The Relationship Among the Inflation, Broad Money and Economic Growth: Evidence from Nepal

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Abstract

This paper intends to study the relationship among the inflation, broad money(M2)and economic growth during 2031-2075B.S. by using time series econometric tools. The stationary of all variable have been examined to determine the order of integration, for this ADF test has been applied. Variables are found to be stationary at level (0) and first I(1) difference. Johnsen Co-integration and vector error correction model (VECM) have been applied to show the relation among the variables and residuals diagnostic tools (serial LM test, Heteroscedasticity test and normal distribution test) have also tested to make estimation free of spurious. The study has shown there is long run association among inflation, broad money and economic growth in Nepal.

Key words: Broad money (M2), ADF, Co-integration, VECM, Heteroscedasticity.

I. Introduction

Central banks, nowadays, are concerned about the rate of inflation because of the realization that inflation is costly, and businesses and households perform poorly when inflation is high and unpredictable. When households and businesses perform poorly, it will have an adverse effect on the sustained economic growth of the country. In addition, the uncertainty related to a high and volatile unanticipated inflation has been found to be one of the main determinants of the rate of return of capital, investment and economic growth. Inflation is also found to have investment effect through human capital and R&D. Despite large volume of recent literature on economic growth, little has been done to integrate monetary factors in the explanation of the growth process. Some scholars point out that the postulation of 'monetary neutrality' is the reason behind 'real' treatment of most of the growth models which overshadowed the monetary aspect of it. When it comes to developing economies, like Nepal, economic growth dominates the scholarly debate. No doubt, poverty reduction, employment creation, proper utilization of natural resources etc. are only possible through sustained economic growth. Recent studies have shown that developing countries are equally vulnerable to erratic inflation rate and if not seriously taken into considerations, might cost economic growth and poverty reduction goals. High and persistent inflation and low economic growth--at the same time-- have been major characteristics of Nepalese economy in recent years. In the last five years, the average inflation rate was about 8.5 percent, which was higher than the projected inflation by 1.3 percentage point. Inter-country comparison of inflation in the South Asian Association for Regional Cooperation (SAARC) countries shows that Nepal has the highest rate of inflation except Bhutan and Pakistan coupled with low economic growth. The average annual economic growth rate for last five years was 3.4 percent. Nepal maintains a pegged exchange rate regime with India, and around two-thirds of its total trade takes place with

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India. Thus, Nepal's inflation is significantly influenced by inflation in India. Several empirical studies have shown that Nepal's inflation is largely determined by Indian inflation. In this context, the sustainability of the peg crucially depends on keeping the inflation rate close to that of India. The main reason behind conducting this research is to analyze the relationship among inflation, broad money and economic growth. So, the research objective is to examine whether there exists relationship among inflation, broad money (M2) and economic growth;

II. Theoretical Framework

Behera, (2014), examined that the impact of inflation on economic growth and established the existence of inflation growth relationship in the context of South Asian countries. In order to examine the impact of inflation on economic growth, the study has used the time series data for the period 1980-2012. The study found that there is high positive correlation exist between inflation and economic growth for all the countries. The co-integration result suggest that there is long run relationship exist for Malaysia. However, the rest of the countries have no long run relationship between inflation and economic growth. In order to know the short run dynamics and direction of causality the study used Error Correction and Granger causality test. The study also employed unidirectional VAR analysis to know the short run dynamics between inflation and economic growth. Bittencourt, (2012), analyzed the existence of a threshold level of inflation and how any such level affects the growth of Indian economy. The article also examined the dynamic short-run and long-run relationship between inflation and economic growth in India. By employing regression method to estimate the threshold level of inflation and the long-run and short-run relationships, the results show a statistically significant structural break in the relationship between inflation and economic growth. Fakhri, (2011) suggested that if inflation exceeds the threshold point, it will negatively affect economic growth. The autoregressive distributed lag (ARDL) model bound testing co-integration suggests that there are two co-integration vectors when gross domestic product and rate of interest are considered as the dependent variables. This result confirms the existence of the long-run equilibrium relationship between economic growth, inflation, exchange rate and rate of interest. From the long-run analysis, the study found that inflation is positively related to economic growth, whereas the other variables are not significant.

