Linear Regression Algorithm Analysis to Predict the Effect of Inflation on the Indonesian Economy

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Abstract

Inflation is an important economic indicator, the growth rate of which is always low and stable so as not to cause a macroeconomic decline which will have an impact on instability in the economy. Inflation has both positive and negative impacts on the economy. The purpose of this study is to see the development of research on the impact of global inflation on the development of the Indonesian economy. This study looks at the relationship between the effect of inflation and economic development in Indonesia. The research method used in this study is a quantitative research method that starts from data collection, preprocessing, Linear Regression Algorithm Implementation Process, and model testing Root mean square error (RMSE) is a predictive regression model that looks at how accurately annual GDP is based on the annual inflation rate. In this case, the RMSE value is around 0.60. This means that, on average, the forecasting model has an error of 0.66 in estimating the annual GDP value. The lower the RMSE value, the better the performance of the model as it indicates a smaller error. Based on the results of the linear regression analysis of the above research, it can be concluded that there is a relationship between GDP economic growth and inflation, namely every 1 percent increase in GDP growth, the inflation rate will increase by 0.722%. In theory, inflation can have a negative impact on economic growth, especially if inflation is high and uncontrollable.

A.   Introduction

Developing countries generally have economic problems such as high inflation rates and slow economic growth. [1]. Inflation characteristics are often associated with domestic factors such as aggregate demand, wage behavior, productivity, inflation expectations, the influence of the balance of all these real factors and national monetary policy. In addition, inflation is also associated with external factors or external shocks such as world energy prices and food prices. In its current development, many researchers argue that globalization has reduced the role of domestic factors and increased the role of the global economy in the process of inflation formation [2]. The warning of the emergence of a global recession in 2023 has become the center of attention for all countries in the world. This issue stems from the many financial institutions in the world that increase interest rates to suppress inflation. Many economic observers argue that Indonesia is far from a recession, but that does not mean that the global economic recession will not have an impact on Indonesia [3].

Prediction is the process of systematically estimating something that will happen in the future based on past and present information. Linear regression algorithm is a statistical method used to determine the effect between one or more variables on one variable. Variables are quantities that change in value. Variables that influence are called independent variables, independent variables, or explanatory variables. The affected variable is called the dependent variable or dependent variable. The use of the linear regression algorithm has also been implemented by research conducted by Heru Wahyu Herwanto, Trianna Widyaningtyas, Poppy Indriana (2019) in "Application of Linear Regression Algorithm for Rice Crop Yield Prediction." Most of the stages in the research conducted apply the use of multiple linear regression because there is more than one independent variable. The implementation of the linear regression algorithm was also carried out by Nani Hartati (2020) to analyze "The Effect of Inflation and Unemployment Rate on Economic Growth in Indonesia for the Period 2010 - 2016". This study proves that the constant value is 1.363, which means that if inflation is zero or constant, the amount of economic growth is 1.363. From this equation it can be interpreted that if economic growth increases, inflation will decrease [5]. Another study was conducted by S. Susanto (2018) on "THE EFFECT OF INFLATION, INTEREST RATES, AND EXCHANGE RATES ON INDONESIA'S ECONOMIC GROWTH" Data sources come from various sources, including Indonesian Statistics published by the Central Bureau of Statistics, Indonesian Economic and Financial Statistics, Monetary Policy Reports published by Bank Indonesia, and scientific journals and other literature related to the research topic [5]. Similar research was also conducted by Faisal Dharma, Shabrina, Astrid Noviana, M. Tahir, Nirwana Hendrastuty, Wahyono (2020) on "Prediction of Indonesian Inflation Rate Using Regression Model Based on Genetic Algorithms" This study demonstrates the use of a genetic algorithm-based regression model to predict inflation. The model was trained and evaluated using real CPI data from Bank Indonesia. Based on the experimental results, the proposed model has proven to be effective in predicting the inflation rate with an MSE of 0.1099 [7]. The research that has been done by H. Guirguis, V. B. Dutra, and Z. McGreevy (2022), about "The impact of global economies on US inflation: A test of the Phillips curve," explores the impact of a new

