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Gold Investment in Indonesia: Prediction and Prospective in Pandemic Era Using LSTM Deep Learning

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Abstract:

The Covid-19 pandemic has a big impact on the world economy, include economic instability. Composite Stock Price Index had been contracted and make investors divert their investments to the safer one, that is gold. Gold has been a popular investment for a long time due to the stability of price despite economic fluctuation. Nowadays, the trend of buying gold to protect an investment is increasing. In addition, Bank Indonesia in the year 2020 had increased gold reserves as foreign exchange reserves due to an increase in commodity prices. Central bank purchases of gold reserves as foreign exchange reserves have become a trend over the past few years as efforts to diversify state reserve assets to stay away from the US dollar, even though this trend has begun to decline in some central banks due to the Covid-19 pandemic.

In 2021, the Covid-19 cases in the world have not been resolved, experts said that the virus might become endemic. This study examines the potential of investing in gold in the pandemic era after economic recovery includes suggestions for the government in taking monetary policies to increase or decrease gold reserves as foreign exchange reserves. The variables that will be used in this study are gold futures (GCF) in IDR, gold futures (GCF) in USD, gold prices in IDR, gold prices in USD, Indonesian exchange rates to USD, and Indonesian composite stock price index with applying Long Short-Term Memory (LSTM) Multivariate method. The network layers in this experiment are three layers of LSTM (unit=256), dropout layers (0.0001), dense layer, and the learning rate is 0.005. The MAPE of this model is about 4.675, and it means that the model good enough to predict with 4,675% of error.

Keywords:

Economy Recovery, Forecasting, Price Index

1. Introduction:

One of the top players in the asset world is the precious metal gold. Gold is a popular store of wealth. Recently, more financial institutions providing attractive offers related to gold investment. Since ancient times, gold has been a proven tool for storing wealth over a long period of time. Regardless of the economic problems, investors still believe in the resilience of the precious metal in facing the volatility of the fundamental instability of a country (Anita, 2015). The Covid-19 pandemic has had many impacts on the world economy, including Indonesia. This pandemic also diminished the stock price index and caused the price of gold to continue to rise since the beginning of 2020. Hence, the rate of gold rose to the highest point, around 30 million rupiahs per troy ounce in August 2020, and the lowest is about 21 million rupiahs per troy ounce in January 2020.

Besides being a store of wealth, gold can also be used to save foreign exchange reserves in countries. The purchase of gold reserves as one of the foreign exchange reserves by the Central Bank of Indonesia has become a trend that is conducted every year. Based on Primananda and Isa's research

(2021), the rate of gold is influenced by the composite stock price index which is a reference for capital market developments. Therefore, this research would conduct using several variables, such as gold futures at closing price (GCF) in IDR, gold futures at closing price (GCF) in USD, gold prices in IDR, gold prices in USD, Indonesian exchange rates to USD, and Indonesian composite stock price index to predict gold prices. This study aims to provide sources to investors in the purchase of gold as an asset, as well as advice for the government in making policies in the purchase of gold as the country's foreign exchange reserves.

Long short-term memory (LSTM) networks are one of the most advanced deep learning architectures for sequence learning tasks, such as handwriting recognition, speech recognition, or time series prediction (Schmidhuber, 2015). However, they are less commonly applied to financial time series predictions tasks. In this study, we apply artificial neural network in the field of deep learning to predict gold prices in pandemic era.

2. Methodology:

Data Collection and Pre-processing

This study use data on daily basis based on daily the gold price, the data consist gold futures price (GCF) in IDR, and gold futures price (GCF) in USD at closing price through id.investing.com, gold prices in IDR and gold prices in USD through World Gold Council (gold.org), Indonesian exchange rates to USD and Indonesian Composite Stock Price Index through finance.yahoo.com at closing price. The data collected from 2001 until 2021. Pre-processing is used by filling the NA value with the average price between before and after the missing value. The dataset can be shown in table 1 below.

