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Whether Inflation Hampers Economic Growth in Nepal

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Abstract: *Present paper seeks to examine whether inflation hampers economic growth in Nepal or not with the help of Distributed Lag Models using the annual data of GDP and Consumer Price Index (CPI). The nominal GDP is converted into real terms and transformed into logarithmic form and the first difference of the real GDP in logarithmic form is taken as the proxy for economic growth. The CPI data is converted into logarithmic form and its first difference is taken as the proxy for inflation. While using the distributed lag models, the economic growth of Nepal at current time is adversely affected by inflation of the same time, whereas the current economic growth is favorably affected by the inflation of preceding time. The estimated regression of economic growth on inflation up to lag one is found to be robust and stable as indicated by residuals diagnostic test (serial correlation, heteroscedasticity and normality tests) and Ramsey's RESET test. The findings of the study throw light in policy point of view. The present study suggests that the rate of inflation would automatically be adjusted with increasing output if rate of investment in increased.*

JEL classification: *E31, E58*
Key Words: *Inflation, Economic Growth, Distributed Lag Models, Stability of Regression*

I. Introduction

There is a great debate among the economists and policy makers whether inflation hampers the economic growth or not. Some economists opine that inflation is necessary in the economy to attain high economic growth. For example, the Keynesian model advocates that there exists a positive relationship between inflation and output. However, Keynesian model concludes that inflation itself is not the growth-enhancing force. The rising aggregate demand may result positive relationship between inflation and economic growth in the short run but the growth will not be sustainable in the long run.

According to Mundell (1965) and Tobin (1965), there is a positive relationship between inflation and capital accumulation. This positive relation brings the positive impact on the economic growth. Mundell-Tobin views that moderate inflation would induce savers to substitute lending for some money holding as a means to finance future spending. That substitution would cause market clearing real interest rates to fall. The lower real rate of interest would induce more borrowing to finance investment. In a similar vein, Nobel laureate James Tobin noted that such inflation would cause businesses to substitute investment in physical capital (plant, equipment, and inventories) for money balances in their asset portfolios. That substitution would mean choosing the making of investments with lower rates of real return. The rates of return are lower because the investments with higher rates of return were already being made before. The two related effects are known as the Mundell-Tobin effect. Unless the economy is already overinvesting according to models of economic growth theory, that extra investment resulting from the effect would be seen as positive.

Besides some positive impact of inflation, a number of studies show the negative influence of inflation on macroeconomic activities. High rate of inflation brings uncertainties in the economy, due to which the investors are afraid of investing on capital goods. Rather they want to purchase the interest bearing certificates like bond and stock. When rate of investment in the economy falls, the real output decreases causing low economic growth. Inflation has a negative impact on the economy, through its costs on welfare. Thus, the most relevant costs associated with unanticipated inflation are: the distributive effects from creditors to debtors; increasing uncertainty affecting consumption, savings, borrowing and investment decisions; and distortions on relative prices (Briault, 1995).

Nepal is bearing high rate of inflation in the current time despite the efforts of central bank and government. According to Nepal Rastra Bank (2013), annual average inflation based on consumer price index was estimated at 9.9 percent in 2012/13 compared to 8.3 percent in the previous year. Point-to-point inflation as of mid-June 2013 came down to 8.2 percent after declining continuously for last three months. During the review period, the y-o-y price index of food and beverage group increased by 7.7 percent, whereas non-food and services group increased by 8.6 percent. These indices of both groups had increased by 9.9 percent in the corresponding period of the previous year. Additional pressure on inflation emerged as a result of a number of

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factors such as decline in food production due to unfavorable weather, weak supply situation, energy crisis, devaluation of Nepalese currency with convertible foreign currencies, increase in the price of petroleum products and Indian inflation.

