



# An Empirical Investigation Between Money Supply, Inflation, Capital Expenditure and Economic Growth in Nepal

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## Abstract

**Background:** Money supply, inflation, and capital expenditure along with others are major issues of consideration for policymakers in developing countries given the need to spark internal demand and to encounter the government's massive fiscal obligations to alleviate poverty and achieve sustainable economic growth. Like other economies, the economic performance of Nepal is also based on these macroeconomic variables.

**Objective:** The principal objective of the study is to explore the association between money supply, inflation, capital expenditure, and economic growth in Nepal.

**Method:** The study applies the ARDL approach to co-integration to check the relationship between selected variables. The bound test is carried out to see the relationship between variables.

**Result:** The empirical findings of the study show that there is a significant long-run positive relationship between money supply, capital expenditure, and growth. There is a unidirectional causation from money supply and capital expenditure to real economic growth in Nepal.

**Conclusion:** The study concludes that an increase in money supply, capital expenditure, and controlling inflation help to increase the long-run real economic growth of Nepal. Nepal Rastra Bank has to emphasize monetary policy instruments that help to increase the money supply in the long run and the Ministry of Finance (MoF) should be encouraged to increase spending on capital overheads to broaden and enhance the growth of the economy.

**Keywords:** Money Supply, Inflation, Capital Expenditure, Real Income, ARDL Approach, Nepal

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**Paper Type:** Research paper

**JEL Classification:** E2, E3, E4, E5

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## Introduction

Economic growth can be viewed as one of the chief macroeconomic goals of the government with grave concern that it influences the living standards of people. Growth in an economic sense is an upward trend in per capita income over time with advancing technology and adjusting institutions as well as ideologies ensuring higher productivity (Ahuja, 2016). Money supply, inflation, and capital expenditure along with others are major issues of consideration for policymakers in developing countries given the need to spark internal demand and to encounter the government's massive fiscal obligations to alleviate poverty and achieve sustained economic growth (Nallari & Griffith, 2011).

Instruments of fiscal and monetary policies have been used in every country to achieve macroeconomic goals such as development, growth, redistribution, stabilization, employment creation, stability of the external sector, and so on. As suggested by different macroeconomic theories, the fiscal deficit results in an expansionary money supply and surplus is contractionary. The basic understanding is that an appropriate policy mix can stimulate economic growth through different mechanisms. Looking at the global arena, policymakers are usually involved in demand management policy and supply-side policy. Demand management policies are normally focused on the management of money supply through monetary policy and management of public spending through fiscal policy. Any deliberate change in monetary policy variables will affect the liquidity position in the financial system and private spending on the economy while public spending management policy affects public expenditure of the economy (Suleman et al., 2009).

Considering different economic thoughts and ideas developed over time, there are varieties of elements and considerations regarding the association between demand management policy measures, supply-side policy measures, and economic growth. Since such policy management is instrumental, public expenditure management policy and demand management policy must pursue overall economic policy goals defined as growth, equity, and stability. It has been long understood that these three goals are complementary over the long term. Hence, these goals of overall policy translate into key objectives of policy management (Fallis, 2013). Therefore, analysis of the effect of money supply, and capital expenditure on economic growth is praiseworthy in the case of resource deficit countries like Nepal.

Nepal persisted almost in isolation from the outside world both economically and politically until the fall of the autocratic Rana regime in 1951. Since then, Nepal started to integrate with the world to a limited degree and started receiving foreign aid in 1951 (Skerry et al., 1991). Nepal pursued an inward-looking and state-led development strategy with the initiation of the planned development process in 1956. Afterward, the government established more than five dozen public sector enterprises and was actively involved in the development process. State-controlled economic activities through a licensing system, quotas, high tariff barriers, and foreign exchange regulation until the 1980s (Khanal et al., 2005). After 1990, Nepal liberalized almost all sectors of its economy and introduced privatization of state-owned enterprises to increase the role of the market and the private sector to integrate with the world. However, Nepal's dependency increased with low economic growth, higher imports than exports, increasing foreign employment, and growing dependency on remittance. Because of prolonged political instability started in the mid-1990s, economic issues were neglected so that Nepalese economy lacks the investment-friendly environment so far (Gyanwaly, 2017).

Therefore, the macroeconomic performance of the Nepalese economy over the past six decades has remained mixed. The country has been implementing a series of plans for moving forward in the economic development process. Despite some progress made, several challenges remain on the economic front (NRB, 2018). Since Nepal has entered the new political era and envisaged a self-reliant, balanced, and independent economy, Gyanwali (2017) suggested different possible avenues

from the development of basic infrastructures to prioritized national production for the self-sufficient economy. Therefore, understanding the causal association between money supply, price level and capital expenditure on output becomes imperative because such a relationship discloses the suitable monetary and fiscal policies as well as their effectiveness in achieving desired economic performance.

There are diverse understandings at the national and international level looking at different determinants of growth. Several studies have considered money supply and capital expenditure as the significant growth factors and tried to inspect the implication of money supply and inflation and capital expenditure as part of a group of independent variables on growth. In underdeveloped countries like Nepal, monetary policy and fiscal policy play a vital role in boosting their economy. Monetary policy can promote economic growth by ensuring adequate availability of credit and lower the cost of credit. On the other hand, government intervention through fiscal policy is essential in the matter of overcoming recession or inflation as well as of promoting and accelerating economic growth. Developing countries thus spend more through both monetary and fiscal measures to raise public investment for maximizing social welfare. They are, thus, prone to inflation. A certain level of mild inflation is growth-promoting and so, the government has to incorporate appropriate monetary and fiscal policy measures and mechanisms to keep it within a threshold level and achieve sustained economic growth (Ahuja, 2016).

