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CLASSIFICATION ANALYSIS USING MINIMUM SPANNING TREE AND PREDICTIONS USING ARIMA ON THE MOST INFLUENTIAL STOCKS ON THE LQ45 INDEX

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ABSTRACT

The 2023 recession, largely driven by high inflation, highlights the importance of investing. The stock market, with its regulated framework and potential for significant returns, presents a viable investment option. The LQ45, an index tracking the top 45 Indonesian stocks by market capitalization, provides a benchmark. To identify promising investments, this study employed the Minimum Spanning Tree (MST) method to pinpoint the most influential stocks within the LQ45 network, followed by Auto-Regressive Integrated Moving Average (ARIMA) for price prediction. The MST analysis, utilizing degree centrality, closeness, and betweenness measures, identified BBNI as the most influential, followed by BBTN and BMRI. Price predictions for BBNI and BBTN exhibited close alignment with actual market prices, while BMRI showed a larger deviation. For BBNI shares, the ARIMA(1,0,0) model is used with a MAPE of 1.78%; for BBTN shares, the ARIMA(0,2,2) model is used with a MAPE of 2.65%; and for BMRI shares, the ARIMA(2,2,1) model is used with a MAPE of 1.84%. This research contributes to the field of stock market analysis by demonstrating the effectiveness of combining network analysis techniques, specifically the MST method, with time series forecasting models like ARIMA for stock selection. The findings provide valuable insights for investors seeking to navigate market volatility and make informed investment decisions. The findings of this research can serve as a valuable guide for investors considering BBNI, BBTN, and BMRI shares.

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1. INTRODUCTION

The strengthening issue of recession in 2023 is due to high inflation. Central banks in various countries raised interest rates, which resulted in a world recession getting closer [1]. One effective way to cope with a recession is by investing to generate additional income. The stock market is among the most attractive investment options due to its clear regulations and potentially high returns, although it also involves substantial risks. A stock represents ownership in a company, signifying that the holder is a partial owner of the issuing corporation. In the capital market, stocks play a vital economic role, widely utilized by companies to raise equity capital and by investors to explore global financial opportunities [2].

The large number of issuers issuing shares makes it difficult for many people to choose shares that have good prospects. One of the indices on the Indonesian Stock Exchange (BEI) is LQ45. The LQ45 index is a calculation of 45 issues on the IDX which were selected based on their large market capitalization value and have the highest number of transactions on the IDX [3]. Every 6 months, the LQ45 share position is updated in February and August. The LQ45 index was created as a complement to the Composite Stock Price Index (IHSG) to provide an objective and trusted means for financial analysts, investment managers, investors, and capital market observers to monitor stock price movements that are actively traded on the Indonesia Stock Exchange (BEI).

To analyze stock behavior within the LQ45 index, this research employs the Minimum Spanning Tree (MST) method. MST is a graph-theoretical approach that identifies the structure of relationships between stocks by constructing a network in which nodes (stocks) are connected with minimum total distance or dissimilarity. This method is effective in detecting influential stocks and clustering behavior in financial markets [4]. Studies by Mantegna [5] and Onnela et al. [6] have shown that MST can reveal hidden structures in complex financial systems by simplifying stock correlation matrices into tree-like topologies that are easier to interpret. Several studies have applied clustering-based methods for portfolio optimization. For example, Putjianto et al. [7] utilized the MST clustering technique with various weighting schemes and found that inverse variance weighting yielded the highest Sharpe ratio. This study applied the MST clustering method to form stock portfolios on the Indonesia Stock Exchange (IDX), using three different weighting schemes—classical weighting, inverse variance, and equal weighting. The results show that inverse variance weighting consistently provided the highest return and Sharpe ratio**,** indicating better risk-adjusted performance. Additionally, portfolios held for longer holding periods yielded better results compared to shorter-term holdings. The MST approach effectively identified stock clusters with strong correlations, enhancing portfolio diversification.

