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Trend Analysis for Daily Gold Price in Malaysia

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ABSTRACT

The awareness of gold price trends is essential for promoting financial stability, wealth preservation, diversified investments, preserving cultural practices and economic stability. However, there is a noticeable absence of studies utilizing least square models to analyze the daily gold price trend (RM), highlighting a gap in research on this crucial financial aspect. This study aims to uncover trends in daily gold prices over time, examine the correlation between gold prices and time, and develop a least squares model for analyzing daily gold price (RM). The dataset consists of 1569 daily gold price observations in Malaysia from August 2018 to November 2022, obtained through the secondary data collection method from the Public Gold website. The study discovered a positive correlation between Gold Price (RM) and Time (Day) with Pearson Correlation Coefficient of 0.879. This implies that, over the specified time frame, there is a consistent upward trend in gold prices, a critical insight for investors and financial decision-makers. Furthermore, the developed least squares model features an intercept of 182.801 and a slope of 0.074. This slope signifies that for each day's increase in time, the gold price is anticipated to rise by RM0.074. The daily gold price analysis not only provides valuable insights into gold price patterns but also offers a practical tool for making informed financial decisions and predicting future gold prices, thereby contributing to economic stability, and fostering responsible and sustainable gold practices.

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1. Introduction

Gold holds a special value as it combines characteristics of a commodity, a precious metal, and a currency. Additionally, it is a valuable metal that serves both as jewelry and an investment for short and long-term goals. Its exceptional ductility and chemical stability, coupled with its scarcity and consistent physical and chemical properties, ensure that gold retains its shape and color over

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time. [1],[2]. Gold ores are mined from the earth using underground extraction technologies, then purified and cooled before being ready for market. It accounts for 8% of global demand, with prevalent uses including consumer electronics, semiconductors, and dental implants. The remainder of annual gold production is mostly affected by jewelry or investment demand, with storage in bank vaults frequently involved [3]. Gold has a finite store of value that derives its supply primarily from mining, recycling, and central bank reserves. Notably, gold mines stand as the predominant contributors, accounting for approximately 75% of annual production [4].

Due to the distinctive features of gold assets, there has been a growing interest in exploring price fluctuations. Economic uncertainty is often identified as a key factor influencing the dynamics of gold prices [5]. Comprehending the volatility patterns and trends in gold futures can assist in figuring out the optimal investment strategies and capital allocation decisions [6]. Internationally, the most important gold markets include both spot and futures trading. Historically, people invested in physical gold through jewelry, coins, and artifacts. Presently, there are alternative investment choices like gold funds and exchange-traded funds (ETFs) accessible [7]. The Middle Eastern market displays a preference for the purest and highest carat gold. The shifting demographics, income growth, and rapid economic expansion in these regions have fueled an augmented interest in this precious metal. Notably, India stands as the largest importer of gold [8]. Because gold jewelry is significant in Indian culture, most of the imported gold is utilized to produce jewelry. Indians regard gold as a sign of wealth and beauty. According to [9], gold is widely regarded as one of the most effective tools for hedging against risks, with its future liquidity surpassing that of holding stocks or paper currency. [10] further emphasizes that gold has consistently symbolized stability and affluence.

Gold presents itself as an investment that is unaffected by inflation, and its prices are frequently thought to rise over time [11]. According to historical statistics, investing in gold during the 1998 global crisis was deemed a safe bet because it remained impervious to the crisis's impact [12]. The decision to invest in gold is determined by the investor's knowledge and education level rather than their income. Those interested in investing in gold are motivated by their understanding of its benefits and advantages [13]. Education level also plays a role because it affects a person's general understanding, which determines their proclivity to invest in gold. Furthermore, except for zakat, gold investments are frequently tax-free. Understanding the fundamental trends in gold prices not only promotes the importance of gold as a means for financial stability, long-term wealth preservation, and investment diversification but also plays a vital role in informed decision-making, the preservation of cultural traditions, and overall economic stability. In addition, knowledge of gold price fluctuations is indispensable for various stakeholders, offering them strategic insights, risk management capabilities, and a deeper understanding of the broader economic and financial context.

