



The Influence of Interest Rates, Consumption, Investment, Unemployment, and Renewable Energy on Inflation and GDP in Indonesia

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Abstract This research aims to determine the influence of interest rates, consumption, investment, unemployment and renewable energy on inflation and gross domestic product (GDP) in Indonesia. The variables in this research are Interest Rates, Consumption, Investment, Unemployment and Renewable Energy as independent variables, while the variables Inflation and Gross Domestic Product (GDP) are the dependent variables. The research period is 1993 - 2023. The data analysis technique used is the Simultaneous model, with testing using Eviews 10. Based on the results of the simultaneous analysis, the variables Interest Rate, Consumption and GDP have a positive and significant effect on Inflation. Meanwhile, the Investment Variable does not have a positive and significant effect on Inflation. The Renewable Energy and Inflation variables have a positive and significant effect on GDP. Meanwhile, the unemployment variable does not have a positive and significant effect on GDP.

Keywords: Inflation, GDP, Interest Rates, Consumption, Investment, Unemployment, Renewable Energy.

1. INTRODUCTION

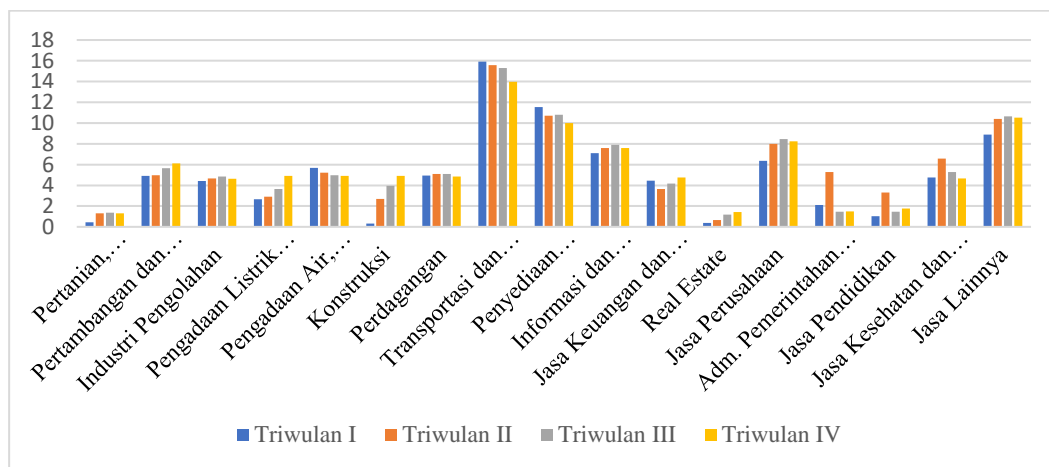
Recently, many countries have been trying to increase their country's economic growth rate by increasing output continuously through the availability of capital goods, technology and human resources (Simanungkalit, 2020) . Economic growth is also related to the process of increasing the production of goods and services in society's economic activities. It can be said that growth concerns development with a single dimension and is measured by increasing production output and income. In this case, it means that there is an increase in national income as indicated by the value of Gross Domestic Product (GDP).

The following is a table of GDP growth by business field in 2023:

Table 1 GDP Growth by Business Field Quarter I - Quarter IV 2023 (%)

GDP	Quarter I	Quarter II	Quarter III	Quarter IV
Agriculture, Forestry and Fisheries	0.44	1.29	1.36	1.3
Mining and Quarrying	4.92	4.97	5.65	6.12
Processing industry	4.43	4.65	4.84	4.64
Procurement of Electricity and Gas	2.67	2.91	3.64	4.91
Water Procurement, Garbage, Waste and Recycling	5.69	5.22	4.98	4.9
Construction	0.32	2.7	3.94	4.91
Trading	4.94	5,11	5,11	4.85
Transportation and Warehousing	15.93	15.59	15.3	13.96
Provision of Accommodation & Food and Drink	11.54	10.71	10.79	10.01
Information and Communication	7.11	7.58	7.89	7.59
Financial Services and Insurance	4.45	3.65	4.18	4.77
Real Estate	0.37	0.67	1.18	1.43
Company Services	6.37	8	8.46	8.24
Adm. Government and Defense	2.1	5.27	1.45	1.5
Education Services	1.02	3.3	1.46	1.78
Health Services and Social Activities	4.77	6.57	5.27	4.66
Other Services	8.9	10.4	10.65	10.52

