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Demand for Money in Nepal:
An ARDL Bounds Testing Approach

Birendra Bahadur Budha
Assistant Director, Nepal Rastra Bank, Research Department

NEPAL RASTRA BANK, RESEARCH DEPARTMENT

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Prepared by

Birendra Bahadur Budha*

Abstract

This paper investigates the demand for money in Nepal using the Autoregressive Distributed Lag (ARDL) approach for the period of 1975-2011.The results based on the bounds testing procedure reveal that there exist the cointegration among the real money aggregates (M_1^r and M_2^r), real income, inflation and interest rate. The real income elasticity coefficient is found to be positive and the inflation coefficient is negative. The interest rate coefficient is negative for both of the real monetary aggregates supporting the theoretical explanation. In addition, the error correction models suggest that the deviations from the long-run equilibrium are short-lived in M_1^r than M_2^r. Finally, the CUSUM and CUSUMSQ tests reveal that the M_1^r money demand function is stable, but M_2^r money demand function is not stable implying that the monetary policy should pay more attention to M_1^r than M_2^r.

Jel Classification: E410
Key words: Money Demand, Bounds test, Stability, Nepal.

*Assistant Director, Research Department, Nepal Rastra Bank, Central Office, Baluwatar, Kathmandu. E-mail: bcbirendra@nrb.org.np, Phone: 00977-1-4419804-7, Ext 428.

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I. Introduction

A stable money demand function is crucial for the conduct of monetary policy. The stability in the function implies the stability in money multiplier and, thus, ensures the changes in the monetary aggregates to have a specific predictable impact on the real variables. Considering this fact, many of the studies related to the demand for money and its stability have been conducted in developed as well as developing countries. Accordingly, there has also been shift in the technique in studying money demand. The partial adjustment framework and the buffer-stock approach were mostly popular in 1980s particularly before the development of the error correction models. The error-correction models have now become the workhorse of the money demand research and, thus, numerous studies have been conducted on money demand function using the cointegration technique (Sriram, 1999). In Nepal's case, few of the studies on the money demand functions, though, have been conducted using the ordinary least squares (OLS) and the cointegration technique developed by Johansen (1988) and Johansen and Juselius (1990), no in-depth study of this topic has been reported yet using ARDL cointegration technique.

Studies on the demand for money in Nepal, for instance, are by Poudel (1987), Khatiwada (1997), Goudel (2003), Kharel and Koirala (2010) and Budha (2011). Using the OLS method, Poudel (1987) estimated the money demand function for Nepal with data from 1975 to 1987 and found the stable demand function for narrow money with income elasticity coefficient being greater than unity. Khatiwada (1997), using the OLS and stability tests like the Chow test and CUSUM test, with Nepalese macroeconomic data from 1976 to 1996, concluded that the demand for money in Nepal is a stable and predictable function of real income and interest rate. The estimated income elasticity of both broad money and narrow money in his study are more than unity. Moreover, using the cointegration technique of Engle-Granger (1987), Khatiwada found the cointegration among the real money balances, real income and the rate of interest. Kharel and Koirala (2010) has employed the cointegration technique developed by Johansen (1988) and Johansen and Juselius (1990) using the sample period of 1974/75-2009/10 and found similar result as in Khatiwada (1997) that money demand function for both narrow and broad money is a stable and predictable function of real income and interest rate. The disequilibrium, according to the study, corrects more rapidly in narrow money than the broad money.

A policy regime shift, among others, is a major cause of instability in the money demand function. Several reforms, in 1990s and since then, have been carried out in Nepal. Some examples of the reforms are deregulation of interest rate, shift in monetary policy stance, reforms in the capital markets, and enactment and revision of the several acts and policies (Shrestha and Chowdhury, 2006). These economic reforms have significantly changed Nepal's financial system. Against this backdrop, the study about the stability of money demand function carries out specific importance.