Moreover, recognizing the significance of comprehending gold price trends within the context of Malaysia, where the currency of interest is the Malaysian Ringgit (RM), certainly holds relevance. This knowledge not only underlines the importance of gold as a safeguard for financial stability, long-term wealth preservation, and investment diversification within the Malaysian economic landscape but also empowers individuals and institutions to make well-informed financial decisions, preserving cultural traditions and contributing to economic stability within the nation. Furthermore, precise insights into gold price fluctuations in RM are imperative for various stakeholders in Malaysia, providing them with the tools to make strategic decisions, manage financial risks, and gain a deeper understanding of the local economic and financial environment.

Despite this pressing need, there remains a substantial research gap in exploring the daily patterns of RM-denominated gold prices using the least squares methodology. Therefore, this study addresses this specific research gap within the Malaysian context. Its primary objectives are to discern the temporal trends in RM gold prices, investigate the intricate relationship between RM gold prices and time, and establish a robust least squares model tailored for the analysis and forecasting of daily RM gold prices.

2. Literature Review

The global gold market has garnered significant interest in recent times, with the price of gold currently exceeding its historical trends. Mining enterprises are actively seeking ways to manage the uncertainties associated with fluctuations in gold prices. Their strategies encompass hedging, prospective investments, and assessment determinations, all which hinge on accurate forecasts of future price trends. Given the substantial role that the gold price plays within the broader economic landscape, the ability to predict it holds considerable significance. Various studies and methodologies

have been employed to achieve this goal. Notably, certain prominent research efforts have employed classical econometric approaches to forecast gold prices [14],[15].

There are many methods in the literature that make predictions of the price of gold based on historical data. Predicting the price of gold constitutes a significant financial challenge, as it holds utmost importance for the government, scholars, and investors who seek to understand its price fluctuations. Gold possesses a unique and multifaceted nature, encompassing attributes of a commodity, a precious metal, and a currency [16]. As the financial market has evolved, the significance of the gold market has steadily grown, elevating it to the status of an equally important financial investment market alongside the stock market, futures market, bond market, and others [17]. Forecasting gold price changes is an important and challenging task and is the focus of both scholars and the government. It is of great theoretical and practical significance to predict fluctuations in gold prices accurately and effectively [16].

The least squares method is commonly used in various fields to fit mathematical models to data, including time series data. Time series data represents observations of a variable taken at different points in time, and the least squares method can be applied to find the best-fitting model that minimizes the sum of squared differences between the observed data points and the values predicted by the model. Least squares can be used to fit a linear regression model to time series data to identify and quantify trends. This is particularly useful in economics, environmental science, and finance [18].

The Least Square model aims to portray the dependent variable's values as precisely as feasible concerning the independent variable using a linear function. This method is widely utilized for forecasting the values of financial instruments, particularly when those values exhibit stability. It involves determining a line that connects existing data points, which is then utilized as an assumption that upcoming data points will align with this line Jovana. The linear regression line is a straight line that is fitted through the scatterplot in a way that minimizes the vertical distances (residuals) between the data points and the line. The line represents the best estimation of the linear relationship between the variables [19].

3. Methodology

This study utilizes a time series dataset containing attributes of Time (Day) and Gold Price (RM). The dataset consists of 1569 daily gold price observations in Malaysia from August 2018 to November 2022, obtained through the secondary data collection method provided by Public Gold Company. Public Gold is a renowned and reputable gold trading company in Malaysia. The independent variable is Time (Day), while the dependent variable is Gold Price (RM). The Least Square Model is employed to establish the best-fit line based on the data [20], enabling the generation of an equation for the Least Square line, which facilitates the forecasting of future daily gold prices. The equation (1) represents the general linear trend pattern**.**

$$Y_t = \alpha + \beta t + \varepsilon_t \tag{1}$$

where

Y_t is the value of the dependent variable at time t

t is the time variable (in day)

α is the estimated trend at time zero (intercept)

β is the slope parameter

ε_t is the error term usually assumed as identically, independently, and normally distributed with mean zero and variance σ_e^2.

As the respective estimated values are obtained, equation (1) can now be written as (2),

$$\hat{Y}_t = \hat{\alpha} + \hat{\beta} t \tag{2}$$

Data partitioning is initially carried out by randomly splitting the dataset into two sets: a development (training) dataset and a validation dataset. This step aims to prevent overfitting issues.

