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Forecasting the Gold Price of LM Antam using the Double Exponential Smoothing Approach

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Abstract — Antam Precious Metal (LM) gold investment is one of the investment choices favored by the public from the many investment choices available. One of the things that must be done if you want to invest in gold is to monitor the price movement of Antam Gold. This study uses the Double Method approach of Exponential Smoothing with the software Minitab 20. Double Method Exponential Smoothing is one of the forecasting methods used for trending data patterns. The gold price data to be forecasted is Antam Precious Metal (LM) gold produced by PT Antam Tbk. The purpose of this study is to obtain a forecast of Antam LM gold prices for the next twelve months from September 2024 to August 2025. The results of the study for the next twelve months the highest price forecast from September 2024 to August 2025 is in August 2025. The price of Antam gold in August 2025 is IDR 1,806,990 and the forecast error value (MAPE) is 2.31% or has a forecast accuracy of 97.69%.

Keywords: Gold Price, LM Antam, Double Exponential Smoothing, Forecasting

1. INTRODUCTION

During the global economic recession, investment has become a very hot topic of conversation. Antam Precious Metal (LM) gold investment is one type of investment choice that is favored by the public from the many investment options available. Currently, the ease of buying and reselling can be accessed from various digital platforms or directly at LM outlets. Antam LM Gold Investment is considered a low-risk investment, protected from inflation, quite promising profits, and safe long-term. One of the things that must be done if you want to invest in gold is to monitor the movement of Antam Gold prices. Because, every day, the purchase and buyback prices of Antam LM Gold always tend to change, either up or down. By knowing the latest Antam LM Gold price, you can determine when is the right time to start buying Gold or selling gold back (buyback). The lack of accurate information makes it difficult for investors to determine the value or price of gold in the next few months or years.

Research on forecasting has been widely conducted. Sagala and Enita used the Arima method to predict the Antam Gold Price in June 2023. The results of the study showed a slight difference between the forecast and the actual data. Then research by Sofiyanti et al. to estimate the price of gold in investment using the Fuzzy method Time Series. Gold price prediction results on July 1, 2023.

Based on these problems, researchers want to know the forecast of LM Antam gold prices for the next 12 months starting from the research time, namely August 2024. This study uses the Double Digit method approach. Exponential Smoothing is expected to get the LM Antam gold price forecast for the period from September 2024 to August 2025. Double Method Exponential Smoothing is one of the forecasting methods used for trend data patterns. The gold price data to be forecast is Antam Precious Metal gold produced by PT Antam. The Antam price data pattern is obtained from the official Antam price history website per month which shows an increase over time.

Gold is one of the profitable investments. Its investment value continues to increase, is not easily affected by inflation, is flexible for buying and selling transactions and the open market makes gold a choice for investment. Investment is a current commitment to gain profit in the future.

Forecasting is a process for obtaining future vision through past data. The method used

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in forecasting very much it is very important so that the desire can achieved. The results of the forecast obtained will become a material consideration in making decisions [4]

Forecasting cannot be done without error (error). Researchers are only capable try to make an error occur as minimally as possible [5]. Method forecasting It is very necessary for investors to know and be required to make decisions in uncertainty. Forecasting is done based on analysis and calculations will be more useful and accepted compared to predictions without any basis. Forecasting done with accuracy will produce benefits in the form of satisfaction among customers, personal pride, trust in the company, control of the operation company, and profit or financial status [6]. Method forecasting can shared in 2 categories main, namely method quantitative and qualitative methods. Quantitative can shared in a series of periodic or sequence times (time series) and methods casual, whereas method qualitative can share become method exploratory and normative.

The method used in this research is Double Exponential Smoothing**. Method qualitative**, Forecasting with method qualitative done with considerations, namely past data Then Not yet Once There is or difficulty obtained, past data trends estimated. The technique used is approach exploratory and normative. The method is quantitative; Forecasting with the method quantitative can done with several conditions, namely past data Can be obtained and quantified, and past data estimates own trend the same as future data. The method used among other methods constant, linear trend, exponential, moving average, single exponential smoothing, and Double Exponential Smoothing.

