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Inflation and its Impact on Economic Growth: Evidence from Six South Asian Countries

Jaganath Behera
Research Scholar, School of Economics, University of Hyderabad, 500046, India
E mail: jaganathbehera1988@gmail.com

Abstract
This study investigated 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 cointegration 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.
JEL Classification: E_{00} and E_{39}
Keywords: Inflation, Economic Growth, South Asia, Granger Causality, Cointegration

1. Introduction

Relationship between inflation and economic growth has been much wider both theoretically and empirically in macroeconomics. In most of the time particularly before 70's there was debate on inflation and growth relationship the argument was that there is no relation or the relationship is positive. The issue has been originated from the Latin American context in the 1980's. This issue has generated continuing debate between stracturalist and monetarist. The stracturalist assume that inflation is essential for economic growth. Whereas the monetarist believe that inflation is detrimental to economic growth. Friedman (1973:4) summarized that the inconclusive nature of the relationship between inflation and economic growth historically, all possible combinations have occurred: inflation with and without development, no inflation with and without development. Earlier works Tunwai (1959) failed to established any meaning full relationship between inflation and economic growth. Paul, Kearney and Chowdhury (1997) investigated the relationship between inflation and economic growth for 8 developing countries for the period of 1960-1989. They found that there is no causal relationship between inflation and economic growth. More interestingly some studies found the relationship is positive in some cases but negative in others. The studies like Fisher (1993), Barro (1996) and Bruno and Easterly (1998) found that the relationship between inflation and economic growth is negative. Paul Keaney and Chowdhary (1997) taking the sample of 70 countries (from which 48 are developing countries) for the period 1960-1989 found no caused relationship between inflation and economic growth in 40 percent of the countries, The study reported bidirectional causality in about 20 percent of countries and a unidirectional relationship in the rest. Lucas (1973) investigated a positive relationship between inflation and growth. The study employed a bivariate model using OLS. The study covers 18 developed and developing countries from 1951-1967. The findings of the study suggest that there is a "stable trade-off between inflation and growth". Karmendi and Maguire (1985) found that a negative relationship between inflation and economic growth. However, it is important to mention that over here that all the above studies are based on the analysis till 1990's.

Bhatia (1960) studied to examine the relationship between inflation and economic growth focusing on five developed countries, namely the United Kingdom (UK), Germany, Sweden, Canada and Japan. The study used a simple bivariate model of the inflation rate and the growth rate. The study found inconclusive evidence on the relationship between inflation and growth. Like several other countries both industrial and developing countries one of the central objective of macroeconomic policies in South Asian countries is to promote economic growth and to keep inflation at a low level. However, there has been substantial debate on whether inflation promotes growth or harm economic growth. Motivated by this controversial, this study examined the impact of inflation on economic growth and established the existence of inflation growth relationship. Time series data for the period 1980-2013 were used to examine the impact of inflation on economic growth. The study examined the relationship between inflation and economic growth for six south Asian countries. Specifically, the paper is organised as follows. Review of literature is given in section 2. Data and methodology are considered in section 3. Empirical results are discussed in section 4. Section 5 explained the VAR analysis. Concluding remarks are given in section 6.

1.1 Review of Literature

W.Stanner (1993) examined that the inflation growth relationship for 12 developed and developing countries.

The study has been based on the annual data covering from the period 1948 to 1986 and 1980 to 1988. The sources of data are collected from German Statistiches Bundesamt (1990). The study has employed simple correlation to find out the relationship among the variables. The empirical findings of the study show that low and zero inflation is essential condition for high and sustained growth.

Barrow (1995) investigated an empirical research on the relation between inflation and economic performance by taking a large sample of countries over the 30 years. This paper employed data around 100 countries from 1960 to 1990 to assess the effects of inflation on economic performance. The annual inflation computed in this study by using the consumer price index. (Deflator was used for the gross when the consumer price data are not available). The framework for the analysis of growth depends upon human capital in the forms of education and health. The study explains that a country grow faster if its human capital grow more rapidly. The study uses the instrumental variables to measure the causation between inflation and growth. The major finding of the empirical analysis is that the estimated effect of inflation on growth and investment are significantly negative when some plausible instruments are used in the statistical procedures. Therefore there are some effects of causation from higher long term inflation to reduce growth and investment.

Sorel (1995) attempted to examine the possibility of nonlinear effects of inflation on economic growth. The data set contains annual information for 87 countries, during the period 1970-90. The data set contains population, GDP, terms of trade, real exchange rates. The CPI and the terms of trade data are used in order to reduce the problems of negative correlation between the inflation and growth. The terms of trade are used in order to eliminate the negative correlation between growth and inflation that is caused by external supply shocks. The study used the OLS regression estimation for growth and inflation. The empirical estimation of the study found that when level of inflation is low, the negative effect of inflation is not significant on economic growth. But when inflation is high it has a negative effect on growth. This negative effect has a robust, statistically significant and very powerful. The study estimated that the structural inflation is 8 percent. This study demonstrated that when the structural break is taken into account the estimated effect of inflation on economic growth increases by a factor of three.

