


## Utilizing linear regression to forecast the stock price fluctuations of top-rated companies

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Article Info	ABSTRACT
<b>Keywords:</b> Stock Prediction, Linear Regression, Indonesian Stock Market	The purpose of this study is to use linear regression to forecast the closing stock price of the top 10 issuers from the LQ45 Index. When it is appropriate to purchase or sell the stock, it is determined by comparing the forecasted close price with the actual stock price. The relationship between independent factors (such past stock prices) and dependent variables (stock prices) is modelled using the linear regression approach. The prediction error rate is then calculated by comparing the expected and actual outcomes using the Root Mean Square Error (RMSE). It is evident from the data that the close stock price's anticipated growth does not consistently rise each month. For this reason, this prediction is crucial in assisting investors in their decision-making. It makes sense to sell the stock if the estimated growth of its closing price is expected to climb; conversely, if the projection is expected to fall, it makes sense to purchase the stock. According to the test findings, the linear regression model is capable of producing precise predictions that help investors decide what to buy on the Indonesian stock market.
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### INTRODUCTION

The adoption of technology and the dissemination of information is very massive in the industrial era 4.0, all information can be accessed and used optimally in various ways, for example in terms of investing at small costs to incurring very large costs. Investment can take various forms, including real estate investment. These investments are the purchase of real estate, such as a house, apartment, or commercial property, with the intention of renting it out or allowing it to increase in value over time.(Apriyansyah et al., 2024; Eka & Nugraha, 2020). The next form of investment is business investment in the form of capital investment where capital is invested in a business with the hope of gaining profits or profits from the business. Next, the most common and frequently used form of investment is investment in the stock market or capital market. The capital market is an organized system that processes securities such as shares, bonds, debentures, and other securities issued by governments and private companies using the services of intermediaries, commission agents, and underwriters.(Bakri et al., 2023; Effendi et al., 2023; Khuan et al., 2023).

Share price movements are influenced by various factors, both fundamental such as company performance and technical such as stock trading patterns. This makes stock price

predictions very complex because they have to consider various interrelated variables (Ain', 2021; Sudipa, Riana, et al., 2023). Traditional methods in financial analysis are often insufficient to accurately predict stock price movements, given the high complexity and dynamics of the stock market (Eka et al., 2022; Harianto et al., 2022).

In the world of stock investment, the ability to predict price fluctuations is a critical aspect that can determine an investor's success in achieving profits. Accurate predictions not only help investors make the right investment decisions but also minimize the risk of loss (Eka & Mayasari, 2019; Kwintiana et al., 2023; Prahendratno et al., 2023). With the development of technology and data analysis methodologies, various prediction techniques have been applied to face this challenge, one of which is the implementation of linear regression. This research focuses on stock price prediction of the 10 best issuers out of 45 issuers in the LQ45 Index using linear regression. The selection of 10 issuers was based on 2 sortings. The first sorting is not selecting cyclical companies and always being included in the LQ45 Index list from 2010 to 2023, this indicates that the company has very good fundamentals and that the company is well-established and reputable and has a good reputation in the market. The following are the 10 best companies from the LQ45 Index, namely Astra International Tbk, Bank Central Asia Tbk, Bank Negara Indonesia Tbk, Bank Rakyat Indonesia Tbk, Bank Mandiri Tbk, Indofood Sukses Makmur Tbk, Kalbe Farma Tbk, Telekomunikasi Indonesia Tbk, United Tractors Tbk, and Unilever Indonesia Tbk (Putra & Mustafa, 2021). The ten companies from the LQ45 Index are recommendations for novice investors because they don't need to think about company fundamental analysis. But to determine which company is better among the 10 companies to invest in share capital, we need to make predictions in order to get maximum results in buying shares. (Andi Primafira, 2021; Utami et al., 2020; Wahyuddin et al., 2023).

On the other hand, linear regression, as one of the most widely used statistical methods for predictive analysis, offers a relatively simple but effective approach. Linear regression allows analysts and investors to identify linear relationships between independent variables (predictors) and dependent variables (stock prices) and use these relationships to make predictions about future value based on historical data (Harianto et al., 2023; Sudipa, Sarasvananda, et al., 2023; Zebua et al., 2023). However, applying linear regression in the context of stock price prediction requires a deep understanding of market dynamics and the ability to select and process relevant variables (Adriani et al., n.d.; Salam et al., 2023; I. K. D. A. Saputra et al., 2022; Sudirjo et al., 2023; Sumesta & Satyawan, 2024).

Considering the importance of the financial and investment sector for the Indonesian economy, as well as the vital role of companies included in the LQ45 index as a barometer of Indonesian capital market performance, studies regarding the application of linear regression to predict stock price fluctuations are very relevant. This research is expected to provide new insights for investors in analyzing stock price movements and making more informed investment decisions in the Indonesian stock market.

