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Examining the Causal Relationship between Inflation and Unemployment in Indonesia

Binanga Angga [a], Aliasuddin Aliasuddin [a],*, Muhammad Abrar [a], Raja Masbar [a] and Jumadil Saputra [b]

[a] Department of Economics, Faculty of Economics and Business, Universitas Syiah Kuala, Kopelma Darussalam, 23111 Syiah Kuala, Kota Banda Aceh, Aceh, Indonesia; binangaangga@gmail.com (B.A.), muhammadabrar@usk.ac.id (M.A.), raja.masbar@unsyiah.ac.id (R.M.)

[b] Department of Economics, Faculty of Business, Economics, and Social Development, Universiti Malaysia Terengganu, 21030 Kuala Nerus, Terengganu, Malaysia; jumadil.saputra@umt.edu.my (J.S.)

* Correspondence: aliasuddin@usk.ac.id (A.A.)

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Abstract
Inflation and unemployment are significant challenges faced by both developing and developed countries. This study analyzes the causal relationship between inflation, as measured by the Gross Domestic Product (GDP) Deflator, and open unemployment in Indonesia. Using a Vector Autoregressive (VAR) panel model, the analysis is based on panel data from 34 provinces from the first semester of 2015 to the second semester of 2022. The results of statistical tests indicate a unidirectional causality, with inflation Granger-causing unemployment, but not vice versa. This finding is further supported by the Vector Autoregression estimates, where Lag 4 reveals that unemployment is primarily influenced by inflation, while inflation remains unaffected by unemployment. To address the issue of unemployment, policymakers should prioritize controlling inflation and keeping it within manageable limits, as reducing inflation could contribute to improved unemployment rates. Future research should explore the relationship between inflation and unemployment through qualitative interviews with individuals who have experienced both issues to understand their daily impacts better.

1. Introduction

Inflation and unemployment are the main concerns of policymakers around the world. Central Banks implement various policies to stabilize inflation (Agénor & da Silva, 2013; Buiter, 2014; Epstein & Yeldan, 2009). The main policy is to protect the public from the impact of rising prices. Sachsida et al. (2011) despite successful efforts to control the inflation rate, unemployment is still a problem for developed and developing economies. Simple statistics worldwide show that unemployment rates are approaching 20 percent of the labor force in some countries.

Inflation and unemployment are problems that must be faced by every country, both developing and developed countries. According to Bhattarai (2016), inflation and unemployment can reduce individual welfare; therefore, it must be kept as low as possible in the economy. Ruprah & Luengas (2011) state that inflation and unemployment can reduce welfare in Latin American countries where unhappiness only ranges from 1 to 8, which is twice the weight of unhappiness due to inflation and unemployment in the Organization for Economic Co-operation and Development, OECD countries. This is in line with the research of Becchetti et al. (2010) who said that welfare due to inflation and unemployment differs by age group and labor market characteristics. The social costs of inflation and unemployment are greater for the middle-aged or working-age group; in other words, the welfare level for this group is lower than for other groups.

Inflation and unemployment are also indicators of economic conditions. Inflation rates have proven to have a major impact on economic conditions. Thanh (2015) says there is a trade-off between inflation and economic growth. High inflation can reduce economic growth,

reduce employment, and increase unemployment. A high inflation rate makes investment riskier because it is more difficult to anticipate future interest and nominal wage growth rates. Safdari et al. (2016) explained that the number of jobs is getting smaller than the number of workers, increasing over time. As a result, the unemployment rate will also increase.

Inflation and unemployment are also problems in Indonesia, a developing country. Indonesia has diverse development and economic conditions, and provinces have various income levels. Provinces with middle income have higher inflation rates than other provinces. This high inflation rate is often not accompanied by an increase in aggregate output, so the goal of increasing inflation to stimulate the economy and create new industries and jobs cannot be achieved. Finally, the high inflation rate will increase the unemployment rate.

The relationship between inflation and unemployment is one of the most important correlations discussed in economics. One of the theories about the relationship between inflation and unemployment is the Phillip curve theory, which shows the relationship between the unemployment rate and the inflation rate in a country. According to Phillip Curve, the relationship between the two is negative. So, when inflation rises, unemployment falls, and vice versa. So, according to Bhattarai (2016), the trade-off between inflation and unemployment means that policymakers can reduce the unemployment rate in the short term by increasing inflation through expansionary policies. Still, as prices increase, workers demand higher wages so that unemployment will increase further.

