The Effects of Foreign Stock Indices on
Thailand Stock Price Index Forecasts Based on ARIMAX

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Abstract

The stock price index plays an important role in the decision of an investor as a necessary profitable index. There are many factors related to stock price indexes, including foreign stock indices. The bulk of investors seek investments with low risks and high returns and analyze the fundamental factors that influence the volatility of the stock price index. This research objective was to analyze the effects of exogenous factors using foreign stock indices on the Thai stock price index using ARIMAX. The data applied in this research covered the period from 2014 to 2023 and utilized the stock price indices of global stock exchanges with significant trade values spanning the dataset, which were the S&P 500, the BOVESPA, the FTSE 100, the Hang Seng, the Nikkei 225, and the IDX Main Board. The methodology was about to apply the ARIMA model to predict the exogenous effects upon the SET price index, while the Autoregressive Integrated Moving Average with Exogenous Factors (ARIMAX) prediction model uses historical univariate time series data to analyze and predict future trends and values. The research summarized that from a relationship point of view, there were positive relations between foreign stock indices and SET index prices listed from maximum to minimum as follows: FTSE 100 Index, IDX Main Board Index, Hang Seng Index, Bovespa Index, Nikkei 225 Index, and S&P500 Index. It can be concluded from the effects of foreign stock indices on the Thai stock price index that the Nikkei 225 Index influences SET index projections the most, followed by the FTSE 100, BOVESPA, Hang Seng, S&P500, and IDX Main Board indexes. This research suggests that investors should consider not only the foreign stock indices but also the other instruments related to investment risks in both domestic fundamentals and technical analysis.

Keywords: ARIMAX; Effect; Foreign Stock Indices; Forecast; Stock Price Index; Thailand Stock Price Index.

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1. INTRODUCTION

The choices that investors all around the globe make about their financial futures are driven by changes in both the economy and technology. Even investments made in Thailand are susceptible to the effects of changes in the market throughout the globe. There are a number of factors that can decrease investment risk and maximize rewards. Cash may be invested in mutual funds, gold, collectibles, shares, and other securities to diversify. Investors buy and sell stocks online via SET trading systems. Examining the multiple factors that affect stock prices reduces investment risks. Commencing the study of equities that are of particular interest. Conducting industry research and examining the economy is done thereafter. Investors will be able to use the knowledge acquired from the research to inform their investment decisions about securities. Consequently, each underlying cause has distinct impacts on fluctuations in the stock price index. The global economy and fluctuations in international stock market indices are interconnected with or impact investments in the Thai stock market.

2. OBJECTIVE

The research objective is to analyze the impacts of global stock price indices on the predictions of the Stock Exchange of Thailand stock price index.

3. LITERATURE REVIEW

There is much relevant literature about using ARIMAX in related research, which includes Dow Jones Index-oil price research (Abd et al., 2021), Nigeria's GDP projection (Ugoh et al., 2021), and the prices of strategic commodities in Indonesia (Anggraeni et al., 2017). The ARIMAX model anticipated Dow Jones index values from 1/1/2020 to 1/5/2020 (COVID-19 spread) utilizing Brent crude's daily price effect. The Dow Jones Index daily price forecast is multi-phased and initiated with time-series stationary testing using enhanced Dickey-Fuller tests, AIC, BIC, and RMSE rank. ARIMAX (3,1,1) (0,0,1) predicted Dow Jones Index daily values using Brent crude. A little index decline was the only difference researchers noticed. (Abd et al., 2021). Furthermore, the Box-Jenkins method fits the residuals into the ARIMA model to verify model adequacy and the Bayesian Information Criterion (BIC). Combining the exogenous variable with the ARIMA (0,1,1) model with a BIC value of 35.253 is recommended. Theil's U prediction accuracy measurements indicated that the ARIMAX (0, 1, 1) is better for projecting Nigeria's GDP. (Ugoh et al., 2021). In addition, the literature conducted a study on the performance of the ARIMAX model and the Vector Autoregressive (VAR) model in forecasting the prices of strategic commodities in Indonesia. The ARIMAX model and VAR model were used in this study to predict the price of rice. The findings indicate that the ARIMAX model is capable of accurately forecasting the rice consumer price, achieving a mean absolute percentage error (MAPE) of 0.15%. (Anggraeni et al., 2017). Moreover, Ting Yao and Yue-Jun Zhang conducted a study to examine the impact and predictive ability of the Google Index on crude oil prices. They added the Google Index as an external variable to the ARIMA and ARMA-GARCH models, which are statistical models used for time series analysis. The empirical findings suggest that the Google Index has a detrimental impact on crude oil prices, but it does not have the ability to predict crude oil prices. (Yao et al., 2017).