Source : ((BPS), 2023)



Source: Table 1

Figure 1 Graph of GDP Growth According to Business Fields Quarter I - Quarter IV 2023

Based on the Table and Graph above, the highest level of GDP is Transportation and Warehousing in the first quarter at 15.93%, the second quarter at 10.71%, the third quarter at 15.3%, and the fourth quarter at 13.96% which is supported by Infrastructure development is gradually becoming more evenly distributed. The construction of toll roads is starting to

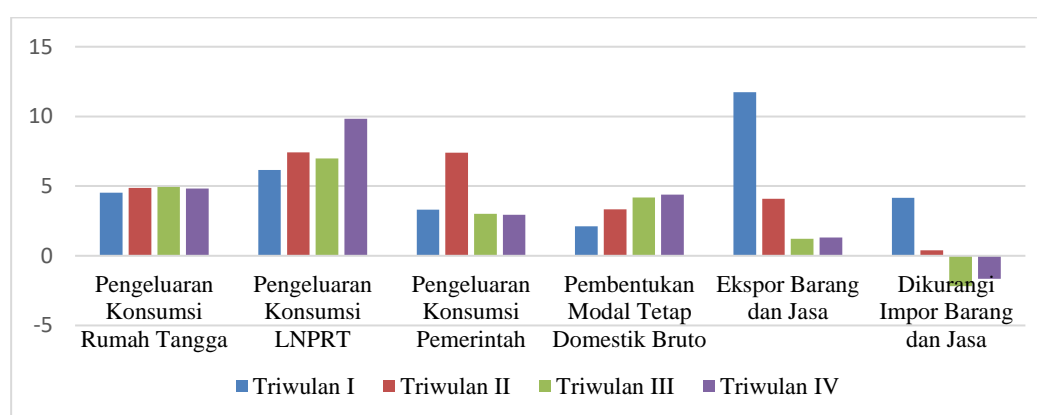
connect in several areas and the logistics sector is developing so that the economy is increasing, especially the transportation and warehousing sectors. The second GDP growth that has a fairly high level of GDP is the provision of accommodation and food and drink in the first quarter of 11.54%, the second quarter of 10.71%, and the third quarter of 10.79%, while in the fourth quarter, namely Other Services, was 10.52%. The third GDP growth that has a high level of GDP is Other Services in the first quarter of 8.9%, the second quarter of 10.4%, and the third quarter of 10.65%, while in the fourth quarter, namely the Provision of Accommodation and Food and Drink, it was 10.01%.

The following is a table of GDP growth according to expenditure, namely:

Table 2 GDP Growth According to Expenditures in Quarter I - Quarter IV 2023 (%)

GDP	Quarter I	Quarter II	Quarter III	Quarter IV
Household Consumption Expenditures	4.53	4.88	4.94	4.82
LNPRT Consumption Expenditures	6.16	7.41	6.99	9.83
Government Consumption Expenditures	3.31	7.39	3.01	2.95
Gross Domestic Fixed Capital Formation	2.11	3.34	4.18	4.4
Export of Goods and Services	11.74	4.1	1.21	1.32
Reduced Imports of Goods and Services	4.15	0.39	-2.17	-1.65

Source : ((BPS), 2023)



Source: Table 2

Figure 2 Graph of GDP Growth According to Expenditures in Quarter I - Quarter IV 2023

Based on the table and graph above, the highest level of GDP in the first quarter was exports of goods and services at 11.74 % . Meanwhile, in the second quarter it was 7.41 % , in the third quarter it was 6.99%, and in the fourth quarter it was 9.83%, namely LNPRT