Andres, *et al* (1999) examined to find out the correlation between growth and inflation of the OECD countries and to discuss whether this correlation withstands. This paper tries to assess the long running costs of inflation, within an explicit theoretical framework stemming from growth literature. This approach is well suited to test the robustness of the correlation between growth and inflation with reasoning well working markets, such as OECD countries during the period from1960-92. The estimation method uses causality between inflation and growth along with VAR approach. The estimation result suggests that there are two channels by which inflation influences growth. These are firstly, through a reduction in propensity to invest. Secondly, a reduction in the efficiency of the input costs. The main empirical findings of this paper is that current inflation has never been found to be positively correlated income per capita over the long run. Overall this result indicates that the long running costs of inflation are non negligible and that efforts to keep inflation under control will sooner or later payoff in terms of better long run performance and highest per capital income.

Mallik, *et al* (2001) attempted to examine the relationship between inflation and GDP growth for four South Asian countries (Bangladesh, India, Pakistan and Sri Lanka).This paper employed co-integration and Error correction model to examine the extent to which economic growth is related to inflation and vice versa. The annual data source collected from the IMF international financial statistics CD-ROM have been used. The empirical evidence defines that there is a long run relationship between economic growth rates and inflation rates in all four countries. Finally, the study evaluates that inflation and economic growth are positively related, the sensitivity of inflation to changes in growth rates is longer than that of growth to changes in inflation rates. It also suggests that the economies are in a knife edge position.

Gylfason, et al (2001) studied to investigate the cross country link between inflation and growth. This study has dealt with cross country analysis for 170 developing and developed countries. The study used annual data series covering the frequency from 1960-1992. The study has employed simple regression techniques in order to determine the link between inflation and growth. The empirical findings suggest that the cross country links between inflation and growth are economically and statistically significant and robust.

Valdovinos, et al (2003) Studied to examine the growth rate of the economy and the level of inflation from a non-structural, low frequency point of view. The study has used annual data for the eight Latin American countries covering the period from 1970-2000. The study employed spectral analysis to examine the growth inflation levels. The empirical findings of the study emphasized that the average long run rate of inflation in a country is negatively associated with the countries long run rate of growth.

Gokal, et al (2004) attempted to investigate the meaningful relationship between inflation and growth in Fiji. The study used the annual data from the period 1970-2003. The study employed the econometric techniques like Unit Root Test (ADF, PP) and Granger Causality. The study found that there exists a weak negative correlation between inflation and growth.

Kin, et al (2005) studied the long run and the short run relationship between inflation and financial development

using the sample of 87 countries. The study used annual data for the period 1960-2005. The study employed pooled mean group estimator of Pesoran, Shin and Smith (1999) to unbalanced panel data. The study empirically found that there is a negative long run relationship between inflation and financial development coexists with a positive short run relationship.

1.1.1 Data and Methodology

Johansen's cointegration approach requires variables should be non stationary at their respective levels, but their liner combination must be stationary and they should be integrated of same order (Johansen, 1991). According to Table-3 both the max and Eigen value statistics in the Johansen cointegration test indicate a cointegrating (long run equilibrium) relationship between inflation and economic growth for Malaysia. However, the rest of the countries did not indicate a long run relationship between two variables. This study uses the CPI data as a proxy for inflation and GDP as an indicator of economic growth for the period of 1980 to 2013. The data were collected from the World Economic Outlook (WEO) and they were converted into their natural log values. The study employed unit root to test the stationarity of the time series data. The stationarity of the series was checked using the Augmented Dickey Fuller (ADF) Test and the Phillips Perron (PP) unit root Tests. If both the variables are stationary at I (1), then the long run relationship was tested using Johansen's cointegration test (Johansen, 1999). If the two variables are stationary of different levels, then the ARDL bound test is used as it is independent of order of integration. (Pesaran, et al, 2001), the number of lags for the cointegration was identified through a VAR lag set up. Further, the causality between inflation and economic growth was tested by a granger causality test (Granger, 1988). Unrestricted VAR is used to understand the short run relationship between two variables. It is important to mention over that all these above time series methods are available in the literature and in the standard text book in time series econometric therefore, the study does not discuss the methodology here.

