also increases. However, the coefficient on $(d\text{-}P_r^e)$ is not statistically significant.

Substituting investment-income ratio by domestic saving income ratio (s/y), the estimated equation is:

$$\ln RM_1 = -5.43 + 1.30 \ln y + .59\frac{s}{y} - .004 (d\text{-}P_r^e)$$

$$(-4.9)^* \qquad (12.5)^{**} \qquad (.78) \qquad (-1.7)$$

$$\overline{R}^2 = .982 \quad F = 279 \quad DW = 2.62 \quad \rho = .53$$

In the above equation, however, the coefficient on $\frac{s}{y}$ is not statistically significant. This implies that the complementarity hypothesis does not hold true for domestic savings. In fact, as a large chunk of gross investment comes from foreign savings, it is obvious that domestic savings-income ratio may not be a close substitute for investment-income ratio for the test of complementarity in the monetary demand equation.

6. UNIT ROOT AND COINTEGRATION TEST

A common problem with time series data is that they may be characterized by some type of trend, particularly when they are in level form . There are mainly two types of non-stationary processes. The first is a deterministic function of time trend plus a stochastic

process which can also be called as trend-stationary. The second process consists of variables which are stationary after differencing appropriate number of times. These are called diference-stationary. If the data are trended, i.e. if they are non-stationary, tl esiduals in the estimating equation will not have constant variance. This casts doubt on the significance of the coefficients based on estimated standard errors. Thus it is essential to ensure stationarity in the time series data before proceding with estimation so that there exists no spurious correlation between the variables. In this context, Unit-Root test suggested by Dickey-Fuller can indicate whether the time series are stationary or not. The Unit Root test for stationarity of any data series y can be processed as follows:

$$y_t = \alpha y_{t-1} + e_t \qquad t = 1, 2, 3 \ldots\ldots$$

Estimating this equation, if $|\alpha| < 1$, y_t tends to become stationary for growing values of t. If $|\alpha| \geq 1$, the variance of y_t increases with time (t). The changing variance of y with respect to time (t) implies violation of one of the underlying assumptions of OLS estimation. From the Dickey-Fuller test, if $|\alpha| = 1$, we infer that the variable is non-stationary.

The following Table depicts the Unit-Root test for the variables specified in our money demand function.

Table 1: Unit Root Test for the Stationarity of the Time Series

Series	Explanatory Variables	Estimated D.F. Test	Critical D-F. Value at 5% Level	Order of Integration
ln RM_1	(T, 1)	–5.96*	–3.67	I (1)
ln RM_2	(T, 1)	–4.22*	-3.66	I (0)
ln y	(T, 1)	-4.31*	-3.66	I (0)
ln P (CPI)	(T, 1)	-3.67*	-3.67	I (1)
ln P (DEFL)	(T, 1)	-3.90*	-3.73	I (3)
r	(C, 1)	-4.40*	-3.01	I (0)
$\frac{AGDP}{GDP}$	(T, 1)	-4.27*	-3.66	I (0)
ln PoP	(T, 1)	-4.76*	-3.67	I (0)

Note: C = constant term, T = constant plus time trend, 1 = one period lagged dependent variable, D-F = Dickey-Fuller test statistics, I (0) = cointegrated of order zero, I (1) = cointegratedof order 1, I (3) = Cointegrated of order 3.

In the above table $\ln RM_2$, $\ln y$, r, $\frac{AGDP}{GDP}$ and $\ln$ Pop have calculated D-F statistics more than critical $D-F$ value at 5 percent level. Therefore, we can reject the null hypothesis that the variables have unit root i.e. we can accept the stationarity of these variables which are integrated of order zero. However, $\ln RM_1$ and $\ln P$ (CPI) could show stationarity only at integration of order 1. As most of the variables (except r) contain trend variable in the test equation, and are stationary in integration of order zero, we can infer that these time series data are trend stationary. In other words, if time trend variable is included in the list of explanatory variable, it will catch the non-stationary component of the relationship between variables. This can also be inferred that the first difference of the time series which are in natural log form ensures stationarity in most of the time series data like real money, real income, population and share of agriculture in GDP[22] . The only stationarity problem that is likely to remain even after first differencing the natural log of the series is in the case of price variables particularly in the case of GDP deflator (DEFL).

