IJCS International Journal of Community Service
ISSN 2961-7162 (online)
https://ejournal.ipinternasional.com/index.php/ijcs

OPEN ACCESS

Vol. 02, No. 01, 2021

DOI : 10.55299/ijcs.v1i2.220

Comparative Study of Stock Price Forecasting Models PT. Unilever Indonesia Tbk Using Arima and Garch

Maya Citra
STEBIS Al Ulum Terpadu Medan

ABSTRACT

The purpose of this study is to know the comparison of forecasting models in predicting the stock price of PT. Unilever Indonesia Tbk. In this study, there are 2 forecasting models, namely ARIMA and GARCH forecasting. The population in this study is data on the daily closing price of PT. Unilever Indonesia Tbk for the period January 2018 to June 2021, so the sample in this study is 1090 time series data. The results showed that the best forecasting model to predict the stock price of PT. Unilever Indonesia Tbk, namely ARIMA (1,1,1) and GARCH (1,1). In the ARIMA model (1,1,1) there are assumptions that are not met, namely the assumption of homoscedasticity or in the model there is an element of heteroscedasticity so that the GARCH (1,1) model with MAPE 1.91% is selected as the best forecasting model to predict stock prices of PT. Unilever Indonesia Tbk.

Keywords: Stock prices, ARIMA, GARCH

Received:	Revised:	Accepted:	Available online:
05.04.2021	22.04.2021	09.05.2021	30.06.2021

Suggested citations:

Citra, M. (2021). Comparative Study of Stock Price Forecasting Models PT. Unilever Indonesia Tbk Using Arima and Garch. *International Journal of Community Service, 02* (01), 1-22. DOI: 10.55299/ijcs.v1i2.220

Open Access | URLs:
https://ejournal.ipinternasional.com/index.php/ijcs/OpenAccessPolicy

INTRODUCTION

Throughout 2021 the global economy faces various challenges, including: rising energy prices, supply chain disruptions *and* the ongoing Evergrande crisis in China and risks affecting Indonesian capital flows, such as *tapering off* The FED and an increase in new cases, namely active variants Delta early Quarter III-2021. The governments of each country respond quickly to mitigate the risk of the Delta variant and remain optimistic until the end of the year. With the re-entry of foreign capital flows into developing countries will help increase the global stock index 2021. Where the Composite Stock Price Index (IHSG) has risen to a level of 6,500 at the end of 2021. Initially, the growth rate for the JCI recorded a new record of 6,723 on 22 November 2021 , surpassed the JCI before the COVID-19 pandemic. Then, the number of investors in the capital market also increased by 92.7% to 7.48 million investors after December 29, 2021, compared to 3.88 million investors before the end of December 2020 (ekon.go.id, 2021) .

The manufacturing industry is a group of companies that produce and sell raw materials, materials and semi-finished products. The role of the manufacturing industry in Indonesia is very important, because it has become one of the industries that increases Indonesia's economic growth and its ability to increase a country's foreign exchange by producing tradable goods, creating jobs, increasing exports and attracting foreign investment.

According to the Ministry of Industry, in the second quarter of 2021, the manufacturing sector made a significant contribution to the country's Gross Domestic Product (GDP) reaching 17.34%. The top two contributors from the manufacturing sector are the food and beverage industry (6.66%) and chemical, pharmaceutical and traditional medicine (1.96%). The total contribution to the GDP of the two industries is 8.62% and the manufacturing industry is the highest source of growth despite pressure from the COVID-19 pandemic (www.bkpm.go.id, 2021) .

One of the companies engaged in manufacturing is PT. Unilever Indonesia Tbk (UNVR) which is one of the largest companies in Indonesia engaged in the production of consumer goods for the cosmetics and household industries and is one of the largest *Fast Moving Consumer Goods* (FMCG) companies in Indonesia, primarily engaged in the production, marketing and distribution of goods consumer. Even though the manufacturing sector is currently in an expansionary zone and is one of the main contributors to the country's GDP in the second quarter of 2021. However, for PT. Unilever Indonesia Tbk (UNVR) is now in the public spotlight.

In Fundamental analysis PT. Unilever Indonesia Tbk (UNVR) is a stock that has good fundamentals, this can be seen clearly over a period of 35 years Unilever Indonesia's share performance has continued to increase from the start after conducting an *Initial Public Offering* (IPO) on January 11, 1982 to 2017. Unilever is one of the *Blue Chip shares* incorporated in LQ45. Shares belonging to the *Blue Chip stock category* are stocks with a large market capitalization of over 40 trillion. *Blue Chip* shares are included in the superior stock category because they have a stock value that tends to be stable and is believed to have a smaller risk. Even though it is one of the

Blue Chip shares, Unilever is currently experiencing a decline in financial performance (Hendarsih & Harjunawati, 2020) .

Literature Review

A. Theory Used

1. *Capital market*

According to (Mustapa & Ismail, 2019) the capital market is a place for various tradable long-term financial products, including bonds, *stocks* /shares, mutual funds, derivatives and other products. The Capital Market is a very interesting place because of the dynamic sale of shares. Stock prices always fluctuate due to various economic factors, such as inflation and the consumer price index.

2. *Share*

According to PT Bursa Efek Indonesia, (2021) Stocks are the most well-known financial market product. Offer attractive benefits. With companies issuing shares is one of the decisions taken by companies when they need funds for the company. According to Nurulhuda et al., (2021) Shares are securities that prove ownership of a company. If the company is profitable, investors are entitled to receive a portion of the company's wealth and profits in the form of dividends.

From this understanding, it can be concluded that shares are a sign of one's ownership and prove the participation of capital in a company with the hope of getting profits in the long term. According to the Indonesian Stock Exchange PT, (2021) Basically, there are two advantages that investors get by buying or owning shares .

3. *Stock price*

According to Nelwan et al., (2020) share price is the price created by the company's capabilities and market conditions that occur in the secondary market. The share price is the price per share in the capital market. According to Susanti & Wirakusuma, (2021) share price is the value of a piece of paper issued by the company, which informs the financial position, with other forms of intent the success of implementing *financial management* is measured by rising or falling stock prices.

4. *Forecasting*

According to Gunawan & Astika, (2021) forecasting is a science that is used to predict something in the future using historical data. According to Satria (2021) forecasting is an estimate for future testing with past data. In social life it is too difficult to predict accurately, so forecasting is needed.

According to Ruamiana et al., (2018) *Forecasting* is the art and science of predicting future events by examining historical data with a view to finding systematic relationships, trends and patterns. According to Ariyanto et al., (2020) forecasting is a calculation analysis technique that can be carried out using both qualitative and quantitative approaches to predict future events using previous data references.

5. ARIMA (Autoregressive Integrated Moving Average)

According to Gunawan & Astika, (2021) the *Autoregressive Integrated Moving Average* (ARIMA) method is a method for increasing short-term forecasting accuracy that uses historical data patterns from the dependent variable as a basis for predicting the value of the dependent variable in the future by ignoring independent variables in making forecasts.

According to Salwa et al., (2018) the ARIMA method (*Autoregressive Integrated Moving Average*) is a method used for short-term forecasting. The ARIMA method has a good level of accuracy for short-term forecasting. If used for long-term forecasting this method is not good for forecasting, because the forecasting value will tend to be constant for a fairly long period.