## METHODS

### Linear Regression Method

One technique for predicting and describing the relationship between two or more variables is the Linear Regression approach, which involves drawing a straight line. The method is known as simple linear regression if the model contains only one independent variable; multiple linear regression is utilised if the model has numerous independent variables (Ardyan et al., 2023; Damanik et al., 2022; Rony et al., 2019). One statistical tool for assessing the strength of the relationship between dependent and independent variables is linear regression. Predicting primarily involves constructing a regression model by determining the correlation between one or more independent variables, also known as predictors (X), and the dependent variable, also known as the response variable (Y). The link between a scalar variable and one or more explanatory factors is modelled using linear regression. The linear regression technique is predicated on past associations in data (Mokodompit et al., 2023; Rony, 2017; I. W. K. W. Saputra et al., 2024). One of the benefits of using linear regression is that it's a straightforward and simple to interpret technique that can determine the linear relationship between variables and yield findings that can be measured quantitatively. When the conditions of linear regression are satisfied, it can also yield very good predictions. However, the drawbacks of linear regression include its limited capacity to manage intricate or nonlinear relationships, as well as its susceptibility to assumptions like residual independence and homoskedasticity, which denote that the variability of the prediction error in linear regression analysis is constant across a range of independent variable values (Anggrain et al., 2024; Rony, 2019). Furthermore, if there is multicollinearity among the independent variables or if the connection between the variables is not entirely linear, linear regression might not be the best option. Even with its drawbacks, linear regression is nevertheless a helpful tool in machine learning and statistical analysis, particularly when there is a linear relationship between the variables (Rony et al., 2024). The expression below is typically used to represent the linear regression equation:

$$Y = a + b_1 \chi_1 + b_2 \chi_2 + \dots + b_n \chi_n \quad (1)$$

In the equation above, Y is the dependent variable, which depends on the value of X (independent variable). The value of a is a constant and b is a regression coefficient of variable X. To get the value of a and b against the value of variable X.

## RESULTS AND DISCUSSION

The scale of error introduced by this linear regression method is determined through the utilisation of Root Mean Square Error in its calculation. Units of the RMSE value range from zero to positive infinity. A reduced root mean square error (RMSE) value signifies that the model generates predictions with greater accuracy and is deemed appropriate for implementation. In order to test the manual calculation of this error rate, a single company or issuer is utilised, as the stock data from ten issuers consists of the same six attributes, with the sole variation being the price of each company attribute. Examining the accuracy of the manual computation of this error rate using PT Bank Central Asia Tbk (issuer code

BBCA) sample data. The monthly sample data utilised in this study spans from January to November 2023, or eleven years of historical data. It comprises six attributes or variables: five independent variables (date, open, high, low, and volume) are represented by their respective X values; and one dependent variable (close) is denoted by the Y value. The dependent variable, or Y value, is the subject of the prediction. Using sample data for the BBCA issuer code, the subsequent calculation test verifies the error rate of the linear regression method and performs a manual calculation to forecast closing stock prices:

**Table 1.** Sample Data on Issuer Shares

Date	Close (Y)	Open (X1)	High (X2)	Low (X3)	Volume (X4)
01/01/2023	8,475	8,575	8,850	8,000	1,941,986,600
01/02/2023	8,750	8,575	8,950	8,400	1,332,060,800
01/03/2023	8,750	8,725	8,900	8,250	1,975,372,100
01/04/2023	9,050	8,825	9,200	8,650	1,097,882,300
01/05/2023	9,050	9,100	9,325	8,700	2,259,737,500
01/06/2023	9,150	9,150	9,325	8,950	1,050,138,400
01/07/2023	9.125	9,025	9,400	9,025	1,307,303,300
01/08/2023	9,175	9,175	9,450	9,100	1,406,160,600
01/09/2023	8,825	9,200	9,275	8,825	1,277,052,400
01/10/2023	8,750	8,900	9,250	8,700	1,473,758,400
01/11/2023	8,975	8,750	9,075	8,600	1,367,708,700
Amount ( $\Sigma$ )	$\Sigma Y$	= $\Sigma X1$	$\Sigma X2$	$\Sigma X3$	$\Sigma X4$
	98.075	=98,000	=101,000	=95,200	=16,489,161,100

#### Determining the Values X1Y, X2Y, X3Y, X4Y

**Table 2.** Variable Values

X1Y	X2Y	X3Y	X4Y
72,673,125	75,003,750	67,800,000	16,458,336,435,000
75,031,250	78,312,500	73,500,000	11,655,532,000,000
76,343,750	77,875,000	72,187,500	17,284,505,875,000
79,866,250	83,260,000	78,282,500	9,935,834,815,000
82,355,000	84,391,250	78,735,000	20,450,624,375,000
83,722,500	85,323,750	81,892,500	9,608,766,360,000
82.353.125	85,775,000	82.353.125	11,929,142,612,500
84.180.625	86,703,750	83,492,500	12,901,523,505,000
81,190,000	81,851,875	77,880,625	11,269,987,430,000
77,875,000	80,937,500	76,125,000	12,895,386,000,000
78,531,250	81.448.125	77,185,000	12,275,185,582,500
$\Sigma X1Y$	$\Sigma X2Y$	$\Sigma X3Y$	$\Sigma X4Y$
=874,121,875	=900,882,500	=849,433,750	=146,664,824,990,000