Cointegretion Test

When the time series representing regression variables in the money demand equation are non-stationary, or if they follow a trend then the relationship exhibited by the estimated equation may represent just the spurious correlation between the variables. From the Unit Root test of the data series in money demand equation, it is observed that most of the series are time trended and by including time trend in the estimating equation or by first differencing the variables, stationarity in the time series can be attained. But, as some of the series did not ensure stationarity even with the inclusion of the trend variable and further as the previous estimations were done without including trend variable in the regression equation, theres is room for casting some doubt on the results derived throughout the study. In this regard cointegration technique can be an appropriate tool for the estimation of money demand function. This technique is preferred over estimating money demand in first difference form or in the level form inclusive of trend variable. As the demand for money is essentially demand for real money stock, estimation of the equation in first difference of the level from (which is change in stock) or in first difference of the natural log form (which is growth in stock) does not seem very consistent with the theory of money demand. The cointegration technique would be preferable to those alternatives. The result of cointegration

---

22   This is in line with the previous tests of stationarity of major time series data done by Khatiwada (1994).

test would establish an underlying relationship of money balance with income and interest rate taking care of the non-stationarity in the data series.

The cointegration test was pursued following Engle–Granger method. The test to investigate whether ln RM_1, lny and r were cointegrated or not reveals significant underlying cointegrating relationship between real money balance real income and interest rate. However, no such relationship was observed when narrow money (M_1) was replaced by broad money (M_2). It is observed that if the money demand equation is specified in the form of equation 1 or 3 as shown in Table 2, demand for real money balance would be cointegrated with real income and interest rate even after taking care of the time trend dominating the relationship.

Table 2: Engle–Granger Cointegration Test

$Eq^{n.}$ No.	Cointegrating Series	D–F t-Statistics	Mckinnon Critical Value at 5% Level
1	ln RM_1, ln y, r, trend	-5.24*	-4.79
2.	ln RM_2, ln y, r, trend	-3.12	-4.79
3.	ln RM PC, ln ypc, r, trend	-5.29*	-4.79
4.	ln RM_1, ln y, trend	-2.41	-4.32

7.   IMPLICATION FOR MONETARY POLICY

The empirical analysis of money demand function exhibits that demand for real money balance in Nepal is a stable and predictable function of a few variables (namely real income and interest rate). The undergoing reforms in the financial system have not so far significantly affected the stability of money demand function. This might be due to the limited diversification of financial instruments, shallow financial market and low pace of financial deepening resulting in a sluggish growth of money substitutes in the financial market and hence little change in the assets demand for money. Moreover, as transaction demand for money overwhelmingly determines the aggregate demand for money, a little change in the demand for money for assets purpose is likely to exert only a trivial effect on demand for aggregate money balance.

As the effectiveness of monetary policy in economic stabilization hinges on the stability of money demand function over time, the estimated results exhibit that monetary policy can be used as an effective economic policy variable for attaining macroeconomic stability;[23] provided that Nepal Rastra Bank has a control over the supply of money. If money demand is predictable, supply of money can be adjusted to it ensuring equilibrium in the money market. When money market remains in equilibrium, no adverse shocks to the economy will be emanating from the monetary sector.

But the crucial issue is whether the monetary authority can really maintain money supply at the desired level. As the recent surges in money supply can be mainly attributed to net foreign assets (foreign exchange inflow) and/or government borrowings from the banking system to meet the budgetary deficit, an accommodative deficit financing policy to monetary programming and an active open market operations are likely to help contain money supply at the desired level. But unlimited degree of open market operations aimed at sterilizing the expansionary effect of huge foreign exchange inflow and bank borrowing of the government on money supply is likely to exert an upward pressure on interest rate and higher financial burden to the central bank as interest cost to issuing large amount of NRB bills. However, the recent external sector development signals the occurrence of such a situation very unlikely in the near future. Thus, only domestic credit is likely to be the expansionary factor for money supply and Nepal Rastra Bank should be in a position to control such credit expansion. Thus money supply being a controllable variable and money demand function being stable and predictable, monetary policy can be an effective tool for the stabilization of nominal income or prices or balance of payments or exchange rate or a combination of all these variables.

