Effect of Money Supply on Inflation in Nepal: Empirical Evidence from ARDL Bounds Test

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ABSTRACT

This study explores the long-run and short-run relationship of money supply and inflation in the context of Nepal. Data are extracted from Economic Survey of Nepal since 1964/65 to 2018/19 to obtain the relationship. ARDL Bounds test is used for cointegration test where the dependent variable is inflation and money supply and Indian inflation are taken as independent variables to estimate the model. Result shows the long-run cointegration between the variables reveals long-run relationship and the error correction term is found to be negative (-0.98) and significant (p=0.02). The study suggests that policy makers can reduce the impact of money supply on inflation and should focus on the control of inflation adopting monetary and fiscal policy mechanism. Creeping inflation in the pace of economic growth is desirable and successful cure of inflation will help in stability and growth of the country.

Key words: ARDL Bounds test; cointegration; economy; inflation; money supply; price level; value of money

INTRODUCTION

Being a major part of macroeconomic issue in the present day world, effects of inflation are widespread and the impacts are far reaching that affect several macroeconomic variables such as saving, investment, income, real interest and real wage etc.(Choudhary, 2018). Inflation is persistence and regular increase in general price level and the value of money diminishes across the economy over time. Here weak purchasing power and lager the quantity is the reality that leads the condition of a lot of money chasing a few goods. Inflation is a substantial and continuing increase in the volume of money and credit relative to available goods, resulting in a substantial and continuing rise in the general price level(Webster's New Collegiate Dictionary,

1973ed.). As an important indicator in the economy indicating the reality of people to purchase goods and commodities it shows the strength of money as medium of exchange in the country. A continuous rise in price level is termed as inflation (Parkin & Bade, 2001).Inflation is typically a broad measure, such as the overall increase in prices or the increase in the cost of living in a country. Wages, salaries and allowances should be increased to maintain the standard of living but the fixed income groups and poor suffer a lot from the condition of inflation.

In Keynesian view inflation does not appear before full employment when it happens it is bottle neck or semi inflation because it starts only after full employment. In Monetarists' view it is purely a monetary phenomenon because it occurs due to excess money supply. The economy can be out of control in the trap of higher-inflation so even the developed countries are trying to keep it within the certain limit. Stability in price is desirable because the inflation or a rise in price level creates uncertainty in the economy, and that may hamper economic growth (Chimobi, 2010). Inflation is a monetary phenomenon and will be within the track from sound monetary and fiscal policy. Central Bank is liable for formulation and implementation of monetary policy in the country and the government controls fiscal policy. It is widely accepted that monetary policy can contribute to sustainable development in the country by maintaining price stability where contractionary and expansionary policies are the major tools of this policy. Reduction of inflation is the major objective of monetary policy and economic and financial situation of a country largely depends on it. Inflation is caused by regular increase in money supply in the country that leads the value of money to decrease. Here it is not the pure reason behind inflation but money supply growing faster than economic growth is the main cause of inflation. Accepted theory shows the inverse relationship between money supply and inflation where narrow money is defined as M1 and broad money M2. Mostly the economists believe that inflation is caused by excessive money supply and increase in credit in the economy.

Inflation in Nepal is within the range of -4 to 18% and when it will be higher it can hamper the growth of the country so it must be kept within its limit. Inflation can hamper the pace of economic development because there is significant positive relationship is found between inflation and economic growth (Adhikari, 2014). With economic development when there is inflation in the economy then it causes the standard of living costly and harm to poor and fixed income earning groups. The inflation should be within certain threshold limit of 6% and beyond this limit the economic growth can be jeopardized (Bhusal, 2012).Inflation in Nepal is at the border line and prevention is necessary to keep it within its limit and adverse consequences can be seen when it crosses the border line. One of the major causes of inflation in Nepal is fixed exchange rate with India. Being huge dependent on import with India, Nepalese inflation is highly caused by Indian inflation. It is always higher than Indian inflation (Choudhary, 2018).This inflation cannot be controlled by the isolate initiation so policy maker should focus on effective other measures. Inflation occurs with growth and it is necessary for the pace of growth because it can have positive impacts on various income earning groups. Inflation should be controlled carefully to keep it within certain limit for the sake of the growth of the country.