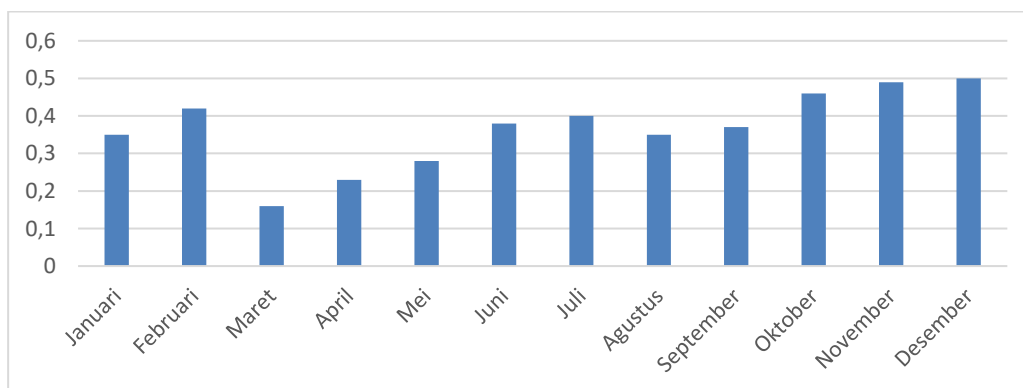
Consumption Expenditures. The second highest level of GDP growth was in the first quarter, namely LNPRC Consumption Expenditure of 6.61%, in the second quarter, namely Government Consumption Expenditure, of 7.39%, while in the third quarter it was 4.94% and in the fourth quarter it was 4.82 % namely Household Consumption Expenditures. The third highest level of GDP growth was in the first quarter at 4.53 % and in the second quarter at 4.88%, namely Household Consumption Expenditures. Meanwhile, in the third quarter it was 4.18 % and in the fourth quarter it was 4.4%, namely Gross Domestic Fixed Capital Formation.

According to Rangkyu & Nasution (2018), the cause of inflation, namely demand pull inflation , occurs due to excessive total demand and is usually caused by increased liquidity in the market and results in high demand, thus triggering changes in price levels. The increase in the volume of exchange tools or liquidity related to demand for goods and services results in an increase in demand for these factors of production. With an increase in demand for production factors, this causes an increase and increase in production.

Table 3. Inflation 2023 (%) :

Month	Inflation
January	0.35
February	0.42
March	0.16
April	0.23
May	0.28
June	0.38
July	0.4
August	0.35
September	0.37
October	0.46
November	0.49
December	0.5

Source : ((BPS), 2023)



Source Table 3

Figure 3 Inflation Graph for Housing, Water, Electricity and Home Fuel Groups 2023

Based on the Table and Graph above, the highest inflation rate in December was 0.5%,

which was caused by increased community activity ahead of Christmas, New Year and school holidays, which then pushed up the prices of a number of goods and services. The second highest inflation rate in November was 0.49%, and in October it was 0.46%.

In research conducted by Hartati Nani (2020), unemployment has a very significant impact on economic growth, which can be explained simply. When a country's economic growth experiences growth at a positive rate and has a continuous trend, this means that the income of the people of a country will certainly increase due to the large number of job opportunities. However, because the unemployment referred to here is open unemployment, the increase in economic growth causes a higher rate in the same direction, namely increasing the value of unemployment. Meanwhile, research conducted by Pramesthi (2012) shows that unemployment has a negative and significant effect on economic growth. Increasing unemployment can cause economic growth to decline because people's purchasing power falls, resulting in entrepreneurs being reluctant to invest. Based on this opinion, there is an influence between unemployment and economic growth. In order to maintain economic growth, policies are needed that are not only oriented towards economic growth, but also reduce unemployment by creating new jobs.

In research conducted by (Silvia et al., 2013) an increase in investment will trigger an increase in economic growth because an increase in investment indicates that there has been an increase in capital investment or capital formation. An increase in investment or capital formation will result in increased production of goods and services in the economy. This increase in production of goods and services will lead to an increase in economic growth. On the other hand, if there is a decrease in investment, GDP will also experience a decrease because a decrease in investment indicates that there has been a decrease in investment or capital formation. This decrease in investment or capital formation will result in the economy reducing production of goods and services. A decrease in the production of goods and services will cause a decrease in economic growth.

2. LITERATURE STUDY

Gross Domestic Product (GDP)

Gross Domestic Product (GDP) is the amount of added value produced by all business units in a particular country, or the total value of final goods and services produced by all economic units. GDP based on current prices describes the added value of goods and services which is calculated using prices in effect in each year, while GDP based on constant prices shows the added value of these goods and services which is calculated using prices in effect in a particular year as a basis. GDP based on current prices can be used to see economic shifts and structure, while constant prices are used to determine economic growth from year to year ((BPS), nd) .

Inflation

Inflation is an economic problem that can cause and is very widespread. If inflation is at a high rate, it will cause slow economic growth, increased unemployment rates, and a decrease in the value of the rupiah currency. Therefore, inflation is the main target of government policy (Nasution & Novalina, 2020) .

