# EFFECT OF MONETARY POLICY ON MACRO ECONOMIC VARIABLES OF NEPAL

**Nirajan Basnet**
Lecturer, Central Department of Management, T.U. Kirtipur

***Corresponding Author:*** Nirajan Basnet, ***Email:*** nbasnetcdm@gmail.com

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## Abstract

*This study examines the effect of monetary policy on macroeconomic variables such as gross domestic product, real interest rate, inflation, unemployment and balance of payment etc. All the variables are intertwined with each other, and one way or the other it affects each other in both short run and long run. It is secondary research with causal comparative research design. It has quantitative nature and time series data are extracted from year 1990 to 2017 of six different macro-economic variables for the study. Statistical tools and applied econometrics namely, descriptive statistics, ADF, Johansen cointegration test, Engle-Granger error correction model are applied. The result from the statistical analysis shows that instruments of monetary policy has influence on the selected macroeconomic variables to some extent and satisfies to be relatively effective. Findings of the study reveals that there is long-run relationship between monetary policy and the selected macroeconomic variables in the Nepalese economy significantly from the error correction mechanism.*

***Key Words: Monetary policy, Gross Domestic Product, Inflation, Money Supply, Augmented Dickey Fuller test.***

## Background of the study

In each country, macroeconomic variables are controlled and managed through monetary and fiscal policies. They are two major macroeconomic policies. Monetary policy is a mean by which central bank controls supply of money and the interest rate to influence output, employment, and price level in an economy. It refers to the attempt made by the monetary authority to realize the national economic objectives of full employment without inflation, rapid economic growth as well as balance of payments equilibrium through the management of the economy's supply of money.

Nepal Rastra Bank (NRB), the central bank of Nepal, was established in 1956 under the Nepal Rastra Bank Act, 1955, to discharge the central banking responsibilities including guiding the development of the embryonic domestic financial sector. Since inception, there has been a significant growth in both the number and the activities of the domestic financial institutions. To reflect this dynamic environment, new NRB Act of 2002 have recast the functions and objectives of the bank, the preamble of which lays down the primary functions of the bank to maintain macro-economic stability through sound and effective monetary, foreign exchange and financial sector policies. The central bank has the authority of influencing monetary policy, by means of monetary instruments, to achieve preferred macroeconomic goals of a nation. NRB is seriously pursuing various policies, strategies and actions, all of which are conveyed in the annual report on monetary policy.

## Objective of the study

The objective of the study is to explore the impact of monetary policy on macro-economic variables such as inflation, gross domestic product, balance of payments and unemployment in Nepal.

## Literature review

Barro (1977) published an article entitle dunanticipated money growt hand unemployment in the United States in which investigated the relationship between the money growth and the unemployment in the country. The study concluded that actual money growth was irrelevant for unemployment, given the values of unanticipated money growth. While statistically testing the relevance of the hypothesis that only unanticipated growth rate of money is relevant to the unemployment, F- test was deliberately used for the analysis.

Hall (1979) argued against hypothesis relevant to the study of the Barro (1977). In the comment made by Hall, he examined Barro's attempt to support the short run rational expectations of the model of unemployment as formulated in the equation developed by Barro. In a formal test, Barro's monetary model was rejected in favor of a more flexible monetary model and Barro's measurement of the natural employment rate was rejected. One of the determinants of the natural rate, the military draft variable in the study of unanticipated growth and unanticipated unemployment in the United States was found to have an implausible effect on the labor market. Hence, after critical analysis of the study it has been found that the rational expectations hypothesis as provided by the Barro has not been shown to be able to satisfactorily explain the unemployment in the United States.

Nepal Rastra Bank (2001) conducted a short review of literature on money price relationship and shows the delayed impact of money on prices in Nepal. The study shows that the impact of money supply on price is distributed over the third quarter where the Almon lag model is applied to ascertain the sum total effects of money supply on prices over the period. Although money supply and measured inflation have a positive relationship, the relationship is not strong and robust. In the light of weak relationship between money supply and inflation in Nepal, it implies that measurement of core inflation is necessary to ascertain the actual degree of relation between money and price. The empirical results also show that there is no structural shift in money price relationship during the study period.