The economy of Nepal is bearing the problem of nearly double digit inflation with very low economic growth rate. According to NRB (2013), as a result of subsistence nature of agriculture sector which contributes one-third to GDP and other economic and non-economic constraints, economic growth of Nepal is very slow. The real GDP in FY 2012/13 grew by 3.6% only at basic price, where as the growth rate of real GDP was 4.5 percent in the previous FY 2011/12. In the FY 2013/14, the economic growth of Nepal is expected to be 5 percent.

Now, the question arises that Nepalese inflation is really harmful in the point view of economic growth or this inflation has the significant role in promoting economic growth. The answer of this question can be given only after the verification using the real data associated with inflation and economic growth. By verification, if it is found that the inflation has negative impact on economic growth, the government of Nepal should immediately give attention to control high rate of inflation. Contrary to this, if Nepalese inflation is found causing the economic growth positively, the policy makers and government should not be worry about inflation. Rather emphasis should be given on other factors such as hydropower generation, industrial development, development of infrastructure, trade and tourism; and enhancement development of new technology to achieve high economic growth.

The rest of the paper is divided as: section two is devoted to review of past studies associated with the impact of inflation on economic growth. Section three traces the description of data and methodological issues; section four is devoted to analysis and discussion of results and section five endeavors the conclusion and policy implications of the present study.

II. Literature Review

A number of studies regarding the relationship between inflation and economic growth are available in the economic literature. Some of the studies have shown that there is a significant role of inflation to economic growth; where as some studies have concluded that inflation has the adverse impact on the economic growth; and some studies have shown that there is no any trade off between inflation and economic growth. This section includes findings and conclusions of some of the key studies regarding the empirical study of inflation and economic growth of different countries.

Thirwal and Barton (1971) report a positive relationship between inflation of below 8 percent per annum and economic growth with unadjusted for population change. Jayathileke and Rathnayake (2013) conclude that inflation will not have negative impact on the economy for the countries with stable high economic growth and stable macroeconomic condition, but countries with no macroeconomic stability suffer from inflation.

Barro (1995) uncovers the adverse relationship between growth and inflation rate significantly with the help of other helping variables, i.e. education, fertility rate, etc. Results of the study point out that 10 percent increase in inflation annually decrease the real GDP by 0.2 to 0.3 percent. On the other hand, Bruno and Easterly (1998) claims that there is no string proof of any reliable relationship between growth and inflation rate for a specific level of inflation rate. Inflation above 40 percentage influence growth bitterly but recovers after inflation comes down below 40 percent. A temporal negative association is observed between these two variables ahead of 40 percent threshold level of inflation rate.

Sarel (1996) used panel data of 87 countries covering the period 1970-1990 and tested for the existence of a threshold effect between inflation and growth; he found evidence of a structural breakpoint at an annual inflation rate of 8%. Below that rate, inflation does not have a significant effect on economic growth, or it may even show a marginally positive impact; above that level, the effect is negative, statistically significant and very strong. Ignoring the existence of the threshold would substantially bias the impact of inflation on growth.

Ghosh and Phillips, (1998) maintain that while there is no doubt about the fact that high inflation is bad for growth, there is less agreement about the effect of moderate inflation. Using panel regressions which allowed for nonlinearity specification, they found a statistically and economically significant inverse relationship between inflation and economic growth which holds robustly at all but the least inflation rates. They concluded that short-run growth costs of disinflation are only relevant for the most severe disinflations or when the initial inflation rate is well within the single-digit range.

Khan and Senhadji (2000, 2001) investigated the inflation-growth interaction separately for both developing and industrial countries applying the threshold panel data estimation technique originally developed by Hansen (1996 ,1999, 2000). They used a panel data set of 140 countries covering the period 1960-1998. Their findings strongly suggested the existence of a threshold level beyond which inflation exerts a negative effect on output growth. The threshold level was respectively 1-3% for industrial countries and 11-12 % for developing countries. The negative and significant relationship between inflation and growth above the

threshold level was quite robust with respect to the estimation method and different specifications. The results clearly suggested that the threshold level is lower for industrialized countries than it is for developing countries.

