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Forecasting The Daily Stock Prices of The Philippine Stock Exchange Index During the Opening and Closing of The Market

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Abstract
While there are many factors and other alternative methods to forecast the future performance of the Philippine Stock Market Index, the researchers have elected to utilize a quantitative approach based on technical market factors available which consists mainly of intra-day daily trading levels of the index.

The primary objective of this research is to develop a mathematical model using the time-series Autoregressive Integrated Moving Average (ARIMA) model to forecast the Philippine Stock Market Index for the subsequent three years (2023–2025) using Econometrics Views (EViews) software to process the past three historical data of the Philippine Stock Exchange Index levels.

The conceptual framework will involve four stages. The first stage is identification, in which the stationarity of the data will be determined by analyzing the autocorrelation function and partial autocorrelation function using a correlogram. In the second stage, all possible candidate models will be estimated, and the best fitting model will be selected using the criteria of significance of the ARIMA components and the smallest value in Akaike, Schwartz, and Hannan Quinn. The third stage is the stability of the univariate will be checked using the Ljung-Box Q statistic. Once the conditions have been satisfied in the diagnostic process, the last stage which is a forecast of the stock prices for 2023-2027 (opening and closing) will be generated.

Methodology
The data source used for daily stock prices of the Philippine Stock Exchange in the opening and closing of the market from January 2017 to December 2022 was Bloomberg. Specifically, we obtained real-time financial data and analysis from the Bloomberg Terminal, which provided us with access to a wide range of financial instruments, including stocks, bonds, currencies, and commodities.

1. Introduction

Movements in the stock market can have a profound economic impact on the economy. If there is a collapse in share prices, it has the potential to cause widespread economic disruption. (Hinlo & Cruz, 2013) [1]
A rise in the stock market's movement helps an economy grow, which leads to greater investor confidence. Investor confidence in stocks leads to more buying activity, which can also help push prices higher. When

stocks rise, people invested in the equity markets gain wealth. This increased wealth often leads to increased consumer spending. Thus, the increase in business revenues.

On the other hand, stock market losses affect market capitalization and market value. The lower the shares are priced, the more a company's or a country's market value declines.

Last year, the Philippine Stock Index closed the last trading day of 2022 with a decrease of 3.2% than the last month's data. Year-to-date, this represented a decline of 7.8% in comparison with the 2021 stock index data. ("PSE Montly Report", 2022) According to Luis Limlingan, head of sales at local brokerage Regina Capital, in an interview conducted by a local newspaper, "Philippine shares continued falling on climbing rates and global recession fears, with other regional indices falling deeper into the bear market," (Royandoyan, 2022) [2]

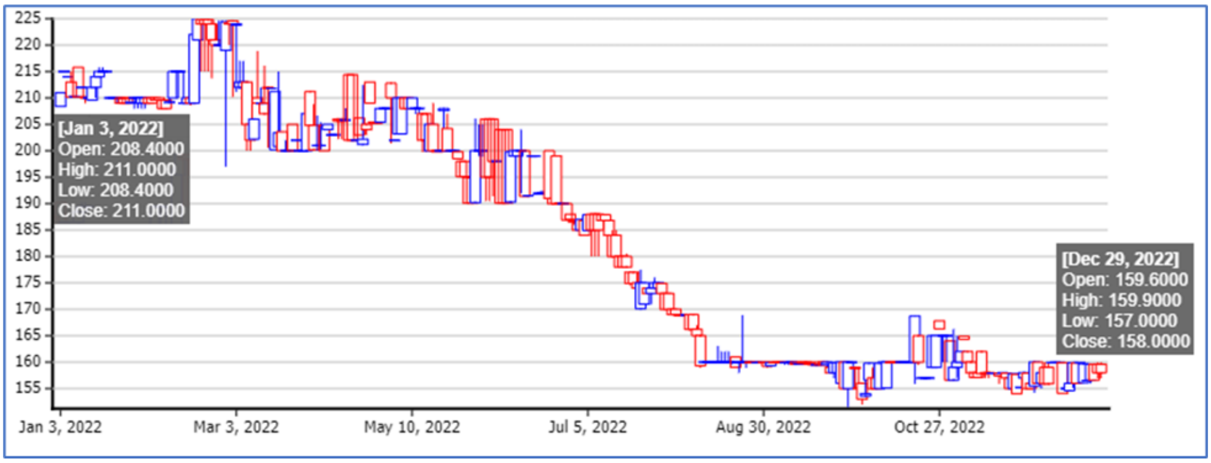

Figure 1: Philippine Stock Exchange Index Stock Data

The figure above shows the gradual decrease of PSE's stock price for the year 2022. This was caused by different incidents not only in the Philippines but also across the world.

The ongoing pandemic is the primary factor contributing to the decline in the Philippine stock market. Wren-Lewis (2020) stated that the COVID-19 pandemic would significantly affect the GDP of countries because of reductions in production and consumer demands. Global stock markets will eventually collapse if banks are unable to provide the financial demands of businesses owing to declining demand. [3] As described by Boon et al. (2020), there are three channels through which the COVID-19 pandemic may affect the global economy: (1) closure of factories, cutbacks in the service sector and disruption in the worldwide supply chain will lead to an overall decline in the supply; (2) significant drop in travel and tourism, education and other entertainment services will affect the demand side; (3) increases in uncertainty will lead to a rise in the opportunity cost of investment.[4]

Another reason why the stock prices are falling is the inflation caused by the Russian invasion of Ukraine. The geopolitical conflict pushed crude oil beyond the $100 per barrel mark, leaving oil importing countries like the Philippines bracing for higher pump prices. (Royandoyan, 2022) [5]

The negative US sentiment spillover is another reason for the decline of the Philippine stock prices. Due to the rising oil prices which fueled inflation, the US equities are now experiencing a fall. This affected the status of the Philippine stocks as well. According to Michael Ricafort, the local stock market (PSE) went down in line with the recent declines in the US stock markets to near two-year lows, after continued hawkish signals from Federal Reserve officials and due to stronger-than-expected US employment data that could support more aggressive Fed rate hikes, as the Fed continues trying to bring down elevated US inflation from 40-year highs. Clair Alviar, a research associate at Philstocks Financial Inc., also stated that if the Fed continues to be hawkish, the US currency may strengthen while the peso may continue to decline. (MSN. 2022) [6]

This study will be helpful to investors, brokers, and researchers in determining projected stock values, which will enable them to make better investment decisions. Hence, this study provides an overview of forecasting the monthly stock prices of the Philippine Stock Exchange using the last 3 years' (2020–2022) opening and closing stock price indexes through the time-series ARIMA model.

1.1 Objectives of the study

While there are many factors and other alternative methods to forecast the future performance of the Philippine Stock Market Index, the researchers have elected to utilize a quantitative approach based on technical market factors available which consists mainly of intra-day daily trading levels of the index.

The primary objective of this research is to develop a mathematical model using the time-series Autoregressive Integrated Moving Average (ARIMA) model to forecast the Philippine Stock Market Index for the subsequent three years (2023–2025) using Econometrics Views (Eviews) software to process the past three historical data of the Philippine Stock Exchange Index levels.

1.2 Research Paradigm

1.3 Conceptual Framework

In this study, the conceptual framework was derived from the Box-Jenkins methodology and involves four main stages. The first stage is identification, which involves analyzing the autocorrelation and partial autocorrelation functions using a correlogram to determine the stationarity of the data. The second stage is estimation, in which all possible candidate models will be estimated, and the best fitting model will be selected based on criteria such as the significance of the ARMA components and the smallest value in Akaike, Schwartz, and Hannan Quinn. The third stage is diagnostic checking, in which the stability of the univariate model will be evaluated using tests such as the Ljung-Box Q statistic. Once the diagnostic process has been completed and the conditions have been satisfied, the final stage is forecasting, which involves generating forecasts of the stock prices for 2023-2027 (opening and closing). By following this rigorous and systematic framework, the researchers can ensure that their analysis is reliable, accurate, and informative.

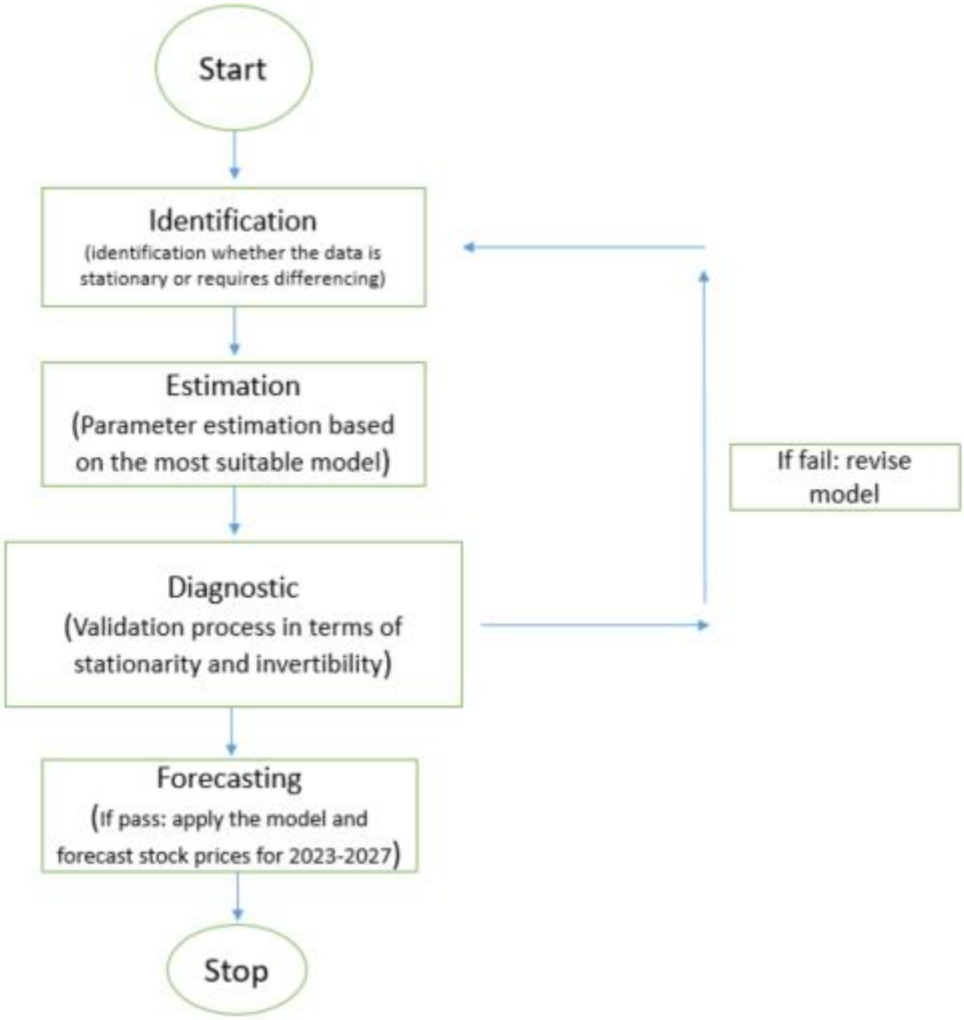

Figure 3. Conceptual Framework

1.3 Statement of the Problem

This study aims to analyze historical data and establish a time-series model to quantitatively forecast the future trajectory of the Philippine Stock Market Index over the next three years. Specifically, the study seeks to determine whether there is a significant statistical relationship relevant for forecasting purposes using the opening and closing levels of the Philippine Stock Market Index analyzed over a time period.

