Universitas Ahmad Dahlan

Bulletin of Applied Mathematics and Mathematics Education
Volume 5, Number 1, April 2025 pp. 71-80
https://dx.doi.org/10.12928/bamme.v5i1.12975
e-ISSN 2776-1029, p-ISSN 2776-1002

Relationship between opening and closing of stock prices for IHSG and issuers: A case study in the Indonesia Stock Exchange

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ARTICLE INFO

Article History
Received 31 March 2025
Revised 31 May 2025
Accepted 2 June 2025

Keywords
Closing price
IHSG
Investor
Irrational behavior
Issuers

How to cite this article:
Manik, E. (2025). Relationship between opening and closing of stock prices for IHSG and issuers: A case study in the Indonesia Stock Exchange. *Bulletin of Applied Mathematics and Mathematics Education*, *5*(1), 71-80.

ABSTRACT

Identifying the most influential variables in stock price movements is a crucial aspect of developing an accurate mathematical model for predicting market trends. This study uses a case study method with cluster sampling on five stocks from different sectors listed on the Indonesia Stock Exchange, using data from the last quarter of 2024 and analyzed with correlation and partial correlation. This study analyzes two main variables: the composite stock price index (IHSG) and the closing price of company shares, to determine the extent of their influence on stock prices on the observation day. The findings indicate that the IHSG from one day prior to the observation day does not have a significant impact on the closing price of a particular stock. This means that changes in the IHSG on the previous day cannot be used as the main indicator to predict a company's stock price on the following day. On the other hand, the closing price of a company's stock on the previous day has a strong correlation with the company's closing stock price on the observation day, which is 70%. Besides historical stock price factors, irrational investor behavior can cause volatility that does not fully reflect a stock's fundamental value. Therefore, it is essential to consider investors' psychological aspects in stock market analysis.

Introduction

Stock price prediction is a highly intriguing and continuously evolving research topic. Numerous models have been developed to attempt forecasting stock price movements, ranging from statistical models to artificial intelligence-based approaches such as machine learning and artificial neural networks. Each model employs different approaches and assumptions tailored to the complexity of financial markets (Fuad & Yuliadi, 2021).

However, despite the various models and methods proposed, no prediction method has been entirely satisfactory or completely accurate to date (Tedeschi, 2006). Stock price fluctuations are influenced by numerous factors, including economic, political, and market sentiment, which are often difficult to predict precisely (Cho & Polk, 2024; Ahmed, 2020). This challenge is further exacerbated by market volatility and uncertainty, making models that perform effectively under certain conditions potentially ineffective in different circumstances

(Gong et al., 2022; Chun et al., 2020). Consequently, research in this field continues to focus on improving prediction accuracy, developing more adaptive models, and gaining a deeper understanding of the factors affecting stock price movements (Reis & Pinho, 2021).

Stock price movements are influenced by various factors from both internal and external aspects of a company (Mikrad et al., 2023). One of the main factors is the company's performance, which includes financial reports and revenue growth. If a company performs well or exceeds market expectations, its stock price tends to rise due to increased investor confidence. Conversely, if a company's performance deteriorates, its stock price is likely to decline (Reis & Pinho, 2021).

Moreover, the overall economic conditions play a crucial role. Economic indicators such as inflation, interest rates, and unemployment levels can impact consumer purchasing power, production costs, and demand for a company's products or services (Grant, 1999). For instance, high-interest rates tend to depress stock prices as borrowing costs increase for companies, making stock investments less attractive compared to other instruments like bonds. Similarly, high inflation can erode corporate earnings, thereby putting downward pressure on stock prices (Reis & Pinho, 2021).

Political factors and government policies also influence stock price movements. Pro-business policies such as tax incentives or deregulation can boost positive sentiment in the stock market. Conversely, political uncertainty or restrictive government policies may have a negative impact. International conflicts, tariff changes, or new trade policies often cause stock prices to fluctuate, as investors reassess potential risks faced by companies (Mikrad et al., 2023).