The objective of this paper is to study the relationship of money supply and inflation in the context of Nepal. ARDL Bounds test is applied to test the co-integration and Error Correction Model to find out short-run and long-run causality. Bounds test finds the long-run co-integration and Error Correction Model coefficient measures the whole system getting adjusted to long-run. ARDL model is also applied for short-run causality of independent variables.

Money supply is one of the major determinants of inflation and lots of developed and developing countries in the history and at present have to face the vast problem of inflation. Huge adverse consequences are seen because of higher inflation and must be controlled within its limit. So it should be studied for policy formulation and implication to keep it within boundary. Creeping inflation is acceptable in the pace of economic growth due to the positive impact on various income earning groups. Some economists believe that a low and stable inflation rate of 3 percent has a small cost in the economy (Mankiw, 2008).Nepal has been facing moderate rate of inflation as per given empirical data available.

This paper is divided into five sections- Introduction is included in section-1,section-2 includes Literature Review, Research Methodology and Data in section-3, Result is in section-4 and Conclusion and Discussion is included in section-5.

LITERATURE REVIEW

Various literatures related with inflation are reviewed where monetarist theory of inflation proposed by Milton Friedman and other structural theories by various economists are examined and Keynesian theory is also reviewed for this purpose.

According to Keynes (1936) inflation occurs after full employment when it occurs before it is bottleneck or semi-inflation. In developing countries the causes and cure of inflation have been dominated by politicians, policy credibility and political will. In past decades many countries tried these strategies for the control of inflation. Applying structure vector autoregression and vector error correction model Moriyama (2008) investigated the condition of inflation in Sudan and concluded that money supply expansion and the nominal exchange rate affected inflation in 18-24 months lag. The study of Almounsor (2010) in Yemen found that the dynamics of inflation has been influenced by its own dynamics of international prices, exchange rate and innovation. In the study Ahmad (1970) states that monetary expansion arising from government borrowing from banking system generates strong inflationary pressure in the country. In the research Khan et al. (2007) constructed econometric model to study inflation in Pakistan concluded that several factors including money supply play roles in macro-economy. Likewise the study of Vuyyuri & Sethaiah (2004) finds that budget deficit cause inflation in India. In the study by Ofori et al. (2017) explains that there is long run relationship between money supply and inflation in Ghana. They used Ordinary Least Square method to calculate the regression analysis. Likewise in Tanzania the study by Mbongo, Mutasa and Msigwa (2014) concluded that OLS and ECM result show that money supply and exchange rate have significant impact upon inflation in the short run and long run and VAR result shows that current inflation can be influenced by the past state inflation in Tanzania. In the next research study Simwaka et

al. (2012) in Malawi presents inflation is a result of both monetary and supply side factors. Exchange rate also play relatively more significant role in fuelling in cost- push inflation. In the work of Narayan et al. (2010) states that budget deficit and money supply are cointegrated with each other and the long run elasticity confirms that budget supply and money supply induce inflation in Fiji. In the paper Nguyen (2015) finds that broad money supply has significantly positive impact on inflation whereas budget deficit, interest and government expenditure are the determinants of inflation in the study. The study by Yasmin et al.(2013) in Pakistan found that government borrowing and money supply has a strong effect on inflation. The study is based on monthly data and Fully Modified Least Square is applied to calculate the result.

Various studies in different countries have shown that the different factors such as money supply, exchange rate, international price, budget deficit have the relationship with inflation in the country. In the study Chaudhary (2018) examined the determinants of inflation in Nepal where money supply, consumer price index, Indian prices and real GDP are taken as determinants significantly influencing inflation in Nepal and the conclusion is money supply and Indian prices cause inflation in the long-run. In the paper by Acharya (2019) found that there is bidirectional relationship between the real income and M1and M2 both but there is no evidence of short run causation between them. Again the study found the unidirectional long-run relationship runs from narrow money supply to consumer price but no long-run relationship between LNCPI and LNM2. So the dilemma is found in the results of various studies and this is an attempt to find out the real situation of the relationship from ARDL Bounds test and ECM model. Here the study is limited with the effect of money supply on inflation in Nepal.

