Causal Relationship between Inflation and Unemployment – A short Run Phenomenal study on India

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Abstract: *This paper tries to introspect into the causal relationship between inflation and unemployment in a short run time horizon under the Phillips curve phenomenon both theoretically and empirically. In the study, monthly data of inflation rate and unemployment rate has been considered from January, 2017 to December, 2020. For the study, we have applied linear regression model along with Wald test to understand the association and causality among the variables during the study period. We further applied Bai-Perron test to ascertain the structural breaks in the time series data. The sample size was finalized at 48 and all the data have been converted into log natural to remove the inherent problems of a time series data. The trend analysis shows the trend of the given variables graphically during the study period. The linear regression model indicates a positive relationship between the variables indicating violation in the Phillips curve phenomenon empirically. There exist a causality between unemployment and inflation in the given study period. Bai-Perron test indicates presence of one structural break in the dataset.*

***Key Words:*** *Inflation, Unemployment, Phillips Curve, Short Run, Relationship, Causality.*

1. BACKGROUND OF THE STUDY:

Inflation and unemployment are the two major and integral part of market economy. Historically inflation and unemployment have maintained an inverse relation. The famous British economist A.W. Phillips first identified the relationship between the rate of unemployment and the rate of increase in money wages (real income or labour productivity. Increase in labour productivity or real income is equilibrium at demand and supply of labour. When equilibrium of demand and supply of labour is very low level of unemployment, the demand for labour depends upon labour productivity and wage rate and the supply of labour depends upon wage rate and population. By applying fiscal and monetary policies government maintains a stable situation in the market economy by the central bank of the country or directs by the government policies to control the aggregate demand of the market. High interest rate, policies to increase competitiveness and efficiency, higher rate of tax burden are some of the remedial measures.https://www.economicshelp.org/blog/2269/economics/ways-to-reduce-inflation.

The productive capacity of the economy goes down in inflation and in India excess supply of money, low productivity, excess import are some of the major causes of inflation. In 1970's almost every country faced stagflation, it is that situation of economy when simultaneous increase in inflation and unemployment occurs at a time. Even developed countries faced this problem very first time, and it puts a question mark on Phillips curve and its implications. In India,

2. CONCEPTUAL FRAMEWORK

The Phillips curve is a single-equation economic model names after Alban William House Phillips, who described an inverse relationship between unemployment and inflation in his book "The Relation between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1861-1957." In simple words decreased unemployment in an economy will correlate with higher rates of wage rises. Phillips found a stable statistical trade-off between inflation and unemployment. This relation between inflation and unemployment was stable for a longer period, 1861-1957. But in the 1970's when stagflation faced by almost every countries then Phillips curve and its trade-off failed and this theory the question on its applicability and its existence. In the below drawn table we can find the trade-off between inflation and unemployment. Here, when the unemployment increases, inflation decreases and vice-versa.
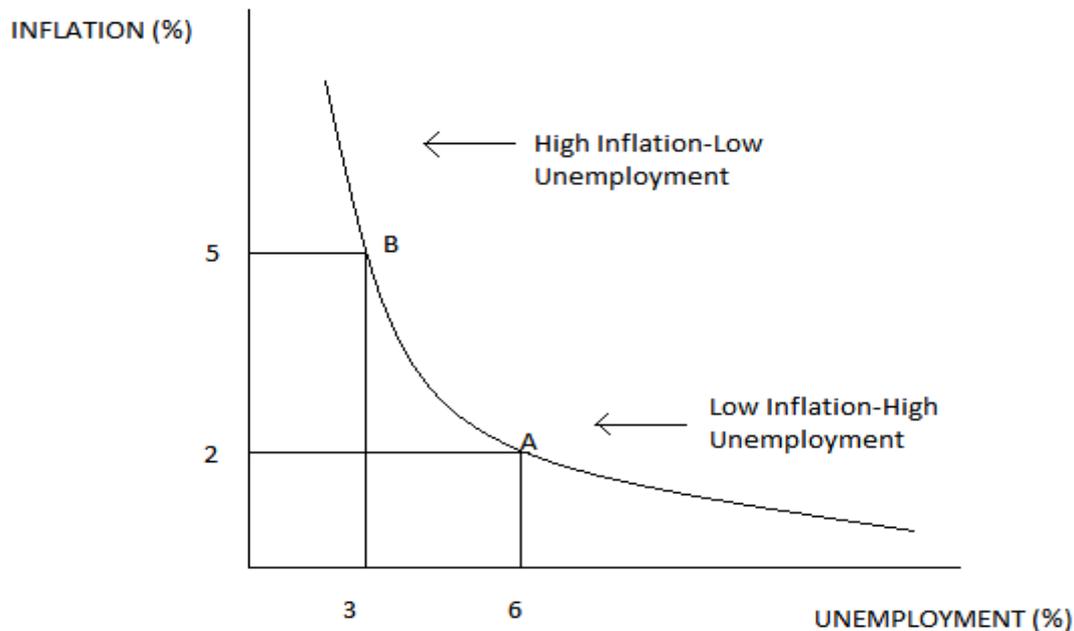
SHORT RUN PHILLIPS CURVE