1.1.2. Empirical Analysis

1.1.3 Correlation Result

Table-1: Correlation Analysis

COUNTRY	VARIABLE	DCPI	DGDP
BANGLADESH	DCPI	1	
	DGDP	0.97	1
BHUTAN	DCPI	1	
	DGDP	0.98	1
INDIA	DCPI	1	
	DGDP	0.98	1
MALDEVIES	DCPI	1	
	DGDP	0.96	1
NEPAL	DCPI	1	
	DGDP	0.99	1
SRILANKA	DCPI	1	
	DGDP	0.99	1

From this table-1, it can be summarised that there is high positive correlation between GDP and CPI for all the countries, the result shows that the strong and significant positive correlation exist between GDP and CPI for all the seven South Asian countries.

1.1.4 Unit Root Test

The literature in the past has experienced an explosion unit root for stationary of time series data as the choice of technique and produce for further analysis depends on their order of integration. Hence, without taking into account the presence of a unit root in the variables, the analysis may produce spurious regression results. Therefore, the Augmented Dicky-Fuller (ADF) and Phillis-perron (PP) tests are conducted to check the stationary property of the data as well as to check the order of integration.

The results of unit root test are presented in Table-2, which shows that all the variables are stationary at their corresponding first difference for all the countries. This is because that the estimated values of the two variables of different countries are significant at 1, 5 and 10 significance level in both the ADF and PP test. Hence, we reject the null hypothesis and concluded that all the variables are stationary.

Table-2: Unit Root Test

Country	variable	ADF TEST				PP Test			
		Level		1st difference		Level		1st difference	
		c	c&t	c	c&t	c	c&t	c	c&t
Bang.	Lngdp	9.89	-0.89	-1.97	-3.52** (0.05)	8.46	-0.86	-1.96	3.30** (0.05)
	Lncpi	0.37	-2.26	-3.21** (0.02)	-1.27	-1.93	-3.01	-3.12** (0.03)	-2.16
Bhutan	Lngdp	-0.25	-1.93	-5.73* (0.00)	-5.65* (0.00)	-0.25	-2.02	-5.73* (0.00)	-5.65* (0.00)
	Lncpi	1.21	-1.79	-3.64* (0.01)	-3.73** (0.03)	-1.64	-1.64	-3.58* (0.01)	-3.70** (0.03)
India	Lngdp	1.39	-1.81	-4.49* (0.00)	-4.71* (0.00)	1.63	-1.52	-4.47* (0.00)	-4.60* (0.00)
	Lncpi	-0.10	-2.97	-3.73* (0.00)	-3.58* (0.04)	-0.73	-1.94	-3.71* (0.00)	-3.56* (0.04)
Maldives	Lngdp	-1.31	-2.61	-6.42* (0.00)	-6.61* (0.00)	-2.32	-2.46	-6.50* (0.00)	-7.40* (0.00)
	Lncpi	-2.27	-2.84	-4.01* (0.00)	-4.45* (0.00)	-0.57	-1.69	-4.21* (0.00)	-4.15* (0.01)
Nepal	Lngdp	-0.84	-2.62	7.52* (0.00)	-7.10* (0.00)	-3.13	-2.58	-8.27* (0.00)	-8.77* (0.00)
	Lncpi	-2.22	-1.80	-4.14* (0.00)	-4.28* (0.00)	-2.04	-1.81	-4.13* (0.00)	-4.28* (0.00)
Sri Lanka	Lngdp	1.36	-0.95	-4.32* (0.00)	-4.54* (0.00)	1.30	-0.95	-4.35* (0.00)	-4.45* (0.00)
	Lncpi	-1.52	-2.26	-5.11* (0.00)	-5.16* (0.00)	-1.64	-2.42	-5.20* (0.00)	-5.30* (0.00)

Note: The *, ** represents 1% and 5% level of significance. c and c&t represents constant and constant and trend, Parenthesis indicates p-values.

1.1.5 Cointegration Result

The concept of cointegration is that non-stationary time series are co-integrated if liner combination of these variables is stationary. The cointegration requires the error term in the long-run relation to be stationary.

Assume that in case of two variables Y_t and X_t and both Y_t and X_t follows I (1) process. The liner combination $U_t = Y_t - \alpha X_t$ is I(0). If so, both Y_t and X_t are said to be cointegrated and α is the cointegrated parameter. The maximum likelihood approach to test for cointegration is based on the equation given below.

$$\Delta yt = Jx_{t-1} + \sum_{i=1}^{p-1} Ji\, \Delta x_{t-1} + \varepsilon_t$$

In the above equation the number of independent cointegrating vectors is equal to the rank of matrix Л, if Л=0, then Л is a null matrix and equation turns out to be a VAR model where as if rank of Л=1, there is a one cointegrating vector and Jx_{t-1} is an error correction term, Johanson suggest that it can be done by testing the significance of characterizes roots of Л.Let rank of Л=0,then $\lambda_i = 0$; hence, $\ln(1-\lambda)=0$whereas, if rank of Л=unity then $0<\lambda_1<1$ and $\ln(1-\lambda_1)$ will be negative and the rest $\ln(1-\lambda_2) = \ln(1-\lambda_3)=0$.

