

ANALYSIS OF MACROECONOMIC VARIABLES USING VAR MODELS ON INFLATION IN INDONESIA, 2020–2024

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Abstract. This study aims to analyze the interactions among the minimum wage, unemployment rate, economic growth, and financial development in relation to inflation, as well as to identify causal relationship patterns among these variables. The research employs a quantitative approach using Vector Error Correction Model (VECM) analysis based on time-series data. Stationarity tests, optimal lag determination, stability tests, Granger causality tests, cointegration tests, and VECM estimation are conducted to examine the direction of relationships among variables and to estimate long-run effects in measuring the impact of each variable on inflation. The data utilized are secondary data obtained from official publications of relevant institutions and are analyzed using the E-Views statistical software. The results indicate that not all variables exhibit causal relationships. Inflation shows a one-way causal relationship with the unemployment rate, while financial development exhibits a one-way causal relationship with inflation. In addition, bidirectional causality is found between financial development and the minimum wage, as well as between financial development and economic growth. Long-run estimation results reveal that the minimum wage and unemployment rate have a positive and significant effect on inflation, whereas economic growth has a negative and significant effect on inflation. Financial development is also shown to have a positive effect on inflation. The findings underscore that inflation is influenced by a combination of labor market factors, macroeconomic conditions, and financial sector development; therefore, effective inflation control requires integrated and sustainable economic policies.

Keywords: Inflation; minimum wage; unemployment rate; economic growth; financial development

I. INTRODUCTION

Inflation is one of the main challenges in a country's economy, including Indonesia. As a macroeconomic indicator, inflation reflects changes in the general price level of goods and services in an economy and has a broad impact on people's purchasing power, economic stability, and long-term economic growth. Inflation stability is one of the main priorities of the government and central bank in designing economic policy, given its impact on the welfare of the community and the business world [1], [2], [3].

Over the past decade, Indonesia has experienced various inflation dynamics influenced by domestic and global factors. In general, inflation in Indonesia has tended to be stable and under control, despite some significant fluctuations. During this decade, the highest inflation rate was in 2014, with an inflation rate of around 8 percent. In the following years, the inflation rate declined and tended to be stable. Finally, in 2022, there was a surge in inflation, reaching 5.51 percent.

Inflation is an economic phenomenon characterized by a general increase in the prices of goods and services over a certain period, thereby reducing people's purchasing power. High inflation rates can disrupt economic stability, affecting

consumption, investment, and financial planning for individuals and companies. Several key factors that influence inflation include minimum wages, unemployment rates, economic growth, and financial developments. An increase in the minimum wage, for example, can increase workers' purchasing power, encouraging consumption, but it also has the potential to increase production costs, thereby putting pressure on prices. High unemployment rates tend to put downward pressure on inflation as aggregate demand weakens, while low unemployment can actually increase price pressures. Rapid economic growth drives demand for goods and services, potentially pushing prices up, while slow growth holds inflation in check. Meanwhile, developments in the financial sector, through the availability of credit, liquidity, and the efficiency of the banking system, affect money circulation and investment, which can stabilize or accelerate inflation depending on the monetary and fiscal policies implemented. Thus, inflation is the result of a dynamic interaction between various interrelated macroeconomic factors. The following table shows the development of each variable over the last 5 years [4], [5], [6], [7].

Table 1. Development of Research Variables 2020-2024

Year	Inflation (%)	Minimum Wage (IDR)	Unemployment rate (%)	Economic growth (billion rupiah)	Financial development (% of GDP)
2020	0.39	2,756,345	7.07	10,722,999.30	33.1
2021	0.26	2,736,463	6.49	11,120,059.70	32
2022	0.56	3,070,756	5.86	11,710,223.20	30.6
2023	0.34	3,178,227	5.32	12,301,475.10	31.3
2024	0.04	3,267,618	4.91	12,920,281.70	31.8

Based on data from 2020–2024, it can be seen that inflation tends to decline and is relatively low, while the minimum wage increases. This condition shows that inflationary pressure is not solely influenced by increases in income or economic activity, but is more determined by the balance between demand and production capacity. This is in line with the results of research presented by. The significant increase in the minimum wage, especially since 2022, has not been followed by a surge in inflation, and the unemployment rate has also declined, indicating that the wage increase can still be absorbed by increased productivity and economic efficiency, so that the effects of cost-push inflation are not too strong. This is in line with research findings that the minimum wage does not have a significant effect on national unemployment, while inflation remains under control and is associated with increased efficiency and quality of human resources. This is consistent with the idea that wage increases are offset by productivity [8], [9].