Table 1. Example of Dataset

Date	Gold Price in IDR	Gold Price in USD	Gold Price Close in USD	Gold Price Close in IDR	Composite Stock Price index at Close	Indonesian Exchange Rate in Close
28/06/2001	3085101.3	269.5	269.3	3082946.40	428.473999	11448.00000
29/06/2001	3082132.3	270.6	270.6	3082134.00	437.619995	11390.00000
02/07/2001	2538344.0	263.2	262.8	2974896.00	431.335999	11320.00000
03/07/2001	2573917.8	260.7	261.4	2959570.80	428.654999	11322.00000
05/07/2001	2919268.4	266.6	266.1	3022097.70	431.005005	11357.00000
...
24/02/2021	25183980.0	1788.0	1797.9	25317339.55	6251.054199	14081.61719
25/02/2021	25061919.8	1779.7	1775.4	25029233.78	6289.645996	14097.79981
26/02/2021	24818185.4	1742.9	1728.8	24148199.18	6241.795898	13968.18555
02/03/2021	25705476.6	1835.5	1835.1	26142137.48	6359.205078	14245.62012
03/03/2021	24378891.6	1711.4	1715.8	24431587.86	6376.756836	14239.18164

4297 rows x 6 columns

Feature's Selection

The feature selection used in this study is Pearson Correlation Coefficient. The correlation between variables is in table 2 and the Pearson Correlation Matrix in figure 1.

Table 2. Features Correlation Value to Gold Price in IDR

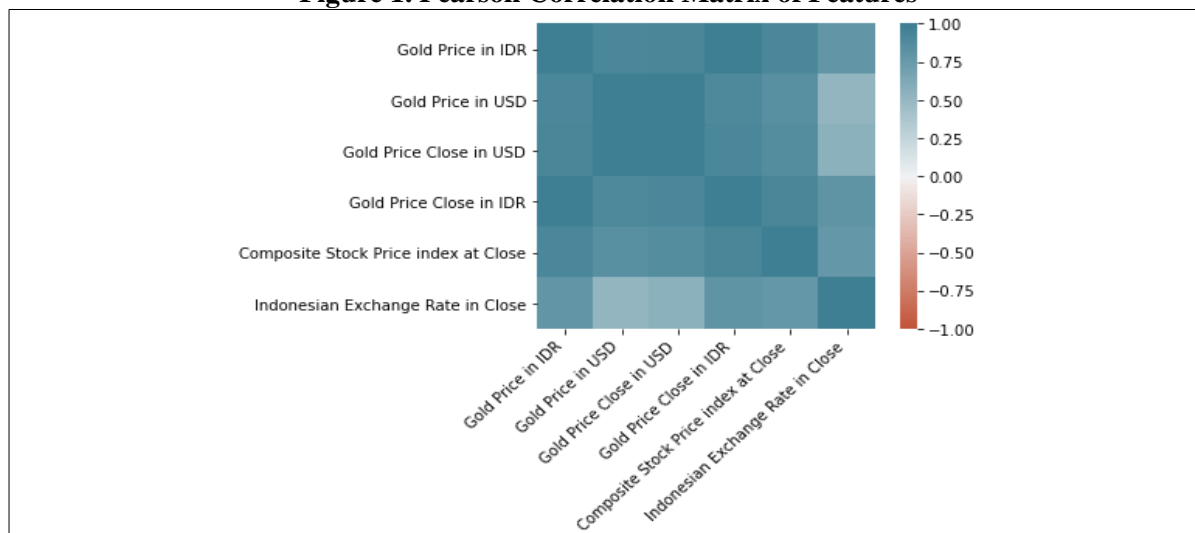
No	Features	Correlation Coefficient Value
1.	Gold Price in USD	0.922639
2.	Gold Price Close in USD	0.935554
3.	Gold Price Close in IDR	0.995849
4.	Composite Stock Price index at Close	0.921134
5.	Indonesian Exchange Rate in Close	0.789291

Model Training and Validation

This study implements the LSTM model to forecast the price of gold in IDR. The training data used by daily price approach, which in this research the dataset split into training dataset for X, and training

dataset for Y. The training dataset for X is data between variables in 14 days past, and the training dataset for Y is data between variables for the next day after the 14 days.

Figure 1. Pearson Correlation Matrix of Features



Model Evaluation

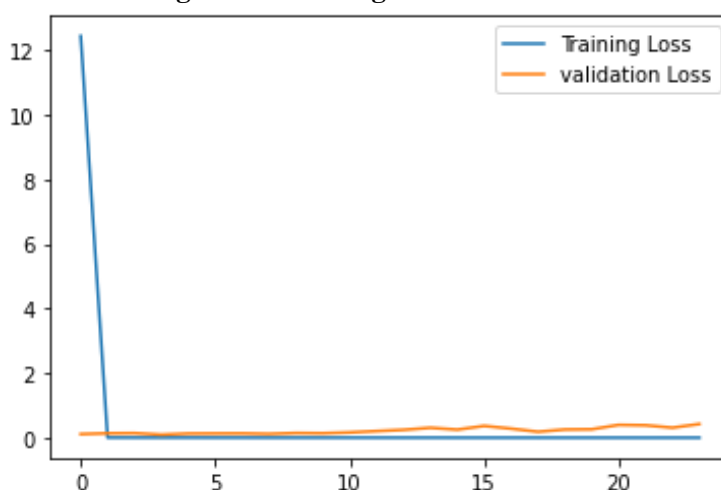
Evaluating the model that has been implemented uses a learning curve that is plotting of the model about validation and training loss. Graphic of validation and training loss can figure how good the network is. Validation loss will decrease if the model learns signal, while training loss will decrease if the model learns signal and noise. The signal help model to predict new data. A good fit learning curve happens if training loss and validation loss decrease to stability point and the gap between them are small.