Hameed and Amen (2011) analyzed impact of monetary policy on gross domestic product. It proved that the interest rate has minor relationship with GDP but the Growth in Money Supply greatly affects the GDP of an economy, obviously various unknown factors also affects the GDP; growth in money supply has a huge impact on GDP. The study analysis was completed using Regression Analysis and Durbin Watson Test. The study was conducted in the scenario of Pakistan with the attempt of the study to discover how much money supply, interest rate and inflationary rate impact the overall growth of the Pakistan where monetary policy of Pakistan now for some years has been largely supportive of the dual objective of promoting economic growth and price stability. In order to achieve the goal monetary aggregates were targeted (broad money supply growth as an intermediate target and reserve money as an operational target) in accordance with real GDP growth and inflation targets set by the government.

Ener and Arica (2012) made study on the current account-interest rate relation: A panel data study for OECD countries in which examined the relationship between current account balance as a percentage of GDP and real interest rate over the period for OECD countries that are high income economies using recent developed panel estimation techniques. The two-way Panel OLS estimation results show that there is a positive relationship between current account and real interest rate as expected. This finding illustrates the fundamental understanding of the role of real interest rate in determining the current account balance for high-income economies, and it is useful for policy considerations. The major finding shows that an increase in real interest rates will induce to improve the current account balance. The coefficient of real interest rate is significant and positive. Therefore, real interest rate is an important determinant in improving CAB.

Feldmann (2013) revealed that a rise in the real interest rate increases the unemployment rate, raises the share of long-term unemployed, and reduces the employment rate. The magnitude of these effects is very small in the short run but much more pronounced though still fairly small in the long run.

Shrestha (2013) examined the money supply process in Nepal empirically on the basis of mainstream and Post-Keynesian theoretical perspectives for both pre and post liberalization period covering the sample period of 1965/66-2009/10. The findings on the study reported that disposable high-powered money is a major contributor to the change in both monetary aggregates and there is no significant structural break even after post-liberalization period. However, controllability of high-powered money is not strong. In addition, neither CRR nor bank rate has been effective monetary policy tools so far. On the other hand, Granger causality-based test of Post-Keynesian hypothesis reveals that money supply endogeneity cannot be ruled out. Hence, monetary policy framework needs to be changed accordingly and OMO should be strengthened further. However, OMO is found to affect change in (disposable) high-powered money to some extent.

Adriana (2014) investigated the relationship between unemployment rates and shadow economy. A Toda-Yamamoto approach for the case of Romania. It proved that whether a long-run equilibrium relationship exists between currency demand and its determinants estimated using multivariate cointegration and vector error correction models (VECM). The evidence, based on Wald-tests, generally supports the existence of the unidirectional causality between unemployment rate (registered and ILO) and shadow economy. The Romanian shadow economy as percentage of official GDP is estimated using the currency demand approach based on vector error correction models in the study.

Chaitipa, et al. (2015) investigated about the impact of money supply on the gross domestic product in the ASEAN countries. The findings from the study shows that money supply was associated with economic growth wide phenomena of AEC open region in long run including a speed of adjustment to long - term equilibrium. 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. In this study employed an empirical analysis based on panel ARDL approach by utilizing Pooled Mean Group Estimator (PMG) to estimate the long run relationship between money supply and economic growth during the research study.

Buda (2015) analyzed about the issue of inflation convergence and the monetary independence in the context of the existing exchange rate peg and the capital flow policy of Nepal through employing a number of macro indicators, and alternative empirical strategies based on the peculiarities of Nepal through SVAR approach. The results show that the existing exchange rate peg has resulted in the convergence of the Nepalese price level to the Indian price level in the long run.

