



## GOLD PRICES FORECASTING USING TRIPLE EXPONENTIAL METHOD

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### Abstract

Governments, organizations, and citizens have taken an interest in gold price fluctuations. Gold price forecasting that is accurate may effectively capture price shift tendencies and reduce the effects of gold market volatility. However, due to the multi-factor and nonlinear nature of the gold market. The triple exponential smoothing strategy is used in this study to predict the rise in a value over time since it can replicate trends and seasonal patterns. according to the gold price swings pattern and seasonal components at the same time To calculate system accuracy, the Mean Absolute Percentage Error is employed (MAPE). With alpha 0.15 and beta 0.85 as parameter values, the triple exponential smoothing (TES) approach achieves an accuracy rate of 86.93 percent and a MAPE of 12.49 percent in this study.

**Keyword** : gold price, market volatility, gold market, trends, seasonal patterns

### INTRODUCTION

Gold price forecasting is a crucial financial problem since governments, scholars, and investors all need to be informed of shifting patterns. Gold is a one-of-a-kind precious metal that combines the characteristics of commodities, valuable metals, and money (FAUSTINA et al., 2017). Gold is a necessary raw commodity for both industrial production and the aesthetics of jewelry. As a result, the gold market is receiving a lot of attention from the domestic and international population, institutional investors, and governments (Istamar et al., 2019). The gold market's importance is growing in tandem with the financial markets, and it is quickly becoming a financial investment market as significant as the stock market, futures market, bond market, and so on (Evamelia & Panjaitan, 2019). The gold market is a global market with a nonlinear system that allows for fast price and volume fluctuations (Chen et al., 2019). In response to the essential and hard task of anticipating gold price changes, which is being undertaken by both researchers and the government (Zhang & Ci, 2021). It is crucial to anticipate changes precisely and effectively in the price of gold, both theoretically and practically (ALTAN & KARASU, 2019).

Forecasting gold price variations has investigated several gold price prediction techniques, ranging from statistical models to moving average models (Qasim et al., 2021). Currently, the most often used statistical model is autoregressive conditional heteroscedasticity (ARCH) (Ayele et al., 2021). In recent years, gold is a precious metal that is in great demand, especially Antam Gold or 24-carat Precious Metal, both for investment and as jewelry (Prananingtyas, 2018). This is indicated by data on gold jewelry demand in Indonesia in the fourth quarter of 2015, which increased by 16.88 percent year over year from 7.7 to 9 tons (Juhro & Iyke, 2021). The total amount of demand in 2015 was 38.9 tons. According to data from the World Gold Council (WGC), Indonesia became the Southeast Asia country with the greatest level of demand in the fourth quarter (Humphreys, 2017).

Prediction is the technique of estimating (measuring) the amount or amount of something in the future based on prior data (time series) that has been properly studied, particularly using statistical methods (Majid, 2018). Gold price prediction aims to determine future investment possibilities for gold prices so that gold investors may use it to determine changes in gold prices (Alameer et al., 2019).

The technique of anticipating future occurrences is known as forecasting. Forecasting is used to decrease uncertainty and offer standards for evaluating actual performance (de Oliveira & Cyrino Oliveira, 2018). Forecasting can help customers forecast the price of all sorts of things that have a sale and buy value. The triple exponential approach is used in this study to forecast gold prices and assess the pattern of growing gold prices using data obtained from national and regional sources.

## LITERATURE REVIEW

### Exponential Smoothing (ES)

Exponential Smoothing is a method that continuously computes utilizing the most recent data based on finding the average exponential smoothing of the preceding data (de Oliveira & Cyrino Oliveira, 2018). This method puts data to the test by giving weight to observations to forecast the future. The most recent observation period on ES is more predictive than the prior observation period (Barrow et al., 2021). The parameters (alpha), (beta), and are used to calculate this weighting value (gamma). SES, DES, and TES are all distinct approaches. Single Exponential Smoothing is a variant of the moving average technique, which involves assigning a value to data in a time series. This method works best with data variations that may be classified as steady, meaning that there is no pattern or regular movement in the ups and downs. This method is used to generate predictions (Majid, 2018).