Interest rate

Interest rates are one of the variables in the economy that is always closely observed because of its broad impact. It directly influences people's daily lives and has an important impact on the health of the economy. Usually the interest rate is expressed as an annual percentage charged on the money borrowed (Indriyani, 2016) .

Consumption

Consumption behavior is an integral part of short-term and long-term macroeconomic policy for two main reasons. First, consumption shapes the business cycle and thus influences short-term monetary policy. Second, the decision to consume determines the level of savings and capital stock, interest rates, wages and welfare in the long term, which in turn influences fiscal and monetary policy (Juhro & Iyke, 2020) .

Investment

According to Sukirno (2008) important factors that determine the level of investment are the level of profit predicted to be obtained by interest rates, predictions regarding future conditions, technological progress, the level of national opinion and its changes, and the profits obtained by the company.

Unemployment

Unemployed is someone who has been classified in the labor force, who is actively looking for work at a certain wage level, but cannot get the job they want. This unemployment was created as a result of job opportunity growth being lower than labor force growth, as a result of which many workers did not find work (Suaidah & Hendry, 2013) .

Renewable energy

Renewable energy is a source of sustainable electricity and economic development (Rusiadi et al., 2024) . Renewable energy is an alternative energy source that is abundantly available in nature. This energy will never run out even if it is continuously used. Renewable energy can be used continuously and will not run out. Renewable energy is energy that comes from sustainable natural processes such as water, sun, wind, geothermal heat, ocean waves, and so on (Muda et al., 2019) .

Relationship Between Variables

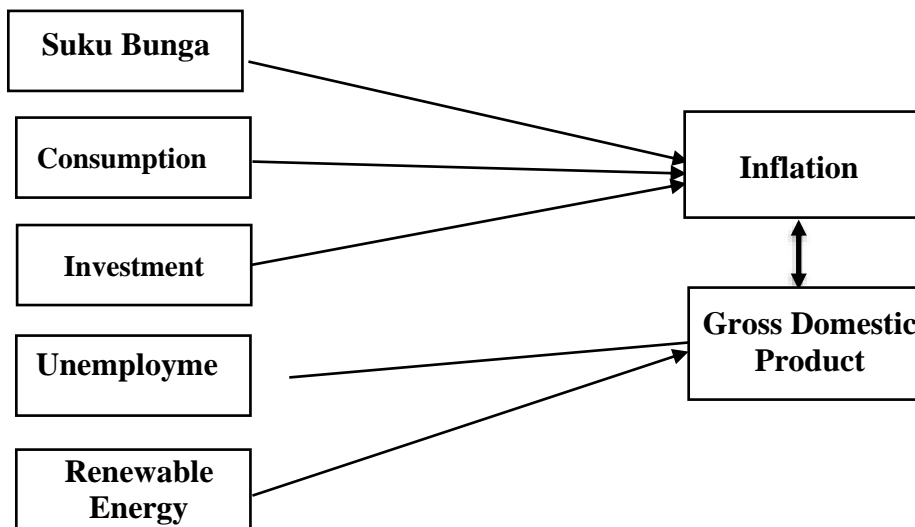
Keynesian theory which describes the relationship between inflation and economic growth. Many factors drive inflation rates and output levels in the short term. These include changes in: expectations, prevailing employment, prices of other factors of production, and/or fiscal monetary policy. Keynes emphasized that inflation occurs because a society wants to live beyond the limits of its economic capabilities. Hypothetically, there is a long-run relationship between inflation and economic growth, where inflation rises but economic growth falls. This situation justifies empirical evidence from several studies relating to the relationship between inflation and economic growth that high inflation causes economic growth to fall (Lubis, 2014)

Based on research conducted by Hakim (2023), interest rates influence economic growth. If interest rates rise, people's desire to save their money or invest will increase. If interest rates fall, people will be more dominant in making loans to banks rather than saving and in the end this will affect economic growth which will increase.

Based on research conducted by Aprileven (2017), interest rates have a positive effect on inflation. When the BI rate falls, people's interest in taking out loans becomes high. For business people, this will encourage economic development, which in turn will increase people's purchasing power. As a result, the demand for goods increases. Furthermore, the prices of goods in general will increase and result in inflation. However, if interest rates rise, inflation will also rise.

Based on research conducted by Zhang et al. (2024) the issue of renewable energy prices has become a concern in recent years due to unstable and record-breaking inflation rates in developed countries. One of the main reasons behind inflation is the high price of energy from non-renewable energy sources.