1.4 Scope and Limitations of the Study

The limitation of the study is that it only focuses on the output of a time-series model using the opening and closing levels of the variable regarding the future behavior of the Philippine Stock Market Index. This study will not cover other macroeconomic factors, data, and other determinants as the focus is to build a time-series quantitative model.

1.6 Review of Related Literature

This part of the paper will present an overview of related literature that would help in defining the study's scope by summarizing previous works and findings to give a better understanding of the development in this field of study.

According to Petrova (2022), the ARIMA model has shown its effectiveness in working with different time series and has become a powerful tool for obtaining accurate forecasts.[7]

Moreover, Subakkar et. al. (2023) stated in their study that ARIMA model is analyzed for time series prediction, and the results obtained using this model show strong accuracy for short term and daily stock prediction, and this engages with other model for predicting stock price.[8]

Urrutia & Olfindo (2015). Their study entitled "MODELLING AND FORECASTING THE EXCHANGE RATE OF THE PHILIPPINES: A TIME SERIES ANALYSIS", formulated an ARIMA model for the 6-year forecast of Exchange Rate of the Philippines. [9] Another study by Urrutia et. al. (2015) used the Autoregressive Integrated Moving Average (ARIMA) to develop a mathematical model to estimate and forecast the Income Tax Revenue of the Philippines for the year 2014-2020. [10]

In a study conducted by Paphawasit, et. Al. (2021), they concluded that the ensemble machine learning methods together with ARIMA can be used as a hybrid method to increase prediction capability for supporting investment decisions. [11]

Urrutia, J. et. al. (2014) focused on using a specific type of ARIMA, specifically Seasonal ARIMA model or SARIMA, to forecast foreign trade.[12] SARIMA, which is another type of ARIMA, was also considered by Urrutia as the best-fitted model to forecast the Real Gross Domestic Product from 1st Quarter of 2014 to 4th Quarter of 2020. [13]

Khan (2020), in his study entitled "ARIMA Model for Accurate Time Series Stocks Forecasting" compared three different models and concluded that ARIMA showed the most accurate result and that it has the potential for accurate stock forecasting. [14]

Ariyo, A. et. al. (2014), created a study focusing on the extensive process of building stock price predictive model using the ARIMA model. Their research's findings demonstrated that the ARIMA model can successfully compete with other stock price prediction methods and has a significant promise for short-term forecasting. [15] Another study conducted by Almasarweh, M. & Wadi S. (2018) concluded that the ARIMA model has significant results for short-term prediction. They were able to come up with the said conclusion after forecasting the banking data from Amman stock market (ASE) in Jordan using the said forecasting tool. [16]

In a study conducted by Mondal P. et. al. (2014), they were able to conclude that the accuracy of ARIMA model in predicting stock prices is above 85%, indicating that ARIMA gives good accuracy when it comes to prediction. [17]

Another study, by Rotela, P., et.al. (2014), demonstrated that the ARIMA model can be used for time-series indices related to stock market index forecasting. They were able to prove such conclusions after evaluating the performance of the model ARIMA for time series forecasting of Ibovespa (Brazil Stock Exchange). [18]

Afeel, M., et. al. (2018) was able to deduce that ARIMA modeling works efficiently for short-term prediction. This conclusion was realized after employing this method on forecasting the stock prices of one of the largest companies in Pakistan, i.e. Oil & Gas Development Company Limited (OGDCL). They collected the daily adjusted closing stock prices of the company were from 2004 to 2018 covering almost 15 years with 3632 observations. [19]

Wahyudi, S. T. (2017). His study entitled "The ARIMA Model for the Indonesia Stock Price", reported empirical evidences that ARIMA models are applicable for forecasting Indonesia stock price. He chose the said model to predict the volatility of Indonesia stock price due to its simplicity and wide acceptability. [20]

Du, Y. (2018) conducted a study comparing ARIMA-BP neural network method and BP neural network method in predicting Shanghai Securities Composition stock index. After his study, he concluded that the prediction accuracy of ARIMA-BP neural network is better than just the BP neural network. [21]

Data Source

The data source used for monthly stock prices of the Philippine Stock Exchange in the opening and closing of the market from January 2017 to December 2022 was Bloomberg. Specifically, we obtained real-time financial data and analysis from the Bloomberg Terminal, which provided us with access to a wide range of financial instruments, including stocks, bonds, currencies, and commodities.

Model Description

AR(I)MA

In this research, we will use the autoregressive integrated moving average (ARIMA) model to forecast monthly stock prices of the Philippine Stock Exchange in the opening and closing of the market from January 2017 to December 2022. The ARIMA model is a widely used time series analysis technique that can capture the linear dependencies and seasonal patterns in the data. It is a popular choice for financial forecasting because it can handle non-stationary and volatile data series. Also, to indicate the type of ARIMA model employed, it is common practice to use the standard notation with integer's p, d, and q as substitutes for the relevant parameters. The parameters themselves can be defined as follows:

p: The parameter p represents the number of autoregressive terms in the model. An autoregressive term refers to the inclusion of previous values of the dependent variable in the regression equation. The value of p can range from 0 to infinity, but in practice, it is typically limited to a small number (e.g. 1-3) to avoid overfitting the model.

d: The parameter d represents the number of differences required to make the time series stationary. Stationarity is a key assumption in the ARIMA model, and it refers to the condition where the statistical properties of the time series do not change over time. If the time series is non-stationary (i.e. exhibits a trend or seasonality), it can be differenced to remove the non-stationarity. The value of d can range from 0 to infinity, but in practice, it is typically limited to a small number (e.g. 1-2) to avoid over-differencing the data.

q: The parameter q represents the number of moving average terms in the model. A moving average term refers to the inclusion of lagged forecast errors in the regression equation. The value of q can range from 0 to infinity, but in practice, it is typically limited to a small number (e.g. 1-3) to avoid overfitting the model.

Thus, the general form of ARIMA can be expressed as:

$$X_t = \boldsymbol{\alpha}_1 \boldsymbol{X}_{t-1} + \cdots + \boldsymbol{\alpha}_p \boldsymbol{X}_{t-p} + \boldsymbol{\varepsilon}_t + \boldsymbol{\theta}_1 \boldsymbol{\varepsilon}_{t-1} + \cdots + \boldsymbol{\theta}_q \boldsymbol{\varepsilon}_{t-q}$$

To apply an ARIMA model to a time series, it is assumed that the observations follow an ARIMA process. A linear regression model is then created with a specific number and type of terms to implement the ARIMA. The data is differenced to achieve stationarity.

Determining the p, d & q

It is assumed that ARIMA models require stationary data. By applying differencing, it is possible to achieve stationarity for various time series. The most straightforward approach to determine the appropriate value of d for our model is to differentiate the data and conduct an ADF test to verify stationarity. Once we have determined the value of d, we can then examine the ACF and PACF to identify the optimal values of p and q for the AR and MA components, respectively.

Augmented Dickey-Fuller (ADF)

In our paper, we will be utilizing the Augmented Dickey-Fuller (ADF) test as a tool for determining the stationarity of our time series data. The ADF test is a statistical test that is commonly used in econometrics and time series analysis to assess whether a series has a unit root (i.e., a value of 1 in the autoregressive model). If the null hypothesis of a unit root is rejected, this implies that the series is stationary and suitable for analysis using ARIMA models. Therefore, by employing the ADF test, we can determine the appropriate level of differencing required to achieve stationarity and ensure that our ARIMA models are reliable and accurate.

$$Y_t = c + \boldsymbol{\beta t} + \boldsymbol{\alpha y}_{t-1} + \boldsymbol{\Phi}_1 \boldsymbol{\Delta Y}_{t-1} + \boldsymbol{\Phi}_2 \boldsymbol{\Delta Y}_{t-2} .. + \boldsymbol{\Phi}_p \boldsymbol{\Delta Y}_{t-p} + e_t$$

Ljung-Box Q statistic

The Ljung-Box Q statistic was used in the research as a method to test for autocorrelation in a time series dataset. The researcher calculated the Ljung-Box Q statistic using a lag parameter and compared the resulting value to the critical value of the chi-squared distribution for a given significance level. If the calculated value exceeded the critical value, the null hypothesis of no autocorrelation was rejected, indicating that the time series exhibited significant autocorrelation. The use of the Ljung-Box Q statistic allowed the researcher to assess the presence of autocorrelation in the data and adjust their analysis accordingly.

Correlogram

Correlogram was used to analyze the correlation between the opening and closing prices. A correlogram is a graphical representation of autocorrelation, which measures the degree of correlation between a variable and its lagged values. In this study, a lag of one day was used, which means that the correlation between the opening and closing of price of a particular day was analyzed.

Result and Discussion

Stage 1 - Identification

The study utilized the Augmented Dickey-Fuller test to determine whether the data is stationary or requires differencing to identify the appropriate time series model, either ARMA or AR(I)MA. The results indicate that a differencing of level 1 is necessary to transform the data into a stationary process, and that the best fitting model for both the opening and closing stock prices of the Philippine Stock Exchange is AR(I)MA. Specifically, the ADF test produced a result of 0.0000 for both the opening and closing stock prices when a level 1 difference was applied to the intercept, trend, and intercept and trend.

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Philippine Stock Exchange Index (Opening)

Null Hypothesis: D(SERIES02) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=23)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-37.76978	0.0000
Test critical values:	1% level	-3.964338	
	5% level	-3.412889	
	10% level	-3.128433	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(SERIES02,2)
Method: Least Squares
Date: 03/14/23 Time: 02:18
Sample (adjusted): 1/05/2017 12/29/2022
Included observations: 1461 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(SERIES02(-1))	-0.989052	0.026186	-37.76978	0.0000
C	1.864991	4.331462	0.430568	0.6668
@TREND("1/03/2017")	-0.002845	0.005127	-0.554899	0.5790

R-squared	0.494550	Mean dependent var	-0.032909
Adjusted R-squared	0.493856	S.D. dependent var	116.1699
S.E. of regression	82.64763	Akaike info criterion	11.66910
Sum squared resid	9959059.	Schwarz criterion	11.67996
Log likelihood	-8521.278	Hannan-Quinn criter.	11.67315
F-statistic	713.2781	Durbin-Watson stat	1.999067
Prob(F-statistic)	0.000000		

Null Hypothesis: D(SERIES02) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=23)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-37.78734	0.0000
Test critical values:	1% level	-2.566546	
	5% level	-1.941040	
	10% level	-1.616554	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(SERIES02,2)
Method: Least Squares
Date: 03/14/23 Time: 02:20
Sample (adjusted): 1/05/2017 12/29/2022
Included observations: 1461 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(SERIES02(-1))	-0.988828	0.026168	-37.78734	0.0000

R-squared	0.494439	Mean dependent var	-0.032909
Adjusted R-squared	0.494439	S.D. dependent var	116.1699
S.E. of regression	82.60001	Akaike info criterion	11.66658
Sum squared resid	9961232.	Schwarz criterion	11.67020
Log likelihood	-8521.437	Hannan-Quinn criter.	11.66793
Durbin-Watson stat	1.999100		