Beyond these fundamental factors, market sentiment also plays a significant role. Stock price movements are often driven by investor psychology, including optimism or pessimism influenced by rumors, recent news, or social media trends (Liu et al., 2023). For example, if there is positive news about a particular company, many investors may buy its stock, pushing the price higher. Conversely, panic due to negative rumors or unverified information can trigger massive sell-offs, leading to rapid stock price declines (Li et al., 2020).

External factors such as natural disasters, pandemics, geopolitical events, or unexpected global occurrences can also cause stock market volatility. These events often have widespread and immediate effects, altering market dynamics in ways that traditional models cannot predict (Mikrad et al., 2023).

In addition to the factors mentioned above, one of the important elements in predicting a company's stock price the next day is the stock index and the price movement of each of the company's shares, especially the opening and closing prices. The opening price reflects the initial market sentiment towards a company's stock based on information available before trading begins. Meanwhile, the closing price represents the final decision of investors after a full trading session. Therefore, these two prices serve as important indicators for investors when making investment decisions.

Investors who invest in a particular stock generally pay close attention to its opening and closing prices. The closing price is particularly significant as it is often used as a reference in technical analysis to determine future price trends (Kumar et al., 2021). If the closing price is higher than the opening price, it can be a positive signal that the stock has upward momentum. Conversely, if the closing price is lower, investors may become more cautious due to increased selling pressure.

Besides individual stock prices, the composite stock price index (IHSG) is also an essential factor in predicting the next day's stock price movements (Sunaryo, 2020). The IHSG reflects the overall condition of the stock market, so significant changes in this index provide a general

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overview of market trends. Active investors in the stock market typically monitor not only the stock prices of the companies they own but also the closing price of the IHSG as a benchmark for overall market sentiment. Thus, a combination of opening price, closing price, and IHSG can help investors formulate better investment strategies.

Identifying influential variables is a crucial step in building a predictive model, as the selected variables determine the model's accuracy and effectiveness in representing the studied phenomenon. Choosing the right variables enhances the model's predictive or analytical capability, whereas irrelevant variables may add complexity without providing significant benefits (Cheng et al., 2020). Therefore, variable selection should be conducted systematically through data analysis, statistical testing, and a deep understanding of the problem context to produce a more accurate, efficient, and interpretable model.

The opening and closing prices of individual stocks, along with the IHSG, are potential variables for predicting a company's closing stock price. However, this study focuses on assessing the feasibility of these variables by determining their correlation in predicting a company's stock price. The research problem addressed in this study is how the composite stock price index (IHSG), a company's closing stock price from one day before observation, and the company's opening stock price on the observation day influence the prediction of the closing stock price at the end of the observation day. The objective of this study is to analyze the extent to which these three variables correlate and contribute to determining stock price movements, thereby assisting in the development of a more accurate predictive model for use by investors and market participants. This study hypothesizes that the previous day's closing price has a stronger predictive power than IHSG for today's closing price.

Method

This study employs a case study approach to analyze the movement of five selected company stocks during the last three months of 2024. The research method used in this study is a case study method for 5 stocks listed on the Indonesia Stock Exchange using cluster sampling techniques. Using cluster sampling across all company sectors, the selected sectors are Infrastructure, Financials, Energy, Basic Materials, and Consumer Cyclicals. From each sector, one company included in the LQ45 group was randomly selected: Company I was selected from the Infrastructure sector, Company II from the Financials sector, Company III from the Energy sector, Company IV from the Basic Materials sector, and Company V from the Consumer Cyclicals sector. The primary objective of this research is to evaluate the partial correlation between key variables in the stock market, namely the correlation and partial correlation between the closing price of the IDX Composite (X_1) and the closing price of a specific company's stock on the day before observation (X_2), with the closing price of the company's stock on the observation day as the predictive variable (Y). Additionally, this study explores the relationship between the company's stock closing price on the day before the observation day and the stock opening price on the observation day concerning the stock closing price on the observation day.