Before 1951, there was no formal government expenditure process in Nepal. During the Rana regime (1847-1951), their main intention was to keep the people out of the scenes of the country's fiscal position. All types of financial authorities were centralized; government expenditure was presented every fiscal year only after the political changes in 1951. Until 1959, the government expenditure was published in the Nepal Raj Patra and, since 1959, it was presented to a legislative body. After the First Five-Year Plan was introduced in 1955-56, the government expenditure was divided into two parts as regular and development expenditure. With four major objectives (to direct development programs by eliminating existing anomalies and by making them more realistic and productive, as well as overseeing their consistency for directly benefiting deprived community; to rationalize the role of private sector and facilities provided by the government; to minimize increasing hardship faced by common people, and to start a process of repaying the accumulated financial liabilities of the government) the finance minister started to present government expenditure in a speech since July 13, 1990 (Mainali, 2010). The most important objective of Nepalese fiscal policy is to attain significant economic growth and public expenditure has remained the most important tool of fiscal policy.

Formulating monetary policy in Nepal formally received its institutional, legal, and more transparent framework in recent decades despite its history of more than five decades. The NRB Act 2002 broadly provides the guidelines and institutional set-up for a policy decision. Monetary policy has the goals of monetary stability, external sector stability, financial stability, and supporting growth through adequate provision of liquidity. Broad money (M2) growth is considered as an intermediate target of the policy, which is set based on projected economic growth and inflation target as per the government's budget for the forthcoming year (NRB, 2018).

This study aims to investigate the linkage between money supply, inflation, capital expenditure, and growth in Nepal, and the study informs the policymakers in formulating monetary and fiscal policies. This study adds some empirical evidence in the case of a land-locked country incorporating not only the measure of monetary policy but also the measure of fiscal policy to the existing literature in the area. To be more precise, this paper examines the relationship between money supply, inflation, capital expenditure, and economic growth applying the ARDL bounds testing approach to co-integration.

To create a sound theoretical foundation, the study reviews theoretical and empirical literature in the selected area in Section II. In Section III, the paper outlines the methodology adopted for this study. Section IV presents the analysis of data. Finally, Section V concludes the study.

## Review of Literature

### *Theoretical Review*

This section discusses different theoretical approaches to the money supply, inflation, government expenditure, and economic growth.

### *Theoretical Review on Money Supply and Economic Growth*

There are various theoretical thoughts relating to the nexus between money supply, inflation, and economic growth. The classical quantity theory of money associated with early economists such as Fisher and Say, assumes that money supply is exogenously determined so that the causation between money supply and price is only in one direction. This theory believes that real variables of the economy do not depend on the quantity of money in circulation. Therefore, money does not play any role in the determination of output, employment, and income of an economy. This implies that the quantity of money is the main determinant of the price level. Any change in the quantity of money produces an exactly proportionate change in the price level. The Fisher's equation of exchange positions that the quantity of money multiplied by the velocity of money is equal to the price level multiplied by the number of goods sold. It is often simulated as  $MV = PQ$ , M is defined as the quantity of money, V is the velocity of money (the number of times in a year that a currency goes around to generate a currency worth of income), P represents the price level and Q is the real output (Gatawa et al., 2017).

The Cambridge School of Economic Thought, based on the cash balance approach, argued that the money supply is equal to the fraction of income in cash form together with the price level (P) and real output (Q). Thus, the money supply model is expressed as;  $M = k.PQ$ . If money increases people will accumulate excess balance, spends more, and as a result increase in the price level given the output.

Neo-classical economists examine the role of money in economic activity. Solow's model uses a production function approach to measure the role of money. Output in this model is a function of capital stock, labor force, and technology. The model concludes that in the long-run output growth depends on capital available per worker and thus, an increase in saving mobilization increases capital per capita and hence output and income in the economy. Therefore, Solow's model says that money is not relevant in economic growth because the output does not depend on monetary growth rather it depends on per capita capital. So, money is neutral.

Patinkin's real balance theory, unlike previous theories, argues that change in money supply leads to change in price level and output and employment; money has a neutral role in the economy. Keynes also disagrees with the older quantity theorists on their conclusion that there is a direct and proportional relationship between the quantity of money and prices. He made it clear that the effect of change in the quantity of money on prices is indirect and non-proportional and changes in the money supply affect only the absolute price level but exercise no impact on the relative price level. Keynes believes that so long as there is unemployment, the output will change in the same proportion as the quantity of money and there will be no change in prices; and when there is full employment, prices will change in the same proportion as the quantity of money (Paul, 2015).

Opposite to the Keynesian approach, the monetarist thought led by Milton Friedman claim that in the long run, the effect of expansion in money supply is primarily on the price level and other nominal variables. The level of economic activity in the real term that is level of employment and real output is determined by a real factor such as capital stock, state of technology, size, and quality of labor force. However, in the short-run change in money is the dominant factor causing cyclical fluctuations in output and employment. An increase in money supply in the short-run is divided into between the rise in price level and increase in real income depending on the elasticity of the short-run aggregative supply curve (Ahuja, 2017).