Null Hypothesis: D(SERIES02) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=23)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-37.76978	0.0000
Test critical values:	1% level	-3.964338	
	5% level	-3.412889	
	10% level	-3.128433	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(SERIES02,2)
Method: Least Squares
Date: 03/14/23 Time: 02:18
Sample (adjusted): 1/05/2017 12/29/2022
Included observations: 1461 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(SERIES02(-1))	-0.989052	0.026186	-37.76978	0.0000
C	1.864991	4.331462	0.430568	0.6668
@TREND("1/03/2017")	-0.002845	0.005127	-0.554899	0.5790

R-squared	0.494550	Mean dependent var	-0.032909
Adjusted R-squared	0.493856	S.D. dependent var	116.1699
S.E. of regression	82.64763	Akaike info criterion	11.66910
Sum squared resid	9959059.	Schwarz criterion	11.67996
Log likelihood	-8521.278	Hannan-Quinn criter.	11.67315
F-statistic	713.2781	Durbin-Watson stat	1.999067
Prob(F-statistic)	0.000000		

Intercept **Trend and Intercept** **None**

Philippine Stock Exchange Index (Closing)

Null Hypothesis: D(SERIES02) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=23)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-38.72096	0.0000
Test critical values:	1% level	-2.566546	
	5% level	-1.941040	
	10% level	-1.616554	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(SERIES02,2)
Method: Least Squares
Date: 03/18/23 Time: 15:17
Sample (adjusted): 1/05/2017 12/29/2022
Included observations: 1461 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(SERIES02(-1))	-1.011999	0.026136	-38.72096	0.0000

R-squared	0.506642	Mean dependent var	-0.116215
Adjusted R-squared	0.506642	S.D. dependent var	124.5707
S.E. of regression	87.49777	Akaike info criterion	11.78179
Sum squared resid	11177555	Schwarz criterion	11.78541
Log likelihood	-8605.596	Hannan-Quinn criter.	11.78314
Durbin-Watson stat	2.003563		

Null Hypothesis: D(SERIES02) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=23)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-38.70817	0.0000
Test critical values:	1% level	-3.434618	
	5% level	-2.863312	
	10% level	-2.567762	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(SERIES02,2)
Method: Least Squares
Date: 03/18/23 Time: 15:16
Sample (adjusted): 1/05/2017 12/29/2022
Included observations: 1461 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(SERIES02(-1))	-1.012007	0.026145	-38.70817	0.0000
C	-0.320397	2.289913	-0.139917	0.8887

R-squared	0.506648	Mean dependent var	-0.116215
Adjusted R-squared	0.506310	S.D. dependent var	124.5707
S.E. of regression	87.52716	Akaike info criterion	11.78314
Sum squared resid	11177405	Schwarz criterion	11.79038
Log likelihood	-8605.586	Hannan-Quinn criter.	11.78584
F-statistic	1498.323	Durbin-Watson stat	2.003573
Prob(F-statistic)	0.000000		

Null Hypothesis: D(SERIES02) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=23)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-38.70008	0.0000
Test critical values:	1% level	-3.964338	
	5% level	-3.412889	
	10% level	-3.128433	

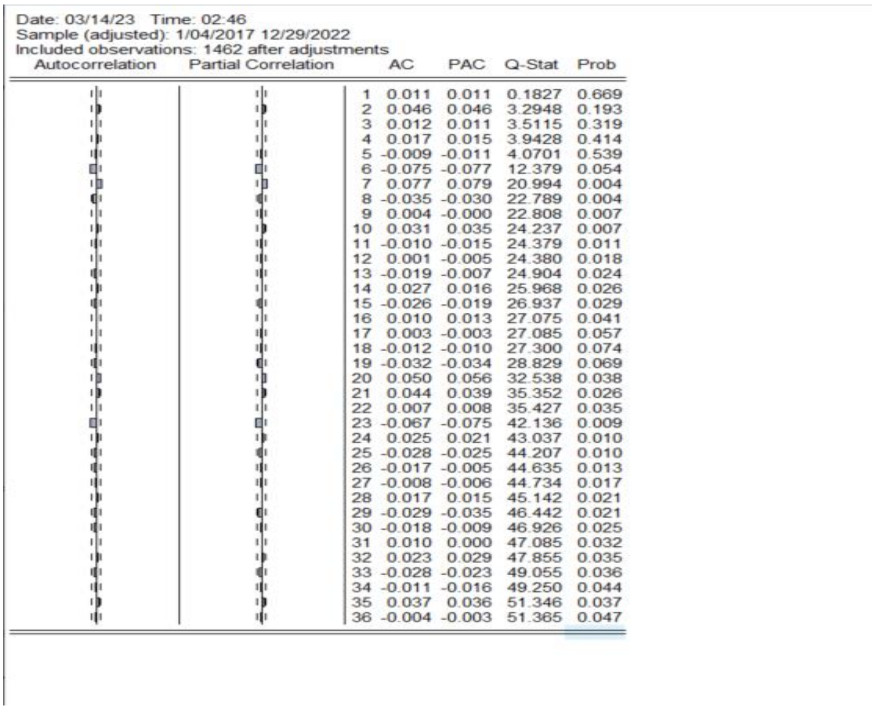
*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(SERIES02,2)
Method: Least Squares
Date: 03/18/23 Time: 15:16
Sample (adjusted): 1/05/2017 12/29/2022
Included observations: 1461 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(SERIES02(-1))	-1.012170	0.026154	-38.70008	0.0000
C	1.464263	4.588395	0.319123	0.7497
@TREND("1/03/2017")	-0.002438	0.005431	-0.448883	0.6536

R-squared	0.506717	Mean dependent var	-0.116215
Adjusted R-squared	0.506040	S.D. dependent var	124.5707
S.E. of regression	87.55112	Akaike info criterion	11.78437
Sum squared resid	11175861	Schwarz criterion	11.79523
Log likelihood	-8605.485	Hannan-Quinn criter.	11.78842
F-statistic	748.8521	Durbin-Watson stat	2.003537
Prob(F-statistic)	0.000000		

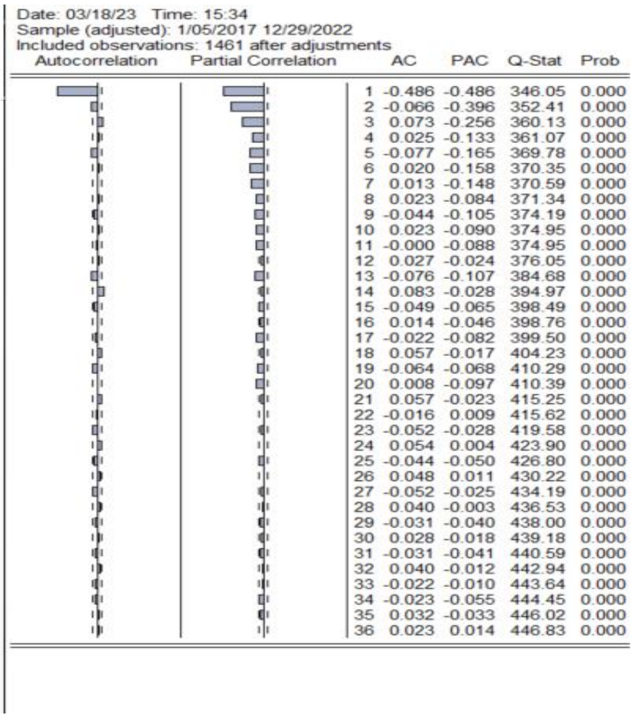
Intercept **Trend and Intercept** **None**



Date: 03/14/23 Time: 02:46
Sample (adjusted): 1/04/2017 12/29/2022
Included observations: 1462 after adjustments

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.011	0.011	0.1827	0.669
		2	0.046	0.046	3.2948	0.193
		3	0.012	0.011	3.5115	0.319
		4	0.017	0.015	3.9428	0.414
		5	-0.009	-0.011	4.0701	0.539
		6	-0.075	-0.077	12.379	0.054
		7	0.077	0.079	20.994	0.004
		8	-0.035	-0.030	22.789	0.004
		9	0.004	-0.000	22.808	0.007
		10	0.031	0.035	24.237	0.007
		11	-0.010	-0.015	24.379	0.011
		12	0.001	-0.005	24.380	0.018
		13	-0.019	-0.007	24.904	0.024
		14	0.027	0.016	25.968	0.026
		15	-0.026	-0.019	26.937	0.029
		16	0.010	0.013	27.075	0.041
		17	0.003	-0.003	27.085	0.057
		18	-0.012	-0.010	27.300	0.074
		19	-0.032	-0.034	28.829	0.069
		20	0.050	0.056	32.538	0.038
		21	0.044	0.039	35.352	0.026
		22	0.007	0.008	35.427	0.035
		23	-0.067	-0.075	42.136	0.009
		24	0.025	0.021	43.037	0.010
		25	-0.028	-0.025	44.207	0.010
		26	-0.017	-0.005	44.635	0.013
		27	-0.008	-0.006	44.734	0.017
		28	0.017	0.015	45.142	0.021
		29	-0.029	-0.035	46.442	0.021
		30	-0.018	-0.009	46.926	0.025
		31	0.010	0.000	47.085	0.032
		32	0.023	0.029	47.855	0.035
		33	-0.028	-0.023	49.055	0.036
		34	-0.011	-0.016	49.250	0.044
		35	0.037	0.036	51.346	0.037
		36	-0.004	-0.003	51.365	0.047

Correlogram for Philippine Stock Exchange Index during the closing



Date: 03/18/23 Time: 15:34
Sample (adjusted): 1/05/2017 12/29/2022
Included observations: 1461 after adjustments

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.486	-0.486	346.05	0.000
		2	-0.066	-0.396	352.41	0.000
		3	0.073	-0.256	360.13	0.000
		4	0.025	-0.133	361.07	0.000
		5	-0.077	-0.165	369.78	0.000
		6	0.020	-0.158	370.35	0.000
		7	0.013	-0.148	370.59	0.000
		8	0.023	-0.084	371.34	0.000
		9	-0.044	-0.105	374.19	0.000
		10	0.023	-0.090	374.95	0.000
		11	-0.000	-0.088	374.95	0.000
		12	0.027	-0.024	376.05	0.000
		13	-0.076	-0.107	384.68	0.000
		14	0.083	-0.028	394.97	0.000
		15	-0.049	-0.065	398.49	0.000
		16	0.014	-0.046	398.76	0.000
		17	-0.022	-0.082	399.50	0.000
		18	0.057	-0.017	404.23	0.000
		19	-0.064	-0.068	410.29	0.000
		20	0.008	-0.097	410.39	0.000
		21	0.057	-0.023	415.25	0.000
		22	-0.016	0.009	415.62	0.000
		23	-0.052	-0.028	419.58	0.000
		24	0.054	0.004	423.90	0.000
		25	-0.044	-0.050	426.80	0.000
		26	0.048	0.011	430.22	0.000
		27	-0.052	-0.025	434.19	0.000
		28	0.040	-0.003	436.53	0.000
		29	-0.031	-0.040	438.00	0.000
		30	0.028	-0.018	439.18	0.000
		31	-0.031	-0.041	440.59	0.000
		32	0.040	-0.012	442.94	0.000
		33	-0.022	-0.010	443.64	0.000
		34	-0.023	-0.055	444.45	0.000
		35	0.032	-0.033	446.02	0.000
		36	0.023	0.014	446.83	0.000

Correlogram for Philippine Stock Exchange Index during the opening

The researchers in this study employed a statistical tool called a correlogram to identify the optimal values for p, d, and q in the AR(I)MA model. Specifically, they utilized a correlogram of the first difference, which is a graph that displays the autocorrelation coefficients for each lag value. By examining this graph, the researchers were able to determine the appropriate values for p, d, and q that would best fit the time series data.

