Optimal Rate of Inflation in Nepal : An Empirical Investigation

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2015

Optimal Rate of Inflation for Nepal: An Empirical Investigation[1]

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January 20, 2015

This paper attempts to empirically examine the optimal rate of inflation for Nepalese Economy on the basis of annual data over the period 1975 to 2014. It employs the non-linear specification by Sarel (1996) and Conditional Least Squares Specification by Khan and Senhadji (2001) to estimate the optimal rate of inflation. The results from the study suggest that the threshold rate of inflation is 6 percent for the Nepalese case. When inflation is below this threshold, it does not have any significant effect on growth or it may have a slightly positive effect, whereas inflation has significant retarding effects on growth beyond the threshold. It is, thus, desirable to contain inflation to less than 6 percent to ensure that economic growth is unharmed by the pernicious effects of high inflation.

JEL Classification: [E31, O40]

Key Words: Inflation, Growth, Optimal Inflation

1. Introduction

One of the fundamental macroeconomic objectives for most countries is economic stability characterized by high and sustained output growth with low inflation. Hence, the question of the existence and nature of the link between inflation and growth has been the subject of considerable interest and debate (Khan and Senhadji, 2001). There is a general consensus among policy makers and economists that high rate of inflation is detrimental to economic growth as it disrupts the smooth functioning of a market economy and impedes efficient resource allocation by obscuring the signaling role of relative price changes, the most important guide to efficient economic decision making (Fischer, 1993). Thus, some of the economies have moved towards the explicit inflation targeting in their monetary policy framework in order to preclude the adverse effect of inflation on growth.

[1] This paper was presented at the 2nd International Conference on Economics and Finance, Organized by Nepal Rastra Bank in 2015.

The economic scenario before the 1970s, however, was dominated by the belief that inflation has either none or positive relationship with economic growth. It is the stagflation of the 1970's which brought a stark change in the argument. The hyperinflation followed by the dismal performance of the economies in a vast majority of countries stimulated a large number of theoretical and empirical studies to bring ahead the idea that inflation adversely affects growth.

In the recent years, works by Fischer (1993), Sarel (1996), and Khan and Senhadji (2001) have added the third dimension to the debate introducing the idea of non-linearity in the relationship between inflation and economic growth. Non-linearity in the relationship implies that at lower rate of inflation, the relationship is positive or nonexistent, but at higher rates, it switches to a negative one. In such a nonlinear relationship, the inflexion point, threshold, or the optimal rate of inflation at which the sign of the relationship between the two variables would switch, can be estimated.

The main purpose of this paper is: (i) to check whether non-linearity in the relationship between inflation and economic growth exists in the Nepalese Case, and (ii) to find the optimal rate of inflation beyond which inflation has pernicious effects on economic growth, in case the non-linear relationship exists.

Rest of the study is organized as follows: Section Two reviews some of the empirical studies carried out at national and international level, Section Three presents the data issues and methodology followed in the study, Section Four discusses the estimation results and the final section presents some concluding remarks.

2. Review of Literature

The debate whether inflation is supportive or detrimental to economic growth has attracted a vast pool of theoretical discussions and empirical studies, especially after the 1970s. Some earlier empirical studies, such as Bruno and Easterly (1995) put forward the argument that inflation affects economic growth negatively at least at double-digit level. Nevertheless, later studies like Sarel (1996), and Khan and Senhadji (2001) found that the effect of inflation on economic growth is indeed non-linear: up to a certain threshold rate of inflation, inflation does have insignificant or positive effects on economic growth whereas beyond that level, it is detrimental to economic growth.

Fischer (1993) examined that high inflation reduces growth by reducing investment and productivity growth. Taking the dataset of 93 countries and employing spline regression with breaks at 15 and 40 percent, he found that there exists non-linearity in the inflation growth relationship and the strength of the relationship weakens for inflation rates higher than 40 percent.

Barro (1995) found a negative relationship between inflation and economic growth on the basis of the dataset of 100 countries covering the period 1960-1990. The regression results of the study indicate that the growth rate of real per capita GDP reduces by 0.2-0.3 percentage points per year for every 10 percentage point increase in inflation. This adverse impact, though seems small, proves to be substantial in the long run e.g. if inflation increases by 10 percentage points each year for 30 years, the level of real GDP will be reduced by 4-7 percent.

Sarel (1995) observed that inflation does not have any influence on growth or at least there may be a slight positive effect when inflation is below a certain optimal rate. He used a panel data set of 248 observations from 87 countries spanning the period 1970 to 1990 and found the structural break at 8 per cent level of inflation. Above the 8 percent level, he observed that the estimated effect of inflation of economic growth is negative, strong, significant and robust.

Bruno and Easterly (1998) observed that a negative, shorter to medium term relationship between inflation and growth is only present with high frequency data and extreme inflation observations (when the inflation is above the threshold rate of 40 percent). They found no evidence of any relationship between inflation and growth at annual inflation rates of less than 40 per cent.

Ghosh and Phillips (1998) used a data set of 145 IMF member countries for the period 1960-1996 to show that there is a negative relationship between high inflation and growth. They found that, at very low rates of inflation (2-3 per cent a year or lower), inflation and growth are positively correlated. Otherwise, inflation and growth are negatively correlated.

Khan and Senhadji (2001) examined an unbalanced panel data set of 140 countries covering the period 1960 to 1998 employing Nonlinear Least Squares (NLSS) regression model and found that the threshold rate of inflation is lower for industrialized countries (1-3 per cent) than it is for developing countries (7-11 per cent). The study reveals that inflation levels below the threshold have no effect on growth, while inflation rates above the threshold have a significant negative effect.

