The Bound Test Approach of the Money Demand Determinants in Nepal

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Abstract

The theory of money demand is an empirically tested theory of Nepal. It aimed at estimating the money demand function in Nepal. The causal research designs were used for the study. An annual time series from 1980/81 to 2021/22 was used as the data. The research used the Bound test and Auto-regressive Distributive lag model (ARDL). Moreover, a unit root test, bound test, stability diagnostic test, and normality test were used. The empirical result indicates the existence of both short-run and long-run relationships between money demand and real gross domestic production. Furthermore, money demand has a good short-run association with inflation and the consumer price index, whereas it has a long-run relationship. The disequilibrium is corrected in the one log period with a speed of adjustment of 0.75 percent. The study concludes an association between broad money supply and real gross domestic production in Nepal exists.

Keywords: ARDL, Bound Test, Monetary, Money demand

Introduction

Money is generally accepted as an instrument of outlay when goods and services are purchased. Money is an asset of the holding public, as such it must have a demand for it and therefore supply for it (Gupta, 1982). The demand for money is the term used to describe the general public's desire to hold money. It is the summation of all the money demanded by an individual, society as public, and government. For the formation of monetary stance initiatives, a consistent and predictable relationship between real money balances, real income, and interest rates is crucial. The Ordóñez (2003) explains that money demand function is an essential component in formulating the monetary policy. Numerous pieces of literature show the theory of demand for money: The quantity theory of money, the cambridge cash balance approach, the general theory and the demand for money, Tobin's portfolio model of demand for money, monetarism and the demand for money, microeconomic transactions models of the demand for the money, etc. (Bain & Howells, 2017). In an economy, money refers to the collection of assets that people frequently use to pay for goods and services.

The cash serves both a means of transaction and source of purchase; citizens prefer to have money in their possession. The interest rate, the actual level of prices in the economy, real GDP, and financial innovations are some of the elements that fix the purchasing power of money. In this study, the researcher has used the real gross domestic production, broad money supply, interest rate, and consumer price index. Therefore, the objective of the study is to estimate the money demand function in Nepal.

Literature review

Budha (2013) studied the purchasing power of money in Nepal: ARDL bounds testing approach. According to the study, real income has a positive correlation with both broad and narrow monetary aggregates. However, the study found the inflation rate has negatively affected the monetary aggregates. Similarly, Tiwari (2018) examined the determining factors of the money supply in Nepal. According to the study, the main variables influencing the money supply are banknotes, demand deposits, time deposits, net domestic properties, and net foreign assets of the banking system. Moreover, according to the study, high-powered money is a significant determinant of the money supply in Nepal. In the same way, Neupane (2019) concluded that a lengthy term exists of causality between the real GDP, Inflation, and consumer price index. The study also concludes that real GDP, Inflation, and Consumer price

index do not exist the short-run causality on the money demand function in Nepal. Likewise, Joshi (2021) explored the long-run and short-run relationship between money supply and inflation in the context of Nepal. The study used the ARDL Bound test methodology. According to the study, an expansion of the money supply causes inflation. Moreover, the study found the long-run co-integration between the money supply and the consumer price index. In addition, Bhatta (2013) found the demand for money balance in Nepal has a stable and predictable function. Further, the study also found that there is a long-term balance relationship between the demand for real balances and its affecting factors in the case of both narrow and broad money aggregates.

Further, Adhikari (2018) found closing outlay and the interest rate are important for money demand in the long run and gross fixed capital formation has no impact on demand for money in the long run. In the same way, Khatiwada (1997) divulged that the income elasticity of a broad money supply is higher than that of narrow money. Besides, demand for real money balance is found to be almost homogenous of degree one in the population. Moreover, the nominal money balance is found to be homogeneous of price degree. By the same token, Poudyal (1989) disclosed it is not proper to use the nominal rate of interest to explain the demand for real money balances in Nepal. The findings also supported the Mckinin complementary hypothesis. Moreover, Budha (2011) revealed that there is co-integration and the long-run relationship between real money demand and its determinants, output, and interest rate. Moreover, VECM has proved the short-run relationship between the real money demand and its determinants.