Selim and Hassan (2019) concluded that an increase in real GDP will cause an increase in employment and a decrease in the unemployment rate. As the unemployment rate falls, MI will also fall, and macroeconomic performance will improve. In addition, the fall in price level will cause a decline in the inflation rate. As the inflation rate falls, the economy becomes more competitive and MI decreases. The analysis was performed using the mean differences and t- test statistics. The test results reveal that where IFMP has been followed, it has relatively lower inflation and unemployment rates than one followed by IBMP. Thus, the countries that follows interest free monetary policy performs better than the interest based monetary policy. In the study, two theorems have been proposed, and they are (i) In IFMP, marginal cost is less compared to the marginal cost in IBMP, i.e., $(MC_{IFMP}) < (MC_{IBMP})$ because of relatively low financing cost across the economy under IFMP; the cost of borrowing will decrease across the different sectors of the entire economy and the interest cost component will decrease. As interest cost decreases, the price level will also decrease and vice versa. As overall price level falls in IFMP, the inflation rate will fall. (ii) Effects of IFMP on unemployment rate: In IFMP, the overall financing cost across the economy will decrease and as a result, investment spending will increase, aggregate expenditure line (AEF) will shift up, equilibrium income and employment will increase and unemployment rate will fall. The above Theorem (i) and Theorem (ii) have clearly established that under IFMP, both inflation and unemployment rates will be lower compared to IBMP. Such theoretical assertion is re-examined by empirical tests.

## Methodological Framework

The study has employed causal comparative research design for the secondary data to deal with the fundamental issues associated with the effect of monetary policy and macro-economic variables in the context of the economy of the Nepal. An effort has been made to describe the nature of time series data by using descriptive statistics with respect to variables in the study; money supply and real interest rate are the instruments of monetary policy in the study. Data are collected from the NRB publications, economic survey of Ministry of Finance, Government of Nepal and financial statistics of International Monetary Fund. Gross domestic product, inflationary rate, unemployment rate and balance of payment are the macro variables take under consideration for the study.

For the purpose of the study, statistical and econometric models are used to analyze the data. Stationarity property of each variable has been examined by employing the Augmented Dickey-Fuller test. Multivariate Johansen cointegration test is applied to analyze the presence of the long-run equilibrium relationship between the variables in all four specified models.

## Unit root test

As a prelude to work with time series variables, it is very essential to investigate whether the underlying time series data is stationary or not. A time series has stationarity, if a shift in time does not cause a change in the shape of the distribution. Basic properties of the distribution like the mean, variance and covariance are constant over time; this specifies that there is no trend. Failure to assess the stationary (or nonstationary) nature of time series data may lead to spurious regressions. Further when forecasting or conducting tests for causality one can obtain the results that may be miss-specified. There are several methods of testing the stationarity in the variables; Dickey and Fuller tests, Augmented Dickey Fuller tests, Phillips Perron test, and Kwiatkowski, Phillips, Schmidt and Shin test. Here in this study, to avoid a spurious regression, it will first check the stationarity property of each variable by employing the Augmented Dickey-Fuller (ADF) (Dickey and Fuller, 1981) unit root tests.

Consider an AR (1) process of the following form:

$$y_t = a_0 + a_1\, y_{t-1} + \varepsilon_t$$

Assigning the sequential year to the dependent variables and independent variables, time series regression equation with respect to AR (1) process are obtained, which are provided as follows:

$$y_1 = a_0 + a_1\, y_0 + \varepsilon_1$$
$$y_2 = a_0 + a_1(a_0 + a_1 y_0 + \varepsilon_1) + \varepsilon_2$$
$$y_3 = a_0 + a_1[(a_0 + a_1 y_0 + \varepsilon_1) + \varepsilon_2] + \varepsilon_3$$

Continuing this process, following form is obtained:

$$y_t = a_0 \sum_{i=0}^{t-1} a_1^i + a_1^t y_0 + \sum_{i=0}^{t-1} a_1^i\, \varepsilon_{t-i}$$

Dickey and Fuller (1979) considered three different equations based on following cases.

$$Case\ 1:\ No\ Constant, No\ trend \rightarrow\ \Delta y_t$$
$$= \gamma y_{t-1} + u_t \begin{cases} H_0 : (\gamma = 0) \\ H_1 : (\gamma < 0) \end{cases} (\tau\ statistics)$$

$H_0 \Rightarrow y_t$ process is a pure random walk.

$H_1 \Rightarrow$ AR (1) process is stationary with zero mean.

$$Case\ 2: Constant, No\ trend \rightarrow\ \Delta y_t$$
$$= \mu + \gamma y_{t-1} + u_t \begin{cases} H_0 : (\gamma = 0) \\ H_1 : (\gamma < 0) \end{cases} (\tau_\mu\ statistics)$$

$H_0 \Rightarrow y_t$ process is a pure random walk with drift; contains deterministic and stochastic trends. The $y_t$ series will drift upwards downwards depending on the sign of .