To complement the structural analysis provided by the MST method, this study also employs the Autoregressive Integrated Moving Average (ARIMA) model to forecast stock prices. ARIMA is a widely used time series forecasting technique that models the linear relationship between past values and forecasted values by incorporating autoregression (AR), differencing (I), and moving average (MA) components. It is particularly effective for financial time series data, where patterns such as trends and seasonality often occur. The ARIMA model helps in understanding the underlying temporal dynamics of stock prices and generating short-term forecasts that support investment decisions. According to Box and Jenkins [8], the ARIMA framework provides a robust approach to modeling non-stationary time series by first transforming them into stationary series through differencing. Several empirical studies, such as those by Atsalakis and Valavanis [9] and Wang et al. [10], have demonstrated the usefulness of ARIMA in forecasting stock indices and individual stock prices with a reasonable level of accuracy. Integrating ARIMA with MST clustering enhances both the structural insight and predictive power, providing a more comprehensive toolset for stock analysis and portfolio management.

Based on this background description, the author is interested in conducting research related to the application of the Minimum Spanning Tree (MST) method to stocks in the LQ45 index. The Minimum Spanning Tree (MST) method aims to determine a network of shares that are interconnected with other shares and to create or determine a network topology. This method will display the shares that have the greatest influence on the LQ45 index, and predictions will be made on the shares that have the greatest influence on the LQ45 index. Predictions on these shares aim to reduce the opportunity for mistakes in making decisions to invest in these shares. Predictions are made to see price

movements in shares; this is very important because the rise and fall of share prices greatly influence decision-making when investing. The prediction method used is the Autoregressive Integrated Moving Average (ARIMA). This method is very accurate in the short term, but on the other hand, for long-term predictions, this method is not very suitable.

2. METHODS

Material and Data

The data used is the LQ45 index dataset on the Indonesia Stock Exchange (BEI) for August 2022 – January 2023, taken from https://finance.yahoo.com. In the Minimum Spanning Tree (MST) method, the data used is weekly price data and weekly stock returns from the LQ45 index from January 2021 to December 2022. In the Auto-Regressive Integrated Moving Average (ARIMA) method, the data used is weekly stock prices starting from 12 September 2022 to 15 September 2023. The variable used consists of 45 shares included in the LQ45 index.

Table 1. List of LQ45 Index Share Company Names

No	Share Name	Stock code	No	Share Name	Stock code
1	Adaro Energy Indonesia Tbk.	ADRO	24	Indofood Sukses Makmur Tbk.	INDF
2	Sumber Alfaria Trijaya Tbk	AMRT	25	Indika Energy Tbk.	INDY
3	Aneka Tambang Tbk	ANTM	26	Indah Kiat Pulp & Paper Tbk.	INKP
4	Aneka Tambang Tbk	ARTO	27	Indocement Tunggal Prakarsa Tbk.	INTP
5	Astra International Tbk	ASII	28	Indo Tambangraya Megah Tbk.	ITMG
6	Astra International Tbk	BBCA	29	Japfa Comfeed Indonesia Tbk.	JPFA
7	Bank Negara Indonesia Persero Tbk.	BBNI	30	Kalbe Farma Tbk.	KLBF
8	Bank Rakyat Indonesia (Persero) Tbk.	BBRI	31	Merdeka Copper Gold Tbk.	MDKA
9	Bank Tabungan Negara (Persero) Tbk.	BBTN	32	Medco Energi Internasional Tbk	MEDC
10	BFI Finance Indonesia Tbk.	BFIN	33	Mitra Keluarga Karyasehat Tbk	MIKA
11	Bank Mandiri (Persero) Tbk	BMRI	34	Media Nusantara Citra Tbk.	MNCN
12	Bank Syariah Indonesia Tbk.	BRIS	35	Perusahaan Gas Negara Tbk.	PGAS
13	Barito Pacific Tbk.	BRPT	36	Bukit Asam Tbk.	PTBA
14	Bukalapak.com Tbk	BUKA	37	Semen Indonesia (Persero) Tbk.	SMGR
15	Charoen Pokphand Indonesia Tbk.	CPIN	38	Tower Bersama Infrastructure Tbk	TBIG
16	Elang Mahkota Teknologi Tbk	EMTK	39	Timah Tbk.	TINS
17	Erajaya Swasembada Tbk	ERAA	40	Telkom Indonesia (Persero) Tbk.	TLKM
18	XL Axiata Tbk.	EXCEL	41	Sarana Menara Nusantara Tbk.	TOWR
19	GoTo Gojek Tokopedia Tbk.	GOTO	42	Chandra Asri Petrochemical Tbk.	TPIA
20	H.M. Sampoerna Tbk.	HMSP	43	United Tractors Tbk.	UNTR
21	Harum Energy Tbk.	HRUM	44	Unilever Indonesia Tbk.	UNVR
22	Indofood CBP Sukses Makmur Tbk.	ICBP	45	Wijaya Karya (Persero) Tbk.	WIKA
23	Vale Indonesia Tbk.	INCO			