METHOD

A. Types of research

The research conducted is *Descriptive Research* using data quantitative. According to Sugiyono, (2019) the descriptive research method is one of the methods used to determine the value of one or more independent variables without having to compare them with other variables. The aim of this research is to be able to predict the stock price of PT. Unilever Indonesia Tbk.

B. Sampling technique

According to Sugiyono, (2019) the *sampling* technique is a sampling technique. The *sampling* technique used in this study is a *nonprobability sampling technique* with a saturated *sampling technique.* According to Sugiyono, (2019) the saturated *sampling* technique is a sampling technique that uses all members of the population as samples. UNVR daily closing price data for the period January 2018 to June 2021 totaling 1090 *time series data* is the sample in this study.

C. Data Analysis Method

The data analysis method in this study uses the ARIMA and GARCH methods to be able to predict UNVR's stock price. There are several steps that must be taken in predicting UNVR's stock price using the ARIMA and GARCH methods .

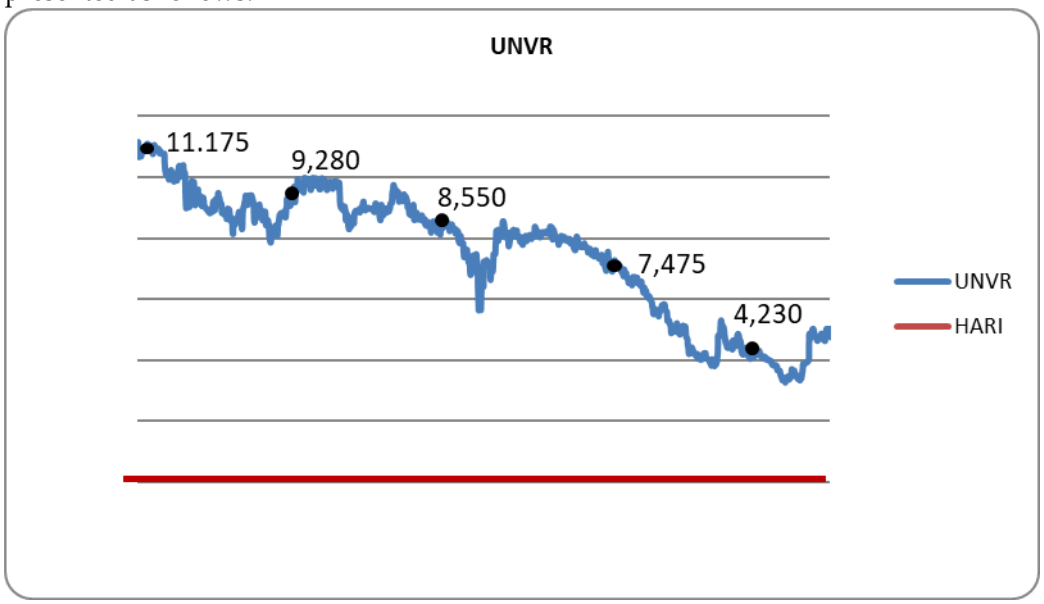
RESULTS AND DISCUSSION

A. Description of Research Variables

PT. Unilever Indonesia Tbk (UNVR) which is one of the largest companies in Indonesia engaged in the production of consumer goods for the cosmetics and household industries and is one of the largest *Fast Moving Consumer Goods* (FMCG) companies in Indonesia, primarily engaged in the production, marketing and distribution of goods consumer.

PT. Unilever Indonesia Tbk is a manufacturing company in the cosmetics and household goods sub-sector and is one of the *Blue Chip shares* incorporated in LQ45. This is certainly an attraction for investors to choose Unilever as a stock investment.

Variable Development of PT. Unilever Indonesia Tbk from 2018 to 2021 can be presented as follows:



Source: Data processed, 2021

Figure 4. 1Development of the Variable Share Price of PT. Unilever Indonesia Tbk for the period January 2018- January 2021

Based on Figure 4.3 it can be seen that the share price of PT. Unilever Indonesia Tbk on January 2 2018 amounted to 11,175 and then dropped to 9,280 on January 2 2019. According to Akbar, (2021) the share price of PT. Unilever Indonesia Tbk experienced a decline in 2019 due to negative sentiment about the Unilever company which stated that there was an economic slowdown in South Asia, which is one of Unilever's largest markets. This caused Unilever shares traded on the London stock exchange to suffer a loss of 6%. Unwittingly, this negative sentiment had an impact on the share price of PT. Unilever in Indonesia because many investors sold Unilever shares coupled with the company's net profit that fell. One of the reasons for the decline in profits is the decline in the company's revenue, in addition to that, the cost of goods sold has increased from the previous Rp. 5.25 trillion to Rp. 5.35 trillion (Wareza, 2019) .

B. Share Price Forecasting PT. Unilever Indonesia Tbk Using the Arima Model

In this section, we will discuss the processing of data on the share price of PT. Unilever Indonesia Tbk in daily units from January 2018 to June 2021 using the ARIMA method using *Eviews* 12 software. The steps taken are as follows:

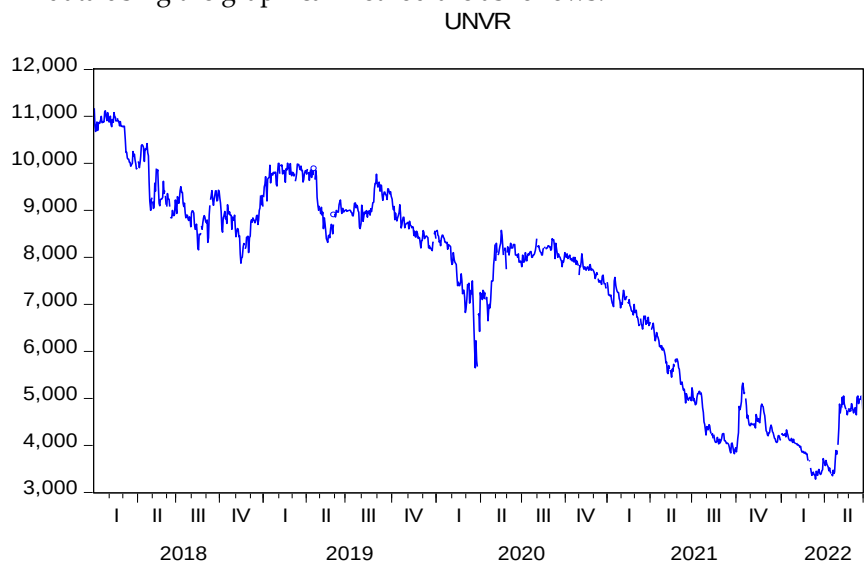
1. *Model Identification*

a. Data Stationarity

This study conducted a stationarity test using the graphical method and the *Augmented Dickey-Fuller test* (ADF *Test*).

1) Graph Method

To see the stationarity of the data can be done with the graphical method. The results of the stationarity test of Unilever's stock price data using the graphical method are as follows:



Source: Data processed, 2021

Figure 1 Stationary Test of Unilever Stock Price Data using the Graphical Method

Based on Figure 4.4 it can be seen that the plot of data obtained shows an up and down trend and does not focus on the median value which indicates that Unilever's share price data is not stationary.