THEORY AND CONCEPTUAL FRAMEWORK

Quantity Theory of Money shows the strong positive relationship between quantity of money and price-level and has inverse relationship between quantity of money and value of money. Milton Friedman (1989) expresses that a given change in quantity of money induces an equal change in the rate of price inflation. Increase in money supply in the country leads to decrease in value of money i.e. inflation and price level increases in this situation and inverse relationship between money supply and inflation can be clearly observed in the theory.

Keynesian inflation theory explains two types of inflation- Demand Pull Inflation and Cost Push Inflation. Money Supply, Government Expenditure, Export, Reduction in Taxation etc. causes demand pull inflation whereas Increase in Wages, Increase in Profit Margin, International Reasons, War etc. causes cost push inflation.
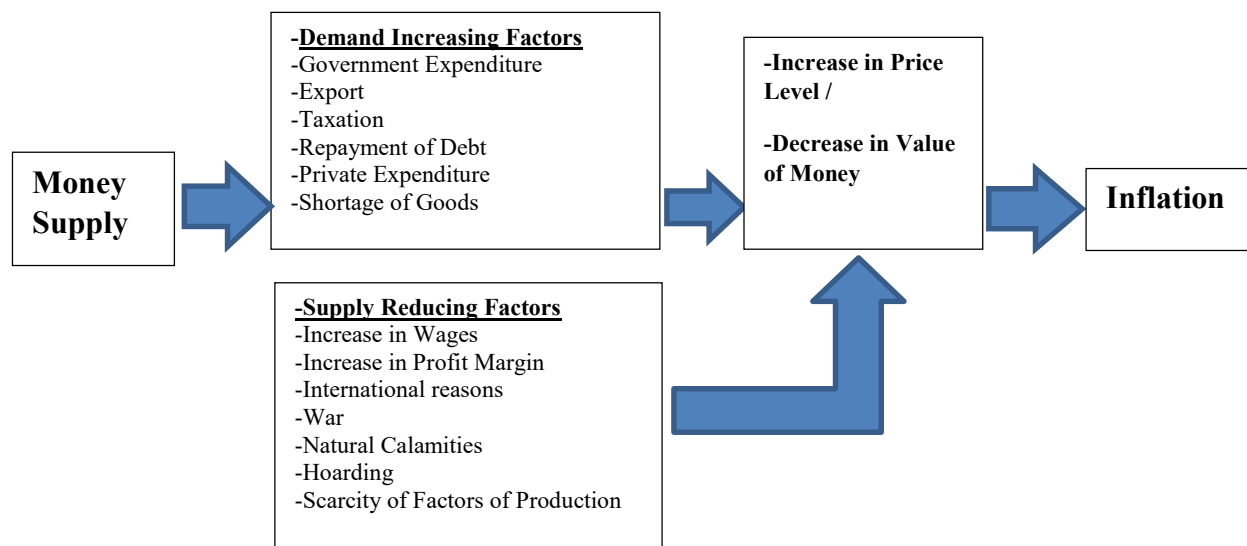
RESEARCH METHODOLOGY AND DATA

The study seeks to explore the relationship between CPI, M2 and ICPI that includes CPI as dependent variable whereas money supply and ICPI are independent variables to find out whether money supply impacts on inflation in Nepal. Data from Economic Survey of Nepal since 1964/65 to 2018/19 are taken for this purpose. ARDL model is applied for inferential analysis and the model can be expressed as:

The Model

In this study log of CPI is taken as dependent variable and log of money supply (M2) and log of Indian CPI (ICPI) are taken as independent variables for estimation. These variables are taken in numerous studies directly or indirectly affect the inflation in Nepal. The model for the study can be built as:

$$CPIt = f(\beta_0 + \beta_1 M2t + \beta_2 ICPIt + \varepsilon_t) \qquad (1)$$

Where CPI is inflation; f= function; M2= money Supply and ε= error term
The model can be written in regression form as:

$$CPIt = \beta_0 + \beta_1 M2t + \beta_2 ICPIt + \varepsilon_t \qquad (2)$$

Econometric Log Model

The prescribed model shows money supply and ICPI are the important variable to show the relationship with inflation. It is important to convert the model into log form to reduce heteroskedasticity. The log model can give appropriate coefficient of the elasticity for CPI against the independent variable M2 and ICPI. Then the log model is;

$$\ln CPIt = \beta_0 + \beta_1 \ln M2t + \beta_2 \ln ICPIt + \varepsilon_t \quad (3)$$