The new classical point of view ignores the association between money supply and income both in the long-run and short-run because of the presence of the rational expectation hypothesis (Froyen, 2014). Rather the overall effect of change in money supply remains only at the price level. New Keynesian economists argue with a strong foundation on Keynesian economics. So, their view supports the Keynesian view of the indirect association between money supply and income (Gordon, 1990).

### ***Theoretical Review on Inflation and Economic Growth***

There are different theories relating to the inflation-growth relationship. Several theories and postulations were put forward by Classical, Keynesian, Neo-Keynesian, Monetarist, and Endogenous growth theorists, each with their respective contribution to the inflation-growth relationship. Both the Keynesian and Neo-Keynesian theory give a more complete model for linking inflation to growth under the aggregate supply-aggregate demand framework. The aggregate supply-aggregate demand (AS-AD) framework claimed a positive relationship between inflation and growth where, as growth increased, so inflation does. According to this model, in the short run, the (AS) curve is upward sloping rather than vertical, which is its critical feature. If the AS curve is vertical, changes on the demand side of the economy affect only prices. However, if it is upward sloping, changes in AD affect both price and output, (Dornbusch, et al., 1996).

Tobin (1972) advised that inflation causes individuals to substitute liquidity for interest-earning assets, which leads to greater capital concentration and promotes economic growth. In effect, inflation exhibits a positive relationship to economic growth. On the contrary, Adam Smith posited the negative impact of inflation on economic growth. The link between the change in price levels (inflation), and its tax effects on profit levels and output were not specifically articulated in classical growth theories. However, the relationship between the two variables is implicitly suggested to be negative, as indicated by the reduction in firms' profit levels through higher wage costs, (Vikesh & Sabrina, 2004). Friedman further supported this view most especially in a situation in which growth in money supply is higher than the economic growth rate. However, inflation does have real consequences for other macroeconomic variables (Dornbusch, et al., 1996).

### ***Theoretical Review on Public Expenditure and Economic Growth***

The classical economists work on the assumption of full employment and laissez-faire. They believed that a deficit budget may increase the net unproductive debt upon the government and the nation. The essence of the classical theory of budget is balancing revenue and expenditure. However, J.M Keynes and his followers believed that the policy of a balanced budget may not always be suitable for the economy. For example, when the economy is in depression, the government should involve itself in economic activities through a deficit spending plan. Similarly, if high inflation is caused by excessive aggregate demand for goods and services, the government should reduce its expenditure programs (Romanus, 2015).

Wagner's law believes that a functional cause and effect association between the growth of an economy and relative growth of public spending. According to the theory, as the economy develops over time, the activities, and functions of government increase (Lamarthina & Zaghini, 2011). Precisely, Wagner's law viewed public expenditure as a behavioral variable that positively responds to the dictates of a growing economy. The hypothesis found a positive relationship between government spending and income as well as a unidirectional causality running from economic growth spending to government expenditure (Muthui et al., 2013).

Musgrave (1969) and Rostow (1971) molded the fundamental basis of most developmental models of public expenditure-economic growth nexus. These models spelled out that in the early stages of economic growth and development, public sector investment is very high. The public sector provides



the social and economic infrastructures, such as roads, electricity, transport system, sanitation system, law and order, education and health, and human capital investment. These infrastructural overheads are vital to trigger the economy to take off into the stage of maturity of development. Once the economy reaches the maturity stage, the mixture of public expenditures will move from expenditures on infrastructure to increase expenditures on education, health, and welfare services. Thus, more from capital expenditures to recurrent expenditures in the economy. In the period of high mass consumption, expenditure on income maintenance programs and programs established to redistribute welfare will increase significantly relative to other items of public expenditure and relative to Gross National Product (Mthethwa, 1998).

Clark (1854) argues that when the share of the government sector exceeds 25 percent of total national economic activities in the economy, inflation takes place even in the balanced budget. Clark assumed that 25 percent is the central limit of the total economic activity of a nation (Ahuja, 2016). In the Solow growth model, the growth of national income or output depends on the combination of physical resources encompassing natural, capital, and human resources encompassing labor and entrepreneurial ability. According to the model, the capacity of an economy to grow depends on what is left from the total level of current savings and what is left from the level of current savings depends on the level of population growth or labor force growth which needs to be sustained by the level of resources saved. In applying this model to Less Developed Countries, Solow stressed that domestic investment through government (recurrent and capital), private expenditures, foreign investments (FDI), and the rate of capital accumulation would have a similar effect as raising domestic savings that enhance the level of capital per worker and, therefore, GDP per head. The capacity to grow, therefore, depends on the ability to save through government and private expenditures on investment. As the government increases its expenditure, it increases production in the economy, and this increases the income of economic agents who then allocate part of their income to savings for further investment (Asomani, 2019).

### ***Empirical Review***

Several empirical studies examined the relationship between money supply and growth, inflation and growth, and public expenditure and growth in the case of Nepal. Almost all the studies showed a positive effect of money supply on long-run economic growth, both positive as well as a negative effect of inflation on economic growth and capital expenditure on economic growth.

### ***Empirical Review on the Impact of Money Supply on Economic Growth***

Ahmad et al., (2016) examined the impact of monetary policy on the economic growth of Pakistan using annual time series data from 1973 to 2014. The study used ARDL co-integration approach and concluded that there is a positive long-run effect of money supply on economic growth. Isiaka et al. (2011) analyzed the relationship between money supply and economic growth in Nigeria for the period of nine years from (1995-2004) using a simple regression technique. The results showed that there exists a long-run insignificant positive relationship between money supply and GDP.