The consistent decline in the unemployment rate from 7.07% in 2020 to 4.91% in 2024 reflects improving labor market conditions in line with the post-pandemic economic recovery, which is also in line with what has been stated. Theoretically, a decline in unemployment has the potential to increase inflation through an increase in aggregate demand and wage pressure, as expressed in the Phillips Curve theory. However, data shows that inflation actually declined in 2023–2024. This indicates that increased employment opportunities and household income were offset by increased output and supply stability, so that demand pressures did not develop into high inflation [10], [11].

The consistent economic growth from 10,722,999.30 billion rupiah in 2020 to 12,920,281.70 billion rupiah in 2024 indicates a fairly strong economic expansion. However, the relationship between economic growth and inflation during this period appears weak, even tending to move in opposite directions. This indicates that economic growth is more supply-driven, i.e., driven by increased production capacity, investment, and efficiency, rather than solely by a surge in consumption. Thus, economic growth actually plays a role in restraining inflationary pressures. This is because economic growth has a negative effect on inflation, suggesting that when capacity and efficiency increase, price pressures can be mitigated. Meanwhile, relatively stable financial development at around 30-33% of GDP indicates that the financial sector is growing moderately. The decline in the financial development ratio until 2022 was followed by low inflation, indicating that credit and liquidity expansion were not excessive, as revealed by research. The stability of the financial sector plays an

important role in maintaining the effectiveness of monetary policy transmission and controlling inflationary pressures [12], [13].

There are several studies that examine the same topic as this study, but they only analyze one or two macroeconomic variables, such as minimum wages and inflation or unemployment and inflation based on the Phillips curve. Therefore, this study fills the gap by examining these macro variables simultaneously. This study also uses the latest data, making it more up-to-date and relevant to the current situation [14], [15].

Inflation

From an economic theory perspective, inflation is defined as a condition in which there is a general increase in the prices of goods and services in the economy that continues over a certain period of time. An increase in the price of only one or two goods cannot be called inflation, unless the price increase spreads to (or causes an increase in) the prices of most other goods. In the long term, inflation is generally believed to be a phenomenon in monetary concepts. In the short and medium terms, inflation is influenced by the relative elasticity of wages, prices, and interest rates. Therefore, there are a number of fundamental differences regarding the factors that cause inflation [16]. According to Paul A. Samuelson, like a disease, inflation can be classified according to its severity, as follows:

- 1) *Moderate Inflation*: a slow increase in price levels, commonly referred to as "single-digit inflation." At this level of inflation, people are still willing to hold on to their money and save their wealth in the form of money rather than real assets.
- 2) *Galloping Inflation*: inflation occurs at a rate of 20% to 200% per year. In this condition, people will hold on to money as necessary, while wealth will be stored in the form of real assets;
- 3) *Hyperinflation*: Inflation occurs at a very high rate of millions to trillions of percent per year. Although it seems that many governments can survive galloping inflation, no government has ever been able to survive this third type of inflation. An example is the Weimar Republic in Germany in the 1920s [17].

Minimum Wage

Wages are income received by workers in the form of money, which includes not only wages or salaries, but also overtime and allowances received on a regular basis, such as transportation allowances, meal allowances, and other allowances as long as they are received in the form of money, excluding Holiday Allowances (THR), annual allowances, quarterly allowances, other non-routine allowances, and

allowances in kind. The definition of wages, as stated in Article 1 Number 30 of Law Number 13 of 2003 concerning Manpower, refers to the rights received by workers or laborers in the form of money as compensation for the work they do, which is determined and paid by employers or employers in accordance with the agreement in the employment agreement, agreement provisions, or applicable laws and regulations. Everyone has the fundamental right to work and receive fair and decent compensation and treatment in the context of employment relationships, as mandated in Article 28D Paragraph 2 of the Constitution of the Republic of Indonesia [18], [19].