The proposed partition ratio is 70:30, with 70% of the data used for training and 30% for validation, following guidelines from [21] and [22]. The training data is utilized to fit the model, while the validation data is used to assess the model's performance. Table 1 displays the sample sizes for both the training and validation sets.

Table 1. The Partitioned Data for Training and Validation

Partition	Number of data
Training (70%)	1099
Validation (30%)	471
Total	1569

Figure 2 displays the process flow diagram of the Least Square Model, developed using RapidMiner Studio. The dataset node (Gold Price Data node) serves as the initial data source, followed by the Select Attribute node, Set Role node, and Split node, all connected sequentially. The Split node is connected to both the Least Square Model and Apply Model nodes, and the Least Square Model node is also connected to the Apply Model node. Lastly, the Performance node is connected to the Apply Model node.

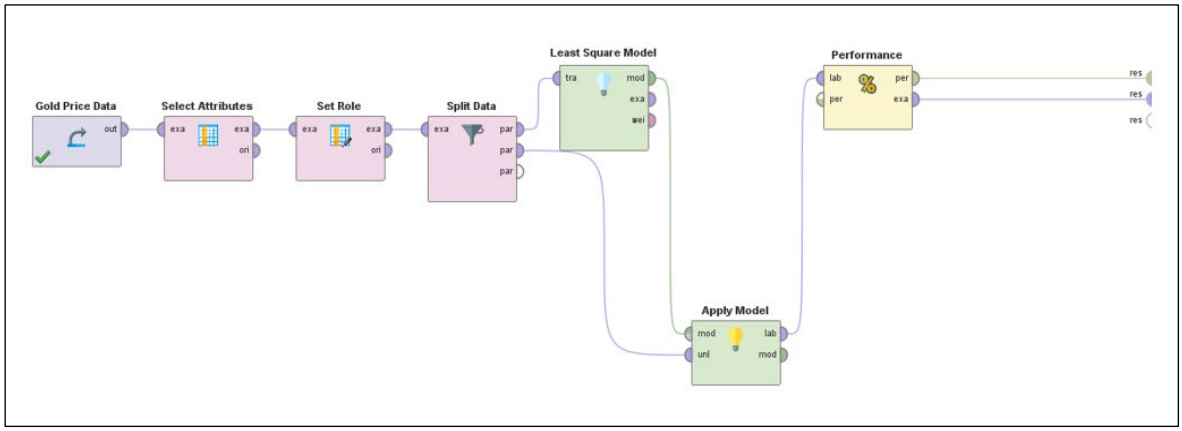

Figure 2. The Flow Diagram of Developing Gold Price Least Square Model.

4. Results and Discussions

In this section, the experimental results for gold price prediction are presented. Data from 3rd August 2021 were used as training samples and data from 4th August 2021 onwards were used as testing samples.

4.1 Result of Descriptive Analysis

Table 2 provides crucial insights into the data. The average Gold Price was RM236.29, providing a central reference point for understanding the general market conditions. Notably, the recorded range was substantial, with the lowest price recorded at RM169 and the highest reaching RM293 that emphasize the volatility and potential for significant price fluctuations within the Malaysian RM gold market.

Table 2. Descriptive Statistics of Gold Price (RM)

Variable	Mean	Minimum	Maximum
Gold Price (RM)	236.29	169	293

4.2 Result of Correlation Analysis

The scatter plot in Figure 3 illustrates the relationship between Gold Price and Time (Day), indicating a positive correlation between the two variables from the training dataset. It becomes evident that as time progresses (Day increases), the Gold Price (RM) tends to rise consistently,

reflecting a positive trend and suggesting a potential long-term appreciation in gold's value within the Malaysian market. The high Pearson's correlation coefficient of 0.879 between two variables present the robustness of this positive correlation. This finding holds significant implications for individuals and entities engaged in the Malaysian RM gold market, as it highlights the potential for gold to serve as a store of value and a strategic asset for wealth preservation and investment diversification over time.