2) *Augmented Dickey-Fuller* Test (ADF *Test*)

Based on the test with the graphical method, it is known that the data is not stationary. Based on the ADF test, the stationarity of Unilever's share price data can be seen as follows:

Table 1 ADF Test *At Level*

Null Hypothesis: UNVR has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=36)

		t-Statistics	Prob.*
Augmented Dickey-Fuller test statistics		-1.427604	0.5699
Test critical values:	1% levels	-3.436138	
	5% levels	-2.863984	
	10% levels	-2.568122	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(UNVR)
Method: Least Squares
Date: 08/09/22 Time: 10:29
Sample (adjusted): 1/03/2018 6/30/2021
Included observations: 1089 after adjustments

Variables	coefficient	std. Error	t-Statistics	Prob.
UNVR(-1)	-0.002985	0.002091	-1.427604	0.1537
C	16.59536	16.33640	1.015852	0.3099

R-squared	0.001871	Mean dependent var	-5.881543
Adjusted R-squared	0.000953	SD dependent var	143.8702
SE of regression	143.8016	Akaike info criterion	12.77658
Sum squared resid	22477959	Schwarz criterion	12.78575
Likelihood logs	-6954,848	Hannan Quinn Criter.	12.78005
F-statistics	2.038053	Durbin-Watson stat	2.127469
Prob(F-statistic)	0.153693		

Source: Processed data, 2021

According to (Cerelia et al., 2021) the standard for determining whether or not a data is stationary is the ADF (*Augmented Dickey - Fuller*) value. If the ADF value is greater than the critical value, then H0 is accepted, which means there is a unit root and it is not stationary. Conversely, if the ADF value is less than the critical value of 5% then H0 is rejected which means there is no unit root and the data is stationary. In addition, whether a data is stationary or not can be seen through the *prob** where if the *prob* * <0.05 then the data is said to be stationary. Based on Table 4.1, it is known that the ADF value for Unilever's share price variable has a value of (-1.427604) > a critical value of 5% (-3.436138) then a *prob* value* of 0.5699 > 0.05 so it is concluded that the data is not stationary at levels.

2. *Parameter Estimation*

After knowing several potential ARIMA models, parameter estimation is then carried out for these models. The estimation results of the ARIMA model parameters (1,1,0) are as follows:

Table 2 ARIMA Model Parameter Estimation (1,1,0)

Dependent Variable: D(UNVR)
Method: ARMA Maximum Likelihood (OPG - BHHH)
Date: 08/04/22 Time: 16:45
Sample: 1/03/2018 6/30/2021
Included observations: 1089
Convergence achieved after 12 iterations

Coefficient covariance is computed using outer product of gradients

Variables	coefficient	std. Error	t-Statistics	Prob.
C	-5.849939	4.287985	-1.364263	0.1728
AR(1)	-0.068986	0.022230	-3.103285	0.0020
SIGMASQ	20581.74	472.8647	43.52563	0.0000

R-squared	0.004733	Mean dependent var	-5.881543
Adjusted R-squared	0.002900	SD dependent var	143.8702
SE of regression	143.6614	Akaike info criterion	12.77555
Sum squared residue	22413510	Schwarz criterion	12.78931
Likelihood logs	-6953.287	Hannan -Quinn criter .	12.78076
F-statistics	2.582396	Durbin-Watson stat	2.002438
Prob (F-statistic)	0.076057		

Inverted AR Roots	-.07

Source: Data processed, 2021

Based on Table 2 , it can be seen that the results of the AR coefficient (1) are -0.068986 , the t - *statistic* value is -3.103285 and the *prob** value is 0.0020 . Based on the analysis, it is known that the ARIMA parameter (1,1,0) is suitable for forecasting because the model parameter has a *prob* value* of less than 0.05.

3. Best Model Selection

Based on the results of parameter estimation of the potential ARIMA model, the best ARIMA model was selected which can be used to forecast Unilever's share price. According to Putri & Aghsilni (2019), choosing the best model can be done by looking at the smallest value of the *Akaike Information Criterion* (AIC), *Schwartz criterion* (SC) and *Hannan-Quinn Criterion* (HQC). The following is a table of AIC, SC and HQC values:

Table 3 Comparison table of AIC, SC and HQC values

ARIMA models (p,d,q)	AIC value	SC value	HQC value
ARIMA(1,1,0)	12.77555	12.78931	12.78076
ARIMA(0,1,1)	12.77476	12.78851	12.77996
ARIMA(1,1,1)	12.77383	12.7 8 217	12.7 7 077

Source: Data processed, 2021

Table 3 shows that the smallest AIC, SC and HQC values are in the ARIMA model (1,1,1) with an AIC value of 12.77383 , SC of 12.7 8 217 and HQC of 12.7

7 077 , it can be concluded that the best model is ARIMA (1 ,1,1) and will be used for the next stage.

4. *Diagnostic Checking*

The *diagnostic checking* stage is the checking and testing stage whether the model fits the data and meets the requirements of a good forecasting model by examining the residual *white noise assumption.* Examination of residual *white noise* is carried out to determine whether the variance is constant or not. This test uses the *Ljung-Box test statistic. The Ljung-Box* statistical test of the ARIMA model (1,1,1) is as follows:

Table 4. *Ljung-Box* ACF and PACF Data Patterns

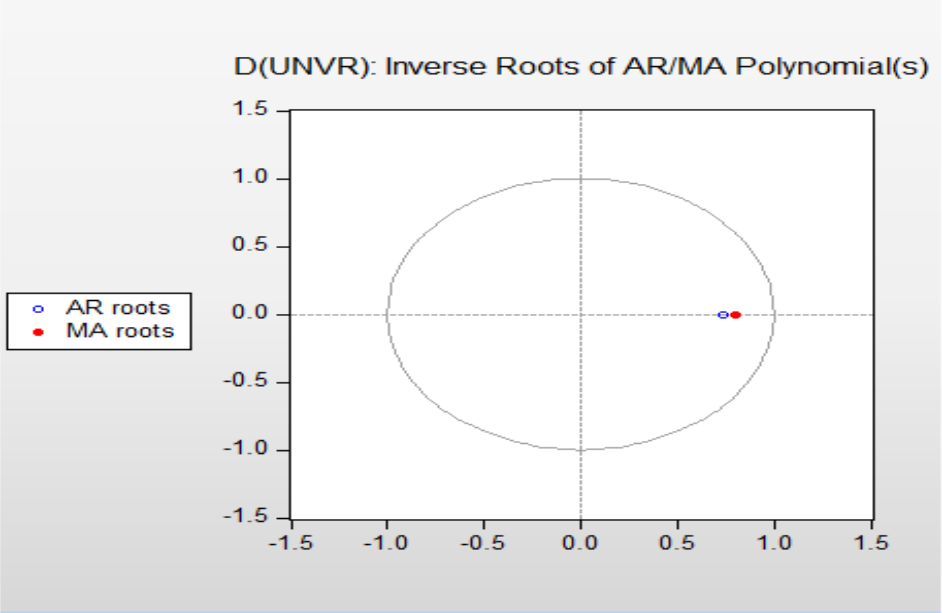
Date: 08/09/22 Time: 21:06
Sample (adjusted): 1/03/2018 6/30/2022
Q-statistic probabilities adjusted for 2 ARMA terms