The estimated parameters in the money demand function hint that so far as interest rate does not change, a five percent growth envisaged for the next few years with an inflation target of also five percent would require desired narrow and broad money growth at slightly more than 11 percent and 12 percent respectively. A higher monetary growth than this would be possible only if output grows at a faster rate, or if inflation target is set at a higher level or if there is some room for the foreign exchange reserves to deplete or the exchange rate to depreciate further. As none of these alternatives are either feasible or

---

23   Whether monetary policy can affect income, price, balance of payments or the exchange rate is another empirical issue. Empirical studies signal external sector stability as the major domain of monetary policy. (see Khatiwada, 1994).

acceptable, monetary programming for long term planning purposes requires targetting money growth at the level of 12 percent per annum at the most.

The other findings are of lesser importance. Nevertheless, some of them which are crucial for future empirical money demand estimation purposes can be listed as following.

(i)   Income elasticity of broad money is found higher than that of narrow money. However, the demand for real money balance has been found as a stable function of real income and interest rate for both narrow and broad definitions of money. But, as bank deposit rate represents the opportunity cost variable, the coefficient on interest rate in money demand equation under broad money definition is difficult to interpret.

(ii)   Estimation of the money demand function either in aggregate or in per capita terms would exert no marked difference; as demand for real money balance is found to be almost homogenous of degree one in population.

(iii)   Demand for nominal money balance is found to be homogenous of degree one in prices for the sample period under consideration. The homogeneity postulate is substantiated as the coefficient on prices in the nominal money demand function is close to unity. However, as the coefficient on GDP deflator as a measure of price is closer to unity as compared to that on CPI, estimation of real money demand function in real terms would give more unbiased result if GDP deflator rather than CPI is applied for deriving real money balances.

(iv)   The empirical evidence signals that all the desired real money balance cannot be realised in the same period (year). The finding that only about one-third of the desired money stock is realized in one period (one year) implies that the money market takes a longer time before the desired level of real money balance is fully met and money market equilibrium attained.

(v)   The Mckinnon type of money demand function fits well in the Nepalese context substantiating the hypothesis that real money and physical capital are not substituting rather they are complementary assets in the portfolio of general public.

(vi)   The Unit Root Test exhibits that most of the time series in the natural logarithmic form of the levels of data used in money demand function are time trended and they are integrated of order zero or one. Only GDP deflator is integrated of order three implying higher degree of non-stationarity in this time series. Notwithstanding this,

the Test indicates that most of the time series are trend-stationary i.e. a first differencing of the natural logarithmic values of those time series would ensure stationarity for most of the series. As trend-stationary data move on a deterministic path together with stationary fluctuations, the series can be forecast even for the longer run with bounded uncertainty. In this regard, as most of the variables in money demand function are trend-stationary, the predictability of money demand function is not seriously threatened by the non-stationary nature of the data series.

(vii) The Engle-Granger (EG) Cointegration Test reveals that real narrow money demand, real income and interest rate (represented by 12 month fixed deposits rate) are cointegrated when time trend variable is included in the cointegration test. The same conclusion can be arrived at when real money balances are in per capital terms. However, the EG Test shows that the cointegrating relationship does not seem significant for broad money definition of real money balance. This is broadly in line with what cointegration test on money demand function had observed in previous studies (IMF, 1993)

(viii) As the intercept term is statistically significant in almost all the estimated equations, it implies that unidentified variables including time trend have significant bearing on real money demand. As the coefficient is negative in many of the equations, it indicates that the unspecified variables including the time trend have negative impact on real money demand.This is quite expected in a situation when money substitutes are emerging in the financial market and efficiency in cash management taking place with the pace of economic development. Further, as it captures the effect of all unspecified variables and the time trend on money demand function, estimation of money demand function without including the trend variable, even though the data series are time trended, ensures that the estimated parameters are not overly biased due to the exclusion of the time trend variable from the estimating equation.