Johansen suggests two test statistics to test the null hypothesis that number of characteristics roots is insignificantly different from unity.

$\lambda_{trace\ (Л)} = -T \sum^{n}_{i=r+1} \ln(1-\lambda^{\wedge}_i)$

$\lambda_{max}(r,r+1) = -T \ln(1-\lambda^{\wedge}_{r+1})$

λ_i =estimated characteristics' roots are Eigen values.

T= the number of usable observations.

Λ_{trace} test the null hypothesis. R=0 against the alternative of r>0

Λ_{max} test the null hypothesis r=0, against the alternative of r=1

The theory expressed in equation (1) asserts that there exists a liner combination of this nonstationary that is stationary. Solving for the error term, we can rewrite the relation (1) as

$\mathcal{E}_t = GDP_t - \alpha - \beta_0 INF_t$ ……. (4)

Since (ε_t) must be stationary, it follows that the liner combination of integrated variables giving by the right hand side must be stationary. ADF test for the residual of the co-integrating regression reveals that the null hypothesis can be rejected at 0.05 level of significance, and the variable (ε_t) is stationary.

Table-3: Cointegration Test

Country	H_0	Eigen value	Trace statistics	Critical value at 5% (p-value)	Eigen value	Max Eigen value	Critical value at 5% (p-value)
Bangladesh	None r=0() Atmost (r=1)	0.21 0.18	14.15 6.47	15.49(0.01) 3.84(0.01)	0.21 0.18	7.68 6.47	14.26(0.41) 3.84(0.01)
Bhutan	None (r=0) Atmost (r=1)	0.27 0.00	10.52 0.04	15.49(0.24) 3.84(0.82)	0.27 0.00	10.48 0.04	14.26 (0.18) 3.84 (0.82)
India	None (r=0) Atmost (r=1)	0.19 0.04	8.48 1.38	15.49(0.41) 3.84(0.23)	0.19 0.04	7.10 1.38	14.26(0.47) 3.84(0.23)
Maldives	None (r=0) Atmost (r=1)	0.13 0.06	6.78 2.25	15.49(0.60) 3.84(0.13)	0.13 0.06	4.53 2.25	14.26(0.79) 3.84(0.13)
Nepal	None (r=0) Atmost (r=1)	0.23 0.04	10.38 1.55	15.49(0.25) 3..84(0.21)	0.30 0.05	13.27 1.84	15.49(0.10) 3.84(0.17)
Sri Lanka	None (r=0) Atmost (r=1)	0.15 0.01	5.95 0.44	15.49(0.70) 3.84(0.50)	0.15 0.01	5.51 0.44	14.26(0.67) 3.84(0.50)

1.1.6 Granger Causality Result

The Granger causality test is used to understand the causality between the two variables under study. Essentially, the Granger causality test determines whether inflation causes economic growth or vice versa. Table-4 reports the Granger causality test between inflation and growth for South Asian countries. The table-4 summarizes the result that there is a unidirectional causality runs from GDP to CPI for Bangladesh, Bhutan and India. There is also unidirectional causality runs from CPI to GDP in the context of Nepal. The study also found that there is no causality runs from the context of Maldives and Sri Lanka.

Table-4: Granger Causality

Country	Hypothesis	F-Statistics	Probability
Bangladesh	DGDP does not Granger Cause DCPI	3.33	0.05
	DCPI does not Granger Cause DGDP	0.15	0.85
Bhutan	DGDP does not Granger Cause DCPI	3.81	0.03
	DCPI does not Granger Cause DGDP	1.12	0.34
India	DGDP does not Granger Cause DCPI	4.61	0.01
	DCPI does not Granger Cause DGDP	0.22	0.79
Maldives	DGDP does not Granger Cause DCPI	1.68	0.20
	DCPI does not Granger Cause DGDP	1.39	0.26
Nepal	DGDP does not Granger Cause DCPI	1.69	0.20
	DCPI does not Granger Cause DGDP	3.04	0.06
Sri Lanka	DGDP does not Granger Cause DCPI	0.03	0.96
	DCPI does not Granger Cause DGDP	1.68	0.20

1.1.7 Error Correction Result

The results conforms the cointegration result and indicate the presence of error correction term both for CPI and GDP in the context of Malaysia. In case of Bhutan, India and Maldives CPI is highly significant which states that there is a no problem for adjustment in the long run in case of shock in the short run. In case of Nepal there is no problem of adjustment in the long run in case of shock in the short run. However, in case of Sri Lanka GDP is highly significant which implies high speed adjustment to the long run equilibrium every year in case of shock in the short run.