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.012	-0.012	0.1652	
		2	-0.028	-0.028	0.9990	
		3	0.064	0.063	5.4479	0.020
		4	0.015	0.016	5.7090	0.058
		5	0.012	0.016	5.8626	0.118
		6	-0.014	-0.017	6.0835	0.193
		7	0.011	0.009	6.2169	0.286
		8	-0.026	-0.029	6.9480	0.326
		9	-0.070	-0.069	12.411	0.088
		10	-0.037	-0.042	13.924	0.084
		11	-0.005	-0.006	13.950	0.124
		12	-0.010	-0.003	14.054	0.171
		13	0.081	0.090	21.226	0.031
		14	0.004	0.010	21.244	0.047
		15	-0.009	-0.003	21.326	0.067
		16	0.013	0.002	21.526	0.089
		17	-0.036	-0.044	22.956	0.085
		18	0.050	0.040	25.689	0.059
		19	0.006	0.001	25.732	0.079
		20	0.020	0.024	26.196	0.095
		21	0.034	0.035	27.499	0.094
		22	-0.039	-0.027	29.221	0.083
		23	0.003	0.006	29.233	0.109
		24	-0.006	-0.011	29.268	0.137
		25	-0.004	-0.004	29.287	0.171
		26	0.073	0.065	35.225	0.065
		27	0.027	0.034	36.022	0.071
		28	-0.041	-0.031	37.924	0.062
		29	-0.013	-0.017	38.109	0.076
		30	-0.049	-0.050	40.799	0.056
		31	0.032	0.023	41.914	0.057
		32	0.033	0.033	43.128	0.057
		33	0.030	0.039	44.164	0.059
		34	0.015	0.012	44.420	0.071
		35	-0.032	-0.016	45.605	0.071
		36	-0.033	-0.039	46.868	0.070

Source: Data processed, 2021

Based on Table 4. it can be seen that the bar graphs on ACF and PACF do not cross the *Bartlett line* so it can be concluded that this model is quite good and meets the classification for forecasting. Furthermore, to see whether the model contains *white noise* can also be done by looking at AR *Roots* and MA *Roots.* If the AR *Roots* and MA *Roots points* are in the unit *circle* , it means that

the data does not have *white noise.* The modulus value of the AR *Roots* and MA *Roots* must be less than 1 so as not to have *white noise.* The following are the results of examining *white noise* by looking at the *inverse roots* of AR/MA in graphical and tabular form:



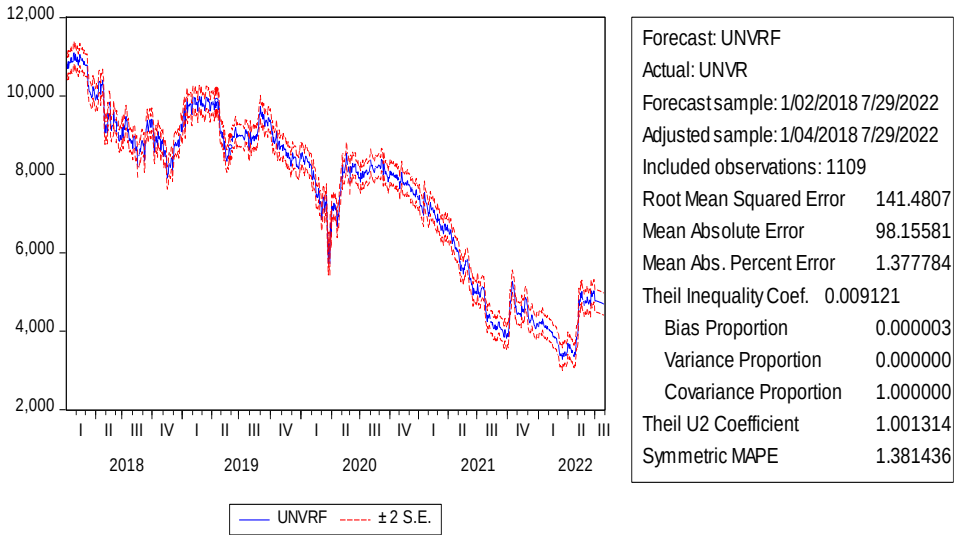
Source: Data processed, 2021

Figure 2 Polynomial Point AR/MA *Roots*

Based on Figure 2 , it can be seen that the AR *Roots* and MA *Roots* points are all in the unit circle, which means that the data does not have *white noise.* Thus it can be concluded that the variance value is constant and the data is good enough so that *forecasting is not problematic.*

5. *Forecasting*

Using the best model that has been selected and has passed the *diagnostic checking process* , forecasting the stock price of PT. Unilever Indonesia Tbk for the next 30 periods which are presented in the following chart:

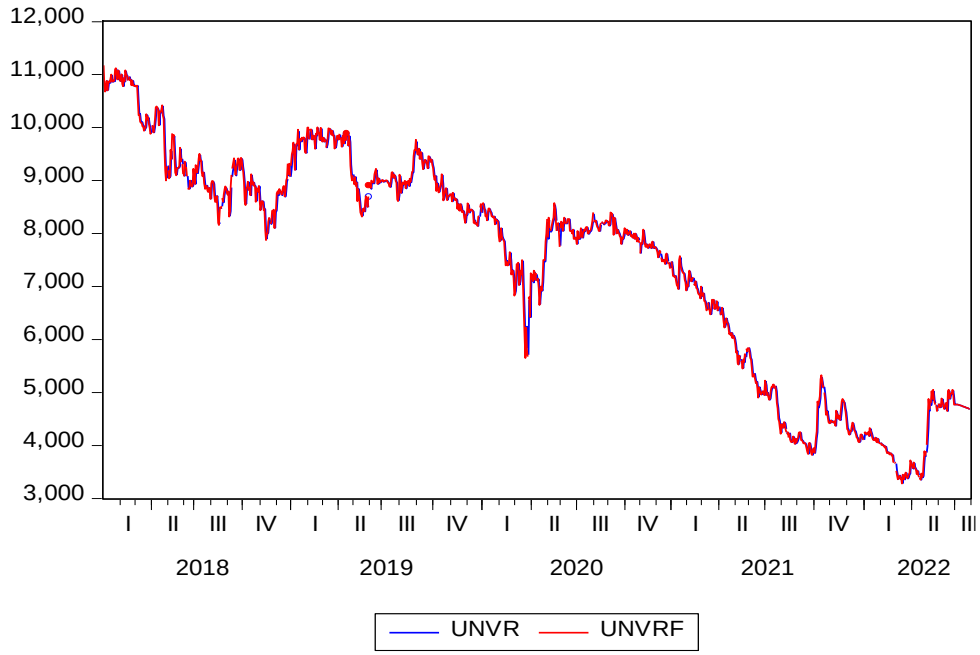


Source: Data processed, 2021

Figure 3 Forecasting Results of PT. Unilever Indonesia Tbk with ARIMA Model (1,1,1)

Based on Figure 4.7 it can be seen that the results of forecasting the stock price of PT. Unilever Indonesia Tbk using ARIMA (1,1,1) obtained an RMSE value of 140.9100, an MAE value of 97.36569 and a MAPE value of 1.366693. Of these three criteria, MAPE was chosen because it has the smallest criterion value, so it can be concluded that the forecasting results are very significant and have a very small *error* .