Research Methodology

In this research work, I used secondary sources encompassing 42 years of time series data from the FY 1980/81 to 2020/21 AD. Real gross domestic product, the overall money supply, interest rate, and consumer price index are the variables used for empirical analysis.

Table 1 ***Sources and Measurement of Variables***

variables Descriptions	Sources	Unit
Broad Money supply (M2)	Various issues of Economic Bulletin (NRB)	In Ten million
Real Gross Domestic Production(RGDP)	Economic survey (MOF,2010/11, 2020/21)	In Ten million

variables Descriptions	Sources	Unit
Interest rate (INT)	Various issues of Economic Bulletin (NRB)	percentage
Consumer Price Index (CPI)	Various issues of Economic Bulletin (NRB)	percentage

Table 1 shows the Broad Money Supply (M2) an endogenous variable. Real Gross Domestic Production (RGDP), Interest rate (INT), and Consumer Price Index (CPI) are used as exogenous variables in the study.

Model Specification

The study has used the following functional model to achieve the research aims.

$M2_t = \beta 0 + \beta_1 RGDP_t + \beta_2 INT_t + \beta_3 CPI_t + \mathcal{E}_t (1)$

The natural log transformation was utilized in an equation by the researcher to verify the linearity of the variables and coefficients.

$lnM2_t = \beta 0 + \beta_1 lnRGDP_t + \beta_2 lnINT_t + \beta_3 lnCPI_t + \mathcal{E}_t (2)$

Where,

$lnM2_t$= Log of Broad Money supply

$lnRGDP_t$= Log of Real Gross Domestic Production

$lnINT_t$= Log of Interest Rate

$lnCPI_t$= Log of Consumer Price Index

Here, an intercept is $\beta 0$. The $\beta 1, \beta 2, \text{and } \beta 3$, are the coefficients and $\mathcal{E}_t$ is the error term. Using equation (2), it examines the relationship between the money demand function of Nepal.

Unit root test

In the time series regression analysis, time series data has the special property that the current event is dependent on the past event. To run the regression analysis time series data must be stationary before running a regression analysis. The regression findings won't be accurate otherwise. Therefore, it is preferable to decide on the order of integration of the study's variables. The unit root test is used as the method: at the level and the first difference.

The unit root results showed that variables suffered unit root at the level and the first difference. Thus, level forms of data and the first difference are employed for empirical analysis, particularly empirical models. The unit root results are reported below.

Table 2 ***Unit Root at Level and First Difference***

At Level		LNM2	LNRGDP	LNCPI	LNINT
	t-Statistic	-0.2538	-0.4915	-2.0716	-1.7572
With Constant	***Prob.***	***0.9228***	***0.8824***	***0.2567***	***0.3957***
	t-Statistic	-1.9830	-4.8869	-1.4749	-2.4095
With Constant & Trend	***Prob.***	***0.5925***	***0.0016******	***0.8213***	***0.3694***
	t-Statistic	3.0709	6.7500	2.3241	-0.8580
Without Constant & Trend	***Prob.***	***0.9992***	***1.0000***	***0.9943***	***0.3382***
At First Difference		d(LNM2)	d(LNRGDP)	d(LNCPI)	d(LNINT)
	t-Statistic	-4.4535	-5.9157	-4.1334	-4.7031
With Constant	***Prob.***	***0.0010******	***0.0000******	***0.0024******	***0.0005******
	t-Statistic	-4.3914	-6.0463	-4.6527	-4.6728
With Constant & Trend	***Prob.***	***0.0062******	***0.0001******	***0.0031******	***0.0029******
	t-Statistic	-0.8712	-0.6918	-1.4339	-4.7366
Without Constant & Trend	***Prob.***	***0.3324***	***0.4090***	***0.1391***	***0.0000******

a: (*)Significant at 10%; (**)Significant at 5%; (***) Significant at 1% and (no) Not Significant

b: Lag Length based on SIC

C: Probability based on MacKinnon's (1996) one-sided p-values.