Sachsida et al. (2011) revealed that when a government imposes a trade-off policy between inflation and unemployment, people expect high inflation to reduce unemployment. However, if the government is not consistent in this policy, then the trade-off will only occur in the short term so that, in the end, a high inflation rate will not be followed by a reduction in the unemployment rate. According to Palley (2012), the Phillip curve only analyzes the relationship between inflation and unemployment in the short term, not the long term. Similarly, the results of Bhattarai (2016) show a significant relationship for 28 out of 37 OECD countries, including the average for the European region and the European Union. However, the Phillips curve is insignificant in Austria, Brazil, Germany, Ireland, Israel, and Norway. This is similar to the research results by Moise (2015), who analyzed the relationship between unemployment and inflation in Romania for the 15-19 age group from 1996-2012. The results showed that the Phillips curve approach can be applied in Romania for the labor force aged 15-19 years, but not for the entire period but only for the 2008-2012 period.

According to Grammy (2019), the relationship between inflation and unemployment under conditions that tend to be fixed and prolonged is a problem for policymakers. If there is a significant policy trade-off, a lower unemployment rate will accelerate the already rapid inflation rate, and efforts to curb inflation tend to increase the unemployment rate, which remains high. This is similar to the research results from Donayre & Panovska (2018), Dritsaki & Dritsaki (2012), Hindrayanto et al. (2019), Karanassou & Sala (2010), and Tesfaselassie & Wolters (2018) who say that inflation and unemployment have a negative relationship. Sánchez, (2012) The unemployment rate will decrease if a country implements inflation and economic activity targeting.

However, the research results from Chletsos et al. (2016), who examined the application of the Phillip curve model in the United States and Canada, said that the Phillip curve theory can be applied in the United States but not Canada. Likewise, the research results from Safdari et al. (2016) said that the relationship between inflation and unemployment is not the same. The relationship between the two is usually negative on a certain time scale but positive on another time scale. The results of research by Haug & King (2014), which says the relationship between inflation and unemployment is positive in the long run, as well as research from Jean Louis & Balli (2013), which shows that inflation shocks, seen from differential interest rates, have no impact on unemployment in the short term.

This study is different from the studies of Grammy (2019), Haug & King (2014), Karanassou & Sala (2010), and Putnam & Azzarello (2015), which only test the causality of inflation and unemployment in one country. Their results provide implications for improving the country's economic conditions, such as labor protection and improving the investment ecosystem to increase production.

This study examines the causality between inflation and unemployment in Indonesia. The systematic illustration begins with an introduction containing the research background. Then, theoretical studies are supported by analytical methods. The research results are discussed in the results and discussion section, ending with conclusions and recommendations.

2. Materials and Methods

The data used in this study are secondary data sourced from Statistics (BPS) Indonesia, namely inflation measured in percentage of Gross Domestic Product (GDP) Deflator, and unemployment measured in percentage of labor force who are not working or looking for work. The data is a panel with 34 Provinces in Indonesia as a cross-section and the period from semester 1 of 2015 to semester 2 of 2022 as a time series. This study uses a Vector Autoregressive (VAR) panel model. This model is used because the data used is stationary at the same level. Therefore, using the VAR panel model is the best for this study. The VAR panel approach determines the intensity and speed of adjustment or the response of each variable in adjusting

itself. The analysis was conducted using the following estimation model:

$$\begin{aligned} IN = {} & C(1,1) * IN(-1) + C(1,2) * IN(-2) \\ & + C(1,3) * IN(-3) + C(1,4) \\ & * IN(-4) + C(1,5) * UN(-1) \\ & + C(1,6) * UN(-2) + C(1,7) \\ & * UN(-3) + C(1,8) * UN(-4) \\ & + C(1,9) \end{aligned} \quad (1)$$

$$\begin{aligned} UN = {} & C(2,1) * IN(-1) + C(2,2) * IN(-2) \\ & + C(2,3) * IN(-3) + C(2,4) \\ & * IN(-4) + C(2,5) * UN(-1) \\ & + C(2,6) * UN(-2) + C(2,7) \\ & * UN(-3) + C(2,8) * UN(-4) \\ & + C(2,9) \end{aligned} \quad (2)$$

Where, IN is inflation, UN is unemployment, and C is a constant term. This study will use Eviews 10 for all statistical tests.

