

## Causal Relationship between Inflation and Unemployment in Indonesia 1986-2018: A Phillips Curve Analysis

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### ABSTRACT

Inflation and unemployment are closely watched indicators in the economy of a country. The consumers in a goods market are willing to get the goods and services at a relatively lower price, or in other words, they expect a low inflation rate. However, if the inflation rate is low, the incentive of producers to produce more is low, and employment will not happen. Therefore, there are trade-off between inflation and unemployment. This phenomenon is called the Phillips curve. This study aims to analyze the causal relationship between inflation and unemployment in Indonesia. We use inflation rate and open unemployment rate from 1986-2018 collected from Statistics Indonesia (bps.go.id). We employed the Granger causality method and found that there is no causal relationship, either one-way or two-way, between inflation and unemployment. Further, we analyzed using simple linear regression and found that inflation significantly affects unemployment and vice-versa.

Keywords: *Inflations; Unemployment; Philips Curve*

### Abstrak

*Inflasi dan pengangguran adalah indikator ekonomi yang penting dalam perekonomian suatu negara. Konsumen di pasar barang berkeinginan untuk mendapatkan barang dan jasa dengan harga yang relatif lebih rendah, atau dengan kata lain mengharapkan tingkat inflasi yang rendah. Namun, jika tingkat inflasi rendah, tidak ada insentif bagi produsen untuk memproduksi lebih banyak, dan penciptaan lapangan kerja baru tidak akan terjadi. Oleh karena itu, inflasi dan pengangguran saling bertolak belakang. Fenomena ini disebut kurva Phillips. Penelitian ini bertujuan untuk menganalisis hubungan kausal antara inflasi dan pengangguran di Indonesia. Kami menggunakan tingkat inflasi dan tingkat pengangguran terbuka tahun 1986-2018 yang diambil dari Badan Pusat Statistik (bps.go.id). Kami menggunakan metode kausalitas Granger dan menemukan bahwa tidak ada hubungan sebab akibat, baik satu arah maupun dua arah, antara inflasi dan pengangguran. Selanjutnya, kami menganalisis menggunakan regresi linear sederhana dan menemukan bahwa inflasi secara signifikan mempengaruhi pengangguran dan sebaliknya.*

Keyword: *Inflasi; Penganggura;, kurva Philips*

## INTRODUCTION

There are at least two variables that are closely watched to ensure that a country has good macroeconomic performances; inflation and unemployment (Mankiw, 2015). These problems often occur in developing countries, including Indonesia. In Indonesia, inflation and unemployment became the main focus of the government and policymakers since inflation and unemployment were staggering high in the past years (Sasongko & Huruta, 2019). For example, in 2005, inflation in Indonesia has reached 17.11%, while unemployment has reached 11.24%. However, inflation and unemployment could be reduced to 6.6% and 10.28 consecutively in the following year, thanks to the inflation-targeting monetary policy implemented by Bank Indonesia (Ruchba & Hadiyan, 2019).

This study aims to analyze the causality between inflation and unemployment in Indonesia. We use 1986-2018 inflation rate and open unemployment rate data collected from Statistics Indonesia (BPS). Recent studies have studied the relationship between inflation and unemployment in Indonesia. However, further knowledge about this issue is needed to understand more about these vital microeconomic indicators and implement the right policy to tackle the problem. Therefore, we provide a further analysis compared to recent studies. We use the most recent data from Statistics Indonesia, which consists of 33 years worth of data from 1986-2018. Further, we use Granger causality to find the causality instead of just analyzing the effect of inflation on unemployment one-way.