From the literature about the effects of foreign stock prices on price indexes, it can be concluded that in the quantitative research there were many factors influencing the consumer goods industry's stock price (Fitriyana

et al., 2020) and also seven (7) macroeconomic factors on the stock price of a joint stock commercial bank, Vietcombank (VCB), in Vietnam (Huy et al., 2020). Rahma Firsty Fitriyana et al. applied principal component analysis (PCA) to determine the main factors influencing the consumer goods industry's stock price. The findings indicate that the profitability ratio significantly influences the determination of the stock price. (Fitriyana et al., 2020). Furthermore, Dinh Tran Ngoc Huy et al. summarized that there was an increase in GDP growth and lending rate, and the risk-free rate had a significant effect on increasing VCB stock price with the highest impact coefficient; the second was decreasing the exchange rate; and finally, there was a slight decrease in the S&P500 (Huy et al., 2020). Furthermore, there are two significant pieces of literature researched on a gold price prediction model and predictions on NSE stock prices. Leow Meng Chew et. al. studied the price prediction model with a 2-way LSTM model using factors such as the SPX500 index, the USD index, crude oil prices, and the CPI. The study findings demonstrated that the use of the 2-way LSTM model significantly enhances the accuracy of gold price prediction. (Chew et al., 2023). Lavanya et al. researched stock price forecasting using logistic regression, SVC, and XGB classifiers to make predictions on NSE stock prices and concluded that XGB classifiers were the most efficient instruments for making predictions. (Lavanya et al., 2023).

There is literature about using machine learning to investigate financial data. Amir Omidi et. al. did research on the predictions of stock prices for firms that manufacture tractors in Iran. Applying artificial neural networks (ANN) for the examination of financial data. The error was evaluated using the Minimum Squared Error (MSE) metric. The findings indicated that the use of artificial neural networks (ANN) in investment risk analysis was limited. Additional variables must be examined in conjunction with this. (Omidi et al., 2011). Furthermore, Jimmy H. Moedjahedy et. al. investigated using machine learning algorithms to anticipate the Indonesia Stock Exchange stock prices of telecom businesses. (Moedjahedy et al., 2020).

Based on the information provided, this research presents a method for studying and analyzing the influence of stock price indices around the world on changes in the stock price indices of the Stock Exchange of Thailand. It utilizes stock price indices of various global stock exchanges with values. Some of the most actively traded stocks between 2014 and 2023 are the S&P500, BOVESPA, FTSE100, Hang Seng, Nikkei225, and IDX Main Board, which can also be used as a helpful tool when considering investments in the Thailand Stock Exchange.

4. MAETHODOLOGY

The database utilized in this research is from the stock price indices of various global stock exchanges collected from 2014 to 2023, including S&P500, BOVESPA, FTSE 100, Hang Seng, Nikkei225, and IDX Main Board. The methodology in the data analysis is the ARIMAX approach to evaluate the data and provide valuable information for investors to make informed choices on stock purchases and sales. The methodologies used to analyze the data are the following:

A. Correlation Coefficient

The correlation coefficient is a statistical measure that quantifies the presence of a link between variables. The correlation coefficient in this context will range from -1.0 to 1.0, encompassing the following interpretations:

- A positive result indicates a positive correlation between the two variables.
- A negative number indicates The two variables have a negative correlation.
- The correlation value approaches 1.0, indicates a significant positive correlation between the two variables.
- The correlation value approaches -1.0, indicating a significant negative relationship between the two variables.
- The correlation coefficient is 0, indicating a lack of relationship between the two variables.

The Correlation Coefficient may be determined by utilizing Equation 1.

$$r = \frac{\sum (x_i - \overline{x})(y_i - \overline{y})}{\sqrt{\sum (x_i - \overline{x})^2 \sum (y_i - \overline{y})^2}}$$

(1)

Where, r is Correlation Coefficient, x_i is value of variable x in data set i, $\overline{x}$ is the mean value of variable x, y_i is value of variable y in data set i, $\overline{y}$ is the mean value of variable y. The calculation of the significance test for the correlation coefficient may be derived using Equation 2.

$$t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}}$$

(2)

Where t is the t-test value, n is the total data, and r is the correlation coefficient. Significance test This will provide insight into the degree of correlation between the two variables. The criteria for determining the correlation coefficient are established in Table I. If the two variables have a strong correlation, the coefficient would be more than 0.7, while if they were less than 0.3, the existing relationship would be weak.

Table I. Definition of Correlation Coefficient

Correlation Coefficient (r)	Definition
0.71 - 1.0	The two variables have a strong correlation.
0.31 - 0.7	The two variables exhibit a modest level of correlation.
0.01 - 0.3	A weak association exists between the two variables.
0.00	There is no relationship between the two variables.