Unemployment Rate

According to the World Bank's definition, unemployment refers to the portion of the labor force that does not yet have a job but is actively seeking work, whereby the definition of unemployment differs from country to country. Unemployment is grouped into four categories, namely (1) people who are actively seeking work, (2) people who are in the process of setting up a new business, (3) people who feel they are not suitable for employment and therefore do not seek work, and (4) people who are not actively seeking work because they already have a job but have not yet started working. Types of unemployment can be divided into two categories: based on cause and based on characteristics. Unemployment based on cause is divided into frictional unemployment, cyclical unemployment, structural unemployment, and technological unemployment. Meanwhile, the classification of unemployment based on characteristics is divided into four types, namely underemployment, hidden unemployment, open unemployment, and seasonal unemployment [20].

Economic Growth

Economic development is generally measured based on the rate of economic growth, which is the main indicator in assessing the success of an economy. The progress and economic welfare of a country are highly dependent on growth as reflected in changes in national output. Changes in national output are usually the main object of short-term economic analysis [21]. Adam Smith argued that economic growth occurs through the interaction between population growth and technological progress, both of which contribute to an increase in national output. In addition, he highlighted two main factors that play a role in improving a country's welfare, namely economies of scale and the development of skills and quality of the workforce. According to Adam Smith, the government has three main functions in supporting economic stability and growth. First, maintaining domestic security and national defense. Second, administering the judicial system to enforce law and justice. Third, providing various goods and services that cannot be provided by the private sector, such as infrastructure and public facilities. To carry out these functions, the government needs a budget that is managed through fiscal policy. This policy includes planning the budget size, the desired economic growth, and the budget structure implemented by a country.

Financial Development

Finance (monetary) comes from the word money or moneta from Latin, which means money. Finance or monetary refers to all activities related to financial flows that are grouped

under the subject of finance/monetary, including theories about money, management, policies, instruments, and institutions that make money the object of their activities.

The following presents a conceptual framework that has been formulated as a guide for this research.

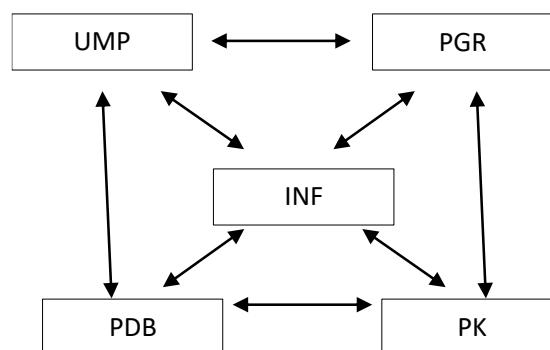


Figure 1. Conceptual Framework

Explanation:

- UMP : Minimum wage
- PPGR : Unemployment
- GDP : Economic growth
- PK : Financial Development
- INF : Inflation

Thus, the hypothesis proposed in this study is formulated as follows:

1. H01: There is no interaction and contribution of minimum wage, unemployment, economic growth, and financial development on inflation.
 H1: There is interaction and contribution of minimum wage, unemployment, economic growth, and financial development to inflation.
2. H02: There is no interaction and contribution of unemployment, economic growth, financial development, and inflation on minimum wages.
 Ha2: There is interaction and contribution of unemployment, economic growth, financial development, and inflation on minimum wage.
3. H03: There is no interaction and contribution of economic growth, financial development, inflation, and minimum wage on unemployment.
 Ha2: There is interaction and contribution of economic growth, financial development, inflation, and minimum wage on unemployment.
4. H04: There is no interaction and contribution of financial development, inflation, minimum wage, and unemployment on economic growth.
 Ha4: There is interaction and contribution of financial development, inflation, minimum wage, and unemployment on economic growth.
5. H05: There is no interaction and contribution of inflation, minimum wage, unemployment, and economic growth on financial development.
 Ha5: There is interaction and contribution of inflation, minimum wage, unemployment, and economic growth to financial development.