The paper aims to examine the empirical relationship between the real monetary aggregates (M_1^r and M_2^r), real income, inflation rate and the interest rate using the recent econometric technique developed by Pesaran *et al.* (1996, 2001), known as Autoregressive Distributed Lag (ARDL) approach to cointegration. In addition, it attempts to determine the stability of the estimated money demand function.

The rest of the paper is organized as follows. Section II presents the model specification. Section III presents the data and econometric methodology and section IV discusses about the empirical results. Finally, section V presents the conclusion.

II.   Model Specification

It is customary to assume that the desired level of nominal money demand depends on the price level, a transaction (or scaling) variable and a vector of opportunity costs (Goldfeld and Sichel, 1990), which can be written as:

$$(M/P) = f(Y, R_1, R_2 \dots) \dots\dots\dots\dots\dots \text{ (1)}$$

Where M stands for nominal money demand, P for the price level, Y for the real income which represents the scale variable and R_i for the elements of the vector of the opportunity costs which possibly also includes the inflation rate. A money demand of this type is not only the result of traditional money demand theories but also of modern micro-founded stochastic general equilibrium model (Walsh, 2003). Following Goldfeld and Sichel (1990), the form of money demand function employed in this paper is:

$$lnM_t^r = \beta_0 + \beta_1 lnY_t + \beta_2 \pi_t + \beta_3 R_t + \mu_t \dots\dots\dots\dots\dots\dots\dots \text{ (2)}$$

Where M^r stands for real money balances i.e. (M/P), R for interest rate/ own rate of return on money, and π inflation rate- a proxy for expected inflation. μ is a stochastic disturbance term such that $\mu_t \sim N(0, \sigma^2)$. Based on the conventional economic theory, the income elasticity coefficient (β_1) is expected to be positive and the coefficient of the inflation (β_2) is expected to have negative sign. The opportunity cost of holding money (i.e. inflation rate) relative to the real value of physical assets exerts negative effects on money demand as the increase in expected inflation lead to substitution away from money to real assets[1]. On the other hand, following the literature on the speculative demand for money, the coefficient of the interest rate, β_3, is expected to have negative sign. The external monetary and financial factors affect the money demand significantly in an open economy through the exchange rate and expected rate of return on the money (Lestano *et al.*, 2009). The capital account in Nepal's balance of payments is partially liberalized including the restrictions on portfolio investment. Capital outflow by

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[1] Expected rate of inflation stands better for the opportunity cost of holding money where the financial sector is not well developed as in the case of developing countries (Sriram, 1999).

Nepalese residents has been completely restricted except few purposes (Foreign Investment and Technology Transfer Act, 1992). The exchange rate and the foreign interest rate, therefore, are not incorporated in the model assuming that these variables have minimal impacts on the real money balances. Dekle and Pradhan (1999) postulates that a simple linear time trend (T) can be used to capture secular changes in the financial systems due to development of the transaction technology. Accordingly, the linear time trend (T) is included as a proxy for the technological change which may reflect the smooth impact of the new financial technologies toward money demand over time.

III.   Data and Methodology

This study is based on the annual data series from 1975 to 2011, which comprises 36 data points. Narrow money (M_1) and broad money (M_2) have been employed as monetary aggregates. Narrow monetary aggregate (M1), according to the broad monetary survey of Nepal Rastra Bank, includes the currency in circulation and the demand deposits whereas the broad monetary aggregate (M_2) includes the M_1 plus the savings and call deposits and time deposits. Real monetary aggregates (M_1^r and M_2^r) used in the study are obtained dividing the nominal monetary aggregates by the consumer price index (CPI). The proxy for the price level (P_t) is the consumer price index whereas the real gross domestic product (GDP) is the proxy for the real income (Y). Similarly, the proxy for the interest rate (R_t) is the rate of interest on the saving deposits at the commercial banks[2]. Due to the unavailability of data on the weighted interest rate on saving deposits, the interest rate is calculated by taking the average of minimum and maximum values of the range. The data on these variables were taken from the various issues of the *Quarterly Economic Bulletin* of Nepal Rastra Bank and *Economic Survey* of Ministry of Finance, Government of Nepal, Nepal.