Table-5: Error Correction Result

Country	Error Correction	D (CPI)	D (GDP)
Bangladesh	CointEq1	-0.071008 (0.02923) [-2.42933]*	-0.016780 (0.00770) [-2.17779]*
Bhutan	CointEq1	-0.135984 (0.04683) [-2.90396]*	-0.113811 (0.06197) [-1.83650]
India	CointEq1	-0.072851 (0.03735) [-1.95067]*	0.013393 (0.03933) [0.34048]
Maldives	CointEq1	-0.131660 (0.66542) [-2.01263]*	0.002237 (0.66780) [0.03300]
Nepal	CointEq1	-0.196688 (0.08124) [-2.42113]*	0.116269 (0.04740) [2.32656]*
Sri Lanka	CointEq1	-0.043673 (0.04991) [-0.87503]	0.051026 (0.02491) [2.04837]*

1.1.8 VAR Analysis

A unidirectional VAR analysis is used to analyse the short run dynamic relationship between inflation and economic growth. Impulse response function shows the possible dynamic response of all the variables in the system to check or innovation in each variable. The standard Choleskey decomposition method is used to obtain impulse response to shocks from either variable over a 10 year period ahead.

For Bangladesh a one standard deviation shock to inflation does not affect economic growth in the short run and one standard deviation shock to economic growth has no effect. However, both variables decay towards zero.

Figure-1: Impulse Responses- Bangladesh

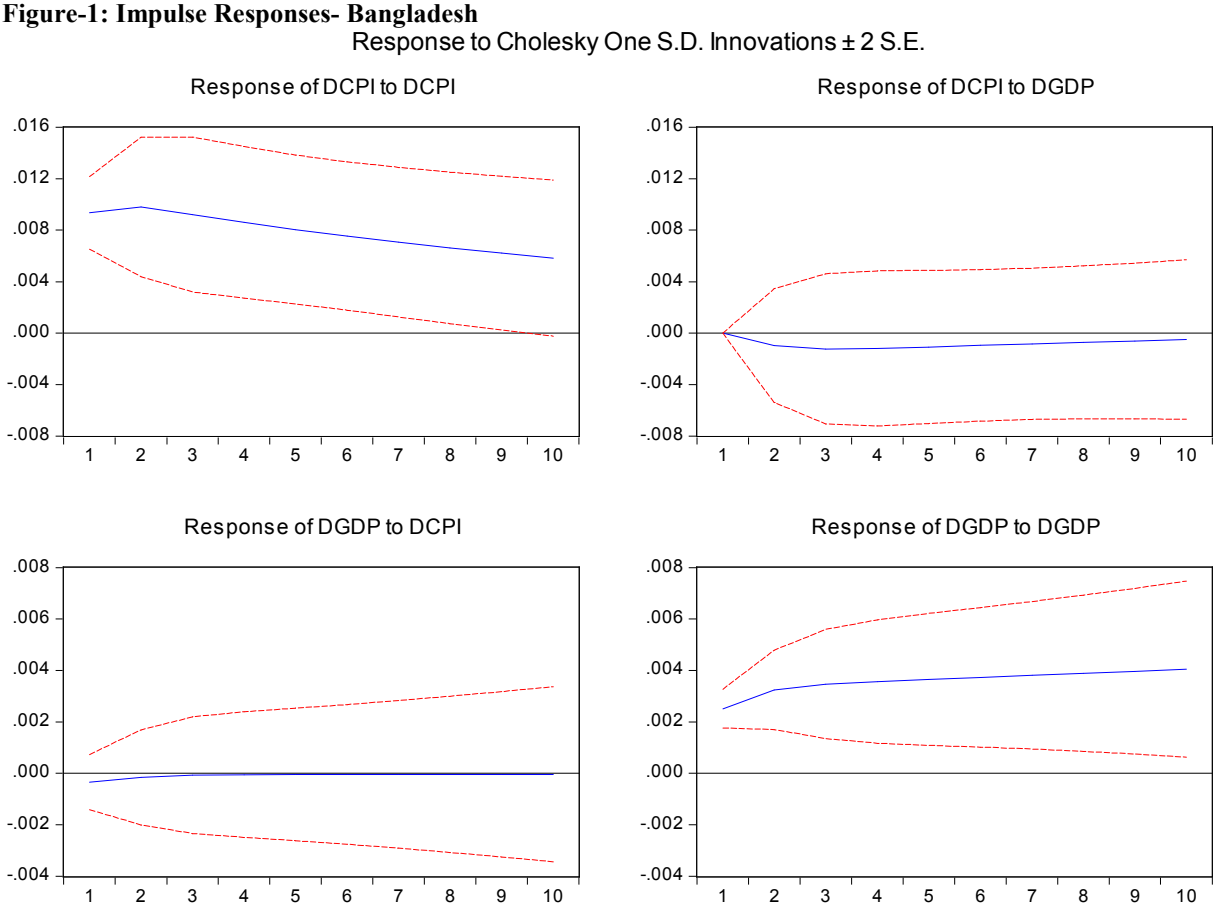
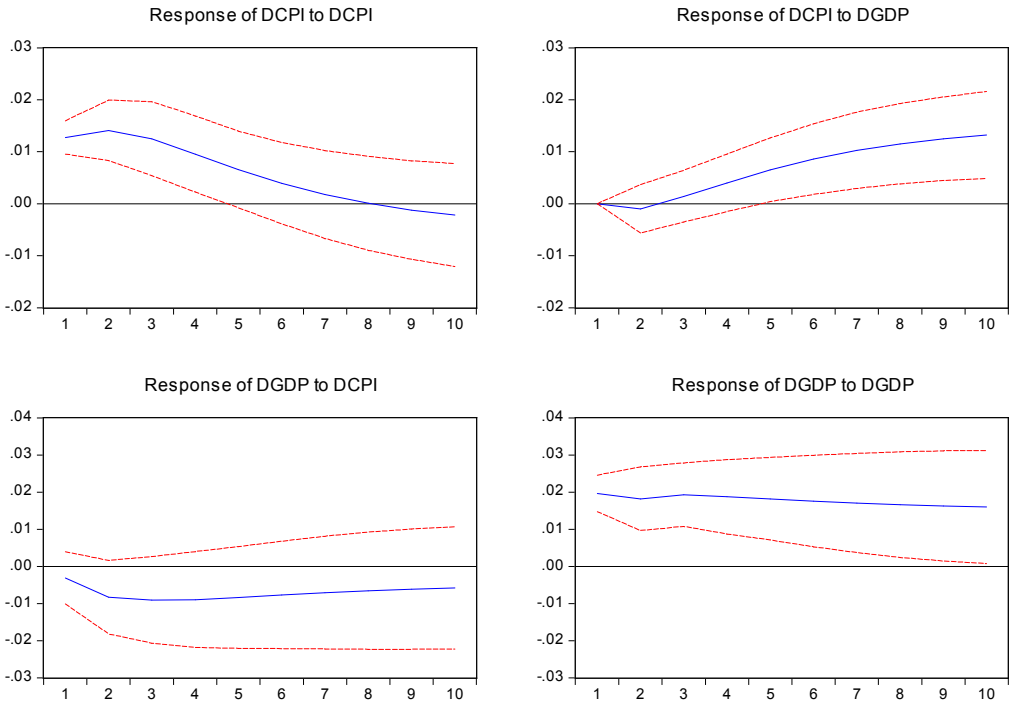