measure for global inflation on domestic inflation in the United States. domestic in the United States (US). [8]. According to research conducted by Dinh Doan Van (2019), on "Money supply and inflation impact on economic growth." Research results show that an increase in income will lead to long-term inflation, but an increase in money will not lead to short-term inflation. This is based on the Quantity Theory of Money analysis. In addition, the relationship between financial growth and inflation in China and Vietnam is 99.1%. This relationship is very close. [9]. Similar research has been conducted by C. Aluthge, A. Jibir, and M. Abdu, "Impact of Government Expenditure on Economic Growth in Nigeria, 1970-2019," This study examines the impact of government expenditure (expenditure differentiated for capital expenditure and current expenditure) on Nigeria's economic growth, using a case study of time series data for the period 1970-2019 [10]. Basically, inflation does not always have a negative impact on the economy. For example, if there is inflation below 10% which falls into the mild inflation category. This mild inflation can encourage economic growth. Entrepreneurs actually tend to be more interested in expanding their production supply, because the price increases that occur provide greater profits for entrepreneurs"[11].

The purpose of this study is to describe the development of research on the impact of global inflation on the development of the Indonesian economy. This research uses a qualitative approach with a literature review. This research looks at the relationship between the effect of inflation and economic development in Indonesia.

B.   Research Method

The research method used in this research is a quantitative research method that starts from data collection, preprocessing, Linear Regression Algorithm Implementation Process, and model testing. The flow of the research stages can be seen in **Figure 1.**
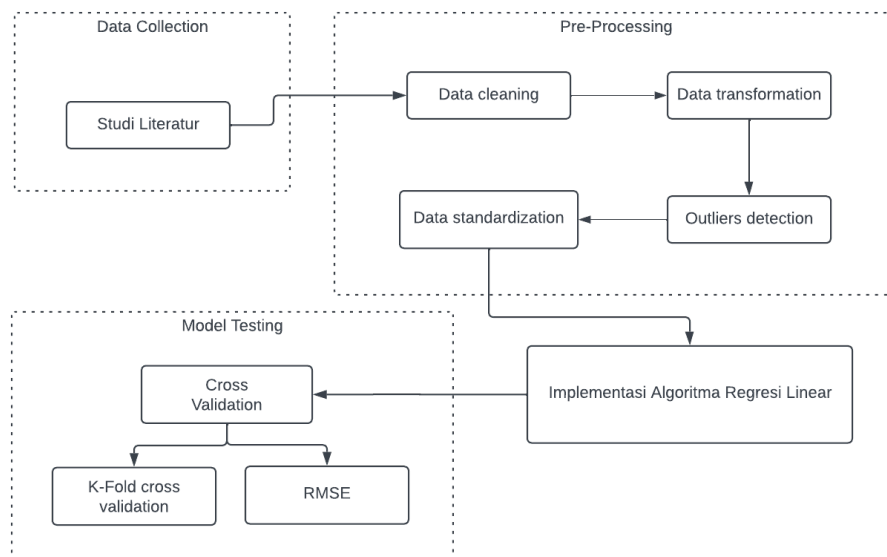
Figure 1: Research Stages

a. **Data Collection**

The data used in this study are international inflation data and GDP economic growth. Information from reliable sources such as the official website of the World Bank and the official website of the central bank. International financial data and economic growth used in this study are secondary data that are publicly available and can be downloaded from the official website of the information provider. The data used in this study includes annual inflation data and Gross Domestic Product growth over time. The data received will be processed before cross-section analysis using pre-processing including data cleaning, data transformation, outlier detection, and data standardization. After the data is processed, model testing is carried out to ensure that the linear regression model used is appropriate and reliable.