Al-Fawwaz and Al-Sawai'e (2012) investigated the relationship between money supply and economic growth by using the data of Jordan covering a period from 1991 to 2011 by using Johansen cointegration analysis. The study found no relationship between money and growth neither in short-run nor long-run terms. Wang (2012) studied the relationship between money supply and economic growth in China using the data from 1998 to 2007 and employed co-integration and causality analysis. The study found no relationship between the variables in the long-run term. Dingela and Kobai (2017) found a positive and significant short-run as well as the long-run relationship between money supply and economic growth in South Africa covering the data from 1980 to 2016.

Gnawali (2019) examined the effect of money supply on the economic growth of Nepal from 1975 to 2016 applying the co-integration and VECM causality test. The study found that money supply positively and significantly affects the economic growth of Nepal and suggested that an increase in money supply boosts the economy. Similarly, Mahara (2020) explored the nexus between money supply and economic growth in Nepal by covering the data of 45 years. The study applied the ARDL approach to cointegration and found that there is a positive and significant long-term relationship between money supply and real economic growth in Nepal. The study concluded that an increase in money supply leads to an increase in real economic growth in Nepal.

### ***Empirical Review on the Impact of Inflation on Economic Growth***

Barro (2013) examined the relationship between inflation and economic growth for 100 countries by using the data from 1960 to 1990. The study concluded that there is a negative relationship between inflation and economic growth. Guerrero (2006) also concluded that the effect of inflation on long-term economic growth is statistically significant and negative. Christian et al., (2010) estimated the inflation threshold in the case of Ghana and Nigeria by using the conditional least square technique and covering a period of 34 years from 1975 to 2008. The result showed that there exists a statistically positive impact of inflation on economic growth in the two countries but the causality test conducted with lags showed no causality between the two variables in each country.

Vinayagathan (2013) inspected the impact of inflation on economic growth for 42 Asian countries for the period from 1980 to 2009. The study found a threshold of 5.43 percent inflation rate, below which inflation rate does not hurt economic growth but beyond the threshold level, inflation harms economic growth. Bhusal and Silpakar (2011) estimated the threshold level of inflation at 6 percent by using annual data for the period 1975 to 2010 and concluded a positive and unidirectional relationship between inflation to economic growth.

Adhikari (2015) examined the association between inflation and economic growth in Nepal by using distributed lag models and the annual data of gross domestic product and consumer price index. The study found that the economic growth of Nepal is adversely affected by inflation of the current time and at the same time, the current economic growth is favorably affected by the inflation of the preceding time. Nepal Rastra Bank (2017) estimated the optimal inflation rate in Nepal based on the data of the period 1978 to 2016 using the ordinary least square method. The study concluded that there exists a threshold effect of inflation and estimated the turning point of inflation to be 6.25 percent. The study also suggested that Nepal should adopt an inflation target range around the computed optimal inflation rate to lower the inflation expectation and enhance economic growth.

### ***Empirical Review on the Impact of Government Expenditure on Economic Growth***

Akpan (2005) used a disaggregated method to verify the components and concluded that there was no significant association between most components of government expenditure and economic growth in Nigeria. Bose et al. (2007) examined the growth effects of government expenditure for a panel of 30 developing countries over the 1970s and 1980s with a particular focus on disaggregated government expenditures. The study showed a significant positive association of government capital expenditure with GDP, but current expenditure showed an insignificant association.

Adu and Ackah (2015) observed a negative significant association between capital and economic growth, and a positive association between recurrent expenditure and economic growth in both the long-run and short-run periods in Ghana by using the ARDL model with annual data spanning from 1970 to 2010. The study indicated a fiscal discipline and efficiency in the disbursement of capital expenditure to trigger positive benefits in the future.

Regmi (2007) studied the impact of fiscal policy on economic growth in Nepal applying an endogenous growth model. The study found a negative effect of all the fiscal policy variables including distortionary taxes, productive expenditure, non-tax revenues, private investment, and budget deficit on economic growth. The study concluded that the inefficiency correlated with the use of public funds as being the cause of the significant negative effect of productive investment in economic growth. Kharel (2012) formed a macroeconomic forecasting model concentrating on fiscal policy and economic growth in Nepal. The empirical evidence indicated that fiscal policy, particularly governments' capital expenditure affects economic growth positively and crowds-in private investment. The positive effect of fiscal policy on economic growth and the crowd-out effect of public investment on private investment are the main findings of his study.

Chaudhary and Acharya (2018) analyzed the causal relationship between government expenditure and the real interest rate on the economic growth of Nepal for the period from 1975 to 2015. The study applied ARDL cointegration techniques and yielded a long-run as well as the short-run association between variables under consideration. The study further confirmed that there is bidirectional causality between government expenditure and real income over the study period.