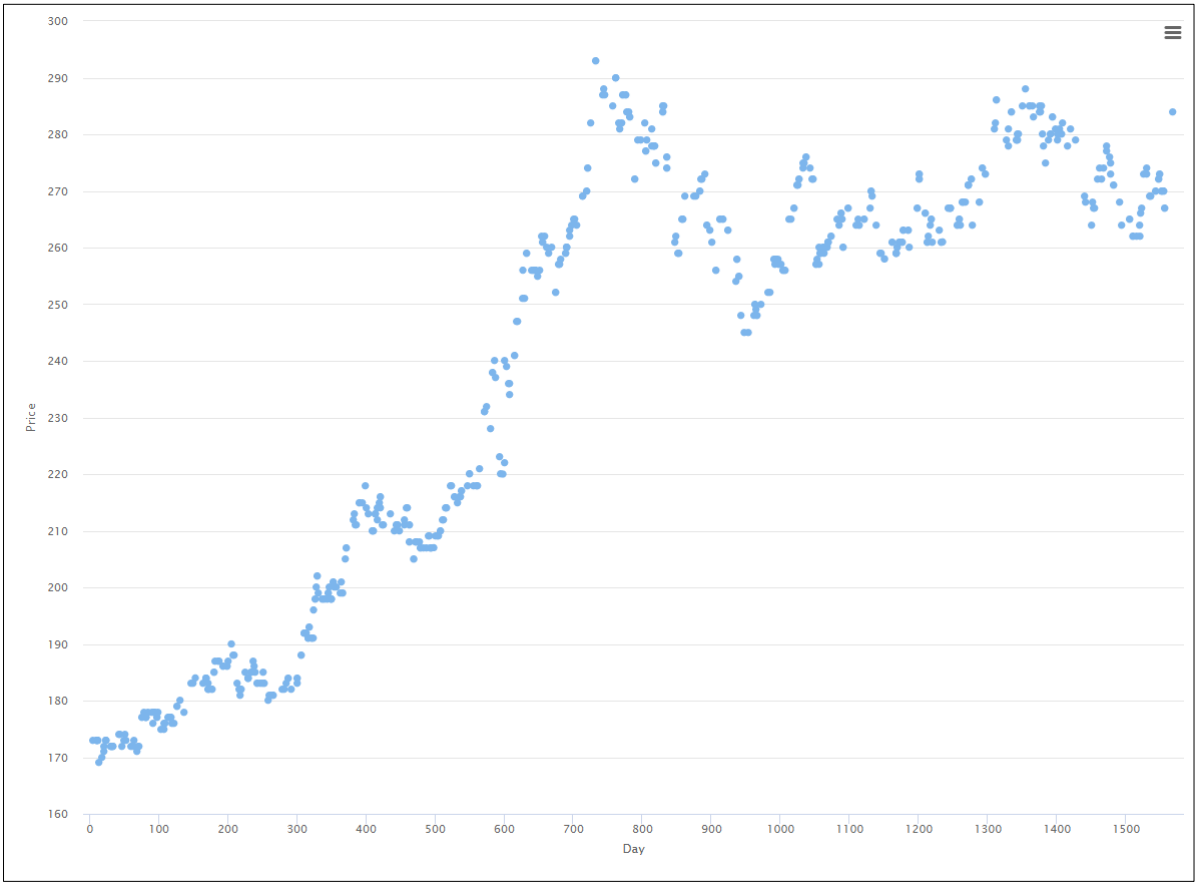

Figure 3. Scatter Plot of Gold Price (RM) against Time (Day)

While the depicted plots specifically relate to the Malaysian RM gold market, it is essential to emphasize that the gold price within this context remains susceptible to the influence of a myriad of global factors, including international gold price fluctuations, currency exchange rate movements, geopolitical developments, and prevailing economic conditions. While localized elements and market dynamics may introduce certain deviations, it is evident that the Malaysian RM gold market is intricately connected with and responsive to the overarching trends and shifts within the broader global gold market. These combined local and global influences can be observed in the price fluctuations throughout the data, with a notable example being the peak prices occurring in the midst of the year, particularly between January and February 2021. A thorough analysis would require in the future research to examine a wide range of economic, financial, and geopolitical data to pinpoint the exact drivers of the price increase during that particular period.