Hasanov, (2010) employed annual data set on growth rate of real GDP, Consumer Price Index Inflation and growth rate of real Gross Fixed Capital Formation to investigate whether there was any threshold effect of inflation on economic growth over the period of 2001-2009. Estimated threshold model indicated that there was non-linear relationship between inflation and economic growth in the Azerbaijani economy and threshold level of inflation for GDP growth was 13 percent. Inflation rate lower than 13 percent reflected statistically significant positive effect on GDP growth but this positive relationship became negative when inflation exceeded 13 percent. He added that, economic growth was expected to decline by about 3 percent when inflation increased above the 13 percent threshold.

III. Research Methodology

Present paper seeks to analyze the impact of inflation on economic growth of Nepalese economy by the methodology of distributed lag models by employing the annual data sets of GDP and consumer price index during the period 1975-2012. The CPIs are transformed into logarithmic form and the first difference of LnCPI, represented as P_t is the proxy for inflation. The nominal GDP are converted into real term taking 2005/06 as the base year and the real GDP is transformed into the logarithmic form and its first difference, represented by Y_t is the proxy for economic growth of Nepalese economy.

The econometric methodology, distributed lag model applied in the present study has been outlined below.

The economic variable Y is affected by not only the value of X at the same time t but by its lagged values plus some disturbance term i.e.$X_t, X_{t-1}, X_{t-2} \ldots\ldots, X_{t-k}, \varepsilon_t$.This can be written in the functional form as:

$$Y_t = f(X_t, X_{t-1}, X_{t-2} \ldots\ldots, X_{t-k}, \varepsilon_t)$$

In linear form

$$Y_t = \alpha + \beta_0 X_t + \beta_1 X_{t-1} + \beta_2 X_{t-2} + \cdots + \beta_j X_{t-k} + \varepsilon_t \quad (1)$$

Where β_0 is known as the short run multiplier, or impact multiplier, because it gives the change in the mean value of Y_t following a unit change of $X_t$in the same time period. If the change of X_t is maintained at the same level thereafter, then, $(\beta_0+\beta_1)$ gives the change in the mean value of $Y_t$in the next period, $(\beta_0 + \beta_1 + \beta_2)$ in the following period, and so on. These partial sums are called interim, or intermediate, multiplier. Finally, after k periods, that is

$\sum_{i=0}^{k} \beta_i = \beta_0 + \beta_1 + \beta_2 + \ldots + \beta_k = \beta$, therefore $\sum \beta_i$ is called the long run multiplier or total multiplier, or distributed-lag multiplier. If define the standardized $\beta_i^* = \frac{\beta_i}{\sum \beta_i}$ then it gives the proportion of the long run, or total, impact felt by a certain period of time. In order for the distributed lag model to make sense, the lag coefficients must tend to zero as $k \to \infty$. This is not to say that β_2 is smaller than β_1; it only means that the impact of X_{t-k}on Y_t must eventually become small as k gets large.

The distributed lag plays vital role in determining the value of dependent variable at time t. But a problem arises regarding the selection of appropriate lag to be employed in independent variable. However, the problem of selection of suitable lag can be solved by using the techniques developed by various econometricians. One of the methods of selection of appropriate lag length is Ad Hoc approach popularized by Alt[2] and Tinbergen[3] for money-price relationship. The following method can be applied in Ad Hoc estimation of distributed-lag models.

First regress $Y_t$on X_t, then regress Y_t on $X_t$and X_{t-1}, then regress Y_t on X_t, X_{t-1} and X_{t-2}, and so on as given below

$Y_t = \alpha + \beta_0 X_t$

$Y_t = \alpha + \beta_0 X_t + \beta_1 X_{t-1}$

$Y_t = \alpha + \beta_0 X_t + \beta_1 X_{t-1} + \beta_2 X_{t-2}$

$Y_t = \alpha + \beta_0 X_t + \beta_1 X_{t-1} + \beta_2 X_{t-2} + \beta_3 X_{t-3}$

$Y_t = \alpha + \beta_0 X_t + \beta_1 X_{t-1} + \beta_2 X_{t-2} + \beta_3 X_{t-3} + \beta_4 X_{t-4} +$