The autoregressive distributed lag (ARDL) cointegration procedure introduced by Pesaran and Shin (1999) and Pesaran, Shin, and Smith (1997, 2001) has been used to examine the long-run relationship between the money demand and its determinants. This test has several advantages over the well-known residual-based approach proposed by Engle and Granger (1987) and the maximum likelihood-based approach proposed by Johansen and Julius (1990) and Johansen (1992). One of the important features of this test is that it is free from unit-root pre-testing and can be applied regardless of whether variables are I(0) or I(1). In addition, it does not matter whether the explanatory variables are exogenous (Pesaran and Shin, 1997). The short-and long-run parameters with appropriate asymptotic inferences can be obtained by applying OLS to

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[2] Handa (2009) postulated that near money assets such as savings deposits in commercial banks proved to be the closest substitutes for M1, so that their rate of return seems to be the most appropriate variable for the cost of using M1. But, for the broad money (M2), the interest rate on medium-term or long-term bonds would become most appropriate, since the savings components of the broad definition of money themselves earn an interest rate close to the short rate of interest.

ARDL with an appropriate lag length. Following Pesaran *et al.* (1997, 2001), an ARDL representation of equation (2) can be written as:

$$\Delta lnM_t^r = \beta_0 + \sum_{i=1}^{n}\beta_{1i}\Delta ln\,M_{t-i}^r + \sum_{i=1}^{n}\beta_{2i}\Delta lnY_{t-i} + \sum_{i=1}^{n}\beta_{3i}\Delta ln\pi_{t-i} + \sum_{i=1}^{n}\beta_{4i}\Delta lnR_{t-i} + \alpha_1 lnM_{t-1}^r + \alpha_2 lnY_{t-1} + \alpha_3 ln\pi_{t-1} + \alpha_4 lnR_{t-1} + \mu_t \dots\dots\dots\dots\dots (3)$$

Where, Δ is the first difference operator, β_0 the drift component, and μ_t the usual white noise residuals. The coefficients (α_1-α_4) represent the long-run relationship whereas the remaining expressions with summation sign (β_1-β_4) represent the short-run dynamics of the model.

In order to investigate the existence of the long-run relationship among the variables in the system, the bound tests approach developed by Pesaran *et al.* (2001) has been employed. The bound test is based on the Wald or F-statistic and follows a non-standard distribution. Under this, the null hypothesis of no cointegration $\alpha_1=\alpha_2=\alpha_3=\alpha_4=0$ is tested against the alternative of cointegration $\alpha_1 \neq \alpha_2 \neq \alpha_3 \neq \alpha_4 \neq 0$. Pesaran *et al.* (2001) provide the two sets of critical values in which lower critical bound assumes that all the variables in the ARDL model are I(0), and the upper critical bound assumes I(1). If the calculated F-statistics is greater than the appropriate upper bound critical values, the null hypothesis is rejected implying cointegration. If such statistics is below the lower bound, the null cannot be rejected, indicating the lack of cointegration. If, however, it lies within the lower and upper bounds, the results is inconclusive. After establishing the evidence of the existence of the cointegration between variables, the lag orders of the variables are chosen by using the appropriate Akaike Information Criteria (AIC) or Schwarz Bayesian Criteria (SBC).

The unrestricted error correction model based on the assumption made by Pesaran *et al.* (2001) was also employed for the short-run dynamics of the model. Thus, the error correction version of the ARDL model pertaining to the equation (3) can be expressed as:

$$\Delta lnM_t^r = \beta_0 + \sum_{i=1}^{n}\beta_{1i}\Delta ln\,M_{t-i}^r + \sum_{i=1}^{n}\beta_{2i}\Delta lnY_{t-i} + \sum_{i=1}^{n}\beta_{3i}\Delta ln\pi_{t-i} + \sum_{i=1}^{n}\beta_{4i}\Delta lnR_{t-i} + \lambda EC_{t-1} + \mu_t \dots\dots\dots\dots\dots\dots (4)$$