II. RESEARCH METHOD

This research is quantitative in nature. The data source used in this study is secondary data. Secondary data is data collected from other parties' publications. This data is usually available in a ready-to-use form, such as reports, statistics, documents, articles, books, or data from government agencies, companies, or research institutions [22]. The data used in this study is secondary data taken from relevant agency publications. Minimum wage data was obtained from BPS, unemployment rate data was obtained from BPS publications, economic growth data was obtained from the Ministry of Trade, data on financial developments was obtained from World Development Indicators, and inflation data was obtained from Ministry of Trade publications. The data used covers the period from 2020 to 2024.

The analysis method used the VAR method. The VAR methodology was first proposed by Sims (1980). The VAR model was created to address situations where the relationship between economic variables can still be estimated without focusing on the issue of exogeneity. In this approach, all variables are considered endogenous and estimates can be made simultaneously or sequentially [23]. Time series data are generally non-stationary at the level. If the data are non-stationary at the level but stationary in the data differentiation process, it must be tested whether the data used in the model have a long-term relationship or not. The existence of a long-

term relationship can be determined by conducting a cointegration test. If there is cointegration, then the model used is the Vector Error Correction Model (VECM). The VECM model is a restricted VAR model. The existence of cointegration indicates a long-term relationship between variables in the VAR system.

The purpose of VECM is to determine the long-term relationship between variables in the model. If the data used is stationary at the first difference, the VAR model will be combined with the error correction model to become a Vector Error Correction Model (VECM). Impulse response function analysis is performed to see the response of an endogenous variable to shocks from other variables in the model. Variance decomposition analysis is also performed to see the relative contribution of a variable in explaining the variability of its endogenous variables. The stages of data analysis in this study begin with a stationarity test, determination of the optimum lag, stability test, cointegration test, Granger causality test, and Vector Error Correction Model (VECM) test.

III. RESULTS AND DISCUSSION

Stationarity Test

The stationarity test method uses a unit root test model using Augmented Dickey-Fuller (ADF) at a 5% level with a test for unit root in level.

Table 2. Stationarity Test Results Test for Unit Root in Level

Variable	ADF t-statistic	Probability	Description
Inflation	-6.510436	0.000	Stationary
Minimum Wage	-0.262116	0.9236	Non-stationary
Unemployment	-2.590980	0.1007	Non-stationary
Economic growth	1.916105	0.9998	Non-stationary
Financial development	-1.976713	0.2961	Non-stationary

Source: Eviews, 2025

Based on the stationarity test on the variables of inflation, minimum wage, unemployment, economic growth, and financial development at the level, they are not yet stationary because there are still variable probability values >0.05 , namely minimum wage, unemployment, economic growth, and financial development. Therefore, a further analysis of the stationarity test at the first difference level was carried out. After conducting a stationarity test at the first difference level, it was found that the data was not yet stationary because there were still variable probability values > 0.05 . Therefore, a stationarity test was conducted at the 2nd difference level with the following results.

The results of the stationarity test for inflation, minimum wage, unemployment, economic growth, and financial development at the second difference level are stationary because all variable probability values are < 0.05 .

Table 3. Results of the Stationarity Test for Unit Root in 2ndDifference

Variable	ADF t-statistic	Probability	Description
Inflation	-6.909387	0.000	Stationary
Minimum Wage	-8.323220	0.0000	Stationary
Unemployment	-7.142931	0.0000	Stationary
Economic growth	-7.432317	0.0000	Stationary
Financial development	-8.422558	0.0000	Stationary

Source: Eviews, 2025

Determination of Optimum Lag

The optimum lag test is the process of determining the most appropriate or optimal number of lags (time delays) in the Vector Autoregression (VAR) model. The optimum lag test is based on the shortest lag using the Akaike Information Criterion (AIC) value. Based on Table 4.4, the optimum lag test used the SC and HQ optimum criteria at lag 1, and the results show an asterisk (*) in Table 4.4. The results of the optimum lag test are attached below.

Table 4. Optimal Lag Test

Lag	LogL	LR	FPE	AIC	SC	HQ
0	930.0704	NA	9.08e-22	-34.26187	-34.07770	-34.19084
1	994.8952	115.2441	2.09e-22	-35.73686	-34.63187*	-35.31071*
2	1027.792	52.39175	1.60e-22	-36.02934	-34.00353	-35.24807
3	1052.709	35.06768	1.70e-22	-36.02625	-33.07961	-34.88985
4	1083.592	37.74580*	1.55e-22	-36.24414	-32.37667	-34.75261
5	1116.862	34.50238	1.42e-22*	-36.55044*	-31.76215	-34.70378

Source: Eviews, 2025

Stability Test

Data is considered stable if all points (inverse roots) lie within the circle.