Unemployment is a term that refers to those individuals employable and seeking a job but unable to find a job or those people who are in the workforce or pool of people who are available for work and does not have or get an appropriate job. Usually unemployment is measured by the unemployment rate which can be found by dividing the number of unemployed people by the total number of people in the workforce which also is an indicator of the status of the economy moreover. We can find out four basic types of unemployment in the economy termed as

a) Demand deficient unemployment,
b) Frictional unemployment,
c) Structural unemployment,
d) Voluntary unemployment.

It is caused by various reasons which come from demand side, or employer, that may be caused by high interest rates, global recession, financial crisis etc. On the other hand, supply side or the worker side frictional unemployment and structural unemployment play a great role. Unemployment that lasts for more than 27 weeks even if the individual has sought employment in the last 4 weeks is called long-term unemployment and less than that time period it is termed as short-term unemployment.
(https://corporatefinanceinstitute.com/resources/knowledge/economics/unemployment/)
Unemployment rate in India averaged 9.21% from 2018 until 2020, reaching an all-time high of 23.50% in April and May, 2020 and a record low of 6.70% in November, 2018 and March, 2019. In India the unemployment rate is estimated by   directly   interviewing   a   large   sample   of   randomly   selected   households.
(https://tradingeconomics.com/india/unemployment-rate).

Inflation is defined as an upward trend in the general level of prices and not the price of only one or two goods it is a persistent and appreciable rise in the general level or average of prices. In other words, it is a state of rising prices, but not high prices. While measuring inflation, we take into account a large number of goods and services used by the people of our country and then calculate average increase in the prices of those goods and services over a period of time. A small rise in prices or a sudden rise in prices is not inflation since they may reflect the short-term workings of the market. There are different types of inflation in the contemporary society, first one on the basis of causes i) Currency inflation, ii) Credit inflation, iii) deficit-induced inflation, iv) demand-pull inflation, v) cost-push inflation.

Secondly on the basis of speed or intensity it can be i) creeping or mild inflation, ii) walking inflation, iii) galloping and hyper-inflation, iv) Government's reaction to inflation. India's retail price inflation climbed to 6.93% year on year in July 2020 from an upwardly revised 6.23% in the previous month and easily beating market expectations of 6.15%. The Reading remain also above the reserve bank of India's medium-term target of 4%, as food prices continued to increase (9.62% versus 8.72% in June) due to disrupted supply chains. Additional airport pressure came from pan, tobacco, intoxicants (12.35%), housing (3.25%), clothing and footwear (2.91%), fuel and light (2.80%), and Miscellaneous (6.95%) mainly boosted by personal care and effects 13.63% and transport and communication 9.95%. (https://tradingeconomics.com/india/inflation-cpi).

