Relationship between Inflation and Unemployment in India: Vector Error Correction Model Approach

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Abstract

The purpose of this study is to investigate the relationship between inflation and unemployment in India. The study is based on secondary data for the period of 1991 to 2016. This paper used the vector error correction model to find the causality link between inflation and unemployment. The result reveals that, there is no causality running between inflation and unemployment in the short run. However, there is one direction of causality running from unemployment to inflation in the long run in India. These findings support the existence of the Phillips curve in the long run in India.

Keywords: *inflation rate, unemployment, VECM, and India.*

1. INTRODUCTION

The relationship between inflation and unemployment was first introduced by William Phillips in 1958 using inflation and unemployment data in the United Kingdom. According to which there existed a trade-off relationship between unemployment and inflation. Since then, the inverse relationship between unemployment rate and inflation rate has been known as the "Phillips curve" (Phillips, 1958). Although this hypothesis has some criticisms regarding the basic assumptions, the Phillips curve remains one of the most important foundations in macroeconomics.

Besides having a theoretical importance, the Phillips curve carries important political implications (Furuoka, 2007). It is a fact that one of the main policy objectives s of central banks is the price stabilisation through inflation control. As a result the central banks develop their monetary policies in such a way that would enable them to keep inflation as low as possible. However, the dilemma is that if there exists an inverse relationship between inflation and unemployment, the central banks would be able to maintain low inflation rates only by the means of high unemployment. Thus, it is difficult for the central bank to choose between having a combination of low-inflation and high-unemployment or vice versa. In this context, the Phillips curve has remained an important consideration for decision-makers and the central banks. Given this background, the objective of this study is to investigate the causal link between inflation and unemployment in India since 1991.

In-spite of huge economic development over the past 10 years, yet India is not able to control inflation. Due to lack of control and check over government spending, increase in the cost of living, and hoarding of essential commodities by greedy traders etc. the prices of goods increasing rapidly. On the other hand, as a result of population explosion, and the lack of vocational and technical education, the number of unemployed youth has already reached an alarming stage in India and the number is increasing every year. In this case the knowledge of causal link between inflation and unemployment could help the policy makers to choose optimum policies.

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The rest of the study is organised in following ways: in section 2, we have discussed various literature; section 3 deals with the discussion of details methodology; section 4 analysed the various results. Finally, section 5 presents the conclusion and policy prescription.

2. REVIEW OF LITERATURE

Many studies have been undertaken to understand linkages between the inflation rate and the unemployment rate. One of the earlier studies by Solow (1970) examined the relationship between the two variable inflation rate and unemployment in the context of the United States. The results led to a conclusion that there existed an inverse relationship between unemployment and inflation rates in the USA. Furthermore, Gordon (1971) also confirmed the existence of a negative trade-off relationship between unemployment and inflation using U.S. macroeconomic data.

Lucas (1976) strongly opposed the proposition of the existence of the Phillips curve. He argued that there could have existed a trade-off relationship between unemployment and inflation if the workers did not expect that the policy makers would try to create an artificial situation where high-inflation is paired with low unemployment. Otherwise, the workers would foresee the high inflation in the future and would demand wage increase from their employers. In this case, there could be coexistence of high unemployment and high inflation rate, which is known as the "Lucas critique".

Turner and Seghezza (1999) employed the panel data method to examine the Phillips curve in 21 OECD countries over the period from the early 1970s to 1997. To analyze the pooled data, Turner and Seghezza used the method of Seemingly Unrelated Estimation (SURE) rather than the OLS. The researchers concluded that the overall result provided a "strong support" for the existence of the "common" Phillips curve among the 21 chosen member countries of OECD. Arratibel et al. (2002) analyzed New Keynesian Phillips curve with forward-looking expectations by using panel data. They found that the unemployment rates have significant relationship with non-tradable inflation rates. By contrast, Masso and Staehr (2005) used the dynamic panel data method and failed to identify a significant relationship between the unemployment rate and inflation rates.