B. ARIMA

Many employ the autoregressive integrated moving average (ARIMA) model. This method also produces accurate short-term projections. This approach produces a prediction with a lower mean square error (MSE) than trend analysis, exponential averaging, and linear regression. Poly, others. Formulating equations and generating predictions is easier than with the macro model, which has several equations. The statistical ARIMA model forecasts short-term events well. It works best for short-term forecasts and needs a large dataset. The auto-regressive (AR(p)) model, integrated process (I(d)), and moving average (MA(q)) make up ARIMA (p,d,q). Each component is described below.

1) Autoregressive process: is a statistical methodology employed in the field of time series analysis. It assumes that previous values determine the present value of a time series. Autoregressive methods employ analogous mathematical techniques to ascertain the probable correlations among items in a series. These models next utilize the acquired knowledge to forecast the subsequent unidentified element in the sequence. The equation 3 represents the autoregressive process equation.

$$y_t = \alpha_0 + \phi_1 y_{t-1} + \phi_2 y_{t-2} + \ldots + \phi_p y_{t-p} + \varepsilon_t \qquad (3)$$

where p is the exact number of orders. As the order increases, the greater the use of y. By employing a limited quantity of y, there is the benefit of effectively forecasting volatile data. However, in the event that y exhibits anomalous values, it will lead to erroneous forecasts. However, the utilization of y over an extended period of time offers the benefit of enhanced predictive capabilities in the presence of outliers. However, there is a drawback: it lacks high accuracy in forecasting volatile data.

2) Integrated: is to calculate the disparity in the time series between the present data and the data from the previous time periods. The purpose of determining the disparity in the time series. This is due to the ARIMA model's specific design for analyzing time series data with constant qualities, commonly referred to as stationarity. When analyzing time series data, there are some qualities that remain constant. We must first transform the nonstationary data into fixed-quality data. By conducting a comparative analysis of time series data prior to its utilization in the construction of an ARIMA model.

3) Moving Average: MA model operates by utilizing historical data to predict future data. Appropriate for forecasting that the data values remain generally stable. The expression may be expressed as an equation in the format that follows.

$$y_t = \alpha_0 + \theta_1 \varepsilon_{t-1} + \theta_2 \varepsilon_{t-2} + \ldots + \theta_q \varepsilon_{t-q} + \varepsilon_t \qquad (4)$$

Based on the aforementioned facts, From the auto-regressive model, the moving average model, and the integrated process, the ARIMA (p,d,q) model is the general form of the ARIMA model used in the estimate process, as shown in 5

$$y_t = \alpha_0 + \sum_{i=1}^{p} \phi_i y_{t-i} + \sum_{j=1}^{q} \theta_j \varepsilon_{t-j} + \varepsilon_t \qquad (5)$$

Where, y_t is the time series data at time t. The mistake term at time j is ε_{t-j}, and j can be anywhere from 1 to q. θ_j is the coefficient at time j, with j between 1 and q. α_0 is a fixed number, and ε_t is the time-series data's white noise.

ARIMA's integrated component is i. This section converts time series data to stationary data using heterogeneous time series. Equation 6 shows a single heterogeneous process. Stability means time series data has no trend or seasonality, resulting in a constant graph and variability. Prior and future data should have similar probability.

$$y_t' = y_t - y_{t-1} \qquad (6)$$

Where y'_t represents the converted data at time t, y_t denotes the time-series data at time t, and y_{t-1} represents the time-series data at one lag time.

C. ARIMAX

As an alternative to the ARIMA model, the Autoregressive Integrated Moving Average with Exogenous Factors (ARIMAX) prediction model uses historical univariate time series data to analyze and predict future trends and values. In contrast to the ARIMA model, which is commonly employed for addressing univariate time series, the ARIMAX model incorporates a greater number of independent components, or explanatory variables. One or more autoregressive (AR) terms and one or more moving average (MA) terms make up an ARIMAX multiple regression model. Furthermore, this approach is applicable to many data forms, including both static and non-static data. and data that remains constant regardless of trends. Equation 8 represents the mathematical model. The AR parameter is denoted as ϕ, whereas the MA parameter is denoted as θ. In addition, the regression error is denoted as ε_t, where a_t represents the zero mean and time series error term, l_i represents the lag level, X_t is the observed value at time t, and y_t represents the output.

$$\varepsilon_t = \frac{\phi}{\theta} a_t \tag{7}$$

$$y_t = \alpha_0 + \sum_{i=1}^{m} \frac{\phi_i}{\theta_i} l_i X_t + \varepsilon_t \tag{8}$$

D. Evaluation

This study employs three assessment criteria to evaluate the effectiveness of time series models in forecasting set indexes. These criteria are root mean square error (RMSE), absolute error (MAE), and percentage root mean square error (%RMSE). The Thai Stock Exchange Table II contains the mathematical equations that represent these observations.

