



Money Supply-Economic Growth Nexus: Evidence from a Landlocked Country

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Abstract

Background: There is a special role of money in the economy due to its astonishing importance as change in the amount of it can have a significant effect on the major macroeconomic variables. Money supply is generally considered as a policy-determined phenomenon. Like in all the nations, macroeconomic stability of Nepal also depends on the variations in the quantity of money.

Objective: The principle objective of the study is to examine the impact of money supply on the economic growth of Nepal.

Methodology: This study applies the ARDL approach to co-integration. Bounds test (F-version) has been carried out to determine the existence of long-run relationship between variables.

Results: The empirical results indicate that there is a positive and significant long-term relationship between money supply and real economic growth in Nepal. Causality result reveals unidirectional causality from money supply (M_2) to real GDP. The error correction term is found negative and statistically significant suggesting a correction of short-run disequilibrium within two and a half years.

Conclusions: The study concludes that increase in the money supply helps to increase the real economic growth in Nepal. So, money supply and real GDP are associated in the long-run.

Implications: The implication of the study is that, real economic growth in Nepal can be achieved if Nepal Rastra Bank emphasized on monetary policy instruments which help to increase the flow of money supply both in the short and long run.

Keywords: Money Supply, Real GDP, Co-integration, ARDL approach, Nepal,

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Paper Type: Research paper

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Introduction

Economic growth is one of the major objectives of macroeconomic policy. It is a crucial means of uplifting living standards as well as achieving economic development (Timsina, 2014). Economists define economic growth from various perspectives. Some economists view that it is an increase in the national income or the level of production of goods and services by a country over a certain time. Economic growth is a long run rise in the capacity to increasingly diversified economic goods and services to its population; this growing capacity based on advancing technology and the institutional and ideological adjustment that is demand (Kuznets, 1995). Generally, growth is an increase in the economy's capacity to produce total volume of goods and services during a particular period. Gross domestic product (GDP) is considered a proxy of economic growth in the study.

To achieve economic growth money supply plays a vital role. The link between money supply and economic growth has received tremendous attention in the field of monetary economics in recent times (Ogunmugiwa & Ekone, 2010, and El-seoud, 2014). This is as a result of the pertinent nature of economic growth among the macro-economic goals of nations either developed or developing.

Monetary policy is the manipulation of the money supply to affect macroeconomic outcomes such as GDP growth, inflation, unemployment, and exchange rates. Monetary policy is formulated and conducted by the central bank of many countries. So, the monetary policy is an important tool for maintaining economic stability and promoting economic growth as well. However, monetarists believe that an increase in the money supply will not affect output or gross domestic product (GDP), but the money supply will affect mainly on inflation. While the Keynesian assumes that the role of money supply is very limited because of the liquidity trap and the investment elasticity of interest is low, so the positive changes in income leads to raising money demand for transactions and raising the amount of money, and this means, the direction of causality comes from income to money and not the opposite. (Abou, 2014, Ghatak 1995, Chaudhary et al. 2012, Marshal, 2016)

Policymakers complementarily used two major macroeconomic policies (fiscal policy and monetary policy) in order to influence the economy. The major factors of economic policy commonly represented by either fiscal policy, which deals with government actions regarding taxation and spending, or monetary policy, which deals with central banking actions regarding the money supply and interest rates. The conducive macroeconomic policies resulted in the price stability, exchange rate stability, interest rate stability and financial stability and thereby the nations can trigger high investment, saving and economic growth.

Money supply, therefore, one of the influencing factors to affect the economic growth of every nation. Money supply and economic growth are macroeconomic policies in each country. Money supply represents the stock of money at a point in time. It can be obtained by summing up the financial assets that can perform functions of money including currency in circulation. All the countries make target higher economic growth with price stability (Gnawali, 2019).

Since 1966, Nepal has been controlling its economy through variation in the stock of money. Since the late 1980s, the NRB gave more emphasis on the indirect monetary instruments by deregulating interest rate determination and brought about reforms in monetary strategy, instruments, and operating procedures, among others. Currently, the monetary policy of Nepal has explicit goals, intermediate strategy, and operational targets. The NRB has the goals of monetary stability, external sector stability, financial stability and supporting growth with adequate provision of liquidity. Broad money (M_2) supply growth is considered as an intermediate target of the policy and which is also taken as the base of economic growth (NRB, 2018).

It is, therefore, very important to understand how money supply affects economic growth over time in Nepal. One of the macroeconomic objectives of Nepal is to achieve sustainable economic growth and which is also the objective of the monetary policy of Nepal. Based on these facts and considerations, this study attempts to measure the impact of money supply on economic growth using the ARDL bounds testing approach to co-integration.

There are a few limitations to the study. The study uses the ARDL approach to co-integration, so the conclusions drawn by this study may not match with the conclusion drawn by the study using other methodologies. Similarly, the study covers the data from 1975 to 2019 because of the unavailability of data before 1975. Despite several variables influencing the economic growth, the study has considered only money supply (M_2) which may be the third limitation of this study.

This paper is organized into five sections. Section 1 represents as introduction. Section 2 deals with reviews of macroeconomic thoughts on money supply and related empirical studies. Section 3 covers the methodology and data within which there is discussion for model specification and econometric approach used in the study. Section 4 presents and discusses the results. Finally, Section 5 includes concluding remarks of the study.