Testing for Unit Root

Augmented Dicky- Fuller test is applied to test the presence of unit root. It is assumed that the error terms may be correlated with each other that use the lagged values of the variable. The advantage to use this test is the ability to include enough terms so that the error term becomes uncorrelated. The model is:

$\Delta lnCPIt = \beta_1 + \beta_2 t + \delta lnCPIt\text{-}1 + \sum_{i=1}^{p} \alpha i \Delta lnCPI\, t\text{-}1$
Where, t is a trend and $\Delta lnCPIt = lnCPIt\text{-}1 - lnCPIt\text{-}2$

ARDL model of cointegration by Pesaran and Shin (1999) is used for inferential analysis instead of Engle-Granger and Johansen cointegration model. In the case of some variable I(0) and some in I(1) the model is best fit model. ARDL model overcome the restriction of multivariate analysis. Wald test is conducted for long-run association ship and unrestricted error correction model (ECM) as the following.

Testing for Cointegration (ARDL) Model

$\Delta lnCPIt = \alpha_0 + \sum_{i=1}^{p} \alpha 1i \Delta lnCPI\, t - 1 + \sum_{i=1}^{q} \alpha 2i \Delta lnM2t - 1 + \sum_{i=1}^{r} \alpha 3i \Delta lnICPI\, t - 1 + b$

$\beta_1 lnCPIt\text{-}1 + b\ \beta_2 lnM2t\text{-}1 + b\ \beta_3 lnICPIt\text{-}1\ \varepsilon_{1t}$

Error correction model specification

$\Delta lnCPIt = \alpha_{01} + \sum_{i=1}^{p} \alpha 1i \Delta lnCPI\, t - 1 + \sum_{i=1}^{q} \alpha 2i \Delta lnM2t - 1 + \sum_{i=1}^{r} \alpha 3i \Delta lnICPI\, t - 1 + \lambda ECTt\text{-}1 + \varepsilon_t$ Where: Δ is difference operator; $\alpha 1i$ and $\alpha 2i$ are short-run coefficients; λ is long-run error correction coefficient and ε_t is error disturbance term. To examine the long-run relationship exists between CPI, M2 and ICPI Bound test proposed by Pesaran and Shin (1999) is carried out.