TABLE II. Methods for Evaluating Model Performance

Method	Equation	Remark
MAE	$\frac{1}{n}\sum_{i=1}^{n}\left|x_i - x'_i\right|$	x is Observed Value.
RSME	$\frac{1}{\sqrt{n}}\sqrt{\sum_{i=1}^{n}(x_i - x'_i)^2}$	x' is Predicted Value. n is the Number of Sample Data.
%RSME	$\frac{100}{x}\sqrt{\dfrac{\sum_{i=1}^{n}(x_i - x'_i)^2}{n}}$	$\overline{x}$ is an Average Value of Sample.

5. DATA AND EXPERIMENTAL

A. Data Set

This study utilized the stock price indices of global stock exchanges with significant trade values spanning from 2014 to 2023, as illustrated in Fig. 1. The following list includes the six equities that comprise the dataset:

1) S&P500: A stock price index of the 500 biggest publicly listed US companies by liquidity, size, and industry. The US stock exchange. The NYSE and Nasdaq are the largest stock marketplaces. 500 businesses from both stock markets comprise the S&P500 Index.

2) BOVESPA: The BOVESPA Index is a financial indicator that serves as a comprehensive evaluation of the performance of significant firms listed on the Brazilian stock market.

3) FTSE100: The FTSE100 index includes the top 100 corporations trading on the London Stock Exchange. This is England's most popular index. The Sondon Stock Exchange will update prices every 15 seconds. FTSE Group manages the FTSE 100 Index. The 100 rating includes UK-listed enterprises and the economy.

4) Nikkei225: The Tokyo Stock Exchange (TSE) trades the Nikkei225 stock price index. The Tokyo Stock Market is a major Asian stock market. The Tokyo Stock Exchange's top 225 corporations' stock prices constitute the Nikkei 225 Index. The Nikkei 225 Index selects stocks based on liquidity and industry balance. We will examine them twice a year.

5) Hang Seng: The strategy involves trading the Hang Seng, a major Asian stock market index. The Hang Seng Index trades highest at 82 places. This index tracks mainland China and Hong Kong stock values. Additionally, it will represent real estate, public utility, and banking market changes. Commerce Industry Sub-Index Using the Hang Seng Index, one can forecast financial and industrial swings in China and Hong Kong.

6) IDX Main Board: is a stock price index that is listed on the Indonesia Stock Exchange (IDX). The IDX Main Board Index is a comprehensive index that quantifies the stock price performance of all stocks listed on the main board of the Indonesia Stock Exchange.

In Fig. 1, it can be summarized that S&P500, BOVESPA, FTSE100, Hang Seng, and IDX Main Board were moving with the same trend, while Nikkei225 illustrated an upward trend.
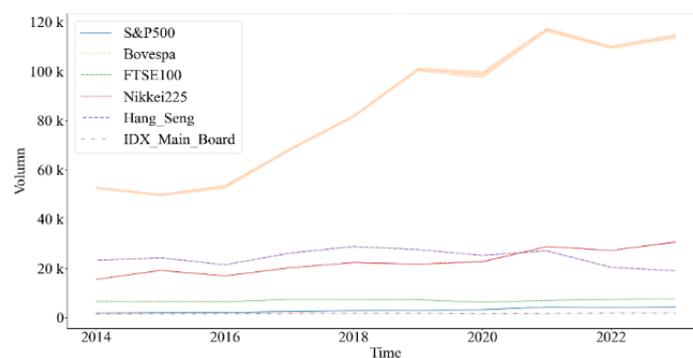

Fig. 1. Stock Price Index and Data Set Employed During 2014-2023

B. Data Correlations

The correlation coefficient study examines the direction-level link between the SET index and other price indexes, which are S&P500, BOVESPA, FTSE100, Nikkei225, Hang Seng, and IDX Main Board. Selecting related variables for analysis in the following phase will utilize that variable as a predictor or explanatory variable. Table III shows the analysis findings of correlation coefficient results among foreign price indices and the Thailand Stock Price Index. There is a high positive association between the FTSE 100 Index and the Stock Exchange of Thailand stock price index. Having a 0.777 correlation and 0.01 statistical significance. Stock Exchange of Thailand stock prices are somewhat correlated with the IDX Main Board Index, Hang Seng Index, and BOVESPA Index. With correlation values of 0.685, 0.436, and 0.315 and statistical significance of 0.01. Nikkei 225 and S&P500 indexes have a poor link with Thailand Stock Price Index. Statistically significant at 0.01 with correlation values of 0.282 and 0.252.