Mario Švigir, (2016) found that the relationship between economic growth and inflation in Italy and Austria, countries featured by long-term low inflation. Econometric comparative analysis conducted for Italy and Austria for period between 1980 and 2016 showed that low inflation is important but not sufficient factor for economic growth. Xiao, (2009) employed co-integration and error correction models accompanying with correlation matrix and the Granger Causality Test to examine the inflation-economic growth relationship. The data is annual time series from 1978 to 2007 of China. The results show that in the long run inflation positively relate to economic growth in bi-direction. China would pay attention to price level when develops economy. Besides, high speed increase of investment would cause inflation in the short run. Najaf (2017) analyzed the impact of money supply on economic growth in all the developing and under developing countries. The researcher has applied the regression analysis and taken the time series data. Our results are showing that there positive relationship between money supply and rate of GDP from last 30 years. Kasidi & Mwakanemela, (2013) used time series data for the period 1990 -2011 to examine the impact of inflation on economic growth. Correlation coefficient and co-integration technique established the relationship between inflation and GDP and Coefficient of elasticity were applied to measure the degree of responsiveness of change in GDP to changes in general price levels. Results suggest that inflation has a negative impact on economic growth. The study also revealed that there was no co-integration between inflation and economic growth during the period of study. No long-run relationship between inflation and economic growth in Tanzania. Vinayagathasan, (2013) investigated the existence of a threshold level for inflation and how any such level affects the

growth of Asian economies. Analyst has used dynamic panel threshold growth regression, which allowed us to work with fixed effect and endogeneity issues and observed a nonlinear relationship between inflation and economic growth for 32 Asian countries over the period 1980–2009. Different estimation methods determined that the effect of inflation on growth is robust. The findings may be useful to central banks as a guide for inflation targeting.

III. Research Methodology

In this study GDP is the dependent variable and inflation and broad money (M2) are the independent variables. The analysis used in this study cover annual time series of 2031/32 to 2074/75 (or 45 observations) of Nepal. Data have been taken from Economic survey published by ministry of Finance. To establish the relationship between independent and dependent variables economic growth function is used which is like this:

GDP = f (Inflation, Broad money)

The function can also be represented in a log-linear econometric format thus:

Log GDP = β0 + β1 log (IN)t + β2log (M2)t + et

Where, GDP= Gross domestic price

β0 = Intercept

β1= coefficient of variable IN (inflation)

β2 = coefficient of variable M2 (broad money)

et = Error term

The random error term assumed to be normally, identically and independently distributed.

IV. Results and Conclusion

Unit Root Test

Stationary is an essential test for time series data and a time series data is said to be stationary if it has invariant mean and variance. This test will examine the order of integration of the data and eradicate the problem of spurious regression. Augmented Dickey- Fuller test has been applied to test stationary of the data as suggested by Dickey and Fuller (1979).

$$\Delta Y_t = \alpha_0 + \alpha_1 t + \gamma Y_{t-1} + \sum_{j=1}^{\rho} \delta_j \Delta Y_{t-j} + \varepsilon_t$$

Null hypothesis (H0) = Variables is not stationary.

Alt. hypothesis (H1) = Variable is stationary.

Table1:

Unit Root Test Result by ADF Procedure.

Variables	At level	At first difference	Conclusion
Ln GDP	-1.9114 (0.6317)	-6.6001 (0.000)	I(1)
Ln IN	-4.8805 (0.0015)	-8.3649 (0.000)	I (0)
Ln M2	-2.1873 (0.4840)	-4.5434 (0.0090)	I(1)

(Numbers in the parenthesis are probability values).   *Source: Author calculation.*

Gross domestic product (GDP), inflation (IN) and broad money (M2) are tested by Augmented Dickey Fuller test to find the variables are stationary or not. In case of level one variable i.e. inflation is stationary because P-value is less than 5%. Similarly at first difference only other variable significant because their p-value is less than 5%. If the variables are significant at first and second difference at that time co integration test is applied to find the relation. Result of model is presented in following figure.

The Johansen Co- integration Test:

Test of co-integration is performed to know if there is long run relationship between inflation and economic growth in Nepal. Co-integration analysis helps to identify long-run relationship or association among the variables. When two series has the same stochastic trend, they are said to be co-integrated. Johansen Co-integration (1988) test depends on his Maximum Likelihood (ML) estimator of the parameters of the following VEC model of two co-integrating variables. Co-integration analysis helps to identify long-run economic relationships between the variables. We then use the FPE: Final prediction error, AIC: Akaike information criterion, SC: Schwarz information criterion and the HQ: Hannan-Quinn information criterion to determine the number of lags in the co-integration test (order of VAR) and then use the trace and maximal eigenvalue tests to determine the number of co-integrating vectors present. We then estimate the Vector Error Correction Model (VECM) for all the endogenous variables in the model. Johansen-Juselius (1990)

$$\Delta X_t = \sum_{i=1}^{p-1} \mu_i \, \Delta X_{t-i} + \omega X_{t-1} + \varepsilon_t$$

Table 2: The Johansen Co- integration Test:

Hypothesized no of CEs	Trace Value		Max-Eigen statistic	
	Statistic	Critical Value	Statistic	Critical value
None *	38.9568	29.7970	31.4978	21.1316
At most one	7.4596	15.4947	7.1394	14.2646
At most two	0.3202	3.8414	3.8414	3.8414

*denotes the rejection of the hypothesis.

