

ABSTRACT

MODELING OF MONTHLY GOLD PRICES USING THE MAXIMAL OVERLAP DISCRETE WAVELET TRANSFORM – AUTOREGRESSIVE INTEGRATED MOVING AVERAGE (MODWT–ARIMA) METHOD

By

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MODWT–ARIMA is a time series modeling method that combines the Maximal Overlap Discrete Wavelet Transform (MODWT) and the Autoregressive Integrated Moving Average (ARIMA) model. This method enables the separation of long-term trend components and short-term fluctuations based on their frequency scales, allowing ARIMA modeling for each component to be performed more optimally. In this study, the MODWT–ARIMA method is applied to forecast global monthly gold prices for the period from January 2010 to September 2025, obtained from Investing.com. The data are then divided into in-sample and out-of-sample datasets for model development and evaluation purposes. Subsequently, the in-sample data are decomposed into four components, namely D1, D2, D3, and S3. Each component is modeled using the ARIMA method, resulting in the best models ARIMA(1,0,1), ARIMA(9,0,4), ARIMA(7,0,10), and ARIMA(9,1,5). The modeling results are then recombined using the inverse MODWT. The results indicate that the MODWT–ARIMA approach improves the performance of the ARIMA model by reducing the MAPE value from 37.74% to 17.88% and the RMSE value from 1,281.321 to 646.5379, thereby producing more accurate and stable forecasts.

Key words: MODWT–ARIMA, Gold Prices, Time Series, Wavelet, Forecasting.

ABSTRAK

PEMODELAN HARGA EMAS BULANAN DENGAN METODE *MAXIMAL OVERLAP DISCRETE WAVELET TRANSFORM – AUTOREGRESSIVE INTEGRATED MOVING AVERAGE* (MODWT–ARIMA)

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MODWT–ARIMA merupakan metode pemodelan deret waktu yang mengombinasikan *Maximal Overlap Discrete Wavelet Transform* (MODWT) dan *Autoregressive Integrated Moving Average* (ARIMA). Metode ini memungkinkan pemisahan komponen tren jangka panjang dan fluktuasi jangka pendek berdasarkan skala frekuensinya, sehingga pemodelan ARIMA pada setiap komponen dapat dilakukan secara lebih optimal. Pada penelitian ini, metode MODWT–ARIMA digunakan untuk meramalkan harga emas bulanan di dunia pada periode Januari 2010 sampai September 2025 yang diperoleh dari situs Investing.com. Data yang digunakan kemudian dibagi menjadi data *in-sample* dan *out-sample* untuk keperluan pembentukan dan evaluasi model. Selanjutnya, data *in-sample* didekomposisi menjadi empat komponen, yakni D1, D2, D3, dan S3. Masing-masing komponen dimodelkan menggunakan metode ARIMA dan diperoleh model terbaik ARIMA(1,0,1), ARIMA(9,0,4), ARIMA(7,0,10), dan ARIMA(9,1,5), yang hasilnya digabungkan kembali menggunakan *Invers* MODWT. Hasil pemodelan menunjukkan bahwa MODWT–ARIMA meningkatkan performa model ARIMA dengan menurunkan nilai MAPE dari 37,74% menjadi 17,88% dan nilai RMSE dari 1.281,321 menjadi 646,5379, sehingga menghasilkan peramalan yang lebih akurat dan stabil.

Kata kunci: MODWT–ARIMA, Harga Emas, Deret Waktu, *Wavelet*, Peramalan.