3. LITERATURE SURVEY:

- **Sagar, S. (2019)** in his paper tried to analyze the trend of unemployment and inflation rate in India and inspect the trade-off between state and inflation in India under the concept of Phillips curve by using secondary data from 2008 to 2017. Data were sourced and collected from depository financial institution of India (RBI) and from Ministry of labour and Employment by using simple average proportion technique and trade off association analysed through trend line. The study reveals that there exists an inverse relationship between the variables.

- **Kasseh Alieu Pa (2018)** in his paper lead the study in Gambia and the aim of this paper is to find out the relationship between inflation and unemployment. In this study researcher employs the new Keynesian curve model on annual time series data taking sample ranging 1991-2015to test the existence of Phillips curve in Gambia. The result of this study shows that the statistically significant variables confirm the inverse relationship between inflation and unemployment.

- **Thiruneelakandan & Ullamudaiyar (2018)** carried out research with the objective to examine the trade-off between unemployment and inflation in India on the basis of Phillips curve concept. In this research paper secondary data was used from 2009 to 2017. Data were collected from statistical bulletin of Reserve Bank of India and Ministry of Labour and employment. Analysis of the data through simple average, percentage method and trend analysis. After the analysis, researchers found that unemployment and inflation are inversely related and strong conformity of existence of Phillips curve in India.

- **Zayed et al. (2018)** in their paper titled "Testing Phillips Curve to examine the Inflation Rate regarding Unemployment Rate, Annual wage rate and GDP of Philippines: 1950-2017" explored whether Phillips curve is recognized or not in Philippines during 1950-2017 concerning inflation rate, unemployment rate, annual wage rate and GDP (Gross Domestic Products). They applied OLS, ADF, CUSUM test and Johansen Co integration test for analysis of the data. There subsists a long run relationship among the variables. Unemployment rate, which is positively correlated with inflation rate, is not steady with the essence of Phillips curve.

- **Anning et al. (2017)** in their paper titled "Inflation, Unemployment and Economic Growth: Evidence from the VAR Model Approach from the Economy of Iraq" analyzed the effect of inflation and unemployment on the economic growth of Iraq empirically. They collected annual time series data spanning from 1990-2014. There exist an equilibrium impact between unemployment and inflation in Iraq thereby following the validity of the Phillips Curve hypothesis

- **Thayaparan, A. (2014)** in his paper studied about inflation and growth on unemployment in Srilanka. To achieve the objective, data was taken between 1990-2012 and nature of data was secondary from different central bank annual reports from the time mentioned above. Augmented Dickey-Fuller Unit Root Test was used to test the stationary which shows that only gross domestic product has stationary and unemployment and inflation has unit root problem or non-stationary at level but when these variables were tested at first difference then the non- stationary problem disappeared and became stationary. Here also ordinary least-square technique is applied. To find out the causality among the variables Granger Causality Test was used, which proves there is only a unidirectional causality between inflation and unemployment but there is bidirectional causality between unemployment, GDP and inflation. Regression test results that the coefficient of inflation is negative and statistically significant. Whereas influence on unemployment and GDP is positive but it has no such significant reaction on unemployment. This study concludes that only inflation reduces unemployment significantly and GDP positively but it has no such significant effect on unemployment.

1. RESEARCH GAP:

Following research gaps could be identified after studying the existing national and international literatures:

- No such work exist in national and international domain to the best of the knowledge
- Application of short run Philips curve concept could not be found

5. RESEARCH OBJECTIVES:
After identification of the research gap, following objectives has been finalized:
- To study the relation between the variables
- To study the causality between the variables over a short-run time horizon
- To study structural breaks in the given variables

6. RESEARCH METHODOLOGY :

6.1 Type of research
The study is empirical in nature with secondary data. There is also theoretical study included for the part of going through the existing research works for identification of research gap and finalization of objectives.

6.2 Period of the study
This study looks forward to consider the period starting from January, 2017 to December, 2020.

6.3 Sample
In our study we have consider monthly data of unemployment rate and inflation rate and sample size was finalized at 48 observations.