Trace and Max- Eigen test indicate 1 co-integrating equation at the 0.05 level. All these three variables are co-integrated. If the variables are found integrated at first difference, vector error correction model (VECM) is run.

If the variables are co-integrated or have a long-run association, we can run VECM model. The VECM model can be specified as:

ΔLGDP= β0ect (-1) + β1 ΔY (t-1) + β2ΔLGDP (t-2) + β1 ΔLIN (t-1) + β2 ΔLIN (t-2) + β1 ΔLM2 (t-1) + β2 ΔLM2 (t-2) ………………………….(i)

Regression Equations:

Δ(GDP)t = -0.0536 ect(t-1) – 0.1823 Δ LGDP(t-1) – 0.1106 ΔLGDP(t-2) – 0.0234 ΔLIN(t-1) – 0.0551 ΔLIN(t-2) + 0.3756 ΔLM2 (t-1) + 0.0010 ΔLM2(t-2) + 0.0963………….(i)

Δ(LIN)t = 0.6734 ect(t-1) – 1.0602 Δ LGDP(t-1) + 0.8743 ΔLGDP(t-2) + 0.0104 ΔLIN(t-1) – 0.2161 ΔLIN(t-2) + 3.9797 ΔLM2 (t-1) - 0.7862 ΔLM2(t-2) – 0.4717……………(ii)

$\Delta(LM2)t = -0.0133 \text{ ect}(t-1) + 0.0292 \Delta LGDP(t-1) - 0.0193 \Delta LGDP(t-2) + 0.0077 \Delta LIN(t-1) + 0.0032 \Delta LIN(t-2) + 0.2320 \Delta LM2(t-1) + 0.7578 \Delta LM2(t-2) + 0.0114 \dots\dots\dots\dots(ii)$

Cointegration equations, ect (t-1) = 1.000 LGDP (t-1) – 0.8936 Lin (t-1) – 0.7808LM2(t-1) – 1.1431

Table 3: Vector Error Correction Model Results

Items	Coefficient	St.error	T-statistic	P-value
C1	-0.05366	0.02265	-2.3693	0.0238
R-sq. = 0.51083	A-R sq= 0.4070	F. stat= 4.923(0.0006)		DW stat: 1.8081

(Numbers in the parenthesis are probability values).   *Source: Author calculation.*

In Table No: 3, the coefficients of the first row indicate the long run relationship among variable considered. The value -0.05366 indicate that Real GDP is affected by inflation (IN) and broad money supply (M2). The negative sign implies the relationship is heading toward equilibrium in the long run. And, this relationship is statistically significant, since, the P-value in the corresponding the coefficient isless than 0.05 level of significance. R square is 51.08% which indicates that both IN and M2 jointly explained GDP to 51.08%. P value of F stat is less than 0.05 so the overall model is fit and D-W test value is greater than R- square, so the regression model is free from spurious.

Table 4: Residual dignosis

Particulars	F-stat	Observed R- square	P-value
BG serial correlation LM test	1.5745	3.7808	0.1510
Heteroscedasticity BPG test	1.2324	10.8043 0.2894	
Normality JB test	-	-	0.7481

In table 4, B-G serial LM test depicts that the residuals are free from serial correlations as p-value of observed R-square is 0.1510 which is more than 5% level of significance. Similarly, BPG test shows that the residuals are homoscedastic where p-value of observed R square i.e. 0.2894 is greater than 5% level of significance. Finally, JB test also shows the residuals are normally distributed where p-value i.e. 0.7481 is also than 5% level of significance.

IV. Conclusion:

The main result as equation of this paper confirms that there is long run association of inflation and broad money in achieving high economic growth. A clear and long-run relationship between inflation and economic growth stipulates policymakers not to rule out the influence of inflation and money supply while formulating growth boosting plans and policies. Naturally, development discourses in the developing countries like Nepal is largely dominated by growth rather than stability. But, present study argues that stability, mostly defined by inflation, is equally important for the sustained economic growth.

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