Auto Regressive Distributed Lag approach of analysis

The ARDL procedure's series is the examination of stationary, co-integration, and causality. After presenting the time series' descriptive statistics (mean, median, minimum and maximum values, skewness, kurtosis, and the standard deviation, as well as the Jarque-Bera normality test and pairwise correlation), the first stage in ARDL analysis is the unit root analysis. The outcomes of the study of unit roots will show the degree of integration of each variable. Each variable needs to be I (0) or I (1) to meet the ARDL model's limits test requirement. Under no circumstances, should it be I (2). The ARDL model can be used to

estimate the short-run relationship. Endogenous and exogenous factors are combined in the ARDL model (Menegaki, 2020).

Table 3 ***Model Selection ARDL (4,1,3,2)***

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
DLNM2(-1)	0.027817	0.146132	0.190355	0.8507
DLNM2(-2)	-0.296497	0.134844	-2.198807	0.0382
DLNM2(-3)	0.337335	0.142256	2.371324	0.0265
DLNM2(-4)	-0.354144	0.125689	-2.817630	0.0098
LNRGDP	0.491663	0.161167	3.050644	0.0057
LNRGDP(-1)	-0.463774	0.163993	-2.828012	0.0095
DLNCPI	-0.044767	0.204825	-0.218562	0.8289
DLNCPI(-1)	0.523769	0.185460	2.824162	0.0096
DLNCPI(-2)	0.301420	0.197595	1.525442	0.1408
DLNCPI(-3)	0.606519	0.202196	2.999657	0.0064
DLNINT	0.005462	0.033885	0.161196	0.8733
DLNINT(-1)	0.002803	0.031878	0.087936	0.9307
DLNINT(-2)	0.077358	0.033531	2.307063	0.0304
C	-0.238692	0.182513	-1.307804	0.2039
R-squared	0.723660	Mean dependent var		0.167584
Adjusted R-squared	0.567468	S.D. dependent var		0.045074
S.E. of regression	0.029644	Akaike info criterion		-3.917774
Sum squared resid	0.020212	Schwarz criterion		-3.308237
Log-likelihood	86.47882	Hannan-Quinn criter.		-3.702884
F-statistic	4.633136	Durbin-Watson stat		2.260795
Prob(F-statistic)	0.000685			

The estimated ARDL regression model's overall goodness of fit is displayed in Table 3 above. The value of R^2 is 0.723660 which means seventy-two percent of dependent variables can be explained by the independent variables under the study. Regression model following correction, 56% of dependent variables are explained by independent variables Moreover, the F value is also significant under the study (0.000685).

The coefficient of DLNM2 (-2) is -0.296497. This, at a 5% level of significance, is statistically significant (0.0382). The coefficient of DLNM2 (-3) is 0.337335 which is

statistically significant at a five per cent level of significance (0.0265). The coefficient of DLNM2 (-4) is -0.354144 which is statistically noteworthy at a five per cent level of significance (0.0098). The coefficient of LNRGDP is 0.491663 which is statistically significant at a five per cent level of significance (0.0057). The coefficient of LNRGDP (-1) is -0.463774 which is statistically valid at a five per cent level of significance (0.0057). The coefficient of DLNCPI (-1) is 0.523769 which is statistically valid at a five per cent level of significance (0.0096).The coefficient of DLNCPI (-3) is 0.606519 which is statistically significant at a five percent level of significance (0.0064). The coefficient of DLNINT (-2) is 0.077358 which is statistically noteworthy at a five per cent level of significance (0.0304)

Bound test

Table 4's unit root results demonstrate that, with the exception of the consumer price index, all series variables are stationary at first difference. Therefore, in order to assess the long-term link between the variables, the researcher uses a bound testing method to co-integration.

Table 4 ***F-Bounds Test***

Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	10.07649	10%	2.37	3.2
k	3	5%	2.79	3.67
		2.5%	3.15	4.08
		1%	3.65	4.66

Therefore, to assess the long-term link between the variables, the researcher uses a bound testing technique for co-integration.

Table 5 ***Long-run relationship among variables***

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNRGDP	0.021695	0.011111	1.952610	0.0631
DLNCPI	1.078921	0.219325	4.919285	0.0001
DLNINT	0.066608	0.040492	1.644958	0.1136
C	-0.185682	0.141303	-1.314065	0.2018

The long-term association between the dependent and independent variables is shown in Table 5. LNRGDP and LNCPI are statistically insignificant. However, LNINT is not significant.