The data used in this research is obtained from reliable sources, namely the Indonesia Stock Exchange. For each stock analyzed, daily data includes the closing price of the IDX Composite, the company's stock closing price one day before the observation day, and the company's stock closing price on the observation day. In an additional analysis, the stock's opening price on the observation day is also included to test the prediction of the stock's closing price on that day. Furthermore, this study describes the upward or downward price patterns of each company's stock over the three-month period, providing a more comprehensive picture of

stock movement trends.

The analysis method employs correlation and partial correlation techniques. The first step is to calculate the relationship between the closing price of the IHSG (X_1) and the company's stock closing price on the day before the observation day (X_2) with the company's stock closing price on the observation day (Y). A similar approach is then applied to the company's stock closing price from the previous evening and the company's stock opening price on the observation day to predict the company's stock closing price on that day. The partial correlation technique is used to control the influence of other variables, allowing the analysis to reveal the pure relationship between each variable.

The results of this study are expected to provide deeper insights into the dynamics of the relationship between the IHSG, a company's stock opening price, and its stock closing price. Additionally, the study aims to illustrate the price change patterns of each company's stock over the three-month period. By understanding the role of opening and closing prices in predicting stock price movements and observing stock price trends, this research can help investors develop more informative trading strategies that are data-driven and adaptable to market trends.

Results and discussion

This study was conducted over the last three months of 2024, focusing on the movement of five selected company stocks listed on the Indonesia Stock Exchange. Cluster sampling technique is used to select 5 company sectors, and from each sector, one LQ45 stock is randomly selected. Company I was chosen from the Infrastructure sector, which includes companies engaged in transportation, telecommunications, and public facility development. Company II comes from the Financials sector, which includes banking institutions, insurance, and other financial services. Stocks from this sector were selected due to their stability, which often serves as a key indicator in capital market analysis.

Company III was taken from the energy sector, which includes companies operating in oil, gas, and renewable energy. This sector is known for its high volatility due to the influence of global commodity prices. Company IV comes from the Basic Materials sector, involving industries such as metals, chemicals, and cement, which are generally sensitive to changes in domestic and global demand. Finally, Company V comes from the Consumer Cyclicals sector, which includes goods and services whose demand tends to fluctuate according to the economic cycle, such as automotive and retail.

This section of results and discussion is divided into two parts. The first subsection presents the findings or data obtained in the study. This section systematically outlines all results obtained from the data collection process. The findings relevant to the study's objectives are elaborated to ensure that readers fully understand the achievements of the research. The second subsection contains discussions and interpretations of the study’s results and data. This section focuses on analyzing the findings by linking them to relevant theories and previous studies. Unexpected or noteworthy findings are highlighted, followed by an in-depth explanation of their possible causes. Additionally, this section discusses the implications of the findings and the limitations that may affect the generalization of the results. The data analysis in this study was conducted using a confidence level of 90%.

Results

Stock market announcements are concluded daily with data on the IHSG closing price and the closing price of each company's stock. This information not only reflects market conditions at the end of trading but also serves as a crucial element in investment decision-making. For investors,

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closing price data provides insights into ongoing market trends. Additionally, this data is often a primary reference for predicting the movement of the IHSG and the closing prices of a company's shares the following day.

The data obtained from these announcements were then processed to analyze the relationship between the IHSG and a specific company's stock closing price one day before the observation day with the stock price movement on the observation day. This analysis aims to identify significant correlations or partial correlations, providing insights into the interrelationships of these variables. Understanding these relationships is useful for investors in developing more targeted investment strategies based on potential linkages between indicators.

The correlation analysis results are presented in a table summarizing data over the three-month study period. Table 1 systematically presents these results, making it easier for readers to understand the relationships between the IHSG, the closing price of the selected companies (Close) one day before the observation day, and the company's stock closing price (Prediction) on the observation day. At the predetermined significance level, the partial correlation between Close and Prediction, after excluding the influence of the IHSG, is statistically significant. Meanwhile, the partial correlation between the IHSG and Prediction, after excluding the influence of Close, is not statistically significant, except for Company V, which is slightly influenced by the IHSG. By squaring the correlation values (Close, Prediction), it was found that the Prediction price (the next day's closing price) is determined by today's closing price at a rate of 72% for Company I, 88% for Company II, 89% for Company III, 93% for Company IV, and 85% for Company V.