3. CONCEPTUAL FRAMEWORK



4. RESEARCH METHODS

This research was conducted in Indonesia. The data used in this research is quantitative data. Quantitative data is that which is in the form of numbers, or quantitative data that is added up (Sugiyono, 2015). The data to be used comes from the World Bank and the Central Statistics Agency (BPS). Period 1993 – 2023.

Research Model

This research uses a simultaneous model. The analysis method uses *Two-Stage Least Squares* or a two-stage regression model, namely:

Stage 1: *Reduced form equation*

$$\text{LOG(INF)} = C(10) + C(11) * \text{LOG(SB)} + C(12) * \text{LOG(KS)} + C(13) * \text{LOG(INV)} + C(14) * \text{LOG(PDB)} + e1$$

Stage 2: enter the estimated export value from the *reduced form equation* into the initial equation, namely:

$$\text{LOG(GDP)} = C(20) + C(21) * \text{LOG(PGR)} + C(23) * \text{LOG(ET)} + C(24) * \text{LOG(INF)} + e2$$

5. RESULTS AND DISCUSSION

Using Eviews 10 software, estimates to determine the influence of variables using 2 simultaneous equations were carried out using the *Two-Stage Least Squares model*. The results of estimating the system of equations with *Two-Stage Least Squares* are shown in the table below. From the table it is known that the simultaneous model equation is:

Table 4. Estimation Results of the Two-Stage Least Squares Equation

	Coefficient	Std. Error	t-Statistics	Prob.
C(10)	505.6255	99.49209	5.082067	0.0000
C(11)	-0.508347	0.179307	-2.835056	0.0065
C(12)	-150.1575	30.58015	-4.910294	0.0000
C(13)	1.117293	0.751645	1.486464	0.1431
C(14)	-1.181141	0.444635	-2.656426	0.0104
C(20)	0.744848	1.751002	0.425384	0.6723
C(21)	0.123270	0.110457	1.115993	0.2695
C(22)	0.164870	0.036537	4.512411	0.0000
C(23)	-0.395247	0.046406	-8.517136	0.0000
Determinant residual covariance		26.15760		
Equation: INF=C(10)+C(11)*SB+C(12)*KS+C(13)*INV+C(14)*PDB				
Instruments: SB KS INV PGR ET C				
Observations: 31				
R-squared	0.852364	Mean dependent var	8.519677	
Adjusted R-squared	0.829651	S.D. dependent var	10.06392	
S.E. of regression	4.153717	Sum squared resid	448.5875	
Durbin-Watson stat	1.904306			
Equation: PDB=C(20)+C(21)*PGR+C(22)*ET+C(23)*INF				
Instruments: SB KS INV PGR ET C				
Observations: 31				
R-squared	0.788998	Mean dependent var	4.504516	
Adjusted R-squared	0.765553	S.D. dependent var	3.776412	
S.E. of regression	1.828527	Sum squared resid	90.27483	
Durbin-Watson stat	1.823686			

Source: Eviews 10 output

Based on the output results of the structural equation, it can be seen that there are two equations, here are the explanations for each of the two equations:

Equation test results 1:

The first equation is used to simultaneously determine inflation and GDP with the following equation:

$$\text{LOG(INF)} = \text{C}(10) + \text{C}(11) * \text{LOG}(\text{SB}) + \text{C}(12) * \text{LOG}(\text{KS}) + \text{C}(13) * \text{LOG}(\text{INV}) + \text{C}(14) * \text{LOG}(\text{PDB}) + e_1$$

Based on this equation, the output results of eviews with the *Two-Stage Least Squares model* are as follows:

$$\text{LOG}(\text{INF})=505.62-0.50*\text{LOG}(\text{SB})-150.15*\text{LOG}(\text{KS})+1.11*\text{LOG}(\text{INV})-1.18*\text{LOG}(\text{GDP})+e1$$

a. Coefficient and Elasticity of SB to INF

Based on the regression results, it is known that the regression coefficient for SB is negative -0.50, which means that if an increase in SB is 1 percent, the INF will decrease by -0.50 percent.

- SB elastic

$$E \text{ SB} = d \text{ INF} \times \text{SB} = -0.50 \times 4.57 = -0.268 < 1 \text{ In Elastic}$$

$$d \text{ SB} \times \text{INF} 8.52$$

The results of the regression coefficient show a negative in elastic value. This means that an increase in SB will result in a smaller percentage decrease in INF.

b. Coefficient and Elasticity of KS to INF

Based on the regression results, it is known that the regression coefficient for KS is negative -150.15, which means that if an increase in KS is 1 percent, INF will decrease by -150.15 percent.