## Research Method

### *Data Sources and Variables*

Table 1: Description of Variables

S.N.	Notation	Variable Description	Source
1	RGDPG	It is the real gross domestic product growth rate. Real GDP is a measure of economic output that accounts for the effect of inflation. The real GDP growth rate considers the effect of inflation and depicts the inflation-adjusted buying power. Thus, it provides a more precise picture of the nation's rate of economic growth.	Current Macroeconomic and Financial Situation-2019/20, NRB
2	M2	It stands for the broad money supply to GDP ratio. Broad money is the summation of currency outside banks, demand deposits, and time deposits.	Current Macroeconomic and Financial Situation-2019/20, NRB
3	INFR	It stands for the inflation rate. It is obtained by computing the percentage change in the CPI index of this year in comparison to the previous year. Thus, $\text{INFR} = \frac{\text{CPI}_t - \text{CPI}_{t-i}}{\text{CPI}_{t-1}} \times 100$	Authors calculation
4	CE	Capital expenditure is the payment made to purchase long-term physical or fixed assets of the government. Capital expenditure brings in the social and economic development of the country through the expenditure made on providing education, health, recreation, public utilities to the community. The study uses capital expenditure as a proxy of government expenditure.	Macroeconomics Dashboard, MoF



### Econometric Analysis

The study applies the autoregressive distributive lag (ARDL) model to trace the relationship between existing variables. Based on the theoretical frameworks and previous empirical studies the general model can be expressed as.

$$RGDPG_t = f(\text{INFR}, \text{M2}, \text{CE}) \dots\dots\dots (1)$$

Making an econometric form of equation (1) gives the following equation.

$$RGDPG_t = \alpha + \beta_1 \text{INFR}_t + \beta_2 \text{M2}_t + \beta_3 \text{CE}_t + \mu_t \dots\dots\dots (2)$$

Where,  $t = 1976-2019$ ,  $\alpha$  is an intercept parameter and  $\beta_1, \beta_2$  and  $\beta_3$  are coefficients of the relevant variables and  $\mu_t$  is the error term. These coefficients are supposed to have a positive sign indicating an increase in INFR, M2 and CE lead to an increase in the rate of real economic growth.

One of the extensively used and most appropriate approaches to examine the causal relationship between the underlying variables regardless of whether the variables are integrated of order zero ( $I_0$ ), one ( $I_1$ ), or mutually integrated is the ARDL model developed by Pesaran and Shin (1999) and Pesaran et al. (2001). This model has several benefits in comparison to other cointegration methods such as Engle-Granger (1987), Johansen (1988), and Johansen and Julius (1990) procedures (Shah & Bhusal, 2017). This technique is also considered a statistically more significant approach to ascertain the cointegrating relation in a small sample size too.

The ARDL version of equation (2) is expressed below.

$$\Delta RGDPG_t = \beta_0 + \sum_{j=1}^p b_j \Delta RGDPG_{t-j} + \sum_{j=0}^q c_j \Delta \text{INFR}_{t-j} + \sum_{j=0}^r d_j \Delta \text{M2}_{t-j} + \sum_{j=0}^s e_j \Delta \text{CE}_{t-j} + \gamma_1 RGDPG_{t-1} + \gamma_2 \text{INFR}_{t-1} + \gamma_3 \text{M2}_{t-1} + \gamma_4 \text{CE}_{t-1} + \varepsilon_t \dots\dots\dots (3)$$

Where ‘ $\Delta$ ’ stands for the first difference operator.  $b_j, c_j, d_j$ , and  $e_j$  signify the short-run parameters whereas,  $\gamma_1, \gamma_2, \gamma_3$ , and  $\gamma_4$  represent the long-run parameters. Similarly,  $\varepsilon_t$  represents the residual in the model.

Again, after computing the long-run coefficient of the variables, we must compute the short-run relationship coefficient of the variables through the error correction mechanism (ECM). The following ECM model is used.

$$\Delta RGDPG_t = \alpha_0 + V(\text{ECM}_{t-1}) + \sum_{j=1}^{q_1} \alpha_{1j} \Delta RGDPG_{t-j} + \sum_{j=0}^{q_2} \alpha_{2j} \Delta \text{INFR}_{t-j} + \sum_{j=0}^{q_3} \alpha_{3j} \Delta \text{M2}_{t-j} + \sum_{j=0}^{q_4} \alpha_{4j} \Delta \text{CE}_{t-j} + \varepsilon_t \dots\dots\dots (4)$$

Where  $q_1 \dots 4$  is the optimal lag length, ECM represents the error correction term derived from a long-run relationship of the model and  $V$  is the speed of adjustment parameter. The negative sign implies convergence to long-run equilibrium whereas the positive sign implies divergence.

To test whether the long-run equilibrium relationship occurs between preferred variables, the bounds test for cointegration is carried out as proposed by Pesaran and Shin (1999). The hypotheses to test the long-run relationship are.

Null Hypothesis ( $H_0$ ):  $\gamma_1 = \gamma_2 = \gamma_3 = \gamma_4 = 0$ ; No cointegration exists.

Alternative Hypothesis ( $H_1$ ):  $\gamma_1 \neq \gamma_2 \neq \gamma_3 \neq \gamma_4 \neq 0$ ; Cointegration exists.

If the result attained from the bound test approves cointegration then there is a long-term relationship among the variables. If the calculated F-statistics is higher than the appropriate upper bound of the critical values, then the null hypothesis of no cointegration is rejected, if it is lower than the appropriate lower bound, the null hypothesis cannot be rejected, and if it lies within the lower and upper bounds, the result is inconclusive.

For exploring the stability of the model, CUSUM and CUSUMSQ tests are applied. Similarly, Ramsey’s RESET test is carried out to check functional misspecification of the model, A Jarque-Bera test is conducted to test the assumption of normality, Lagrange Multiplier (LM) test is carried out for

serial correlation, and KB test for heteroscedasticity. For confirming the robustness of the model and indicating the direction of causality, the TY non-Granger Causality test is also used by the study.