3. Results and Discussions

The following will describe the results of descriptive and inferential statistical testing to determine the causality relationship between inflation and unemployment in 34 provinces in Indonesia from Semester 1 of 2015 to Semester 2 of 2022.

3.1. Descriptive Statistics Analysis

This section describes the condition of all 544 data from each of inflation and unemployment in Indonesia. It includes the mean, median, highest value, lowest value, standard deviation, normality of the data distribution, and cumulative value.

Table 1. Result of Descriptive Statistics Analysis

Descriptive	Inflation	Unemployment
Mean	0.019106	5.070643
Median	0.015786	4.710000
Maximum	0.144699	10.95000
Minimum	-0.044398	0.880000
Std. Dev.	0.021218	1.825974
Skewness	2.135071	0.624641
Kurtosis	12.64768	3.065505
Jarque-Bera	2523.070	35.47331
Probability	0.000000	0.000000
Sum	10.39361	2758.430
Sum Sq. Dev.	0.244465	1810.461
Observations	544	544

Table 1 shows the descriptive statistics of inflation and unemployment in Indonesia during the analysis period. Inflation has a mean value of 0.019 percent, a median of 0.015 percent, the highest inflation rate during the analysis period is 0.144 percent, and the lowest is -0.044 percent. Unemployment averages 5.07 percent, the median is 4.71 percent, the highest is 10.95 percent, and the lowest is 0.088 percent.

3.2. Panel Regression

3.2.1. Stationary Test

The stationarity test in VAR uses the unit root test, which is intended to see whether the data does not contain unit roots which means stationary or otherwise. This test is used as the basis for selecting the next analysis model.

Table 2. Result of Unit Root Test

IN (Inflation)			UN (Unemployment)		
Method	**Statistic**	**Prob.**	**Method**	**Statistic**	**Prob.**
Individual Intercept at Level			Individual Intercept at Level		
ADF - Fisher Chi-square	137.651	0.0000	ADF - Fisher Chi-square	204.964	0.0000
ADF - Choi Z-stat	-4.5389	0.0000	ADF - Choi Z-stat	-8.4536	0.0000
PP - Fisher Chi-square	114.250	0.0004	PP - Fisher Chi-square	231.851	0.0000
PP - Choi Z-stat	-2.9819	0.0014	PP - Choi Z-stat	-9.4587	0.0000
Levin, Lin & Chu	-2.4393	0.0074	Levin, Lin & Chu	-9.6391	0.0000
Individual Intercept and Trend at Level			Individual Intercept and Trend at Level		
Breitung t-stat	3.1979	0.9993	Breitung t-stat	-5.5115	0.0000
Individual Intercept at 1st Difference			Individual Intercept at 1st Difference		
ADF - Fisher Chi-square	261.854	0.0000	ADF - Fisher Chi-square	406.890	0.0000
ADF - Choi Z-stat	-10.9440	0.0000	ADF - Choi Z-stat	-15.5051	0.0000
PP - Fisher Chi-square	323.436	0.0000	PP - Fisher Chi-square	510.505	0.0000
PP - Choi Z-stat	-19.9028	0.0000	PP - Choi Z-stat	-18.5874	0.0000
Levin, Lin & Chu	-14.7675	0.0000	Levin, Lin & Chu	-31.0840	0.0000
Individual Intercept and Trend at 1st Difference			Individual Intercept and Trend at 1st Difference		
Breitung t-stat	-3.6569	0.0001	Breitung t-stat	-10.3394	0.0000

Table 2 shows that inflation and unemployment are stationary at the same level within 5 percent α significance, both by Fisher-ADF, Fisher-PP, and Levin, Lin & Chu tests. Only the Breitung t-stat test showed different results. These results conclude that the unit

root probability value is already stationary at a level, so the VAR panel model is the best model choice.

3.2.2. Lag Selection Criteria

Determining the optimal lag length in this study uses several criteria, including Sequential Modified LR Test Statistic (SMLR), Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC), and Hannan-Quinn Information Criterion (HQIC).

