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Relationship between Money Supply, Income and Price Level in Nepal[#]

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ABSTRACT

This paper intends to find out the relationship between money supply, income and price level in Nepal using the data from the end of fiscal year 1974/75 to 2017/18. The paper tries to establish the relationship between real money supply (both M1 and M2) and real GDP, nominal money supply (both M1 and M2) and price level as well as nominal GDP and price level separately. The econometric tools such as ADF for unit root tests, SIC for lag length selection, bivariate Johansen Cointegration tests followed by VECM for long-run causality, and VEC as well as VAR Granger Causality/Block Exogeneity Wald tests for short-run causality are used in the study. The paper found that there is bidirectional long-run casualty between the real income and both type of money supply in real terms. But there is no evidence of short run causation between these variables. Likewise, the study has found the unidirectional long-run relationship runs from narrow money supply to consumer price. However, there is no short-run relationship from either side. Accordingly, there is no evidence of long-run as well as short-run relationship between broad money supply and consumer price level. Lastly, there is no evidence of long-run causality between nominal GDP and general price level. But the study found the unidirectional short-run causality running from general price to nominal GDP. The results suggest that the Nepal should focus on steady growth of broad money supply (time deposit rather than narrow money supply) in long-run for economic growth and control of inflation both.

JEL Classification: E51, E31, C32

Key Words: Broad and Narrow Money Supply, Price level, Short-run and Long-run Causality

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I. INTRODUCTION

The relationship between money, income and prices has been a subject of discussion among economists for a long time. Specifically, the role of money in determination of income and prices has been being debated extensively over the decades. According to the classicists, the increase in money stock shifts up the aggregate demand without affecting the supply side (Ackley, 2007). This increment on money supply leads to increase in price level which just offsets the increase in nominal money, leaving the real money stock unchanged. Money, then, is completely neutral in the classical economy, real output, income and other real variables are completely left unchanged by change in the money supply (Branson, 2005).

Keynesians held the view that money does not play an active role in determining income and prices. They stress on that the direction of causation runs from income to money without any feedback (Al-Jarrah, 1996). According to their view changes in the stock of money supply affects the interest rate and hence investment and consumption (Salih, 2013; Coddington, 1976). The effect goes through the income at last. They say changes in the stock of money supply affects income only indirectly (Shapiro, 2001). Accordingly, changes in income cause changes in the stock of money supply through change in the demand for money, given sticky interest rates (Branson, 2005). This indicates a unidirectional causality from income to money supply. Similarly, according to the Keynesians, prices are determined by the demand and supply forces. In Keynesian point of view, inflation as a real phenomenon caused mainly by real factors (Al-Jarrah, 1996; Blinder, 1988). The Keynesians economists negate the role of money in the price change. They are of the view that changes in prices are mainly due to structural factors (Ahmad, Asad and Hussian, 2008).

Contrary to the Keynesians, The Monetarists led by Milton Friedman faithfully claim that money supply plays an active role in determining income and prices (Salih, 2013; Laidler, 1981). This indicates that both income and prices are mainly caused by changes in the stock of money supply in the short-run (Froyen, 2014). 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). In clear notation, the monetarists' proposition suggests that there is a unidirectional causality from money supply to income and a unidirectional causality from money supply to prices.

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 on price level (Maddock & Carter, 1982). Their view coincides the view of classical.

The new Keynesian are giving the strong microeconomic foundation to the Keynesian system (Froyen, 2014). So, they are in the supporting view to the Keynesian view of indirect association between money supply, income and price (Gordon, 1990). But they are not so much rigid like the early Keynesian to believe the effectiveness of monetary policy (Froyen, 2014).

Despite this clear dispute, it is very crucial to understand the relationship between the variables such as; income, money and prices in an economy. Understanding this relationship is important, especially to the public policymakers, in conducting effective stabilization policies. The causal relationships between money and income as well as between money and prices have been an active area of research in economics particularly after the publication of the influential paper by Sims (1972). Based on Granger causality; Sims developed a test of causality and applied it to data from the United States to examine the causal relationship between money and income. He found the evidence of unidirectional causal relationship running from money to income supporting the Monetarists' claim (Salih, 2013).

The money supply, income and price level have increasing tendency over the years in Nepal. The average increment rate of narrow money, broad money, GDP and price level over the last 43 years are 15.69, 18.65, 4.35 and 8.19 percent respectively. Accordingly, the average growth rate of real narrow money and real broad money are 6.98 and 9.72 percent respectively. These figures clearly show that all these macroeconomic variables are in increasing trend. Therefore, there may be possibility of achieving the unidirectional or bilateral causal relationship between money, price and income though the ideology differs from one school to another (Gyanwaly, 2012). Hence, there might be long run as well as short-run relationship between these variables. The relationship between these variables has significant importance because it traces out the nexus between these variables and provides policy implications to the policy makers (www.intelligenteconomist.com). So, the main task of this study is to discuss and identify the casual relationship between these variables in the latest context of Nepal.