Mubarik (2005) examined the threshold point of inflation for Pakistan employing the methodology put forward by Khan and Senhadji (2001) and found that the inflation rate beyond 9 percent is detrimental to economic growth. His study is based on the annual dataset from 1973 to 2000. **Hussain and Malik (2011)** confirmed the 9 percent threshold rate of inflation of Pakistan using the dataset of 1960 to 2006. They suggest that Pakistan must contain inflation to single digit for optimal economic growth.

Singh (2010) observed that the optimal rate of inflation is 6 percent for Indian economy, employing Khan and Senhadji (2001) methodology with the annual dataset for 1971 to 2009 and quarterly dataset for 1996:Q1 to 2009:Q3. **Mohanty et.al. (2011)** examined the threshold rate for India employing Sarel (1996), Khan and Senhadji (2001) and Espinoza et al. (2010) methodologies and found that there are significant retarding effects of inflation when it is above the threshold rate of 4 to 5.5 percent, while there is significant positive relationship between inflation and economic growth when inflation is below its threshold range. Furthermore, Chakarvarty Committee (1985) considered the acceptable inflation of 4 percent while Rangarajan (1998), Vasudevan et al. (1998), Samantaraya and Prasad (2001) observed the optimal rate of inflation lying in the range of 6–7 percent.

Leshoro (2012) estimated the threshold rate of inflation for South Africa at 4 percent using the quarterly dataset for the period 1980:Q2 to 2010:Q3. He found that inflation has positive and insignificant relationship with economic growth up to 4 percent level of inflation whereas it has significant negative relationship with growth beyond the threshold rate. The policy makers should strive to keep inflation preferably below 5 percent to avoid its pronounced adverse effects on growth.

Younus (2012) observed that the optimal growth for Bangladesh lies between 7 to 8 percent. He has employed annual data from 1976 to 2012 in his quadratic regression model. He suggests that targeting too low an inflation rate (relative to the threshold) would be hurtful for growth in terms of potential cost of forgone output and, at the same time, too high rate of inflation would also impede economic growth.

In case of Nepal, **Bhusal and Silpakar (2011)** estimated the threshold rate of inflation to be 6 percent using the annual dataset for the period 1975 to 2010. However, their study has a poorer overall fit as evidenced by the inclusion of inflation as a single independent variable in the growth equation with a resultant low R^2 value of less than 2 percent. Furthermore, it fails to examine whether the existence of the threshold rate is significant or not.

3. Data Issues and Methodology

3.1 Data Issues

The study has used annual time series data of Real Gross Domestic Product, Inflation, Population Growth, Export Income and Total Investment for the Nepalese Economy spanning the period 1975 to 2014. Real Gross Domestic Product (at 2001 price), export and total investment figures have been taken from Economic Survey 2011 and 2014 Issues published by Ministry of Finance, Nepal. Total investment includes private investment as well as public investment. Export and total investment figures have been deflated by using consumer price index. CPI, instead of GDP deflator has been used to deflate the time series to remove the negative correlation between inflation and growth rate, which is not caused by the effects of inflation[2]. Consumer Price Index (CPI) series (2006=100) has been taken from Quarterly Economic Bulletin (July 2014 Issue) published by Nepal Rastra Bank. The population figures have been extracted from the World Bank database maintained at data.worldbank.org for the period 1980 to 2014 and for the population data for 1975 to 1979, estimates made by United Nations Department of Economic and Social Affairs in 'World Population Prospectus: 2010 Revision' have been used.

3.2 Methodology

Following the conventional economic theory and empirical literature (Barro 1991, Sala–i–Martin 1997 and Romer 1993), the following growth equation has been used in this study.

$$\Delta Y = \alpha + \beta_1 \pi + \Theta X + e \quad (1)$$

[2] As argued by Sarel (1996), changes in GDP deflators are, by construction, negatively correlated with the growth rate. Thus, it is better to use CPI rather than GDP deflator in the studies related to the relationship between inflation and growth.

Where,

ΔY = Growth Rate

π = Rate of Inflation

X = A vector of other control variables that includes growth rate of population, growth rate of exports and growth rate of total investment, and

e = iid$(0,\sigma^2)$

Introducing the concept of extra inflation in equation (1);

$$\Delta Y = \alpha + \beta_1 \pi + \beta_2 * D(\pi - \pi^*) + \Theta X + e \qquad (2)$$

Where $\pi - \pi^*$ *is* the difference between actual inflation and the threshold inflation defined as extra inflation.

D is a dummy such that:

D=0 when $\pi \le \pi^*$, *and*

D=1 when $\pi > \pi^*$

Relation (2) shows that below the threshold rate of inflation (π^*), the impact of inflation on growth is shown by the value of β_1 whereas beyond the threshold rate, the impact of inflation on growth is shown by the sum of β_1 and β_2. The value of β_2 , thus, shows the difference of the impact between the two sides of the threshold.

In more convenient terms, relation (2) can be expressed as:

$$G\_RGDP = \alpha + \beta_1 INF + \beta_2 * D(INF - \pi^*) + \beta_3 G\_POP + \beta_4 G\_RX + \beta_5 G\_RTI + e \qquad (3)$$

The coefficients $\beta_3, \beta_4, \beta_5$ are expected to bear a positive sign with them and β_2 is expected to have a negative sign showing the negative relationship between inflation and growth beyond the threshold level.