- KS elastic

$$E \text{ KS} = d \text{ INF} \times \text{KS} = -150.15 \times 3.27 = -57.62 < 1 \text{ In Elastic}$$

$$d \text{ KS} \times \text{INF} 8.52$$

The results of the regression coefficient show a negative in elastic value. This means that an increase in KS will result in a smaller percentage decrease in INF.

c. Coefficient and Elasticity of INV to INF

Based on the regression results, it is known that the regression coefficient for INV is positive 1.11, meaning that if an increase in INV is 1 percent, INF will increase by 1.11 percent.

- Elastic INV

$$E \text{ INV} = d \text{ INF} \times \text{INV} = 1.11 \times 1.30 = 0.169 < 1 \text{ In Elastic}$$

$$d \text{ INV} \times \text{INF} 8.52$$

The results of the regression coefficient show a positive in elastic value. This means that an increase in INV will result in a smaller percentage increase in INF.

d. Coefficient and Elasticity of GDP to INF

Based on the regression results, it is known that the regression coefficient for GDP is negative -1.18, which means that if an increase in GDP is 1 percent, INF will decrease by -1.18 percent.

- GDP elastic

$$E_{GDP} = d \frac{INF}{GDP} \times \frac{GDP}{INF} = -1.18 \times 4.50 = -0.623 < 1 \text{ In Elastic}$$

$$d \frac{GDP}{INF} \times \frac{INF}{GDP} 8.52$$

The results of the regression coefficient show a negative in elastic value. This means that an increase in GDP will result in a smaller percentage decrease in INF.

t-test

Prob. SB (0 .0065) < 0.05 Significant

Prob. KS (0 .0000) < 0.05 Significant

Prob. INV (0 .1431) > 0.05 Not Significant

Prob. GDP (0 .0104) < 0.05 Significant

Based on the estimation results, it is known that there are three variables, namely SB, KS, and GDP which are significant to INF, so H_a is accepted. This means that INV does not have a significant effect simultaneously on INF.

D-test

Based on the estimation results above, it can be shown that $R^2 = 0.852364$ or which means that the SB, KS, INV and GDP variables are able to explain 85.23% of INF and the remaining 14.77% of INF is influenced by other variables outside the estimates in the model study.

Equation test results 2:

The second equation is used to simultaneously determine inflation and GDP with the following equation:

$$\text{LOG}(\text{GDP}) = C(20) + C(21) * \text{LOG}(\text{PGR}) + C(22) * \text{LOG}(\text{ET}) + C(23) * \text{LOG}(\text{INF}) + e_2$$

Based on this equation, the output results of eviews with the *Two-Stage Least Squares model* are as follows:

$$\text{LOG}(\text{GDP}) = 0.74 + 0.12 * \text{LOG}(\text{PGR}) + 0.16 * \text{LOG}(\text{ET}) - 0.39 * \text{LOG}(\text{INF}) + e_2$$

a. PGR Coefficient and Elasticity of GDP

Based on the regression results, it is known that the regression coefficient for PGR is positive 0.12, which means that if an increase in PGR is 1 percent, GDP will increase by 0.12 percent.

- Elastic PGR

$$E_{PGR} = d \frac{GDP}{PGR} \times \frac{PGR}{GDP} = 0.12 \times 8.73 = 0.2328 < 1 \text{ In Elastic}$$

$$d \frac{PGR}{GDP} \times \frac{GDP}{PGR} 4.50$$

The results of the regression coefficient show a positive in elastic value. This means that an increase in PGR will result in a smaller percentage increase in GDP.

b. ET Coefficient and Elasticity of GDP

Based on the regression results, it is known that the regression coefficient for ET is positive 0.16, which means that if an increase in ET is 1 percent, GDP will increase by 0.16 percent.

- Elastic ET

$$E_{ET} = d \frac{GDP}{ET} \times \frac{ET}{GDP} = 0.16 \times \frac{36.70}{4.50} = 1.3048 > 1 \text{ In Elastic}$$

The results of the regression coefficient show a positive in elastic value. This means that an increase in ET will result in a greater percentage increase in GDP.

c. INF Coefficient and Elasticity of GDP

Based on the regression results, it is known that the regression coefficient for INF is negative -0.39, meaning that if an increase in INF is 1 percent, INF will decrease by -0.39 percent.