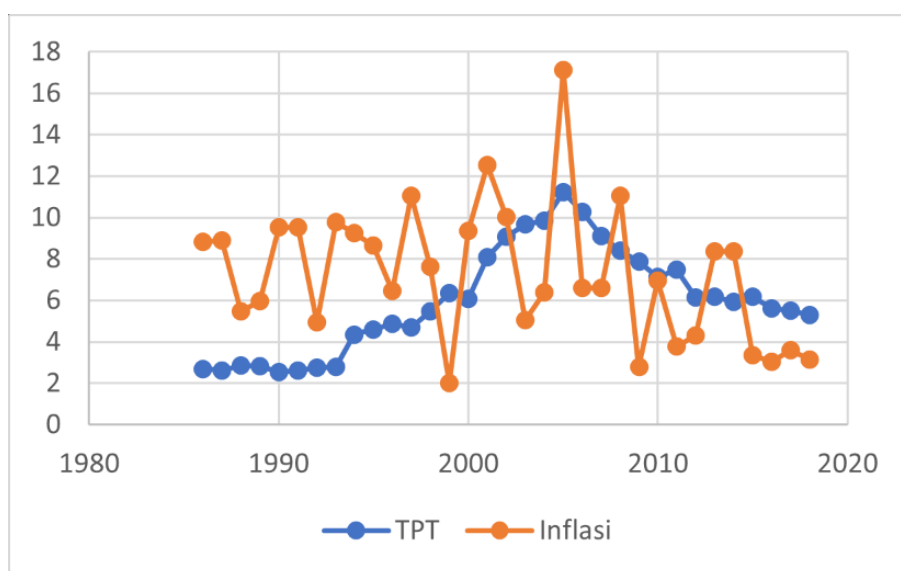
The theory stated that inflation and unemployment are related negatively (Blanchard, 2016). It means that unemployment is high when inflation is low and vice-versa. This particular relation is often called as Phillips curve. The relationship between inflation and unemployment was introduced by A. W. Phillips in 1958 using 1861-1957 UK data. Samuelson and Solow replicated the work using 1900-1960 USA data two years later. Both obtained the relatively similar result that a country will face a trade-off between lowering inflation with the risk of high employment or otherwise (Blanchard, 2016).

Inflation is a continuous increase in the average level of prices. With a higher level of inflation, the prices of goods in a market increases. Hence, consumers' purchasing power in the economy decreases (Khatir et al., 2021). Inflation increases as the money supply increases. Therefore, implementing a contractive monetary policy is the best way to control inflation (Kumar & Dash, 2020).

According to International Labor Organization (ILO), unemployment is a condition in which a person has been in a working-age but is not currently working or is seeking a job during a specified

period (Baah-Boateng, 2015). Unemployment is important to manage since unemployed people have no income, so they find it challenging to meet their daily basic needs (Aldrich et al., 2020). Okun's law also stated that a higher unemployment rate is related to a decrease in GDP (Lee & Huruta, 2019).

Both inflation and unemployment hurt the economy. However, the government faces a trade-off between lowering inflation or unemployment (Mangnejo et al., 2020), or in other words, the government cannot do both. On the other hand, the right amount of inflation or increase in market price is good to increase production and increase the GDP eventually (Pagliacci, 2020). Therefore, it is crucial to managing inflation and unemployment at the optimal level.



**Figure 1.** Inflation and Unemployment in Indonesia

Based on Figure 1 above, the data shows that inflation and unemployment have a negative relationship. Inflation decreases when unemployment increases. On the other hand, inflation increases when unemployment decreases. However, Figure 1 shows that inflation data fluctuates and unemployment data is more stable throughout the years.

Inflation drives up the prices of goods and services in the market, motivating firms to produce more (Davcev et al., 2018). To produce more goods, firms need to hire more labor from the input market (Anakpo & Kollamparambil, 2021). This behavior decreases unemployment since more labor forces enter the market. On the other hand, when prices of goods and services in the market or

inflation is low, firms tend to decrease their production and fire or decrease the labor, which will increase unemployment.

## **LITERATUR REVIEW**

Several studies analyzed the relationship between inflation and unemployment, resulting in various conclusions. However, the studies that applied the Phillips curve theory in developing countries remain scant. This study aims to fill the gap and be one of the considerations for the policymaker regarding the inflation and unemployment policy.

A study stated that there is no causal relationship between inflation and unemployment in G6 countries like Australia, Brazil, Canada, France, Germany, Italy, Russia, Turkey, and the UK (Korkmaz & Abdullazade, 2020). By using the 1980-2014 data, the study found no causal relationship of the Phillips curve in Nigeria (Darma & Onimisi, 2017). Other studies in Jordan (Al-zeaud & Al-hosban, 2015), the Philippines (Furuoka, 2008), and Nigeria (Umaru & Zubairu, 2012) also found no causal relationship between inflation and unemployment.

Aside from the recent studies that found no causal relationship, several studies found a one-way relationship between inflation and unemployment. A number of studies obtained a result that stated that inflation affects unemployment and not all the way around (Caporale & Skare, 2011; Kogid et al., 2011; Sasongko & Huruta, 2019; Stefan & Bratu, 2016). The results gave policymakers the implication that they can control unemployment by controlling inflation through monetary policy, provided the government with a policy other than fiscal policy such as unemployment benefit, training, etc. On the contrary, the results from middle-east countries revealed that the Phillips curve happens in an inverse relationship. It means that the unemployment rate affects inflation rather than the opposite (Bokhari, 2020; Khalaf, 2019; Khanssa et al., 2018).