Graph 1

ACTUAL AND FITTED VALUES OF REAL NARROW MONEY

(At 1985 prices, Rs in million)
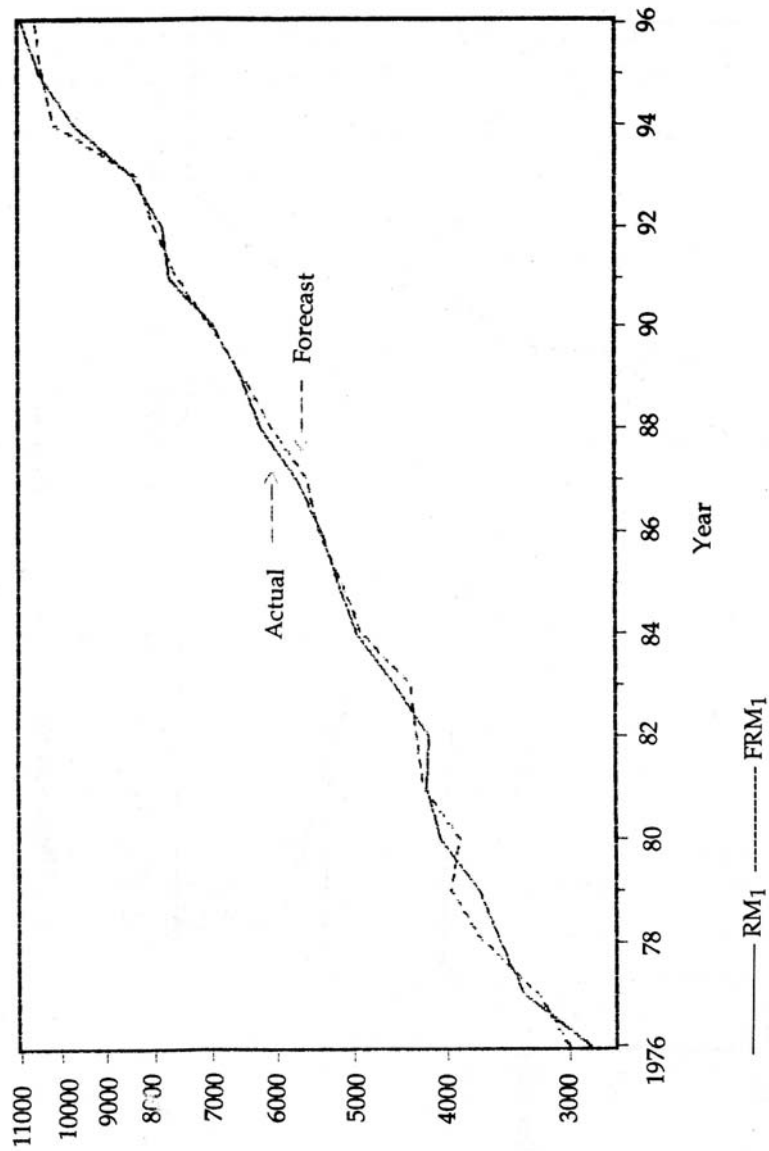
Graph 2
CUSUMSQ TEST FOR THE STABILITY OF M_1