Table 1. Partial correlation of IDX composite (IHSG), closing price, and prediction

Correlation/Partial Correlation	Company				
	I	II	III	IV	V
Correlation (Close, Prediction)	0.8468	0.9369	0.9422	0.9656	0.9194
Correlation (IHSG, Prediction)	0.6277	0.7033	0.4095	0.3150	0.5239
Correlation (Close, Prediction) |IHSG	0.7316	0.8711	0.9301	0.9618	0.8905
Correlation (IHSG, Prediction)|Close	0.0675	-0.0424	0.0006	0.0274	0.1715

To understand the relationship between a company's stock closing price (Close) one day before the observation day, the stock opening price (Open) on the observation morning, and the stock closing price (Prediction) on the observation day, a correlation analysis was conducted. The results are systematically presented in Table 2. The data reveal a very strong relationship between Close and Open. By squaring the correlation values (Close, Open), it was found that the contribution of the previous day's closing price to the next morning's opening price is 99.54% for Company I, 95.80% for Company II, 98.80% for Company III, 99.37% for Company IV, and 98.45% for Company V. Furthermore, after conducting a difference test, no significant average differences were found between the Close price one day before the observation day and the Open price on the observation day for all five companies.

Table 2. Correlation/partial correlation of closing price, opening price, and prediction

Correlation/Partial Correlation	Company				
	I	II	III	IV	V
Correlation (Close, Open)	0.9977	0.9788	0.9940	0.9969	0.9922
Correlation (Close, Prediction)	0.8468	0.9369	0.9422	0.9656	0.9194
Correlation (Open, Prediction)	0.8464	0.9650	0.9473	0.9755	0.9211

This study also analyzed the magnitude of stock price changes, both increases and decreases, to provide a deeper understanding. Information on the average, maximum, minimum, and standard deviation of stock price changes is detailed in Table 3. The highest relative price increase occurred in Company I, at 0.2268 or a 22.68% rise from the previous closing price. Meanwhile, the largest relative price decrease also occurred in Company I, at -0.0670 or a 6.70% decline from the previous closing price.

Table 3. Summary of relative stock price changes

Data Description	Company				
	I	II	III	IV	V
Maximum	0.2268	0.0373	0.0748	0.0613	0.0742
Minimum	-0.0670	-0.0516	-0.0455	-0.0446	-0.0541
Average	0.0033	0.0006	0.0021	0.0032	0.0019
Standard Deviation	0.0376	0.0163	0.0267	0.0200	0.0201

These findings indicate that the closing price of a company's stock one day before the observation day is the most reliable factor for predicting its closing price on the observation day. Meanwhile, external factors such as investor sentiment, stock volatility, news sentiment, and social media influence may also impact price movements.

Discussion

The capital market is one of the key components of a country's economy, including Indonesia (Fuad & Yuliadi, 2021). Indonesia has the Composite Stock Price Index (IHSG) and the Indonesia Sharia Stock Index (ISSI) (Mikrad et al., 2023).

In developing a prediction model, identifying the most influential variables is crucial (Tedeschi, 2006) to ensure that the model remains simple yet reliable. Many models have been developed to predict stock prices, but none have yielded entirely satisfactory results. Numerous studies have been conducted to determine the factors influencing IHSG movements (Fuad & Yuliadi, 2021). Although individual stock prices affect IHSG, Table 1 demonstrates that IHSG cannot be used to predict the closing price of a company's stock on the following day.

When controlling for the effect of a company's stock closing price from the day before the observation, the correlation between IHSG and the company's stock closing price on the observation day is found to be insignificant or negligible. Therefore, IHSG from the previous day cannot be used to predict a company's stock closing price on the observation day.