Karanassou and Sala (2010) argued there is a tradeoff between inflation and unemployment in long run because of money and productivity growth which leads to decrease in International Finance and Banking unemployment, while supply shock like oil prices which leads to increase in unemployment. He also argued that the increase in productivity growth causes decrease in inflation and also fall in unemployment. Al- Zeaud (2014) argued that there is no tradeoff between inflation and unemployment in the Jordan economy between 1984 and 2011 because foreign labours were not involved in the unemployment rate calculation. He used Granger-Causality test to check the relationship between variables and the direction of causation and techniques depends on testing stationary, integration, co-integration as per-requisites.

Furuoka, (2007) examined the trade-off the relationship between inflation rate and unemployment rate in Malaysia. This paper used vector error correction (VECM) to test the relationship. The results revealed the existence of the long run relationship among the variables. In other words, this paper has provided an empirical evidence to support the existence of the Phillips curve in the case of Malaysia. Afzal and Awais, (2012) also investigated the Inflation-Unemployment Trade Off in Pakistan. The empirical results show that the Phillips curve holds in Pakistan. Similarly, Singh, and Verma, (2016) estimated the short-run tradeoff between inflation and unemployment for the Indian economy over the period 2009-2015 using bi-variate regression. The result showed the existence of the inverse relationship of inflation with the unemployment in the short run.

Based on the empirical findings we have seen that, the relationship between the unemployment rate and inflation rates are mixed results. Some researcher found the significant trade-off relationship between the unemployment rate and inflation rates and other does not Furuoka, (2007). The relationship is depending on geographical location and type of methodology used. In aggregate a number of studies to understand the relationship between the unemployment rate and inflation rates, but the studies are very limited in India. Thus, this study is an attempt to fill this gap.

3. DATA AND METHODS

3.1. Data

The study is entirely based on secondary data for the period of 1991 to 2016. The data on unemployment rate are compiled from the World Bank. On the other hand data on inflation rate are collected from

(http://www.inflation.eu/inflation-rates/india/inflation-india.aspx). The statistical software Eviews7 has been used for statistical calculations. Detail descriptions of the variables are shown in table 1:

Table 1: Summary Statistics

Variables	Description	Mean (SD)
Inflation rate (INF)	Inflation rate is defined as the annual percent change in consumer prices compared with the previous year's consumer prices	7.70 (3.19)
Unemployment rate (UNP)	The unemployment rate is the percentage of the total workforce that is unemployed and is looking for employment	3.91 (0.30)

Source: author's calculation

3.2. Methods

The Granger causality test (Granger 1969) has been generally used to find the causality relationship between variables. This test tells us that if the past values of a variable (say *y*) significantly contribute to forecast the future value of another variable (say *x*) then *y* is said to Granger-cause *x*. Conversely, if past values of *x* statistically improve the prediction of *y*, then we can conclude that *x* Granger causes *y* (Granger 1969). However, if two variables are stationary at I(1) (i.e. integrated of order one) and co-integrated then it shows that, there would be a causal relationship at least in one direction Engle and Granger (1987). But the presence of co-integration doesn't show the causality. Thus, in order to find causality in first-differences system with co-integrated variables, the Granger causality test must be conducted in a vector error correction model (VECM) setting (Greene 2008). The equations are:

$$\Delta INF_t = \alpha + \sum_{i=1}^{n} \beta_i \Delta INF_{t-i} + \sum_{j=1}^{m} \gamma_j \Delta UNP_{t-j} + \vartheta ECM_{t-1} + u_t \quad (1)$$

$$\Delta UNP_t = \alpha + \sum_{i=1}^{q} \delta_i \Delta UNP_{t-i} + \sum_{j=1}^{r} \theta_j \Delta INF_{t-j} + \mu ECM_{t-1} + v_t \quad (2)$$

Where, u_t and v_t are white noise error component. Akaike's Information Criterion (AIC) and/or Schwarz Bayesian Criterion (SBC) and/or log-likelihood ratio test (LR) are used to select the optimum lag length of *n*, *m*,*q* and *r*.

4. RESULTS

The objective of this study is to investigate the causality relationship between inflation and unemployment in India. For this purpose, we have used the standard econometric model of granger causality. But, before estimating the granger causality we must have to check the stationary property of the variables. This is because if the variables are non-stationary then, the granger causality test may give misleading results. To test the stationary property of variables, we have used Phillips and Perron (1988). The result of unit root test is shown the table 2:

Table 2: Phillips-Perron test for unit root

Variables	**Level**	**1st difference**
Inflation rate (INF)	-11.61 (P=0.18)	-29.09*** (P=0.00)
Unemployment rate (UNP)	-10.97 (P= 0.13)	-32.03*** (P=0.00)

Source: author's calculation; Note: *** represent the 1 percent level of significance.