Table 3. Result of Lag Optimum Test

Lag	LogL	SMLR	FPE	AIC	SIC	HQIC
0	108.0041	NA	0.001838	-0.623554	-0.601031	-0.614579
1	427.3202	632.9971	0.000288	-2.478354	-2.410785	-2.451431
2	482.4051	108.5496	0.000213	-2.778853	-2.666237	-2.733981
3	501.7177	37.82997	0.000195	-2.868928	-2.711265	-2.806106
4	521.8651	39.22819	**0.000177***	**-2.963912***	**-2.761203***	**-2.883141***
5	524.1889	4.497237	0.000179	-2.954052	-2.706297	-2.855332
6	529.5571	**10.32601***	0.000177	-2.962101	-2.669299	-2.845432

The lag length included in this study is the value of lag 0 to lag 6. Based on Table 3, the FPE, AIC, SIC, and HQIC criteria show that lag 4 is the optimum lag; only the SMLR criterion shows lag 6 as the optimum lag. Therefore, the VAR model in this study mainly uses the smallest lag indicated by most criteria, lag 4.

3.2.3. Stability Test

Before further testing, a stability test is required to show that the VAR model used in this study is stable.

Table 4. Result of Root for Characteristic Polynomial

Root	Modulus
0.960269	0.960269
0.739411 - 0.566991i	0.931777
0.739411 + 0.566991i	0.931777
-0.719869	0.719869
-0.492642 - 0.360456i	0.610431
-0.492642 + 0.360456i	0.610431
0.096577 - 0.473507i	0.483256
0.096577 + 0.473507i	0.483256

Table 4 shows that the VAR panel model used in this study has a modulus value smaller than 1 (one) for each root, so it can be declared stable.

3.2.4. Causality Test

The Granger causality test is used to test the relationship between the two variables in this study and show whether inflation Granger causes unemployment or vice versa.

Table 5. Granger Causality Test

Null Hypothesis: Does Not Granger Cause	Obs	F-Statistic	Prob.	Decision
Lag 4 Unemployment ~ Inflation	408	0.6628970	0.6180927	Fail to Reject Ho
Inflation ~ Unemployment		8.5903451	0.0000012	Ho Rejected
Lag 6 Unemployment ~ Inflation	340	0.8166407	0.5575894	Fail to Reject Ho
Inflation ~ Unemployment		5.0785084	0.0000531	Ho Rejected

The Granger causality test results in Table 5 show that at Lag 4 of the VAR panel model, there is only a one-way relationship between Inflation and Unemployment. Where Inflation Granger Cause Unemployment in Critical F-Value 1.15177 and significance level α 5 percent. While Unemployment Does Not Granger Cause Inflation.

3.2.5. Impulse Response Function (IRF) & Variance Decomposition (VD)

This section describes how a change in one of the variable impulses the response and changes the composition of the other variables.