In other circumstances, other studies found a positive relationship between inflation and unemployment, or in other words, the Phillips curve does not exist. A study using quarterly US data from 1952-2010 found that unemployment will follow inflation in the long run (Haug & King, 2014). Gomis-Porqueras et al. (2020) also argued that the positive relationship between inflation and unemployment, in the long run, was caused by a frictional labor market. The positive relationship also happened in European developed countries such as France, Germany, and the UK (Israel, 2015). The study argued that such a result was caused by political intervention.

There are also studies that obtained the two-way causality between inflation and unemployment (Arshad & Sukkur, 2014; Bhattarai, 2016; Madurapperuma, 2016). The results suggest that inflation

affects unemployment, and unemployment also affects inflation. This implies that the government controls the macroeconomics indicator through inflation by using monetary policy and through unemployment by using fiscal policy.

Recent studies have shown various results regarding the relationship between inflation and unemployment, such as no causality, one-way causality from inflation to unemployment, one-way causality from unemployment to inflation, and two-way causality. Those recent studies also employed numerous methods. The method used in this study, Granger causality, also referred to one of the recent studies mentioned earlier. These uncertain results leave Phillips curve studies unconcluded. These results vary among different periods in a different economy.

## METHODS

This study is a quantitative study. The data used in this study are inflation rate and open unemployment rate time series data from 1986-2018 in the context of Indonesia. The data were collected from Statistics Indonesia (bps.go.id). Since the data were time series, this study uses the Granger causality test to find whether inflation and unemployment in Indonesia have a two-way causality. Granger causality test only applied in time series data rather than pure cross-sectional one because this test is very sensitive to the lag length of the data (Gujarati et al., 2012).

Before doing the Granger causality test, the time series data must first be a stationary dataset. If the time series data is not stationary, the time series will have a time-varying mean or a time-varying variance, or both. After ensuring that the time series data is stationary, the next step is to do the Granger causality test. The granger causality test in this study was carried out by estimating these equations:

$$INF_t = \sum_{t=1}^n \alpha_t UNM_{t-1} + \sum_{j=1}^n \beta_j INF_{t-1} + U_{1t} \dots\dots\dots(1)$$

$$UNM_t = \sum_{t=1}^n \lambda_t UNM_{t-1} + \sum_{j=1}^n \delta_j INF_{t-1} + U_{2t} \dots\dots\dots(2)$$

*INF* from the above equation is inflation, and *UNM* is unemployment, while *u1t* and *u2t* are error terms that are assumed to be uncorrelated. The output of the Granger causality test gave four outcome possibilities, which are:

1. There is one-way causality from *UNM* to *INF* if  $\sum \alpha \neq 0$  and  $\sum \delta_j = 0$
2. There is one-way causality from *INF* to *UNM* if  $\sum \alpha_i = 0$  and  $\sum \delta_j \neq 0$
3. There is two-way causality between *INF* and *UNM* if  $\sum \alpha_i \neq 0$  and  $\sum \delta_j \neq 0$
4. There is no causality between *INF* and *UNM* if  $\sum \alpha_i = 0$  and  $\sum \delta_j = 0$

## RESULTS AND DISCUSSION

To ensure that the dataset used in this study is stationary, this study employs the stationarity test using the Augmented Dickey-Fuller (ADF) method. The ADF test result is as follows:

**Table 1.** Stationarity Test

Variable	p-value	Conclusion
Inflation ( <b>INF</b> )	0.0003	Stationary
Unemployment ( <b>UNM</b> )	0.6090	Not stationary
D Unemployment ( <b>D_UNM</b> )	0.0014	Stationary

Note : The alpha used in this study is at 5%. D Unemployment is the unemployment variable at the first difference

$H_0$ :  $p - value > alpha$ , the data is not stationary

$H_1$ :  $p - value < alpha$ , the data is stationary

The Augmented Dickey-Fuller test required the p-value to be below alpha 5% (0.05) to be called stationary. Originally, the unemployment data is not stationary. Hence, the first difference form is needed to be able to obtain stationary data. Therefore, using 5% of alpha is enough to reject the  $H_0$  hypothesis, or in other words, all of the data used in this study is stationary.