Where, λ is the speed of adjustment parameter and EC is the residuals that are obtained from the estimated cointegration model of equation (3). The error correction term (EC) is, thus, defined as: $EC_t = lnM_t^r - \gamma_1 lnY_t - \gamma_2 \pi_t - \gamma_3 R_t$. Where, $\gamma_1 = -(\alpha_2/\alpha_1)$, $\gamma_2 = -(\alpha_3/\alpha_1)$ and $\gamma_3 = -(\alpha_3/\alpha_1)$ are the OLS estimators obtained from equation (3). The coefficients of the lagged variables provide the short run dynamics of the model covering the equilibrium path. The error correction coefficient (λ) is expected to be less than zero and implies the cointegration relation. In order to check the performance of the model, the diagnostic tests associated with the model which examines the serial correlation, functional form and heteroscedasticity have been conducted. The CUSUM and CUSUMSQ tests to the residuals of equation have also been applied in order to test the model stability. The CUSUM test is based on the cumulative sum of recursive residuals based on the first set of n observations. For the stability of the long-run and short-run coefficients, the plot of the two statistics must stay within the 5 % significant level.

IV. Empirical Results

In order to apply the cointegration, the first step is to determine the order of integration of each variable under study. This is because of the fact that ARDL technique cannot be used if the order of the integration of the variables is two or more. The Augmented Dickey Fuller (ADF) test has been employed for this purpose both at the level and difference of the variables. The lag length used for this test is determined using a model selection procedure based on the Schwarz Information Criterion. The statistical results of the ADF tests are reported in table 1.

The table 1 shows that all the variables are stationary in the first difference. Inflation rate is stationary at the level with constant with no trend and constant with trend. Similarly, real money balances, both broad money (M_2^r) and narrow money (M_1^r), are also trend stationary at the level. The ARDL approach to cointegration, therefore, may be better to use since the variables are either I (0) or I (1).

Table 1. Results of ADF tests

Variables	Level		First Difference	
	Intercept	Intercept and Trend	Intercept	Intercept and Trend
lnM_1^r	-1.20(0.66)	-4.66(0.00)*	-4.21(0.00)*	-4.14(0.01)*
lnM_2^r	-1.91(0.32)	-5.25(0.00)*	-4.03(0.00)*	-4.05(0.02)**
lnY	1.27(0.99)	-2.35(0.40)	-5.74(0.00)*	-6.03(0.00)*
π	-5.35(0.00)*	-5.26(0.00)*	-9.67(0.00)*	-9.47(0.00)*
R	-1.28(0.63)	-1.57(0.79)	-6.13(0.00)*	-6.06(0.00)*

Notes: 1. * and ** denote the statistical significance at the 1% and 5% level respectively.
2. The numbers within the parentheses for the ADF statistics are the p-values.

In the first stage of ARDL procedure, we impose arbitrary and the same number of lags on each first differenced variables in equation (3) and carry out F-test. The result will depend on the choice of the lag length (Bahmani-Oskooee & Brooks, 2007). Akaike's and Schwarz's Baysian Information Criteria have been employed in order to select the optimal lag length. The LM test has been used in order to test the serial correlation in residuals.

Table 2. Statistics for Selecting Lag Order

	Narrow Money, M_1^r			Broad Money, M_2^r		
Lags	AIC	SBC	LM(1)	AIC	SBC	LM(1)
1	-3.36	-2.78	0.59**	-3.64	-3.06	0.27**
2	-3.16	-2.40	0.66**	-3.40	-2.64	4.18*
3	-3.56	-2.61	0.51**	-3.50	-2.55	0.01**

Note: * and ** refers to marginal significance level at 1% and 10% respectively.

The results for selecting lag order are reported in table 2. The results of both AIC and SBC criteria are similar for the model of broad money. For the model of narrow money, AIC and SBC criteria give the conflicting results. Taking lag of one or three in the model of narrow money does not make any significant difference in the value of F-statistic so the optimal lag length selected and reported for the ARDL equation (3) with no serial correlation problem is one for both M_1^r and M_2^r.