Review of Literature

This section deals with the review of various previous studies associated with the money supply and economic growth of Nepal. Without a review of earlier studies, it is difficult for the researcher to deal with a particular research problem. To identify the gaps in this field, previous studies have been reviewed. Several studies in the area of money supply are carried out at the national level and international level. However, national empirical studies have not applied the ARDL approach. A review of earlier studies related to the present study is provided as a backup for this study. The literature review section is classified into two parts: a) review of macroeconomic thoughts, concepts and theories and b) review of empirical studies.

Review of Macroeconomic Thoughts on the Concept of Money Supply

Some approaches have attempted to define money and the compositions of a country's money stock. Four approaches have been distinguished, namely, the conventional approach, the Chicago approach, the Gurley and Shaw approach, and the Central Bank approach (Ezirim, 2005).

The Conventional Approach

The Conventional Approach views money from a functional standpoint, i.e. in the light of what money uniquely does. Accordingly, money has been seen as “a generalized means of purchasing power that is accepted as payment for goods and services” (Copper and Fraser, 1990). Thus, as the common denominator for economic and business transactions, money mediates between the vast number of goods and services transacted in the community” (Chew 2009). Thus, what constitutes the money stock of any country would be those mediums that facilitate readily the exchange mechanism and command general acceptability (DD) created by commercial banks. In Nepal, this is defined as Narrow Money (M_1). Thus, $M_1 = C + DD$. As per the Central Bank of Nepal’s definition, M_1 is the currency (notes and coins) held by the public plus privately held demand deposits with the commercial banks and other deposits of Central Bank.

The Chicago Approach

The Second approach is championed by the monetary theorists of Chicago University. As propounded by one of their leading spokesmen, Milton Friedman, “money is a temporary abode of purchasing power”. The basic argument is that, since there seems to be an imperfect synchronization between income receipts and expenditure streams over time, then money not only function as a medium of exchange but also as a temporary store of purchasing power. By implication, the total money stock must not be restricted to M_1 as expressed above but must include any other asset that commands liquidity akin, or near to currency. These other assets have fixed interest-bearing time deposits of commercial banks. This originated the M_2 definition of the total money stock. Therefore, $M_2 = M_1 + TD$, where $M_1 = C + DD$; $TD =$ Fixed interest-bearing time deposits of commercial banks. In Nepal, there is a little variation, not in principle but in the context of what has been described as M_2 . For the Central Bank of Nepal, the M_2 definition of money includes M_1 plus time deposits (including saving, fixed, call and margin deposits) with commercial banks.

The Gurley and Shaw Approach

The Gurley and Shaw approach introduced another dimension to the definition of money and money supply. Apart from broadening the content of the money stock, they added a cardinal element of assigning weights to the various components. Accordingly, they define currency (C) and demand deposits (DD) as claims against financial intermediaries (central bank and commercial banks, in this case). However, they do not constitute the intermediaries, which are close substitutes for money. Such close substitutes include commercial banks time deposits, credit institutions share, bonds, etc. They argue that all these are viable alternatives to liquid stores of value to the public. Thus, the money stock is broadened as; $M_3 = C + DD + T - D_1 + SD_1 + S + B$, where, S = Share of credit institutions; B = Bonds.

The Central Bank Approach

This approach is the widest view of money. This view has been favoured by central banks of most developed countries, which earned it the name, the central bank approach. The Federal Reserve Systems of the United States seems to favour this viewpoint in their definition of money which comprises M₃ plus non-bank public holding of U.S. savings bonds, short-term U.S. Treasury securities, commercial papers and bankers' acceptance, net of money market mutual holdings of these assets. Thus, we can define M₄ as; $M_4 = M_3 + SB + TS + CP + BA + M_3H$, where SB = Savings bonds; TS = Short-term Treasury securities; CP = Commercial papers; BA = Bankers' Acceptances; M₃H = Net of Money market mutual holdings of assets.

Review of Macroeconomic Theories on Money

In this regard, this paper focuses on the major theories on money which has established significant economic doctrines. For instance, the quantity theory of money is one of the oldest economic doctrines that survived despite the Great Depression followed by severe Keynesian criticism. The major theories relating to money are as follows;

Quantity Theory of Money (QTM)

Fisher's (1911) exchange equation (MV=PT) is considered as the famous classical mathematical formulas. It expresses the relationship between the amount of money and the general price level, where (M) is the amount of money, (V) is the money velocity, (P) is the general price level, and (T) is the volume of transactions. The theory assumes that output will be fixed at full employment, the velocity of the money will be fixed too, and thus the equation shows only the relationship between the amount of money (M) and the general price level (P), especially in the long run. Consequently, an increase in the money supply leads to a proportionate increase in the price level. Fisher has explained his theory in terms of the following equation of exchange; $PT = MV + M_1V_1$, where M₁ = Circulation of cheque; V₁ = Velocity of cheque. To find out the effect of the quantity of money on the price level or the value of money, we write the equation as;

$$P = \frac{MV + M_1V_1}{T}$$

Cambridge Cash Balance Theory

During almost the same period when Fisher was developing his equation of exchange in America, Marshall, Pigou, Robertson, Keynes, etc. at the Cambridge University popularized the classical Cambridge cash-balance approach to the quantity theory of money. The Cambridge version of Quantity Theory of Money points out, the money supply affects both prices and output in the short run, but in the long, the money supply only affects the general price level and not output. They reformulated the exchange equation to the new equation called the equation of Cambridge, which states that, "the amount of nominal money demand and then money supplies (at money market equilibrium) are proportionally linked directly to the nominal per capita income or output". This equation can be presented as; $MS = MD = KY$, where (MD) is money demand, (Ms) Money supply, (K) is the liquidity preferences, and (Y) is nominal income (Pigou, 1917).