Stage 2 – Estimation

Philippine Stock Exchange Index during the opening

Based on the correlogram, the most suitable model is an AR(I)MA (7,1,6), which has an Akaike Information Criterion of -11.65867, a Schwartz Criterion of -11.67314, a Hannan-Quinn Criterion of -11.66407, and an Adjusted R2 of 0.009520. The model was selected based on the statistical significance of its ARMA components and by comparing the different criteria to choose the one with the smallest value.

Models	AR	MA	Akaike Info Criterion	Schwartz Criterion	Hannan-Quinn Criterion	Adjusted R^2
AR(I)MA (7,1,6)	Significant	Significant	11.65867	11.67314	11.66407	0.00952

Dependent Variable: DIFFSERIES02
Method: ARMA Maximum Likelihood (OPG - BHHH)
Date: 03/14/23 Time: 04:18
Sample: 1/04/2017 12/29/2022
Included observations: 1462
Convergence achieved after 27 iterations
Coefficient covariance computed using outer product of gradients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.199473	2.354906	-0.084705	0.9325
AR(7)	0.076477	0.019716	3.878986	0.0001
MA(6)	-0.075373	0.015803	-4.769678	0.0000
SIGMASQ	6736.320	92.14503	73.10562	0.0000

R-squared	0.011554	Mean dependent var	-0.195889
Adjusted R-squared	0.009520	S.D. dependent var	82.58163
S.E. of regression	82.18760	Akaike info criterion	11.65867
Sum squared resid	9848500.	Schwarz criterion	11.67314
Log likelihood	-8518.487	Hannan-Quinn criter.	11.66407
F-statistic	5.680783	Durbin-Watson stat	1.962419
Prob(F-statistic)	0.000724		

Inverted AR Roots	.69	.43+.54i	.43-.54i	-.15-.68i
	-.15+.68i	-.62-.30i	-.62+.30i	
Inverted MA Roots	.65	.32+.56i	.32-.56i	-.32-.56i
	-.32+.56i	-.65		

Philippine Stock Exchange Index during the closing

The correlogram analysis indicates that the optimal model is an AR(I)MA (3,1,21) with an Akaike Information Criterion of -11.77980, a Schwartz Criterion of 11.79427, a Hannan-Quinn Criterion of -11.78520, and an Adjusted R2 of 0.006103. The ARMA components of the model were chosen based on their statistical significance, and the selection was confirmed by comparing the different criteria, with the smallest value being preferred.

Models	AR	MA	Akaike Info Criterion	Schwartz Criterion	Hannan-Quinn Criterion	Adjusted R^2
AR(I)MA (3,1,21)	Significant	Significant	11.7798	11.79427	11.7852	0.006103

Dependent Variable: DIFFSERIES02
Method: ARMA Maximum Likelihood (OPG - BHHH)
Date: 03/22/23 Time: 20:49
Sample: 1/04/2017 12/29/2022
Included observations: 1462
Convergence achieved after 30 iterations
Coefficient covariance computed using outer product of gradients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.170213	2.666068	-0.063844	0.9491
AR(3)	0.062251	0.016056	3.877223	0.0001
MA(21)	0.060137	0.021188	2.838268	0.0046
SIGMASQ	7603.705	182.5230	41.65889	0.0000

R-squared	0.008143	Mean dependent var	-0.201724
Adjusted R-squared	0.006103	S.D. dependent var	87.58642
S.E. of regression	87.31876	Akaike info criterion	11.77980
Sum squared resid	11116616	Schwarz criterion	11.79427
Log likelihood	-8607.034	Hannan-Quinn criter.	11.78520
F-statistic	3.990210	Durbin-Watson stat	2.022854
Prob(F-statistic)	0.007642		

Inverted AR Roots	.40	-.20-.34i	-.20+.34i	
Inverted MA Roots	.86+.13i	.86-.13i	.79+.38i	.79-.38i
	.64+.59i	.64-.59i	.44-.76i	.44+.76i
	.19-.85i	.19+.85i	-.07+.87i	-.07-.87i
	-.32+.81i	-.32-.81i	-.55+.68i	-.55-.68i
	-.72+.49i	-.72-.49i	-.84+.26i	-.84-.26i
	-.87			

Philippine Stock Exchange Index During the Opening						
Models	AR	MA	Akaike Info Criterion	Schwartz Criterion	Hannan-Quinn Criterion	Adjusted R^2
ARIMA (2,1,2)	Not Significant	Not Significant	11.66806	11.68252	11.67345	0.000129

ARIMA (2,1,6)	Significant	Significant	11.66244	11.67691	11.66784	0.05749
ARIMA (2,1,7)	Significant	Significant	11.66236	11.67683	11.66776	0.005836
ARIMA (2,1,8)	Significant	Not Significant	11.66703	11.68150	11.67243	0.001162
ARIMA (2,1,20)	Significant	Significant	11.66542	11.67989	11.67082	0.002802
ARIMA (2,1,21)	Significant	Not Significant	11.66593	11.68039	11.67132	0.002288
ARIMA (2,1,23)	Significant	Significant	11.66351	11.67798	11.66891	0.004732
ARIMA (2,1,35)	Significant	Not Significant	11.66662	11.68108	11.67201	0.001605
ARIMA (6,1,2)	Significant	Significant	11.66260	11.67706	11.66799	0.005597
ARIMA (6,1,6)	Not Significant	Not Significant	11.66452	11.67898	11.66991	0.003683
ARIMA (6,1,7)	Significant	Significant	11.65892	11.67339	11.66432	1.962703
ARIMA (6,1,8)	Significant	Not Significant	11.66368	11.67814	11.66907	0.004525
ARIMA (6,1,20)	Significant	Significant	11.66179	11.67626	11.66719	0.006436
ARIMA (6,1,21)	Significant	Not Significant	11.66296	11.66743	11.66836	0.005255
ARIMA (6,1,23)	Significant	Significant	11.65966	11.67413	11.66506	0.008585
ARIMA (6,1,35)	Significant	Not Significant	11.66339	11.67786	11.66879	0.004828
ARIMA (7,1,2)	Significant	Significant	11.66221	11.67668	11.66761	0.005985
ARIMA (7,1,6)	Significant	Significant	11.65867	11.67314	11.66407	0.009520
ARIMA (7,1,7)	Significant	Significant	11.66111	11.67558	11.66651	0.007155
ARIMA (7,1,8)	Significant	Not Significant	11.66323	11.67770	11.66863	0.004974
ARIMA (7,1,20)	Significant	Significant	11.66141	11.67588	11.66681	0.006819
ARIMA (7,1,21)	Significant	Not Significant	11.66280	11.67727	11.66820	0.005414

ARIMA (7,1,23)	Significant	Significant	11.65983	11.6743	11.66523	0.008413
ARIMA (7,1,35)	Significant	Not Significant	11.66333	11.67780	11.66873	0.004889
ARIMA (8,1,2)	Significant	Significant	11.66709	11.68155	11.67248	0.001105
ARIMA (8,1,6)	Not Significant	Significant	11.66364	11.67811	11.66904	0.004555
ARIMA (8,1,7)	Significant	Significant	11.66341	11.67788	11.66881	0.004795
ARIMA (8,1,8)	Not Significant	Not Significant	11.66898	11.68345	11.67438	-0.000793
ARIMA (8,1,20)	Significant	Significant	11.66630	11.68077	11.67170	0.001928
ARIMA (8,1,21)	Significant	Not Significant	11.66738	11.68185	11.67278	0.000828
ARIMA (8,1,23)	Significant	Significant	11.66444	11.67891	11.66984	0.003811
ARIMA (8,1,35)	Significant	Not Significant	11.66771	11.68218	11.67311	0.000505
ARIMA (10,1,2)	Not Significant	Significant	11.66712	11.68158	11.67251	0.001077
ARIMA (10,1,6)	Not Significant	Significant	11.66337	11.67783	11.66876	0.004836
ARIMA (10,1,7)	Not Significant	Significant	11.66364	11.67811	11.66904	0.004562
ARIMA (10,1,8)	Not Significant	Significant	11.66800	11.68246	11.67339	0.000200
ARIMA (10,1,20)	Not Significant	Significant	11.66667	11.68113	11.67206	0.001559
ARIMA (10,1,21)	Not Significant	Not Significant	11.66751	11.68197	11.67290	0.000706
Models	**AR**	**MA**	**Akaike Info Criterion**	**Schwartz Criterion**	**Hannan-Quinn Criterion**	**Adjusted R^2**
ARIMA (10,1,23)	Not Significant	Significant	11.66498	11.67945	11.67038	0.003267
ARIMA (10,1,35)	Not Significant	Not Significant	11.66777	11.68224	11.67317	0.000452
ARIMA (15,1,2)	Not Significant	Significant	11.66756	11.68203	11.67296	0.000630

ARIMA (15,1,6)	Not Significant	Significant	11.66402	11.67848	11.66941	0.004188
ARIMA (15,1,7)	Not Significant	Significant	11.66400	11.67847	11.66939	0.004208
ARIMA (15,1,8)	Not Significant	Significant	11.66840	11.68286	11.67379	-0.000200
ARIMA (15,1,20)	Not Significant	Significant	11.66684	11.68131	11.67224	0.001389
ARIMA (15,1,21)	Not Significant	Not Significant	11.66796	11.68243	11.67336	0.000248
ARIMA (15,1,23)	Not Significant	Significant	11.66493	11.67940	11.67033	0.003325
ARIMA (15,1,35)	Not Significant	Not Significant	11.66822	11.68269	11.67362	-0.000001
ARIMA (19,1,2)	Not Significant	Not Significant	11.66698	11.68145	11.67238	0.001220
ARIMA (19,1,6)	Not Significant	Significant	11.66322	11.67769	11.66862	0.004993
ARIMA (19,1,7)	Not Significant	Significant	11.66357	11.67804	11.66897	0.004642
ARIMA (19,1,8)	Not Significant	Significant	11.66795	11.68242	11.67335	0.000255
ARIMA (19,1,20)	Not Significant	Significant	11.66638	11.68084	11.67177	0.001862
ARIMA (19,1,21)	Not Significant	Not Significant	11.66732	11.68178	11.67271	0.000907
ARIMA (19,1,23)	Not Significant	Significant	11.66499	11.67945	11.67038	0.003266
ARIMA (19,1,35)	Not Significant	Not Significant	11.66796	11.68243	11.67336	0.000260
ARIMA (20,1,2)	Significant	Significant	11.66560	11.68007	11.67100	0.002617
ARIMA (20,1,6)	Significant	Significant	11.66186	11.67632	11.66725	0.006368
ARIMA (20,1,7)	Significant	Significant	11.66181	11.67627	11.66720	0.006423
ARIMA (20,1,8)	Significant	Significant	11.66642	11.68088	11.67181	0.001808
ARIMA (20,1,20)	Not Significant	Significant	11.66727	11.68174	11.67267	0.000959
ARIMA (20,1,21)	Significant	Not Significant	11.66592	11.68039	11.67132	0.002320