Error Correction Model (ECM)

ECM is used to analyze and correct the deviation from the long-run equilibrium between the independent variables. The long-term outcome of the error correction model is displayed in the following table.

Table 6 ***Error Correction Model***

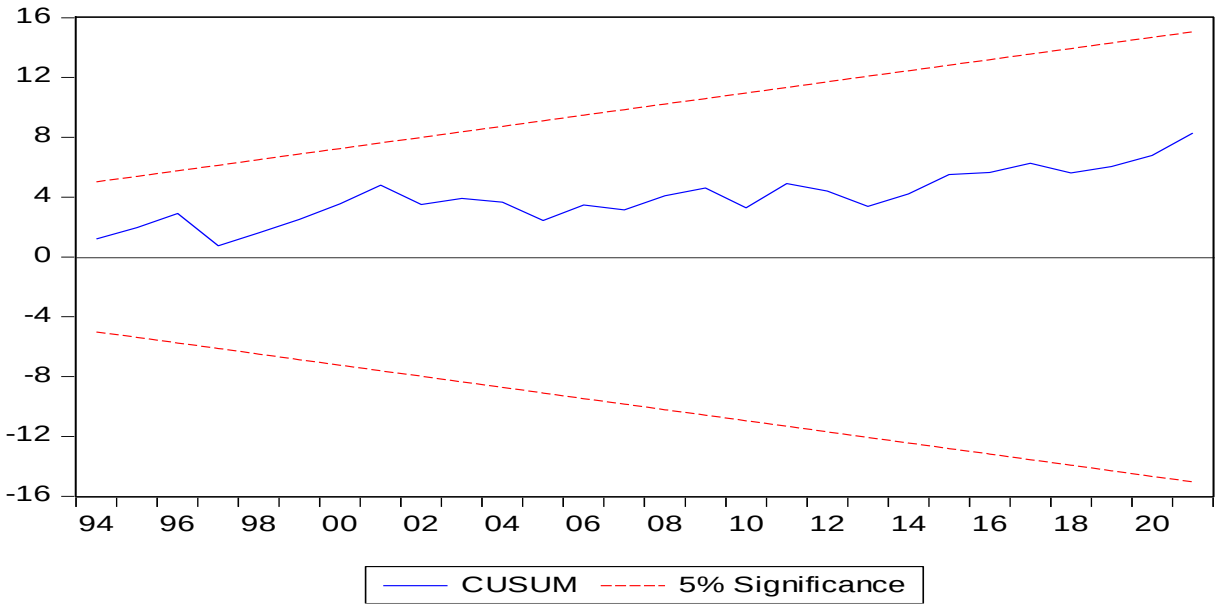
Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLNM2(-1)	0.607212	0.121005	5.018068	0.0000
DLNRGDP	0.379875	0.179970	2.110769	0.0439
DLNRGDP(-1)	0.259283	0.190031	1.364425	0.1833
DLNCPI	0.188999	0.252796	0.747634	0.4609
DLNCPI(-1)	0.301921	0.252522	1.195626	0.2419
DLNINT	-0.030106	0.042083	-0.715395	0.4803
DLNINT(-1)	0.058089	0.040531	1.433182	0.1629
ECM(-1)	-0.756868	0.313948	-2.410807	0.0227
R-squared	0.389848	Mean dependent var		0.167733
Adjusted R-squared	0.237310	S.D. dependent var		0.045704
S.E. of regression	0.039915	Akaike info criterion		-3.411016
Sum squared resid	0.044609	Schwarz criterion		-3.059122
Log-likelihood	69.39828	Hannan-Quinn criter.		-3.288195
Durbin-Watson stat	2.263711			

The coefficient of DLNM2 (-1) is 0.607212, which is statistically significant at a one per cent (0.0000) level of significance. Moreover, the coefficient of DLNRGDP is 0.379875which is statistically significant at a five percent level of significance (0.0439). Moreover, the ECM (-1) has the -0.756868 coefficient with a five percent level of significance (0.0227)