Keynesian Theory of Money

Keynes (1936) rejected the classical quantity theory of money on the following grounds: a) It is based on the unrealistic assumption of full employment and the absence of money illusion. b) It unnecessarily assumes money as neutral and is based on a false division of the economy into the real and monetary sectors. c) It fails to integrate the monetary theory with the general theory of value. d) It fails to provide a casual process between the money supply and the price level (Paul, 2015).

Thus, Keynes denied the classical exchange equation in the short run because their assumptions (Y was fixed at full employment and V was fixed) do not apply in uncertainty real world with a high level of unemployment. Keynes argues that changing in money supply is not the only reason for changing the general price level, but there is another variable that affects the price level which is the employment of production factors. In the case of the absence of full employment, the increase in the money supply will lead to an increase in total spending and then increased the total output. When the economy reaches full employment, the increase in the money supply only leads to higher prices. Thus, the money supply is no neutral when the economy operated at less than the full employment level, where there is an indirect effect of money supply on economic activity, through the influence of money supply on interest rates, and then investment and output (Branson, 2005).

Monetarist Theory of Money

Contrary to the Keynesians, the Monetarists led by Milton Friedman faithfully claim that money supply plays an active role in determining income and prices (Laidler, 1981). This indicates that both income and prices are mainly caused by changes in the stock of money supply in the short-run. Monetarists believe that the direction of causation runs from money to income without any feedback only in the short-run and the inflation is a monetary phenomenon in that changes in money supply cause changes of prices in both short-run as well as long-run (Mayer, 1975). Thus, the view of monetarism is that there is a unidirectional causality from money supply to income and a unidirectional causality from money supply to prices.

New Classical Theory of Money

The new classical point of view totally ignored the association between money supply and income in both long-run and short-run because of rational expectation hypothesis (Froyen, 2014). Rather the overall effect of change in money supply remains only in price level (Maddock & Carter, 1982). Their view is similar with the classical view.

New-Keynesian Theory of Money

The new Keynesians are giving the strong microeconomic foundation to the Keynesian system. So, their views support the Keynesian view of indirect association between money supply, income and price (Gordon, 1990). But they are not as rigid as Keynesians to believe the effectiveness of monetary policy (Froyen, 2014).

Review of Empirical Studies

Several studies confirmed the significance of money supply and economic growth in different types of economics. This section of the review of literature deals with some of the international and Nepalese empirical studies showing relationship between money supply and economic growth.

Review of International Empirical Studies

Abbas (1991), in a cross country study, tests the causal relationship between money and output in some Asian countries, and the study finds that there is a mutual relationship between money and income in Pakistan, Malaysia, and Thailand.

Ahmad et al. (2016) explored the impact of monetary policy on the economic growth of Pakistan using annual time series data from 1973 to 2014. The study used Augmented Gross Domestic Product, Money Supply, and Interest Rates are stationary at level while exchange rate at first difference. The ARDL co-integration approach applied to distinguish the robust among the variables with specification short run and long run. They concluded that long-run association occurs among variables, money supply, inflation, and exchange rate etc. positively influence economic growth and interest rate negatively.

Asogu (1998) examined the influence of money supply and government expenditure on Gross Domestic Product. The study adopted the St Louis model on annual and quarterly time series data from 1960 to 1995. The paper finds money supply and export as being significant which is similar to the earlier work of Ajayi (1974). Nwaobi (1999) examining the interaction between money and output in Nigeria between the periods 1960- 1995. The model assumed the irrelevance of anticipated monetary policy for short-run deviations of domestic output from its natural level. The result indicated that unanticipated growth in the money supply would have a positive effect on output.

Chaitip et al. (2015) examined the relationship between money supply and economic growth-wise phenomena of AEC open region including Thailand, Indonesia, Singapore, Malaysia, Philippines, Vietnam, Lao PDR, and Cambodia. The macro variables comprise of economic growth-wise phenomena or GDP growth rates and money growth-wise phenomena or money supply, consisting of money (M_1) and demand deposits (DD) of selected countries in ASEAN were tested by using secondary data, covering time periods from 1995 to 2013. Panel unit root and estimation models by using panel ARDL of Pooled Mean Group Estimator (PMGE) were conducted to observe the long-run relationship and the short-run relationship as a speed of adjustment to the long-run equilibrium. The result showed coefficients of estimation indicated that money supply was associated with economic growth wide phenomena of AEC open region in the long run including a speed of adjustment to long term equilibrium.

Chaudhary et al. (2012) examined to explore the long run and short-run relationship of monetary policy, inflation, and economic growth in Pakistan using co-integration and causality analysis from 1972 to 2010. The paper concluded that the exchange rate significantly influences economic growth and exchange rates are causing each other bi-directionally.

Ishan and Anjum (2013) described the main role of money supply (M_2) on the GDP of Pakistan. The study used secondary data from 2000 to 2011. The study revealed the impact of money supply (M_2) on the GDP of Pakistan whereby the country has seen inflation rate in double digits. The study has used regression model and proved that interest rate and CPI have a significant relation with GDP. Thus, they have suggested that the money supply needs aggressive control to boost the economy.