ARIMA (20,1,23)	Significant	Significant	11.66317	11.67763	11.66856	0.005110
ARIMA (20,1,35)	Significant	Not Significant	11.66621	11.68068	11.67161	0.002044
ARIMA (21,1,2)	Not Significant	Significant	11.66582	11.68029	11.67122	0.002398
ARIMA (21,1,6)	Not Significant	Significant	11.66279	11.67725	11.66818	0.005431
ARIMA (21,1,7)	Not Significant	Significant	11.66287	11.67734	11.66826	0.005351
ARIMA (21,1,8)	Not Significant	Not Significant	11.66725	11.68172	11.67265	0.000961
ARIMA (21,1,20)	Not Significant	Significant	11.66567	11.68014	11.67107	0.002574
ARIMA (21,1,21)	Significant	Significant	11.66590	11.68036	11.67129	0.002380
ARIMA (21,1,23)	Not Significant	Significant	11.66345	11.67792	11.66884	0.004833
ARIMA (21,1,35)	Not Significant	Not Significant	11.66717	11.6816400	11.67257	0.001065
ARIMA (23,1,2)	Significant	Significant	11.66346	11.67792	11.66885	0.004795
ARIMA (23,1,6)	Significant	Significant	11.65955	11.67401	11.67401	0.008703
ARIMA (23,1,7)	Significant	Significant	11.65996	11.67443	11.66536	0.008289
ARIMA (23,1,8)	Significant	Significant	11.66438	11.67885	11.66978	0.003876
ARIMA (23,1,20)	Significant	Significant	11.66294	11.67741	11.66834	0.005338
ARIMA (23,1,21)	Significant	Not Significant	11.66349	11.67796	11.66889	0.004787
ARIMA (23,1,23)	Not Significant	Not Significant	11.66534	11.67981	11.67074	0.002926
Models	**AR**	**MA**	**Akaike Info Criterion**	**Schwartz Criterion**	**Hannan-Quinn Criterion**	**Adjusted R^2**
ARIMA (23,1,35)	Significant	Not Significant	11.66415	11.67862	11.66955	0.004132
ARIMA (25,1,6)	Not Significant	Significant	11.66360	11.67806	11.66899	0.004616

ARIMA (25,1,7)	Not Significant	Significant	11.66373	11.67820	11.69913	0.004484
ARIMA (25,1,8)	Not Significant	Significant	11.66819	11.68265	11.67358	0.000019
ARIMA (25,1,20)	Not Significant	Significant	11.66693	11.68139	11.67232	0.001312
ARIMA (25,1,21)	Not Significant	Not Significant	11.66760	11.68206	11.67299	0.000625
ARIMA (25,1,23)	Significant	Not Significant	11.66515	11.67961	11.67054	0.003109
ARIMA (25,1,35)	Not Significant	Not Significant	11.66799	11.68246	11.67339	0.000243
ARIMA (29,1,6)	Not Significant	Significant	11.66347	11.67793	11.66886	0.004750
ARIMA (29,1,7)	Not Significant	Significant	11.66366	11.67813	11.66906	0.004556
ARIMA (29,1,8)	Not Significant	Significant	11.66820	11.68267	11.67360	0.000002
ARIMA (29,1,20)	Not Significant	Significant	11.66677	11.68123	11.67216	0.001469
ARIMA (29,1,21)	Not Significant	Not Significant	11.66776	11.68222	11.67315	0.000465
ARIMA (29,1,23)	Not Significant	Significant	11.66434	11.67881	11.66974	0.003942
ARIMA (29,1,35)	Not Significant	Not Significant	11.66818	11.68264	11.67357	0.000049
ARIMA (33,1,6)	Not Significant	Significant	11.66383	11.67830	11.66923	0.004384
ARIMA (33,1,7)	Not Significant	Significant	11.66388	11.67834	11.66927	0.004338
ARIMA (33,1,8)	Not Significant	Significant	11.66815	11.68262	11.67355	0.000062
ARIMA (33,1,20)	Not Significant	Significant	11.66683	11.68130	11.67223	0.001409
ARIMA (33,1,21)	Not Significant	Not Significant	11.66778	11.68225	11.67318	0.000438
ARIMA (33,1,23)	Not Significant	Significant	11.66519	11.67966	11.67059	0.003069
ARIMA (33,1,35)	Not Significant	Not Significant	11.66798	11.68245	11.67338	0.000256
ARIMA (35,1,6)	Not Significant	Significant	11.66331	11.67778	11.66871	0.004909

ARIMA (35,1,7)	Not Significant	Significant	11.66349	11.67795	11.66888	0.004737
ARIMA (35,1,8)	Not Significant	Significant	11.66766	11.68212	11.67305	0.000567
ARIMA (35,1,20)	Not Significant	Significant	11.66600	11.68047	11.67140	0.002261
ARIMA (35,1,21)	Not Significant	Not Significant	11.66724	11.68170	11.67263	0.000997
ARIMA (35,1,23)	Not Significant	Significant	11.66421	11.67868	11.66961	0.004070
ARIMA (35,1,35)	Not Significant	Not Significant	11.66804	11.68251	11.67343	0.000212

Philippine Stock Exchange Index During the Closing						
Models	**AR**	**MA**	**Akaike Info Criterion**	**Schwartz Criterion**	**Hannan-Quinn Criterion**	**Adjusted R^2**
ARIMA (1,1,1)	Not significant	Not significant	11.78760	11.80207	11.79300	-0.001740
ARIMA (1,1,2)	Not significant	Significant	11.78617	11.80064	11.79157	-0.000308
ARIMA (1,1,5)	Not significant	Significant	11.78320	11.79766	11.78859	0.002677
ARIMA (1,1,9)	Not significant	Significant	11.78715	11.80161	11.79254	-0.001281
ARIMA (1,1,13)	Not significant	Significant	11.78533	11.79979	11.79072	0.000544
ARIMA (1,1,14)	Not significant	Not significant	11.78598	11.80044	11.79137	-0.000098
ARIMA (1,1,15)	Not significant	Not significant	11.78693	11.80139	11.79232	-0.001059
ARIMA (1,1,19)	Not significant	Significant	11.78669	11.80115	11.79208	-0.000812
ARIMA (1,1,21)	Not significant	Significant	11.78349	11.79795	11.78888	0.002430
ARIMA (1,1,23)	Not significant	Significant	11.78545	11.79992	11.79085	0.000445

ARIMA (1,1,24)	Not significant	Not significant	11.78760	11.80207	11.79300	-0.001741
ARIMA (1,1,25)	Not significant	Not significant	11.78665	11.80112	11.79205	-0.000771
ARIMA (1,1,26)	Not significant	Not significant	11.78767	11.80214	11.79307	-0.181000
ARIMA (1,1,27)	Not significant	Significant	11.78566	11.80013	11.79106	0.002440
ARIMA (1,1,28)	Not significant	Not significant	11.78774	11.80221	11.79314	-0.001883
ARIMA (1,1,32)	Not significant	Not significant	11.78721	11.80168	11.79261	-0.001339
ARIMA (2,1,1)	Not significant	Significant	11.78610	11.80056	11.79149	-0.002340
ARIMA (2,1,2)	Not significant	Not significant	11.78570	11.80017	11.79110	0.000166
ARIMA (2,1,5)	Not significant	Not significant	11.78201	11.79648	11.78741	0.003858
ARIMA (2,1,9)	Significant	Not significant	11.78562	11.80080	11.79101	0.000250
ARIMA (2,1,13)	Significant	Significant	11.78361	11.79808	11.78901	0.002270
ARIMA	Significant	Significant	11.78431	11.79878	11.78971	0.001568

(2,1,14)						
ARIMA (2,1,15)	Significant	Not significant	11.78517	11.79964	11.79057	0.000701
ARIMA (2,1,19)	Significant	Not significant	11.78522	11.79969	11.79062	0.000653
ARIMA (2,1,21)	Significant	Significant	11.78229	11.79676	11.78769	0.003619
ARIMA (2,1,23)	Significant	Not significant	11.78399	11.79846	11.78939	0.001906
ARIMA (2,1,24)	Significant	Not significant	11.78600	11.80046	11.79139	-0.000130
ARIMA (2,1,25)	Significant	Not significant	11.78475	11.79921	11.79014	0.001143
ARIMA (2,1,26)	Significant	Not significant	11.78606	11.80052	11.79145	-0.000190
ARIMA (2,1,27)	Significant	Significant	11.78381	11.79827	11.78920	0.002104
ARIMA (2,1,28)	Significant	Not significant	11.78615	11.80061	11.79154	-0.002830
ARIMA (2,1,32)	Significant	Not significant	11.78563	11.80009	11.79102	0.002500

ARIMA (3,1,1)	Significant	Not significant	11.78359	11.79806	11.78899	0.002278
ARIMA (3,1,2)	Significant	Not significant	11.78245	11.79692	11.78785	0.003416
ARIMA (3,1,5)	Significant	Significant	11.77925	11.79371	11.78464	0.006615
ARIMA (3,1,9)	Significant	Not significant	11.78304	11.79750	11.78843	0.002832
ARIMA (3,1,13)	Significant	Significant	11.78113	11.79559	11.78652	0.004755
ARIMA (3,1,14)	Significant	Significant	11.78186	11.79633	11.78726	0.004015
ARIMA (3,1,15)	Significant	Not significant	11.78266	11.79713	11.78806	0.003212
ARIMA (3,1,19)	Significant	Not significant	11.78261	11.79707	11.78800	0.003270
Models	**AR**	**MA**	**Akaike Info Criterion**	**Schwartz Criterion**	**Hannan-Quinn Criterion**	**Adjusted R^2**
ARIMA (3,1,21)	Significant	Significant	11.77980	11.79427	11.78520	0.006103
ARIMA (3,1,23)	Significant	Not significant	11.78110	11.79557	11.78650	0.004801
ARIMA (3,1,24)	Significant	Not significant	11.78356	11.79803	11.78896	0.002305

ARIMA (3,1,25)	Significant	Not significant	11.78257	11.79703	11.78796	0.003320
ARIMA (3,1,26)	Significant	Not significant	11.78347	11.79793	11.78886	0.002406
ARIMA (3,1,27)	Significant	Significant	11.78141	11.79588	11.78681	0.004492
ARIMA (3,1,28)	Significant	Not significant	11.78363	11.79810	11.78903	0.002234
ARIMA (3,1,32)	Significant	Not significant	11.78317	11.79763	11.78856	0.002712
ARIMA (4,1,1)	Not significant	Not significant	11.78718	11.80165	11.79258	-0.001319
ARIMA (4,1,2)	Not significant	Significant	11.78570	11.80017	11.79110	0.000166
ARIMA (4,1,5)	Not significant	Significant	11.78284	11.79731	11.78824	0.003208
ARIMA (4,1,9)	Not significant	Not significant	11.78681	11.80128	11.79221	-0.000947
ARIMA (4,1,13)	Not significant	Not significant	11.78491	11.79937	11.79030	0.000977
ARIMA (4,1,14)	Not significant	Significant	11.78557	11.80003	11.79096	0.000312

ARIMA (4,1,15)	Not significant	Not significant	11.78650	11.80096	11.79189	-0.000626
ARIMA (4,1,19)	Not significant	Not significant	11.78632	11.80078	11.79171	-0.000440
ARIMA (4,1,21)	Not significant	Significant	11.78295	11.79742	11.78834	0.002968
ARIMA (4,1,23)	Not significant	Significant	11.78517	11.79963	11.79056	0.000729
ARIMA (4,1,24)	Not significant	Not significant	11.78716	11.80163	11.79256	-0.001299
ARIMA (4,1,25)	Not significant	Not significant	11.78612	11.80056	11.79152	-0.000236
ARIMA (4,1,26)	Not significant	Not significant	11.78722	11.80168	11.79261	-0.001354
ARIMA (4,1,27)	Not significant	Not significant	11.78534	11.79981	11.79073	0.000564
ARIMA (4,1,28)	Not significant	Not significant	11.78731	11.80177	11.79270	-0.001446
ARIMA (4,1,32)	Not significant	Not significant	11.78679	11.80125	11.79218	-0.000911