The existence of the long-run relationship between money demand and its components has been tested by calculating F-statistics with one lag. The F-statistics is calculated by applying Wald tests that impose zero value restriction to only one period lagged level coefficient value of the variables. These test results are reported in table 3 with new critical values as suggested by Pesaran *et al.* (2001) and Narayan (2004) for bounds test procedure.

Table 3. Bounds tests for Cointegration Analysis

Order of Lag	1
M_1^r	6.70*
M_2^r	5.86*

Notes:
1. The relevant critical value bounds are obtained from Table C1. iv (with an unrestricted intercept and restricted trend; with three regressors k=3) in Pesaran et al. (2001). These are 2.97- 3.74 at 90 %, 3.38-4.23 at 95% and 4.30-5.23 at 99%.
2. * denotes the significance at 99%.
3. The critical values presented in Pesaran et al. (2001) are based on large samples (Narayan, 2004). For small sample sizes ranging from 30 to 80 observations, Narayan (2004) provides a set of critical values, which are 2.496-3.346 at 90%, 2.962-3.910 at 95% and 4.068-5.250 at 99%.

The computed F-statistics in table 3 was compared with the critical values provided by Narayan (2004) for small samples. The results clearly indicate that, since computed F-statistic is greater than critical values, there exists cointegration between real money balances, real income, inflation rate and interest rate.

The lag length for each variable need not be identical except for the identification purpose above[3]. In this stage, a more parsimonious model is selected for the long-run money demand using the Akaike information criteria. Pesaran and Shin (1997) and Narayan (2004) suggested two as the maximum order of lags in the ARDL approach for the annual data series. The total number of regressions to be estimated for the ARDL *(p, q, r, s)* is $(p+1)^k$, where *p* is the maximum number of lag order to be used and *k* is the number of variables in the equation. As *p=2* and *k=4*, the total number of regressions to be estimated are 81. For this procedure, the Microfit 5.0 software program has been used and, thus, estimated ARDL *(1, 0, 0, 0)* model for the narrow money and ARDL *(2, 0, 1, 0)* model for broad money based on AIC criterion.

The long-run coefficients of the real money balances (M_1^r and M_2^r) are reported in table 4 and 5. The table 4 shows that the coefficients of real income, inflation rate and interest rate all have the expected sign as suggested by economic theories, but these are statistically insignificant. The long run model of the corresponding ARDL *(1, 0, 0, 0)* for narrow money (M_1^r) can be written as:

$$lnM_1^r = 0.20 + 0.42 lnY - 0.003\pi_t - 0.009R_t + 0.04\, t \ldots\ldots (5)$$

In table 5, the estimated long-run coefficients for broad money demand are presented. The coefficients of real income, although statistically insignificant, have the expected positive sign indicating the positive relationship between real income and money demand. The coefficient of the inflation rate is negative supporting the theoretical explanation. This implies that people

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[3] See Pesaran (2001) and Dagher and Kovanen (2011).

prefer to substitute real assets for money balances. Similarly, the coefficient of the interest rate is negative and statistically insignificant. The long-run model of the corresponding ARDL *(2, 0, 1, 0)* for broad money (M_2^r) is:

$$lnM_2^r = 4.91 + 0.06lnY - 0.003\pi_t - 0.004R_t + 0.08\,t \ldots\ldots\ldots (6)$$

Table 4. Estimated Long-run Coefficients of Real Money Balances

	Coefficient	S.E	t-Statistic	p-value
	Dependent Variable: Narrow Money Aggregate, lnM_1^r			
lnY	0.42	0.33	1.29	0.21
π	-0.003	0.005	-0.64	0.53
R	-0.009	0.01	-0.77	0.45
Constant	0.20	3.91	0.05	0.96
Trend	0.04*	0.02	2.69	0.01

Note: * denotes the significance at 99%.

