PREDICTION OF CLOSING PRICE COMBINED STOCK INDEX (IHSG) USING THE FUZZY MAMDANI METHOD

Amrul Hinung Prihamayu
Prodi Ekonomi Syariah, FEBI IAIN Ponorogo,
E-mail: amrul.hp@iainponorogo.ac.id

ABSTRACT
The aim of this study is to predict the closing price of the IHSG stock price using the Mamdani fuzzy approach. This model uses historical stock closing price data as input, and generates closing price predictions using the Mamdani fuzzy rule. This research method uses quantitative with the type of experimental research. Data analysis is the collection of daily stock price data for 1 year from Yahoo Finance. The data is then processed to calculate fuzzy variables that will be used in Mamdani's fuzzy rules. The results of the study indicate that this model may not be suitable for predicting stock prices accurately and reliably. Therefore, this study does not recommend the use of the Mamdani fuzzy method for the purpose of predicting stock closing prices.

Keywords: *Predict the closing stock price, Mamdani fuzzy method, fuzzy logic*

A. INTRODUCTION

The stock market is one of the most popular forms of investment in the financial world. Shares represent ownership or share of ownership in a company. Investors who buy shares of a company become part owners of the company and have the right to dividends or profits generated by the company. Shares are traded on the stock market, where investors can buy and sell shares to profit from changes in share prices (Gunawan and Cahyadi 2019). Investing in the stock market is often seen as a way to generate long-term profits. Investors can buy shares at a low price and sell them at a higher price in the future or can receive dividends as a share of the company's profits. However, stock prices are influenced by many factors, including economic conditions, company performance, political factors, market sentiment, and other factors that can make stock prices fluctuate and become difficult to predict.

Therefore, many investors and stock market participants are trying to develop stock price prediction methods or models that can assist them in making better investment decisions (Seputra and Meirinaldi 2020). Stock price prediction models use a variety of approaches, including technical analysis, fundamental analysis, and artificial intelligence-based approaches such as fuzzy logic, neural networks, or machine learning. The purpose of predicting stock prices is to provide useful information for investors in making investment decisions that are more based on analysis and accurate information. Prediction of stock prices is an interesting topic in the field of finance and investment. (Hansun 2012). In this study, the authors propose a closing stock price prediction method using the Mamdani fuzzy approach. IHSG is generally used as a tool for analysis and investment decision making. IHSG movements are considered to reflect market sentiment, economic conditions, and business conditions in a country or region. Investors and stock market participants use the IHSG to understand and analyze changes in overall stock prices, identify market trends, and make more informed investment decisions .

IHSG is usually calculated using the market capitalization method, namely by considering the weight or market capitalization value of each stock listed in the index. Stocks that have a larger market capitalization will have a greater influence on the movement of the IHSG. In addition, the IHSG can also be calculated using the average price method or other

weighted price methods, depending on the methodology used by the stock exchange or index managing institution. The IHSG is often used as a benchmark for the performance of a country's or region's stock market, and its movements are followed by investors, analysts and stock market participants to make investment decisions. However, keep in mind that the IHSG is only one indicator and does not directly provide accurate predictions about future stock price movements. Predicting stock prices remains complex and challenging, and requires comprehensive analysis and multiple approaches to produce accurate predictions.

Mamdani's fuzzy approach was chosen because of its ability to deal with uncertainty and data complexity (Abrori and Prihamayu 2015). This model uses historical closing stock price data as input (Kevin 2018) and combining fuzzy variables derived from historical data (RIFQI, Samsuryadi, and Marieska 2021), such as changes in stock prices, changes in trading volume, and other technical indicators, in Mamdani's fuzzy rules. The prediction results of the model are tested and evaluated using the accuracy method. This study contributes to the development of a closing stock price prediction method based on the Mamdani fuzzy approach.