Table 1. Annual Inflation Rate

Year	2015	2016	2017	2018	2019	2020	2021	2022
annual Inflation %	3.35	3.02	3.61	3.13	2.72	1.68	1.57	5.51

Source : www.bps.go.id

Economic growth is a long-term problem to be solved by every country with the prospect of rapid economic growth. All countries have the same goal, a way to increase economic growth. Economic growth is the process of increasing individual productivity over time. Economic growth is the cause of the country's economic health, and economic growth is the sine qua non of the country's well-being. If a country cannot achieve economic growth, it will create new economic and social problems such as massive poverty. Economic growth can be measured by Gross Domestic Product (GDP).

Table 2. Gross Domestic Product (GDP) Growth

Year	2015	2016	2017	2018	2019	2020	2021	2022
Annual GDP %	4.88	5.03	5.07	5.17	5.02	-2.07	3.7	5.31

Source : www.bps.go.id

In Table 2, it can be seen that the GDP growth rate calculated with a constant rate of change of Economic growth from 2015 to 2022 shows that the Indonesian economy is experiencing a recession due to global economic uncertainty and financial problems such as fiscal deficits, high inflation and low national currency exchange rates. Gross Domestic Product (GDP) Experienced a decline, for example the Gross Domestic Product (GDP) of the country fell to -2.50 in 2020 as a result of the Covid-19 pandemic in Indonesia, which resulted in a decrease in purchasing interest and an increase in unemployment in Indonesia. All of these events affect and impact the public health and the government. Therefore, efforts to eliminate inflation must be made thoroughly and successfully.

C. Result and Discussion

This study provides an overview of the relationship between independence and change, the accuracy of model predictions and the importance of the analysis

results. These effects can be used to identify or further understand the phenomenon under study. However, keep in mind that linear regression models also have limitations and shortcomings, and future research can be recommended to address these issues.

a.   Text Preprocessing

The text preprocessing process is a stage carried out to clean and prepare the incoming question data so that it can be classified later. The preprocessing stages carried out in this study include data cleaning, data transformation, outlier detection, and data standardization. This preprocessing process takes input in the form of data sets and produces output in the form of preprocessing results.

1.   Data cleaning process

Data cleaning aims to improve data quality and reduce errors in data analysis. The specific objectives of data cleaning include removing irrelevant data, handling missing values, handling outliers, correcting data errors, and adjusting data formats. Performing data cleaning can improve data quality and minimize errors in data analysis, making it easier to make data-driven decisions.

2.   Data Transformation Process

Data transformation aims to transform data into a format that is easy to understand and use in data analysis and predictive models. Data transformation helps you improve data quality, enhance model performance, interpret data, refine data distribution, and combine data from multiple sources. Data transformation helps clean, filter, and eliminate irrelevant, duplicate, or invalid data, thereby improving data quality and reducing data analysis errors.

3.   Outlier detection process

Outlier detection aims to identify unusual or extreme data that may affect the results of data analysis or predictive models. Outlier detection helps reduce errors in data analysis and improve the accuracy of predictive models. In addition, outlier detection allows you to define more accurate models, determine thresholds, and understand data properties. By performing outlier detection, you can identify anomalous or extreme data, correct errors in data analysis, and drive data-driven decision making.

4.   Data standardization process

By applying data standardization, we can change the scale and units of data to enable objective and accurate comparisons, improve the accuracy of data analysis, facilitate data comparison, improve the accuracy of forecast models, increase computational efficiency and improve performance. Interpretation of analysis results. This facilitates data-driven decision-making.

5.   Linear Regression Algorithm Implementation Process

Regression is a modeling technique used to predict values from given input data. Regression is a statistical measure used to determine the strength of the relationship between dependent (independent) variables and independent (independent) variables.

The main method of forecasting is the construction of a regression model by finding one or more relationships of independent or predictor variables that include the Dependent or Answer variable (X) (Y). linear regression model is the relationship between a scalar variable and one or more descriptor variables.

In general, linear regression algorithms can be divided into two types, namely simple linear regression and multiple linear regression. simple linear regression is the relationship between the dependent variable and one independent variable and multiple linear regression is the relationship between the dependent variable and two or more independent variables.