Table III. Correlation Coefficient Results

No.	Exogenous Factors	Coefficient (r)	P Value
1	S&P500	0.252[a]	0.00
2	BOVESPA	0.315[a]	0.00
3	FTSE100	0.777[a]	0.00
4	Nikkei225	0.282[a]	0.00
5	Hang Seng	0.436[a]	0.00
6	IDX Main Board	0.685[a]	0.00

[a] correlation is significant at the 0.01 level ($p < 0.01$)

C. Data Imputation

A significant impact is the fact that stock exchanges are closed during holidays. There were several days that lacked information. On account of this, input is required. Information from the prior day was included in this study. This technique of inputting data is rationalized by the fact that the closing price index of the previous business day is used while the stock market is closed. The data imputation can be illustrated in Fig. 2. The red data were imputed into the original data of the Thailand Stock Price Index during 2014-2023.
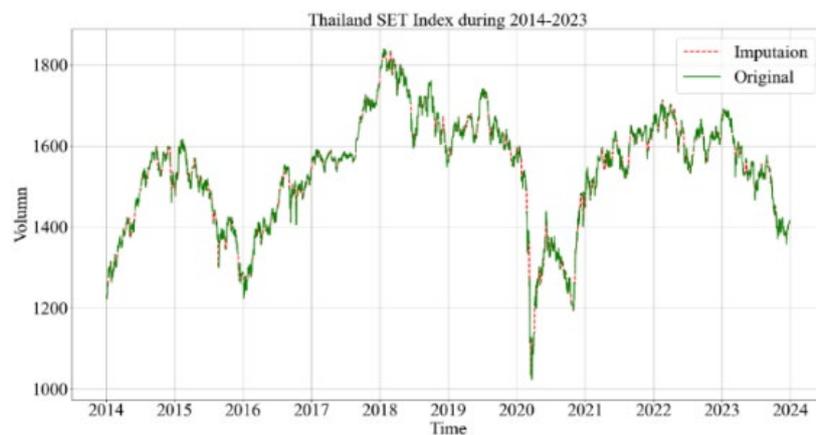

Fig. 2. Imputation of the Thailand Stock Price Index

D. Data Analysis

Performing preliminary data analysis is a prerequisite for studying time series data. the steps of which are as follows:

1) Decomposition: Time series Decomposition is a procedure that involves extracting the important components of a time series from the information that is being shown. The observable, the trend, the seasonal, and the residual are the four components that come together to form the composition. The decomposition process of the Thailand SET Index Dataset can be summarized in Fig. 3. The actual data, trend decomposition, and residual performed the same movement, while the seasonal decomposition performed seasonal movement patterns.
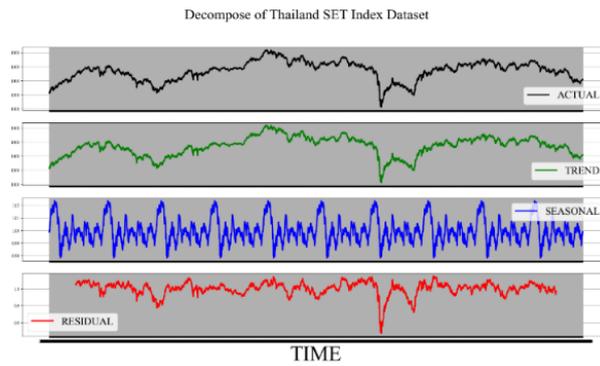
Fig. 3. Decompose of Thailand Stock Price Index During 2014-2023

2) Stationarity: Stationarity is a fundamental characteristic of time series data, indicating that the information it encompasses remains unaffected by the passage of time. It is important for information to be of high quality and free from the influence of trends or seasonal changes. These variables have the potential to cause models to overfit, which can be problematic. There are various classifications of stationery. Various methods can be used to conduct stationary tests, including decomposition for graphing or statistical analysis in the test. Utilizing the Augmented Dickey-Fuller Test (ADF Test) method, commonly referred to as unit root analysis, the present study conducted its investigation. The example of ADF test results can be illustrated in Fig. 4. The number of this example is 2,415, and it can be concluded that this time it is a stationary process.
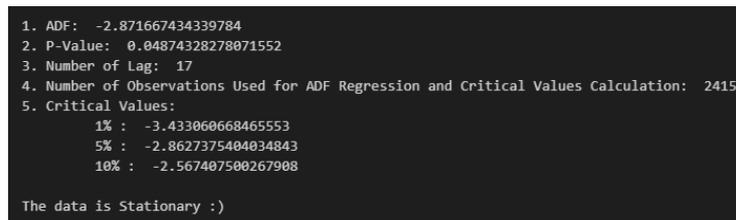