Table 3.1

Data Definitions[3]

G_RGDP	Growth Rate of Real Gross Domestic Product at 2001 Price defined as $\Delta \ln(\text{Real GDP})$
INF	Inflation Rate defined as the Growth Rate of CPI (2006=100) and (INF= $\Delta \ln(CPI)$)
π^*	Threshold Rate of Inflation
G_POP	Growth Rate of Population defined as $\Delta \ln(Population)$
G_RX	Growth Rate of Export (deflated by CPI) defined as $\Delta \ln(\textit{Deflated}\ \text{Export Income})$

[3] The growth rates of the variables have been calculated by taking the difference of the log values of the variables and, thus, may slightly differ from the discrete growth rates reported in the data sources.

G_RTI	Growth Rate of Total Investment (deflated by CPI) defined as $\Delta \ln(\textit{Deflated}\text{ Total Investment})$

One important issue here is whether the variables should be used in the model in log form. Sarel (1996), Khan and Senhadji (2001), among few others, have used the variables in the growth equation in log form as it provided more symmetrical distribution of inflation in their case. In case of Nepal, the distribution of Real GDP growth and INF are near symmetrical as shown by the histograms provided in **Appendix A**. Thus, the variables are used without taking the log form.

3.2.1 Sarel Methodology

Sarel (1996) methodology consists of iterating the regression model presented in relation (3) with different π* values using the OLS estimation. The threshold rate of inflation occurs at that value of π* which produces the maximum value of R-squared or minimum Root Mean Square Error (RMSE). The coefficient of extra inflation indicates the difference in the inflation effect on growth between the two sides of the structural break and its t-statistic value tests whether or not the structural break is significant.

3.2.2 Khan and Senhadji Methodology

Khan and Senhadji (2001) methodology estimates the regression equation presented in (3) using conditional least squares. They argue that conventional gradient search techniques to implement Non Linear Least Squares (NLSS) are inappropriate as π* enters the model in a non-linear and non-differential manner. In this case, Conditional Least Squares can be used in which for any π* the model is estimated by OLS, yielding the sum of squared errors as a function of π*. The least squares estimate of π* is found by searching over π and selecting the value that yields the lowest sum of squared errors. Formally, if $S_1(\pi)$ denotes the residual sum of squares with different assumed threshold rate of inflation, the threshold rate π* is chosen so as to minimize $S_1(\pi)$,: that is,

$$\pi^* = \arg\min_{\pi}\{S_1(\pi),\ \pi_1, \ldots\ldots\ldots \pi_r\}$$

Where, π_1 to π_r are the assumed threshold values of inflation during the iteration process. For this value of π* the slope parameters are estimated by OLS. Chan and Tsay (1998) have shown that these NLLS estimates are consistent and asymptotically normal.

To test whether threshold rate of inflation is significant, Khan and Senhadji (2001) employed the Hansen (1999) Likelihood Ratio, as the classical tests such as t-test have nonstandard distribution due to non-identification of π*. Hansen (1999) showed how to bootstrap to simulate the asymptotic distribution of LR_0 statistic.

Under the null hypothesis of no threshold effect (H_0: $\beta_1 = \beta_2$), the LR_0 ratio is defined by

$$LR_0 = \frac{S_0}{\hat{\varsigma}} \quad \varsigma \quad ;$$

This hypothesis is tested against the alternative hypothesis H_1: $\beta_1 \neq \beta_2$

Where,

S_0=Residual sum of squares under H_0 or no threshold effect.

S_1=Residual sum of squares under H_1or threshold effect and

$\hat{\varsigma}$ =residual variance under H_1.

4. Results and Discussion

4.1. Historical Facts about Inflation and Growth

Nepal has achieved 4.18 percent average growth rate of real GDP on average over the period 1975 to 2014. Growth rate has fluctuated between 0.16 percent to 8.55 percent: somewhat higher in the late 1980s and 1990s followed by the structural reform program recommended by IMF and World Bank, lower in the early 2000s due to heightened domestic political insurgency and improving thereafter (Table 4.1 and Chart 4.1)

Table 4.1

Summary Statistics

Variable	Average	Std.	Maximum Value	Minimum Value
G_RGDP	4.18	1.99	8.55	0.16
INF	7.96	3.89	19.05	-1.13
G_POP	2.04	0.55	2.64	0.95
G_RX	5.04	18.23	65.81	-41.89
G_RTI	6.65	10.27	28.57	-17.33

Inflation, on the other hand, has always been greater than the growth rate except few years averaging 7.96 percent over the sample period (Chart 4.1). Inflation was higher in the 1980s and early 90s due to an increase in electricity tariff and fertilizer prices, impact of Gulf War, low agricultural production, devaluation of Nepalese Rupee against US dollar and other convertible currencies by 20.9 percent in 1991, and an upsurge of prices in