Several calculation methods are commonly used in calculating prediction errors (forecasts). Error). One way to evaluate forecasting techniques is MAPE. The average absolute percentage error or Mean Absolute Percent Error (MAPE). MAPE is the average absolute differentiation between forecasted and actual values, expressed as a percentage of actual values. MAPE is calculated as the average absolute differentiation between forecasted and actual values, expressed as a percentage of actual values. The MAPE value can be found using the formula in Equation 1.

$$\text{MAPE} = \frac{1}{n}\sum\frac{|A - F|}{A} \quad (1)$$

Where: At = actual value on data t Ft = forecast value on data tn = number of data periods.

The use of MAPE in evaluating prediction results can avoid measuring the accuracy of the actual value and predicted value. The MAPE value criteria are shown in Table 1.

Table 1. MAPE Value Criteria

MAPE Value	Criteria
<10%	Very good
10% - 20%	Good
20% - 50%	Enough
> 50%	Bad

Double Exponential Smoothing is a method that continuously improves forecasting by taking the average value of past smoothing values from time series data in a decreasing manner (exponential). Linear Exponential Method Smoothing (Double Exponential Smoothing). The forecast value can be found using equation 2-4 [8].

Double Formula Exponential Smoothing Brown :

$$S't = \alpha Xt + (1-\alpha) S't-_1 \quad (2)$$
$$S''t = \alpha S't + (1-\alpha) S''t-_1 \quad (3)$$
$$aT = 2S't - S''t \quad (4)$$

The advantage of the Brown DES method compared to other forecasting methods is its ability to handle data that has significant trends and fluctuations. Unlike simple forecasting methods such as moving averages or single exponential methods that only rely on the latest historical data, Brown DES also takes into account changes in data trends gradually. This makes it more responsive to changes in complex and unstable data patterns, such as those that often occur in the coal extraction and export industry. This method also allows for the accounting of seasonal effects or cyclical patterns

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in the data, although not as comprehensive as dedicated seasonal forecasting methods. Thus, this method provides sufficient flexibility in dealing with natural variations in coal production for export purposes, while still providing relatively accurate estimates in the short to medium term.

2. RESEARCH METHODS

Data collection

The data used in this study is secondary data, namely the price of Antam gold. The sample taken in this study is the gold price for the period 1 Tren 2022 - 1 August 2024. So the number of data is 32 data. The downloaded data is historical monthly data on gold prices that are summarized and can be seen in Table 2.

Data Types and Sources

Data collection begins with a preliminary research stage, namely a literature study by studying previous research related to this research topic. At this stage, a review of the data needed is also carried out, namely regarding the type of data, data availability and an overview of how to process the data. The next stage is the main research which is used to collect all the data needed to answer the objectives of the research and enrich the literature to support the quantitative data obtained.

Data Analysis Methods

The data analysis method used by researchers is one of the methods with forecasting techniques. Researchers use the Double Exponential Smoothing. The software used is Minitab 20. The steps taken in this study are shown in Figure 1.

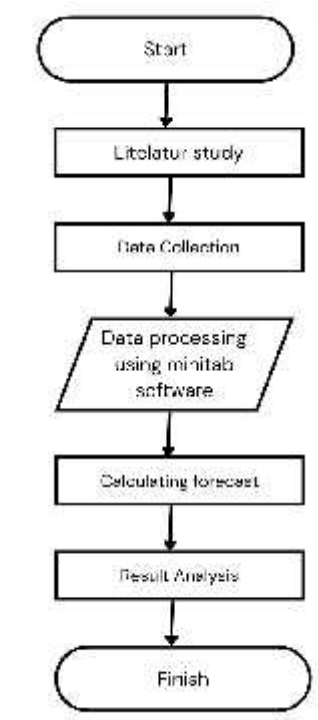

Figure 1. Research Flow Diagram

3. RESULTS AND DISCUSSION

Gold Price Data; This study uses monthly gold prices with a period of 32 months. The gold price data used is for the period 1 Tren 2022 to 1 August 2024. The data was obtained from the logammulia.com site. The gold price download data can be seen in Table 2.