Marshal (2016) studied the link between money supply and economic growth in Nigeria by applying co-integration and VAR model in a simple regression framework with annual time series data 1970 to 2014. The study finds Money supply (M_2) has a short and long-run positive and significant link on Real Gross Domestic Product in Nigeria.

Ogunmuyiwa and Ekone (2010) investigate the impact of money supply on economic growth in Nigeria between 1980 and 2006 and the results reveal that money supply is positively related to economic growth but insignificantly on the choice between contractionary and expansionary money supply.

Salih (2013) examined the relationship between the three macroeconomic variables money, income, and prices in the Saudi Arabian economy by applying co-integration, bivariate and trivariate Vector Autoregressive (VAR) models, and Granger Causality/Block Exogeneity tests. The results indicated two-way causation between income and money supply, income Granger causes prices, and money Granger causes money prices.

Review of Nepalese Empirical Studies

Acharya (2018) analysed the relationship between money supply, income and price level in Nepal using the data from 1974/75 to 2017/18. The paper has established the relationship between real money supply concerning real GDP, nominal money supply concerning price level and nominal GDP concerning price level separately by using VECM for long-run causality and VEC, as well as VAR Granger Causality/Block Exogeneity Wald tests for short-run causality. The study found bidirectional long-run causality between the real incomes concerning money supply in real terms with no evidence of short-run causation between these variables.

Gnawali (2019) examined the effects of money supply on the economic growth of Nepal over the period 1975 to 2016, using co-integration, Vector Error Correction Model (VECM) and Causality test to conclude. The study showed that money supply is positively significant to economic growth and foreign assistant is negatively significant to the economic growth of Nepal and the study suggests to increase the money supply for achieving higher and rapid economic growth.

Gyanwaly (2012) analysed the causal relationship between money, price, and income in Asian countries by employing the annul data from 1964 to 2011. The study concluded that money supply is an endogenous variable in all the countries though the extent of endogeneity in terms of price and income variables slightly differs from one to another. The study found that both narrow and broad money are unidirectionally causing the general price level and bidirectional causality between broad money and GDP in Nepal. The study also found money

supply in Nepal is not neutral because it is causing income and output of the economy at the cost of high inflation.

Thapa (2017) published the article “The Money Supply Function in Nepal” and analysed that reserve money has been the dominant determinant of money supply for both M_1 and M_2 . This analysis has also shown that the value for the M_1 multiplier has been less than one in some years of the study period. Reserve money has been more or less the sole determinant of M_1 . The gap between M_1 and reserve money is rather narrow. The direct monetary policy instrument like CRR which work through its impact on money multiplier is still relevant for an effective reign over the money supply in developing economies like Nepal.

Research Method

Data sources

Broad money is regarded as more inclusive in calculating the money supply of an economy and as a result, this paper has taken M_2 as the measure of money supply in Nepal. Money supply itself is a macroeconomic indicator at affects investment and economic growth directly. Therefore, this paper aims to quantify the relationship between broad money and economic growth in Nepal.

TABLE 1: The Description of Variables

S.N	Notation	Variable	Unit
1	RGDP	Real Gross Domestic Product	Natural log transformation; Values with Base year: 200/01
2	M_2	Broad Money Supply	Natural log transformation

Real GDP is the inflation-adjust monetary value of all goods and services produced within the political boundary of a country regardless of factors of production. Real GDP provides a more precise picture of a nation’s rate of economic growth. This study has used the real GDP as the dependent variable representing the proxy of economic growth. The broad money supply is a monetary aggregate that acts as an explanatory variable. The broad money supply is sum of narrow money and time deposit. The time deposit consists of saving deposits, fixed deposits, call deposits, and margin deposits.

The study uses the annual data on the broad money supply and real GDP of Nepal. These data are obtained from the Nepal Rastra Bank that covered the period from 1975 to 2019. The collected data are measured in Nepalese currency and entire variables are expressed in the form of natural logarithm for data analysis.

Econometric Analysis

Based on the selected variables and theoretical frameworks, the general model can be expressed as;

$$RGDP = f(M_2) \dots\dots\dots (1)$$

The equation can be arranged in a linear form as;

$$RGDP_t = \alpha + \beta_1 M_{2t} + \mu_t \dots\dots\dots (2)$$

By placing natural logarithms on both sides, the equation can be expressed in its natural log form as;

$$\ln RGDP_t = \alpha + \beta_1 \ln M_{2t} + \mu_t \dots\dots\dots (3)$$

Where, α = Constant; β_1 = Coefficient; μ_t = Error Term

Following the ARDL approach proposed by Pesaran and Shin (1995), the existence of a long-run relationship could be tested using the equation below:

$$Y_t = \beta_0 + \beta_1 Y_{t-1} + \beta_2 Y_{t-2} + \dots + \beta_p Y_{t-p} + \alpha_0 X_t + \alpha_1 X_{t-1} + \alpha_2 X_{t-2} + \dots + \alpha_p X_{t-p} + \mu_t \dots (4)$$

Where μ_t is the random disturbance term and the above equation shows the basic ARDL model.

Again, the above equation can be termed into error correction model as;

$$\Delta \ln RGDP_t = \alpha + \beta_1 \Delta \ln M_2 + \beta_2 ECT_{t-1} + \mu_t \dots\dots\dots (5)$$

Here, $\ln RGDP$ and $\ln M_2$ are the first differentiated variables, β_{1-2} are coefficient and μ_t is the random disturbance term. The ECT_{t-1} is the equilibrium error term of one-period lag. It tells that the variable of the system to restore to the equilibrium or it signifies the time to correct the disequilibrium.