$H_1 \Rightarrow$ AR (1) process is stationary with non - zero mean $\left(= -\frac{\mu}{\gamma}\right)$.

$$Case\ 3: Constant\ and\ trend \rightarrow \Delta y_t$$
$$= \mu + \delta t + \gamma y_{t-1} + u_t \begin{cases} H_0 : (\gamma = 0) \\ H_1 : (\gamma < 0) \end{cases} (\tau_t\ statistics)$$

$H_0 \Rightarrow y_t$ process contains deterministic and stochastic trends.

$H_0 \Rightarrow y_t$ process has linear deterministic trends.

## Augmented Dickey Fuller Test

If a simple AR (1) model is imposed when underlying $y_t$ follows an AR (p) process, then the error terms will be correlated. The Dickey Fuller tests will be invalid. In this case, add lagged dependent variables to the right-hand side of the Dickey Fuller equation to obtain Augmented Dickey Fuller (ADF) equation as follows:

$$\Delta y_t = \mu + \gamma y_{t-1} + \sum_{i=1}^{p} \Delta y_{t-i} + u_t \qquad \begin{cases} H_0 : (\gamma = 0) \textit{ implies unit root} \\ H_1 : (\gamma < 0) \textit{ implies no unit root} \end{cases}$$

The above equation form is considered, where there is stationarity present; the case where there is a constant only as a deterministic term and there is no trend. The null hypothesis to test remains the same as before.

## Cointegration Test

If a series needs to be differentiated 'd' times before it becomes stationary, then it contains 'd' unit roots and is said to be integrated of order 'd' i.e. I(d). Granger and Newbold (1976) warned that with I(1) variables there is possibility of spurious regression. It is possible to obtain, when conducting a regression analysis involving time series variables, a very high $R^2$, even though there is no meaningful relationship between the variables. This situation exemplifies the problem of spurious regression. According to Granger and Newbold, $R^2 > d$ is a good rule of thumb to suspect that the estimated regression is spurious.

Engle and Granger (1987) defined $y_t$ and $x_t$ to be cointegrated, if there exists a vector ($\beta_1$, $\beta_2$) such that $\beta_1 y_t + \beta_2 x_t \sim I(0)$, where $y_t$ and $x_t$ are I(1). The elements of vector $x_t = (x_{1t}, x_{2t}, \ldots\ldots x_{nt})'$ are co – integrated of order d, b i.e. CI (d, b) if

(i) All elements of $x_t$ vector are I(d)

(ii) ∃ a vector of where $\beta = (\beta_1, \beta_2, \ldots\ldots \beta_m) : \beta x_t \sim I(d - b)$ where b > 0 and b is the co-integrating vector

When there are non-stationary variables in a regression model, results may be spurious. So if $Y_t$ and $X_t$ are both I(1), regressing the following equation will not give the satisfactory estimates of $\hat{\beta}_1$ and $\hat{\beta}_2$.

$$Y_t = \beta_1 + \beta_2 X_t + u_t \quad \ldots\ldots(1)$$

One way of resolving this is to differentiate the data to ensure stationarity of the variables. After doing this ~ I(0) and I(0), and the regression model would be:

$$\Delta Y_t = \alpha_1 + \alpha_2 \Delta X_t + u_t \quad \ldots\ldots(2)$$

In this case, the regression model may give the correct estimate of the parameters and

and the spurious equation problem has been solved. However, the equation is only the short-run relationship between the two variables.

## Johansen Cointegration test

As analysis of related but more complex cases with reference to Granger Representation Theorem is covered by Johansen (1985). One important test for cointegration that is invariant to the ordering of variables is the full-information maximum likelihood test of Johansen (aka Johansen test). The Johansen test approaches the testing for cointegration by examining the number of independent linear combinations (k) for an m time series variable set that yields a stationary process. As stated that cointegration assumes the presence of common non-stationary (i.e. I(1)) process underlying the input time series variables.

$$X_{1,t} = \alpha_1 + \gamma_1 Z_{1,t} + \gamma_2 Z_{2,t} \ldots + \gamma_p Z_{p,t} + \varepsilon_{1,t}$$

$$X_{2,t} = \alpha_2 + \phi_1 Z_{1,t} + \phi_2 Z_{2,t} \ldots + \phi_p Z_{p,t} + \varepsilon_{2,t}$$

....

$$X_{m,t} = \alpha_m + \psi_1 Z_{1,t} + \psi_2 Z_{2,t} \ldots + \psi_p Z_{p,t} + \varepsilon_{m,t}$$

The number of independent linear combinations (k) is related to the assumed number of common non-stationary underlying processes (p) $p = m - k$

Consider three plausible outcomes:

(i) k = 0, p = m. Here, time series variable are not cointegrated.