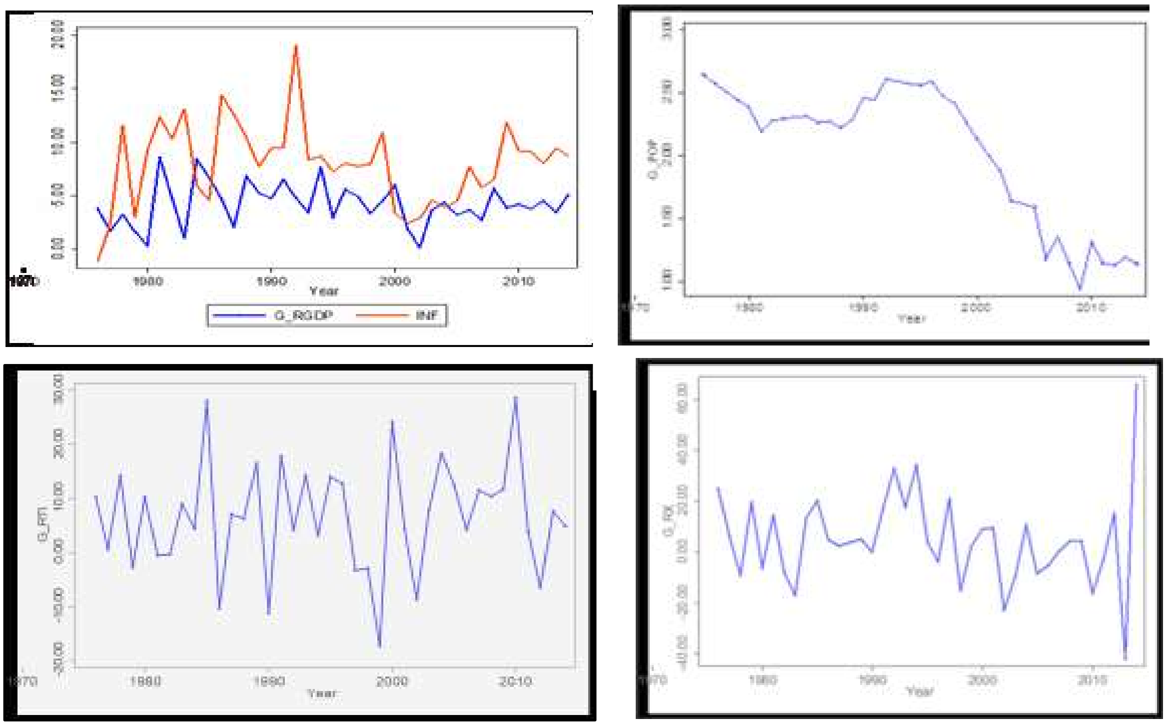
India. Rise in the Food and Beverage index in 1992 was 24.49 percent leading to the highest ever-recorded rate of Inflation in Nepal (NRB, 2007).

4.2 Time Series Properties of the Variables

Chart 4.1 shows the time series plot of the variables used in the study. All the variables seem to be stationary[4] in nature except the growth rate of population which has a downward trend.

Chart 4.1

Time Series Plot of the G_RGDP, INF, G_POP, G_RX and G_RTI



To confirm the exact order of integration of the variables, Augmented Dickey Fuller Test (ADF) and Phillips-Perron Test (PP) were employed. The results in table 4.2 demonstrate that the null hypothesis of unit root in the time series can be easily rejected for the variables G_RGDP, INF, G_RX and G_RTI at level making them stationary at level [I(0)] whereas the null for G_POP can be rejected only at its first difference making it stationary at first difference [I(1)].

Table 4.2

Unit Root Test Results

Variable	Constant	Constant and Trend	Order of

[4] A time series variable is stationary if its mean, variance and covariance remain constant overtime.

	ADF Value	p-value#	PP Value	p-value#	ADF Value	p-value#	PP Value	p-value#	Integration
G_RGDP	-6.25*	0.00	-6.25*	0.00	-6.17*	0.00	-6.17*	0.00	I(0)
INF	-4.88*	0.0	-4.87*	0.00	-4.90*	0.00	-4.93*	0.00	I(0)
G_POP	-0.25	0.93	-0.31	0.92	-1.29	0.88	-1.38	0.86	I(1)
D(G_POP)	-7.30*	0.00	-7.18*	0.00	-7.32*	0.00	-7.19*	0.00	
G_X	-6.94*	0.00	-6.98*	0.00	-6.88*	0.00	-6.93*	0.00	I(0)
G_RTI	-7.85*	0.00	-8.13*	0.00	-7.82*	0.00	-8.18*	0.00	I(0)

p-value refers to Mackinnon approximate probability values.
*shows the statistical significance of the statistic at 5 percent level.

4.3 Optimal Rate of Inflation for Nepal

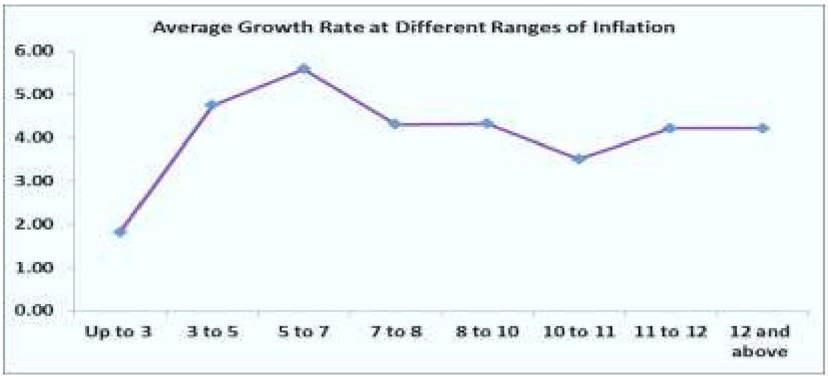
Table 4.3 and Chart 4.2 present average growth rate of real GDP for different ranges of inflation, inflation being arranged in the ascending order. For the five years when inflation ranged up to 3 percent only, average growth rate was rather low. In the higher inflation range of 3 to 5 percent, growth rate is higher than the previous inflation range. Average growth rate is highest when inflation lies in the range of 5 to 7 percent. Average growth rates for the inflation ranges greater than seven percent are lower than the inflation range of 5 to 7 percent. This bi-variate relationship between inflation and real GDP growth sheds light on the existence of some sort of non-linearity in the relationship between inflation and GDP growth with a structural break or inflexion point after which such a relationship switches from positive to a negative one.