The concept of co-integration was first developed by Engle and Granger (1987), providing tests, and estimation procedures to ensure the existence of long-run relationships. Following the shortcomings of Engle and Granger (1987), Johansen (1988) and Johansen and Juselius (1990) proposed a new procedure for testing the co-integration of several, say k, I (1) time series. This test permits more than one co-integrating relationship, so it is more applicable than the Engle and Granger (1987) test. However, when one co-integrating vector exists, Johansen (1988) and Johansen and Juselius (1990) co-integrating procedure cannot be applied (Nkoro and Uko, 2016). Hence, it is of the essence to explore the ARDL bounds testing approach to co-integration developed by Pesaran and Shin (1995) and Pesaran et al. (2001).

Narayan and Smyth (2006), Bhatta (2013), and Nkoro and Uko (2016) have discussed several advantages of using the ARDL approach:

- Each of the underlying variables stands as a single equation and endogeneity is less of a problem in the ARDL technique because it is free of residual correlation;
- When there is single long-run relationship, the ARDL procedure can distinguish between dependent and explanatory variables;
- The error correction model (ECM) can be derived from the ARDL model through a simple linear transformation, which integrates short-run adjustments with long-run equilibrium without losing long-run information;

It can be applied on a time series data irrespective of whether the variables are I(0) or I(1), while Johansen co-integration technique requires all the variables in the system be of equal order of integration, nevertheless, ARDL cannot be applied if variables are I(2);

The ARDL procedure is statistically more significant approach to determine the cointegration relation in small samples;

The ARDL technique allows the variables may have different optimal lags,

The ARDL is considered sufficient numbers of lags to capture the data generating process in a general specific modelling framework, removes dilemma connected with omitted variables and provides unbiased results and validates the t-statistics even when some of the regressors are endogenous.

The orders of the lags in the ARDL model are selected by either the Akaike Information Criterion (AIC) or the Schwarz Bayesian Criterion (SBC) (Narayan, 2004). However, the study uses the SBC criterion in lag selection as ARDL-SBS estimators perform slightly better than ARDL-AIC in the majority of the experiments (Pesaran and Shin, 1995). The general hypothesis for co-integration can be stated as:

H_0 = No co-integrating equation

H_1 = H_0 is not true.

For testing the long-run equilibrium relationship between economic growth and money supply, bounds test (F-version) for co-integration is carried out. The F-statistics is then compared with the critical values provided by Pesaran et al. (2001). If the computed F-statistics is higher than the appropriate upper bound of the critical value, the null hypothesis of no co-integration is rejected, if it lies within the lower and upper bounds, the result is inconclusive, and if it lies below the lower bound, the null hypothesis cannot be rejected. Based on the model, ARDL bound testing is given as:

$$\Delta \ln RGDP_t = \beta_0 + \sum_{i=1}^q \beta_{1i} \Delta \ln RGDP_{t-1} + \sum_{i=0}^q \beta_{2i} \Delta \ln M2_{t-1} + \beta_3 \ln RGDP_{t-1} + \beta_4 \ln M2_{t-1} + \mu_t \dots \dots \dots (6)$$

Where Δ is the first difference operator, q is the optimum lag length, β_0 represents the short-run dynamics of the model, β_{1i} are the long-run coefficients, β_{2i} represents the dynamic disturbance term. The error correction form of ARDL model will be:

$$\Delta \ln RGDP_t = \beta_0 + \sum_{i=1}^{q_1} \beta_{1i} \Delta \ln RGDP_{t-1} + \sum_{i=0}^{q_2} \beta_{2i} \Delta \ln M2_{t-1} + \delta Ec_{t-1} + \mu_t \dots \dots \dots (7)$$

Where q_1 and q_2 represent the optimum lag length, δ represents the speed of adjustment parameter and Ec_{t-1} represents the error correction term derived from the long-term relationship of the model.

The simple Pairwise Granger Causality is employed to test the causality between the variables. If the variables are I (1) individually and they are co-integrated then there exists unidirectional or bidirectional causality between them. A variable granger causes the other variable if it helps to forecast its future values (Engle and Granger, 1987). The null hypothesis to be tested are:

$H_1 = \delta_j = 0$, this means that money supply does not granger cause real economic growth.

$H_2 = \gamma_j = 0$, this means that real economic growth does not granger cause money supply.

If $H_1=\delta_j=0$ is rejected, it shows that money supply granger causes RGDP. Rejection of $H_2=\gamma_j=0$ means that the causality runs from growth to money supply. If both hypotheses are rejected, there is bi-directional causality between money supply and economic growth and if none of the hypothesis is rejected, it means that money supply does not granger cause growth and growth does not granger cause money supply.

For the test of the stability of the model, CUSUM and CUSUMSQ tests are carried out in this study. Besides these tests, several other tests are also carried out, such as Lagrange Multiplier (LM) test for serial correlation, Ramsey Reset test for functional form misspecification, Jarque-Berra test for normality, and KB test for heteroscedasticity.

Data Analysis and Result

This section shows the magnitude of the relationship between money supply and economic growth in Nepal.

