

## **Co-integration and Causal-Nexus between Inflation Rate and Economic Growth in India**

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## ABSTRACT

Increase in money supply and general rise in prices of goods and services leads to inflation in the country. Inflation affects consumers, business organizations, government and international trade in different ways. Mild inflation encourages economic growth, however, running and hyperinflation hampers economic growth and development of the country. High inflation for a longer time may lead to economic slowdown and unemployment. In the same way, too much GDP is also dangerous as it will lead to inflation and people have to spend more money for their purchases which leads to dis-savings. The present study attempts to analyze the causal-nexus between inflation and economic growth in India. In order to identify cointegration, it is necessary to check whether the variables are stationary. Using the Augmented Dickey-Fuller (ADF) test it was found that the variables Gross Domestic Product (GDP) and Consumer Price Index (CPI) are stationary in the first difference. Johansen's cointegration test confirmed the existence of cointegration between GDP and CPI. Since both the variables were integrated in the first order Vector Error Correction Model (VECM) was used to ascertain the long-run causal relationship between CPI and GDP and the results indicated uni-directional causation between CPI and GDP i.e., inflation rate causes economic growth in the long-run.

**Key words:** *Inflation, Economic Growth, Stationarity, Cointegration, Vector Error Correction Model*

## INTRODUCTION

Increase in money supply and general rise in prices of goods and services leads to inflation in the country. Usually, inflation is caused by several factors, viz., increase in public spending, deficit financing, hoarding, tax evasion, exports, shortage of essential commodities etc. Inflation affects consumers, business organizations, government and international trade in different ways. Inflation brings about negative externalities on the economy when it interferes with an economy's efficiency (Gokal and Subrina, 2004). Mild inflation encourages economic growth, however, running and hyperinflation hampers economic growth and development of the country. The relationship between inflation and GDP is delicate and the slightest of disturbance in these can be dangerous for the economy. High inflation for a longer time may lead to economic slowdown and unemployment. So, rising inflation has to be controlled quickly. In the same way, too much GDP is also dangerous as it will lead to inflation and people have to spend more money for their purchases which leads to dis-savings. The present study attempts to analyze the relationship between India's inflation and economic growth in the long-run.

## REVIEW OF LITERATURE

Anidiobu et.al. (2018) analysed the effect of inflation on economic growth in Nigeria. The researchers have taken data for the period 1986 – 2015 and employed ex-

post research design. The researchers used Ordinary Least Square (OLS) technique to estimate the variables viz., Real Gross Domestic Product (RGDP), Inflation Rate (INFR), Interest Rate (Interest Rate) and Exchange Rate (EXCHR). The results showed that inflation rate had a positive and non-significant effect on economic growth.

Saha (2018) highlighted the relationship between inflation and economic growth in India. The VAR model confirmed that there is a negative relationship between inflation and economic growth. During the period of study economic growth caused inflation in India.

Behera and Mishra (2017) investigated the relationship between inflation and economic growth in India using regression. It was found that there if inflation exceeds the threshold point, i.e., 4 per cent it will negatively affect the economic growth. The existence of long-run relationship between economic growth and inflation was confirmed.

Aydin et.al., (2016) examined the impact of inflation on economic growth for Turkish Republics viz., Azerbaijan, Kazakhstan, Kyrgyzstan, Uzbekistan, and Turkmenistan through dynamic panel data analysis. The results indicated that there is a nonlinear relationship between growth and inflation and the threshold for the influence of inflation on economic growth is 7.97 per cent. The inflation rate above the threshold has a negative influence on economic growth while an inflation rate below this threshold has a positive influence on economic growth.

Mamo (2012) underscored that there is a negative relationship between growth and inflation using panel data from 13 SSA countries for the period 1969 to 2009. Panel granger causality test result proved that inflation can predict economic growth for most of the countries in the sample.

Salian (2011) examined the relationship between GDP and inflation in India using the cointegration and error correction models. It was found that there is negative relationship between GDP and inflation in the long-run.

## **RESEARCH METHODOLOGY**

For the study, secondary data was collected from the Handbook of Statistics on Indian Economy and World Bank Database. In order to study the impact of inflation on the economic growth of India, GDP at factor cost and consumer price index for the period 2000 to 2020 was taken. GDP at factor cost is used as a proxy for economic growth and inflation is measured by consumer price index. To remove the price effect from GDP at factor cost, this variable was deflated with the GDP deflator considering 2011-12 as base year. Augmented Dickey-Fuller (ADF) test was conducted to examine the presence of unit root in the variables and Johansen Cointegration test was done to identify whether these two variables were cointegrated. Vector Error Correction Model was employed to find the long-run relationship between the chosen variables.

## OBJECTIVES OF THE STUDY

1. To identify the cointegration among inflation rate (CPI) and economic growth (GDP) in India during the study period.
2. To examine the causal-nexus between inflation rate and economic growth in India in the long-run.

## HYPOTHESES OF THE STUDY

1. There is no cointegration among inflation rate (CPI) and economic growth (GDP) in India during 2000-2020.
2. There is no causal-nexus between inflation rate and economic growth in India in the long-run.