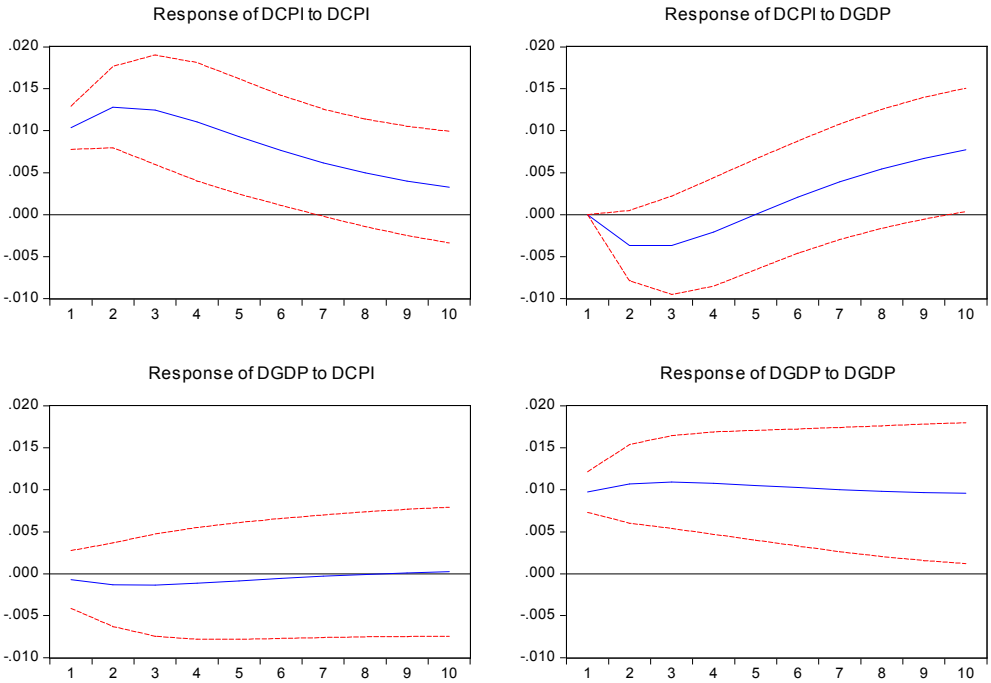
Figure-2: Impulse Responses- Bhutan



In case of Bhutan a standard deviation shock to inflation increases the economic growth in the short run as well as in the long run in the 10 lag periods. But, one standard deviation shock in economic growth reduces inflation in the short run up to the lag period two but in the long run has no effect.