Table 5. Estimated Long-run Coefficients of Real Money Balances

Regressor	Coefficient	S.E	t-Statistic	p-value
	Dependent Variable: Broad Money Aggregate, lnM_2^r			
lnY	0.06	0.21	0.30	0.29
π	-0.003	0.004	-0.81	0.43
R	-0.004	0.008	-0.50	0.62
Constant	4.91*	2.54	1.94	0.06
Trend	0.08**	0.01	7.48	0.00

Note: * and ** denote the significance at 99% and 90% respectively.

The short-term dynamics of the model has been examined by estimating an error correction model in equation (4). In the short run, the deviations from the long-run equilibrium can occur because of the shocks in any of the variables in the model. The diagnostic tests, which are used in this paper to examine the properties of the model, include the test of serial autocorrelation ($\chi2_{Auto}$), normality ($\chi2_{Norm}$), heteroskedasticity ($\chi2_{BP}$) and omitted variables /functional form ($\chi2_{RESET}$). The results of the short-run dynamic money demand models and the associated diagnostic tests are reported in table 6 and 7.

Table 6 shows that the estimated lagged error correction term (ECM$_{-1}$) is negative and statistically significant. This result indicates the cointegration among the variables: narrow money, real income, inflation and interest rate. The absolute value of the coefficient of error correction term (i.e. 0.81) implies that about 81 percent of the disequilibrium in the real money demand is adjusted toward equilibrium annually. For instance, if the real money demand (M_1^r) exceeds its long-run relationship with the other variables in the model, then the money demand adjust downwards at a rate of 81% per year. As presented in the table 6, there is no evidence of diagnostic problem with the model. The Lagrange Multiplier (LM) test of serial correlation indicates the evidence of no serial correlation since the estimated LM value or $\chi2$Auto is less than the critical values. The Jarque-Bera normality test implies that the residuals are normally

distributed. The Breusch-Pagan test (BP) for heteroscedasticity shows that the disturbance term in the model is homoscedastic. The Ramsey's RESET test for functional specification shows that the calculated RESET statistic or $\chi2_{RESET}$ is less than its critical values and, thus, the ARDL model is correctly specified.

Table 6. Error Correction Representation of ARDL Model, ARDL (1, 0, 0, 0)

Dependent Variable: Narrow Money, lnM_1^r			
Regressor	Coefficient	t-statistic	p-value
$\Delta lnM_{1,-1}^r$	0.24***	1.70	0.09
ΔlnY	0.31	1.48	0.15
$\Delta\pi$	-0.004**	-0.66	0.03
ΔR	-0.005	-0.66	0.52
Ecm_{-1}	-0.81*	-5.82	0.00
Constant	0.17*	6.89	0.00
Trend	0.03*	5.63	0.00

R^2= 0.63	R^2_{adj}= 0.55	F = 7.92 (0.00)	S.E. = 0.04	DW= 1.88	AIC=-3.47

Diagnostic test:
- A. Serial correlation $\quad\quad \chi^2_{Auto}(2)=0.55\ (0.76)$
- B. Functional Form $\quad\quad\quad \chi^2_{RESET}\ (2)=0.22(0.80)$
- C. Normality $\quad\quad\quad\quad\quad\quad \chi^2_{Norm}\quad = 0.01(0.99)$
- D. Heteroscedasticity $\quad\quad\quad \chi^2_{BP}\ (2)=5.96(0.47)$

Notes: 1. *, ** and *** indicate the significance at the 99%, 95% and 90% level respectively.
2. The value in parentheses are the probabilities

Table 7. Error Correction Representation of ARDL Model, ARDL (2, 0, 1, 0)

Dependent Variable: Broad Money, lnM_2^r			
Regressor	Coefficient	t-statistic	p-value
$\Delta lnM_{2,-1}^r$	0.17	1.06	0.30
$\Delta lnM_{2,-2}^r$	-0.09	-0.63	0.54
ΔlnY	0.22	1.12	0.27
$\Delta\pi$	-0.004**	-2.45	0.02
$\Delta\pi_{-1}$	-0.0003	-0.02	0.98
ΔR	-0.001	-0.15	0.87
Ecm_{-1}	-0.68*	-5.97	0.00
Constant	0.16*	5.01	0.00
Trend	0.02*	3.11	0.00