## RESULTS AND DISCUSSION

To identify the long-run relationship between the two variables i.e., GDP and CPI, there is a need to test if the data series is stationary or not. So, ADF test was employed to verify the stationarity of the data.

**Table – 1: Test of Stationarity for GDP and CPI Using Augmented Dickey – Fuller Test**

Augmented Dickey - Fuller Test				
Data Series	At Level		At first-order difference	
	t-statistic	Prob.	t-statistic	Prob.
GDP	1.8297	0.9797	-3.7511	0.0008**
CPI	0.0815	0.6973	-3.3719	0.002**

Source: Computed by investigators

Table 1 shows that the two variables GDP and CPI were not stationary at level and became stationary at first difference and they were integrated in same order I(1). So, Johansen Cointegration test was performed.

## JOHANSEN COINTEGRATION TEST

Johansen Cointegration test was used to find the cointegration between GDP and CPI and the result is given in table 2.

**Table – 2: Johansen Cointegration Test**

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigen value	Trace Statistic	0.05 Critical Value	Prob.
None	1	672.2827	12.3209	0.0001

At most 1	0.0323	0.6231	4.1299	0.4908
<b>Unrestricted Cointegration Rank Test (Maximum Eigen value)</b>				
<b>Hypothesized No. of CE(s)</b>	<b>Eigen value</b>	<b>Max-Eigen Statistic</b>	<b>0.05 Critical Value</b>	<b>Prob.</b>
None	1	671.6596	11.2248	0.0001
At most 1	0.0323	0.6231	4.1299	0.4908
*MacKinnon-Haug-Michelis (1999) p-values				

Source: Estimates based on secondary data

Note: \*5 per cent significance level

It was found from table 2 that the critical value (12.3209) is less than the trace statistic (672.2827) hence the null hypothesis is rejected. It is inferred that there is cointegration between GDP and CPI during the study period. As there is cointegration between the variables the study is further taken up to assess the long-run relationship.

### VECTOR ERROR CORRECTION MODEL (VECM)

According to Granger representation theorem, if variables are cointegrated then their relationships can be expressed as long-run model i.e., VECM. Since the variables GDP and CPI were cointegrated in the same order I(1), VECM can be given in model 1 and 2 as follows:

$$\Delta \ln GDP_t = c_1 + \sum_{k=1}^n \alpha_{1i} \Delta \ln GDP_{t-k} + \sum_{k=1}^n \beta_{2i} \Delta \ln CPI_{t-k} + \rho_1 ECT_{t-k} + \varepsilon_{gdpt} \quad (1)$$

$$\Delta \ln CPI_t = c_2 + \sum_{k=1}^n \beta_{1i} \Delta \ln CPI_{t-k} + \sum_{k=1}^n \alpha_{2i} \Delta \ln GDP_{t-k} + \rho_2 ECT_{t-k} + \varepsilon_{cpit} \quad (2)$$

GDP and CPI in model 1 and 2 represents economic growth and inflation in India. ECT is the error correction term.

**Table – 3: Causal Nexus between GDP and CPI**

Regression Equation	C	$\Delta \ln g_{t-1}$	$\Delta \ln g_{t-2}$	$\Delta \ln c_{t-1}$	$\Delta \ln c_{t-2}$	$ECT_{t-1}$	Inference
$\Delta \ln g$ on $\Delta \ln c$	0.0421 (0.025) [1.68]	0.4551 (0.290) [1.57]	-	0.1728 (0.132) [1.31]	-	-0.8898** (0.313) [-2.84]	Inc → lng (CPI → GDP)
$\Delta \ln c$ on $\Delta \ln g$	0.0271 (0.072) [0.38]	-0.5766 (0.830) [-0.70]	-	-0.0941 (0.378) [-0.25]	-	-0.4555 (0.897) [0.51]	

Source: Computed by the investigators

lng and lnc are GDP and CPI respectively

\*\*denotes the significance at 5percent level

Figures in the parentheses ( ) show the standard error

Figures with in square brackets [ ] are z statistics

The results of VECM are presented in table 3 and it shows that the error correction coefficient,  $ECT_{t-1}$ , (-0.8898) in first equation is negative and significant at 5 per cent level. The results indicated the existence of long run relationship among the variables. The results proved that there is uni-directional long run causality from CPI to GDP. It is evident from the result that inflation causes economic growth in India during the study period.

## CONCLUSION

The present study examined the relationship between inflation and economic growth in India in long-run. It was found that there exists uni-directional causation between inflation rate and economic growth. The results suggested that inflation rate caused economic growth in the long-run. However, there is no reverse causality i.e., economic growth does not cause inflation during the study period. Therefore, the policy makers have to take due care while framing monetary policy so that there is adequate money supply in the economy to stimulate growth but at the same time the rate of inflation must be kept under tolerance level of 6 per cent as stated by the central government in consultation with Reserve Bank of India (Monetary Policy Report, April 2021).

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