(ii) 0 < k < m and 0 < p < m. Here time series variables are cointegrated.

(iii) k = m, p = 0. All time series are stationary I(0). Cointegration is not relevant.

The Johansen test has two tests in the form of the trace test and maximum eigenvalue test. Both tests address the cointegration hypothesis, but each asks very different questions. While trace test examines the number of linear combinations (K) to be equal to the given value ($K_0$), maximum eigenvalue test asks the same central question as the trace test but differ at the alternative hypothesis. Mathematical interpretation of these tests in the form of hypothesis are provided as follows.

$$Trace\ Test \begin{cases} H_0 : K = K_0\ implies\ no\ cointegration \\ H_1 : K > K_0\ implies\ cointegration \end{cases}$$

$$Maximum\ Eigenvalue\ Test \begin{cases} H_0 : K = K_0\ implies\ no\ cointegration \\ H_1 : K = K + 1_0\ implies\ cointegration \end{cases}$$

A special case for using the maximum eigenvalue test is when $K_0 = m - 1$, where rejecting the null hypothesis implies the existence of $m$ possible linear combinations. This is impossible, unless all input time series variables are stationary I(0) to start with.

## Engle-Granger Error Correction Model

Error correction models and cointegration was first pointed out in Granger (1981). A theorem showing precisely that error correction models can represent co-integrated series was originally stated and proved in Granger (1983). A vector time series x, has an error correction representation if it can be expressed as:

$$A(B)\ (1 - B)x_t = \ Z_{t-1} + u_t$$

Where, $u$, is a stationary multivariate disturbance, with A(0) = I, A(1) has all elements finite, $Z_r = a'\, x_r$, and $\gamma \neq 0$, $B$ is the backshift operator variable and $x_t$ is the variance.

In this representation, only the disequilibrium in the previous period is an explanatory variable. However, by rearranging terms, any set of lags of the z can be written in this form, therefore it permits any type of gradual adjustment toward a new equilibrium.

Following the equation (2) from cointegration, if, then, $Y_t$ and $X_t$ are co-integrated, by definition it will be as follows.

$$\Delta Y_t = a_0 + b_1 \Delta \mathrm{X_t} - \pi \hat{u}_{t-1} + e_t$$

This will now have advantage of including both long-run and short-run information. In this model, $b_1$ is the impact multiplier (the short-run effect) that measures the immediate impact change in $X_t$ will have on change in $Y_t$. On the other hand,  is the feedback effect, or the adjustment effect, and shows how much of disequilibrium is being corrected – that is the extent to which any disequilibrium in the previous period affects any adjustment in $Y_t$. Hence, everything is stationary, the change in X and Y is stationary because they are assumed to be I(1) variables, and the residual from the levels of the regression as provided, $\hat{u}_t = Y_t - \hat{\beta}_1 - \hat{\beta}_2 X_t$ is also stationary, by the assumption of cointegration.

## Empirical Analysis

## Unit Root Test

Augmented Dickey Fuller (ADF) unit-root test has been applied to test the order of the integration of the variables. Before conducting ADF test, an attempt is made of whether to include the trend as a variable in the ADF regression or nor. The general rule of thumb provides that trended variables are stationary as well, however ADF unit-root is applied to confirm this statement regarding the stationarity and non-stationarity of the variables. The analysis is as provided as follows.

