

Vietnam V30 Closing Price Forecast Based on ARIMA and ETS

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Abstract: Stock price forecasting is a key subject in the financial field. Accurate stock price simulations are crucial for investors to make decisions about when to buy or sell stocks for profit. Under the current environment of global economic fluctuations, it is particularly urgent to develop and implement an effective stock price forecasting model. In this study, the VN30 composite index of Vietnam from 2016 to 2023 was selected as the research object, and the ARIMA model and ETS model were used to predict the index. The results show that the ARIMA model outperforms the ETS model in forecasting accuracy, which is reflected in its lower root-mean-square error (RMSE) values. This indicates that the ARIMA model can provide a more accurate prediction of the VN30 index in Vietnam. This study compares ARIMA and ETS models for predicting Vietnam's VN30 index closing prices. It advances financial market research, offering valuable insights for investors, policymakers, and analysts. By enhancing prediction accuracy, it supports informed decision-making, market transparency, and policy formulation, while also providing guidance for model selection and optimization in future studies.

Keywords: Prediction, ARIMA, ETS, VN30

1. Introduction

Stock price forecasting has always been a classic and important problem in the financial field. Over time, the enthusiasm of both individual and institutional investors for stock investment has continued unabated. Accurate stock price forecasting is critical to them because it not only helps them make more informed investment decisions and optimize risk management, but also has a significant impact on corporate strategic planning, efficient allocation of resources, market efficiency, consumer confidence, and government economic policy formulation. In addition, accurate stock price forecasting helps maintain the stability of financial markets and promotes the healthy functioning of the entire economic system.

From an academic perspective, studying the predictability of stocks not only drives a deeper understanding of capital market efficiency, but also promotes the development of more practical and accurate capital market models. So, while stock price forecasting is critical to investment success, the challenges in this area are just as great. Stock prices are subject to a variety of unpredictable factors, such as global political dynamics, fluctuations in economic data, changes in corporate performance, and market sentiment, which make it difficult for even the most experienced investors and analysts

to accurately predict stock prices. Nevertheless, stock price forecasting remains an indispensable and challenging subject in the study of finance and economics.

The Vietnam VN30 Index is one of the core indicators in the Vietnamese stock market. Compared with other major stock market indexes in the world, the VN30 index uniquely presents the overall trend and performance of the Vietnamese stock market, reflecting investors' confidence and expectations for the Vietnamese stock market. The index covers some of the most prominent company stocks listed on the Ho Chi Minh Stock Exchange, which are typically highly representative in several important aspects such as market size and liquidity.

A notable feature of the VN30 index is its comprehensiveness, which is due to its inclusion of all securities listed on the Vietnamese stock market as far as possible, thus providing a broad market perspective for analysis and investors. Therefore, the study and analysis of the VN30 index is of vital significance for understanding and predicting the movement of the Vietnamese stock market, making it an important tool for investors and analysts to evaluate the performance of the Vietnamese market.

At present, the academic circle has done quite a lot of research on stock price prediction, which can be roughly divided into four types. The first is to study the impact of variables other than the stock itself on the stock price, such as the analysis from the perspective of emotions caused by financial news and stock price prediction, the stock prediction from the perspective of emotions caused by unexpected financial events, and the stock prediction based on the sentiment analysis of stock social media [1-3]. The second is to use machine learning methods to forecast asset prices. For example, stock price prediction project based on artificial neural network (ANN) algorithm [4-5]; establishment of asset price prediction model based on machine learning algorithm [6]; dynamic neural network based on simple IIR filter (DNN) And the innovative optimized adaptive odourless Kalman filter for financial market prediction [7]; the application of science and engineering technology for stock prediction [8]; the optimized Extreme Learning Machine (SADHS-OELM) based on adaptive differential sound search, the hybrid prediction framework for single hidden layer feedforward neural network (SLFN) [9], etc. Third, the stock price prediction model is constructed through stock feature selection or combination, such as principal component analysis (PCA), genetic algorithm (GA) and decision tree (CART), three well-known feature selection methods [10]. Fourthly, asset price prediction models are built based on time series data of stock prices, including LSTM model, structural time series model, variable dimension reduction method [11-13], etc. However, previous investigations still appear to be limited. Therefore, this paper selects the historical data of Vietnam's VN30 index from 2016 to 2023 and uses ARIMA and EST models to forecast the data of Vietnam Ho Chi Minh Index VN30. In this paper, ARIMA model and ETS model are constructed to predict the stock price of Vietnam VN30 index time series data. This paper uses data from 2016 to 2023 as the training set and data from 2023 to 2024 as the test set. After fitting the data of the training set with ARIMA model and ETS model, the results show that both models can correctly predict the development trend of stock price. Therefore, the RMS error index of the two models is further compared in this paper. The results show that the RMSE value of the ARIMA model fitting result is smaller than that of the ETS model fitting result, so this paper believes that the ARIMA model prediction result is more accurate.

2. Data

Vietnam VN30 index includes shares of listed companies from different sectors listed on the Ho Chi Minh Stock Exchange, which have a high representation in key aspects such as market size and liquidity. Compared with other indexes, the VN30 index contains companies that are not only larger in size, but also cover a variety of industries, and thus have a more prominent advantage in terms of risk diversification and broad reflection of market fluctuations.