Hence, the problem of this study can be synthesized in the following research question;

i. Is there any long-run and short-run relationship between these macroeconomic variables?

So, the objective of the study is to find out the long run and short run relationship between the money supply, income and the price level in Nepal.

There are few limitations of the study. First, there are methodological limitations of this study. The conclusions drawn by this study may not be matched with the conclusions drawn by the study which used another methodology. Secondly, the quarterly or monthly data are usually needed for the dynamic analysis of the model, but because of the unavailability of such data recorded in Nepal. This study is obliged to use the annual data which may lead the less dynamic results. Third limitation of this study is that it covers only the data from 1975-2018 of Nepal, which may not provide the conclusion for all. Another limitation of this study is that it uses bivariate models to illustrate relationship between variables.

II. REVIEW OF LITERATURE

Friedman and Schwartz (1963) found that the changes in the behavior of the money stock had been closely related with the changes in economic activity, money income, and prices in American economy during the period from 1867 to 1960. They also found that the interaction between monetary and economic change had been highly stable. However, they observed that monetary changes often had an independent origin; they have not been simply a reflection of changes in economic activity.

Al-Jarrah (1996) investigated the nature of the linkages between money, real income, and prices in Saudi Arabia. The study used multivariate Johansen technique, Granger-causality tests, and variance decomposition and impulse response functions to test for causal relationships among variables. The results indicated that real income contributes significantly in explaining changes in the money, while the reverse was not true. Consumer prices were also significant in predicting changes in money in the Kingdom. The evidence on the contribution of money in explaining prices change, however, was weak.

Holod (2000) investigated the relationships between the money supply, exchange rate and prices in the Ukrainian economy by employing the monthly data from 1995:01 to 1999:06. The study used vector autoregression (VAR), vector error correction model and impulse response functions as its methodology to show how a shock in one of the variables influences the time behavior of others. The paper found some evidence that money supply shocks affected the price level behavior, but the effect was not very strong. On the other hand, the paper found that the money supply responded significantly to the shocks in the price level.

Ahmad, Asad and Hussian (2008) used the time series data of real GDP, nominal GDP, prices and money supply for the period of 1973 to 2007. The study used ADF to test the stationary of the data series and series were found integrated of the order zero. The Granger causality test was used for causal relationship. The paper found the estimated coefficient between the growth of money supply and inflation positive and significant. The study accepted the Monetarist proposition that money supply determined the price levels and income. The authors suggested a tight monetary policy along with fiscal measures to control inflation in Pakistan.

Ishan and Anjum (2013) described the main role of money supply (M2) on GDP of Pakistan. The study used the secondary data of 12 years from 2000 to 2011. The paper found the excessive money supply (M2) by SBP (State Bank of Pakistan) to run the country entails to high rate of inflation if the indicators i.e. CPI, interest rate are not controlled within the prescribed limits. The research found the evidence that high rate of inflation has adversely affected the economy of Pakistan because of excessive supply of money (M2) by SBP. The study revealed the impact of money supply (M2) on the GDP of Pakistan whereby the country has seen inflation rate in double digits. By using regression model, the paper has proved that Interest rate and CPI have a significant relation with GDP but inflation has no significant relation with the GDP. Thus, they have suggested that the money supply needs aggressive control to boost the economy.

Salih (2013) examined the relationship between the three macroeconomic variables money, income, and prices in the Saudi Arabian economy. The methodology used in the paper is cointegration, bivariate and trivariate Vector Autoregressive (VAR) models, and Granger Causality/Block Exogeneity tests. The author further supplemented the results with impulse response and variance decomposition. The results for Saudi Arabia for the period 1968-2011 indicated two-way causation between income and money supply. The results also showed that income Granger causes prices, and money Granger causes money prices.

Luo (2013) investigated the money supply behavior (endogeneity or exogeneity) of BRICS (Brazil, Russia, India, China, and South Africa) using quarterly data from 1982 to 2012. The author used the econometric methodologies like Chow Breakpoint Test, Unit Root Test, Johanson Cointegration Test, Granger causality Test, Vector Error Correction and Trivarite Vector Autocorrelation Matrix for the thesis. In four countries: Brazil, China, Russia (the period of 2004-2012) and South Africa (1982-1993), the study found money supply endogeneity evidence. Thus, this implies that bank loans cause the money supply, or there is bidirectional causality between these two. Regarding the other countries (India and the 1982-2003 period of Russia) the thesis found money supply to be exogenous which means money supply cause bank loans. The study concluded that in the short run; most of the countries share at least some degree of the monetarist view which envisages exogeneity of money supply.

