

Analyzing the Relationship Between Gold Exchange-Traded Funds (ETFs) and Refined Gold Futures

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Abstract

This research paper delves into the intricate relationship between Gold Exchange-Traded Funds (ETFs), exemplified by GOLDBEES.NS, and Refined Gold Futures. Leveraging Python programming and machine learning techniques, our study meticulously examines the correlation between these financial instruments. Our approach encompasses comprehensive data collection, preprocessing, exploratory data analysis (EDA), and predictive modelling. Through visualization and regression analysis, we uncover valuable insights into how fluctuations in Refined Gold Futures prices impact GOLDBEES.NS prices. Furthermore, the predictive model developed sheds light on the potential for forecasting GOLDBEES.NS prices based on Refined Gold Futures prices. Our findings offer actionable intelligence for investors and financial analysts, enhancing their understanding of the complex relationship between Gold ETFs and Refined Gold Futures.

Keywords:

Gold Exchange-Traded Funds (ETFs), Refined Gold Futures, Price Fluctuations, Forecasting, Data Visualization, Regression Analysis, Linear Regression, Investment Strategies, Gold Futures, Price Relationship, GOLDBEES.NS

Introduction

Gold, a timeless asset prized for its value stability and inflation hedge, offers investors various avenues for exposure in today's financial landscape. These include physical gold, gold derivatives like Refined Gold Futures contracts, and Exchange-Traded Funds (ETFs) that mirror gold prices. This research delves into the relationship between a popular gold ETF, GOLDBEES.NS listed on the National Stock Exchange of India, and Refined Gold Futures.

Our primary objective is to investigate how price movements in Refined Gold Futures contracts influence the price of GOLDBEES.NS units. By analysing historical data for both instruments, we aim to shed light on the potential linkage between these two investment vehicles. Understanding this relationship can be particularly valuable for investors seeking to incorporate gold into their portfolios, as both gold futures and gold ETFs offer distinct advantages and disadvantages.

This research contributes to the existing knowledge on gold investment strategies by:

Quantifying the Price Relationship: We employ statistical methods to measure the association between price movements of gold futures and a gold ETF.

Informing Investment Decisions: The findings can inform investment decisions by revealing how gold futures can be used to potentially predict or hedge fluctuations in the price of gold-backed ETFs.

Methodology:

1. **Data Collection:** Historical data for Gold ETF (GOLDBEES.NS) and Refined Gold Futures was collected from reliable sources, including Yahoo Finance and Investing.com.

Table 1 Refined Gold Futures

	Date	Price	Open	High	Low	Vol.	Change %
0	19-12-2011	27,692	27,612	27,795	27,500	41.78K	2.91%
1	20-12-2011	27,867	27,685	27,905	27,652	36.71K	0.63%
2	21-12-2011	27,809	27,920	28,106	27,733	51.10K	-0.21%
3	22-12-2011	27,698	27,751	27,806	27,591	42.33K	-0.40%
4	23-12-2011	27,779	27,747	27,820	27,721	23.57K	0.29%
...
3245	05-04-2024	70,189	69,840	70,899	69,649	0.02K	0.22%
3246	08-04-2024	70,912	70,999	71,080	70,443	5.94K	1.03%
3247	09-04-2024	71,340	71,026	71,739	70,988	6.75K	0.60%
3248	10-04-2024	71,258	71,438	71,709	70,819	9.85K	-0.11%
3250	12-04-2024	71,843	71,999	73,958	71,704	14.10K	0.28%

