# LQ45 Stock Price Predictions Using The Deep Learning Method

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**Abstract:** The stock price prediction is very useful for investors to see how the company's investment prospects in the future. Stock price predictions can be used to anticipate stock price deviations and assist investors in making decisions. Prediction of stock price index movements can be categorized as a problem that is quite challenging in financial predictions However, the complexity of the stock market has made it very difficult to develop predictive models that can be said to be effective. We offer a systematic analysis of the use of deep learning neural networks to analyze and predict the stock market. The ability of this deep learning neural network method is able to extract features from a large amount of data without relying on prior knowledge from predictors, thus making this deep learning method suitable for predicting stock prices at high frequencies.

**Keywords:** Stock Price, Prediction, Deep Learning, LSTM

## 1. Introduction

Prediction of stock price index movements can be categorized as a problem that is quite challenging in financial predictions. Changes in microeconomic factors cause uncertainty in stock prices so predictions are needed to see future stock market movements [1]. Research on stock price index predictions has a long history in financial economics (i.e. [2][3][4]). While it differs from market efficiency, many empirical studies show that financial markets reach a certain threshold can be predicted [1][5][6][7]. Among the methods for predicting the stock price index, econometrics, statistical methods based on the analysis of past market movements have been widely adopted. This approach uses various linear and nonlinear methods to predict stock price indexes, for example autoregressive models and artificial neural networks (ANN) [8][9][10][11][12][13][14][15]. Today there is a lot of research on predictions in the financial sector, but most models do not provide satisfactory results for prediction results, because data in the stock market has a very large frequency. Comprehensive studies show the deep learning method is very appropriate for predicting the stock market. The ability to extract abstract features from data, and to identify hidden non-linear without relying on prior information makes deep learning suitable and appropriate for predicting stock prices. Chourmouziadis and Chatzoglou [16] also predicted that the deep learning method would play a key role in the prediction of time series in the financial sector. Viewed as a multilayer neural network, deep learning algorithms vary greatly in choosing network structure, activation functions and other model parameters. Therefore in this study will predict stock price index using the deep learning methods. The purpose of this study is to assess the accuracy of the deep learning method in predicting stock price index. In this research, IHSG data input with IDX LQ45 member profile index ADHI (PT. Adhi Karya Tbk.) and BBRI (Bank BRI) codes.

## 2. Methodology

The data analysis method used is a Quantitative Method. The data used in this research are IDX LQ45 stock price data of ADHI and BBRI codes. The data is Closing price data taken from 22 January 2018 to 31 October 2019 obtained from https://id.investing.com/. The deep learning method used in this study is a type of long short-term memory (LSTM) network. The software used to calculate LQ45 stock price predictions is MATLAB software version R2018a update 2. Prediction stages using the deep learning neural network method can be seen in Figure 1.

## 3. Results and Discussion

### 3.1 Plot of LQ45 stock price data

The data used in this research are IDX LQ45 stock price data of ADHI and BBRI codes. ADHI data plot can be seen in Figure 2 and BBRI data plot can be seen in Figure 3.

### 3.2 Preprocessing Data

LQ45 data partition into two parts, namely training data and testing data. the testing data on the first 90% of sequence and the testing data is 10% the last sequence. the next step is to standardize training data for better suitability and to prevent training from deviating.

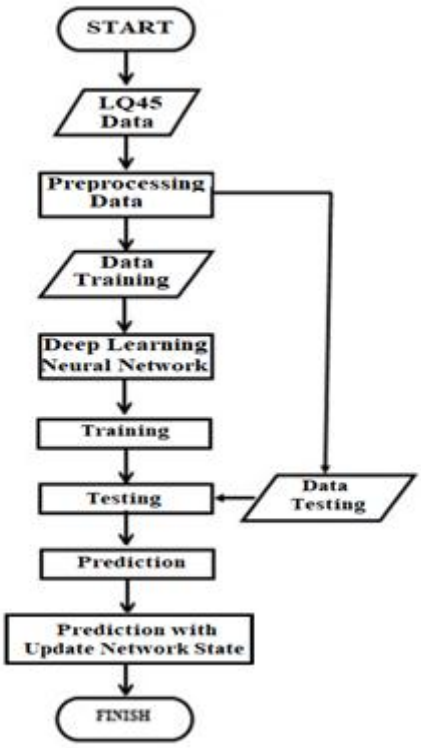


***Figure 1.*** *Prediction stages using the deep learning neural network method*


***Figure 2****. Time series Plot of Stock Price PT Adhi Karya Tbk*

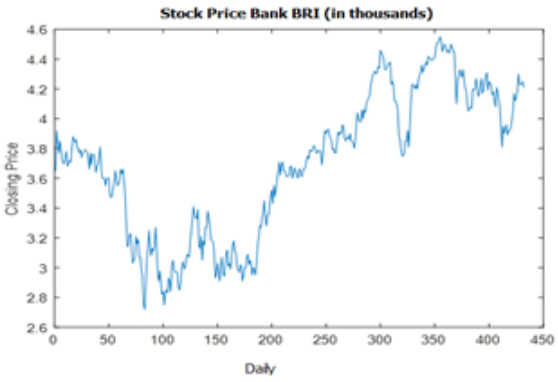


***Figure 3****. Time series Plot of Stock Price Bank BRI*

### 3.3 Define LSTM Network Architecture

LSTM network in this study has input 1, output 1, hidden layer 300. The maximum epoch used is 500 using the "Adam" solver. To avoid gradient from exploding, this research uses a gradient threshold to 1 and the learn rate used is 0.005. the training progress from ADHI can be seen in Figure 4 and BBRI in Figure 5.