6. *Share Value Validation PT. Unilever Indonesia Tbk*



Source: Data processed, 2021

Figure 4. Comparison of Actual Value and Forecasted Value of PT. Unilever Indonesia Tbk

Based on Figure 4.8 it can be seen that the estimated results of the stock price forecasting of PT. Unilever Indonesia Tbk for the next 30 periods tends to experience a decline. Forecasting results follow the actual value line in each period, which means that the forecasting results have the same value as the actual value of PT. Unilever Indonesia Tbk.

According to Rahmawati et al., (2021) to find out the accuracy of the ARIMA method in predicting PT. Unilever Indonesia Tbk can be seen using the *Mean Absolute Percentage Error* (MAPE) by comparing the actual value and the forecast value. To compare it can use *Microsoft Excel.*

D. Heteroscedasticity Testing

In this section, we will discuss the processing of PT. Unilever Indonesia Tbk in daily units from January 2018 to June 2021 using the GARCH method using Eviews12 *software* . The steps taken are as follows:

1. *Identification of Heteroscedasticity Effects*

After obtaining the best ARIMA model, the next step is testing the effect of heteroscedasticity on the residual squared the best model is the ARIMA model (1,1,1).

Table 5. Identification of ARCH Effects

Heteroskedasticity Test: ARCH

F-statistics	22.41350	Prob. F(1.1086)	0.0000
Obs*R-squared	22.00072	Prob. Chi-Square(1)	0.0000

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 08/10/22 Time: 12:30
Sample (adjusted): 1/04/2018 6/30/2021
Included observations: 1088 after adjustments

Variables	coefficient	std. Error	t-Statistics	Prob.
C	17493.17	1767697	9.896022	0.0000
RESID^2(-1)	0.141920	0.029977	4.734290	0.0000

R-squared	0.020211	Mean dependent var	20402.94
Adjusted R-squared	0.019319	SD dependent var	55205.17
SE of regression	54669.32	Akaike info criterion	24.65783

Sum squared resid	3.25E+12	Schwarz criterion	24.66701
Likelihood logs	-13411.86	Hannan Quinn Criter.	24.66130
F-statistics	22.41350	Durbin-Watson stat	2.048502
Prob(F-statistic)	0.000002		

Source: Data processed, 2021

Based on Table 5 , it can be seen that the results of the *Chi-square prob** 0.0000 <0.05 means that H0 is rejected, then the model has an element of heteroscedasticity or has an ARCH *effect* on the data . The existence of heteroscedasticity problems makes the assumptions of ARIMA not fulfilled, so the forecast is continued to the GARCH model.

2. *GARCH Model Identification*

To find out *the lag* in GARCH modeling, it can be used by looking at the *Autocorrelation Function* (ACF) and *Partial Correlation Function* (PACF) plots of the squared residuals of the AR(1) and MA(1) models. The results of the ACF and PACF plots are used to identify the p and q orders so that p and q will be chosen in the GARCH model.

3. *Parameter Estimation*

After knowing several potential GARCH models, parameter estimation of these models is then carried out. The parameter estimation results of the ARCH (1) and GARCH (1,1) models are as follows:

Table 6 Estimation of ARCH Model Parameters (1)

Dependent Variable: D(UNVR)
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 08/10/22 Time: 18:00
Sample (adjusted): 1/04/2018 6/30/2021
Included observations: 1088 after adjustments
Convergence achieved after 26 iterations
Coefficient covariance is computed using outer product of gradients
MA Backcast: 1/03/2018
Presample variance: backcast (parameters = 0.7)
GARCH = C(4) + C(5)*RESID(-1)^2

Variables	coefficient	std. Error	z-Statistics	Prob.
C	-4.847131	2.310164	-2.098176	0.0359
AR(1)	0.702084	0.044719	15.69991	0.0000
MA(1)	-0.822429	0.033593	-24.48238	0.0000
Variances Equations				
C	13458.04	559.9091	24.03612	0.0000
RESID(-1)^2	0.388548	0.043759	8.879341	0.0000
R-squared	-0.001989	Mean dependent var		-5.542279

Adjusted R-squared	-0.003836	SD dependent var	143.4999
SE of regression	143.7749	Akaike info criterion	12.67200
Sum squared resid	22428261	Schwarz criterion	12.69494
Likelihood logs	-6888569	Hannan Quinn Criter.	12.68068
Durbin-Watson stat	1.892439		
Inverted AR Roots	.70		
Inverted MA Roots	.82		

Source: Data processed, 2021

Based on Table 6 it can be seen that the probability value of the ARCH model (1) is 0.0000 <0.05. Based on the analysis, it is known that the ARCH (1) model is suitable for forecasting because the model parameters have a probability value of less than 0.05.

4. *Best Model Selection*

Based on the results of parameter estimation of the potential ARCH (1) and GARCH (1,1) models, the best GARCH model was selected which can be used to predict the stock price of PT. Unilever Indonesia Tbk According to Putri & Aghsilni, (2019) choosing the best model can be done by looking at the smallest value of the *Akaike Information Criterion* (AIC), *Schwartz criterion* (SC) and *Hannan-Quinn Criterion* (HQC). The following is a table of AIC, SC and HQC values:

Table 7 Comparison Table of AIC, SC and HQC values

GARCH model (p,q)	AIC value	SC value	HQC value
ARCH (1,0)	12.67200	12.69494	12.68068
GARCH (1,1)	12.56468	12.59221	12.57510

Source: Data processed, 2021

Table 7 shows that the smallest AIC, SC and HQC values are found in the GARCH model (1.1) with an AIC value of 12.56468, SC of 12.59221 and HQC of 12.57510, it can be concluded that the best model is GARCH (1.1) and will be used for the next stage.

5. *ARCH-LM test*

After obtaining the best GARCH model, the next step is to do the ARCH-LM test on the GARCH model (1,1) to see whether there is an element of heteroscedasticity. If there is no element of heteroscedasticity in the model, this model is the best model and can be used for forecasting.

Table 8 ARCH-LM Test

Heteroskedasticity Test: ARCH

F-statistics	0.249703Prob. F(1.1085)	0.6174
Obs*R-squared	0.250105Prob. Chi-Square(1)	0.6170

Test Equation:
Dependent Variable: WGT_RESID^2
Method: Least Squares
Date: 08/20/22 Time: 20:37
Sample (adjusted): 1/05/2018 6/30/2021
Included observations: 1087 after adjustments

Variables	coefficient	std. Error	t-Statistics	Prob.
C	0.985795	0.069596	14.16453	0.0000
WGT_RESID^2(-1)	0.015168	0.030355	0.499703	0.6174