RESULTS

In this section results from the study is presented where the model contains inflation (CPI) is dependent variable and money supply (M2) and ICPI as independent variables. Using time series data since 1964/65 to 2018/19 a certain relationship can be obtained between them. Result is presented using ARDL Bounds test and ECM test shows the long-run cointegration between money supply and inflation that means money supply significantly impact on inflation in Nepal.
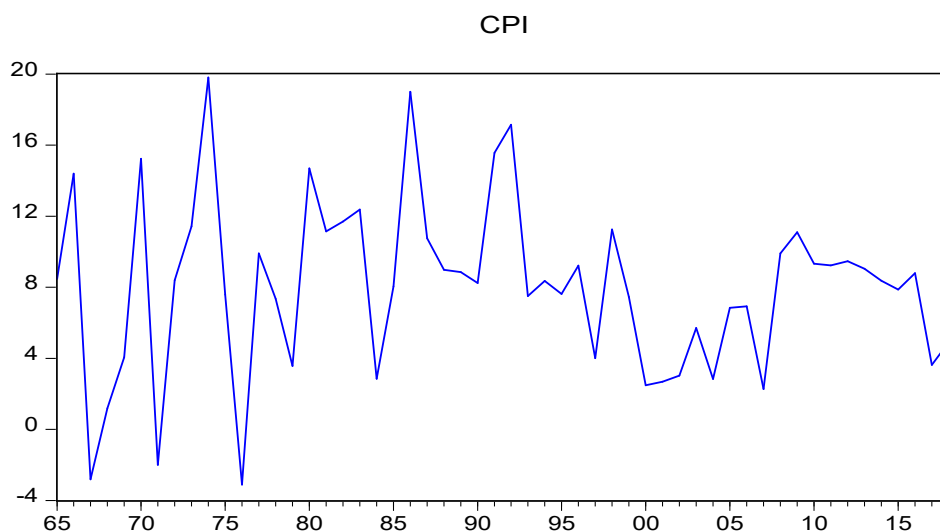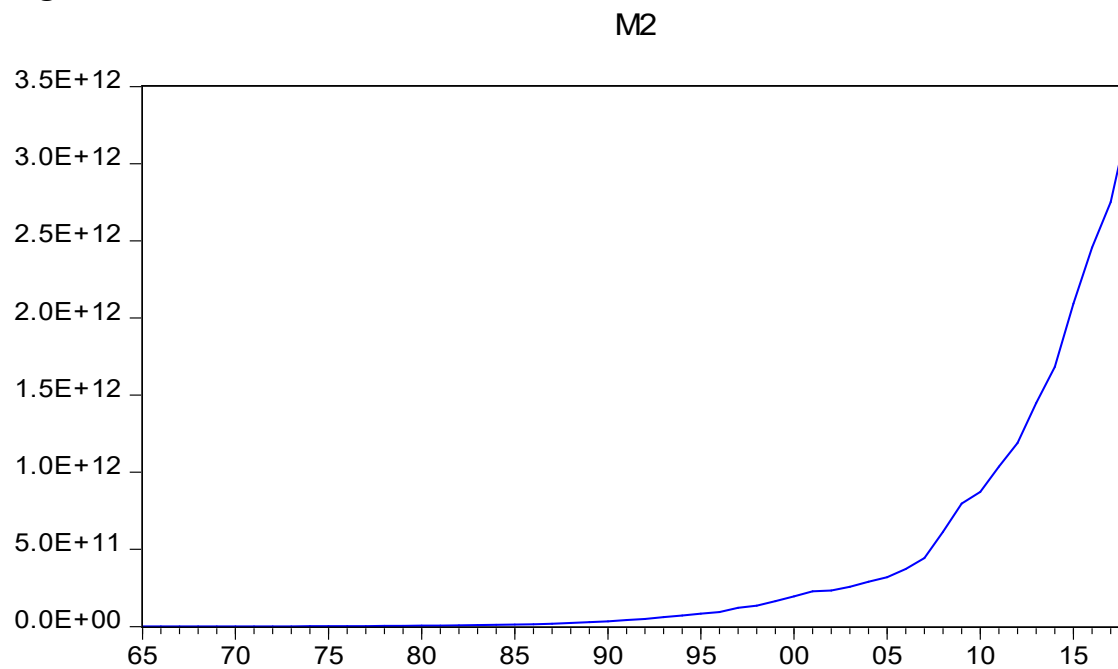
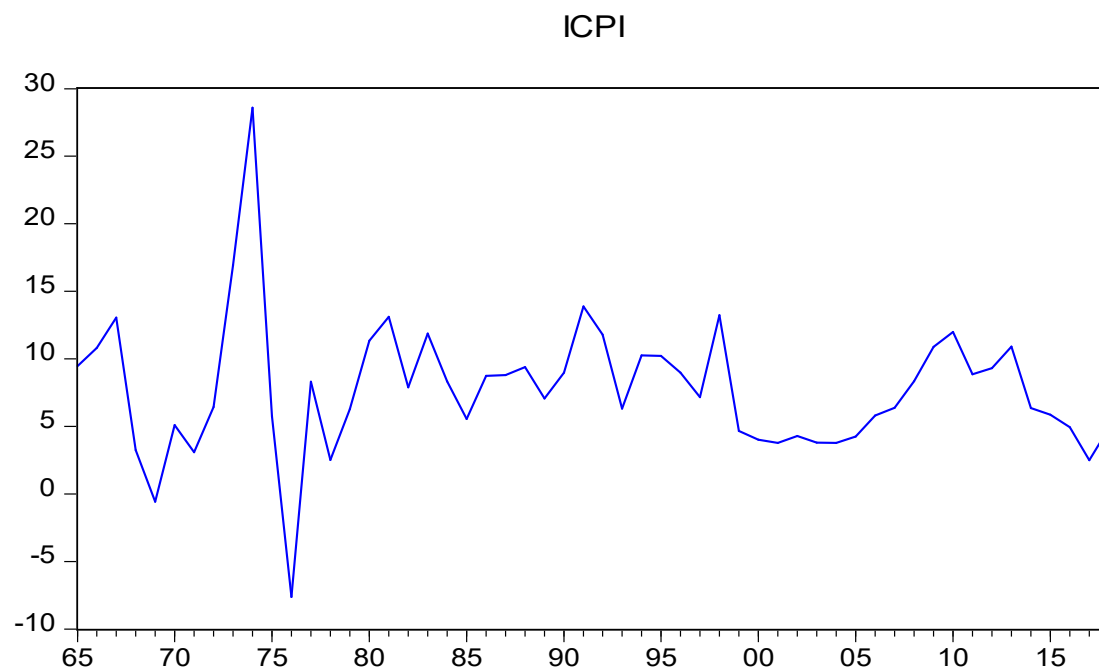**Figure-1:** CPI