Descriptive Statistics

A critical examination of the descriptive statistics for the variable considered in the study is shown in Table 2:

Table 2: Descriptive Statistics

Statistics	ln RGDP	ln M2
Mean	5.546174	4.973203
Median	5.563748	5.015865
Maximum	5.977739	6.554142
Minimum	5.155579	3.314794
Std. Dev.	0.249747	0.947723
Skewness	-0.018272	-0.062253
Kurtosis	1.760723	1.866584
Jarque-Bera	2.882144	2.437749
Probability	0.236674	0.295563
Observations	45	45

Source: Author's calculation using EViews9

Unit Root Test Results

The ARDL co-integration technique requires underlying variables of I (0) or I (1) or a combination of both; integration of order I (2) leads to the crashing of the technique. Further, the ARDL error correction representation becomes relatively more efficient if the F-statistics (wald test) establishes that there is a single long-run relationship and the sample data size is finite (Nkoro and Uko, 2016). The Augmented Dickey-Fuller (ADF) is used to test the unit root of the dependent and explanatory variables. Table 3 shows the results of Augmented Dickey-Fuller tests of the time series variables used in this study and Figure 1 depicts the trend with stationary.

TABLE 3: Unit Root Test performed on the Variables using ADF

Variables	Level		First Difference		Order of Integration
	Intercept	Intercept with trend	Intercept	Intercept with trend	
ln RGDP	0.9655 (0.9955)	-3.1797 (0.1017)	-7.4653 (0.0000)	-7.5964 (0.000)	I (1)
ln M2	-0.7595 (0.8203)	-2.1013 (0.5304)	-4.7114 (0.0004)	-4.7239 (0.0024)	I (1)

Source: Author's calculation using EViews9

The ADF test reveals that the selected variables are found to be non-stationary at level with intercept and trend. At 1st difference, all the variables become stationary. It is concluded that the variables are integrated at I (1) confirmed by the ADF test.

Table 4: KPSS Output for the Variables

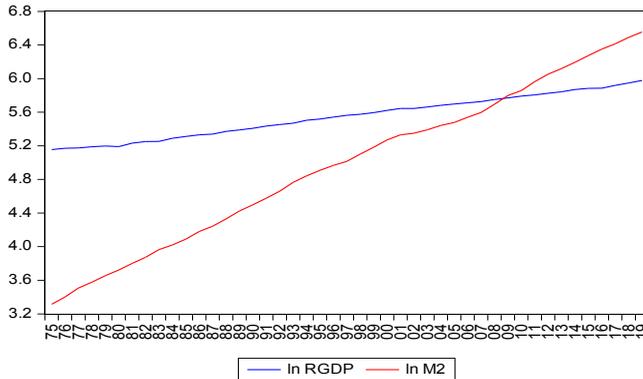
Variable	Test with order	Test statistic	Level of significance	Critical values	Prob.
ln RGDP	KPSS at level	0.8584	1%	0.7390	Nil
			5%	0.4630	
			10%	0.3470	
	KPPS at first order differencing	0.2037	1%	0.7390*	
			5%	0.4630*	
			10%	0.3470*	
ln M2	KPSS at level	0.8607	1%	0.7390	Nil
			5%	0.4630	
			10%	0.3470	
	KPPS at first order differencing	0.1589	1%	0.7390*	
			5%	0.4630*	
			10%	0.3470*	

* indicates significant values and acceptance of null hypothesis

Source: Author's calculation using EViews9

Table 4 presents the result related to KPSS unit root test to determine an order of integration. The KPSS is used as a cross check for stationarity. In the ADF the null hypothesis is on non-stationarity time series and in KPSS it is of stationarity time series. From Table 4, at level KPSS test shows that both variables are non-stationary as test statistics are higher than asymptotic critical values at all the level of significance. So, this test advised to move towards difference stationary process. At the first difference, both variables are stationary as the values of test statistics are less than asymptotic critical values at all the level of significance. Thus, like the ADF test, KPSS also suggest that both of the variables are integrated of order 1.

FIGURE 1: Trend of Variables



Source: Author's calculation using EViews9

Lag Length Selection

Table 5 shows the different lag length criteria with the help of the VAR approach.

TABLE 5: LAG length criterions

Lag	LogL	LR	FPE	AIC	SC	HQ
0	79.68396	NA	7.75e-05	-3.789462	-3.705873	-3.759023
1	245.6700	307.6814*	2.87e-08*	-11.69122*	-11.44045*	-11.59990*
2	248.8143	5.521677	3.00e-08	-11.64948	-11.23153	-11.49728
3	251.4267	4.332854	3.22e-08	-11.58179	-10.99667	-11.36872
4	253.2109	2.785036	3.62e-08	-11.47370	-10.72140	-11.19976

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

Source: Author's calculation using EViews9

Co-integration Result

The association between economic growth and money supply can be analysed with the help of following econometric tests;

TABLE 6: Bounds test (F-version) result

Variables	Critical Values	F-Statistics	8.1468**	Lag Option
F (RGDP / M2)		Lower bound I (0)	Upper bound I (1)	(1,0)
	5%	7.1069	7.7933	
	10%	5.8814	6.5704	

Note: **, and *** shows 5%, and 10% level of significance respectively

Source: Author's calculation using Microfit 5.0

Table 6 presents the outcome of the bound test. The calculated F-statistics lies above the upper critical value of 7.7933, which rejects the null hypothesis of no cointegration. Thus, it can be said that there is a long-term association between money supply and economic growth. This result is also supported by the significantly negative coefficient obtained from , which is considered more efficient for testing cointegration (Bahmani-Oskooee and Bahmani, 2015; Banerjee, Dolado and Mestre, 1998).