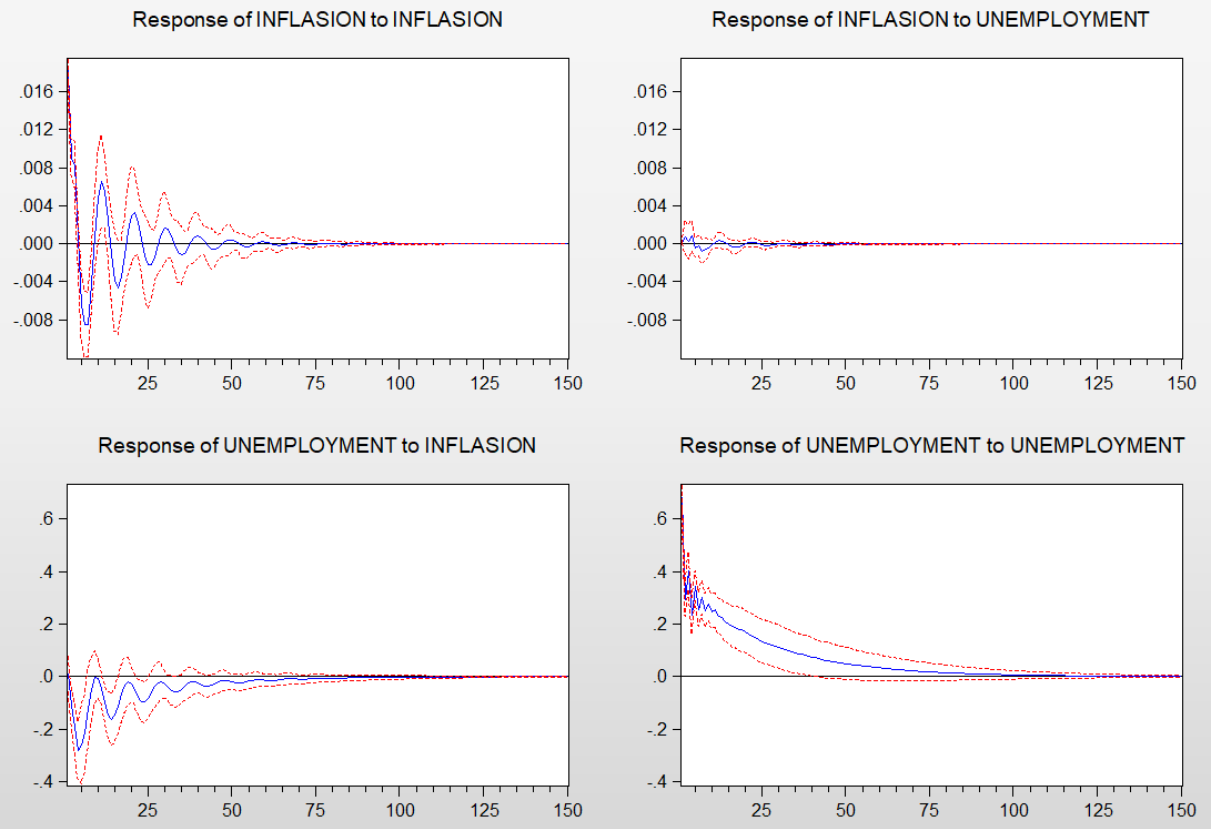

Figure 1. Response to Cholesky One S.D. (d.f. adjusted) Innovations ± 2 S.E.

Figure 1 shows how inflation responds to changes in inflation in the previous period, inflation responds to changes in unemployment, unemployment responds to changes in unemployment during the last period, and unemployment responds to changes in inflation. The fluctuation in the figure shows that the variable response is volatile following the shock of other variable data. However, the fluctuation decreases and approaches the equilibrium point (convergence), meaning that the variable response due to the shock of different variables is not permanent.

Table 6. Variance Decomposition Using Cholesky (d.f. adjusted) Factors

Variance Decomposition of Inflation:				Variance Decomposition of Unemployment:		
Period	S.E.	IN	UN	S.E.	IN	UN
1	0.018200	100.0000	0.000000	0.682679	0.022658	99.97734
5	0.022958	99.70983	0.290169	1.043182	18.28541	81.71459
10	0.026706	99.61608	0.383921	1.228951	17.42171	82.57829
15	0.028442	99.63257	0.367428	1.357515	18.70868	81.29132
20	0.029240	99.61291	0.387090	1.423317	17.94310	82.05690
25	0.029623	99.61625	0.383746	1.472768	18.30265	81.69735
30	0.029805	99.61037	0.389627	1.499891	17.96161	82.03839

Table 7 shows that the proportion of Inflation series movement due to the shock of the variable itself is greater than the proportion of Unemployment variable shock. Similarly, the movement of the Unemployment series is greater due to the variable itself than the proportion of the Inflation variable shock.

4. Conclusions

This study examines the causal relationship between inflation and unemployment in Indonesia. The results from the panel VAR model's statistical tests indicate a unidirectional causality, with inflation Granger-causing unemployment, while unemployment does not Granger-cause inflation. This finding is further supported by the Vector Autoregression estimates, which demonstrate that unemployment is more influenced by inflation, whereas inflation is unaffected by unemployment.

Consequently, in addition to efforts aimed at reducing unemployment, policymakers should prioritize addressing inflation and keeping it within manageable limits, as controlling inflation may contribute to improvements in the unemployment rate. While this research provides valuable insights, it has certain limitations, as it primarily examines the relationship

between inflation and unemployment from a macroeconomic perspective. Future research should consider exploring this relationship through qualitative interviews with individuals who have directly experienced inflation and unemployment to better understand their daily impacts and consequences.

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