Figure 2: M2

Figure 3: ICPI

The time series data of CPI and M2 are plotted in the figures and shown below. Fluctuation is seen in CPI and ICPI whereas upward trend in M2 can be obtained. CPI and ICPI show stationary nature whereas money supply data has no stationary trend.

Results for Unit Root Tests
Unit Root Tests

Null Hypothesis: LNCPI has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.482873	0.0000
Test critical values:	1% level	-3.577723	
	5% level	-2.925169	
	10% level	-2.600658	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNM2 has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.308281	0.9766
Test critical values:	1% level	-3.560019	
	5% level	-2.917650	
	10% level	-2.596689	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNM2) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.118283	0.0000
Test critical values:	1% level	-3.562669	
	5% level	-2.918778	
	10% level	-2.597285	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNICPI has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.125179	0.0021
Test critical values:	1% level	-3.571310	
	5% level	-2.922449	
	10% level	-2.599224	

*MacKinnon (1996) one-sided p-values.

Table 1 presents the findings of unit root test using Augmented Dicky Fuller Test (ADF) consisting CPI and ICPI show stationary in the level I(0) and M2 shows stationary at first difference conforming the importance of transforming variables into stationary in order to avoid the spurious regression effect. Computed t-statistics LNCPI (-5.482873),DLNM2 (-7.118283) and LNICPI (-4.125179) are less than critical values at 1%, 5% and10% level of significance. All variables are transformed into stationary in table 1.

Cointegration Test (ARDL Bounds Test)

Cointegration explains the long-run relationship between the variables in the model. Here CPI is dependent and M2 and ICPI independent variables where CPI shows stationary at level I(0); M2 is stationary at first difference I(1) and ICPI is stationary at level I(0). ARDL Bounds Test is applied for cointegration testing that shows long run relationship between the variables under study.

Table 2

Dependent Variable: D(LNCPI)
Method: Least Squares
Date: 07/01/20   Time: 14:16
Sample (adjusted): 1975 2018
Included observations: 40 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.692977	0.661883	1.046979	0.3035
D(LNCPI(-1))	-0.116923	0.289336	-0.404107	0.6890
D(LNCPI(-2))	-0.233055	0.196193	-1.187885	0.2442
D(LNM2(-1))	2.488685	1.693653	1.469418	0.1521
D(LNM2(-2))	0.106598	1.920587	0.055503	0.9561
D(LNICPI(-1))	0.160681	0.342951	0.468526	0.6428
D(LNICPI(-2))	0.185752	0.279686	0.664145	0.5117
LNCPI(-1)	-0.924287	0.402805	-2.294625	0.0289
LNM2(-1)	-0.028281	0.050487	-0.560168	0.5795
LNICPI(-1)	0.261673	0.423929	0.617255	0.5417

R-squared	0.538410	Mean dependent var		-0.006968
Adjusted R-squared	0.399933	S.D. dependent var		0.292270
S.E. of regression	0.226404	Akaike info criterion		0.079325
Sum squared resid	1.537761	Schwarz criterion		0.501545
Log likelihood	8.413500	Hannan-Quinn criter.		0.231986
F-statistic	3.888078	Durbin-Watson stat		1.837637
Prob(F-statistic)	0.002330			

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	2.568368	(3, 30)	0.0729

Chi-square	7.705104	3	0.0525

Null Hypothesis: C(8)=C(9)=C(10)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(8)	-0.924287	0.402805
C(9)	-0.028281	0.050487
C(10)	0.261673	0.423929

Restrictions are linear in coefficients.