ARIMA (5,1,1)	Significant	Not significant	11.78307	11.79752	11.78846	0.002807
ARIMA (5,1,2)	Significant	Not significant	11.78194	11.79641	11.78734	0.003929
ARIMA (5,1,5)	Significant	Significant	11.78234	11.79681	11.78774	0.003539
ARIMA (5,1,9)	Significant	Not significant	11.78274	11.79720	11.78813	0.003139
ARIMA (5,1,13)	Significant	Significant	11.78106	11.79552	11.78645	0.004826
ARIMA (5,1,14)	Significant	Not significant	11.78162	11.79609	11.78702	0.004261
ARIMA (5,1,15)	Significant	Not significant	11.78247	11.79694	11.78787	0.003409
ARIMA (5,1,19)	Significant	Not significant	11.78229	11.79676	11.78769	0.003589
ARIMA (5,1,21)	Significant	Significant	11.77876	11.79323	11.78416	0.007151
ARIMA (5,1,23)	Significant	Not significant	11.78110	11.79557	11.78650	0.004798
ARIMA (5,1,24)	Significant	Not significant	11.78309	11.79756	11.78849	0.002782

ARIMA (5,1,25)	Significant	Not significant	11.78219	11.79666	11.78759	0.003694
ARIMA (5,1,26)	Significant	Not significant	11.78297	11.79743	11.78836	0.002911
ARIMA (5,1,27)	Significant	Not significant	11.78113	11.79560	11.78653	0.004776
ARIMA (5,1,28)	Significant	Not significant	11.78319	11.79766	11.78858	0.002685
ARIMA (5,1,32)	Significant	Not significant	11.78287	11.79733	11.78826	0.003014
ARIMA (6,1,1)	Not significant	Not significant	11.78774	11.80221	11.79314	-0.001883
ARIMA (6,1,2)	Not significant	Significant	11.78627	11.80074	11.79167	-0.000407
ARIMA (6,1,5)	Not significant	Significant	11.78330	11.79777	11.78870	0.002571
ARIMA (6,1,9)	Not significant	Not significant	11.78726	11.80173	11.79266	-0.001399
Models	**AR**	**MA**	**Akaike Info Criterion**	**Schwartz Criterion**	**Hannan-Quinn Criterion**	**Adjusted R^2**
ARIMA (6,1,13)	Not significant	Significant	11.78541	11.79987	11.79080	0.000475
ARIMA (6,1,14)	Not significant	Significant	11.78602	11.80049	11.79142	-0.001400

ARIMA (6,1,15)	Not significant	Not significant	11.78704	11.80151	11.79244	-0.001173
ARIMA (6,1,19)	Not significant	Significant	11.78675	11.80121	11.79214	-0.000869
ARIMA (6,1,21)	Not significant	Significant	11.78366	11.79813	11.78906	0.002254
ARIMA (6,1,23)	Not significant	Significant	11.78557	11.80030	11.79096	0.000332
ARIMA (6,1,24)	Not significant	Not significant	11.78771	11.80217	11.79310	-0.001843
ARIMA (6,1,25)	Not significant	Not significant	11.78675	11.80122	11.79215	-0.008710
ARIMA (6,1,26)	Not significant	Not significant	11.78778	11.80225	11.79318	-0.001919
ARIMA (6,1,27)	Not significant	significant	11.78579	11.80025	11.79118	0.000117
ARIMA (6,1,28)	Not significant	Not significant	11.78787	11.80233	11.79326	-0.002007
ARIMA (6,1,32)	Not significant	Not significant	11.78732	11.80179	11.79272	-0.001450

ARIMA (7,1,1)	Not significant	Not significant	11.78727	11.80173	11.79266	-0.001403
ARIMA (7,1,2)	Not significant	Significant	11.78593	11.80040	11.79133	-0.000660
ARIMA (7,1,5)	Not significant	Significant	11.78291	11.79738	11.78831	0.002965
ARIMA (7,1,9)	Not significant	Not significant	11.78683	11.80130	11.79223	-0.000966
ARIMA (7,1,13)	Not significant	Significant	11.78349	11.79935	11.79028	0.001000
ARIMA (7,1,14)	Not significant	Significant	11.79571	11.80018	11.79111	0.000166
ARIMA (7,1,15)	Not significant	Not significant	11.78654	11.80101	11.79194	-0.000670
ARIMA (7,1,19)	Not significant	Not significant	11.78627	11.80074	11.791670	-0.000393
ARIMA (7,1,21)	Significant	Not significant	11.78329	11.79776	11.788690	0.002621
ARIMA (7,1,23)	Not significant	Not significant	11.78508	11.79955	11.790480	0.000817
ARIMA (7,1,24)	Not significant	Not significant	11.78723	11.80169	11.792620	-0.001361

ARIMA (7,1,25)	Not significant	Not significant	11.78619	11.80065	11.791580	-0.000300
ARIMA (7,1,26)	Not significant	Not significant	11.78729	11.80175	11.792680	-0.001422
ARIMA (7,1,27)	Not significant	Significant	11.78528	11.79975	11.790680	0.000628
ARIMA (7,1,28)	Not significant	Not significant	11.78742	11.80188	11.792810	-0.001554
ARIMA (7,1,32)	Not significant	Not significant	11.78687	11.80134	11.792270	-0.001000
ARIMA (8,1,1)	Not significant	Not significant	11.78733	11.80179	11.792720	-0.001463
ARIMA (8,1,2)	Not significant	Significant	11.78581	11.80027	11.791200	0.000059
ARIMA (8,1,5)	Not significant	Significant	11.78283	11.79730	11.788230	0.003041
ARIMA (8,1,9)	Not significant	Not significant	11.78685	11.80132	11.792250	-0.000988
ARIMA (8,1,13)	Not significant	Significant	11.78498	11.79944	11.790370	0.000910
ARIMA (8,1,14)	Not significant	Significant	11.78560	11.80006	11.790990	0.000286

ARIMA (8,1,15)	Not significant	Not significant	11.78664	11.80111	11.792040	-0.000770
ARIMA (8,1,19)	Not significant	Not significant	11.78639	11.80086	11.791790	-0.000516
ARIMA (8,1,21)	Not significant	Significant	11.78300	11.79747	11.788390	0.002922
ARIMA (8,1,23)	Not significant	Not significant	11.78524	11.79970	11.790630	0.000062
ARIMA (8,1,24)	Not significant	Not significant	11.78730	11.80177	11.792700	-0.001434
ARIMA (8,1,25)	Not significant	Not significant	11.78637	11.80084	11.791770	-0.000488
ARIMA (8,1,26)	Not significant	Not significant	11.78737	11.80184	11.792770	-0.001508
ARIMA (8,1,27)	Not significant	Significant	11.78535	11.79981	11.790740	0.000561
ARIMA (8,1,28)	Not significant	Not significant	11.78745	11.80192	11.792850	-0.001591
ARIMA (8,1,32)	Not significant	Not significant	11.78688	11.80134	11.792270	-0.001001
Models	**AR**	**MA**	**Akaike Info Criterion**	**Schwartz Criterion**	**Hannan-Quinn Criterion**	**Adjusted R^2**

ARIMA (9,1,1)	Not significant	Not significant	11.78709	11.80156	11.792490	-0.001225
ARIMA (9,1,2)	Significant	Not significant	11.78564	11.80010	11.791030	0.000230
ARIMA (9,1,5)	Not significant	Significant	11.78282	11.79728	11.788210	0.003058
ARIMA (9,1,9)	Significant	Significant	11.78523	11.79970	11.790630	0.000656
ARIMA (9,1,13)	Not significant	Significant	11.78477	11.79924	11.790170	0.001115
ARIMA (9,1,14)	Not significant	Not significant	11.78558	11.80004	11.790970	0.000304
ARIMA (9,1,15)	Not significant	Not significant	11.78637	11.80084	11.791770	-0.000499
ARIMA (9,1,19)	Not significant	Not significant	11.78612	11.80059	11.791520	-0.000239
ARIMA (9,1,21)	Not significant	Significant	11.78287	11.79734	11.788270	0.003044
ARIMA (9,1,23)	Not significant	Not significant	11.78504	11.79951	11.790440	0.000855
ARIMA (9,1,24)	Not significant	Not significant	11.78706	11.80153	11.792460	-0.001193

ARIMA (9,1,25)	Not significant	Not significant	11.78605	11.80051	11.791440	-0.000160
ARIMA (9,1,26)	Not significant	Not significant	11.78708	11.80155	11.792480	-0.001217
ARIMA (9,1,27)	Not significant	Not significant	11.78522	11.79969	11.790620	0.000681
ARIMA (9,1,28)	Not significant	Not significant	11.78720	11.80167	11.792600	-0.001340
ARIMA (9,1,32)	Not significant	Not significant	11.78672	11.80119	11.792120	-0.000847
ARIMA (10,1,1)	Not significant	Not significant	11.78747	11.80193	11.792860	-0.001604
ARIMA (10,1,2)	Not significant	Significant	11.78593	11.80039	11.791320	-0.000060
ARIMA (10,1,5)	Not significant	Significant	11.78307	11.79754	11.788470	0.002802
ARIMA (10,1,9)	Not significant	Not significant	11.78701	11.80148	11.792410	-0.001144
ARIMA (10,1,13)	Not significant	Significant	11.78509	11.79956	11.790490	0.000793

ARIMA (10,1,14)	Not significant	Significant	11.78580	11.80027	11.791200	0.000076
ARIMA (10,1,15)	Not significant	Not significant	11.78684	11.80130	11.792230	-0.000967
ARIMA (10,1,19)	Not significant	Not significant	11.78655	11.80101	11.791940	-0.000669
ARIMA (10,1,21)	Not significant	Significant	11.78336	11.79782	11.788750	0.002560
ARIMA (10,1,23)	Not significant	Not significant	11.78539	11.79986	11.790790	0.000506
ARIMA (10,1,24)	Not significant	Not significant	11.78744	11.80190	11.792830	-0.001573
ARIMA (10,1,25)	Not significant	Not significant	11.78647	11.80094	11.791870	-0.000590
ARIMA (10,1,26)	Not significant	Not significant	11.78750	11.80197	11.792900	-0.001640
ARIMA (10,1,27)	Not significant	Significant	11.78557	11.80003	11.790960	0.000338
ARIMA (10,1,28)	Not significant	Not significant	11.78759	11.80206	11.792990	-0.001727

ARIMA (10,1,32)	Not significant	Not significant	11.78708	11.80155	11.792480	-0.001206
ARIMA (11,1,1)	Not significant	Not significant	11.78759	11.80205	11.792980	-0.001726
ARIMA (11,1,2)	Not significant	Significant	11.78618	11.80064	11.791570	-0.000313
ARIMA (11,1,5)	Not significant	Significant	11.78315	11.79762	11.788550	0.002722
ARIMA (11,1,9)	Not significant	Not significant	11.78711	11.80158	11.792510	-0.001250
ARIMA (11,1,13)	Not significant	Significant	11.78529	11.79976	11.790690	0.000589
ARIMA (11,1,14)	Not significant	Significant	11.78592	11.80038	11.791310	-0.000371
ARIMA (11,1,15)	Not significant	Not significant	11.78685	11.80132	11.792250	-0.000984
ARIMA (11,1,19)	Not significant	Not significant	11.78659	11.80106	11.791990	-0.000715
ARIMA (11,1,21)	Significant	Not significant	11.78355	11.79802	11.788950	0.002365