6.4 Data and its Source
The data has been collected from RBI website and the website of trading economics and investing.com and unemploymentindia.cmie.com and other websites.

6.5Tools used
To conduct the empirical study, following tools have been used:

- Trend analysis (graphical)
- Linear regression model
- Wald Test (1943)
- Bai-Perron Test (1998)

We have applied E-views 8 statistical package for analysis.

7. SIGNIFICANCE OF THE STUDY:

This study will provide innovative findings as to how inflation is affected by unemployment considering the short run phenomena of the trade-off between inflation and unemployment as postulated by the Phillips curve (1958) theory in the short run. It will also enable to study the relationship between the given variables empirically where the Phillips Curve phenomenon is violated or not can be witnessed. It will enable prospective investors to take major decision considering the persistence of inflation along with researcher to made studies in this area. It will also allow the economist to frame policies to curb inflation and also correct the status of unemployment. During the presence of covid-19 violation in the Phillips curve takes place or not could also be found.

8. EMPIRICAL DATA ANALYSIS AND FINDINGS

$$Inflation\ Rate = \beta_0 + \beta_1 * Unemployment\ Rate + \varepsilon_t$$

8.1 Linear Regression Model

Dependent Variable: Inflation Rate					
Variable	Coefficient	Std. Error		t-Statistic	Prob.
Unemployment Rate	0.740835	0.027857		26.5939	0
R-squared	0.15493		Mean dependent var		1.408198
Adjusted R-squared	0.15493		S.D. dependent var		0.40153
S.E. of regression	0.369117		Akaike info criterion		0.865207
Sum squared resid	6.403624		Schwarz criterion		0.90419
Log likelihood	-19.76496		Hannan-Quinn criter.		0.879939
Durbin-Watson stat	0.434512				

In the above table, the R square value of 0.15493 suggests that about 15.493 percent of the variation of y values around the mean are explained by x values. Due to only one independent variable, the explanation power is less. A greater number of variables would have increased the explanation power of the model.

8.2 Wald Test (1943)

Wald Test			
Test Statistic	Value	df	Probability
t-statistic	26.5939	47	0
F-statistic	707.2358	(1, 47)	0
Chi-square	707.2358	1	0