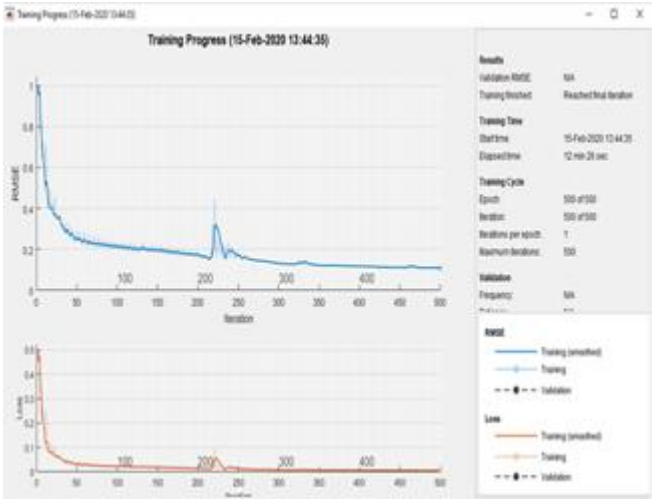


***Figure 4****. Training Progress of PT. Adhi Karya Tbk*

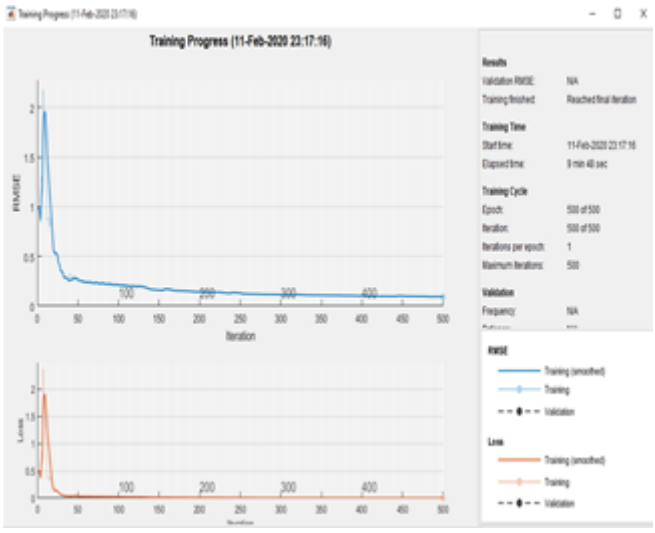


***Figure 5****. Training Progress of Bank BRI*

### 3.4 Forecast Future Time Steps

The next step is to calculate the forecast value, and the forecasting result using the LSTM deep learning method can be seen in Figure 6 for ADHI's stock Price and Figure 7 for BBRI's stock price. This prediction is applied to the testing data by using the same parameters in the training data.

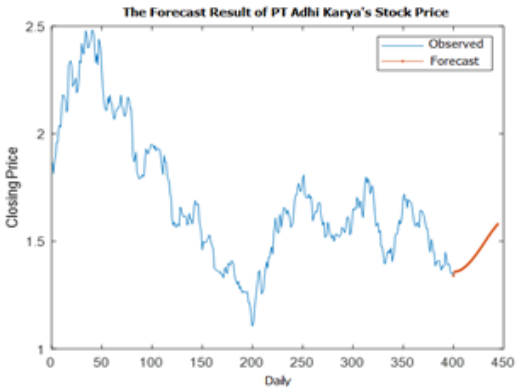


***Figure 6.****The Forecast Result of PT. Adhi Karya's Stock Price*

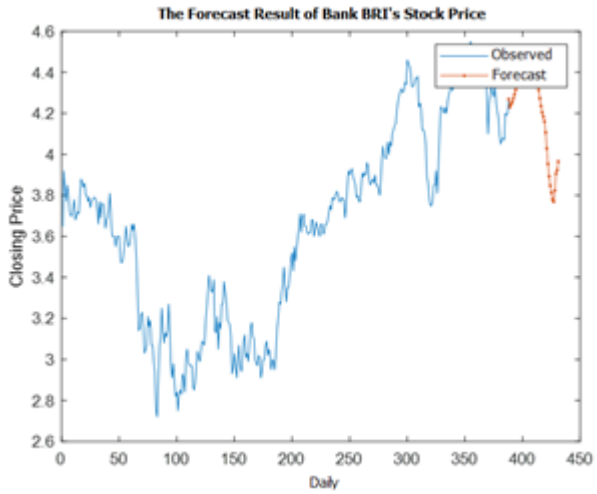


***Figure 7***. *The Forecast Result of Bank BRI's Stock Price*

The next step is to compare the results of forecasting values with data testing and calculate RMSE. The comparison results for Adhi's stock price can be seen in Figure 10 and the BRI stock price in Figure 11.