ARDL Regression Results and Interpretation

Given the existence of cointegration between real economic growth and money supply long-run and short-run estimates for equation (6) were estimated using an ARDL model. Based on SBC criteria, we set the maximum lag length equal to 1 as indicated in Table 5. The diagnostic tests result for the ARDL analysis is reported in Table 7.

TABLE 7: Information of Diagnostic Test of ARDL Output

Diagnostic Tests		
Test Statistics	LM Version	F Version
A: Serial Correlation	CHSQ (1) = 2.4330[.119]	F (1,39) = .2827[.13]
B: Functional Form	CHSQ (1) = .089619[.765]	F (1,39) = .07959[.779]
C: Normality	CHSQ (2) = 11.1469[.004]	Not applicable
D: Heteroscedasticity	CHSQ (1) = 1.7399[.187]	F (1,42) = 1.7291[.196]

Source: Author's calculation using Microfit 5.0

Note:

A: Lagrange multiplier test of residual serial correlation;

B: Ramsey's RESET test using the square of the fitted values;

C: Based on a test of skewness and kurtosis of residuals;

D: Based on the Breusch-Pagan-Godfrey Test.

*, **, and *** shows the significance of coefficients at a 1%, 5%, and 10% level of significance respectively;

The result of diagnostic test in Table 7 signifies that the model passes all of the tests except the normality test. However, as per the central limit theorem if the number of observations is greater than 30, the issue of normality can be ignored (Ayunku, 2018).

TABLE 8: Estimated Long-run Coefficients using the ARDL Approach

ARDL (1, 0) selected based on Schwarz Bayesian Criterion

Dependent variable is ln RGDP

44 observations used for estimation from 1976 to 2019

Regressor	Coefficient	Standard Error	T-Ratio [Prob]
LNM2	.16471**	.070604	2.3329[.025]
INPT	4.5812*	.23189	19.7562[.000]

Note: *, and ** show the significance of coefficients at a 1%, and 5% level of significance respectively.

Source: Author's calculation using Microfit 5.0

The estimated long-run function of the model is given with the following equation:
 $lnRGDP_t = 4.5812 + 0.16471M2_t \dots\dots\dots (8)$

The long-run coefficients are reported in Table 8. The coefficient of explanatory variable M_2 is positive and significant at a 5 percent significance level. Quantitatively, the long-run elasticity of M_2 is 0.16471 and it is significant. This, in turn, shows that a one percent increase in the money supply leads to an increase in economic growth by 0.16471%. Hence the result supports that the increase in money supply leads to economic growth in the context of Nepal which further confirms with the finding of Gnawali (2019). This finding of the study supports Keynesian view of indirect long-run relationship between the money supply and real income and prices. According to Keynesian thought, there is the chain of causation between change in quantity of money and real income through interest rate. So, when the quantity of money is increased, its first impact is on the rate of interest which tends to fall. Given the marginal efficiency of capital, a fall in the rate of interest will increase the volume of investment. The increased investment will rise effective demand through the multiplier effect thereby increasing income, output and employment. Thus, the finding of the study follows the same causation between money supply and real income. However, the study has denied the early Keynesians ignorance to the important role of money supply in the economy.

TABLE 9: Error Correction Representation for the Model

ARDL (1, 0) selected based on Schwarz Bayesian Criterion
 Dependent variable is d LNRGDP
 44 observations used for estimation from 1976 to 2019

Regressor	Coefficient	Standard Error	T-Ratio [Prob]
ΔLNM_2	.068800**	.029331	2.3457[.024]
EC_{t-1}	-.41770*	.10740	-3.8894[.000]

Note: *, and ** show the significance of coefficients at 1%, and 5%, level of significance respectively.
 Source: Author's calculation using Microfit 5.0

The estimated error correction model of the corresponding ARDL (1, 0) is given as:
 $\Delta lnRGDP_t = 0.0688\Delta lnM2_t - 0.4177EC_{t-1} \dots\dots\dots (9)$

After estimating the long-term coefficients, the above equation shows the error correction version of the ARDL model. Table 9 reports the short-run coefficient estimates obtained from the ECM version of the ARDL model. The result shows that the money supply has a positive and significant effect on economic growth in the short run. The short-run elasticity of the money supply is 0.0688 and is significant at 5%. This finding partially supports the monetarists thought on money supply which suggests that there is causal relationship runs from money supply to income and price in the short-run. The monetarists also postulate that the causality disappears in the long-run but the study has found that the money supply

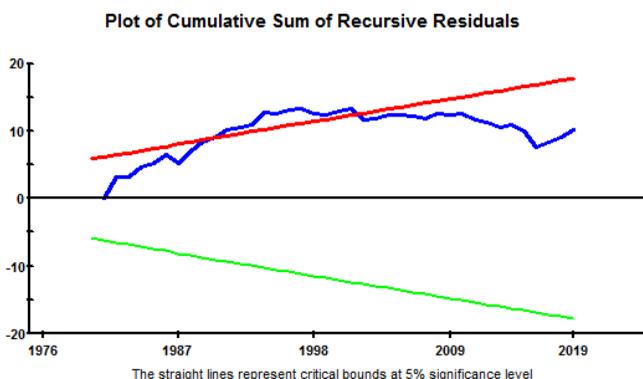
causes national income in the long run. So, such proposition of monetarists has denied by this study in case of Nepal.