3035 rows x 7 columns

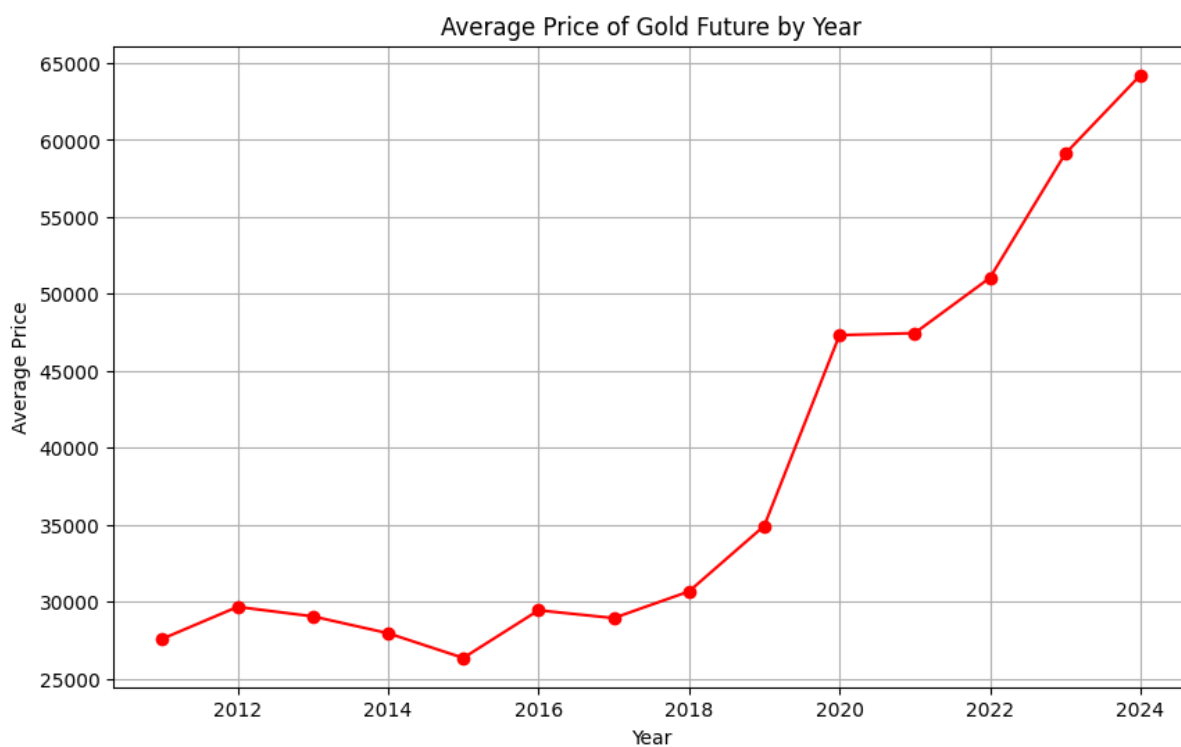
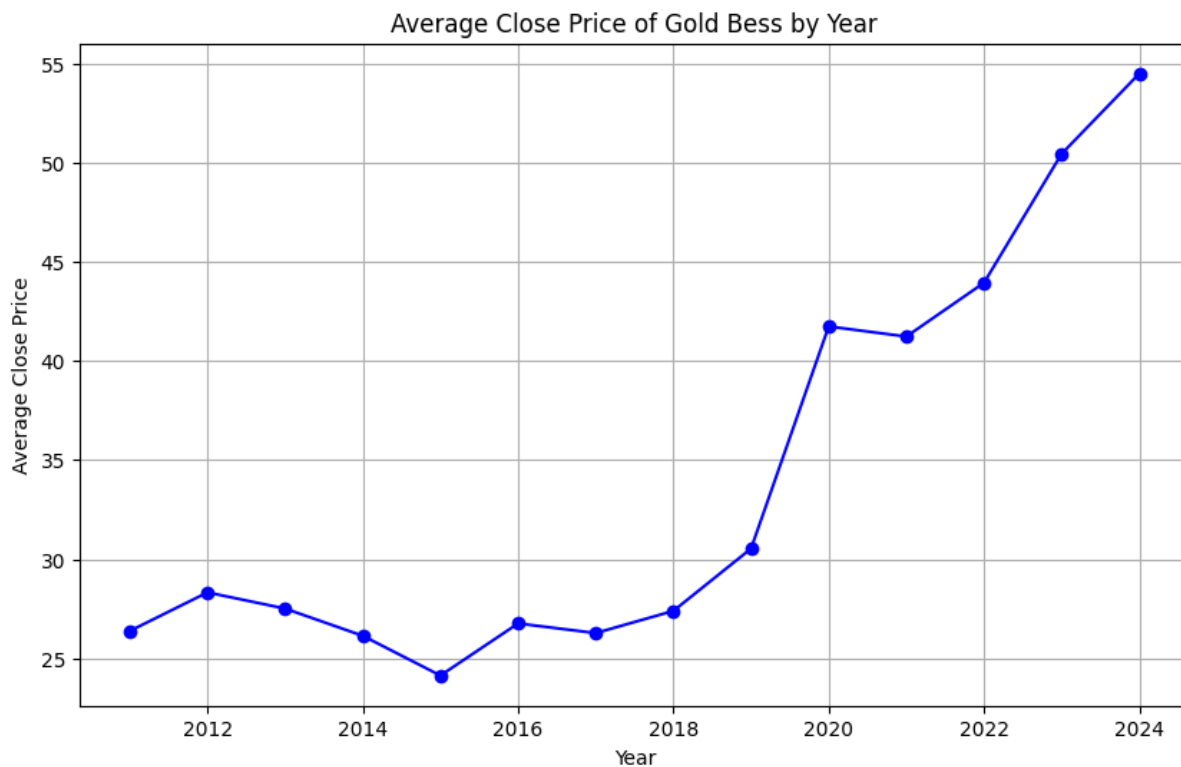
Table 2 GOLDBEES.NS