- Elastic INF

$$E_{INF} = d \frac{GDP}{INF} \times \frac{INF}{GDP} = -0.39 \times \frac{8.52}{4.50} = -0.7384 < 1 \text{ In Elastic}$$

The results of the regression coefficient show a negative in elastic value. This means that an increase in INF will experience a smaller percentage decline in GDP.

t-test

Prob. PGR (0.2695) Not Significant

Prob. ET (0.0000) < 0.05 Significant

Prob. INF (0.0000) < 0.05 Significant

Based on the estimation results, it is known that there are two variables, namely ET and INF, which are significant to GDP, so H_a is accepted. This means that ET does not have a significant effect simultaneously on GDP.

D-test

Based on the estimation results above, it can be shown that $R^2 = 0.788998$ or which means that the PGR, ET and INF variables are able to explain 78.89% of GDP and the remaining 21.11% of GDP is influenced by other variables outside the estimates in the research model.

a. Classical Assumption Test

1) Data Normality Test

Table 5. Normality Test Results

Components	Skewness	Chi-sq	Df	Prob.
1	-0.295259	0.450418	1	0.5021
2	-1.443836	10.77075	1	0.0010
Joins		11.22117	2	0.0037

Components	Kurtosis	Chi-sq	Df	Prob.
1	3.130592	0.022028	1	0.8820
2	5.464686	7.846456	1	0.0051
Joint		7.868485	2	0.0196

Component	Jarque-Bera	Df	Prob.
1	0.472446	2	0.7896
2	18.61721	2	0.0001
Joint	19.08966	4	0.0008

Sumber: Output Eviews 10

In this study, to test the normality of the data, *the Jarque-Bere test was used*. The criterion used is if the probability of *the Jarque-Bere* (JB) test is $> \alpha 0.05$ then the data is said to be normal. In the table it is known that the probability value is $0.0000 < 0.05$ so the assumption of normality is not met.

b) Autocorrelation Test

To detect whether there is an appropriate correlation in this research model, the *Residual Portmanteau Tests For Autocorrelations were carried out*. The assumption is that there is no autocorrelation effect if the prob value is > 0.05 . Following are the results of the Eviews processing output :

Table 6. Autocorrelation Test

Lags	Q-Stat	Prob.	Adj Q-Stat	Prob.	df
1	3.694860	0.4489	3.818022	0.4312	4
2	10.21791	0.2501	10.79094	0.2138	8
3	11.31712	0.5020	12.00792	0.4450	12
4	14.04042	0.5957	15.13467	0.5148	16
5	16.54482	0.6823	18.12069	0.5795	20
6	21.71842	0.5961	24.53595	0.4313	24
7	22.73715	0.7461	25.85181	0.5812	28
8	23.65644	0.8566	27.09086	0.7135	32
9	26.43769	0.8780	31.00988	0.7047	36
10	27.15719	0.9394	32.07201	0.8097	40
11	28.34343	0.9677	33.91068	0.8640	44
12	28.91076	0.9868	34.83632	0.9223	48

Based on the results of *df* is degrees of freedom for (approximate) chi-square distribution, it is known that the Q-Stat prob values for all indicators are (0.4312, 0.2138, 0.4450, 0.5148, 0.5795, 0.4313, 0.5812, 0.7135, 0.7047, 0.8097, 0.8640, 0.9 223) > 0.05, then all lag movement indicators over time do not show any autocorrelation effect in the data movement, so the data is declared free from autocorrelation problems.

6. CONCLUSION

This research is to look at the relationship between variables, namely Interest Rates, Consumption, Investment, Unemployment and Renewable Energy on Inflation and Gross Domestic Product (GDP). The analysis model used is the Simultaneous Model. After going through several stages of testing, the author can draw conclusions, including:

Based on the results of data analysis in equation 1, it is known from the results of the t-calculation data that interest rates have a positive and significant effect on inflation. The consumption variable has a positive and significant effect on inflation. The investment variable does not have a positive and significant effect on inflation. The GDP variable has a positive and significant effect on inflation.

Based on the results of the data analysis of equation 2, it is known from the results of the t-count data that the unemployment variable does not have a positive and significant effect on GDP. The Renewable Energy variable has a positive and significant effect on GDP. The inflation variable has a positive and significant effect on GDP.

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