Singh, Das and Baig (2015) examined the casual relationship between money supply, output and prices of India in the short and long-term both. Different metrics for money, output and prices were used to understand the relationship between each. The paper used ADF and PP test for unit root test, EG test and Johansen test for co-integration and Granger causality test for causal relationship among variables. The paper deployed quarterly as well as monthly data for analysis. Variables to understand food inflation was especially used considering the fact that food prices are less income elastic and are viewed differently by citizens. The findings of the study indicated that the relationship is sensitive to the choice of variable which is relevant in the understanding of relationship between money, output and prices. Narrow Money was found to be a better policy variable than reserve money or Broad Money in India.

Koti and Bixho (2016) have presented different approaches and theories associated with money and inflation. The paper analyzed the theoretical links between money supply and the variables such as unemployment, trade and exchange rate, taxes and wages by occupying the data of Albania from 1994 to 2015. The study used the multiple regression analysis formulated with the guidance of the theories of money. The results of the study showed the strong relationship of the money supply with economic growth, interest rate and inflation, but it had a negative sign toward inflation showing that the case of Albania was special, because of the lack of optimum money supply from the banking system and outside. So, they found that all money supplied in the economy is fully absorbed by the individuals and private sector without increasing the inflation.

Khatiwada (1994) analyzed the causal relationship between money and money income as well as money and prices by deploying the regression, the Granger's causality test and Sim's test. The paper covered the annual Nepalese data from the FY 1965/66 to 1989/90. The study found a unidirectional causality running from money to money income. The test of causality between money and prices uniformly indicated that there is unidirectional casual relation from money to prices and no feedback from prices to money.

NRB (2001) examined the money-price relationship in Nepal. The study estimated the money-price relationship by using quarterly data from third quarter of 1975 to second quarter of 1999. The study showed the delayed impact of money on prices in Nepal disapproving the theory of money and price which suggests an instantaneous relationship between money and price. The study occupied ADF to test unit root and Engel- Granger co-integration test to check long run relationship among variables. The Almon lag model was applied to ascertain the sum total effects of money supply on prices over the period. The study found that 10 percent changes in M1 bring about 4.5 percent changes in prices in Nepal. M1 compared to M2 was found to have stronger relationship with prices in Nepal. The results of the paper also showed that there was no structural shift in money price relationship during the study period.

Gyanwaly (2012) analyzed the causal relationship between money, price and income in Asian countries by employing the annul data from 1964 A.D. to 2011 A.D. The paper used the Unit Root Test as well as the Granger's cointegration and causality test in its methodology. The study reached to the conclusion that money supply is an endogenous variable in all the countries though the extent of endogeneity in term of price and income variables slightly differs from on to another. The paper found that both narrow and broad money are unidirectionally causing the general price level in case of Nepal. The study found the 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.

Travelling on the literature regarding the relationship between money supply and the macroeconomic variables such as income and price level, there are evidence of unidirectional as well as bidirectional causality depending on different countries. In Nepalese context, there are couple of studies done so far. These studies found unidirectional causality runs from money to price and income. So, this study is going to check the robustness of these findings. And this paper is going to use the Johnsen cointegration test followed by VECM and VAR Granger causality which is purely new methodology regarding this topic in Nepalese context. And the time gap is another inspiration to study in this topic.

III. RESEARCH METHODOLOGY

This study is quantitative in nature and it has used inferential research design. To analyze the relationship macroeconomic variables, the study has used the annual secondary data series from July 1975- July 2018 (end of the fiscal year) of Nepal. The data are used from *Quarterly Economic Bulletin 2017* and *Current Macroeconomic and Financial Situation of Nepal 2017* published by Nepal Rastra Bank and various issues of *Economic Survey* published by

Ministry of Finance of Nepal. However, this study has used the data in natural logarithm form rather than in original form for analysis.

3.1 Model Specification

In the analysis, we have used narrow money supply (M1), broad money supply (M2), income (GDP), and general price level (NCPI) as variables. However, we have separated former three variables into nominal as well as real form for the different model. The reason behind this is to find out impact of real money supply to real income, nominal money supply to price level and price level to nominal income separately. The real variables are deflated on 2014/15 prices. Likewise, the price level is also based on 2014/15 prices.

Relationship between Macroeconomic Variables

Most of the theories and empirical studies suggest that the money supply causes the price level and income. The models are set as follows (Gujarati & Sangeetha, 2007).

$$RGDP = f(RM)$$

or, $$RGDPt = a1 + b1RMt + e1 \quad \text{.......... (1)}$$

There are two models for this relationship with narrow and broad money supply.