For India, a standard deviation shock to inflation has a negative effect up to the lag period two then from lag period three onwards it has a positive shock to economic growth in the long period. Similarly, one standard deviation shock in economic growth have a very little effect to reduce inflation however, in the long run the shock becomes ineffective for India.

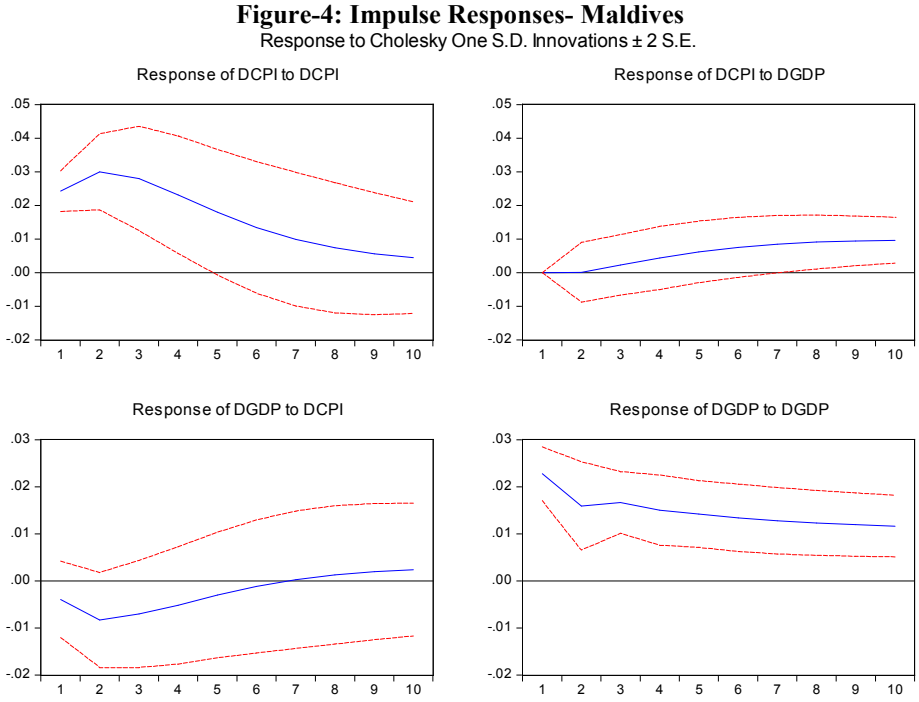
Figure-3: Impulse Responses- India



In case of Maldives one standard deviation shock to inflation have a positive shock to economic growth in the short run as well as in the long run in the ten period lag. However, a standard deviation shock to economic growth reduces the inflation up to the lag period two then it has a positive shock in the long run in the ten period

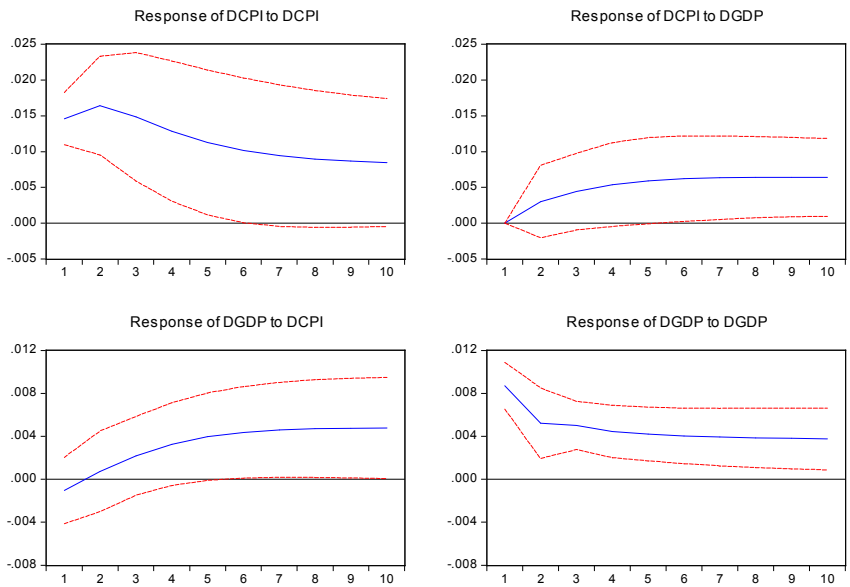
lag.