3. Result:

Predicting model of Multivariate LSTM

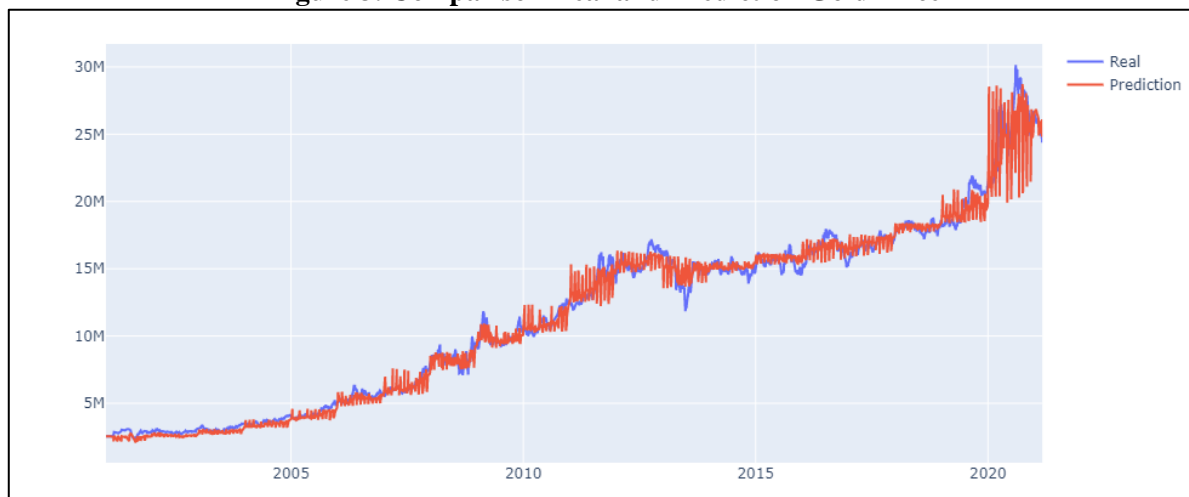
Figure 3 below shows the learning curve model of Multivariate LSTM to predict data. It is comparing gold prices between the original dataset and predicted. The network layers in this experiment are three layers of LSTM (unit=256), dropout layers (0.0001), dense layer, and the learning rate is 0.005.

Figure 2. Learning Curve of Model



From the figure, training loss and validation loss decrease into stability point, and their gap is small, which means that the model used to train the data is a good fit for the dataset. In order to know how the model has predicted the entire dataset, the graph that compares the original data and predicted data can be shown in figure 3, from the graph the predicted data almost same, although it has more volatile especially in 2020 or pandemic era.

Figure 3. Comparison Real and Prediction Gold Price



Forecast the data

Forecasting the gold prices in this study is about four months, and it shows in figure 4 below. According to the figure, gold prices would have a volatile graph. The MAPE of this model is about 4.675, and it means that the model is good enough to predict with 4,675% of error.

Figure 4. Graphic of Real and Prediction Gold Price



4. Discussion and Conclusion:

Based on the result of this research with the LSTM Multivariate Method, the best model use three layers of LSTM (unit=256), dropout layers (0.0001), dense layer, and the learning rate is 0.005. The learning curve describes the good fit model, and MAPE’s score is 4,675, which means that the model can be applied to forecast the price of gold. In the year 2021, the rate of gold between April and July will rise. The situation is the right time for investors to sell the gold, while post-July is the right time to purchase gold.

References:

1. Anita. (2015). Analysis of Comparison of Precious Metal Investment With Mining Company Stock in Indonesia Stock Exchange 2010-2014. Business and Manajamen Journal. Vol.2.
2. Primananda & Isa. (2021). Forecasting Gold Price in Rupiah Using Multivariate Analysis with LTSM and GRU Neural Networks. Advanced in Science, Technology and Engineering Systems Journal. Vol.6, No.2, 245-253.
3. Schmidhuber, J. (2015). Deep learning in neural networks: An overview. Neural Networks 61, 85–117.