R^2= 0.55	R^2_{adj}= 0.40	F = 3.77 (0.01)	S.E. = 0.03	DW= 1.85	SBC=-3.66

Diagnostic test:
- A. Serial correlation $\quad\quad \chi^2_{Auto}(2)=0.45\ (0.79)$
- B. Functional Form $\quad\quad\quad \chi^2_{RESET}\ (2)=0.42(0.66)$
- C. Normality $\quad\quad\quad\quad\quad\quad \chi^2_{Norm}\quad = 0.01(0.99)$
- D. Heteroskedasticity $\quad\quad\quad \chi^2_{BP}\ (2)=8.07(0.42)$

Notes: 1. ** indicates the significance at the 99% level.
2. The value in parentheses are the probabilities.

Table 7 presents the results for broad monetary aggregate, M_2^r. The coefficient of the error correction term is negative and statistically significant, indicating the evidence of the cointegration among the broad money and other variables in the model. The high value of the

error correction term for M_2 implies relatively faster adjustment in money demand when shocks arise. The coefficient of error correction term (i.e. 0.68) implies that about 68 % of total adjustment takes annually when shock arises. The smaller error correction coefficient of M_2^r than M_1^r implies the slow speed of adjustment when shocks arises. This result is consistent with the previous study by Kharel and Koirala (2010). The diagnostic tests applied to the error correction model indicate that there is no evidence of serial correlation and heterosketasticity. In addition, the RESET test implies the correctly specified ARDL model and the Jarque-Bera normality test indicates that the residuals are normally distributed.

In the final stage, the stability of the long-run coefficients is examined by using the CUSUM and CUSUM squares tests. The graphical presentation of these tests is presented in the figure below.

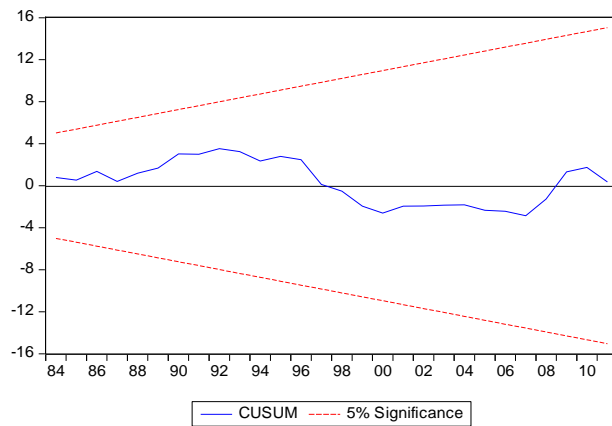Figure 1: Cumulative Sum of Recursive Residuals(M1)

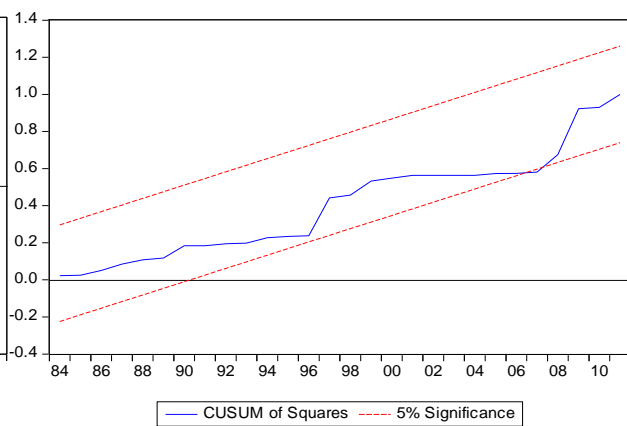Figure 2: Cumulative Sum of Squares of Recursive Residuals(M1)