Research Method

Stock Return

Stock return is the level of profit obtained by investors on an investment they make [11]. In capital market theory, the rate of return received by an investor from shares traded on the capital market is usually called the return:

$$r_i(t) = \left(\frac{p_i(t) - p_i(t-1)}{p_i(t-1)}\right) \times 100\% \quad (1)$$

where:
i : i -th shares
t : stock time
$r_i(t)$: the stock return at a time t
$p_i(t)$: share price at the time to t
$p_i(t-1)$: the share price at time t minus the share price at the previous time where for all i

Correlation Matrix

A correlation matrix is a matrix with matrix elements that are correlation coefficients with values located in the interval $[-1, 1]$, and specifically, the diagonal elements of the matrix have a value of one. Construction of a correlation matrix $C = (C_{ij})$ of size $n \times n$, where C_{ij} is the correlation between shares i and j [12],

$$C_{ij} = \frac{N\sum r_i r_j - (\sum r_i)(\sum r_j)}{\sqrt{(N\sum r_i^2 - (\sum r_i)^2)(N\sum r_j^2 - (\sum r_j)^2)}} \quad (2)$$

where:
C_{ij} : correlation between shares
$\sum r_i$: statistical average of stock returns i
$\sum r_j$: statistical average of stock returns j
N : number of shares

$\sum r_i$ here is the statistical average $r_i(t)$ for all values t. The value of C_{ij} indicates the strength of the linear relationship between stocks i and j. This means that stocks and shares are said to be fully correlated with the coefficient if the value is 1 or (-1) or not correlated at all if the value is 0.

Distance Matrix

The distance matrix is a matrix that contains the distance between one region and another region. If there are several n regions, a distance matrix of $n \times n$ will be formed because a region will measure its distance to all other regions in the data. Formation of the distance matrix D_{ij} from the correlation matrix (C) by changing the correlation coefficient C_{ij} to distance D_{ij} as follows [13]:

$$D_{ij} = \sqrt{2(1 - C_{ij})} \quad (3)$$

where:
D_{ij} : distance between shares
C_{ij} : correlation between shares

Minimum Spanning Tree

The minimum spanning tree is a tree that can be defined by a graph. Directed graphs and undirected graphs are subgraphs where each node is connected to each other. A graph can give different spanning trees. For each edge, we can assign weight to determine a value [14]. Each weight will be compared with other weights that lead to the next node, and then the smallest weight will be selected. To form a minimum spanning tree, one of the ways is to use the Kruskal algorithm. The Kruskal algorithm, which is included in graph theory, can be used to obtain a minimum spanning tree from a weighted graph with the weight orientation of the graph edges by sorting the edges of the graph in order from smallest to largest weight, but it does not form a circuit [15]. Kruskal algorithm steps:

1. Sort each edge in the graph starting from the edge with the smallest weight to the largest weight.
2. Select the edge that has the minimum weight that does not form a circuit in the tree, then add that edge to the tree.
3. Repeat the second step until the minimum spanning tree is formed, A minimum spanning tree is formed after experiencing repetition n - 2 times. (n is the number of graph vertices)

To gain a network analysis perspective, the role or relative importance of each stock can be analyzed using several centrality measures. such as degree, betweenness, and closeness.

Degree of Centrality

The degree of centrality relates to the sociometric concept of identifying individuals who act as "stars", namely, the most popular individuals in a network or individuals who occupy a central position and are the center of attention. Individuals in central roles occupy an advantageous position because they have many relationships, each individual may have alternative ways to meet needs and are therefore less dependent on other individuals [16].

$$C_D(i) = \frac{\sum_{j=1}^{N} A_{ij}}{N-1} \tag{4}$$

where:
$C_D(i)$: degree of centrality i-th stock
A_{ij} : element of i-th row and j-th column from matrix adjacency was obtained previously
N : the total number of stocks

The measure of degree of centrality is the number of connections each share has. Where A_{ij} is the ith row element of the adjacency matrix. The greater the value of $C_D(i)$, the more shares are related/highly correlated with share i.