… …

This sequential procedure stops when the regression coefficients of the lagged variables start becoming statistically insignificant and / or the coefficient of at least one of the variables change signs. However, the Ad Hoc method of distributed lag models have different problems such as there is no priori guide as to what is the maximum length of the lag, as number of lags rises there will be fewer degrees of freedom left and it makes the

[2] Alt, Franz L. 1942 Distributed Lags. *Econometrica* 10: 113–128

[3] Tinbergen, Jan 1949 Long-term Foreign Trade Elasticities. Macroeconomica 1:174–185.

statistical inference somewhat shaky. Likewise, successive lags suffer from multi-colinearity, which lead to imprecise estimation and it needs long enough data to construct the distributed-lag model.

The Koyck approach can also be applied to estimate the distributed lag model. However, the Koyck approach also suffers from many drawbacks. Autoregressiveness, serial correlation, violation of Durbin-Watson d-test and non-linearity of parameter estimation are some of the problems of this approach. Similarly, Shirley Almon has also developed polynomial distributed lag model. However, the Almon approach involves the selection of the maximum lag length in advance, which in itself is the problem. Hence, the Almon approach also does not provide solution to the problem.

Next, Schwarz and Akaike have developed formal test of lag length, which are popularly known as Schwarz Criterion and Akaike Information Criterion respectively. According to these criteria, the maximum lag length is selected based on the least value of the lag. Both Schwarz criterion and Akaike information criterion is used to determine the optimum length of the lag.

Of the various approaches for selection of suitable lags of independent variable, the Ad Hoc approach is used in the present analysis of inflation-growth relationship. It is because; the Ad Hoc approach suffers fewer problems as compared to other approaches. However, Almon approach of Polynomial distributed lags is also applied to find the total impact of distributed lags of independent variables (inflation) on the dependent variable (economic growth).

IV. Analysis and Discussions of Results

In order to find the magnitude of relationship between economic growth and inflation, it is necessary to run the OLS regression with economic growth dependent variable and inflation independent variable. However, the regression results will be spurious as non-stationary variables are used in regression. So, for robust regression results we should use the stationary variables in the regression. Being the time series variables economic growth and inflation in logarithmic transformation are stationary at first difference, these stationary variables are used in our OLS regression under distributed lag models. The present study has used Y_t as dependent variable and P_t and its lags are used as independent variables to examine whether inflation hampers economic growth under Autoregressive Distributed Lag Models.

Selection of optimum lag length of independent variable is inevitable before running the OLS regression. There are various approaches for selecting appropriate lag length. Of which, the present study has used the ad hoc estimation of distributed-lag model popularized by Alt and Tinbergen. According to this approach, first Y_t, dependent variable is regressed on P_t, current independent variable, and then P_t is lagged one period, two periods and so on until the coefficient of lagged variable is statistically insignificant and algebraic sign of the variable changes. In the present model, the dependent variable Y_t is regressed on the independent variable P_t at lag 1 and 2. The coefficient of P_t at lag 2 is not statistically significant. Therefore, lag 1 is taken as the appropriate lag for independent variable P_t in the present regression. Therefore, the regression model of Y_t on P_t is given by equation (2) as,

$$Y_t = \alpha + \beta_0 P_t + \beta_1 P_{t-1} + \varepsilon_t \quad (2)$$

The results of the regression (Y_t on P_t) have been presented through Table-1.