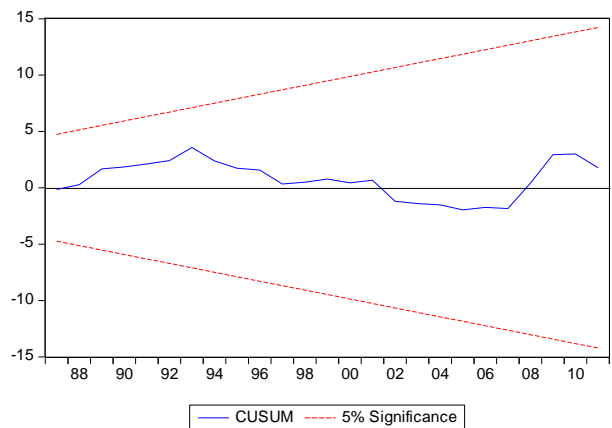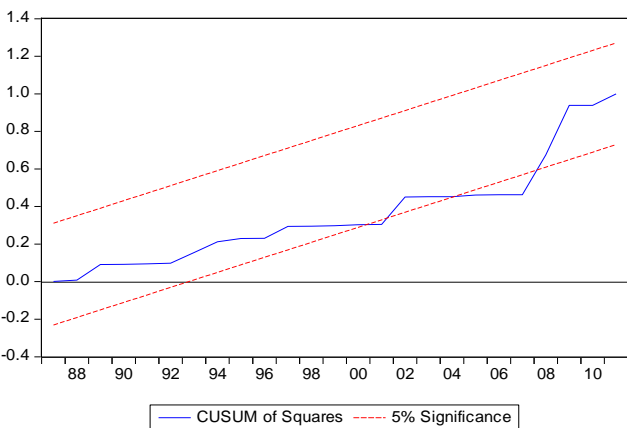Figure 3: Cumulative Sum of Recursive Residuals (M2)

Figure 4: Cumulative Sum of Squares of Recursive Residuals (M2)

Since the plots of CUSUM and CUSUMSQ statistic for M_1^r are within the critical lines at the 5% significance level, the money demand functions for M_1^r is stable. The plot of CUSUM, though, is within the critical lines at the 5% significance level, the plot of CUSUMSQ does not lie within the critical limits implying some instability in the money demand function for M_2^r. Since the plot of CUSUMSQ for M_2^r is returning back towards the critical bands, the deviation is only transitory. The central bank, since the money demand function for narrow money is relatively stable than broad money, should pay more attention to M_1^r for the monetary policy purposes.

v. Conclusion

The formulation and implementation of the monetary policy requires the information on the money demand function. As a result of this importance, there are many studies pertaining to the money demand function using various techniques. This paper has estimated the demand for money in Nepal using ARDL approach to cointegration analysis developed by Pesaran *et al.* (1997, 2001). Despite the limitations of the unavailability of data on weighted interest rate and the quarterly series of some variables that may improve the results of the model, this paper may provide some empirical basis for further analysis of money demand function in Nepal.

The bounds test and the estimated coefficient of error correction term indicate that there exists a long-run equilibrium relationship between real money balances (M_1^r and M_2^r), real income, inflation rate and interest rate. The results also show that the real income is positively associated with narrow monetary and broad monetary aggregates while the inflation rate negatively affects the monetary aggregates. The negative association between the inflation rate and real money balances supports the theoretical explanation that the rise in inflation rate causes the fall in demand for money and vice versa. This may result from the people's preferences to substitute physical assets for money balances. In addition, the relationship between the interest rate and monetary aggregates is negative supporting the theoretical explanation. The higher error correction coefficient of M_1^r than M_2^r implies that the speed of adjustment in narrow money is faster than broad money if the shocks arise. By incorporating the CUSUM and CUSUMSQ tests to the cointegration analysis, this paper has also revealed that money demand function for M_1^r is stable, but the money demand function for M_2^r is not stable. This stability tests apparently imply that M_1^r stands as a better monetary aggregate than M_2^r in terms of formulation and implementation of monetary policy.

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