In table 2 F-statistics of dependent variable is calculated from ARDL Bounds testing. This approach involves comparison of F-statistics calculated in the model against critical value. The result of the table using Wald test shows probability of F-statistics is significant i.e. value of F-statistic 2.568368 is greater than Pesaran critical value at 10% level of significance. It denotes the null hypothesis is rejected and acceptance of alternative hypothesis that there is cointegration between the variables. This is the evidence of long-run relationship between money supply, ICPI and inflation.

The study is also focused on short-run impact of money supply on inflation and error-correction model. Using error-correction model short-run causality and speed of adjustment are also measured to long-run equilibrium. A negative and statistically significant coefficient shows the speed of adjustment and existence of cointegration.

Table 3
Dependent Variable: D(LNCPI)
Method: Least Squares
Date: 06/18/20   Time: 06:10
Sample (adjusted): 1975 2018
Included observations: 40 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.074471	0.166856	-0.446321	0.6584
D(LNCPI(-1))	-0.116931	0.287038	-0.407373	0.6864
D(LNCPI(-2))	-0.233957	0.193981	-1.206087	0.2366
D(LNM2(-1))	1.860119	1.618720	1.149130	0.2590
D(LNM2(-2))	-1.044201	1.690803	-0.617577	0.5412
D(LNICPI(-1))	-0.011386	0.310923	-0.036622	0.9710
D(LNICPI(-2))	0.022268	0.243588	0.091417	0.9277
ECT(-1)	-0.978113	0.399154	-2.450464	0.0199
R-squared	0.511519	Mean dependent var		-0.006968

Adjusted R-squared	0.404664	S.D. dependent var	0.292270
S.E. of regression	0.225509	Akaike info criterion	0.035947
Sum squared resid	1.627345	Schwarz criterion	0.373723
Log likelihood	7.281056	Hannan-Quinn criter.	0.158076
F-statistic	4.787035	Durbin-Watson stat	1.792265
Prob(F-statistic)	0.000903		

The result of error-correction model in the table 3 shows negative and significant coefficient signifies the short-run disequilibrium adjusts by 97% towards long-run equilibrium. The model consists of no short run causality of M2 and no serial correlation but stability exists in the model. The model is also normally distributed and the CUSUM and CUSUM of square test in figures 2 show the estimation is stable as the residuals are within the critical bounds at 5% level of significance