Table 4.3

Average Growth Rates at Different Ranges of Inflation

Inflation Range (in %)	Sample Years	Average Growth Rate
Up to 3	5	1.82
3 to 5	5	4.75
5 to 7	3	5.59
7 to 8	7	4.31
8 to 10	9	4.33
10 to 11	3	3.51
11 to 12	2	4.22
12 and above	5	4.22

Chart 4.2
Average Growth Rates at Different Ranges of Inflation



4.3.1 Estimation Results from Sarel (1996) Methodology

Following the Sarel (1996) methodology, relation (3) has been iterated taking the value of threshold rate of inflation from 1 to 11 percent. For π*=6 percent, the Residual Sum of Squares has reached a minimum and equivalently, the value of R-squared has reached a maximum value as depicted in chart 4.3. Also, the coefficient of extra inflation is statistically significant at 5 percent level of significance implying the significance of the structural break. The estimation results for all values of π* considered in this study have been provided in **Appendix B** along with the diagnostic test statistics. Here, estimation result for π*=6 only has been reported (Table 4.4).

Table 4.4
Estimation Results for Sarel (1996) Methodology

Variable	Coefficient	Std. Err.	t-ratio	Prob>t
_Cons	0.42	1.70	0.25	0.81
INF	0.55*	0.22	2.53	0.02
D(INF-6)	-0.64*	0.29	-2.14	0.04
G_POP	0.34	0.55	0.62	0.54
G_RX	0.05*	0.02	3.11	0.01
G_RTI	0.25	0.03	0.86	0.39
Source	Sum of Squares	df	Mean Square	
Model	49.12	5	9.82	F(5,33) = 3.22
Residual	100.63	33	3.04	Prob>F = 0.02
Total	149.75	38	3.94	R-squared = 0.33
No. of Observations = 39		Root MSE = 1.75		Adj. R-squared = 0.23
Shapiro Swilk W-Test Stat. = -0.79(0.78)		BP Heteroskedasticity Test Stat. = 1.44 (0.23)		Mean VIF = 4.30
RESET Test Stat. = 1.38 (0.27)		LM Autocorrelation Test Stat. = 2.79(0.09)		

*shows that the coefficients are significant at 5 percent level.
Numbers in the parenthesis show the probability associated with the statistic.

The estimated threshold rate of inflation (of 6 percent) is consistent with the studies by Bhusal and Silpakar (2011) for Nepal, and Singh (2010), Rangarajan (1998), Vasudevan et.al.(1998), and Samantaraya and Prasad (2001) for India.

The positive and significant value of the coefficient of INF shows that inflation is conducive to growth below the threshold rate of inflation (6 percent). The sum of the coefficients of the INF and Dummy is negative (0.55-0.64=-0.09) implying that if inflation rate increases by one percentage point above the threshold, real GDP will be reduced by 0.09 percentage on the average, other factors affecting the growth rate of GDP remaining as they are. Though, the negative impact seems small, it can have serious repercussionary effects on the economy in the long run. The coefficients of other variables are positive as expected. However, the coefficients of population growth and growth of real total investment are not significant. In Nepalese case, population growth may not be a good proxy for the labor force growth due to open broader with India, and increasing trend of Nepalese workers going abroad for work, which might have caused a mismatch between population growth and labor force growth.

All the diagnostic tests show satisfactory results for the estimated model. The regression line is significant as shown by the probability of F-statistic. The Shapiro Wilk W test statistic shows that we cannot reject the null hypothesis of error terms being normally distributed. It is also evident from the Kernel Density Plot of the residuals in Chart 4.4. Furthermore, Heteroskedasticity Test statistic shows that we cannot reject the null of the constant error variance due to high probability value associated with it. The average Variance Inflation Factor (VIF) being less than ten suggests that the model variables are not suffering from the problem of multicollinearity. The high probability value associated with the RESET test statistics implies that we cannot reject the null hypothesis of no omitted variables in the regression model. Finally, the LM test for Autocorrelation shows no presence of Autocorrelation in the error term of the estimated regression model.

Chart 4.3

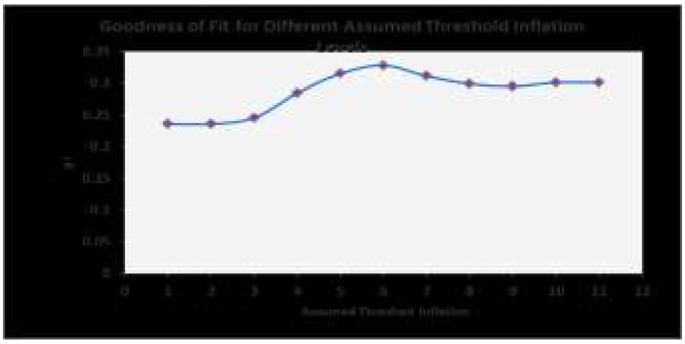
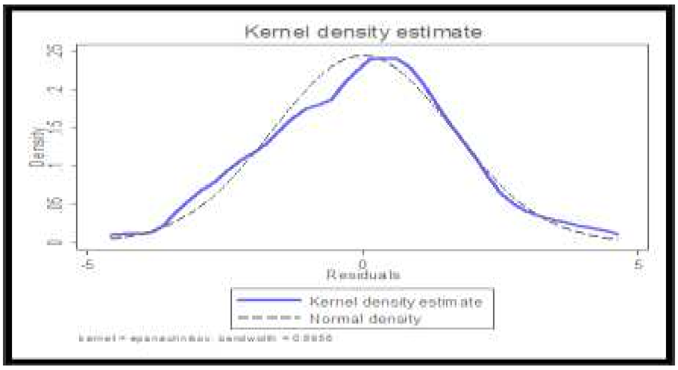