In the above table we see the results of Wald test which predicts the short run causality or association between two variables. In our study, our dependent variable is Inflation. The test result predicts that there is short run causality among the variables due to significant p value.
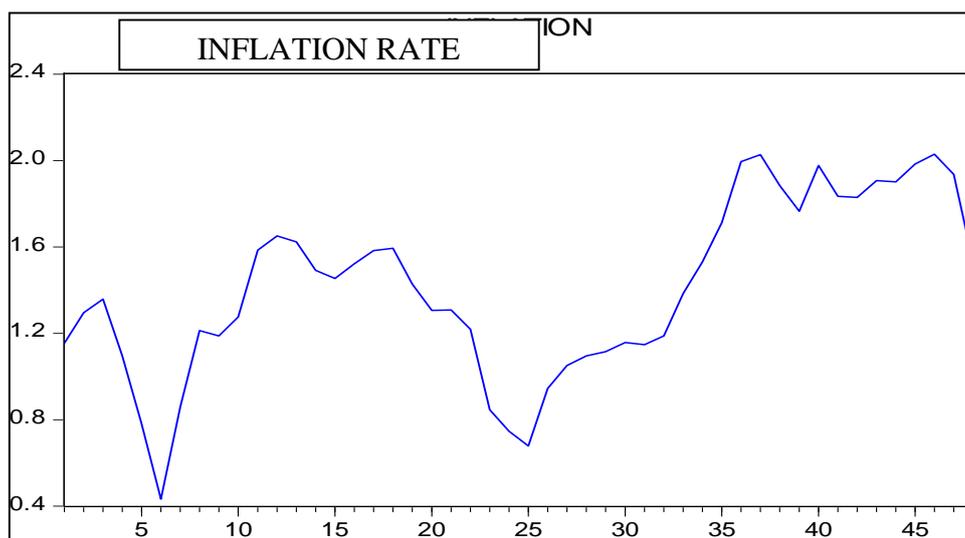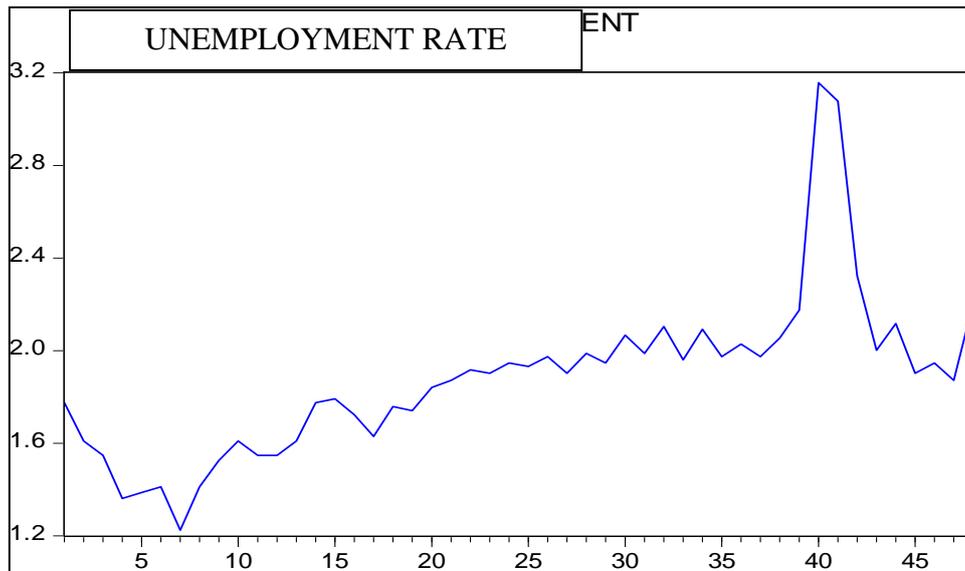
8.3 BAI-PERRON TEST (1998)

$$y_t = x_t^{'} \beta + z_t^{'} \partial_j + u_t$$

BAI-PERRON TEST (1998)	
Inflation Rate	Unemployment Rate
Nov, 19	Sept, 18

The above table portrays the structural breaks in the time series model of the given two variables. Inflation rate changes its structure on November, 2019 whereas Unemployment rate has a structural break on September, 2018.

8.4 TREND-ANALYSIS (GRAPHICAL)

The above two graphs shows the trend of the given two variables, inflation rates and unemployment rates during the given study period January, 2017 to December, 2020.

9. LIMITATIONS OF THE STUDY :

- We have considered monthly data; daily data could have given a better result.
- Impact of COVID-19 has not been studied minutely in the research.
- Inherent disadvantages of secondary data remains within the data.

10. FURTHER SCOPE OF THE RESEARCH :

- Time period could be extended
- Pre and post COVID-19 situation can be analyzed
- Other econometric model can also be implemented

11. CONCLUDING OBSERVATIONS

The empirical results portray that there exist a positive relation between unemployment and inflation that is significant in nature. This indicates that empirically the relationship between the variables violates the Phillips curve phenomenon in the short run time span. A 1 percent increase in unemployment rate leads to 0.7408 percent increase in inflation. A significant Wald test result predicts the causality between variables in the short run. The result of Bai-Perron Test indicates a single change in the curvature or the structure of both inflation rate and unemployment rate. The unemployment rate changes its structure on September, 2018 where as inflation rate changes its structure on November, 2019. The change in unemployment rate could be due to cyclical unemployment or natural unemployment where as the change in inflation rate structure could be due to unemployment rate. The impact of COVID-19 may also cause a change in their nature of the data but it has not been measured in our study.

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