Stability diagnostic

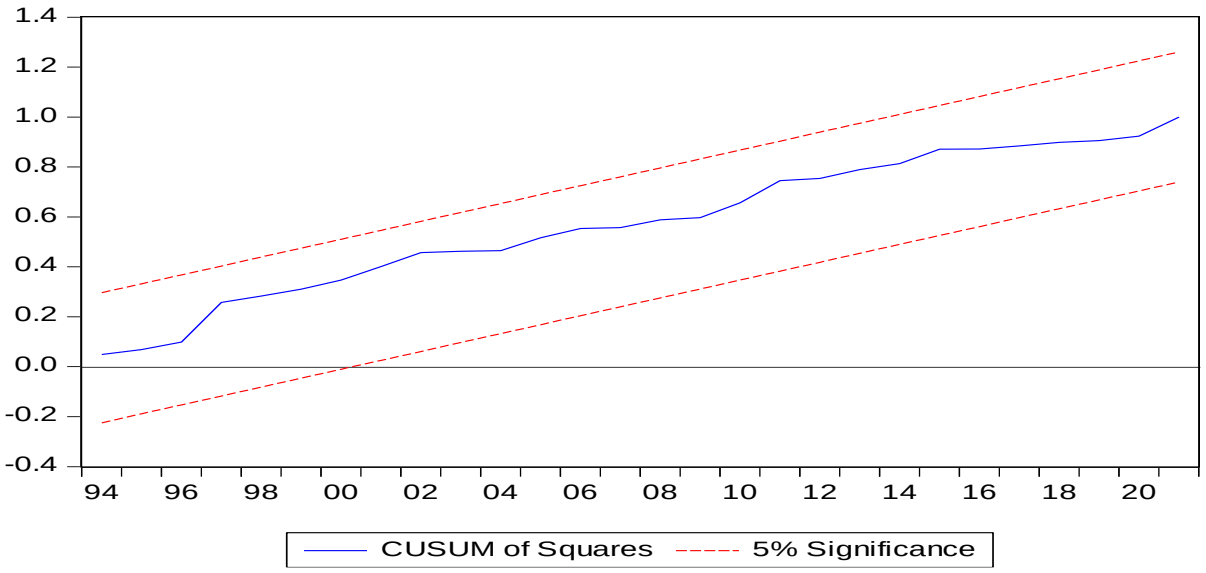
The stability of the long-run coefficients is assessed in the ARDL model's final stage by plotting the CUSUM and CUSUM square graphical representations, respectively depicted in Figures 1 and 2.

Figure 1 ***CUSUM Test***



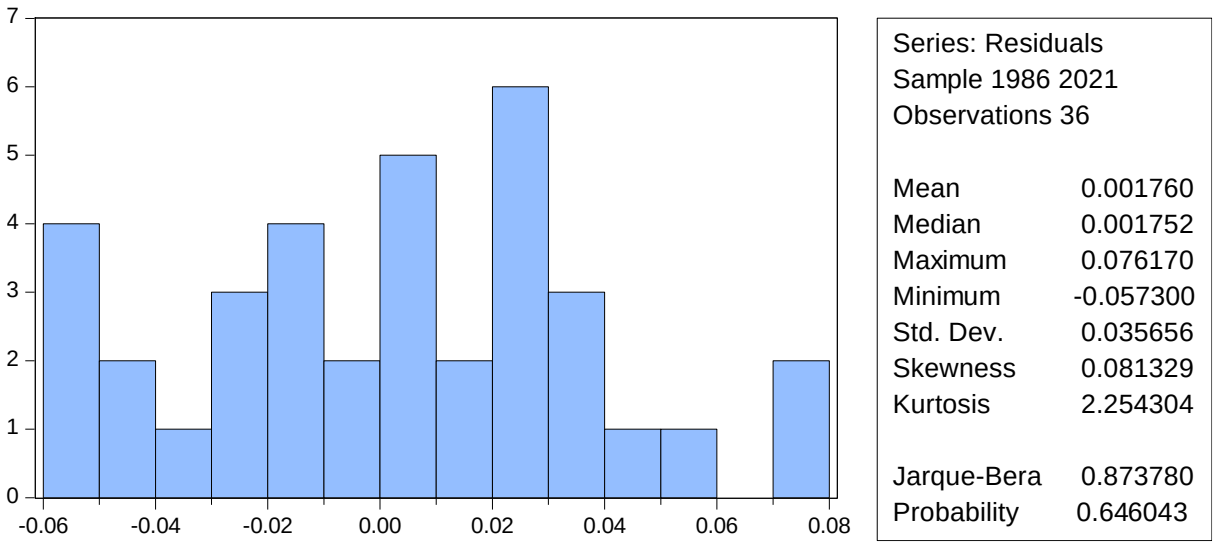
The plot of CUSUM data for LNM2 within the crucial lines at a 5% significance level is shown in Figure 4 above. The CUSUM plot is within the critical limit, suggesting that both model 1 and the log of money supply are stable.