And, $$NCPI = f(NM)$$

or, $$NCPIt = a2 + b2NMt + e2 \quad \text{.......... (2)}$$

There are two models for the relationship between NCPI and two money supply as well.

Accordingly, the theory suggests that the price level causes the nominal income of a nation. So, the model is as follows.

$$NGDP = f(NCPI)$$

or, $$NGDPt = a3 + b3NCPIt + e3 \quad \text{.......... (3)}$$

Hence, there are five models in this paper.

3.2 Methods of Analysis

Time series econometrics has been used to estimate and analyze the coefficients. This paper intends to use the following methods of analysis.

Unit Root Test

The classical regression model assumes that the both data series of dependent and explanatory variables be stationary, i.e, the errors have a zero mean and finite variance

(Enders, 2010). But in the most cases, the macroeconomic time series are non-stationary (Asteriou & Hall, 2007). 'Whether the data is stationary or not?' we can find out by performing the unit root test. There are few methods of testing unit root of the data. Here, the paper has performed the Augmented Dickey-Fuller (ADF) test for the test of stationarity of the data. There are three possible forms of the ADF test (Enders, 2010);

The equation for no intercept and no trend is,

$$\Delta Y_t = \gamma Y_{t-1} + \sum_{i=1}^{P} \beta_i \Delta Y_{t-1} + u_t \qquad \text{………. (4)}$$

The equation for only intercept and no trend is,

$$\Delta Y_t = \alpha_0 + \gamma Y_{t-1} + \sum_{i=1}^{P} \beta_i \Delta Y_{t-1} + u_t \qquad \text{………. (5)}$$

The equation for both intercept and trend is,

$$\Delta Y_t = \alpha_0 + \gamma Y_{t-1} + \alpha_2 t + \sum_{i=1}^{P} \beta_i \Delta Y_{t-1} + u_t \qquad \text{………. (6)}$$

However, the paper has used last two equations to analyze the unit root in the data. The unit root is often denoted by order of integration I(n) (Asteriou & Hall, 2007). The order of integration refers the number of unit roots.

Schwarz Information Criterion (SIC)

The Johansen cointegration test requires the selection of appropriate lag length. There are so many ways of selecting the lag length of the model. Some scholars prefer the ad-hoc methods (Gyanwaly, 2012) and some are employing different techniques developed by the econometricians. The one of the most popular methods of selecting the lag length is Schwarz Information Criterion (SIC) (Luo, 2013). In this criterion, the lower the value, the better the model (Gujarati & Sangeetha, 2007). This study has fixed the lag length of the model based on the SIC.

The SIC is given as (Gujarati & Sangeetha, 2007);

$$SIC = n^{k/n} \frac{\sum \hat{u}^2}{n} = n^{k/n} \frac{RSS}{n} \qquad \text{………. (7)}$$

or, in log form

$$\ln SIC = \frac{k}{n} \ln n + \ln\left(\frac{RSS}{n}\right)$$

Johansen Cointegration Test

The cointegration refers the existence of a long-run equilibrium relationship between the variables in which an economic system converges over time (Bhusal, 2016). In general, for the cointegration test, the all data series used in the model should be integrated in same order. While testing the cointegration one cannot use the first difference data rather should use the level data. So, cointegration becomes an over-riding need for any econometric modelling occupying the non-stationary time series (Asteriou & Hall, 2007).

The most powerful and reliable method of testing the cointegration between the variables is Johansen Cointegration test. Cointegration only tells about long-run relationship between the series but it does not fix the direction of such relationship (Luo, 2013). For Johansen cointegration test, Trace statistics and Maximal Eigenvalue statistics are used which can be expressed as follows (Luo, 2013), (Asteriou & Hall, 2007);

$$\lambda\text{Trace (r)} = T\sum_{i=r+1}^{g} \ln\left(1-\hat{\lambda}_i\right) \quad \text{………. (8)}$$

$$\lambda\text{Max (r, r + 1)} = -T\ln\left(1-\hat{\lambda}_{r+1}\right) \quad \text{………. (9)}$$

The bivariate Johnsen cointegration test has been performed in this study. When the data are found to be co-integrated, the study has performed the Vector Error Correction Method for long-run and short-run relation between variables. When the data are not co-integrated, the unrestricted Vector Autoregressive Model has been used for short-run relationship.

Vector Error Correction Method (VECM)

VECM is used for cointegrating model with first-difference stationary data. It can be used to test the short-run and long-run causality between a dependent and an explanatory variable: the long-run causality (from explanatory variable to dependent variable) can be identified in the test of the significance of the error-correction coefficient of the VECM by using ordinary least squares (OLS) estimation of the model (Luo, 2013). For instance, the VECM equation for the RGDP and RM is as follows (Asteriou & Hall, 2007);

For example, the bivariate error correction model as RGDP as dependent and RM as explanatory variable is given as:

$$\Delta\text{RGDPt} = \alpha_0 + \sum_{i=1}^{n}\alpha_{1i}\Delta\text{RGDP}_{t-1} + \sum_{i=1}^{n}\alpha_{2i}\Delta\text{RM}_{t-1} + \sum_{i=1}^{n}\alpha_{3i}\Delta\text{EC}_{t-n} + e_i \quad \text{………. (10)}$$

For the long run causality form RM to RGDP α_3 must be significant.