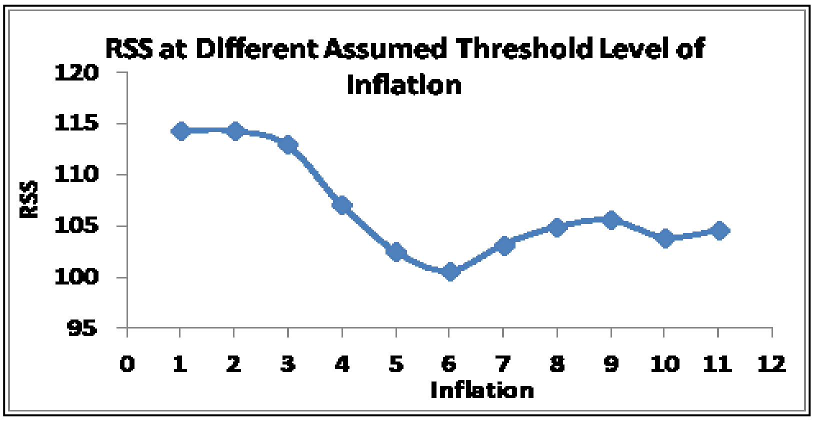
Chart 4.4



4.3.2 Estimation Results from Khan and Senhadji (2001) Methodology

The iteration procedure for Khan and Senhadji (2001) methodology is same as Sarel (1996). Iterating relation (3) assuming the threshold inflation from 1 to 11 percent, the Residual Sum of Squares reached a minimum for $\pi^*=6$ percent (depicted in chart 4.5).

Chart 4.5



The threshold rate of inflation ($\pi^*=6$) is statistically significant as shown by the LR_0 statistic.

Table 4.5
Hansen Likelihood Ratio Test Result

Test Statistic	LR-Statistic	Critical Value (5 percent)
LR_0	5.28*	5.23

*shows that the coefficient is significant at 5 percent level.

4.4 Model Excluding the Growth Rate of Population

It is desirable to see whether population growth rate (I(1) variable) in the model has spuriously affected the relationship between inflation and growth rate of real GDP. The results show that even after excluding the growth rate of population, the threshold rate of inflation comes out to be 6 percent reinforcing the finding from the earlier model (Table 4.6 and Chart 4.6).

Chart 4.6

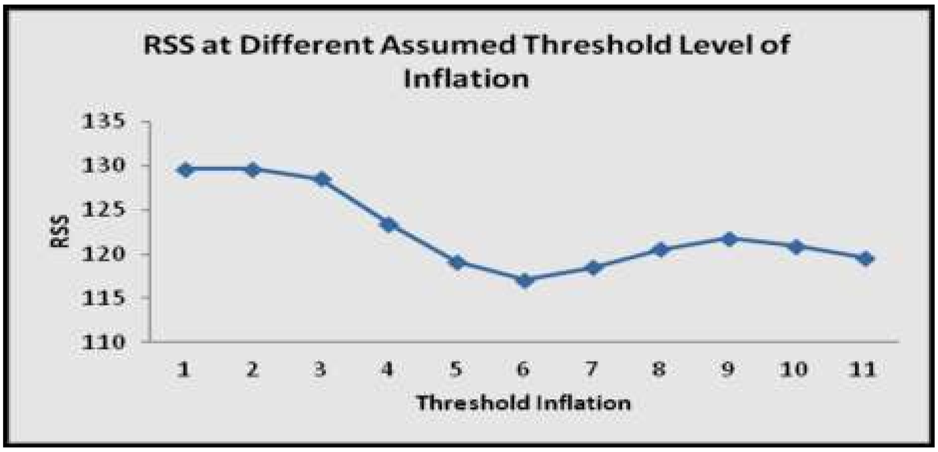


Table 4.6
Estimation Results without Population Growth

Variable	Coefficient	Std. Err.	t-ratio	Prob>t
_Cons	1.40	0.11	1.26	0.21
INF	0.45*	0.22	2.04	0.04
D(INF-6)	-0.56**	0.29	-1.92	0.06
G_RX	0.04*	0.01	2.92	0.01
G_RTI	0.03	0.03	0.89	0.38
Source	Sum of Squares	df	Mean Square	
Model	46.29	4	11.57	F(4,34) = 3.36
Residual	117.10	34	3.44	Prob>F = 0.02
Total	163.39	38	4.29	R-squared = 0.28
No. of Observations = 39		Root MSE = 1.73		Adj. R-squared = 0.19
Shapiro Swilk W-Test Stat. = -1.59(0.93)		BP Heteroskedasticity Test Stat. = 2.78 (0.09)		Mean VIF = 5.56
RESET Test Stat. = 2.00 (0.13)		LM Autocorrelation Test Stat. = 2.14(0.14)		

*shows that the coefficients are significant at 5 percent level.
**shows that the coefficients are significant at 10 percent level.
Numbers in the parenthesis show the probability associated with the statistic.