Table 2. Gold Price Data

No	Month	Price
1	Jan-22	938
2	Feb-22	927
3	Mar-22	977
4	Apr-22	989
5	May-22	975
…	…	…
28	Apr-24	1254
29	May-24	1310
30	Jun-24	1336
31	Jul-24	1363
32	Aug-24	1433

Source: logammulia.com [8]

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Data analysis

Data analysis using descriptive statistical data aims to measure data centralization, to find out the distribution of data visually in the form of a time series plot which can be seen in Figure 2.

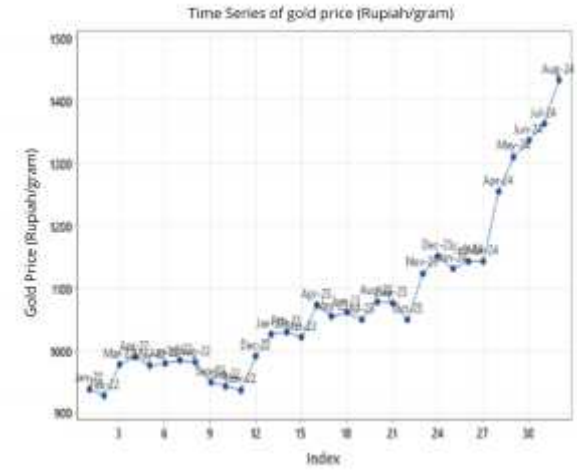

Figure 2. Gold Price Data

Figure 2 is a gold price graph for period 1 Tren 2022 to August 1, 2024. Based on the graph above, it can be seen that within 32 months, the lowest gold price was in February 2022 at IDR 927,000 per gram. While the highest per gram. From the graph, it can be seen that the movement of LM Antam gold prices tends to be an upward trend.

Forecasting Results

This study uses a Double Approach to Exponential Smoothing. Antam LM price data is processed using software Minitab 20 then the following output can be seen in Figure 3.

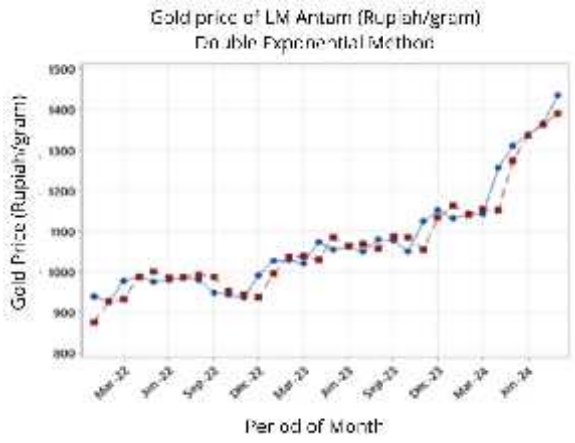

Figure 3. Double Exponential Smoothing

Test results using the software Minitab 20 with Double approach Exponential Smoothing show that the predicted value graph pattern is almost the same as the actual data value pattern. The parameter value used is alpha (α). The predicted value closest to the actual value is when α = 0.9. From the results of the Double Exponential Smoothing calculation, the value initialization holds a very vital role in mark results prediction. Double MAPE test Exponential The most optimal smoothing is obtained when α= 0.9 with a MAPE value of 2.31. The smaller the MAPE value that appears, the better the test results will be. The MAPE value and when α = 0.9 can be seen in Figure 4.

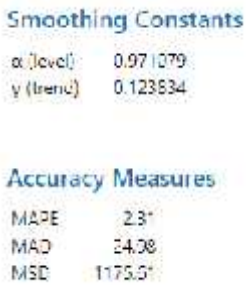

Figure 4. MAPE Value

Forecast Results forward

From the data in Table 2. Forecasting going forward starting from period 33. In this study, the price prediction of LM Antam was carried out for the next twelve months, namely the 33rd to 44th period. By using software Minitab 20 forward calculation of the 33rd to 44th period, the value can be seen in Table 3. From the calculation results, it can be seen that the price of LM Antam gold tends to continue to increase without any decrease each month. The highest price prediction in the 44th period, namely August 2025, is IDR 1,806,990 with a lower price threshold of IDR 1,383,000 and an upper price threshold of IDR 2,230,850.