Degree of Betweenness

Betweenness centrality shows how often a stock is a bridge or link from one stock to another.

$$C_B(i) = \sum_{j \neq k \neq i}^{j,k \in V} \frac{\sigma_{jk}(i)}{\sigma_{jk}} \tag{5}$$

where:
$C_B(i)$: stock betweenness centrality i-th stock
$\sigma_{jk}(i)$: total number of pairs
σ_{jk} : total number and path

The measure of betweenness centrality is the number of paths through j-th stock to k-th stock. Where (1) $\sigma_{jk}(i)$ shows the total number of pairs (j, k) with $j \neq k \neq i$ where between stock j and stock k there is a path that passes through the stock i, and (2) σ_{jk} is the total number and path between stock j and stock k. Greater the value of $C_B(i)$, the greater the influence of stock i in the correlation between other stocks [10]. In other words, a high value in this measure means there is a high number of shares whose behavior will influence other shares passing through the stock i. $C_B(i)=0$ This means that share i have no role or no influence in this coordination.

Centrality of closeness

Closeness centrality shows how close an individual (node) is to all other individuals in the network. Closeness is measured by how many steps (path) an actor can contact and be contacted by other actors in the network [15]:

$$C_c(i) = \left[\frac{\sum_{i=1}^{N} d_g(i,k)}{N-1}\right]^{-1} \quad (6)$$

where:

$C_c(i)$: closeness centrality i-th stock
$d_g(i,k)$: the shortest path from i-th stock to k-th stock
N : number of stocks N

The closeness centrality measure is the inverse of the average shortest distance from the stock i to other stocks. Where $d_g(i,k)$ is the shortest path (geodesic distance) from the stock i to stock k. The greater the value of $C_c(i)$ the higher the correlation between stock i and other stocks.

Autoregressive Integrated Moving Average (ARIMA)

Autoregressive Integrated Moving Average (ARIMA) is a method that uses historical values of the dependent variable to produce predictions [17]. ARIMA is the right method for predicting time series data. The ARIMA model is used with the following notation:

$$\phi_p = (B)(1-B)^d Z_t = \mu + \theta_q(B)_{\epsilon t} \quad (7)$$

3. RESULTS

Stock Return Calculation

The aim of calculating stock returns is to determine the level of profit/loss obtained by investors on an investment in a share. If the return value is positive, it means that shareholders make a profit, but if the return value is negative, it means that shareholders incur a loss. In the example of calculating stock returns on WIKA shares, the result is an increase in share value profits from the previous time, namely 6%. The results can be seen in Table 3 in the numbers marked in green. Example of calculating stock returns on WIKA shares for January 11, 2021:

$$return_{(WIKA)}(11\ jan\ 21) = \left(\frac{price(11jan) - price(10jan)}{price\ (10jan)}\right) \times 100\%$$
$$= \left(\frac{2360 - 2220}{2220}\right) \times 100\% = 6\%$$

Table 2. Stock Return Value

Date	Return			
	WIKA	UNVR		ADRO
1/4/2021	12%	-2%	…	1%
1/11/2021	6%	-3%	…	1%
1/18/2021	-17%	5%	…	-7%
1/25/2021	-8%	-5%	…	-11%
2/1/2021	8%	4%	…	1%
2/8/2021	2%	-1%	…	0%
…	…	…	…	…
12/26/2022	-4%	-2%	…	1%

Correlation Matrix Calculation

For example, a correlation calculation was carried out on WIKA and UNVR shares and a correlation value of 0.16 was obtained. The results can be seen in Table 3 in the numbers marked in green.

$$C_{ij} = \frac{N\sum r_i r_j - (\sum r_i)(\sum r_j)}{\sqrt{(N\sum r_i^2 - (\sum r_i)^2)}\sqrt{(N\sum r_j^2 - (\sum r_j)^2)}}$$

$$= \frac{104 \times 5.71\% - (-72\%)(-30\%)}{\sqrt{(104 \times 36{,}52\% - (-72\%)^2)(104 \times 52\% - (-30\%)^2)}} = 0.16$$

Table 3. Correlation Matrix

j / i	WIKA	UNVR	…	ADRO
WIKA	1	0.16	…	0.20
UNVR	0.16	1	…	-0.008
UNTR	0.24	0.008	…	0.70
TPIA	-0.13	-0.03	…	0.01
…	…	…	…	…
…	…	…	…	…
ADRO	0.20	-0.008	…	1