4.3 Result of Trend Estimation using Least Square Method

The least squares method was used to find the best-fitting linear regression equation that minimizes the sum of the squared differences between the observed data points and the values predicted by the equation. Thus, the trained linear model for this data is shown in Equation (3) below.

$$Y(t) = 182.801 + 0.074t \quad (3)$$

where $Y(t)$ is the gold price (RM) at time (in days) t and t is the time variable (in days).

The Least Square equation is valuable for predicting future gold price values. The estimation can be adjusted according to different time frames. Using equation (3), the slope is 0.074, indicating that with each day's increase in time, the gold price is expected to rise by RM0.074. The obtained intercept is 182.801, implying that when time is zero, the forecasted gold price is approximately M182.80. The squared correlation was 77.26% represented that this model explained 77.26% variation of the prices. The root mean squared error was 17.707 generated from the training data.

The data visualization in Figure 4 employs a line chart to provide a clear visual representation of the dataset, enabling the identification of distinct components within the time series. The prominent feature observed in this representation is the predicted line model, which unmistakably showcases the presence of a robust linear trend component in the data. This is evident through the consistent upward trajectory of the line, signifying a sustained and systematic increase in Gold Price over Time. The linear model serves as a valuable tool for understanding and forecasting the overarching trend within the Malaysian RM gold market, providing insights that can inform investment strategies and financial decision-making in this context.

Figure 4. Line chart of Gold Price (RM) against Time (Day)

5. Conclusion

Historically, the oscillations in gold prices have attracted the attention of governments, institutions, and individuals alike. Thus, leveraging predictive analytics plays a pivotal role in maximizing profits within time constraints, a critical consideration for financial decision-makers. Indeed, forecasting holds paramount significance for these stakeholders. The model derived from this research, expressed as $Y(t) = 182.801 + 0.074t$, stands as a valuable tool that can be readily adapted to accommodate additional daily gold price data or data from other gold-related sources. It is anticipated that the model developed within this study will substantially enhance our ability to predict daily gold prices, offering valuable insights for investment and financial strategies.

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Conflict of Interest

The authors declare no conflict of interest in the subject matter or materials discussed in this manuscript.

References

[1] S. Setyowibowo, M. As'ad, Sujito, & E. Farida, "Forecasting of daily gold price using ARIMA-GARCH Hybrid Model", *Jurnal Ekonomi Pembangunan*, vol. 19, no. 2, pp. 257-270, 2021.

[2] S. Liu, Y. Geng, Z. Gao, J. Li, & S. Xiao, " Uncovering the key features of gold flows and stocks in China", *Resources Policy*, vol. 82, pp. 1-9, 2023.

[3] S. Lezak, C. Wilson, A. Ansar & M. Bazilia, "The case against gold mining", *Environmental Research*, vol. 18, pp. 1-7, 2023.

[4] J. A. Hernandez, "Forecasting of dependence, market, and investment risks of a global index portfolio", *Journal of Forecasting*, vol. 39, no. 3, pp. 512-522, 2019.

[5] T. L. D. Huynh, "The effect of uncertainty on the precious metals market: New insights from Transfer Entropy and Neural Network VAR", *Resources Policy 66*, 2020.

[6] Y. Wei, C. Liang, Y. Li, X. Zhang, & G. Wei, "Can CBOE gold and silver implied volatility help to forecast gold futures volatility in China? Evidence based on HAR and Ridge regression models", *Finance Research Letters*, vol. 35, 2020.

[7] N. N. Tripathi, A. B. Raj, A. K. Tiwari, " Do employees' salaries and board of director's remuneration impact gold demand?: An empirical study", *Resources Policy*, vol. 75, pp. 1-13, 2022.

[8] S. Sonmez, "The dynamic effects of oil price shocks on the economies of the twelve major oil exporting countries from 1970-2013: The role of political economy factors", *International Journal of Business and Economic Sciences Applied Research*,vol. 13,no. 1, pp. 29-31, 2020.

[9] O. B. Adekoya, J. A. Oliyide, E. A. Olubiyi, & A. O. Adedeji, "The inflation-hedging performance of industrial metals in the world's most industrialized countries", *Resources Policy*, vol. 81, 2023.