Unrestricted Vector Autoregressive (VAR) Model

The models which are not co-integrated has been tested short run causality under unrestricted VAR. As the data are integrated of first order, the first-difference data have been used for the VAR models. The equation of bivariate VAR models are as follows (Asteriou & Hall, 2007);

$$\Delta RGDPt = \beta 10 - \beta 12\ \Delta RMt + \gamma 11\ \Delta RGDPt{-}1 + \gamma 12\ \Delta RMt{-}1 + uyt \quad \ldots\ldots\ldots (11)$$

$$\Delta RMt = \beta 20 - \beta 21\ \Delta RGDPt + \gamma 21\ \Delta RGDPt{-}1 + \gamma 22\ \Delta RMt{-}1 + uxt \quad \ldots\ldots\ldots (12)$$

Granger Causality Test

The Granger causality/ block exogeneity Wald test has been performed under both VECM and VAR for the short-run causality between the variables. For instance, the Granger causality test between real income and real money supply is given as (Gujarati & Sangeetha, 2007);

$$\Delta RGDPt = \sum_{i=1}^{n} bi\ \Delta RM(t-i) + \sum_{j=1}^{n} ci\ \Delta RGDP(t-j) + e2t \quad \ldots\ldots\ldots (13)$$

$$\Delta RMt = \sum_{i=1}^{n} gi\ \Delta RM(t-i) + \sum_{j=1}^{n} hi\ \Delta RGDP(t-j) + e3t \quad \ldots\ldots\ldots (14)$$

Where e_{2t} and e_{3t} are disturbances and assumed to be uncorrelated to each other.

Unidirectional causality from RM to RI is indicated if $\Sigma b_i \neq 0$ and $\Sigma h_i = 0$. Conversely, unidirectional causality from RI to RM exists if $\Sigma b_i = 0$ and $\Sigma h_i \neq 0$. Feedback or bilateral causality is suggested if both coefficients $\Sigma b_i \neq 0$ and $\Sigma h_i \neq 0$. Finally, independence is suggested if $\Sigma b_i = 0$ and $\Sigma h_i = 0$. (Gujarati & Sangeetha, 2007).

The Granger causality test for other models are also same as above.

Residual Test

The serial correlation is tested by using Breush- Godfrey Serial Correlation LM tests in this study. The heteroscedasticity is checked by using Breush-Pagan Godfrey test. Accordingly, Jarque-Bera test is used to test the normality of residuals. Similarly, Cumulative Sum test and cumulative sum of square test are used to test the stability of the models.

IV. EMPIRICAL ANALYSIS

4.1 Results of Unit Root Test

The Augmented Dickey-Fuller (ADF) is used to test the unit root of the dependent and explanatory variables. Table 4.1 shows the results of Augmented Dickey-Fuller tests of the time series variables used in this study.

Table 4.1: Results of Augmented Dickey-Fuller Tests

Variable	Level		First Difference		Order of Integration
	Intercept without trend	Intercept with trend	Intercept without trend	Intercept with trend	
LNGDP	0.133 [0.9647]	-1.418 [0.8414]	-4.780* [0.0003]	-4.714* [0.0025]	I(1)
LRGDP	-0.484 [0.9841]	-3.236 [0.0911]	-6.557* [0.0000]	-6.525* [0.0000]	I(1)
LNCPI	-1.527 [0.5105]	-1.334 [0.8653]	-4.923* [0.0002]	-5.073* [0.0009]	I(1)
LNM1	-0.845 [0.7958]	-1.565 [0.7904]	-6.247* [0.0000]	-6.354* [0.0000]	I(1)
LRM1	-0.825 [0.8017]	-4.084 [0.0130]	-7.030* [0.0000]	-6.999* [0.0000]	I(1)
LNM2	-0.617 [0.8559]	-2.076 [0.5436]	-4.639* [0.0005]	-4.618* [0.0032]	I(1)
LRM2	-0.916 [0.7735]	-3.883 [0.0214]	-6.033* [0.0000]	-5.929* [0.0001]	I(1)

Source: writer's own calculation using e-views 9

Note:

1. *H0: has a unit root (non-stationary)*
   H1: does not has a unit root (stationary)
2. *Star * shows 1 percent level of significance*
3. *The p-values are based on MacKinnon (1996) one-sided p-values*

Table 4.1 shows that LNGDP, LRGDP, LNCPI, LNM_1, LRM_1, LNM_2 AND LRM_2 have unit root at 1 percent level of significance in both intercept with trend and without trend in the form of level data. So, the variables are not stationary at level. However, all these variables are stationary at 1 percent level of significance in first difference form in both intercept with trend and without trend. It means all the variables are integrated of order 1. i.e. I (1). Hence, the variables can be used for Johansen Cointegration test.