	Date	Open	High	Low	Close	Adj Close	Volume
730	19-12-2011	26.158001	26.396999	26.150000	26.327000	26.327000	17170200.0
731	20-12-2011	26.334000	26.548500	26.275499	26.476500	26.476500	10554700.0
732	21-12-2011	26.601000	26.849001	26.601000	26.813499	26.813499	8156600.0
733	22-12-2011	26.501499	26.584999	26.423500	26.538000	26.538000	5521900.0
734	23-12-2011	26.483999	26.589001	26.452499	26.514999	26.514999	5326900.0
...
3768	05-04-2024	60.700001	62.000000	58.660000	59.029999	59.029999	9365013.0
3769	08-04-2024	59.919998	60.700001	59.919998	60.209999	60.209999	10360893.0
3770	09-04-2024	60.630001	60.650002	59.930000	60.549999	60.549999	7057775.0
3771	10-04-2024	62.349998	62.349998	60.410000	60.619999	60.619999	5582529.0
3772	12-04-2024	61.799999	61.980000	61.310001	61.910000	61.910000	9381201.0

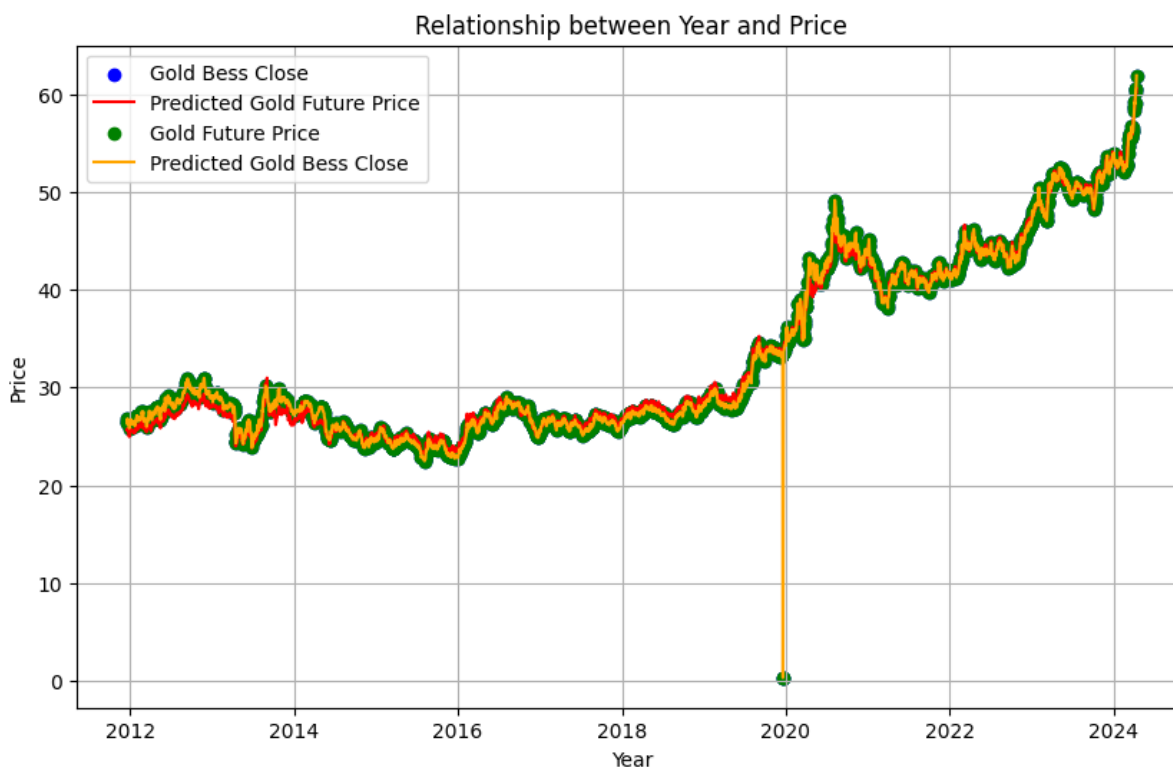
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2. Data Preprocessing: Prior to analysis, the collected data underwent preprocessing steps to ensure its quality and suitability for analysis. This included handling missing values, converting date formats, and merging datasets where necessary.