Figure 2 ***CUSUMSQ Test***



The above figure 2, the plot of CUSUMSQ statistics for LNM2 within the critical lines at a 5% significance level. The plot of CUSUMSQ lies within the critical limit implying the stability of the model as well as the stability of the money supply.

Figure 3 Normality test:



The results of the normality test are shown in Figure 3. More than 5% of the time, Jarque-Bera will occur. This indicates that the data have a normal distribution. In other words, the figure is naturally shaped like a bell. The data are therefore regularly distributed.

Real gross domestic production, consumer price index, and interest rate have positively influenced the money supply in Nepal in the short run-time period. In the long run, real gross domestic production and consumer price index have an impact on the money supply in Nepal. Moreover, disequilibrium will be corrected with the speed of adjustment of 0.7568 per cent.

The log of RGDP has positively influenced the LNM2 in Nepal. The one per cent increase in the log of RGDP leads to an increase of 0.0057 per cent to the lnM2 in Nepal. Moreover, the first difference of log of log of real gross domestic production leads to an increase of 0.0095 per cent to the log of money supply in Nepal. In the same token, the log of the first difference to the log of the consumer price index leads to an increase in the log of money supply at 0.0096 per cent. Similarly, the log of third difference to the log of consumer price index leads to an increase in the log of money supply at 0.0664 per cent. Moreover, the log of the first difference to the log of interest rate leads to an increase in the log of money supply at 0.0304 per cent.

In the same token, the log of real gross domestic production leads to an increased log of money supply at 0.02 percent, with a ten per cent level of significance. Moreover, the log of consumer price index leads to an increase of 1.07 per cent to the log of money supply with a one per cent level of significance. Moreover, long-run disequilibrium will be corrected with the speed of 0.75 per cent with a five per cent level of significance. The study shows the LNRGDP has a positive impact on the Log of money supply. The findings are consistent with the findings of (Godana, 2023), (Neupane, 2019), (Ogunmuyiwa & Ekone, 2010), and (Muhammad et al., 2009). However, Chindengwike (2022) found money supply has a positive impact on economic growth in East African countries The study shows the LNCPI has a positive impact on the Log of the money supply. The findings are consistent with the findings of (Godana, 2023),(Doan Van, 2020), (Sheikh et al., 2020) and (Joshi, 2021). Moreover, the study shows that LNINT has a positive impact on the Log of money supply. The findings are consistent with the findings of (Godana, 2023) Thus the empirical result provides a positive relationship between gross domestic production and money supply.

Conclusion

The purpose of the study is to estimate the money demand function in Nepal. The relationship among the real broad money supply, real GDP at the consumer price index the inflation rate to estimate the short-run and long-run relationship using the ARDL bound test approach, Inquiries of the determinant of the money demand function of Nepal have been studied. Broad money supply as the dependent and real gross domestic production, consumer price index, and inflation as a dependent variable have been used in the study. The study found there is a positive and significant relationship between real GDP, consumer price index, and inflation. Moreover, the bound test suggests there is a long-run relationship between broad money supply to the RGDP and CPI. Furthermore, the CUSUM and CUSUMSQR tests have confirmed the long-run money supply**.** The finding shows the significance of money supply and economic growth. The more the money supply, it leads to help to increase the economic growth. Policymakers have to be more concentrated on economic growth by increasing broad money supply. Moreover, future researchers could use the quarterly data to estimate the determinants of the money demand in Nepal.

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