B. METHOD

This study uses daily stock price data for 1 year taken from public data sources Yahoo Finance. This daily data includes closing stock prices for the Jakarta Composite Index (IHSG) for a 1-year period starting from April 12, 2021 to April 8, 2022, which is used as a basis for developing and testing a closing stock price prediction model using the Mamdani fuzzy method. The closing stock price data used includes daily closing stock prices for 1 year prior to the date of the study. This data includes real-time closing stock price information obtained from the stock market and may include several other variables, such as trading volume, opening price, highest price, and lowest price. (Karnyoto 2017). One-year daily data taken from Yahoo Finance is used as a basis for developing a closing stock price prediction model using the Mamdani fuzzy method. The data is analyzed and processed to produce fuzzy variables that are used in Mamdani's fuzzy rules, such as changes in stock prices, changes in trading volume, and other technical indicators. The data is also used to test and evaluate the accuracy of the prediction model developed in this study. In this study, the method used to analyze the data is the Mamdani fuzzy method (Kusumadewi and Purnomo 2010), which is one approach in fuzzy logic. The Mamdani fuzzy method is used to process daily stock price data that has been taken from Yahoo Finance (IDX COMPOSITE (^JKSE) Historical Data - Yahoo Finance n.d.) and generate closing stock price predictions.

Yahoo Finance is one of the most popular platforms providing financial information and market data, especially in the context of investing and stock trading. Yahoo Finance provides a variety of features and services to assist investors and stock market participants in accessing data, news, analysis, and financial tools that can be used to make informed investment decisions. The initial stage in data analysis is the collection of daily stock price data for 1 year from Yahoo Finance. The data is then processed to calculate fuzzy variables that will be used in Mamdani's fuzzy rules. These fuzzy variables can include changes in stock prices, changes in trading volumes, and other relevant technical indicators. After the fuzzy variables are generated, the next step is to develop Mamdani fuzzy rules based on understanding and domain knowledge about the stock market. These rules are used to link the fuzzy input variables with the fuzzy output variables, namely the prediction of closing stock prices. Furthermore, the daily data that has been processed and the Mamdani fuzzy rules that have been developed are used to test and evaluate the prediction model. Accuracy method, used to measure the accuracy of model predictions. Methods and data analysis techniques in this study involved collecting daily stock price data, data processing to produce fuzzy variables, developing Mamdani fuzzy rules, testing and evaluating the accuracy of model predictions.

C. DISCUSSION

RESULTS AND DISCUSSION

Fuzzy Mamdani is a method in fuzzy logic that is used for decision making based on linguistic or uncertain reasoning. This method was discovered by Prof. Lotfi A. Zadeh in 1975 and is widely used in the fields of artificial intelligence, expert systems, and decision making (Zadeh 1988). The basic principle of Mamdani fuzzy is the combination of the concept of fuzzy logic with the principle of human decision making which is not always based on exact or true/false values. In this method, input and output variables are expressed in fuzzy form which allows the use of fuzzy sets and fuzzy rules to relate input and output variables. (Ayuningtias, Jumadi, and others 2017).

The Mamdani fuzzy method uses fuzzy sets as a mathematical representation of uncertainty or ambiguity in data or information used in decision making. Fuzzy sets are defined by membership functions that describe how much a value or data is included in a fuzzy set. Membership functions can be triangular, trapezoidal, or other membership functions, and can be set by the user based on understanding the domain or characteristics of the data used.
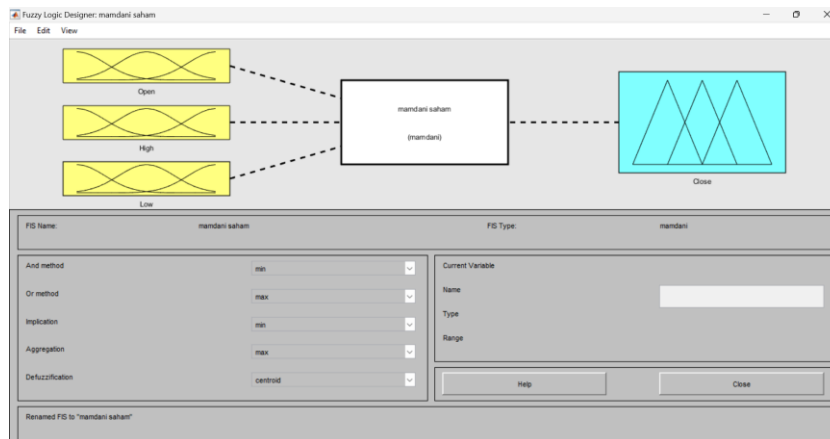