### Determining Linear Regression Equations

The following is the linear regression equation:

$$Y' = a + b_1 \chi_1 + b_2 \chi_2 + b_3 \chi_3 + b_4 \chi_4$$

$$Y' = 5285.33 + -0.296$$

Prediction by entering one of the data, namely data for January 2023:

$$Y' = 5285.33 + -0.296 (8,575) + -0.269 (8,850) + 0.989 (8,000) + 0.0000001246 (1,941,986,600)$$

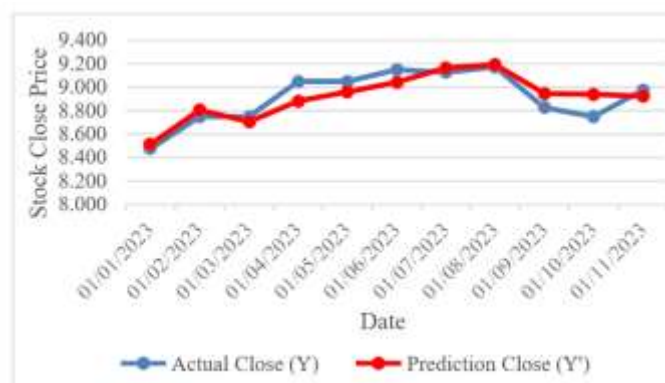
$Y' = 8,512$  (prediction results for closing shares in January 2023) This prediction calculation was carried out on all sample data for BBCA issuers and the results are in the prediction results subsection below.

### Issuer Stock Prediction Results

The following are the results of a comparison between the predicted close price of shares and the actual close price of shares using sample data from BBCA issuers from January-November 2023. These results are explained in the form of tables and graphs, as follows:

**Table 1.** Predicted and Actual Close Results of Issuer Shares

Date	Actual Close (Y)	Close Prediction (Y')	Difference (Y - Y')
01/01/2023	8,475	8,512	-37
01/02/2023	8,750	8,805	-55
01/03/2023	8,750	8,706	44
01/04/2023	9,050	8,881	169
01/05/2023	9,050	8,960	90
01/06/2023	9,150	9,042	108
01/07/2023	9.125	9,165	-40
01/08/2023	9,175	9,194	-19
01/09/2023	8,825	8,945	-120
01/10/2023	8,750	8,942	-192
01/11/2023	8,975	8,922	53



**Figure 1.** Comparison graph of predicted and actual stock closes

The projected increase in the closing share price for December 2023 is computed using the closing share price of the preceding month, November 2023. As a consequence of this forecast, the monthly growth of the closing share price is not consistent; therefore, this forecast is critical. In December 2023, it will be appropriate to divest shares if the projected increase in the closing price of the shares surpasses the actual closing price of the shares in the preceding month. On the contrary, a decline in the anticipated growth of the shares' closing price signifies that purchasing shares in December 2023 would be prudent, given that the share prices of all ten issuers comprising the LQ45 Index are anticipated to appreciate over time. Inexperienced investors who are not well-versed in the fundamental analysis of the company would do well to consider investing in both the purchase and sale of shares from the ten issuers.

## CONCLUSION

The stock's actual close price differs from the close price projection for January-November 2023. Prediction outcomes aid investment decisions. If the expected close price growth is growing, sell the stock; if reducing, buy it. Linear regression predicts the share price of the top 10 LQ45 Index issuers. To show the link between two or more variables, the linear regression approach makes straight line predictions. Linear regression helps analysts and investors to detect linear relationships between independent variables (predictors) and dependent variables (stock prices) and predict future values using past data. Historical data linkages underpin linear regression. Linear regression is basic and easy to interpret, understanding linear correlations between variables and providing numerically quantifiable findings. Linear regression's inability to handle complicated or nonlinear interactions and sensitivity to assumptions like homoscedasticity and residual independence hinder it. To assess prediction error, this study manually tested the linear regression approach using Root Mean Square Error (RMSE). A model with a lower RMSE makes more accurate predictions and is suitable for use. Sample data from PT Bank Central Asia Tbk (issuer code BBKA) was used for manual error rate calculation testing. This test helps investors analyse stock price changes and make better Indonesian stock market investments. This study concludes that linear regression stock price prediction can help investors make stock market investments. Linear regression is effective in statistical analysis and machine learning when variables are linear, despite its drawbacks.

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