[10] Y. Tang, & J. Zhong, "Predicting gold volatility: Exploring the impact of extreme risk in the international commodity market", *Finance Research Letters*, vol. 58, pp. 1-6, 2023.

[11] R. Iriani, & N. Suprayogi, "Akuntansi tabungan emas pegadaian syariah", *Jurnal Ekonomi Syariah Teori dan Terapan*, 5(10), 848-859, 2018.

[12] C. Gu, A. Kurov, & R. Stan, "Monetary policy and uncertainty resolution in commodity markets", *Finance Research Letters*, vol. 55, 2023.

[13] A. P. Rahma, & C. Canggih, "Analisis faktor-faktor yang mempengaruhi minat masyarakat terhadap investasi emas", *Jurnal Ekonomika dan Bisnis Islam*, 4(2), 98-108, 2021.

[14] S. Shafiee & E. Topal, "An overview of global gold market and gold price forecasting", *Resources Policy*, 35(3), 178–189, 2010.

[15] G. Aye, R. Gupta, S. Hammoudeh, W. J. Kim, Forecasting the price of gold using dynamic model averaging," *International Review of Financial Analysis*, 41(C), pp. 257–266, 2015.

[16] P. Zhang, & B. Ci, "Deep belief network for gold price forecasting", *Resources Policy*, 69 (2020), pp. 1-11, 2020.

[17] F.H. Wen, X. Yang, X. Gong, & K.K. Lai, "Multi-scale volatility feature analysis and prediction of gold price", *International Journal of Information Technology & Decision Making,* Vol. 16, No. 01, pp. 205-223, 2017.

[18] D. C. Montgomery, C. L. Jennings, & M. Kulahci, "Introduction to time series analysis and forecasting" *Wiley,* 2015.

[19] J. Stokanović Sević, & A. Jovancai Stakić, "Prediction of gold price movement considering the number of infected with COVID-19", *The European Journal of Applied Economy*, 19(2), pp. 71-83, 2022.

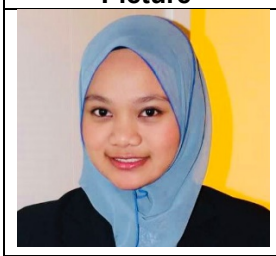
[20] M. A. Lazim,"Introductory business forecasting" *A practical approach 3rd edition*, UiTM Press.

[21] M. S. A. Basha, P. M. Oveis, C. Prabavathi, M. B. Lakshmi, & M. M. Sucharitha, " An efficient machine learning approach: Analysis of supervised machine learning methods to forecast the diamond price", *International Conference for Advancement in Technology*, pp. 1-6, 2023.

[22] A. SP, J. Shekhawat, H. Hashmi, A. Joshi, " Study on price forecasting for gold commodities

using tree-based customized adaboost algorithm", International Journal of intelligent systems and applications in engineering, vol. 11, no. 8s, pp. 429–433, 2023.

Biography of all authors

Picture	Biography	Authorship contribution
	Nurul Hunsa Jamian is an academician at the College of Computing, Informatics and Mathematics, Universiti Teknologi MARA (UiTM), Perak Branch, Tapah Campus, Perak, Malaysia. Her area of expertise includes Statistical Modeling, Forecasting and Data Mining. You can contact her at nurul872@uitm.edu.my.	Design the research work, data analysis and interpreting the results.
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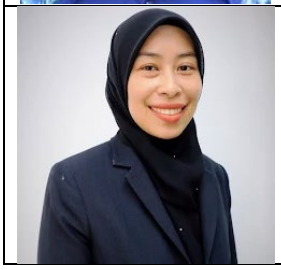
	Mohd Hafiz bin Mohammad Hamzah is an academician at the College of Computing, Informatics and Mathematics, Universiti Teknologi MARA (UiTM), Perak Branch, Tapah Campus, Perak. His area of interest is Applied Mathematics. He can be contact via email mhafiz85@uitm.edu.my.	Writing the literature review and references
	Farah Waheeda Azhar is a lecturer at the College of Computing, Informatics and Mathematics, Universiti Teknologi MARA (UiTM), Perak Branch, Tapah Campus, Perak. Her area of interest is Mathematics. She can be contacted at email: farah154@uitm.edu.my	Writing the abstract and introduction