**Table 1** : *Unit root test of the variables*

| | Test Statistics | Critical values at 5% | Order of Integration |
|---|---|---|---|
| MSS | -3.300822 | -2.981038 | I(1) |
| RIR | -6.155080 | -2.981038 | I(1) |
| GDP | -4.509354 | -2.981038 | I(1) |
| INF | -6.921604 | -2.981038 | I(1) |
| UNEMP | -5.789256 | -2.981038 | I(1) |
| BOP | -3.301269 | -2.981038 | I(1) |

From the table 1, it is observed that none of the variables are stationary at the level I (0); all the variables are stationary at the first difference I (1). Real interest rate, gross domestic product and inflationary rate among the variables are highly stationary with the p value i.e. $P < 0.05$.

## Cointegration test

Cointegration tests analyze non- stationary time series processes that have variances and means which vary over time. After this test, both dependent and explanatory variables are cointegrated; the regression model will not be spurious and the regression model will provide the correct estimates of the parameters. In the unit root tests performed before, the variables are significant at first difference I (1), and this test helps to develop at least one co-integrating equation to move forward towards error correction mechanisms.

**Table 2 :** *Johansen Cointegration tests results*

| | Trace Test | | | Max. Eigenvalue Test | | |
|---|---|---|---|---|---|---|
| | Statistics | Critical value @ 5% | CE(s) | Statistics | Critical value @ 5% | CE(s) |
| GDP Model | 34.71954 | 29.79707 | 1 | 28.70779 | 21.13162 | 1 |
| INF Model | 51.30415 | 29.79707 | 2 | 31.17634 | 21.13162 | 2 |
| UNEMP Model | 41.94925 | 29.79707 | 2 | 24.35567 | 21.13162 | 2 |
| BOP Model | 36.16012 | 29.79707 | 1 | 27.12719 | 21.13162 | 1 |

Table 2 shows that all the statistical values are less than critical values at 5% in both trace test and maximum eigenvalue test. There is one co-integrating equation in gross domestic model and balance of payment model, whereas there are two co-integrating equation in the inflationary model, unemployment model. From the above test, it is clearly visible that there are co-integrating equations present in the model and long run relationship between the variables.

## Error Correction Mechanism

Error correction mechanism is applied to test the significance of the variables against another in the study. From this model, autocorrelation is tested with the help of Durbin-Watson (DW) statistics, and test the hypotheses developed for the study as well. Under the fact, estimated models are co-integrated, it is viable to proceed for using the error correction model.

**Table 3 :** *Growth Model*

| Variables | Coefficient | t-statistics | Probability |
|---|---|---|---|
| C | 0.078092 | 3.955444 | 0.0033 |
| D(Log(GDP(-2))) | -0.304276 | -1.997585 | 0.0769 |
| D(Log(MSS(-1))) | 0.582937 | 4.557660 | 0.0014 |
| D(RIR) | 0.004518 | 4.686165 | 0.0011 |
| ECM(-1) | -1.22E-0.7 | -0.718296 | 0.4908 |

*$R^2$ = 0.928959; F-statistics = 9.177952; DW = 2.094690*

Table 3 shows the log linear model for gross domestic product i.e. Growth Model. The result from the analysis shows that the growth model is statistically significant with the f-statistics of 9.18. $R^2$ provides whether the model had good degree of fit or not; higher the $R^2$, higher the degree of fit and lower the $R^2$, lower the degree of fit. To be precise, the value of R square near to 1 is considered as the higher degree of fit. From the value of $R^2$ observed above, the value is approximately near to 1; Hence, the model has a high degree of fit as well. This is further supported from the value from the probability of the F-statistics also indicates the model consists of high degree of fit. Since, the value from $R^2$ is also lower than the value provided by DW statistics; the model is also not spurious.

Additionally, Durbin-Watson (DW) statistics is also very important to detect the autocorrelation between the white noise or error terms in the model. The value of 2.09 from the DW statistics indicates that there is minimal autocorrelation. Furthermore, both the money supply and real interest rate proved to be significant (i.e. *$P < 0.05$)* instrument that explains economic growth in Nepal between year 1990/91 and 2017/18. The negative sign and coefficient of the residual of ECM (Error Correction Mechanism) meets the requirement for the short run adjustment to long rum equilibrium. In simpler terms, sign and the coefficient of the error correction mechanism confirms the adjustment from the short run dynamics to long run equilibrium.