Inverse Roots of AR Characteristic Polynomial

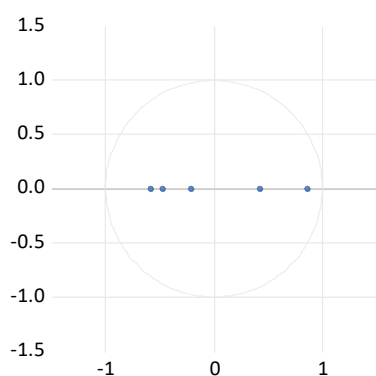


Figure 2. Data Stability Test
 Source: Eviews, 2025

The stability test results based on the graph above show that all points are within the circle. Based on the provisions, the data is considered stable. Thus, the Impulse Response

Function (IRF) and Forecast Error Variance Decomposition (FEVD) results in the next test can be considered valid.

Granger Causality Test

The Granger Causality Test is a statistical method used to test whether a time series variable can be used to predict another time series variable.

Based on the results of the Granger causality test presented in the table above, it can be seen that there are only a few variables that have interactions, whether one-way or two-way, and there are even variables that have no causality. Among the variables that have a one-way relationship are the interaction between the inflation variable and unemployment, the interaction between the financial development variable and inflation, the interaction between the unemployment variable and the minimum wage, economic growth (GDP) and the minimum wage, unemployment and economic growth, and unemployment and financial development. Variables that have a two-way relationship are indicated by the interaction between the financial development variable and the minimum wage, and financial development and economic growth. Meanwhile, there are several variables that do not have a causal relationship, including the interaction between the minimum wage variable and inflation and vice versa, as well as the interaction between the economic growth variable and inflation and vice versa.

Table 5. Granger Causality Test Results

No	Relationship	F-stat	Prob	Causality results
1	UMP → INF	0.36767	0.5467	No causal relationship
	INF → UMP	2.59964	0.1125	No causal relationship
2	→ PGR INF	0.23067	0.6329	Unidirectional relationship
	INF → PGR	4.08387	0.0481	INF → PGR
3	GDP → INF	0.04915	0.8253	No causal relationship
	INF → GDP	3.65716	0.0609	No causal relationship
4	→ PK INF	7.26379	0.0093	Unidirectional relationship
	INF → PK	0.67974	0.4132	PK → INF
5	PGR → UMP	18.1156	8.E-05	One-way relationship
	→ PGR UMP	0.11973	0.7306	→ PGR UMP
6	GDP → UMP	7.67231	0.0076	One-way relationship
	→ GDP UMP	2.52265	0.1179	→ GDP UMP
7	→ 's PK UMP	28.6715	2.E-06	Two-way relationship
	→ PK UMP	28.1322	2.E-06	← → PK UMP
8	GDP → PGR	1.09210	0.3005	One-way relationship
	→ PGR GDP	26.7586	3.E-06	→ -GDP PGR
9	PK → PGR	1.29759	0.2595	One-way relationship
	→ PGR PK	15.4038	0.0002	PGR → PK
10	→ PK GDP	31.6236	6.E-07	Two-way relationship
	→ GDP PK	16.1533	0.0002	← → GDP GDP

Source: Eviews Output, 2025

Cointegration Test

The cointegration test was conducted to determine whether there would be long-term equilibrium, i.e., whether there was similarity in movement and stability in the relationship between the variables in this study. Long-term information is obtained by first determining the cointegration rank to find

out how many equation systems can explain the entire existing system. To determine the existence of cointegration, the trace statistic value is compared with the critical value (5%), and it can be concluded that these variables have cointegration.

Table 6. Cointegration Test Results

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.** Critical Value
None *	0.765389	187.5982	69.81889	0.0000
At most 1 *	0.646965	104.9581	47.85613	0.0000
At most 2 *	0.416703	45.61030	29.79707	0.0004
At most 3	0.146432	14.88395	15.49471	0.0616
At most 4 *	0.097686	5.859165	3.841465	0.0155

Source: Eviews, 2025

Based on the table above, it can be concluded that all *trace statistic* values are greater than *the critical value* at several hypothesized values, meaning that there is a long-term relationship between variables. In accordance with the

provisions of the data analysis method used, the VECM test was applied.