4.2 Lag Length Selection

Table 4.2 has presented the lag length selection of different models under Schwartz Information Criterion (SIC).

Table 4.2: Optimal Lag Length Selection for Johansen Cointegration Tests

Model		Lag length selection	
Dependent	**Explanatory**	**Lags**	**SIC**
LRGDP	LRM1	1	-7.781*
LRGDP	LRM2	1	-7.862*
LNCPI	LNM1	1	-6.869*
LNCPI	LNM2	1	-7.131*
LNGDP	LNCPI	1	-7.378*

Source: writer's own calculation using e-views 9
*Note: *shows the minimum SIC value, where the corresponding lag length is optimal for the model.*

Table 4.2 shows that all five models in this study can be tested by using lag length 1 which is suggested by Schwartz Information Criterion (SIC).

4.3 Results of Johansen Cointegration Tests

Since all the variables used are I (1), cointegration test can be done for the models. The lag length for all the models is uniformly one. There are five models in this study. Now, the next task is to perform Johansen Cointegration tests for all bivariate models in this study one by one.

Table 4.3: Results of Johansen Cointegration Tests for LRGDP and LRM1

Hypothesized No. of CE(s)	Trace Statistics	p-value for trace statistics	Max-Eigenvalue statistics	p-value for Max-Eigenvalue
None	26.936*	0.0006	26.846*	0.0003
At most 1	0.089	0.7651	0.089	0.7651

Source: writer's own calculation using e-views9
Notes:
1. *Star * denotes the rejection of hypothesis at 1 percent level of significance*
2. *The p-values are MacKinnon-Haug-Michelis (1999) p-values*

Table 4.3 presents the results of Johansen cointegration tests for the model 1 where there are two variables LRGDP and LRM1. The both trace statistic and max-eigenvalue tests show one cointegrating equation at 1 percent level of significance. It shows that there is long run association between real GDP and real narrow money supply. So, the VECM is performed in the next section.

Likewise, Table 4.4 shows the results of Johansen cointegration tests for the model with LRGDP and LRM2. The Maximum Eigenvalue statistic suggests that there is one cointegrating equation at 10 percent level of significance. So, we can say that there may be a long run relationship between RGDP and RM2.

Table 4.4: Results of Johansen Cointegration Tests for LRGDP and LRM2

Hypothesized No. of CE(s)	Trace Statistics	p-value for trace statistics	Max-Eigenvalue statistics	p-value for Max-Eigenvalue
None	14.242	0.0765	14.26*	0.0550
At most 1	0.241	0.6238	3.84	0.6238

Source: writer's own calculation using e-views9
Notes:
1. *Star * denotes the rejection of hypothesis at 10 percent level of significance*
2. *The p-values are MacKinnon-Haug-Michelis (1999) p-values*

Similarly, the results of Johansen cointegration tests for the model with LNCPI and LNM1 have been shown in table 4.5. The both statistics suggest that there is one cointegrating equation at 10 percent level of significance. So, the study has found that there is a long run association between RGDP and RM2.

Table 4.5: Results of Johansen Cointegration Tests for LNCPI and LNM1

Hypothesized No. of CE(s)	Trace Statistics	p-value for trace statistics	Max-Eigenvalue statistics	p-value for Max-Eigenvalue
None	8.568	0.4068	5.818	0.6366
At most 1	2.749*	0.0973	2.749*	0.0973

Source: writer's own calculation using e-views9
Notes:
1. *Star * denotes the rejection of hypothesis at 10 percent level of significance*
2. *The p-values are MacKinnon-Haug-Michelis (1999) p-values*

In Table 4.6, the results of Johansen cointegration tests for the model with LNCPI and LNM2 has been shown. The both statistics suggest that there is no cointegrating equation at 10 percent level of significance.

Table 4.6: Results of Johansen Cointegration Tests for LNCPI and LNM2

Hypothesized No. of CE(s)	Trace Statistics	p-value for trace statistics	Max-Eigenvalue statistics	p-value for Max-Eigenvalue
None	3.756	0.9222	3.515	0.9066
At most 1	0.240	0.6236	0.241	0.6236

Source: writer's own calculation using e-views9
Notes:
1. *Star * denotes the rejection of hypothesis at 10 percent level of significance*
2. *The p-values are MacKinnon-Haug-Michelis (1999) p-values*

So, there is no long run relationship between NCPI and NM2. So, the unrestricted VAR Granger causality is performed for the short run causality of the model in next section.