Table-1: Regression of Y_t on Lagged P_t

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant (C)	α = 0.039767	0.014549	2.733341	0.0100
P_t	β_0 = -0.366451	0.147272	-2.488256	0.0181
P_{t-1}	β_1 = 0.397968	0.137500	2.894304	0.0067

$R^2 = 0.255807$ $\bar{R}^2$ =0.210704, S.E.of Regression=0.031601, D-W statistic=1.930832

From Table-1 it is observed that with economic growth (Y_t) as dependent variable and inflation (P_t) up to lag 1 as independent variable, the coefficient of P_t is $\beta_0 = -0.366451$, which is significant at 5% level and negative. The negative coefficient implies that current inflation causes the economic growth to fall. A ten percent rise in current inflation causes the economic growth to decrease by 3.6 percent. However, the coefficient of P_{t-1}, $\beta_1 = 0.397968$, which is positive and significant at less than 1 percent level. The increase in inflation in the previous period causes economic growth to increase by 39 percent. There is mixed impact of inflation on economic growth. When inflation increases in the current time, the economic agents have no sufficient time to adjust their economic activities to mitigate with high inflation. As a result, the rise in inflation will have negative impact on the economic growth. On the other hand, when there was high inflation in the preceding time, the economic agents could adjust their economic activities in accordance with high inflation. The economic activities adjusted during a year could mitigate with inflation and there was positive impact on the economic growth in the current time. Though there is mixed impact of inflation on economic growth, the increase in economic growth due to high inflation has exceeded the decrease in growth resulting the positive impact of inflation on economic growth. The net increase in economic growth by increasing inflation is found to be more than 3 percent.

After having the results of OLS regression of economic growth on inflation by distributed lag models, our next job is to examine the robustness of the estimated regression equation (2). The estimated regression equation (2) can be claimed to be robust if residuals of the equation are not serially correlated, the residuals are normally distributed and residuals are homoscedastic. Additionally, the estimated equation (2) is stable as it does not lack the property of linearity and misspecification of OLS regression. Table-2 presents the results from Breusch-Godfrey serial correlation LM test, Heteroscedasticity (White method) test, Jarque-Bera normality test and Ramsey's RESET test.

The F-statistic and value of $(T \times R^2)$ of Breusch-Godfrey Serial Correlation LM test imply that the null hypothesis of no serial correlation cannot be rejected. Hence, the residuals of estimated equation (2) are not serially correlated. Likewise, as reported by Jarque-Bera statistic and the corresponding probability value, the null hypothesis of normal distribution is not rejected. The residuals are also free from heteroscedasticity problem. Finally, as reported by t-statistic, F-statistic and Likelihood ratio of Ramsey's RESET test, the estimated equation (2) is correctly specified bearing the property of linearity and hence it is stable equation.

Table-2: Residuals Diagnostic and Stability Test of Estimated Equation (2)

Breusch-Godfrey Serial Correlation LM Test			
F-statistic	0.150017	Prob. F(2,135)	0.8608
$T \times R^2$	0.314892	Prob. Chi-Square(2)	0.8543
Jarque-Bera Statistic: 3.1923 Probability: 0.2026			
Heteroscedasticity(White) Test			
F-statistic	1.345267	Prob. F(14,127)	0.1903
$T \times R^2$	18.33863	Prob. Chi-Square(14)	0.1918
Ramsey's RESET Test			
Test Statistic	Value	Degree of Freedom	Probability
t-statistic	0.231013	32	0.8188
F-statistic	0.053367	(1, 32)	0.8188
Likelihood ratio	0.059988	1	0.8065

V. Conclusions and Policy Implications

The present study confirms that Nepalese inflation has mixed impacts on economic growth. The suspicion of researchers and policy makers is partly supported that inflation hampers economic growth. The economic growth at current time is hampered by high inflation of current time. Whereas the doubt of the researchers and policy makers that inflation hampers economic growth is partly rejected. It is because the inflation of preceding time has positive impact on the economic growth of current time. The net effect of inflation is positive on the growth of Nepalese economy.

The present study throws light in policy implication. The inflation will have adverse impact on economic growth only when there is galloping and hyper inflation in the economy. The mild inflation is necessary to attain high economic growth. The inflation of Nepalese economy is not very much serious on economic development and growth as suspected by policy makers and other economic agents. The inflation is a time variant factor that cannot be suppressed. The business investors and government should give high priority on investment. As rate of investment increases, there would be more output in the economy. The increasing level of output would automatically control high inflation via economic growth.

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