The coefficients of the model excluding population growth rate are consistent with the earlier model. And all the diagnostic statistics show that the regression model is free from the problems of autocorrelation, multicollinearity, heteroskedasticity, non-normality of residuals and model misspecification.

4.5 Impact of Ignoring the Non-linearity

If the inflation-growth relationship is modeled in a linear fashion ignoring the role of the threshold rate of inflation, a bias is introduced in the relationship between inflation and growth in the Nepalese case too. Table 4.7 shows that the average relationship between inflation and growth becomes positive and insignificant when the point of inflection is ignored.

Table 4.7
Impact of Ignoring the Non-linearity

Variable	Coefficient	Std. Err.	t-ratio	Prob>t
_Cons	2.80	1.38	2.03	0.05
INF	0.05	0.08	0.66	0.51
G_RX	0.03*	0.01	2.51	0.02
G_RTI	0.03	0.03	1.15	0.25
Source	Sum of Squares	df	Mean Square	
Model	33.74	4	8.44	F(4,34) = 2.21
Residual	129.64	34	3.81	Prob>F = 0.08
Total	163.39	38	4.29	R-squared = 0.20
No. of Observations = 39		Root MSE = 1.95		Adj. R-squared = 0.11

*shows that the coefficient is significant at 5 percent level.

5. Concluding Remarks

The main purpose of this paper was to check for any non-linearity in the relationship between inflation and economic growth in the Nepalese case. The results show that there is a point of inflection at 6 percent rate of inflation in the relationship between inflation and growth making the relationship between them a non-linear one. Moreover, the results clearly indicate that inflation does have positive and/or insignificant relationship with growth below 6 percent whereas it has a significant negative relationship with growth beyond the threshold. This fact highlights the need that policy makers should strive to contain inflation below 6 percent in order to achieve optimal economic growth. Thus, a macroeconomic policy aiming at the inflation rate below 6 percent is one of the best recommendations that can be made from the results of the study.

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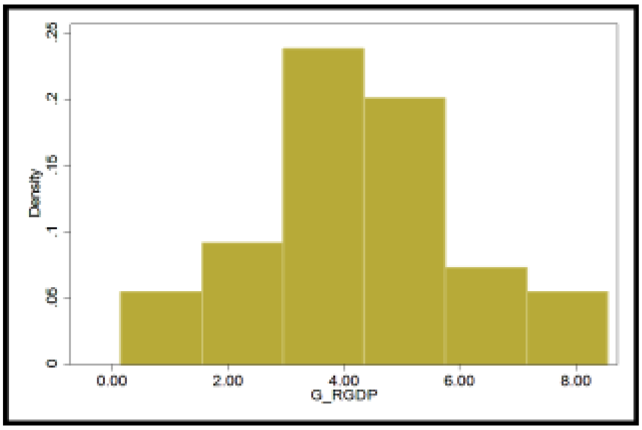
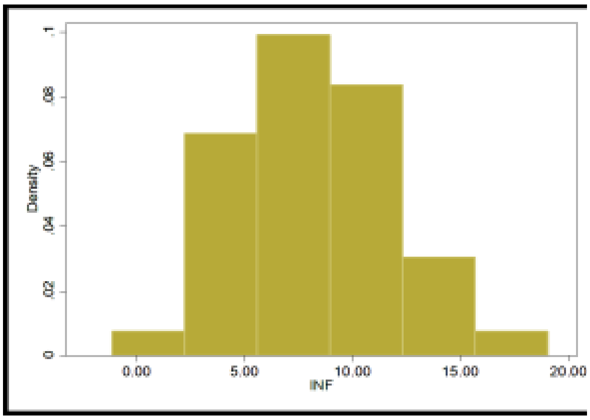
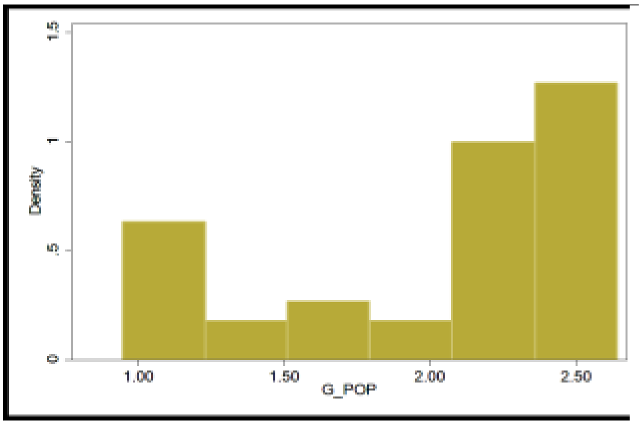
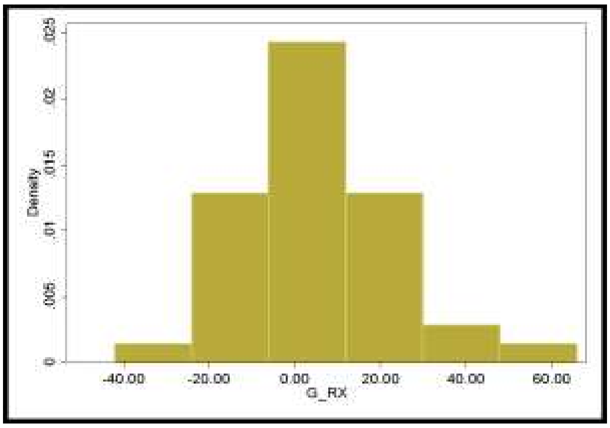
Appendix A