Distance Matrix Calculation

The distance matrix calculation aims to find out or determine the distance of one stock to another stock using the values from the correlation matrix calculation. The correlation value has a value in the interval -1 to 1. If the correlation value is negative between 2 shares, then the price movement for the two shares moves in the opposite direction, for example, if share A experiences a price increase, then the price of share B experiences a price decrease. If the correlation value is between 2 shares, then the price movements of both shares move in the same direction. Example of distance matrix calculation for WIKA and UNVR shares:

$$Distance_{WIKA,UNVR} = \sqrt{2(1 - Correlation_{WIKA,UNVR}} = \sqrt{2(1 - 0{,}164)} = 1{,}29$$

Table 4. Distance Matrix

j / i	WIKA	UNVR	…	ADRO
WIKA	0	1.29	…	1.26
UNVR	1.29	0	…	1.42
UNTR	1.22	1.40	…	0.76
TPIA	1.50	1.43	…	1.40
TOWR	1.44	1.46	…	1.42
...	…	…	…	…
...	…	…	…	…
...	…	…	…	…
ADRO	1.26	1.42	…	0

The calculation results in Table 4 show the distance value from one share to another. If the distance value obtained is smaller, the distance between shares is closer, if the value is greater, the distance between shares is farther. The distance matrix values can be used as a reference for graph visualization. The Minimum Spanning Tree is obtained from the adjacency matrix and then visualized

as a graph by taking the shortest distance using the Kruskal algorithm. The results of the Minimum Spanning Tree using the Kruskal algorithm display a network of 43 shares listed on the LQ45 stock index; the results can be seen in Figure 1.

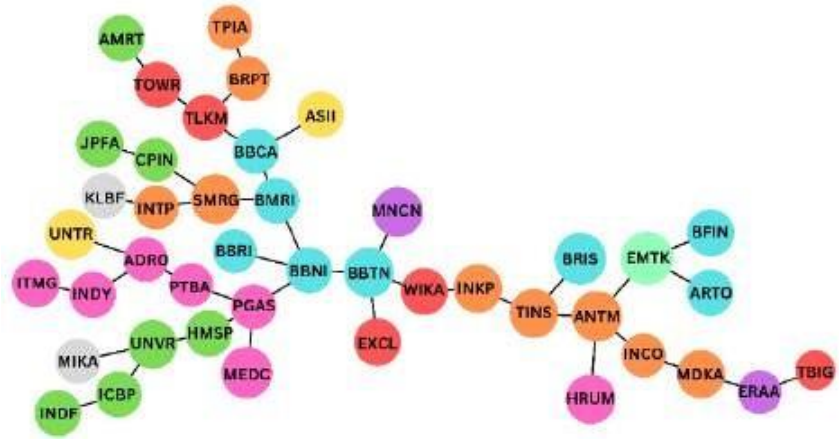

Figure 1. Minimum Spanning Tree Network

To find out which shares influence the network, network analysis is carried out using centrality tests such as degree centrality, closeness centrality, and betweenness centrality. The following are the results of the highest scores from the 3 centrality tests carried out, along with network images.

Centrality Test

Table 5. Degree of Centrality Test

Stock Name	Stock Code	Degree of Centrality
Perusahaan Gas Negara Tbk.	PGAS	0.095238095
Bank Tabungan Negara (Persero) Tbk.	BBTN	0.095238095
Bank Negara Indonesia (Persero) Tbk.	BBNI	0.095238095
Aneka Tambang Tbk	ANTM	0.095238095

Based on Table 3.1, four shares with the highest value were obtained, namely shares of Perusahaan Gas Negara Tbk (PGAS), Bank Tabungan Negara (Persero) Tbk (BBTN), Bank Negara Indonesia (Persero) Tbk (BBNI), and Aneka Tambang Tbk (ANTM), the four shares have the same centrality value, namely 0.095238095.