ARIMA (11,1,23)	Not significant	Not significant	11.78543	11.79990	11.790830	0.000467
ARIMA (11,1,24)	Not significant	Not significant	11.78755	11.80202	11.792950	-0.001688
ARIMA (11,1,25)	Not significant	Not significant	11.78655	11.80102	11.791950	-0.000667
Models	**AR**	**MA**	**Akaike Info Criterion**	**Schwartz Criterion**	**Hannan-Quinn Criterion**	**Adjusted R^2**
ARIMA (11,1,26)	Not significant	Not significant	11.78761	11.80208	11.793010	-0.001747
ARIMA (11,1,27)	Not significant	Significant	11.78561	11.80008	11.791010	0.000293
ARIMA (11,1,28)	Not significant	Not significant	11.78772	11.80219	11.793120	-0.001860
ARIMA (11,1,32)	Not significant	Not significant	11.78723	11.80170	11.792630	-0.001361
ARIMA (13,1,1)	Significant	Not significant	11.78527	11.79973	11.790660	0.000618
ARIMA (13,1,2)	Significant	Significant	11.78361	11.79809	11.789020	0.002262
ARIMA (13,1,5)	Significant	Significant	11.78111	11.95580	11.786510	0.004772

ARIMA (13,1,9)	Not significant	Significant	11.78475	11.79922	11.790150	0.001138
ARIMA (13,1,13)	Not significant	Not significant	11.78534	11.79981	11.790740	0.000541
ARIMA (13,1,14)	Significant	Not significant	11.78372	11.79819	11.789120	0.002174
ARIMA (13,1,15)	Significant	Not significant	11.78438	11.79884	11.789770	0.001517
ARIMA (13,1,19)	Significant	Not significant	11.78429	11.79875	11.789680	0.001608
ARIMA (13,1,21)	Significant	Significant	11.78099	11.79545	11.789680	0.004945
ARIMA (13,1,23)	Significant	Not significant	11.78316	11.79763	11.788560	0.002754
ARIMA (13,1,24)	Significant	Not significant	11.78521	11.79968	11.790610	0.000673
ARIMA (13,1,25)	Significant	Not significant	11.78428	11.79874	11.789670	0.001626
ARIMA (13,1,26)	Significant	Not significant	11.78524	11.79971	11.790640	0.000644
ARIMA	Significant	Significant	11.78324	11.79770	11.788630	0.002986

(13,1,27)						
ARIMA (13,1,28)	Significant	Not significant	11.78535	11.79982	11.790750	0.000535
ARIMA (13,1,32)	Significant	Not significant	11.78491	11.79937	11.790300	0.000986
ARIMA (15,1,1)	Not significant	Not significant	11.78690	11.80137	11.792300	-0.001033
ARIMA (15,1,2)	Significant	Not significant	11.78523	11.79970	11.790630	0.000641
ARIMA (15,1,5)	Not significant	Significant	11.78257	11.79703	11.787960	0.003311
ARIMA (15,1,9)	Not significant	Not significant	11.78640	11.79180	11.791800	-0.000526
ARIMA (15,1,13)	Not significant	Significant	11.78442	11.79888	11.789810	0.001477
ARIMA (15,1,14)	Not significant	Significant	11.78526	11.79973	11.790660	0.000627
ARIMA (15,1,15)	Not significant	Not significant	11.78682	11.80128	11.792210	-0.000942
ARIMA (15,1,19)	Not significant	Not significant	11.78592	11.80038	11.791310	-0.000033

ARIMA (15,1,21)	Not significant	Significant	11.78267	11.79714	11.788070	0.003250
ARIMA (15,1,23)	Not significant	Not significant	11.78479	11.79925	11.790180	0.001118
ARIMA (15,1,24)	Not significant	Not significant	11.78682	11.80128	11.792210	-0.000942
ARIMA (15,1,25)	Not significant	Not significant	11.78583	11.80030	11.791230	0.000062
ARIMA (15,1,26)	Not significant	Not significant	11.78692	11.80138	11.792310	-0.001045
ARIMA (15,1,27)	Not significant	Not significant	11.78508	11.79955	11.790480	0.000827
ARIMA (15,1,28)	Not significant	Not significant	11.78700	11.80146	11.792390	-0.001126
ARIMA (15,1,32)	Not significant	Not significant	11.78648	11.80095	11.791880	-0.000598
ARIMA (17,1,1)	Not significant	Not significant	11.78773	11.80220	11.793130	-0.001874
ARIMA (17,1,2)	Not significant	Significant	11.78621	11.80068	11.791610	-0.000346

ARIMA (17,1,5)	Not significant	Significant	11.78338	11.79775	11.788680	0.002589
ARIMA (17,1,9)	Not significant	Not significant	11.78725	11.80171	11.792640	-0.001384
ARIMA (17,1,13)	Not significant	Significant	11.78541	11.79988	11.790810	0.000473
ARIMA (17,1,14)	Not significant	Significant	11.78599	11.80046	11.791390	-0.000112
ARIMA (17,1,15)	Not significant	Not significant	11.78701	11.80148	11.792410	-0.001140
ARIMA (17,1,19)	Not significant	Not significant	11.78675	11.80122	11.792140	-0.000873
Models	**AR**	**MA**	**Akaike Info Criterion**	**Schwartz Criterion**	**Hannan-Quinn Criterion**	**Adjusted R^2**
ARIMA (17,1,21)	Not significant	Significant	11.78360	11.79807	11.789000	0.002313
ARIMA (17,1,23)	Not significant	Not significant	11.78554	11.80000	11.790930	0.000362
ARIMA (17,1,24)	Not significant	Not significant	11.78769	11.80216	11.793090	-0.001829
ARIMA (17,1,25)	Not significant	Not significant	11.78677	11.80124	11.792170	-0.000891

ARIMA (17,1,26)	Not significant	Not significant	11.78777	11.80233	11.793160	-0.001904
ARIMA (17,1,27)	Not significant	Significant	11.78575	11.80022	11.791150	0.000154
ARIMA (17,1,28)	Not significant	Not significant	11.78785	11.80232	11.793250	-0.001989
ARIMA (17,1,32)	Not significant	Not significant	11.78732	11.80179	11.792720	-0.001446
ARIMA (19,1,1)	Not significant	Not significant	11.78666	11.80113	11.792060	-0.000786
ARIMA (19,1,2)	Not significant	Significant	11.78527	11.79974	11.790670	0.000605
ARIMA (19,1,5)	Not significant	Significant	11.78238	11.79685	11.787780	0.003503
ARIMA (19,1,9)	Not significant	Not significant	11.78615	11.80061	11.791540	-0.000267
ARIMA (19,1,13)	Not significant	Significant	11.78434	11.79880	11.789730	0.001558
ARIMA (19,1,14)	Not significant	Not significant	11.78512	11.79958	11.790510	0.000773

ARIMA (19,1,15)	Not significant	Not significant	11.78592	11.80038	11.791310	-0.000033
ARIMA (19,1,19)	Not significant	Not significant	11.78665	11.80112	11.792050	-0.000772
ARIMA (19,1,21)	Not significant	Significant	11.78278	11.79724	11.788170	0.003144
ARIMA (19,1,23)	Not significant	Not significant	11.78468	11.79914	11.790070	0.001230
ARIMA (19,1,24)	Not significant	Not significant	11.78468	11.80106	11.791990	-0.000716
ARIMA (19,1,25)	Not significant	Not significant	11.78557	11.80004	11.790970	0.000327
ARIMA (19,1,26)	Not significant	Not significant	11.78665	11.80111	11.792040	-0.000769
ARIMA (19,1,27)	Not significant	Not significant	11.78471	11.79917	11.790100	0.001210
ARIMA (19,1,28)	Not significant	Not significant	11.78675	11.80121	11.792140	0.000869
ARIMA (19,1,32)	Not significant	Not significant	11.78633	11.80079	11.791720	-0.000442

ARIMA (20,1,1)	Not significant	Not significant	11.78705	11.80151	11.792440	-0.001176
ARIMA (20,1,2)	Not significant	Significant	11.78551	11.79998	11.790910	0.000365
ARIMA (20,1,5)	Not significant	Significant	11.78281	11.79728	11.788210	0.003066
ARIMA (20,1,9)	Not significant	Not significant	11.78660	11.80107	11.792000	-0.000726
ARIMA (20,1,13)	Not significant	Significant	11.78471	11.79918	11.790110	0.001179
ARIMA (20,1,14)	Not significant	Significant	11.78532	11.79979	11.790710	0.000566
ARIMA (20,1,15)	Not significant	Not significant	11.78641	11.80087	11.791800	-0.000527
ARIMA (20,1,19)	Not significant	Not significant	11.78602	11.80049	11.791420	-0.000133
ARIMA (20,1,21)	Not significant	Significant	11.78285	11.79732	11.788250	0.003073
ARIMA (20,1,23)	Not significant	Not significant	11.78459	11.79906	11.789990	0.001325

ARIMA (20,1,24)	Not significant	Not significant	11.78704	11.80151	11.792440	-0.001167
ARIMA (20,1,25)	Not significant	Not significant	11.78624	11.80071	11.791640	-0.000355
ARIMA (20,1,26)	Not significant	Not significant	11.78711	11.80158	11.792510	-0.001238
ARIMA (20,1,27)	Not significant	Significant	11.78508	11.79954	11.790470	0.000838
ARIMA (20,1,28)	Not significant	Not significant	11.78719	11.80166	11.792590	-0.001324
ARIMA (20,1,32)	Not significant	Not significant	11.78664	11.80111	11.792040	-0.000761
ARIMA (25,1,1)	Not significant	Not significant	11.78671	11.80118	11.792110	-0.000833
ARIMA (25,1,2)	Not significant	Significant	11.78494	11.79941	11.790330	0.000948
ARIMA (25,1,5)	Not significant	Significant	11.78239	11.79685	11.787780	0.003501
ARIMA (25,1,9)	Not significant	Not significant	11.78617	11.80064	11.791570	-0.000290
Models	**AR**	**MA**	**Akaike Info Criterion**	**Schwartz Criterion**	**Hannan-Quinn Criterion**	**Adjusted R^2**

ARIMA (25,1,13)	Not significant	Significant	11.78440	11.79886	11.789790	0.001502
ARIMA (25,1,14)	Not significant	Significant	11.78479	11.79926	11.790180	0.001114
ARIMA (25,1,15)	Not significant	Not significant	11.78592	11.80038	11.791310	-0.000025
ARIMA (25,1,19)	Not significant	Not significant	11.78566	11.80013	11.791060	0.000233
ARIMA (25,1,21)	Not significant	Significant	11.78248	11.79694	11.787870	0.003458
ARIMA (25,1,23)	Not significant	Not significant	11.78435	11.79881	11.789740	0.001573
ARIMA (25,1,24)	Not significant	Not significant	11.78688	11.80115	11.792080	-0.000798
ARIMA (25,1,25)	Significant	Significant	11.78399	11.79846	11.789390	0.003798
ARIMA (25,1,26)	Not significant	Not significant	11.78677	11.80124	11.792170	-0.000890
ARIMA (25,1,27)	Not significant	Significant	11.78452	11.79899	11.789920	0.001408