This study focuses on data from August 2016 to March 2023, a time period chosen because it provides an up-to-date snapshot of market dynamics, ensuring the timeliness and relevance of the data. In order to further improve the consistency of data analysis and reduce the impact of daily market fluctuations, this paper adopts a data smoothing processing technology to convert the original daily data into monthly data with higher continuity through averaging. This approach not only helps to reveal longer-term market trends, but also makes the analysis more stable and reliable.

The VN30 index over the sample period is shown in Figure 1 below.

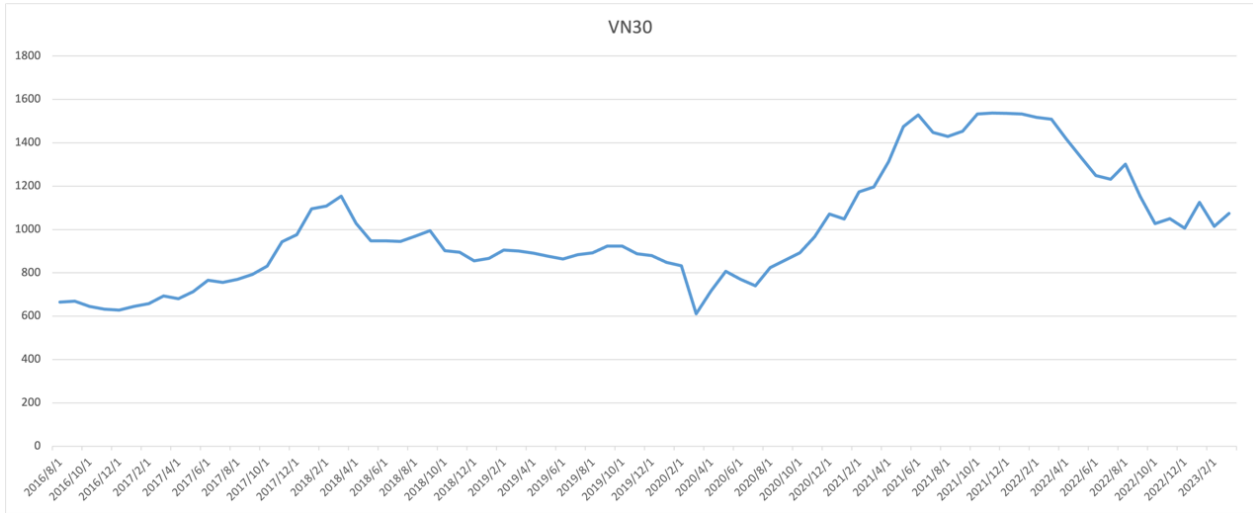


Figure 1: Trend of VN30

3. Method

3.1. ARIMA

The ARIMA, or AutoRegressive Integrated Moving Average, model is a widely used statistical tool for time series forecasting, characterized by three key components. The autoregressive part predicts future values based on past observations by establishing a linear relationship between the current and lagged values. The differencing component helps manage non-stationary data by removing trends and making the series stationary through differencing, which involves subtracting the current value from the previous one. The moving average part adjusts the forecast based on past forecast errors, refining predictions with a linear combination of residuals. ARIMA is defined by three parameters: the number of lag observations for autoregression, the number of different steps required to make the series stationary, and the order of the moving average. While primarily used for non-seasonal data, ARIMA can be extended to handle seasonal trends through a model known as SARIMA. The combination of autoregression, differencing, and moving average components makes ARIMA highly effective for forecasting non-stationary time series data.

The specific formula is as follows in Equation (1).

$$Y_t = c + \sum_{i=1}^p \varphi_i Y_{t-i} + \sum_{i=1}^q \theta_i \epsilon_{t-i} + \epsilon_t \quad (1)$$

In this formula, Y_t is the VN30 this paper studies. φ_1 to φ_p are the parameters of the AR model. These parameters are used to describe the relationship between the current value and the value of the past p time points. θ_1 to θ_q are the parameters of the AR model. These parameters are used to describe

the relationship between the current value and the error at q time points in the past. ϵ_t is the error term at time t . c is a constant term.

3.2. ETS

Exponential Smooth Transition (ETS) models are designed to solve time series forecasting problems and are particularly good at identifying trends and periodicity in data. By smoothing historical data, this model has shown remarkable results in predicting economic indicators. This is mainly because forecasts of economic indicators often rely on analysis of historical trends and cyclical changes. As a powerful time series analysis tool, exponential smooth transition model can use historical data to predict future development trends.

The ETS model contains several key components that allow it to effectively simulate long-term trends and short-term fluctuations in the data.

4. Results

In this study, this paper uses data from 2016 to 2023 as the training set and data from 2023 to 2024 as the test set. The parameters obtained by fitting training set data are shown in Table 1 below.