The error correction term $ECt-1$ indicates the speed of adjustment restoring the equilibrium in the dynamic model. The EC coefficient shows how quickly/slowly the relationship returns to its equilibrium path, and it should have a statistically significant coefficient with a negative sign (Pahlavani and Rahimi, 2009). Also, a highly significant negative error correction term is proof of the existence of a stable long-term relationship. The EC coefficient is -0.4177 and is statistically significant at a 1% level of significance and suggests that the convergence towards the long-run equilibrium is quick, which means the short-run disequilibrium on the system converges to equilibrium at a speed of 41.77 % per annum.

Stability Test

For the robustness, efficiency, and reliability of the model, the CUSUM and the CUSUMSQ tests proposed by Brown, Durbin, and Evans (1975) have been applied. The CUSUM test makes use of the cumulative sum of recursive residuals based on the first set of n observations and is updated recursively and plotted against breakpoints (Bhatta 2013). If the plot of the CUSUM statistics lies within the critical bounds of a 5% significance level represented by a pair of straight lines drawn at the 5% level of significance, the null hypothesis that all coefficients in the error correction model are stable cannot be rejected. If either of the lines is crossed, the null hypothesis of coefficient constancy can be rejected at the 5% level of significance. The CUSUMSQ test, which is based on the squared recursive residuals, is carried out with a similar procedure.

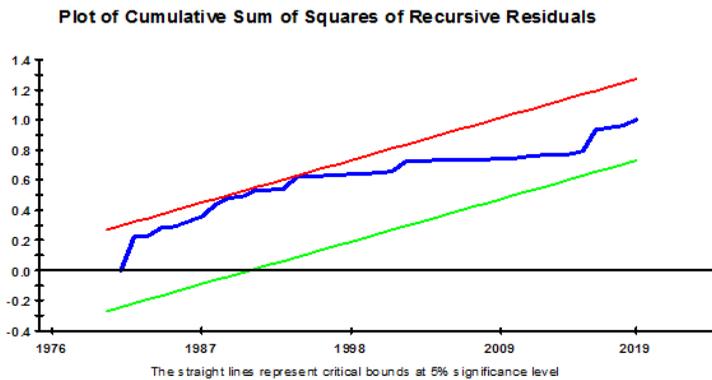
FIGURE 2: Plots of CUSUM Statistics



Source: Author's calculation using Microfit 5.0

Figure 2 presents the plot of the cumulative sum of recursive residuals. The result indicates the presence of instability of the coefficients over the period because the plot lies outside the 5% critical bounds. It means there is a structural break in the data series used in the study period.

FIGURE 3: Plots of the CUSUMSQ Statistics



Source: Author's calculation using Microfit 5.0

Figure 3 provides the plot of the cumulative sum of squares of recursive residuals. The CUSUMSQ plots lie inside the bound supporting the stability of the model. However, plots of the CUSUMSQ statistics providing evidence that the parameter of the model suffers from structural instability over the period. It shows that there is a structural break in the data series used for the study.

Existence of Structural Break

TABLE 10: Chow Test Result

Null hypothesis	F-statistics	Probability	Conclusion
No breaks at specified breakpoints	19.06800	0.0000	Rejected

Note: Year 1985 is taken as a break period

Source: Author's calculation using EViews9

The chow test result shown in Table 10 confirms the structural break in the data series during the year 1985. The null hypothesis of no break at specified break point (1985) is rejected at 1 % level.

TABLE 11: Pairwise Granger Causality Test

Null Hypothesis	f-statistic	Prob.	
$\ln M_2$ does not Granger Cause \ln RGDP	14.2883	0.0005	Uni-directional causality from $\ln M_2$ to \ln RGDP
\ln RGDP does not Granger Cause $\ln M_2$	0.79594	0.3775	

Source: Author's calculation using EViews9

Conclusions

The study aims to investigate the nexus between money supply and economic growth. Econometric techniques based on the ARDL bounds test approach and the Pairwise Granger causality tests were applied to test and examine the long-run relationship and causality between chosen variables. The econometric results provided significant evidence of the existence of positive short-run as well as long-run relationship between money supply and economic growth. It means money supply has positive and significant short-run and long-run effect on economic growth in Nepal. On causality, the result shows that there is unidirectional causality from money supply (M_2) to Real GDP in Nepal over the study period. With this, the paper can infer that changes in the money supply help to explain the changes in real economic growth in Nepal. This study supports the Keynesian view of the indirect (long-run) relationship between the money supply and real income. The error correction coefficient (known as speed of adjustment) is negative and statistically significant and a comparatively higher in magnitude, suggesting high speed of adjustment process, meaning the short-run disequilibrium converges to the long-run equilibrium within two and a half years. Furthermore, in the short-run real economic growth is positively and significantly affected by changes in money supply but the response is small as comparison to that of in the long-run.

Based on above findings, the study can derive some important policy implications. First, economic growth can be achieved if monetary policy emphasized both in the short-run and long-run by central bank of Nepal. To ensure and promote growth, Policymakers (NRB) have to give attention on growth and the responsible use of monetary measures through long-run policies. Second, the increment in the broad money supply is found healthier for the overall Nepalese economy. Hence, the monetary policy should focus to increase the time deposit in the economy as it is the only factors that differentiate the measure of broad money from the measure of narrow money.

Conflict of Interest

Author has declared no conflicting interests exists.

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