$$S'_t = aX_t + (1 - a) S'_{t-1} \dots\dots\dots 1$$

$$S''_t = aS'_t + (1 - a) S''_{t-1} \dots\dots\dots 2$$

Triple Exponential Smoothing is an approach for dealing with seasonal impacts and trend features that emerge on time series data at the same time. This method necessitates the inclusion of a new variable, frequency, to denote the number of periods in each cycle. The multiplicative seasonal model and the additive seasonal model are two models that might be utilized in this method depending on the season. The multiplicative model's key feature is that the amplitude of seasonal variations fluctuates and is dependent on the smoothing of the entire time series. This approach is useful when there is a trend or a seasonal pattern that increases with increasing data amount.

### Triple Exponential Smoothing Method

The Triple Exponential Smoothing technique is used to forecast the price of gold for a single day. This technique will process today's gold price data with method parameters that may be generated randomly or via trial and error to estimate the gold price for the next day. Ten gold price data points were collected sequentially from the preceding several months to assess the capability of this procedure, which was measured by the level of accuracy.

$$S'''_t = aS''_t + (1 - a) S'''_{t-1} \dots\dots\dots 3$$

## RESULTS AND DISCUSSION

The Triple Exponential Smoothing technique is employed in this study to forecast the price of gold over a one-day period. This approach will process today's gold price data by employing method parameters selected at random or by trial and error to estimate gold prices



for tomorrow. Data on gold prices can be taken up to 10 times in a row. The strategy will then be tested using gold price data from the preceding several months to determine its ability as evaluated by the amount of accuracy of its success. Then proceed to perform manual computations. In this manual computation, gold price data from 01 August 2021 to 26 September 2021 is used as a test of this approach, with 5 sources of gold prices for each date.

Table 1  
Gold price data

Date	Gold Price Data Source (0.7 grams)				
	1	2	3	4	5
01/08/2021	Rp 693.520,79	Rp 693.826,15	Rp 697.867,08	Rp 653,105.00	Rp 652,901.00
02/08/2021	Rp 622.859,18	Rp 698.781,23	Rp 697.275,34	Rp 692,338.00	Rp 732,686.00
03/08/2021	Rp 704.608,96	Rp 705.225,78	Rp 695.475,24	Rp 642,972.00	Rp 687,117.00
04/08/2021	Rp 702.615,63	Rp 705.299,84	Rp 708.033,59	Rp 682,412.00	Rp 734,906.00
05/08/2021	Rp 703.852,69	Rp 688.784,92	Rp 708.538,27	Rp 696,599.00	Rp 663,294.00
22/08/2021	Rp 687.817,27	Rp 701.089,88	Rp 685.324,00	Rp 685,736.00	Rp 674,889.00
23/08/2021	Rp 689.074,29	Rp 689.503,11	Rp 686.710,86	Rp 709,371.00	Rp 658,334.00
24/08/2021	Rp 696.947,92	Rp 695.954,72	Rp 690.243,62	Rp 696,004.00	Rp 727,635.00
25/08/2021	Rp 685.426,79	Rp 685.257,26	Rp 696.552,12	Rp 646,640.00	Rp 702,968.00
26/08/2021	Rp 687.434,13	Rp 687.671,65	Rp 683.430,44	Rp 669,523.00	Rp 652,083.00
01/09/2021	Rp 685.610,96	Rp 686.227,56	Rp 676.364,92	Rp 696,749.00	Rp 725,764.00
02/09/2021	Rp 686.586,44	Rp 686.056,88	Rp 684.944,48	Rp 734,301.00	Rp 678,965.00
03/09/2021	Rp 685.598,10	Rp 684.908,58	Rp 689.234,26	Rp 713,427.00	Rp 670,410.00
04/09/2021	Rp 683.677,41	Rp 682.718,40	Rp 684.944,48	Rp 656,311.00	Rp 675,300.00