Table 4.7: Results of Johansen Cointegration Tests for NGDP and NCPI

Hypothesized No. of CE(s)	Trace Statistics	p-value of trace statistics	Max-Eigenvalue Statistics	p-value for max-eigenvalue
None	9.431	0.3270	9.061	0.2811
At most 1	0.371	0.5426	0.371	0.5426

Source: writer's own calculation using e-views9

Notes:

1. *Star * denotes the rejection of hypothesis at 10 percent level of significance*
2. *The p-values are MacKinnon-Haug-Michelis (1999) p-values*

In Table 4.7, the results of Johansen cointegration test for the model with LNGDP and LNCPI is presented. The both statistics suggest that there is no long run association between NGDP and NCPI in Nepal. So, the unrestricted VAR Granger causality has been performed for the short run causality of the model in next section.

4.4 Results of VECM Results

The long-run causality of cointegrating variables has been tested with the help of Vector Error Correction Model (VECM) framework. It is found that the bivariate models with LRGDP and LRM1, LRGDP and LRM2 as well as LNCPI and LNM1 have the long-run cointegrating relationship.

Table 4.8: Results of VECM long run causality of the cointegrating model

Model	Dependent variable	Explanatory variable	Coefficient of CE	Standard error	t-statistics	p-value	Direction of causality
1	LRGDP	LRM1	-0.191*	0.0688	-2.7700	0.0070	Bi-directional long-run causality
	LRM1	LRGDP	-0.532*	0.1148	-4.6351	0.0000	
2	LRGDP	LRM2	-0.192*	0.0721	-2.6602	0.0095	Bi-directional long-run causality
	LRM2	LRGDP	-0.229**	0.0880	-2.6029	0.0111	
3	LNCPI	LNM1	-0.175***	0.0928	-1.8836	0.0635	Uni-directional long-run causality from NM1 to NCPI
	LNM1	LNCPI	-0.077	0.0812	-0.9425	0.3489	

Source: writer's own calculation by using e-views9

Note:

1. *Star * indicates the rejection of null hypothesis at 1% level of significance, ** indicates the rejection of null hypothesis at 5% level of significance and *** indicates the rejection of null hypothesis at 10% level of significance.*
2. *CE stands for cointegrating equation.*

Table 4.8 shows the results of the VECM long-run causality tests of the cointegrationg model. In the model 1, the study has found the bidirectional causal relationship between real GDP and the real narrow money supply in the long-run at 5 percent level of significance. Similarly, in the model 2, there is long-run bidirectional causal relationship between real GDP and real broad money supply at 5 percent level of significance. But in the model 3, there is a unidirectional causal relationship between NCPI and the narrow money supply in nominal term in the long-run at 10 percent level of significance.

Now, the short-run causality between the variables in these three models is presented in Table 4.9 where the results of Vector Error Correction Granger Causality/ Block Exogeneity Wald tests have been shown.

Table 4.9: Results of VEC Granger Causality/ Block Exogeneity Wald tests for short-run causality

Model	Dependent variable	Explanatory variable	Chi-square statistics	p-value	Direction of causality
1	DLRGDP	DLRM1	0.8633	0.3855	No short-run causality
	DLRM1	DLRGDP	0.7725	0.3794	
2	DLRGDP	DLRM2	9.43E-05	0.9923	No short-run causality
	DLRM2	DLRGDP	0.5440	0.4608	
3	DLNCPI	DLNM1	0.3317	0.5647	No short-run causality
	DLNM1	DLNCPI	0.0601	0.8063	

Source: writer's own calculation by using e-views9
*Note: Star *** indicates the rejection of null hypothesis at 10% level of significance.*

Table 4.9 shows that there is no short-run causation between variables in all three cointegrating models. In this test, chi-square statistics is used and the p-values of the all models which are more than even 10% suggest that the null hypothesis of there is no short-run causality cannot be rejected.

So, in a nutshell, the study infers that there is bidirectional causality between real GDP and both form of real money supply. And there is a unidirectional causality runs from nominal money supply to NCPI.

4.5 Results of Unrestricted VAR

In this heading, the short-run causal relationship between the variables of the bivariate models which are found to be not cointegrated in the long-run are investigated. While testing the long-run association of the variables in the section 4.8, the model with NCPI and nominal broad money supply as well as nominal GDP and NCPI do not have the long-run relationship. However, it is mandatory task for this study to go for the short-run causality investigation of the variables.