The above table shows the result of Phillips-Perron test unit root test. It noted from the table that, the null hypothesis of unit roots is not rejected for both the variables i.e. inflation rate and unemployment rate. This indicates that both variables are not stationary at level. However, inflation rate and unemployment rate are found to stationary after first difference. Since the variables are stationary at first difference, they can be further tested for co-integration. We have used Johansen Co-integration Test to find the Co-integration.

Table 3: Johansen tests for co-integration

Null hypothesis	**Trace statistic**	**Max-Eigen Statistic**
r=0	13.57*	12.84*
r=1	0.72	0.72

Note: (1) r indicates the number of Co-integration vectors. (2) * indicates 10 percent level of significance.

In table 3, we have represented the result of Johansen Co-integration Test. This test is based on Trace statistic and Max-eigen value. On the basis the null hypothesis of r=0 i.e. no co-integration is rejected at 10 percent level of significant. This implies that, there is at least one direction relationship between inflation and unemployment. But, this can't show the causality relationship. So, in order to find the causality among the variables we have to use the Granger causality with VECM setting.

According to Akaike's Information Criterion (AIC) and Schwarz Bayesian (SBC), the optimum lag length is one. Moreover, the absence of autocorrelation[2] and hetoroscadasticity[3] of have also confirmed the correct order lag length. Finally, the result of Granger causality with VECM setting is present in table 4:

Table 4: Granger causality with VECM

Null hypothesis	**Chi. Square (Prob.)**	**df**	**ECT**
Non-causality Δ INF =>Δ UNP	2.38 (P=0.12)	1	-0.48**
Non-causality Δ UNP =>ΔINF	0.22 (P= 0.63)	1	-0.04
Diagnostic test			
LM test (null = no autocorrelation)	1.47 (P=0.83)		
Heteroskedasticity Tests (null = no heteroskedasticity)	17.88 (P=0.46)		

Source: author's calculation; Note: ** represent the 1 percent level of significance.

[2] The absence of residual serial correlation (or autocorrelation) implies that error terms of different time periods are serially uncorrelated.

[3] Heteroscedasticity is one important assumption of regression. This problem arises if the variance of the errors does not constant across observation.

Table 4 reveals the result of short run and long run relationship between inflation and unemployment. We first begin with the short-run Granger causality, it is seen that, the null hypothesis of no causality between inflation and unemployment is not rejected. This is true from the fact that, the chi square is not statistically in any direction. Thus, there is no causality running from inflation and unemployment in the short run in India.

Further, if we look at the coefficient error correction term of equation (2) is insignificant. This suggests that, ΔUNP_t do not react to the co-integrating errors. Therefore, the variable is exogenous in the long run. However, the error-correction term in Equation (1) is highly significant. Therefore, the null hypothesis of no long-run causality from unemployment to inflation is rejected at 5 percent level significance. This implies that there is one direction relationship between inflation and unemployment in the long run.

5. CONCLUSION

In this paper, we have investigated the causal link between inflation rate and the unemployment rate in India using Granger causality test. Firstly, we have tested unit root using Phillips-Perron test. The result shows that, both the variables are stationary after first difference. So, we have performed Johansen tests for co-integration to find the co-integration among the variables. Based on Trace statistic and Max-eigen value, the test suggests that inflation rate and unemployment rate are co-integrated in the long run. As, both variables are I(1) and co-integrated, we have used the Granger causality with VECM setting to find the causality. The result reveals that, there is no causality running from inflation and unemployment in the short run in India. However, we find one direction of causality running from unemployment and inflation and the nature of the relationship is negative. This implies that, if the unemployment rate increases, the balance of bargaining power between a firm and a worker tilts in favour of the former; firms gain the ability to hire workers at lower wages. As a result the firm is able to produce at low cost and which in turn decreases the price level and vice versa. Thus, the govt. should take suitable policy to control the inflation and unemployment to accelerate the economic growth in India.

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