## Data Analysis and Results

The results show the relationship between money supply, inflation, capital expenditure, and economic growth in Nepal.

### Unit Root Test Results

To avoid spurious regression, it is necessary to find out whether a time series is stationary or not. Generally, the time series becomes stationary after the integration of order I (1) or order I (2) if it is not stationary at a level I (0). If the variables are stationary, we can further proceed with the econometric analysis. The bounds test can be applied regardless of whether the underlying variables are stationary at the level I (0), at the first difference I (1), or a combination of both. Tables 2 displays the results of the Augmented Dickey-Fuller (ADF) tests, the Philips-Perron (PP) tests, and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) tests of the variables.

**Table 2: Unit Root Test Results of the Variables**

Variables	ADF Test Results		PP Test Results		KPSS Test Results		Order of Integration
	Constant	Trend	Constant	Trend	Constant	Trend	
RGDPG	-7.4833*	-7.6003*	-7.6271*	-7.7024*	0.1964*	0.1093*	I (0)
$\Delta$ RGDPG	-6.925*	-6.820*	-20.445*	-20.132*	0.0566*	0.0532*	
INFR	-4.9382*	-5.1702*	-4.9200*	-5.1702*	0.1842*	0.1002*	I (0)
$\Delta$ INFR	-9.435*	-9.448*	-12.520*	-14.036*	0.2332*	0.1274*	
M2	2.0745	-0.2160	2.9022	-0.0497	0.7970	0.1949	I (1)
$\Delta$ M2	-6.377*	-7.422*	-6.386*	-7.647*	0.5482	0.1126*	
CE	-1.4153	-2.5144	-1.4153	-2.5817	0.5339	0.1230	I (1)
$\Delta$ CE	-6.039*	-5.969*	-6.031*	-5.961*	0.133*	0.1124*	

Source: Author's calculation

Note: \* significant at 1% level of significance and  $\Delta$  denotes difference operator and order of integration.

Table 2 shows that the real GDP growth rate and inflation rate are stationary at the level as confirmed by all the tests and money supply and capital expenditure are stationary only after the first differentiating. So, the series is a mixture of variables I (0) and I (1), and the ARDL model is wise to be used for further exploration.

### Lag Length Selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-484.2599	NA	259389.7	23.81756	23.98473	23.87843
1	-360.0754	218.0800	1330.936	18.54027	19.37615*	18.84465*
2	-342.3217	27.71317*	1251.702*	18.45472	19.95932	19.00261
3	-325.1058	23.51446	1254.418	18.39540*	20.56871	19.18680

\* 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

## Cointegration Result

The result of the relationship between selected variables is analyzed with the help of the ARDL Bound testing approach.

**Table 4: ARDL Bound Test Result**

Dependent Variable	SBC lag length	F-statistic	Decision
RGDPG/INFR, M2, CE	(1,0,1,1)	22.90651	Cointegration
INFR/RGDPG, M2, CE	(1,0,0,0)	7.383820	Cointegration
M2/ RGDPG, INFR, CE	(1,0,0,0)	2.019828	No Cointegration
CE/ RGDPG, INFR, M2	(1,0,0,0)	0.895595	No Cointegration
Critical Values	I (0)	I (1)	
10 percent significance level	2.72	3.77	
5 percent significance level	3.23	4.35	
1 percent significance level	4.29	5.61	

Source: Author's calculation

The information presented about the bound test results in Table 4 confirms that calculated F-statistics is beyond the upper bound of critical value at a 1 percent level of significance for the considered relationship by the study. It ensures the rejection of the null hypothesis of no cointegration. Thus, there is a long-term association between the selected variables.

## ARDL Regression Results and Interpretation

Confirming the long-term association between selected variables, the long-run and short-run coefficients for equation (2) are estimated by using the ARDL model. The following section shows the long-run as well as the short-run relationship among the variables used in the model based on SBC criteria.

### Long-run Coefficients

**Table 5: Estimation of the Long Run Coefficients**

ARDL (1, 0, 1, 1) based on Schwarz Bayesian Criteria; Dependent Variable: RGDPG				
Regressors	Coefficient	Std. Error	t-Statistic	Prob.
INFR	-0.047650	0.067613	-0.704744	0.486
M2	0.050665*	0.013451	3.766621	0.001
CE	0.32488*	0.106250	3.057698	0.004
C	0.139484	1.375932	0.101374	0.919

Source: Author's calculation

Note: \* significant at 1% level of significance

Table 5 reveals the long-run coefficients from the selected ARDL model. The result revealed that money supply (M2) is positively related to economic growth and significant at 1%, in conformism with a priori expectation and also in line with the work of Mahara (2020), Ganwali (2019), and Acahraya (2018). This implies that real economic growth is an increasing function of money supply, meaning that as money supply increases, so does economic growth. This finding tends to support the relevance of monetary expansion policies as explained by Keynes. According to Keynes, expansionary monetary policy is a declining function of interest rate, which increases personal income, this further leads to an increase in aggregate demand and triggered investment which eventually leads to an increase in economic growth.

Similarly, capital expenditure is also positively related to real economic growth at a 1 % level of significance as earlier expected. This finding also reveals that an increase in capital expenditure by the government will increase employment opportunities, utilize resources, and thereby economic growth. Increasing capital expenditure, and expansion in money supply cause aggregate demand of the people to increase, and that has a multiplier effect on the economy. The findings also support the working of Keynesian investment multiplier in the case of the Nepalese economy. This is reflected by the positive and significant long-run coefficient of capital expenditure.