Fig. 4. ADF-Test Results

E. Optimizing Parameters

The partial autocorrelation function may determine the ARIMA model's AR or p value. The operating mechanism of this system is to determine the correlation coefficient between data and lag time. Compared to the PACF technique, the autocorrelation function (ACF) makes it easier to determine q or MA. Data and lag time are correlated, and the ACF measures that connection. An example of parameter modification results is in Fig. 5.
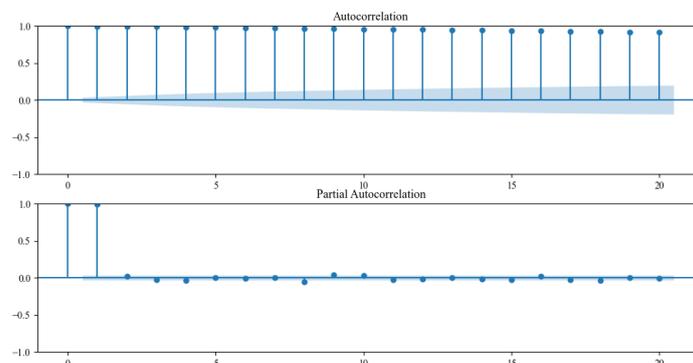

Fig. 5. ACF and PACF Results

6. RESULTS

This study utilizes the Python pmdarima package to determine the best modeling parameters to investigate the impact of external factors on the Stock Exchange of Thailand index over the past 10 years. All exogenous factors were tested. The six parts are: S&P500, BOVESPA, FTSE100, Nikkei225, Hang_Seng, and IDX_Main_Board. Table IV shows the ARIMAX model optimum parameter results. Table IV shows the best parameters for the 2023 Thailand Stock Price Index projection model. To consider the order ARIMAX (p, d, q), stepwise methods are applied to consider each pair among exogenous factors and the endogeneity of the Thailand Stock Index. The processes are conducted until the AIC is lowest compared to every stepwise order of ARIMAX (p, d, q). The ARIMAX (2, 1, 2) is the most efficient and appropriate model of exogenous factor to forecast the Thailand Stock Index in the future, and the AIC of each analysis performed the lowest points compared to other orders of ARIMAX (p, d, q) (< 27,000.000).

TABLE IV. ARIMAX Modeling Results

No.	Exogenous Factors	ARIMAX (p, d, q)	AIC
1	S&P500	(2,1,2)	27,333.719
2	BOVESPA	(2,1,2)	27,603.623
3	FTSE100	(2,1,2)	26,960.587
4	Nikkei225	(2,1,2)	27,195.230
5	Hang Seng	(2,1,2)	26,795.363
6	IDX Main Board	(2,1,2)	27,072.205

Fig. 6 presents a comparison of the results obtained from forecasting the stock market price index of Thailand using the ARIMAX model with the inclusion of different external factors. It was discovered that incorporating different external factors into the forecast yields a consistent impact. The model ARIMAX (2,1,2) is best fitted in Thailand Stock Price Index Forecast Results in 2023 because the actual time series and the exogenous forecast are plotted as if they were in the same movement.
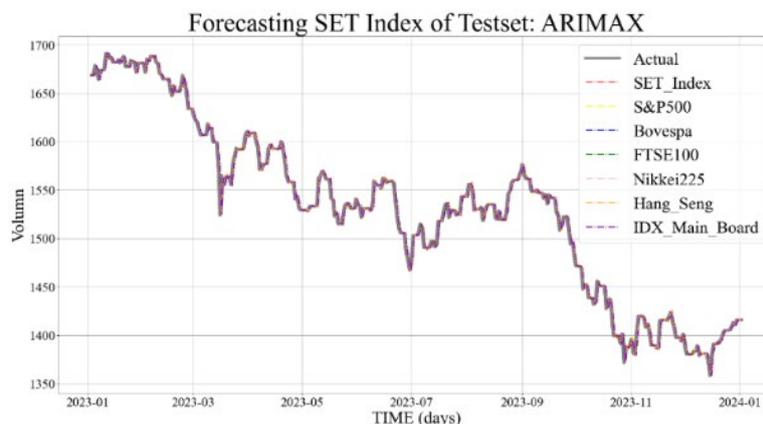