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Table 3. Forecast Result of 12-month forward

No	Forecast	Upper	Lower
33	1462.998	1524.205	1401.791
34	1494.27	1585.985	1402.556
35	1525.543	1649.406	1401.68
36	1556.815	1713.461	1400.17
37	1588.087	1777.821	1398.354
38	1619.36	1842.35	1396.369
39	1650.632	1906.984	1394.281
40	1681.905	1971.685	1392.124
41	1713.177	2036.432	1389.921
42	1744.449	2101.214	1387.685
43	1775.722	2166.02	1385.423
44	1806.994	2230.846	1383.142

Source: Process Data, 2024

The next twelve months are September 2024 to August 2025. Using α = 0.9, the MAPE value that appears is 2.31, the MAD value is 24.98, while the MSD value is 1175.61. The graph can be seen in Figure 5. It can be seen that the graph pattern tends to increase regularly every month. This can be interpreted that investment, especially LM Antam gold, can be an attractive alternative because its value is stable and protected from inflation and has a safe long-term investment value.

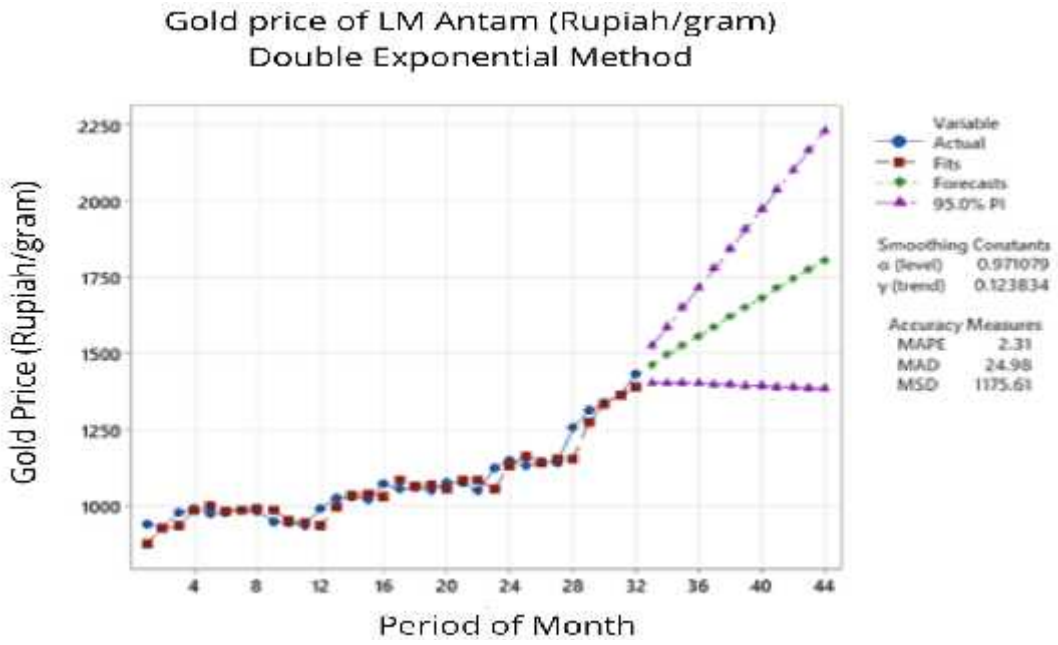

Figure 5. Forecast of Gold Price

4. CONCLUSION

From the results of the study on the LM Antam gold price forecast, there is a trending gold price data pattern with a tendency for data to always increase in each period. The highest price forecast using the Double Exponential Smoothing approach for the next twelve months from September 2024 to August 2025 is in August 2025. The highest LM Antam gold price for the 44th period in August 2025 was IDR 1,806,990 with a lower price threshold of IDR 1,383,000, an upper price threshold of IDR 2,230,850 and a forecast error value of 2.31% or a forecast accuracy of 97.69%. It can be seen from the graph pattern that it tends to increase regularly every month. This can be interpreted that investment, especially LM Antam gold, can be an attractive alternative because its value is stable and protected from inflation and has a safe long-term investment value.

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