Figure 2
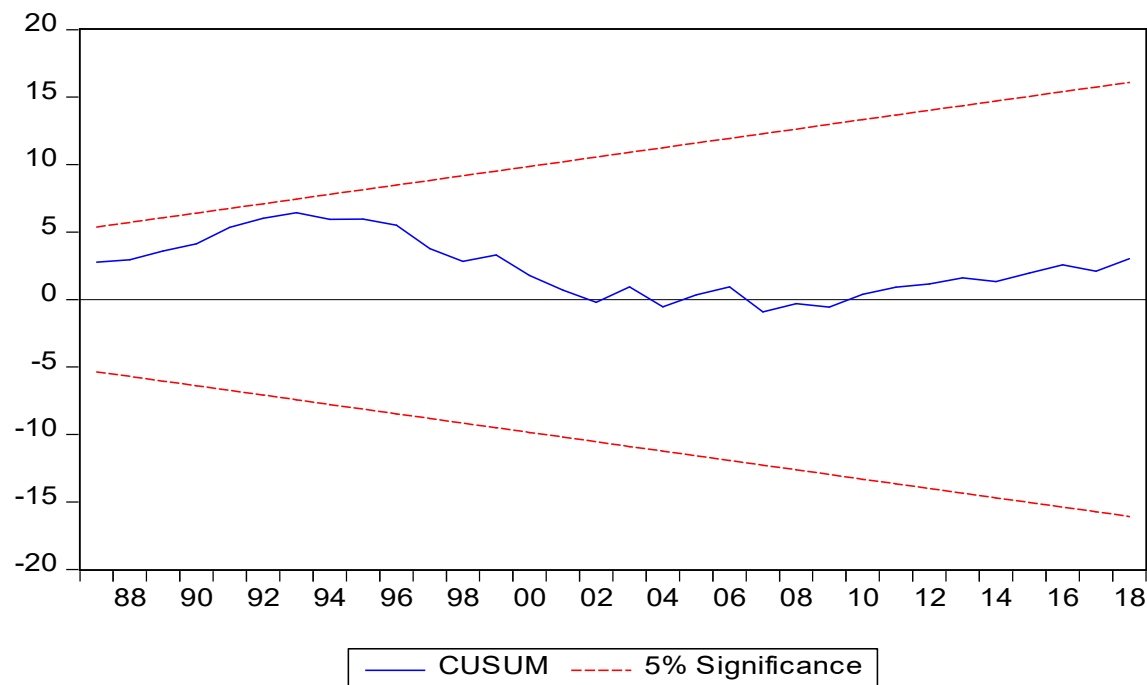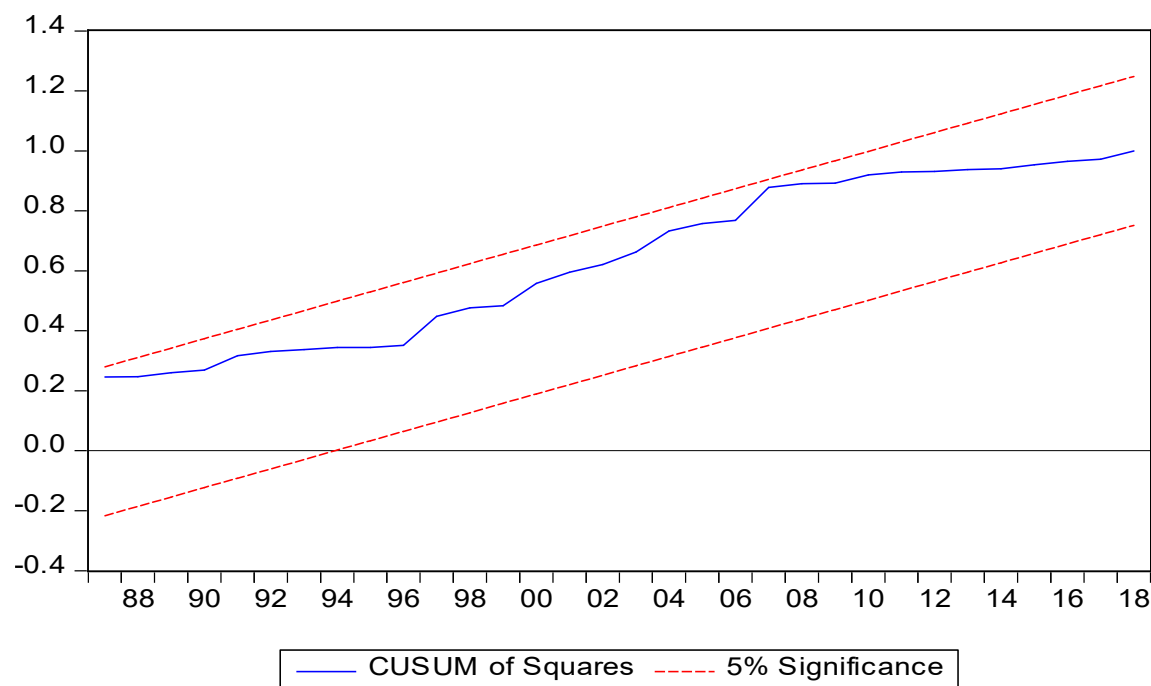
CONCLUSION AND DISCUSSION

The main objective of this study is to find out the relationship between money supply and inflation from the data of the economic survey of Nepal. Money supply is one of the major determinants of inflation and the study helps to examine whether money supply effect on inflation in the context of Nepal. ARDL Bound test result rejects null hypothesis concluding there is significant long-run relationship between money supply and inflation confirms the Monetarist theory of inflation that increase in money supply cause inflation.   On the base of the result the policy makers can reduce the impact of money supply on inflation and Central Bank is the independent body to check inflation through monetary policies. Expansionary and contractionary policies are the major monetary policies adopted by Central Bank that help to keep the inflation in the right track. Low level of creeping inflation is acceptable for the growth of the country because it can improve the level of various income earning groups (Mankiw, 2008). So it is desirable to keep the inflation within the control for the sake of the betterment of the economy.

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