Fig. 6. Thailand Stock Price Index Forecast Results in 2023

TABLE V. The Impact of External Influences

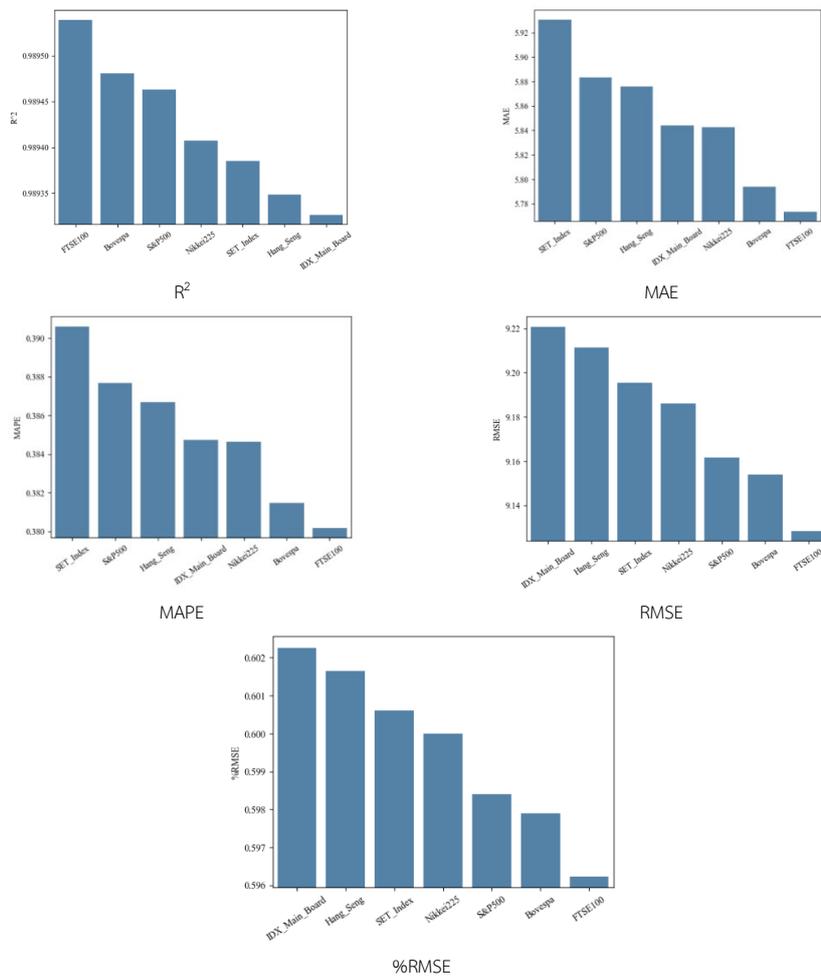|	Exogenous Factors				
	R^2	MAE	MAPE	RMSE	%RMSE
S&P500	0.989385	5.930802	0.390605	9.195483	0.600613
BOVESPA	0.989463	5.883195	0.387693	9.161543	0.598397
FTSE100	0.989481	5.79365	0.381480	9.154037	0.597906
Nikkei225	0.989539	5.773439	0.380187	9.128454	0.596235
Hang Seng	0.989407	5.842590	0.384640	9.185927	0.599989
IDX Main Board	0.989348	5.875606	0.386694	9.211414	0.601654

Fig. 7. The Influence of External Factors.

Assess the efficacy of the time series model in forecasting the set index using the ARIMAX model while using the international set index of each country as an explanatory variable. It can be summarized in Table V that for all models, MAE is less than 5.77 and MAPE is less than 0.380, while the statistics RMSE are less than 9.12 and %RMSE are 0.59. The R2 from these models analyzing the exogenous factors is very high (>0.989) because the methods using the ARIMAX model are to forecast the time series using their own historically statistical data of their own time series lagged and forecast for one period. In Fig. 7, MAE and MAPE are presented

from highest to lowest starting from SET Index, S&P500, Hang Seng, IDX Main Board, Nikkei225, BOVESPA, and FTSE100, respectively, while RMSE and %RMSE are illustrated in order of IDX Main Board, Hang Seng, SET Index, Nikkei225, S&P500, BOVESPA, and FTSE100 descending. To be compared with the statistics between MAPE and %RMSE, the number of statistics that indicated the last two orders was BOVESPA and FTSE100, respectively.
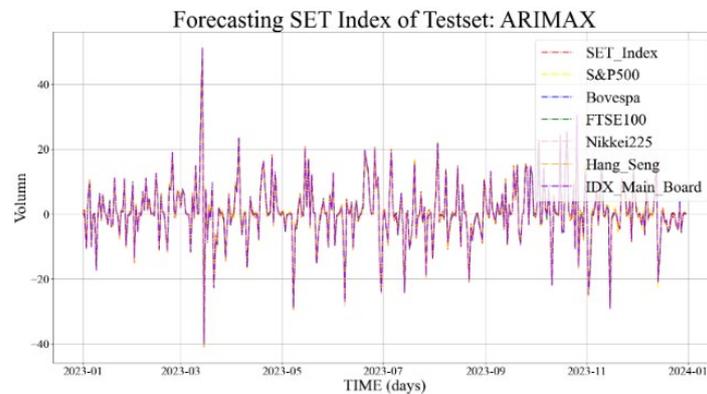

Fig. 8. Error Results of Forecasting the Thailand Stock Price Index in 2023.