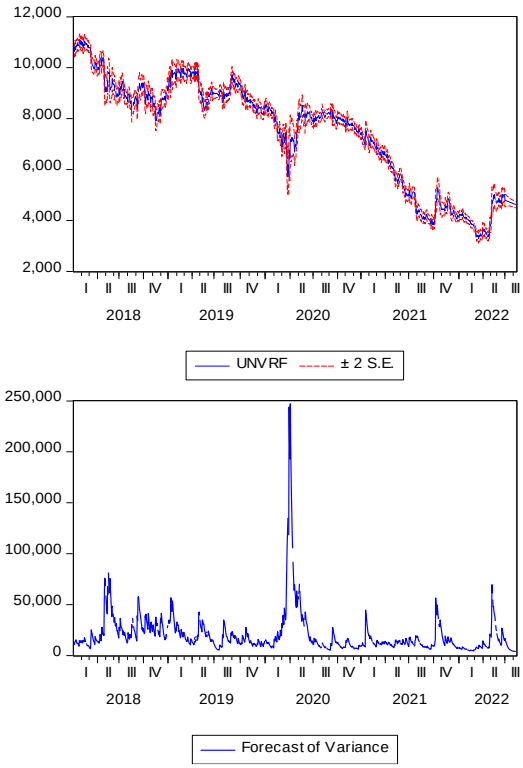
R-squared	0.000230	Mean dependent var	1.000951
Adjusted R-squared	-0.000691	SD dependent var	2.064487
SE of regression	2.065201	Akaike info criterion	4.290170
Sum squared resid	4627584	Schwarz criterion	4.299354
Likelihood logs	-2329,707	Hannan Quinn Criter.	4.293646
F-statistics	0.249703	Durbin-Watson stat	1.998808
Prob(F-statistic)	0.617386		

Source: Data processed, 2021

Based on Table 8 , the results of the ARCH-LM test can be seen that the *prob* Chi-square* result is 0.6170 > 0.05, meaning that H0 is not rejected, so there are no heteroscedasticity problems. This shows that the GARCH model (1,1) was selected as a model that does not contain elements of heteroscedasticity, which means that the model is the best forecasting model and can be used for the forecasting stage.

6. *Forecasting*

Using the best model that has been selected and has passed the *diagnostic checking process* , forecasting the stock price of PT. Unilever Indonesia Tbk for the next 30 periods which are presented in the following chart:



Forecast: UNVRF	
Actual: UNVR	
Forecast sample: 1/02/2018 8/11/2022	
Adjusted sample: 1/04/2018 8/11/2022	
Included observations: 1118	
Root Mean Squared Error	141.0299
Mean Absolute Error	97.00828
Mean Abs. Percent Error	1.362524
Theil Inequality Coef.	0.009116
Bias Proportion	0.000052
Variance Proportion	0.000005
Covariance Proportion	0.999947
Theil U2 Coefficient	1.003259
Symmetric MAPE	1.366125

Source: Processed data, 2021

Figure 5 Forecasting Results of PT. Unilever Indonesia Tbk with GARCH Model (1,1)

Based on Figure 4.9 it can be seen that the results of forecasting the stock price of PT. Unilever Indonesia Tbk using GARCH (1.1) obtained a RMSE value of 141.0299, an MAE value of 97.00828 and a MAPE value of 1.362524. Of these three criteria, MAPE was chosen because it has the smallest criterion value, so it can be concluded that the forecasting results are very significant and have a very small *error* .

E. Discussion

Based on the results of data processing that has been carried out using the ARIMA and GARCH methods to predict the stock price of PT. Unilever Indonesia Tbk is known that the ARIMA model (1,1,1) is the best model that can predict UNVR for the next 30 periods. ARIMA (1,1,1) is able to predict the stock price of PT. Unilever Indonesia Tbk accurately because it has a MAPE value of 1.69%, which means the accuracy of forecasting using this model is 98.31%. This proves that forecasting the stock price of PT. Unilever Indonesia Tbk uses daily data with the ARIMA method which is very appropriate to do. However, in modeling the share price data of PT. Unilever Indonesia Tbk using ARIMA has an element of heteroscedasticity so that forecasting continues using the GARCH model. The GARCH model (1,1) is the best model that can predict the stock price of PT. Unilever Indonesia Tbk for the next 30

periods. GARCH (1.1) has a prediction error rate in the MAPE measure of 1.91% which indicates that the forecasting accuracy is 98.09%.

Based on the MAPE value from *Forecasting* ARIMA and GARCH it was found that the MAPE ARIMA value (1,1,1) was 1.69% and the MAPE value GARCH (1,1) is 1.91%, it can be concluded that ARIMA *forecasting* (1,1,1) has a lower MAPE value compared to GARCH *forecasting MAPE value* (1,1) so if based on MAPE values, ARIMA *forecasting is more* better than *forecasting* GARCH in predicting the stock price of PT. Unilever Indonesia Tbk. However, in the ARIMA model there are assumptions that are not met, namely the assumption of homoscedasticity or in the model there is an element of heteroscedasticity. Heteroscedasticity is a condition where the variance and residual data varies or is not constant for each period. If this research is continued using the ARIMA model, the ability or precision of forecasting will change from time to time. So the residual variance will vary depending on how big the residual is in the past. Related to the volatility in Unilever's stock price data, the ARIMA model will be inappropriate to use if the residual variance still contains heteroscedasticity, so you have to use the GARCH model. Where the GARCH model is a model that includes the possibility of non-constant residual variance or heteroscedasticity modeling. The GARCH model looks at the pattern of variance in the residuals so that the model formed becomes more precise with a constant variance. Therefore the best forecasting method was chosen, namely GARCH even though the MAPE value obtained was greater than ARIMA. This is because in the ARIMA model there are assumptions that are violated, namely homoscedasticity.

The results of this study are in line with the results of research by Kanal et al., (2018) which also used daily closing price data to predict the Beta Value of the Pefindo25 Index Stock which stated that GARCH (1.1) for ARNA, GARCH (1.1) for SMSM and GARCH (1.4) for TOTL is appropriate because it has good forecasting abilities in overcoming the problem of heteroscedasticity in the data. The results of this study are also in line with Chi's research, (2018) , which uses daily closing price data for the Shanghai Composite Index which states that GARCH (1.1) is more effective in estimating and forecasting the volatility of stock returns on the Chinese stock market. However, this study is not in line with the research of Junaid et al., (2020) which used data on daily closing prices for ADRO and PTBA shares which stated that the ARIMA model was better than the GARCH model.

Throughout the research period data, Unilever's share price fluctuated greatly due to several factors, including a decline in financial performance, the Covid-19 pandemic, coupled with an increase in raw materials, especially for oil and CPO as well as various negative sentiments in the market, causing Unilever's share price performance to continue to decline. so it is very difficult for investors to predict, but research using the GARCH model is able to predict Unilever's share price precisely because it can overcome volatility problems in data.

The use of the GARCH model as a forecasting method has been proven to be a good and appropriate choice for forecasting containing elements of heteroscedasticity and appropriate for short-term forecasting, so that the use of the GARCH method can be said to be included in investment analysis, namely technical analysis. Where technical analysis is an investment analysis that is widely used by investors who make short-term investments because it is practical to predict stock movements based only

on historical charts of stock price movements. Therefore, this research will be useful for investors and the public who wish to invest in the capital market because it can assist in making investment decisions.

CONCLUSION

The results showed that the best GARCH model for predicting the stock price of PT. Unilever Indonesia Tbk namely GARCH (1,1). GARCH (1,1) can predict the stock price of PT. Unilever Indonesia Tbk very well because the value of the forecast results is not much different from the actual value. This is also proven by looking at the accuracy of the GARCH model (1.1) using MAPE which has a result of 1.91, which means that the accuracy of forecasting is 98.09%.

Thank-you note

Thanks to all those who helped write this article.