Year

—— CUSUM of Squares   ------ 5% Significance
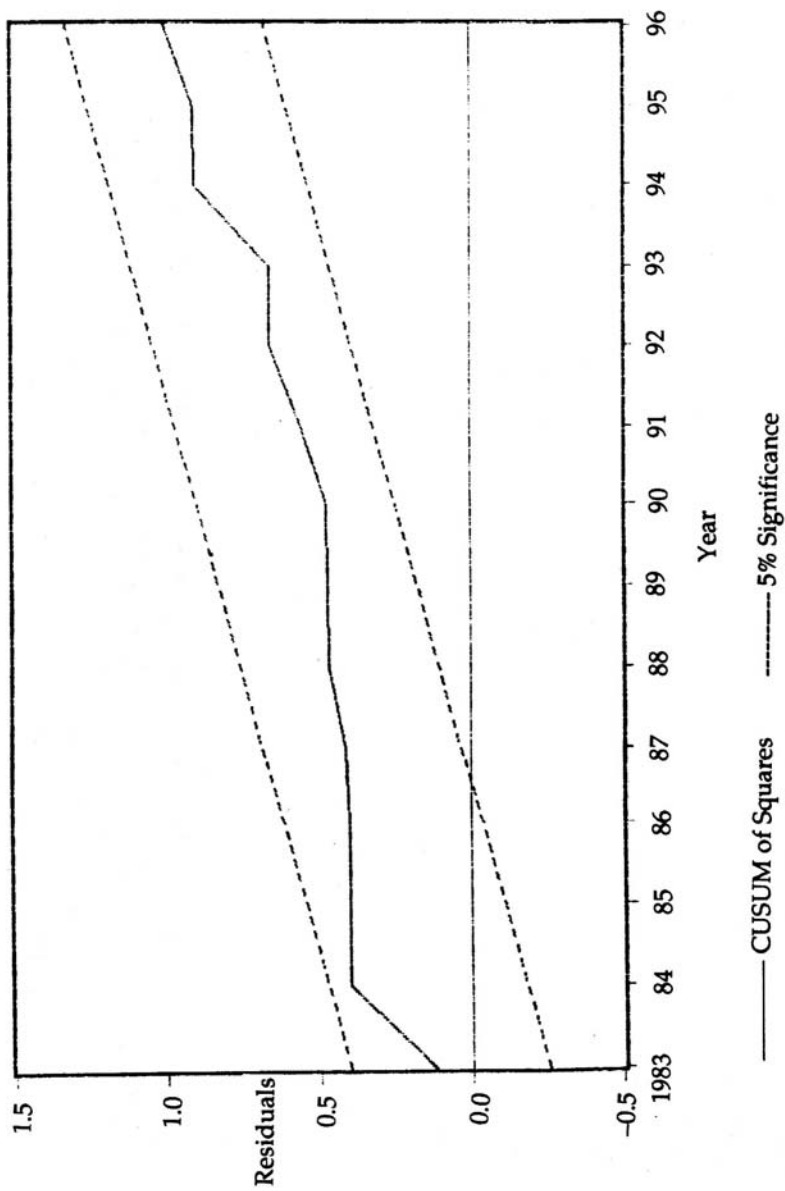
REFERENCES

1. Adekunle, Joseph O. (1968), "The Demand for Money: Evidence from Developed and Less Developed Economies", **IMF Staff Papers,** Vol. 15, pp 220–64.

2. Akhtar, M. A. (1974), "The Demand for Money in Pakistan", **Pakistan Development Review,** Vol. 18 (I), pp 40–45.

3. Bhattacharya, B. B. (1974), "Demand and Supply of Money in a Developing Economy: A Structural Analysis for India", **Review of Economic and Statistics,** Vol. 56, pp 502–10.

4. Bronfenbrenner, M. and Mayer, Thomas (1960), "Liquidity Function in the American Economy", **Econometrica,** Vol. 28, pp 810–34

5. Brunner, K. and Meltzer, A. H. (1963), "Predicting Velocity: Implications for Theory and Policy", **Journal of Finance,** Vol. 18 (May), pp 319–54.

6. Bruner, Karl and Meltzer, Allan H. (1964), "Some Further Investigations on Demand and Supply Functions for Money", **Journal of Finance,** Vol. 19 (May), pp 240–83.

7. Cagan, Phillip (1956), "The Monetary Dynamics of Hyper Inflation" in Milton Friedman (ed.), **Studies in the Quantity Theory of Money,** (I.U. Chicago)

8. Chandavarkar, A. G. (1975), "Incentives, Motivation and Roles of Fiscal, Monetary and Other Politics for Generating and Mobilizing Private Savings", **U. N. Economic Bulletin for Asia and the Pacific,** Vol. 24 (1)

9. Courchene, Thomas, J. and Kelly, Alex K. (1971), "Money Supply and Money Demand: An Econometric Analysis for Canada", **Journal of Money, Credit and Banking,** Vol. 3(2) pp 219–44.

10. Courchene, T. and Shapiro, H. (1964), "The Demand for Money: A Note from Time Series", **The Journal of Political Economy,** Vol 72 (5), pp 498–503.