7. CONCLUSION AND DISCUSSION

From the examination of global stock price indexes, the Stock Exchange of Thailand index was created. Using 2014-2023 data, global stock price indexes are tied to Stock Exchange of Thailand indices in the same way. From maximum to minimum: FTSE 100 Index, IDX Main Board Index, Haneg Seng Index, Bovespa Index, Nikkei 225 Index, S&P500 Index. When the analytical data was utilized to anticipate the Stock Exchange of Thailand stock price index using the ARIMAX model, the SET index prediction was similarly affected. The Nikkei 225 Index influences SET Index projections the most, followed by the FTSE 100, BOVESPA, Hang Seng, S&P500, and IDX Main Board Indexes. The provided data suggests the following:

Nikkei225 is a key stock market indicator. According to the ARIMAX model, it has the highest impact on Thai stock exchange index volatility. For numerous reasons, Nikkei225 index fluctuations forecast Thai stock market movements. Thailand and Japan's close economic cooperation. Thai trade and investment with Japan are crucial. Automotive, electronics, manufacturing, tourism, knowledge transfer, and cultural exchange are among its many economic partnerships. Thus, Japanese economic and stock market movements affect Thailand.

Because it is based on the top 100 London Stock Exchange businesses with the highest turnover, the FTSE 100 Index may have an impact on SET Index projections. It contains big-company stocks. Shell, HSBC, AstraZeneca, Unilever, Diageo, British American Tobacco, and BP are examples. There are a number of significant FTSE 100 firms that have invested in Thailand.

The BOVESPA Index is a measure of the Brazilian stock market's performance. These developing markets are significant and have a crucial influence on the global economy. Stock market performance changes in these areas may have an impact on other economies. Thailand is included.

The BOVESPA Index is a measure of the Brazilian stock market's performance. These developing markets are significant and have a crucial influence on the global economy. Stock market performance changes in these areas may have an impact on other economies. Thailand is included.

The Hang Seng Index is an indicator of the Hong Kong stock market and serves as a significant financial hub in Asia. Furthermore, fluctuations in the stock market may serve as indicators of larger patterns and attitudes within the area, including patterns that might impact the Thai stock market. Due to disparities in economic scale, the Hang Seng Index has less impact on the SET Index compared to the Nikkei 225, FTSE 100, and BOVESPA Index.

The S&P 500 Index measures US stock market performance. A major global financial market. and has the most developed economy. If the US economy grows, the company's revenues and investor confidence will be affected by monetary policy. Thus, stock market swings affect global markets. Including Thailand. Due to variations in the economy and stock market structure, the S&P 500 index may have less influence on estimates than other indexes. and trading volume. Sizes vary greatly.

IDX shows how the Indonesian stock market is doing. Though the prognosis of the Thai stock price index is less affected by the IDX Main Board Index than by the other stock indices mentioned above, this might be because of the distinct traits of investor bases, trading patterns, and economic systems.

Based on literature about using ARIMAX, there are important similarities and differences among those literature which are

1. ARIMAX employs the efficient method to project price index including Dow Jones Index-oil price research (Abd et al., 2021), the prices of strategic commodities in Indonesia (Anggraeni et al., 2017), crude oil prices. (Yao et al., 2017).

2. the process of checking stationary of time series in many literatures should be applied before using ARIMAX to forecast the price index using different kinds of test which are Dickey-Fuller tests, AIC, BIC, and RMSE rank.

3. Not only the prediction of prices could be applied using ARIMAX, but also this model can be utilized in GDP forecast which are Nigeria's GDP projection (Ugoh et al., 2021)

4. There are strong positive relationship among foreign price index and domestic price index as in the research influencing the consumer goods industry's stock price (Fitriyana et al., 2020) and gold price prediction. (Chew et al., 2023).

5. The machine learning process could be possibly investigated the financial data science to improve efficiency of data compliance (Omidi et al., 2011; Moedjahedy et al., 2020)

8. SUGGESTION

The research suggestion can be summarized as follows:

1. The investors should take into account concurrently not only the price information but also other elements like examination of domestic fundamentals, technical analysis, etc. in order to improve decision-making efficiency and utilize it as information to examine risks originating from investments.

2. The investors should consider the influence of the currency units used in the data analysis. The data units should be changed to the same unit in the next data analysis.

3. The investors should utilize ARIMAX (2, 1, 2) to forecast the Thailand Stock Index in the future because of its best efficiency and appropriate model.

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