05/09/2021	Rp 683.677,41	Rp 687.890,65	Rp 683.935,12	Rp 712,308.00	Rp 671,319.00
22/09/2021	Rp 671.597,84	Rp 671.966,53	Rp 674.093,86	Rp 675,309.00	Rp 724,898.00
23/09/2021	Rp 677.855,40	Rp 678.565,19	Rp 671.822,80	Rp 653,508.00	Rp 691,057.00
24/09/2021	Rp 677.816,53	Rp 677.639,10	Rp 683.935,12	Rp 682,275.00	Rp 714,812.00
25/09/2021	Rp 678.848,05	Rp 674.584,65	Rp 678.635,98	Rp 700,371.00	Rp 669,084.00
26/09/2021	Rp 678.848,05	Rp 673.098,00	Rp 677.987,34	Rp 724,239.00	Rp 670,835.00

### MAPE (Mean Absolute Percentage Error)

The mean absolute percentage error is calculated by dividing the absolute error in each period by the actual value observed at that moment (MAPE). After that, the absolute percentage errors are averaged. When the size or magnitude of the forecasting variable is relevant in determining prediction accuracy, this strategy is useful. The size of the anticipated error in proportion to the real value is measured with MAPE.

$$\begin{aligned} \text{MAPE} &= \frac{100\%}{1} \sum_{t=1}^n \frac{|A_t - F_t|}{A_t} \\ &= \frac{100\%}{1} \sum_{t=1}^n \frac{|\text{Rp. } 693.520.79 - \text{Rp } 574,665.384|}{\text{Rp. } 693.520.79} = 17,14\% \end{aligned}$$

Table.2

Mean Absolute Percentage Error (MAPE)

Date	Actual Price 1	Forecast 5	MAPE
01/08/2021	Rp 693.520,79	Rp 574,665.384	17.14 %
02/08/2021	Rp 622.859,18	Rp 632,332.392	1.52 %
03/08/2021	Rp 704.608,96	Rp 584,994.756	16.98 %
04/08/2021	Rp 702.615,63	Rp 616,428.656	12.27 %



05/08/2 021	Rp 703.852,69	Rp 590,783.876	16.06 %
22/08/2 021	Rp 687.817,27	Rp 590,962.084	14.08 %
23/08/2 021	Rp 689.074,29	Rp 589,729.988	14.42 %
24/08/2 021	Rp 696.947,92	Rp 613,432.104	11.98 %
25/08/2 021	Rp 685.426,79	Rp 591,596.102	13.69 %
26/08/2 021	Rp 687.434,13	Rp 575,937.022	16.22 %
01/09/2 021	Rp 685.610,96	Rp 610,228.510	10.99 %
02/09/2 021	Rp 686.586,44	Rp 603,841.771	12.05 %
03/09/2 021	Rp 685.598,10	Rp 595,679.698	13.12 %
04/09/2 021	Rp 683.677,41	Rp 581,311.976	14.97 %
05/09/2 021	Rp 683.677,41	Rp 595,284.703	12.93 %
06/09/2 021	Rp 683.449,08	Rp 594,950.870	12.95 %
22/09/2 021	Rp 671.597,84	Rp 603,265.017	10.17 %
23/09/2 021	Rp 677.855,40	Rp 584,226.350	13.81 %
24/09/2 021	Rp 677.816,53	Rp 603,191.608	11.01 %
25/09/2 021	Rp 678.848,05	Rp 589,090.324	13.22 %



26/09/2021	Rp 678.848,05	Rp 595.888.565	12.22 %
MAPE Average			12,49 %

The MAPE value for each date is determined from the table above, and the average MAPE value of 61 gold price data is 12.49 percent. So, based on the table above, the average error rate (MAPE) is low, and if the error rate is low, the accuracy level is high.

## CONCLUSION

Forecasting on the system with the Triple Exponential Smoothing technique yields an accuracy rate of 86.93 percent and a MAPE value of 12.49 percent. The alpha and beta values are computed between 0.10 and 0.99, yielding an alpha of 0.15 and a beta of 0.85. This system is expected to generate output in the form of gold price data per gram in the future, making it one of the features of decision assistance for investors before investing in gold and limiting losses.

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