11. Chow, Gregory C. (1966), "On the Long-run and Short-run Demand for Money", **The Journal of Political Economy,** Vol. 74 (2), pp 111–31.

12. Dennis, Geoffrey E. J. (1981), **Monetary Economics,** Longman, London & New York.

13. Fan, Liang-Shing and Liu, Zeng Rung (1971), "Demand for Money in Asian Countries: Empirical Evidence", **The Indian Economic Journal,** Vol. 18, pp 475–81.

14. Fisher, Douglas (1968), "The Demand for Money in Britain: Quarterly Results 1951 to 1967", **The Manchester School of Economic and Social Studies,** Vol. 3, pp 329–44.

15. Feige, Edger L. (1967), "Expectations and Adjustments in the Monetary Sector", **American Economic Review,** Vol. 57, pp 462–73.

16. Friedman, Milton (1959), "The Demand for Money: Some Theoretical and Empirical Results", **The Journal of Political Economy,** Vol. 67 (4), p 327–351.

17. Fry, Maxwell J. (1976), "A Purchasing-Power-Parity Application to Demand for Money in Afghanistan", **The Journal of Political Economy,** Vol. 84 (5), pp 1133–38.

18. Fry, Maxwell J. C. (1978), "Money and Capital or Financial Deepening in Economic Development ?", **journal of Money, Credit and Banking,** Vol 10 (4), pp 464–75.

19. Goldsmith, R. W. (1966), **Determinants of Financial Structure,** O. E. C. D.

20. Gujarati, Damodar (1968), "The Demand for Money in India", **Journal of Development Studies,** Vol. 5 (1), pp 59–64.

21. Gupta, G. S. (1970), "A Monetary Policy Model for India, 1948–49 to 1957–68", **Unpublished Ph. D. Dissertation,** John Hopking University, Baltimore.

22. Gupta, Suraj B. (1979), **Monetary Planning for India,** Oxford University Press, Delhi.

23. Hamburger, Michael J. (1966), "The Demand for Money by Households, Money Substitutes and Monetary Policy", **The Journal of Political Economy,** Vol. 74 (DPC), pp 600–23.

24. International Monetary Fund, (IMF), **Economic Reviews,** Nepal 1993.

25. Jacobs, Rodney L. (1974), "Estimating the Long-run Demand for Money from Time-series Data", **The Journal of Political Economy,** Vol. 82 (6), pp. 1221–37.

26. Joshi, H. and Saggar, M., "The Demand for Money in India: Stability Revisited", **RBI Occasional Papers,** Vol. 16 (2), pp 79–100.

27. Khan, M. S. (1974a), "Experiments with a Monetary Model for the Venezuelan Economy", **IMF Staff Papers,** Vol. 21, pp 389–413.

28. Heller, H. R. (1965), "The Demand for Money — The Evidence from the Short-run Data", **Quarterly Journal of Economics,** Vol. 79 (June), pp 291–303.

29. Khan, Mohsin S. (1974 b), "The Stability of the Demand for Money Function in the United States, 1901–1965", **The Journal of Political Economy,** Vol. 82 (6), pp 1206–19.

30. Khatiwada, Y.R., (1994) **Some Aspects of Monetary Policy in Nepal,** South Asian Publishers, New Delhi.

31. Lahiri, A. K. (1977), **The Demand for Money,** (A Ph. D Dissertation Submitted to the University of Delhi).

32. Laidler, D. E. W. (1969), "The Definition of Money", **Journal of Money, Credit and Banking,** Vol. 1 (August), pp 508–25.

33. Laidler, David (1966 a), "Some Evidence on the Demand for Money", **The Journal of Political Economy,** Vol. 74, pp 55–68.

34. Laidler, David (1966 b), "The Rate of Interest and the Demand for Money – Some Expirical Evidence", **The Journal of Political Economy,** Vol. 74 (6), pp 543–55.

35. Laidler, D. E. W. (1971), "The Influence Money on Economic Activity – A Survey of Some Current Problems" in G. Clayton et al (eds.), **Monetary Theory and Monetary Policy in the 1970s** (Proceedings of the 1970 Shetfield Money Seminar), Oxford University Press.