Figure 1. Fuzzy Input and Output Sets

Mamdani's fuzzy rules are defined based on domain understanding or expert knowledge about the relationship between input and output variables. These rules are usually of the form "if this condition, then this action" which uses fuzzy sets and fuzzy logic operations such as AND, OR, and NOT. These rules are used to relate input and output variables in a Mamdani fuzzy system.
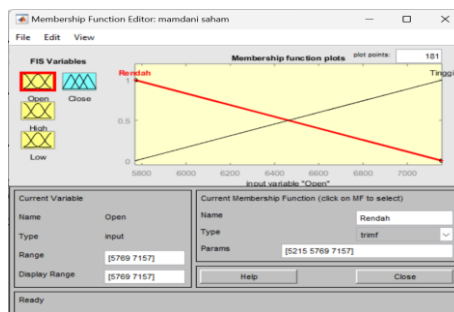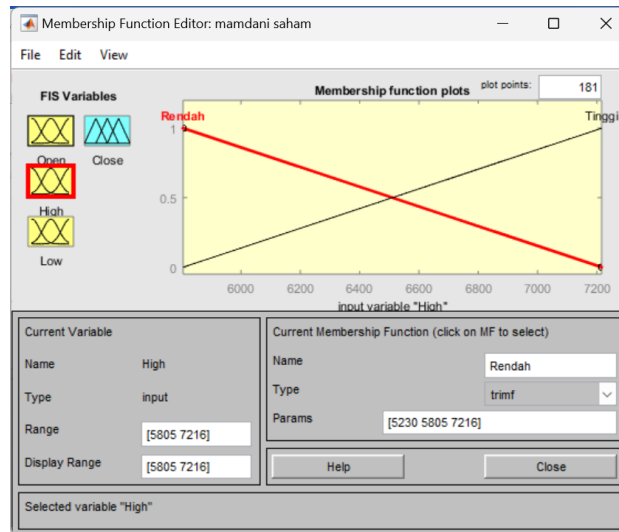

Figure 2. Fuzzy Input Open Set

Figure 3. Fuzzy Input High Set

After the fuzzy rules are defined, the Mamdani fuzzy method combines information from the given input variables to produce output in the form of a fuzzy set. This fuzzy output is then processed into a crisp value or an exact value that is used as the result of decision making. Calculations in research using fuzzytoolbox in matlab applications (Batubara 2017).
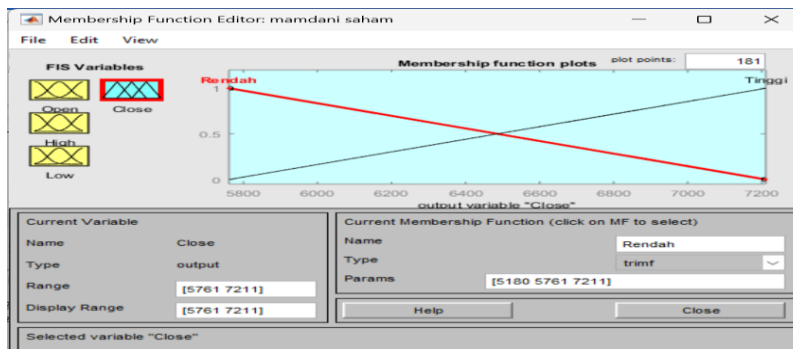

Figure 4. Fuzzy Output Close Set

Figure 5. Calculation Results Using Fuzzy Rule

Predictive data in this study uses daily IHSG data April 11 2022 – April 18 2022. It is known that the daily data for the coming period is larger than the fuzzy set that has been created and can be an obstacle in the Mamdani fuzzy method which is used to predict closing stock prices, this is may result in inaccurate or inconsistent results.

Table 1. Future Period Prediction Data

Date	Open	High	Low	Close
11 April 2022	7,212.00	7,355.30	7,194.61	7,203.79
12 April 2022	7,205.08	7,320.24	7,146.59	7,214.78
13 April 2022	7,240.19	7,266.40	7,212.86	7,262.78
14 April 2022	7,265.32	7,282.91	7,234.33	7,235.53
18 April 2022	7,245.50	7,277.08	7,243.36	7,275.29

D. CONCLUSION

The conclusion that can be drawn is that the prediction of stock closing prices using the Mamdani fuzzy method faces obstacles, if the future period's daily data is greater than the fuzzy set that has been made. This can result in unfavorable prediction results. Therefore, steps such as updating fuzzy sets, using extrapolation techniques, updating fuzzy rules, and conducting validation and evaluation need to be taken to deal with this obstacle. Thus, this study does not recommend using the Mamdani fuzzy method for the purpose of predicting closing stock prices, if you do not evaluate the fuzzy sets that have been created..

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