Table 6. Degree of Closeness Test

Stock Name	Stock Code	Degree of Closeness
Bank Negara Indonesia (Persero) Tbk.	BBNI	0.257668712
Bank Tabungan Negara (Persero) Tbk.	BBTN	0.24137931
Bank Mandiri (Persero) Tbk.	BMRI	0.233333333
Perusahaan Gas Negara Tbk.	PGAS	0.230769231
Wijaya Karya (Persero) Tbk.	WIKA	0.219895288

Based on closeness centrality, five shares with the highest value were obtained, namely BBNI, BBTN, BMRI, PGAS and WIKA shares. The closeness centrality test aims to look for shares that are close to other shares. The higher the value of closeness centrality, the closer the relationship a share has with other shares

Table 7. Degree of Betweenness Test

Stock Name	Stock Code	Degree of Betweenness
Bank Negara Indonesia (Persero) Tbk.	BBNI	0.235827664
Bank Tabungan Negara (Persero) Tbk.	BBTN	0.229591837
Bank Mandiri (Persero) Tbk.	BMRI	0.204081633
Wijaya Karya (Persero) Tbk.	WIKA	0.204081633
Perusahaan Gas Negara Tbk.	PGAS	0.193310658

In terms of betweenness centrality, five shares with the highest value were obtained, namely BBNI, BBTN, BMRI, WIKA and PGAS shares. The betweenness centrality test aims to find shares that have an important role in bridging one stock to another stock. The higher the value of betweenness centrality, the more important the role of a stock is in bridging one stock to another stock.

Most Influential Stocks

The results of the 3 tests that have been carried out show that several shares have the highest value from each test. Based on the test results, Bank Tabungan Negara (Persero) Tbk (BBNI) shares were selected as the most influential shares in the LQ45 share network because BBNI shares have the highest value. in each centrality test. For alternative shares other than BBNI, 2 shares will be used that have the highest centrality value after BBNI shares, namely BMRI shares and BBTN shares.

Stock Price Prediction

a. BBNI Stock Price Prediction

BBNI shares will be predicted because they have the most influence on the centrality test. The prediction method uses ARIMA prediction using BBNI weekly share price data from 12 September 2022 to 15 September 2023.

Table 8. BBNI Price Comparison

Date	Prediction Stock Price	original price
22 September 2023	Rp9,357.27	Rp9,750
29 September 2023	Rp9,284.68	Rp10,234
06 Oktober 2023	Rp9,239.92	Rp5,200.00
13 Oktober 2023	Rp9,212.32	Rp5,175.00
20 Oktober 2023	Rp9,195.30	Rp4,970.00
27 Oktober 2023	Rp9,184.81	Rp4,890.00
03 November 2023	Rp9,178.34	Rp4,860.00
10 November 2023	Rp9,174.35	Rp4,860.00
17 November 2023	Rp9,171.89	-
24 November 2023	Rp9,170.37	-
01 December 2023	Rp9,169.44	-
08 December 2023	Rp9,168.86	-

The predicted results in Table 8 show detailed prices for each week starting from 22 September 2023 to 8 December 2023. There is a decrease in prices each week, but the decrease is not drastic. Comparing the predicted price with the original price in the first week, the difference was 393 rupiah, the prediction result was close to the original price. In the second week, there was a price difference of 950 rupiah. When comparing the predicted price and the original price, the results were quite different. On 6 October 2023, PT Bank Negara Indonesia Tbk. (BBNI) officially carried out a stock split, so that price comparisons from 6 October 2023, onwards cannot yet be compared.

b. BBTN Stock Price Prediction

BBTN shares are one of the shares that will be predicted because BBTN shares are one of the shares that have the most influence on the centrality test. The prediction method used is ARIMA. Predictions using BBTN weekly share price data starting from 12 September 2022 to 18 September 2023.

Table 9. BBTN Price Comparison

Date	Prediction Stock Price	Original Price
25 September 2023	Rp1,213.03	Rp1,220.00
02 Oktober 2023	Rp1,206.52	Rp1,255.00
09 Oktober 2023	Rp1,200.02	Rp1,245.00
16 Oktober 2023	Rp1,193.51	Rp1,210.00
23 Oktober 2023	Rp1,187.00	Rp1,205.00
30 Oktober 2023	Rp1,180.49	Rp1,200.00
06 November 2023	Rp1,173.98	Rp1,215.00
13 November 2023	Rp1,167.47	-
20 November 2023	Rp1,160.96	-
27 November 2023	Rp1,154.45	-
04 December 2023	Rp1,147.95	-
11 December 2023	Rp1,141.44	-