36. Lailder, D. E. W., and Parkin, J. M. (1970), "The Demand for Money in the U.K., 1967–1967: Preliminary Estimates", **Manchester School,** Vol. 38, pp 187–208.

37. Latane, H. A. (1954), "Cash Balances and the Interest Rate – A Pragmatic Approach", **Review of Economic and Statistics,** Vol. 36 (Nov.), pp 456–60.

38. Latane, H. A. (1960), "Cash Balances and the Interest Rate – A Pragmatic Approach", **Review of Economic and Statistics,** Vol. 42, pp 445–49.

39. Lee, H. T. (1967), "Alternative Interest Rates and Demand for Money: The Empirical Evidence", **American Economic Review,** Vol. 57 (Dec.), pp 1168–81.

40. Mammen, Thampy (1971), "The Monetary Sector of India: An Econometric Study", **Indian Economic Journal,** Vol. 18, pp 482–95.

41. McKinnon, R. (1973), **Money and Capital in Economic Development,** The Brooking Institution, Washington.

42. Meltzer, Allan H. (1936), "The Demand for Money: A Cross Section Study of Business Firms", **Quarterly Journal of Economic,** Vol. 77, pp 405–22.

43. Melitz, J. and Correa, H. (1970), "International Differences in Income Velocity", **Review of Economic and Statistics,** Vol. 52, pp 12–17.

44. Motley, Brian (1967), "A Demand for Money Function for the Household Sector – Some Preliminary Findings", **Journal of Finance,** Vol. 22, pp 405–18.

45. Meltzer, Allan H. (1963 a), "The Demand for Money: The Evidence from the Time Series", **The Journal of Political Economy,** Vol. 71, pp 219–46.

46. Otani, Ichiro and Park, Yung Chul (1976), "A Monetary Model of the Korean Economy", **IMF Staff Papers,** Vol. 23, pp 164–99.

47. Poudel, S. R. (1987), **Demand for Money in Nepal** (mimeo), Research Department, Nepal Rastra Bank, Kathmandu.

48. Prasad, Kamta (1969), **The Role of Money Supply in a Developing Economy,** Allied Publishers, New Delhi.

49. Rangarajan, C. (1965), **Demand for Money: Some Empirical Estimates Relating to India,** (Paper presented at the 5th Indian Econometric Conference, New Delhi, mimeo)

50. Sampath, R. K. and Hussain, Zakir (1981), "Demand for Money in India", **The Indian Economic Journal,** Vol. 29 (1), pp 17–36.

51. Schulz, John (1978), **Aspects of a Realistic Interest Rate Policy in Nepal: Preliminary Draft,** Nepal Rastra Bank (mimeo).

52.   Shapiro, Harold T. (1967), "Distributed Lags, Interest Rate Expectations, and the Impact of Monetary Policy: An Econometric Analysis of a Canadian Experience", The **American Economic Review,** Vol. 77, pp 444–61.

53.   Sharma, G. N. (1987), **Monetary Structure of the Nepalese Economy: Policy Issues** in **Theory & Practice,** South Asian Publishers, Delhi.

54.   Teigen, R. L. (1964), "Demand and Supply Functions for Money in the U. S.: Some Structural Estimates", **Econometrica,** Vol. 32 (4), pp 476–509.

55.   Tseng, W. and Corker, (1991), Financial Liberalization, Money Demand, and Monetary Policy in Asian countries, **International Monetary Fund Occasional Paper,** Washington D.C.

56.   Upadhyay, G. (1992) "Modelling Non-Stationary Macroeconomic Time Series" RBI **Occasional Papers,** Vol. 13 (1) pp 35 - 43.

57.   White, William H. (1978), "Improving the Demand for Money Function in Moderate Inflation", **IMF Staff Papers,** Vol. 25, pp 564–607.

58.   Wong, Chorng-huey (1977), "Demand for Money in Developing Countries: Some Theoretical and Empirical Results", **Journal of Monetary Economics,** Vol. 3, pp 59–86.

●●●