Looking at the coefficient of the rate of inflation, it revealed an insignificant long-run negative relationship with economic growth. This implies that inflation does not promote economic growth in the long run. Inflation has a deteriorating impact on the value of money so in the long run, it becomes a threat to national development. A continuous decline in the real value and the purchasing power of money discourages long-term investment, resulting in deteriorating aggregate demand due to a fall in purchasing power of money. Besides, a high rate of inflation does not encourage investments in the real sector of the economy but encourages investment in low-risk businesses with a quick return, thus discouraging output growth. This finding supports the classical thought of linkage between inflation and growth.

### *Short-run Coefficients*

**Table 6: Short Run Coefficients**

<b>ARDL (1, 0, 1, 1) based on Schwarz Bayesian Criteria Dependent Variable: <math>\Delta</math>RGDPG</b>				
Regressors	Coefficient	Std. Error	t-Statistic	Prob.
$\Delta$ INFR	-0.062150	0.088721	-0.700508	0.4881
$\Delta$ M2	-0.223818***	0.116742	-1.917201	0.0632
$\Delta$ CE	-0.042704	0.227131	-0.188015	0.8519
C	0.181929	0.363879	0.499971	0.6201
ECM (-1)	-1.304299*	0.139429	-9.354553	0.0000
R <sup>2</sup> = 0.737 Adj. R <sup>2</sup> = 0.693 F=25.2472 (P-value 0.0000) D-W= 2.1477				

Source: Author's calculation

Note: \*\* significant at 5%; and \*\*\* significant at 10% level of significance

As shown in Table 6, there is a negative and statistically significant relationship between money supply and real economic growth rate and a statistically insignificant and negative relation between capital expenditure, inflation, and economic growth in the short run. Thus, money supply and capital expenditure are only long-run growth factors for the Nepalese economy. The negative and statistically significant impact of the money supply is not supported by Mahara (2020) taking money supply only as an explanatory variable.

The negatively linked association between money supply and economic growth in the short run infers that money supply did not subsidize economic growth in the short run as postulated by Keynes in his advanced quantity theory of money. This could be due to financial institutions that are anticipated to serve as a midway between the surplus and deficit unit of the economy are not working as per the expectations. Credit rationing has been one of the measures adopted by monetary policy to allocate loanable funds to different sectors of the economy. However, if such is not in favor of the real sector or not able to allocate scarce funds in the productive sector, achieving sustainable growth through increasing monetary aggregates will be indefinable. In such a case, expansionary monetary policy in form of increasing the money supply will not translate into economic growth in the short-run until the long-run as supplied by the results.

Further, in the results, the statistically significant and negative ECM term reconfirms the existence of co-integration among the variables under investigation. The ECM coefficient is about -1.31 and suggests that the readjustment for any disequilibrium in the short run towards long-run equilibrium takes about 1.31 years. In general, the value of the ECM coefficient lies between -0.01 to -1 but there are few cases that the ECM coefficient has reached up to -2 and it is valid as discussed by Loyaza and Ranciere (2004).

### ***TY Granger Non-Causality Test***

The causality test (Toda & Yamamoto, 1995) is applicable irrespective of any order(s) of integration of the time series. It also allows causality testing between integrated variables in finite samples based on asymptotic theory and hence is appealing (Nepal & Pajja, 2019). For the T-Y procedure, first, the maximum order of integration ( $d_{max}$ ) is to determine. If  $X_t=I(0)$  and  $Y_t=I(1)$  then the maximum order of integration ( $d_{max}$ ) is 1 and if  $X_t=I(1)$  and  $Y_t=I(2)$  then the maximum order of integration ( $d_{max}$ ) is 2. The next step is to decide the optimal lag length for the variable in var and denoted by  $p$ , using the usual methods like AIC or SBC, etc. Here the study has used SBC criteria to decide the optimal number lag length for the selected model. Lastly, the VAR model is projected using the lag length of  $d_{max} + p$ . In this paper, the optimal number of lag lengths based on the SBC criteria is ( $p = 1$ ) and the maximum number of integration ( $d_{max}=1$ ). Therefore, VAR is projected with a lag length of 2 i.e.,  $(d_{max} + p) = 2$ , and the model showed no serial correlation. The rejection of the null hypothesis implies a rejection of Granger's non-causality and ensures that there is a presence of Granger causality between the variables.

**Table 7: Results of Granger Causality Tests**

Dependent Variables	RGDPG	INFR	M2	CE
RGDPG	-	1.05	4.45	0.35
INFR	0.03	-	0.03	0.71
M2	3.29***	0.69	-	0.47
CE	3.45***	1.92	3.39***	-

Source: Author's calculation

Note: \*\*\* denotes significant at 10% level of significance

The results presented in Table 7 show that there is unidirectional causality from money supply and capital expenditure to real GDP growth rate and from capital expenditure to the money supply. The causation from money supply to growth supports the Keynesian view on the relationship between money supply and economic growth in the short run. Similarly, causation from capital expenditure to growth also supports the Keynesian theory of income.

Another unidirectional causality running from capital expenditure to money supply implies that an increase in real income due to increased public investment further motivates the government to expend more on capital formation as suggested by Keynesian theory and study of Musgrave (1969) and Rostow (1971) and increases the money supply in the economy.