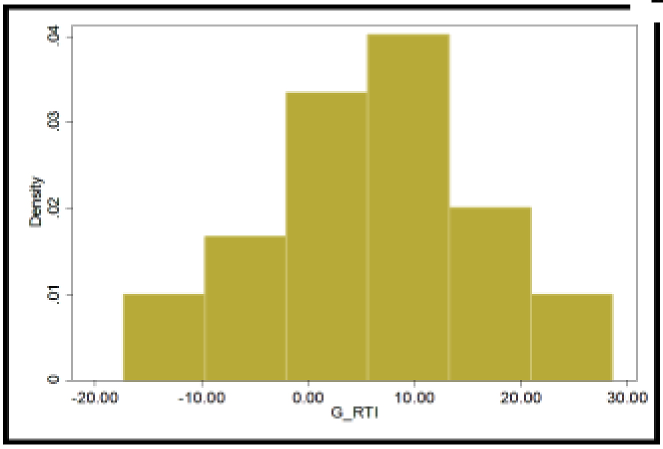
Histograms of G_RGDP, INF, G_RX, G_POP and G_RTI











Appendix B

Regression Results for Different Assumed Threshold Rates of Inflation

Coefficient	$\pi^* = 1$	$\pi^* = 2$	$\pi^* = 3$	$\pi^* = 4$	$\pi^* = 5$	$\pi^* = 6$	$\pi^* = 7$	$\pi^* = 8$	$\pi^* = 9$	$\pi^* = 10$	$\pi^* = 11$
Constant	2.60 (0.12)	2.51 (0.19)	1.84 (0.36)	0.69 (0.72)	0.30 (0.87)	0.42 (0.81)	0.97 (0.55)	1.35 (0.39)	1.52 (0.33)	1.54 (0.30)	1.70 (0.25)
INF	0.36 (0.70)	0.28 (0.67)	0.44 (0.37)	0.67 (0.08)	0.66 (0.03)	0.55 (0.02)	0.41 (0.02)	0.31 (0.03)	0.27 (0.03)	0.26 (0.02)	0.23 (0.03)
$D(INF - \pi^*)$	-0.26 (0.79)	-0.17 (0.79)	-0.36 (0.49)	-0.66 (0.14)	-0.70 (0.06)	-0.63 (0.04)	-0.50 (0.06)	-0.41 (0.09)	-0.40 (0.10)	-0.47 (0.07)	-0.50 (0.08)
G_POP	0.03 (0.95)	0.03 (0.96)	0.09 (0.87)	0.25 (0.66)	0.33 (0.55)	0.34 (0.54)	0.27 (0.63)	0.22 (0.69)	0.22 (0.69)	0.20 (0.71)	0.18 (0.75)
G_RX	0.04 (0.01)	0.04 (0.01)	0.05 (0.01)	0.05 (0.01)	0.05 (0.01)	0.05 (0.01)	0.05 (0.01)	0.05 (0.01)	0.05 (0.01)	0.05 (0.01)	0.05 (0.01)
G_RTI	0.03 (0.30)	0.03 (0.30)	0.03 (0.36)	0.02 (0.41)	0.02 (0.44)	0.02 (0.39)	0.03 (0.36)	0.03 (0.32)	0.03 (0.32)	0.03 (0.30)	0.03 (0.28)
R-Square	**0.236**	**0.236**	**0.246**	**0.285**	**0.315**	**0.328**	**0.311**	**0.299**	**0.295**	**0.301**	**0.301**
R-bar Square	**0.121**	**0.121**	**0.131**	**0.176**	**0.211**	**0.226**	**0.210**	**0.193**	**0.188**	**0.201**	**0.195**
F-Value	2.04 (0.09)	2.04 (0.09)	2.15 (0.08)	2.63 (0.04)	3.04 (0.02)	3.22 (0.02)	2.98 (0.02)	2.82 (0.03)	2.76 (0.03)	2.91 (0.02)	2.85 (0.03)
Shapiro Swilk W-Test	-0.34 (0.63)	-0.34 (0.63)	-0.09 (0.54)	-0.75 (0.77)	-1.33 (0.90)	-0.79 (0.78)	-0.32 (0.62)	-0.20 (0.57)	-0.36 (0.64)	-0.13 (0.55)	-0.03 (0.51)
BP Test for Heteroskedasticity	0.91 (0.34)	0.91 (0.34)	0.90 (0.34)	0.57 (0.45)	0.75 (0.39)	1.44 (0.23)	1.78 (0.18)	1.75 (0.18)	2.12 (0.14)	2.36 (0.12)	2.28 (0.13)
Mean VIF	62.36	28.47	16.93	10.78	6.84	4.30	2.88	2.08	1.73	1.55	1.42
RESET Test	1.92 (0.15)	1.92 (0.15)	1.59 (0.21)	1.38 (0.26)	1.36 (0.27)	1.38 (0.27)	1.22 (0.32)	1.24 (0.31)	1.36 (0.27)	1.58 (0.21)	1.66 (0.19)
LM Test for Autocorrelation	1.08 (0.29)	1.08 (0.29)	1.23 (0.27)	1.96 (0.16)	2.64 (0.10)	2.79 (0.09)	2.58 (0.10)	2.29 (0.13)	2.03 (0.15)	2.21 (0.13)	2.23 (0.13)
$\beta_1 + \beta_2$	**0.10**	**0.11**	**0.08**	**0.02**	**-0.04**	**-0.08**	**-0.09**	**-0.10**	**-0.13**	**-0.21**	**-0.27**