ARIMA (25,1,28)	Not significant	Not significant	11.78678	11.80125	11.792170	-0.000897
ARIMA (25,1,32)	Not significant	Not significant	11.78627	11.80073	11.791660	-0.000374
ARIMA (34,1,1)	Not significant	Not significant	11.78754	11.80201	11.792940	-0.001680
ARIMA (34,1,2)	Not significant	Significant	11.78610	11.80057	11.791500	-0.000232
ARIMA (34,1,5)	Not significant	Significant	11.78314	11.79761	11.788540	0.002734
ARIMA (34,1,9)	Not significant	Not significant	11.78705	11.80152	11.792450	-0.001184
ARIMA (34,1,13)	Not significant	Significant	11.78527	11.79974	11.790670	0.000615
ARIMA (34,1,14)	Not significant	Significant	11.78582	11.80028	11.791210	0.000068
ARIMA (34,1,15)	Not significant	Not significant	11.78678	11.80125	11.792180	-0.000908
ARIMA (34,1,19)	Not significant	Not significant	11.78654	11.80100	11.791930	-0.000656

ARIMA (34,1,21)	Not significant	Significant	11.78356	11.79802	11.788950	0.002359
ARIMA (34,1,23)	Not significant	Not significant	11.78535	11.79982	11.790750	0.000550
ARIMA (34,1,24)	Not significant	Not significant	11.78750	11.80196	11.792890	-0.001629
ARIMA (34,1,25)	Not significant	Not significant	11.78654	11.80100	11.791930	-0.000649
ARIMA (34,1,26)	Not significant	Not significant	11.78757	11.80204	11.792970	-0.001703
ARIMA (34,1,27)	Not significant	Not significant	11.78557	11.80003	11.790960	0.000345
ARIMA (34,1,28)	Not significant	Not significant	11.78766	11.80212	11.793050	-0.001793
ARIMA (34,1,32)	Not significant	Not significant	11.78716	11.80163	11.792560	-0.001284
ARIMA (35,1,1)	Not significant	Not significant	11.78654	11.80100	11.791930	-0.000645
ARIMA (35,1,2)	Not significant	Significant	11.78521	11.79967	11.790600	0.000682

ARIMA (35,1,5)	Not significant	Significant	11.78223	11.79670	11.787620	0.003667
ARIMA (35,1,9)	Not significant	Not significant	11.78607	11.80053	11.791460	-0.000172
ARIMA (35,1,13)	Significant	Not significant	11.78427	11.79873	11.789660	0.001641
ARIMA (35,1,14)	Not significant	Significant	11.78498	11.79944	11.790370	0.000926
ARIMA (35,1,15)	Not significant	Not significant	11.78584	11.80031	11.791240	0.000059
ARIMA (35,1,19)	Not significant	Not significant	11.78565	11.80012	11.791050	0.000251
ARIMA (35,1,21)	Not significant	Significant	11.78270	11.79717	11.788190	0.003230
ARIMA (35,1,23)	Not significant	Not significant	11.78432	11.79878	11.789710	0.001612
ARIMA (35,1,24)	Not significant	Not significant	11.78652	11.80099	11.791920	-0.000627
ARIMA (35,1,25)	Not significant	Not significant	11.78554	11.80001	11.790940	0.000371

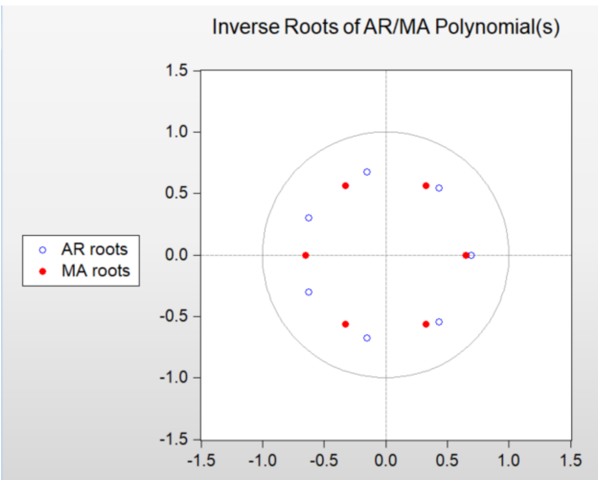
ARIMA (35,1,26)	Not significant	Not significant	11.78653	11.80100	11.791930	-0.000636
ARIMA (35,1,27)	Not significant	Significant	11.78452	11.79899	11.789910	0.001417
ARIMA (35,1,28)	Not significant	Not significant	11.78688	11.80114	11.792070	-0.000785
ARIMA (35,1,32)	Not significant	Not significant	11.78624	11.80070	11.791630	-0.000340

Stage 3 – Diagnostic

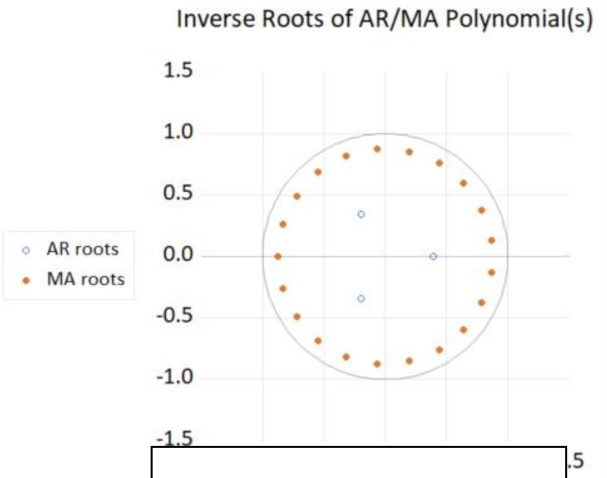
The Ljung-Box Q statistic is a statistical test used to determine whether a time series is a random process with no correlation or not. In this study, the Ljung-Box Q statistic was used to examine the stationarity and invertibility of the AR and MA roots of the PSEi closing and opening time series data.

The results of the test indicate that the AR roots lie inside the unit circle, which is a necessary condition for covariance stationarity. Additionally, the MA roots also lie inside the unit circle, indicating that the time series data is invertible.

Overall, the results suggest that both the PSEi closing and opening time series data are covariance stationary and invertible, indicating that they can be modeled effectively using AR(I)MA models. These findings provide important insights for future time series analysis and forecasting of the PSEi levels.



Philippine Stock Exchange Index During the Opening



Philippine Stock Exchange Index During the Closing

Stage 4 – Forecasting

The analysis of the time series presented in Figure 4 reveals a complex pattern of fluctuations that occurred between 2017 and 2019, with a range of values between 8,000 and 6,000. Despite these fluctuations, an upward trend is observed. However, the time series experienced a significant decline between 2019 and 2020, with the value dropping as low as 4,000. The series then returned to the range of 6,000 and 8,000 between 2020 and 2023.

To analyze the time series and make future predictions, the AR(I)MA model (7,1,6) was used. This model takes into account the lagged values of the time series and the first difference of the series to capture any trend or seasonality in the data.

Based on the AR(I)MA model, the analysis of the time series and the forecasting result suggest that the opening stock is expected to remain stable in the next few years, with values ranging from 6,000 to 8,000. This information provides a basis for further analysis and decision-making based on the data.

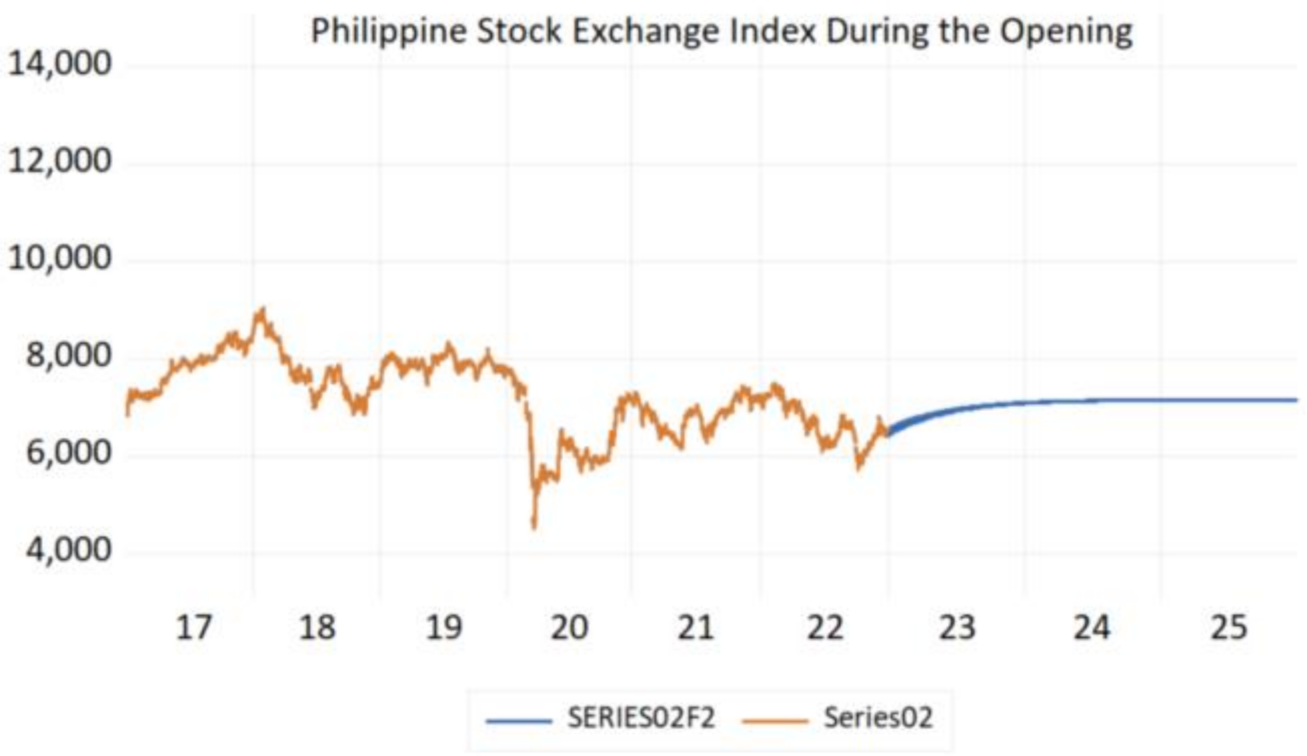


Figure 4. PSEi During the Opening

In figure 5, the analysis of the graph shows that there was a gradual increase in stock from 2017 to early 2018, with the value ranging from 7,000 to 9,000. However, the stock declined sharply in late 2018 and remained relatively stable at around 7,000 until the end of 2019. In 2020, the stock declined sharply again, falling from 7,000 to 5,000. The stock then continued to decline gradually from 2021 to 2022.

To analyze the time series and make future predictions, the AR(I)MA model (3,1,21) was used. This model takes into account the lagged values of the time series and the first difference of the series, capturing any trends or seasonality in the data.

To make future predictions based on this data, the ARIMA model was used. The results of the model predict that the stock will further increase from 2022 to 2025, with a value of around 7,000. This suggests that the stock is expected to remain stable during the forecast period.

Figure 5. The PSEi During the Closing

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