The prediction results in Table 9 show detailed prices for each week starting from 25 September 2023 to 11 December 2023. There is a decrease in prices each week, but the decrease is not drastic. Comparing the predicted price with the original price in the first week, the difference was 7 rupiah, the predicted results were quite close to the original price. In the second week onwards, there was a price difference that was not too big, with a difference ranging from 18 to 50 rupiah. When comparing the predicted price and the original price, the results were quite close. The results of this prediction can be used as a reference to see BBTN share price movements and can be used as a reference for making decisions about investing in BBTN shares.

c. BMRI Stock Price Prediction

BMRI shares are one of the shares that will be predicted because BMRI shares are one of the shares that have the most influence on the centrality test. The prediction method used uses ARIMA predictions using BMRI weekly stock price data starting from 12 September 2022 to 18 September 2023.

Tabel 10. BMRI Price Comparison

Date	Prediction Stock Price	Original Price
25 September 2023	Rp 6,026.554	Rp 6,025.00
02 Oktober 2023	Rp 6,071.176	Rp 6,025.00
09 Oktober 2023	Rp 6,112.016	Rp 6,075.00
16 Oktober 2023	Rp 6,152.861	Rp 5,750.00
23 Oktober 2023	Rp 6,194.078	Rp 5,700.00
30 Oktober 2023	Rp 6,235.119	Rp 5,825.00
06 November 2023	Rp 6,276.206	Rp 5,775.00
13 November 2023	Rp 6,317.289	-
20 November 2023	Rp 6,358.369	-
27 November 2023	Rp 6,399.451	-
04 December 2023	Rp 6,440.532	-
11 December 2023	Rp 6481.614	-

The prediction results in Table 10 show detailed prices for each week starting from 25 September 2023 to 11 December 2023. There is a decrease in prices each week, but the decrease is not drastic. Comparing the predicted price with the original price in the first week, the difference is 1 rupiah, the prediction results are very close to the original price. In the second week and so on, the price difference is not too far, but it has the opposite price movement, where the predicted results tend to move up, and the original price tends to move down. To compare the predicted price and the original price, the results were quite close in the first 3 weeks and from the 4th week onwards, the price difference tended to be large. The results of this prediction can be used as a reference to see the movement of BMRI share prices and can be used as a reference for making decisions about investing in BMRI shares.

4. DISCUSSIONS

The Minimum Spanning Tree (MST) algorithm, in the context of stock analysis, functions as a tool to identify the strongest relationships between stocks in an index or portfolio. MST helps us understand the deeper structure of the stock market. We can look at groups of closely related stocks and identify key stocks that can influence overall market movements. In this research, several metrics are used in the analysis of the most influential stocks in the LQ45 index, namely degree centrality, closeness centrality, and betweenness centrality, which resulted in the most influential shares being in the financial sector. There are BBNI, BMRI, and BBTN. This can be caused by the financial sector being the heart of every economy. Banks, insurance companies, and other financial institutions play an important role in facilitating transactions, providing credit, and managing risk. The performance of this sector directly impacts overall economic growth.

5. CONCLUSION

Based on the Minimum Spanning Tree (MST) method and reinforced with 3 centrality tests, there is first stock that has the most strategic position namely shares from Bank Negara Indonesia (Persero) Tbk. (BBNI). BBNI shares received the highest score in each centrality test, which indicates that BBNI is very strategic in terms of connection, closeness, and betweenness (connection). In calculating the correlation matrix, BBNI shares also have a positive correlation with shares in the financial sector, in other words, BBNI shares have movements in the same direction as shares in the financial sector. Apart from BBNI shares, there are 2 shares chosen as alternatives, namely BBTN and BMRI shares, because these two shares have quite high scores in the centrality test.

For BBNI shares, the ARIMA(1,0,0) model is used with a MAPE of 1.78%; for BBTN shares, the ARIMA (0,2,2) model is used with a MAPE of 2.65%; and for BMRI shares the ARIMA (2,2,1) model is used with a MAPE of 1.84%. BBNI shares cannot be compared because the stock-split policy occurred on 6 October 2023. BBTN shares have a price comparison that is very close to the original price and has a small difference. In BMRI shares, there is an opposite share price movement, the original price shows a price decrease while the predicted price shows a price increase. This can be a reference for investing in BBNI, BBTN, and BMRI shares.

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