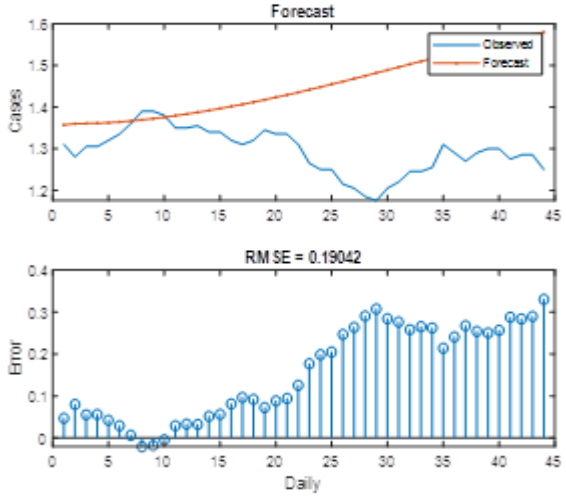


***Figure 10***. *Comparasion of observed and forecast PT. Adhi Karya's Stock Price an RMSE value*

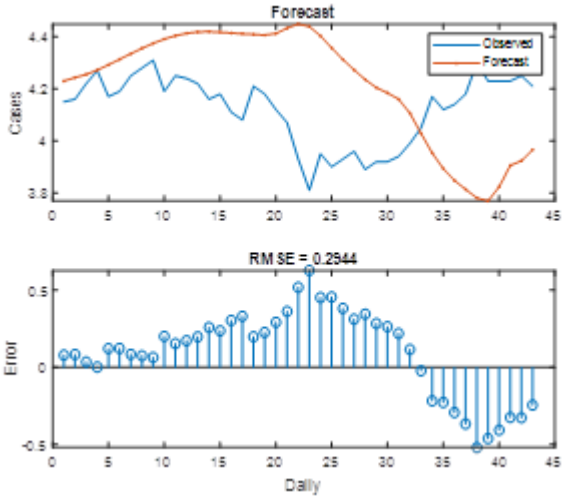


***Figure 11*** *Figure 10. Comparasion of observed and forecast Bank BRI's Stock Price an RMSE value*

### 3.5 Prediction with Update Network State

Update the network state with the observed values instead of the predicted values. After the new forecast value is obtained, the next step is to re-calculate the RMSE. Forecasting results of PT Adhi's stock prices can be seen in Figure 12 and BRI banks in Figure 13.

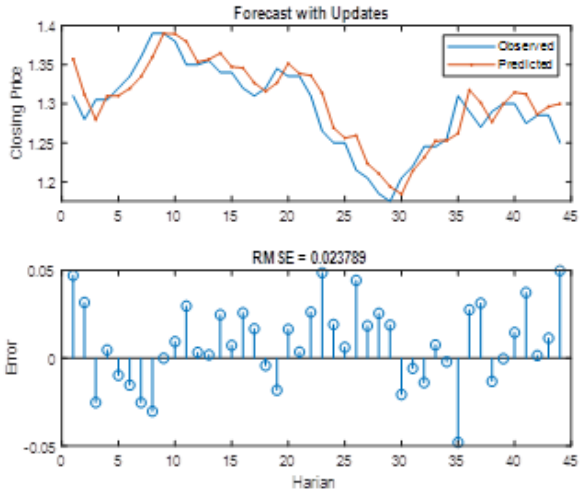


***Figure 12***. *Forecast with Update of PT Adhi Karya's Stock Price*

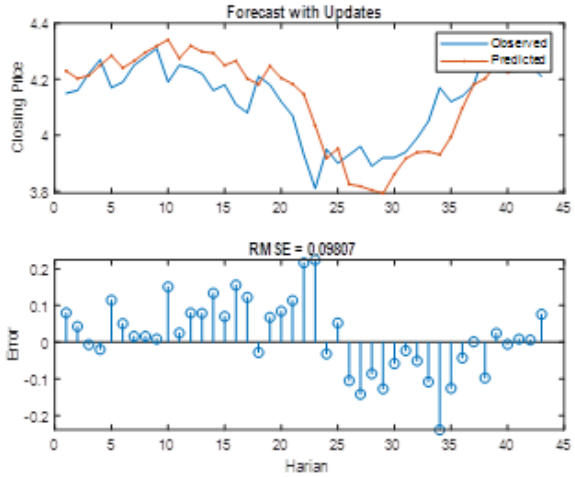


***Figure 13.*** *Forecast with Update Bank BRI's Stock Price*

## 4. Conclusion

Based on the results and discussion can be concluded that: (1) The deep learning neural network method type LSTM can be used to accurately predict LQ45 stock prices member ADHI with an RMSE is 0.023789; (2) The deep learning neural network method type LSTM can be used to accurately predict LQ45 stock prices member BBRI with an RMSE is 0.09807.

## 5 Acknowledgement

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