VECM Test

The following presents the results of the VECM test that has been conducted.

Table 7. Long-Term VECM Test Results

Endogenous variables	Exogenous Variable	Coefficient	Standard error	t-Statistic
Inflation	C	1.005285		
	Minimum wage	32.64790	10.2930	3.17184
	Unemployment	31.02246	7.30904	4.24439
	Economic growth	-252.7725	71.5612	-3.53226
	Financial development	10.59988	4.34866	2.43750

Source: Eviews, 2025

The results of the study show that several economic factors have a significant effect on inflation in the long term. Minimum wages and unemployment rates both have a positive effect, meaning that wage increases or rising unemployment will drive inflation; specifically, a 1 million rupiah increase in the minimum wage is estimated to increase inflation by 32.65%, while a 1% increase in unemployment increases inflation by around 31.02%. Economic has a negative effect on inflation, meaning that higher economic growth tends to reduce the inflation rate, with a decrease of 252.77% for every 1 billion increase in economic growth. Meanwhile, developments in the financial sector have a positive effect on inflation; a 1% increase in financial development is estimated to increase inflation by around 10.6%. Overall, these results show that inflation is influenced by a combination of labor factors, macroeconomic conditions, and developments in the financial system.

Based on the results of the Granger causality test and long-term analysis, the research findings show that inflation dynamics are influenced by complex interactions between labor market variables, economic growth, and financial sector development. The results of the Granger causality test

indicate that not all variables directly influence each other, either in a one-way or two-way relationship. Inflation has been proven to have a one-way causal relationship with the unemployment rate, indicating that changes in prices in general can affect labor market conditions, in line with the view that inflation has an impact on the cost of living and labor decisions. In addition, financial developments have a one-way causal relationship with inflation, suggesting that financial sector expansion, increased liquidity, and access to credit have the potential to drive inflationary pressures through increased consumption and investment [24].

On the other hand, the causality test results also show that unemployment and economic growth play a role in influencing minimum wages, reflecting that wage policy is not only determined by normative aspects, but also by macroeconomic and labor market conditions. The one-way relationship between unemployment and economic growth as well as financial developments indicates that labor market conditions are an important factor in determining the dynamics of growth and stability in the financial sector. Meanwhile, the two-way causal relationship between financial development and minimum wages and economic growth confirms the existence of a reciprocal relationship,

whereby a developing financial sector drives economic growth and wage increases, while economic growth and wage policies accelerate the development of the financial sector. This is as stated in studies [25], [26].

The findings of long-term estimates show that minimum wages and unemployment rates have a positive and significant effect on inflation. An increase in the minimum wage tends to increase production costs and people's purchasing power, thereby driving up prices, while an increase in unemployment can reflect structural imbalances in the economy that also trigger inflationary pressures. Conversely, economic growth has a negative effect on inflation, indicating that increased production capacity and economic efficiency can curb price increases. Meanwhile, the development of the financial sector has a positive effect on inflation, indicating that increased liquidity and financial activity without being balanced by a strengthening of the real sector has the potential to increase inflationary pressures [27], [28], [29].

IV. CONCLUSIONS

Based on the results of the research and discussion described above, it can be concluded that inflation is influenced by complex interactions between labor market variables, economic growth, and developments in the financial sector. The results of the Granger causality test show that not all variables have a causal relationship, either unidirectional or bidirectional, indicating that economic dynamics do not always proceed linearly. Inflation has been proven to have a one-way causal relationship with the unemployment rate, while financial developments act as a driving factor for inflation. On the other hand, minimum wages and economic growth do not have a direct causal relationship with inflation. Long-term estimation results reinforce these findings by showing that minimum wages and unemployment rates have a positive and significant effect on inflation, while economic growth has a negative and significant effect, and financial developments have a positive effect on inflation. Overall, this study confirms that inflation control requires integrated and balanced economic policies, taking into account labor market stability, the quality of economic growth, and sound financial sector management in order to control inflationary pressures in a sustainable manner.

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