After testing for the stationarity of the data using the Augmented Dickey-Fuller method, the next step is to analyze the causality between inflation and unemployment using the Granger causality method. The results of the Granger causality method are as follows:

**Table 2.** Granger Causality

Variable	p-value	Conclusion
<b>INF → D_UNM</b>	0.1143	Does not Granger Cause
<b>D_UNM → INF</b>	0.8310	Does not Granger Cause

Note: The alpha used in this study is at 5%. The arrow signs indicate the direction of the causality. The Granger causality method has its own term for stating the causality between variables, which is called "Granger cause".

$H_0$ :  $p - value > alpha$ , not Granger cause

$H_1$ :  $p - value < alpha$ , Granger cause

The information in Table 2 indicates that this study accepts the H0 hypothesis since the p-value is greater than alpha 5% (0.05). The results suggest that inflation does not Granger cause unemployment and unemployment also does not Granger cause inflation, which means that there is no causality between inflation and unemployment, either one-way or two-way. The result also shows that the Phillips curve does not exist in Indonesia between 1986-2018. This result aligns with the recent studies, implying that the absence of a Phillips curve in developing countries such as Nigeria, Jordan, and the Philippines is common (Al-zeaud & Al-hosban, 2015; Darma & Onimisi, 2017; Furuoka, 2008; Umaru & Zubairu, 2012). However, this result contradicted Sasongko & Huruta (2019), which also analyzed Indonesia. A different result is possibly caused by the different periods and the condition in the economy.

Since the Granger causality results do not show the causal relationship between inflation and unemployment, this study employs the simple linear regression method to understand further the relationship. The simple linear regression equation used in this study is as follows:

$$INF_t = \alpha_t + \beta UNM_t + u_{1t} \dots\dots\dots(3)$$

$$UNM_t = \lambda_t + \delta INF_t + u_{2t} \dots\dots\dots(4)$$

INF is inflation, UNM is unemployment,  $\beta$  is the regression coefficient of unemployment on inflation, and  $\delta$  is the regression coefficient of inflation on unemployment. This study does the simple regression for two equations. The equation (3) is to analyze the effect of unemployment on inflation, and the equation (4) is to analyze the effect of inflation on unemployment. The result is presented in Table 3 below:

**Table 3.** Simple Linear Regression

Regression	p-value	Coefficient
UNM on INF	0.0382	1.633917 (0.753644)
INF on UNM	0.0382	0.082902 (0.038238)

Note: The alpha used in this study is at 5%.  
Standard error presented in parentheses.

H<sub>0</sub>: *p - value* > *alpha*, does not significant

H<sub>1</sub>: *p - value* < *alpha*, significant

Since both regressions have the p-value below alpha 5% (0.05), the H0 hypothesis is rejected, or inflation affects unemployment significantly and vice-versa. Hold everything else constant; every

increment of 1% unemployment increases inflation by 1.633%, and every increment of 1% inflation increases unemployment by 0.082%. We could only find one study that used linear regression to analyze the Phillips curve, which is Muchdie (2016). Using this approach, we found that the Phillips curve does exist in Indonesia.

## **CONCLUSIONS**

This study aims to analyze the existence of the Phillips curve in Indonesia from 1986-2018. To achieve the goal of this study, we used the Granger causality method to analyze the time-series data and found no one-way or two-way causal relationship between inflation and unemployment in Indonesia. Based on several recent studies, it is common that the existence of the Phillips curve cannot be found in the developing world. Phillips curve commonly exists in the long run in developed countries such as the US, France, Germany, the UK, and other developed European countries.

Furthermore, using two simple linear regression equations, we found that inflation significantly affects unemployment in a positive manner. It means that monetary policies implemented by policymakers to control inflation also will be able to control unemployment. For the government, inflation and unemployment are relatively easier to control because they go hand in hand. However, we found only one study that used simple linear regression to analyze the Phillips curve. Although it is not the most common way to analyze the Phillips curve, using simple linear regression gave us a broader understanding that comparing the Phillips curve with the Granger causality method and simple linear regression could give completely different results.

Since inflation and unemployment are the most important macroeconomic indicator, we suggest that policymakers and the next study could take a closer look at these indicators by using a longer dataset, including other control variables, and using the state-of-the-art research method to produce the more rigorous results that this study could not achieve. Lastly, we hoped that this study would contribute to the economics subject, especially on the topic of the Phillips curve, and give the readers a new perspective regarding the existence of the Phillips curve in Indonesia.

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