Table 1: Parameter Fitting Results

	Parameter 1	Parameter 2	Parameter 3
ARIMA	2	2	1
ETS	M	A	N

The table presents the parameter fitting results for ARIMA and ETS models used in time series forecasting. The ARIMA model is characterized by three key parameters: Parameter 1 is set to 2, which represents the autoregressive order, indicating the number of past observations used in predicting future values. Parameter 2 is also set to 2, referring to the differencing order, which accounts for the number of times the data needs to be different to achieve stationarity. Parameter 3 is set to 1, which reflects the moving average order, capturing the relationship between a value and past forecast errors. On the other hand, the ETS model parameters include Parameter 1 set to M, representing a multiplicative error component. Parameter 2 is set to A, which indicates an additive trend component, and Parameter 3 is set to N, showing that there is no seasonal component in the model. These parameter configurations form the basis for comparing the forecasting performance of both models on the dataset.

By comparing Figure 2 and Figure 3, it is not difficult to find that the ARIMA model and the ETS model have similar predictions for the VN30 index, and both have made upward predictions for its development trend, which is the same as the actual situation. In order to further compare the performance of the two forecasting stock indexes, this paper uses RMSE index to further compare the forecasting accuracy. Table 2 shows the accuracy of ARIMA and ETS model predictions.

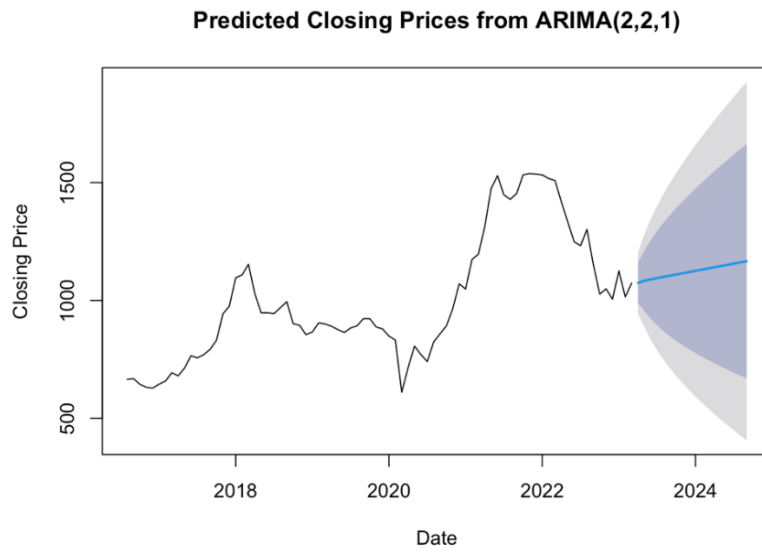


Figure 2: ARIMA Result

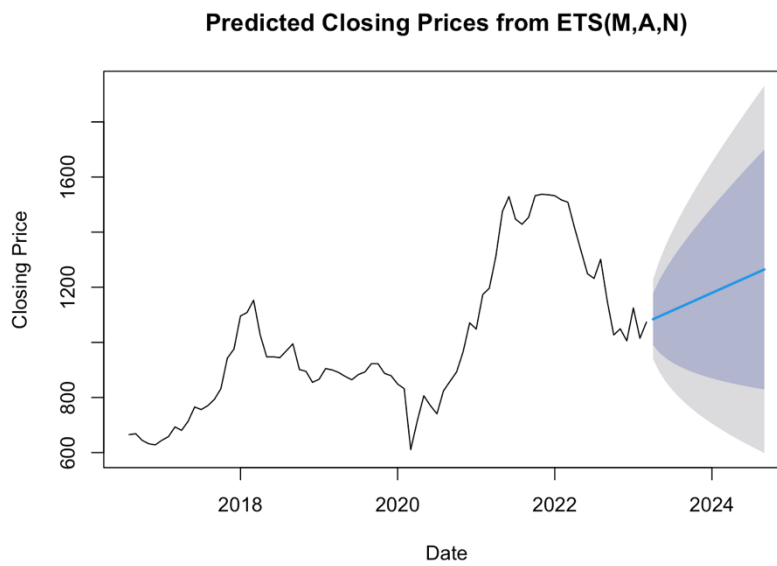


Figure 3: ETS Result

Table 2: Comparison Results

Model	Rmse Results
ARIMA	110.9214
ETS	68.6134

By observing Table 2, it is not difficult to find that ETS model has lower Rmse value.

5. Conclusion

Predicting stock prices has always been a central issue in finance. Given Vietnam's important role in the global stock market, it is critical to develop and evaluate efficient asset price forecasting models. By comparing the performance of ARIMA and ETS model in predicting VN30 index, it is found that ETS model outperforms ARIMA model in predicting accuracy. This study expands the theoretical horizon of asset price forecasting and puts forward a new thinking path for asset price forecasting in Vietnam.

Future research can further explore the prediction of VN30 index from two aspects. On the one hand, researchers can expand the time frame of the study to analyze and predict the VN30 index from a more macro perspective. On the other hand, in order to find the best model to predict the VN30 index of Vietnam, researchers can try to use a variety of different prediction models. Through these measures, researchers will be able to grasp market trends more comprehensively, which in turn will provide investors with more accurate asset price forecasts.

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