### ***Diagnostic Test Results***

**Table 8: Information of Diagnostic Tests Result of ARDL output**

Test Statistics	LM Version	F Version
A: Serial Correlation	CHSQ (1): 1.1865 [0.276]	F (1, 35): 0.9931 [0.326]
B: Functional Form	CHSQ (1): 0.3724 [0.524]	F (1, 35): 0.3058 [0.584]
C: Normality	CHSQ (2): 0.0356 [0.982]	Not applicable
D: Heteroscedasticity	CHSQ (1): 0.6647 [0.415]	F (1, 40): 0.6438 [0.427]



Source: Author's calculation

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 regression of squared residuals on squared fitted values.

The diagnostic tests indicate that the model passes all the tests. The null hypothesis of the normality of residuals, no first-order serial correlation, no heteroscedasticity, and no misspecification of functional form are accepted as both LM and F version exhibits the p-values more than the 5 percent level. This means the model is free from serial correlation, heteroscedasticity, functional form misspecification, and the issue of normality.

### Stability Test of the ARDL Model

For testing the consistency of the parameters of the estimated model, a stability test is applied. The cumulative sum of recursive residuals (CUSUM) and cumulative sum of squares of recursive residuals (CUSUMSQ) statistics are used to measure the structural stability in the model. The null hypothesis for the stability test is that the parameters are stable. The value of the sequence outside the range of 5 % significance rejects the null hypothesis and indicates a structural change in the model over time. CUSUM measures the systematic change in the parameter over time and a quick change in the parameter is measured by CUSUMSQ.

Figure 1: Plot of CUSUM Test

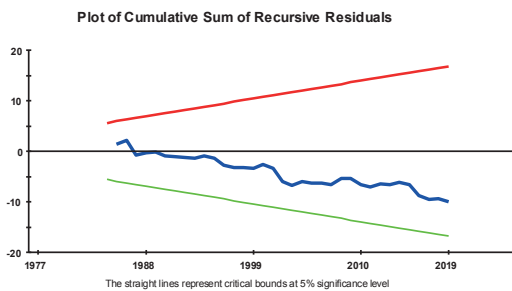


Figure 2: Plot of CUSUMSQ Test

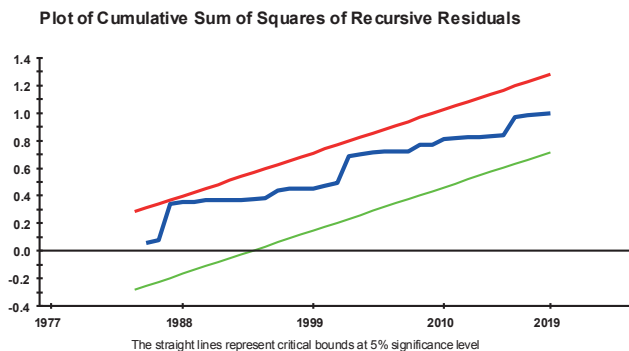


Figure 1 and Figure 2 show that the plots of CUSUM and CUSUMSQ lines lie within the 5 percent critical bounds and prove that the model is stable and robust.

## Conclusion and Recommendations

This study empirically investigated the relationship between money supply, inflation, capital expenditure, and economic growth in Nepal using the time series annual data from 1976 to 2019 applying the ARDL to co-integration approach. The empirical result from the estimation of the long-run co-integration reveals a significant relationship of economic growth concerning money supply and capital expenditure. Based on the findings of this study, it determines that money supply has donated positively to economic growth in the long run, while in the short run the opposite has been the case. Also, capital expenditure has substantially induced economic growth in the long run while in the short run it has insignificantly hampered growth. Inflation has affected growth adversely both in the short run as well as in the long run, but the statistical measure is insignificant. Therefore, the nature of the association is such that money supply and capital expenditure have a significant positive impact on economic growth in the long run only and inflation has adverse in the short run and long run both.

From the above findings, the study has some suggestions for policy alteration.

- The expansionary monetary policy requires lowering the higher cost of loanable funds. A decrease in the cost of capital encourages productive investment in the economy. Furthermore, zero-interest base finance on a selective basis could be introduced to raise investment in the real sector which will ultimately influence economic growth.
- The Ministry of Finance (MoF) is encouraged to increase spending on capital overheads to broaden and enhance the growth of the economy. Furthermore, capital expenditure must use efficiently and come into mainstream production within time. For this, the government must make its mechanism and institutions responsive and accountable to use the scarce productive resources more efficiently.
- Since inflation adversely affects growth, the government should efficiently control the liquidity in the economy not to increase inflation because that may hamper economic growth. Moreover, inflation in Nepal is also caused by several structural factors so the government needs to remove structural barriers to keep inflation within the threshold suggested by Nepal Rastra Bank. For this, fiscal policy must be designed in such a way that could boost real sectors that have been identified as key to national development. This boosts the supply of output and reduces prices.
- Funding and development of small and medium scale enterprises in Nepal could be a very good scheme designed to tap the opportunity in the real sector on both short and long terms basis as applied by several LDCs. Therefore, arrangements are needed to make to ensure funds availability by financial institutions to drive the real sector on short-run and long-run both.

There are some limitations to the study. The study uses the ARDL approach to check the cointegration and thus conclusion drawn may differ from other studies using different methodologies. Besides the variable used in the model, other significant variables like exchange rate, interest rate are to be included to check the effect more precisely.

## Conflict of Interest

No conflict of interest exists in this paper.

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