In this study, researchers tried to predict the impact of inflation on the Indonesian economy using simple linear regression. Simple linear regression is a statistical analysis technique used to determine the relationship between two variables, namely the independent variable (x) and the dependent variable (y). In this study, the global inflation rate is the independent variable and the dependent variable is the GDP economic growth rate.

b. Framework

The theoretical framework or framework is a conceptualization of how one theory relates among various factors that have been identified as important to the research problem.

So, the framework in this study is as follows.

Figure 2. Thinking Framework

The calculations used for simple linear regression are expressed in the steps below.

a.   C
alculate the average annual inflation expressed in Equation 1.

$$X = \frac{\Sigma_{i=1}^{n} X_i}{n} \tag{1}$$

$$X = \frac{3.35 + 3.02 + 3.61 + 3.13 + 2.72 + 1.68 + 1.57 + 5.51}{8} = 2.93\%$$

After getting the average value of annual inflation, the next step is to calculate the Annual Inflation Standard Deviation from the existing dataset using the Equation 2 formula.

$$S_x = \sqrt{\Sigma_{i=1}^{n}}$$

$$S_x = \sqrt{} = 1.26\% \tag{2}$$

b.   T
he next step is to Calculate Average Annual GDP Growth expressed in Equation 3.

$$Y = \frac{\Sigma_{i=1}^{n} Y_i}{n} \tag{3}$$

$$Y = \frac{4.88 + 5.03 + 5.07 + 5.17 + 5.02 - 2.07 + 3.70 + 5.31}{8} = 3.28\%$$

After obtaining the average value of GDP Growth, the next step is to calculate the Annual GDP Standard Deviation from the existing dataset using the Equation 4 formula.

$$S_Y = \sqrt{\Sigma_{i=1}^{n}}$$

$$S_Y = \sqrt{} = 3.46\% \tag{4}$$

c.   T

he next step is to calculate the coefficient (a) to see the positive relationship between annual inflation and annual GDP using the regression formula, stated in Equation 5. Where:

$$a = \frac{(n\sum XY - \sum X \sum Y)}{}$$

$$n = amount\ of\ data = 7$$

Then:

$$\sum XY = 48.8312 \hspace{6cm} (5)$$

$$\sum X = 20.52$$
$$\sum Y = 22.96$$
$$\sum X^2 = 75.8412$$
$$a = \frac{\left((748.8312) - (20.5222.96)\right)}{}$$

After getting the results of the steps that have been carried out above, we can then calculate the intercept (b) using **Equation 6.**

$$b = (AverageY) - a(AverageX)$$
$$AverageX = 2.93$$
$$AverageY = 3.28$$
$$b = 3.28 - (0.722 * 2.93) = -0.144.$$

c. Testing root mean squared error (RMSE)

Root mean square error (RMSE) is a predictive regression model that looks at how accurate annual GDP is based on the annual inflation rate. For available data, RMSE calculates the difference between the model's predicted value and the true value, and then takes the square root of the average difference in the equation.

The result of the RMSE value can be seen in Equation 7.

$$RMSE = \sqrt{\left(\left(\frac{1.26}{3.46}\right) * (1 - 0.722^2)\right)} = \sqrt{(0.3639)} = 0.6034$$

$$(7)$$

In this case, the RMSE value is about 0.60. This means that, on average, the forecasting model has an error of 0.66 in estimating the annual GDP value. The lower the RMSE value, the better the performance of the model as it indicates a smaller error.

D.   Conclusion

Based on the results of the linear regression analysis of the above research, it can be concluded that there is a relationship between GDP economic growth and inflation, namely every 1 percent increase in GDP growth, the inflation rate will increase by 0.722%.

It can be said that the RMSE value obtained and the simple linear regression model in the above study provide good accuracy in estimating the relationship between annual inflation and annual GDP. The lower the RMSE value, the better the accuracy of the model.

In theory, inflation can have a negative impact on economic growth, especially if inflation is high and uncontrollable. High inflation affects people's purchasing power, destabilizes the economy, and lowers business confidence.

However, inflation at low and manageable levels can help stimulate economic growth by increasing demand and encouraging investment.

E.   Acknowledgment

F.   References

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