Table 4.10: Results of VAR Granger Causality/Block Exogeneity Wald tests

Model	Dependent variable	Explanatory variable	Chi-square statistics	p-value	Direction of causality
4	DLNCPI	DLNM2	1.6980	0.1926	No short-run causality
	DLNM2	DLNCPI	1.4251	0.2326	
5	DLNGDP	DLNCPI	5.6933**	0.0170	Unidirectional short-run causality from NCPI to NGDP
	DLNCPI	DLNGDP	0.0651	0.7987	

Source: writer's own calculation by using e-views9
*Note: Star ** indicates the rejection of null hypothesis at 5% level of significance.*

In Table 4.10, the results of Vector Auto Regressive (VAR) Granger Causality/Block Exogeneity Wald tests for short-run causality has been performed. It is found that there is no short-run causal relationship between NCPI and the nominal broad money supply. However, the test shows that the unidirectional causality runs from NCPI to nominal GDP in the short-run at 5% level of significance.

4.6 Residual Diagnostic of the Models

Serial Correlation Test

The Breusch-Godfrey Serial Correlation LM Test shows that there is not any serial correlation problem in all models used in this study as the p-value are more than 5 percent.

Results of Heteroscedasticity Test

The Breush- Pagan Godfrey test is used to detect heteroskedasticity. There is not any problem of Heteroskedasticity problem in all models used in this study as the p-values are more than 5 percent. So, the residuals have equal variance.

Results of Normality Test

As the sample period is just 44 which may not be enough for time series analysis. So, the residuals are not found normally distributed except model. The Jarque-Bera statistics were used to test normality.

Results of Stability Test

The stability of the model is tested by using CUSUM and CUSUM square tests. The test shows that the models are stable though in some model the red line is crossed which violets the 5 percent critical bound.

V. CONCLUSIONS AND RECOMMENDATIONS

At the end, the paper has found out some conclusions or inferences from the study. The paper found that there is bidirectional long-run casualty between the real income and real narrow money supply as well as the real income and real broad money supply. So, it is to conclude that in the long-run the real money supply causes the real income and real income also reciprocates the real money supply (without causing in the short-run) in Nepal. In other words, the money supply causes the income in the long-run with strong feedback effect. But there is no evidence of short run causation between these two variables. It means the growth rate of money supply and income in Nepal is not associated.

Likewise, the study has found the unidirectional long-run relationship runs from narrow money supply to consumer price. However, there is no short-run relationship from either side. Here, it is to conclude that, the nominal narrow money supply causes the general price level of the country in the long-run without feedback.

However, there is no evidence of long-run as well as short-run relationship between broad money supply and consumer price level. It concludes that there is no association between broad money supply and general price level of Nepal in both short and long run.

From the both short-run results between money supply and inflation, it can be inferred that there is no evidence of short-run causal relationship between the growth rate of money supply and inflation in Nepal.

Accordingly, there is no evidence of long-run causality between nominal GDP and general price level. But the study found the unidirectional short-run causality running from general price to nominal GDP. It means that the growth rate of general price level affects the growth rate of nominal income of the nation.

The conclusions of our study do not support the monetarists' point of view which suggests that there is causal relationship runs from money supply to income and price in the short-run. They also postulate that the causality disappears in the long-run. Contrary to that our conclusion in the Nepalese context suggests that the money supply causes to national income with the same feedback and causes to price level without feedback in the long-run.

This study also denied the early Keynesians' ignorance to the important role of money supply in the economy. However, this study supports the Keynesian view of indirect (long-run) relationship between the money supply, real income and prices. So, the conclusion of this study suggests that the money supply has significant role in the long-run rather than short-run for Nepalese economy.

This study intends to make some inferences which may be useful for the policymaker to make the appropriate policies for the nation. The major recommendations of this study can be prescribed as follows;

- The inflationary pressure in Nepal is so high. As this study suggests, the nominal narrow money supply causes the general price level in the long-run but broad money supply does not. So, the monetary policy should be focused to increase the time deposit rather than the currency and demand deposit in the economy.

- In this study, it is found that both real money supply causes the real income of the nation and real income also causes the both real money supply in the long-run. So, this paper suggests that the policymakers have to maintain an appropriate growth rate of money supply in real term to achieve the certain level of real income growth.

- On the one hand, the main cause of the growth of nominal income of Nepal is growth rate of the general price level. On the other hand, the nominal narrow money causes the price level in the long-run. It means that the policymakers can infer that the nominal narrow money supply causes the nominal income of the nation indirectly. Hence, the narrow money supply can be an instrumental to handle the inflation and nominal growth rate in the long-run.

- From the results of this study, the policymakers can view that the broad money supply is more appropriate than the narrow money supply because both causes the real income in the long-run but narrow money causes inflation as well. So, the increment in broad money supply (time deposit component) is healthier than narrow money supply (currency and demand deposit components) for the Nepalese economy.

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