REFERENCES

Akbar, A. (2021). *UNVR Stock Split, Here's the Stock Condition and Recommendations [Latest]* . Retrieved 03 September 2022, from Https://Lifepal.Co.Id/. https://lifepal.co.id/media/saham-unvr-After-stock-split-apakah-layak-dikoleksi/

Arianto, BW (2017). *Forecasting the Number of Train Passengers in Java and Sumatra Using Arima Box-Jenkins* [Institute of Technology Ten November]. http://repository.its.ac.id/43384/

Ariyanto, Y., Ananta, AY, & Darwis, MR (2020). Goods Sales Forecasting Information System Using Double Exponential Smoothing Method (Case Study of Vegetable Palace). *Polinema Informatics Journal* , *6* (3), 9–14. https://doi.org/10.33795/jip.v6i3.283

Cahyaningdyah, D., & Faidah, F. (2017). Analysis of the Effect of Trading Days on Stock Returns on the Indonesia Stock Exchange: Tests Using Garch (Generalized Autoregressive Conditional Heteroskedasticity). *Ekspektra: Journal of Business and Management* , *1* (1), 1–10. https://doi.org/10.25139/ekt.v1i1.84

Cerelia, JJ, Sitepu, AA, Azzahra, TS, & Pontoh, RS (2021). Forecasting Daily Closed Stock Prices Using ARIMA and ARCH-GARCH Methods Case Study of PT. Indofood CBP Sukses Makmur Tbk. *Online Statistical National Seminar* . https://doi.org/https://doi.org/10.1234/pns.vi.29

Cermak, V. (2017). Can Bitcoin Become a Viable Alternative to Fiat Currencies? An Empirical Analysis of Bitcoin's Volatility Based on a GARCH Model. *SSRN Electronic Journal* . https://doi.org/10.2139/ssrn.2961405

Chi, W. (2018). Stock Price Short-term Forecasting Based On GARCH Model. *Mechanical, Electronic, Control and Automation Engineering (MECAE)* , *149* (March), 8–12. https://doi.org/10.2991/mecae-18.2018.7

Chowdhury, TU, & Islam, MS (2021). ARIMA Time Series Analysis in Forecasting

Daily Stock Price of Chittagong Stock Exchange (CSE). *International Journal of Research and Innovation in Social Science* , *05* (06), 214–233. https://doi.org/10.47772/ijriss.2021.5609

Deviana, S., Nusyirwan, Azis, D., & Ferdias, P. (2021). *Analysis of Autoregressive Model Integrated Moving Average Time Series Data Using Moment Method as Parameter Estimation* . *02* (02), 57–67. https://doi.org/http://dx.doi.org/10.23960%2Fjsm.v2i2.2812

Diana, & Khadijah. (2019). Jrak Journal of Accounting and Business Research. *Distance Journal of Accounting and Business Research* , *5* (1), 1–10. https://doi.org/https://doi.org/10.38204/jrak.v8i1.693

Dwi Arini, SK, Afendi, FM, & Silvianti, P. (2021). Handling Outliers in Forecasting Time Series Data Using Holt and Robust Holt Smoothing Methods. *Xplore: Journal of Statistics* , *10* (2), 112–128. https://doi.org/10.29244/xplore.v10i2.205

ekon.go.id. (2021). *Coordinating Minister for Airlangga: In 2021, Dominate Domestic Investors, Strengthen Capital Market Fundamentals against External Risk - Coordinating Ministry for Economic Affairs of the Republic of Indonesia* . Retrieved from March 19, 2022, from https://ekon.go.id/publikasi/detail/3572/menko-airlangga-di-2021-dominated-investor-domestik-perkuat-fundamental-pasar-modal-terhadap-risiko-eksternal

Faydian, P., Hasana, AE, Irfan, M., & Taqiyyuddin, TA (2021). Application of the ARCH / GARCH Model to Predict the Stock Price of Tokai Carbon Companies. *Journal of Mathematical Sciences and Statistics* , *7* (2), 50–61. https://doi.org/https://dx.doi.org/10.24014/jsms.v7i2.13138

Febriyanti, GA (2020). The impact of the Covid-19 pandemic on stock prices and trading volume activity (Case study of LQ-45 shares on the Indonesia Stock Exchange). *Indonesia Accounting Journal* , *2* (2), 204. https://doi.org/10.32400/iaj.30579

Ghozali, I., & Ratmono, D. (2017). Multivariate analysis and econometrics: theory, concepts, and applications with EVIEWS 10. In *Semarang: Diponegoro University Publishing Agency* (2nd ed.).

Gunawan, D., & Astika, W. (2022). The Autoregressive Integrated Moving Average (ARIMA) Model for Predicting the Jakarta Composite Index. *Journal of Business Economics Informatics* , *4* (January 2020), 2–7. https://doi.org/10.37034/infeb.v4i1.114

Hendarsih, I., & Harjunawati, S. (2020). CLASSIFICATION OF BLUE CHIP SHARE BASED ON MARKET CAPITALIZATION ON THE INDONESIAN STOCK EXCHANGE, 2017-2020. *FAMOUS CHAMPIONS* , *5* (May), 115–133. http://www.akrabjuara.com/index.php/akrabjuara/article/view/1030

Junaid, MT, Juliana, A., & Sabrina, H. (2020). Comparative Study of the Arima and Garch Models for Predicting Share Prices in Mining Companies in Indonesia. *Journal of Finance and Banking (IF)* , *10* (1), 83–98. https://doi.org/10.34010/jika.v10i1.3331

Kanal, FA, Manurung, T., & Prang, JD (2018). Application of the Garch Model (Generalized Autoregressive Conditional Heteroscedasticity) in Calculating the Pefindo Index Stock Beta Value25. *Scientific Journal of Science* , *18* (2), 67. https://doi.org/10.35799/jis.18.2.2018.19732

kontan.co.id. (2020). *Unilever's (UNVR) Share Price Continues to Fall, This Says Analysts* . Retrieved 03 September 2022, from Https://Investasi.Kontan.Co.Id/. https://investasi.kontan.co.id/news/harga-saham-unilever-unvr-terus-turun-begini-kata-analis

Kufel, T. (2020). ARIMA-based forecasting of the dynamics of confirmed Covid-19 cases for selected European countries. *Equilibrium. Quarterly Journal of Economics and Eco- Nomic Policy* , *15* (2), 181–204. https://doi.org/10.24136/eq.2020.009

Kushartanti, R., & Latifah, M. (2020). Autoregressive Integrated Moving Average (ARIMA) as a Dengue Hemorrhagic Fever Case Forecasting Model. *Journal of Environmental Health* , *10* (2), 76–80. https://doi.org/10.47718/jkl.v10i2.1165

Malkan, Indra Kurniawan, Nurdin, & Noval. (2021). The Effect of Knowledge of the Islamic Capital Market on Interest in Stock Investment in the Islamic Capital Market. *Journal of Islamic Banking and Finance* , *3* (1), 57–73. https://doi.org/10.24239/jipsya.v3i1.39.57-78

Maulana, HA (2018). Time Series Modeling and Rainfall Forecasting at Twelve Stations in Bogor. *Journal of Statistical and Computational Mathematics* , *15* (1), 50. https://doi.org/10.20956/jmsk.v15i1.4424