The closing price of a company's stock from the day before the observation is a reliable factor in predicting the company's closing price on the observation day. This study reveals that the correlation between the closing price from the previous day and the closing price on the observation day exceeds 72%. In some cases, up to 93% of the prediction for the closing price is influenced by the stock's closing price from the previous day. Consequently, any stock closing price prediction model should incorporate the stock closing price from the previous day as a primary input variable. Other influencing factors include various sentiments such as stock volatility sentiment, investor sentiment, news sentiment, social media sentiment, and others (Reis & Pinho, 2021), (Li et al., 2020), (Yao & Li, 2020), (Bouteska et al., 2024), (Gong et al., 2022), (Liu et al., 2023).

Table 2 shows that the relationship between a stock's closing price from the previous day, the stock's opening price on the observation day, and the closing price on the observation day

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reveals a unique pattern. The time gap between the previous day's closing price and the observation day's opening price is 17 hours, whereas the gap between the opening price and the closing price on the observation day is only 7 hours. However, despite having 17 hours to gather extensive market news, the difference between the previous day's closing price and the observation day's opening price remains minimal. In contrast, the difference between the opening and closing prices on the observation day is significantly larger, even though the trading session lasts only 7 hours. Official news and social media news that influence investor decisions are certainly more abundant over a 17-hour period compared to a 7-hour period. However, investor decisions to buy and sell stocks are inversely related to the amount of news received. Therefore, investor decisions to buy and sell are more strongly determined by stock price movements and trading volume at the time the decisions are made. This indicates that irrational investor behavior (Reis & Pinho, 2021) plays a substantial role in stock price fluctuations during trading sessions.

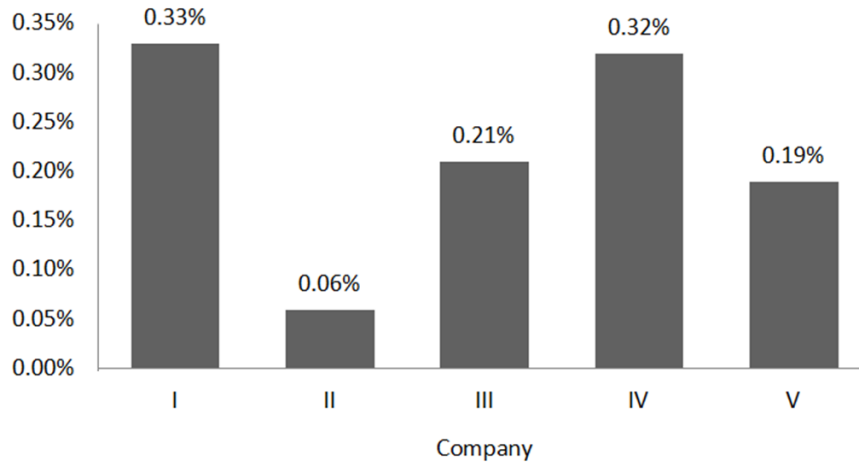

Figure 1. The average of these relative price changes.

The relative stock price changes in Table 3 indicate that the main variable for predicting a company's next-day closing stock price is its closing price on the previous day. The average of these relative price changes can be seen in Figure 1. The average prediction error for the closing price does not exceed 0.0033 or 0.33%, indicating that the highest average prediction error among the five companies is only 0.33%. The least accurate prediction occurred on one day for a stock in the Infrastructure sector, amounting to 0.2268 or 22.68%. The standard deviation is low, no more than 0.0376, indicating that the data tend to be concentrated near the mean value (Walpole et al., 1993). Therefore, in general, because the average error is very small, the predicted closing stock price of a company does not differ significantly from its closing price on the previous day.

Conclusion

The closing data of the composite stock price index and the closing prices of listed company stocks are figures that remain in investors' minds at the end of each trading day. However, the previous day's composite stock price index does not affect a company's closing price on the observation day. In contrast, a company's stock closing price from the previous day has a significant impact, exceeding 70%, on its closing price on the observation day.

Investor irrational behavior plays a crucial role in stock price movements during trading sessions. The extent of this irrational behavior's influence should be explored further in future

research to gain a deeper understanding of its implications on stock market dynamics. Additionally, future research may consider combining sentiment analysis with historical price data to enhance predictive performance.

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