Figure-4: Impulse Responses- Maldives



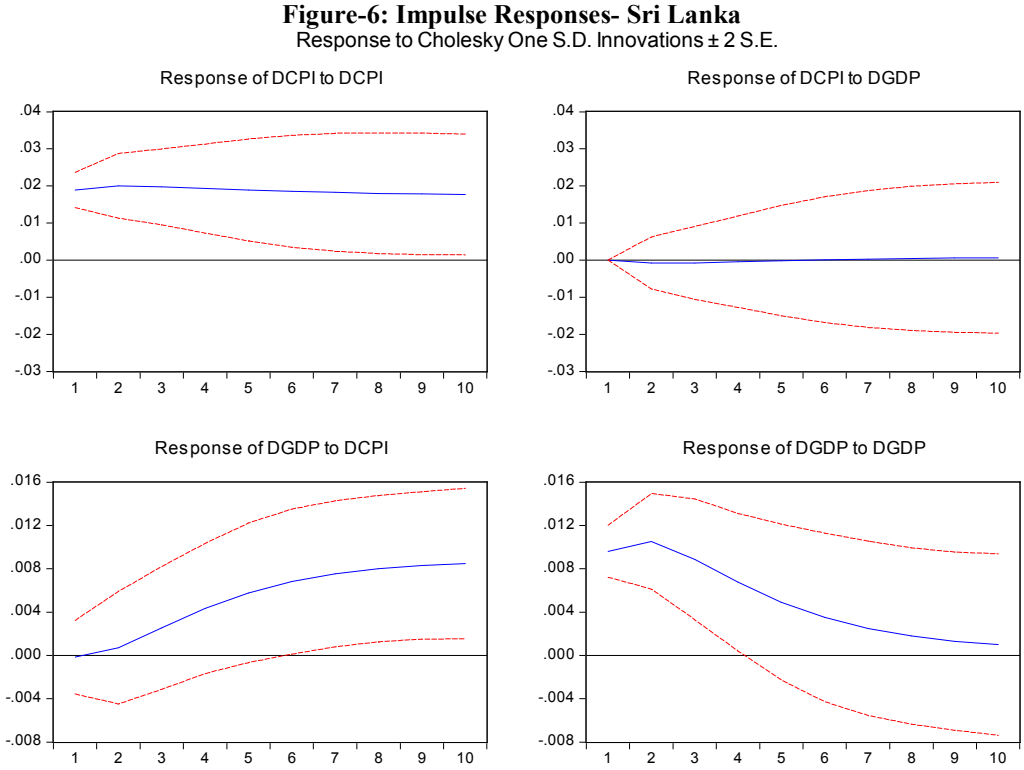
For Nepal one standard deviation shock to inflation have a positive shock to economic growth up to the lag period ten in the short run as well as in the long run. Similarly, one standard deviation shock to economic growth increases inflation. However, the shock becomes effective for Nepal in the long run also.

Figure-5: Impulse Responses- Nepal



In the context of Sri Lanka one standard deviation shock to inflation has no effect to economic growth in the short run. However, one standard deviation shock to economic growth has a positive shock to inflation in the short run as well as in the long run for Sri Lanka.

Figure-6: Impulse Responses- Sri Lanka



6. Concluding Remarks

High output and low inflation are among the most important objective of macroeconomic policy. But there are perceived trade-off between lowering inflation and achieving high growth. This study explores the nexus of inflation growth relationship among the South Asian Countries. The main objective of this study is to investigate the impact of inflation on economic growth in six South Asian countries based on the annual data for the period 1980-2013. The correlation result of the study found that there is high positive correlation exist between inflation and economic for all the countries. In order to test the time series properties the study employed unit root test which indicates that are the variables are stationary at their corresponding first difference for all the countries. The cointegration result suggests that there is a long run relationship exists for Malaysia. However, the rest of the countries have no long run relation between inflation and economic growth. The Granger causality result explains that there is a unidirectional causality runs from GDP to CPI for Bangladesh, Bhutan, and India. The result also indicates unidirectional causality run form CPI to GDP in the context of Nepal. However, there is no causality runs for Maldives and Sri Lanka. The Error correction result identified that there is short run adjustment takes place both for GDP and CPI in the context of Malaysia. In case of Bhutan, India and Maldives CPI is highly significant which states that there is no problem for adjustment in the long run in case of shock in the short run. However, in case of Sri Lank GDP is highly significant which implies high speed adjustment to the long run equilibrium every year in case of shock in the short run. The result of VAR analysis suggest that one standard deviation shock to inflation has a positive shock to economic growth in the short run as well as in the long run for Bhutan and Maldives. However, in case of Sri Lanka growth has a positive shock to inflation but inflation has no shock to growth in the ten period lag. The study also indicates that there is short run and as well as long run shock takes place in the context of Nepal in the ten period lag. But the study found that there is no significant consistent short run relationship between inflation and economic growth over the ten period of lag in the context of Bangladesh. The result of the study has significant policy implications for the South Asian countries.

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