Melani, A. (2021). *UNVR Shares Have Dropped Since 2018, This Says Analysts* . Www.Liputan6 News.Com. https://www.liputan6.com/saham/read/4553768/saham-unvr-merosot-sejak-2018-ini-kata-analis

Mustapa, FH, & Ismail, MT (2019). Modeling and forecasting the S&P 500 stock prices using the hybrid Arima-Garch Model. *Journal of Physics: Conference Series* , *1366* (1). https://doi.org/10.1088/1742-6596/1366/1/012130

Nelwan, R., Sjahruddin, H., & Sohilauw, MI (2020). Profitability and Solvability Effects on Manufacturing Company Stock Prices. *JSMBI Indonesian Journal of Management and Business Science* , *10* (1), 10–17. https://doi.org/https://doi.org/10.32528/jsmbi.v10i1.3195

Ngantung, M., & Jan, AH (2019). Forecasting Analysis of Antibiotic Drug Demand at Edelweis Tatelu Pharmacy. *EMBA Journal: Journal of Economics, Management, Business and Accounting Research* , *7* (4), 4859–4867. https://doi.org/https://doi.org/10.35794/emba.v7i4.25439

Nizar, M., & Syuabi, M. (2020). *Capital Market Investment Instruments in Indonesia* (A. Rakhmawati (ed.); 1st ed.). Yudharta Press.

Nurulhuda, ES, Lutfiati, A., & Setiawan, T. (2022). Analysis of Stock Prices for Automotive and Component Companies on the Indonesia Stock Exchange. In *Journal of Economics and Business* (Vol. 4, Issue 1). https://doi.org/https://doi.org/10.34005/kinerja.v4i1.1793

ocbcnisp.com. (2022). *Definition of Stock Prices, Methods of Analysis and Factors of Change* . Retrieved April 20, 2022, from https://www.ocbcnisp.com/en/article/2022/01/05/harga-saham-ada

Indonesia Stock Exchange PT. (2022). *Learn Capital Markets* . Retrieved April 4, 2022, from https://www.idx.co.id/investhub/belajar-pasar-modal/

PT Unilever Indonesia Tbk (UNVR.JK) Interactive Stock Chart - Yahoo Finance . (2022). Retrieved 03 July 2022, from https://finance.yahoo.com/quote/UNVR.JK/chart

Son. (2022). *Unilever Stock Price (UNVR) Stuck? Time to Buy?* Retrieved 03 September

2022, from https://www.cnbcindonesia.com/market/20220329104737-17-326825/harga-saham-unilever--unvr-- already-mentok-time-beli

Putri, DM, & Aghsilni. (2019). The Best Estimation Model For Forecasting PT. Polychem Indonesia Tbk. With Arima. *MAp Journal* , *1* (1), 1–12. https://doi.org/DOI: https://doi.org/10.15548/map.v1i2.1176

Rahmawati, YF, Zukhronah, E., & Pratiwi, H. (2021). *Application of the ARIMA-ARCH Model to Forecast the Share Price of PT Indofood Sukses Makmur Tbk* . *03* (03), 171–177. https://doi.org/https://doi.org/10.35899/biej.v3i3.307

Robial, SM (2018). Comparison of Statistical Models in the Analysis of Time Series Forecasting Methods (Case Study: PT. Telekomunikasi Indonesia, Tbk Kandatel Sukabumi). *SANTIKA Scientific Journal* , *8* (2), 1–17. https://doi.org/https://doi.org/10.37150/jsa.v8i2.400

Ruamiana, WB, Nangi, J., & Tajidun, L. (2018). Forecasting Application of the Number of Passengers of Lion Air Aircraft at Halu Oleo Airport Using the Least Square Method. *SemanTIK* , *4* (1), 151–160. https://doi.org/http://dx.doi.org/10.55679/semantik.v4i1.4468

Saluza, I. (2017). *GARCH Application in Overcoming Volatility in Financial Data* . *7* (2), 107–118. https://doi.org/10.24843/JMAT.2017.v07.i02.p87

Salwa, N., Tatsara, N., Amalia, R., & Zohra, AF (2018). *Bitcoin Price Forecasting Using the ARIMA (Autoregressive Integrated Moving Average) Method* . *1* (1), 21–31. https://doi.org/10.24815/jda.Vlil.11874

Satria, W. (2021). Backpropagation Neural Network For Product Sales Forecasting (Case Study in Metro Electronic and Furniture). *Djtechno: Information Technology Journal* , *1* (1), 14–19. https://doi.org/10.46576/djtechno.v1i1.966

Singh, S., Sundram, BM, Rajendran, K., Law, KB, Aris, T., Dass, SC, & Gill, BS (2020). *Forecasting daily confirmed COVID-19 cases in Malaysia using ARIMA models* . https://doi.org/10.3855/jidc.13116

Sugiyono, PD (2019). Educational Research Methods (Quantitative, Qualitative, Combination, R&d and Educational Research). In *Educational Research Methods* .

Susanti, NKR, & Wirakusuma, MG (2022). Financial Performance and Stock Price: Study of Mining Companies. *E-Jurnal of Accounting* , *32* (1), 3389. https://doi.org/10.24843/eja.2022.v32.i01.p06

Tandelilin, E. (2017). Capital market portfolio & investment management. In *Yogyakarta: PT Kanisius* .

Wareza, M. (2019). *Sales Dropped, Unilever's Profits Shrink 4% to IDR 1.74 T* . Retrieved 03 September 2022, from Https://Www.Cnbcindonesia.Com/. https://www.cnbcindonesia.com/market/20190426080244-17-68998/penjualan-turun-laba-unilever-ikut-susut-4-jadi-rp-174-t

www.bkpm.go.id. (2021). *Manufacturing Industry to Accelerate Indonesia's Economic Growth BKPM* . Retrieved March 20, 2022, from https://www.bkpm.go.id/en/publikasi/detail/berita/industri-manufaktur-untuk-percepatan-permbuh-ekonomi-indonesia

Yahaya, AE, Etuk, EH, & Emeka, A. (2021). Comparative Performance of ARIMA and GARCH Model in Forecasting Crude Oil Price Data. *Asian Journal of Probability and Statistics* , *15* (4), 251–275. https://doi.org/10.9734/ajpas/2021/v15i430378

Simanungkalit, B. A. (2019). Stop Contact Controlled By Android App Via Bluetooth. *Journal of Science Technology (JoSTec)*, *1*(1), 1–7. https://doi.org/10.55299/jostec.v1i1.45

Tri Isra Janwardi. (2019). Design of Digital Height Measurement Based Microcontroller AT89C51. *Journal of Science Technology (JoSTec)*, *1*(1), 29–35. https://doi.org/10.55299/jostec.v1i1.49

Tri Isra Janwardi. (2020). Design of Automatic Doors Using Body Temperature Sensors. *Journal of Science Technology (JoSTec)*, *2*(1), 36–41. https://doi.org/10.55299/jostec.v2i1.50

Azarya NJ Siahaan. (2021). PLTS Design for Big Industry Needs. *Journal of Science Technology (JoSTec)*, *3*(1), 68–74. https://doi.org/10.55299/jostec.v3i1.55

Published by IPI Global Press in collaboration with the Inovasi Pratama Internasional Ltd