**Table 4 :** *Inflation Model*

| Variables | Coefficient | t-statistics | Probability |
|---|---|---|---|
| C | -0.160904 | -0.274002 | 0.7878 |
| D(Log(INF(-2))) | -0.103182 | -0.355800 | 0.4183 |
| D(Log(MSS)) | 3.159034 | 1.470373 | 0.1621 |
| D(Log(MSS(-2)) | -2.021946 | -0.991652 | 0.3371 |
| D(Log(RIR)) | -0.002688 | -0.152143 | 0.8811 |
| D(Log(RIR(-2))) | 0.014539 | 0.949874 | 0.3572 |
| ECM(-1) | -0.455774 | -1.309973 | 0.2099 |

*$R^2$ = 0.368174; F-statistics=0.971190; DW=1.578829*

The inflation model, as shown in the table 4, shows that all the selected instruments of monetary policy are insignificant at 5% level for the inflationary rate volatility. DW statistics indicate that there is minimal autocorrelation in the inflation model.

**Table 5 :** *Unemployment Model*

| Variables | Coefficients | t-statistics | Probability |
|---|---|---|---|
| C | 0.075291 | 0.662900 | 0.5240 |
| D(Log(UNEMP(-2))) | 0.856541 | 2.496494 | 0.0341 |
| D(Log(MSS(-2))) | -1.374623 | -2.888595 | 0.0179 |
| D(RIR) | -0.007616 | -2.042203 | 0.0715 |
| ECM(-1) | -0.754415 | -2.245775 | 0.0514 |

*$R^2$ = 0.716350; F-statistics = 1.748399; DW = 1.824265*

Table 5 shows that only money supply as an instrument of monetary policy is significant; whereas real interest rate is insignificant with the unemployment rate. DW test at 1.82 indicates that there is minimal autocorrelation in the model.

**Table 6 :** *Balance of Payment Model*

| Variables | Coefficient | t-statistics | Probability |
|---|---|---|---|
| C | -29015.10 | -0.603483 | 0.5552 |
| D(BOP(-1)) | 0.795999 | 2.202228 | 0.0437 |
| D(Log(MSS)) | 581513.8 | 2.451854 | 0.0269 |
| D(RIR) | -3857.123 | -1.783022 | 0.0948 |
| D(RIR(-1)) | -1091.664 | -0.512134 | 0.6160 |
| ECM(-1) | -0.988289 | -2.503612 | 0.0243 |

*$R^2$=0.527168; F-statistics = 1.858190; DW = 1.744210*

Table 6 provides that money supply, as an instrument of monetary policy, is statistically significant at 5% with balance of payment. However, the table also states that the real interest rate does not have significant relationship with the balance of payment value in the scenario of Nepal during the period of study. Durbin-Watson statistics value of 1.74 indicates that there is minimal autocorrelation in the model.

## Conclusion and implications

Monetary policy is defined as the actions taken by the monetary authority aimed at influencing the supply or demand for base money, with the ultimate objective of influencing a broader set of macro variables, such as inflation and GDP growth. It is a more potent and useful tool for stabilization than is fiscal policy under the liberal and open economy. The study concludes that money supply has the long-run relationship with the gross domestic product, inflation, unemployment and the balance of payment. The results from the findings indicates that about 93 percentage of the variations in the gross domestic product have been explained by the money supply and real interest rate. In addition, adoption of monetary policy measures has significant impact to regulate interest rate and mitigate price instability in the nation. So, the policy makers should focus on ensuring appropriate money supply and ensure interest rate stability to grow the economy in the long-run. Similarly, significant impact of real interest rate on gross domestic product and long-run relationship between the macroeconomic variables exist as well.

Hence, fundamental understanding of the role of real interest rate is very essential in determining the current account balance for high-income economies, and it is useful for policy considerations. From policy perspective, we can say that the authorities can overcome current account imbalances by altering interest rates. While money supply has the long run relationship with the unemployment rate as well, it advised that possibly better measures of the amount and role of intermediation should be introduced and deviate from the monetary policy shocks.

In order to boast the growth of the economy, Government of Nepal (GON) together with the Nepal Rastra Bank should develop and pursue prudent monetary policies. In this regard, the study concludes that the factors, which cause an increase in the economic growth, unemployment and interest rate fluctuations in the country should be addressed with appropriate macroeconomic policies.

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