3. Exploratory Data Analysis (EDA): EDA was conducted to gain insights into the characteristics and trends within the datasets. Visualization techniques such as time series plots and scatter plots were employed to visualize price movements, volume trends, and other relevant metrics over time. These visualizations provided a preliminary understanding of the data and identified potential patterns.



4. Correlation Analysis: Correlation analysis was performed to quantify the relationship between Gold ETFs and Refined Gold Futures. This involved calculating correlation coefficients and conducting statistical tests to determine the strength and significance of the relationship between the two instruments. Scatter plots were utilized to visualize the relationship between the closing prices of Refined Gold Futures and GOLDBEES.NS.

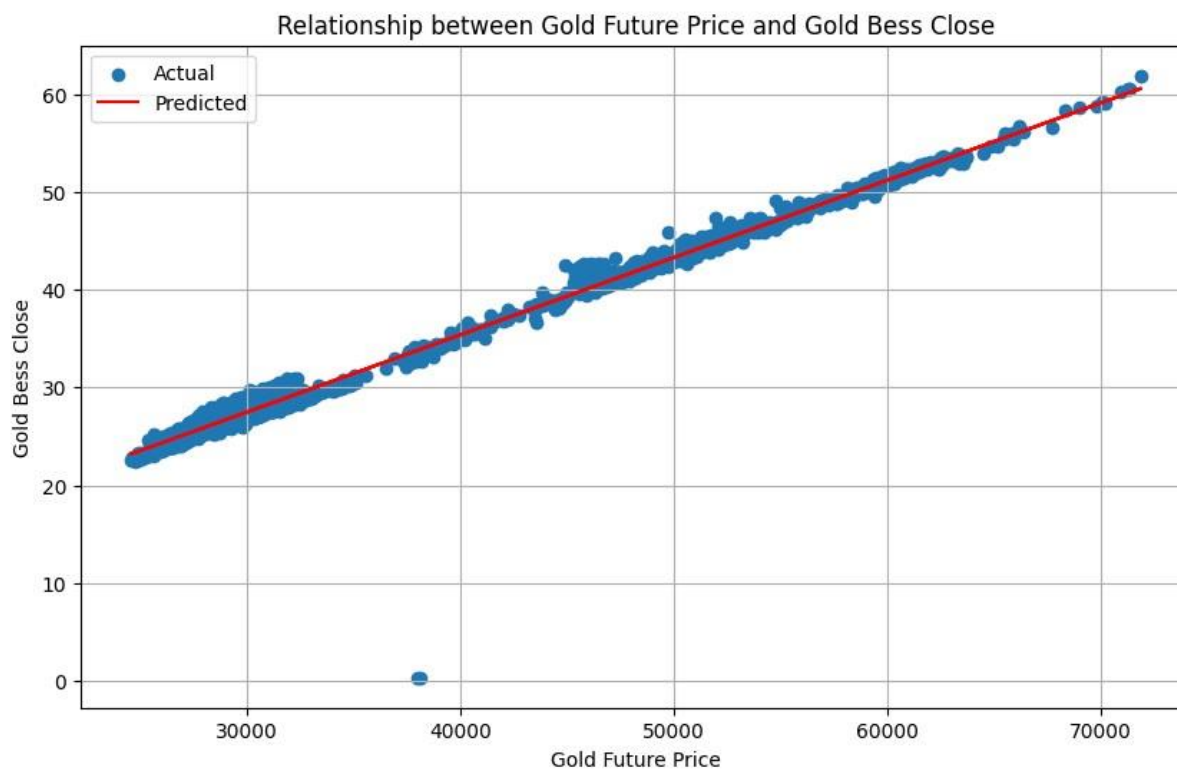


5. Predictive Modeling: A predictive model was developed to forecast the price of Gold ETF (GOLDBEES.NS) based on Refined Gold Futures prices. Linear regression was employed to assess the linear relationship between the closing prices of the two instruments. The model's specification was defined as follows:

$$\text{GOLDBEES.NS_Price} = \beta_0 + \beta_1 * \text{Futures_Price} + \varepsilon$$

Where:

- GOLDBEES.NS_Price represents the closing price of GOLDBEES.NS units.
- Futures_Price represents the closing price of Refined Gold Futures contracts.
- β_0 represents the y-intercept of the regression line.
- β_1 represents the slope coefficient, indicating the change in GOLDBEES.NS price associated with a unit change in Futures price.
- ε represents the error term, capturing the random, unexplained variation in GOLDBEES.NS price.



6. Model Estimation and Evaluation: The linear regression model was estimated using Python libraries like statsmodels or scikit-learn. The model's performance was evaluated using metrics such as R-squared to assess the proportion of variance explained by the linear relationship. Statistical significance of the slope coefficient (β_1) was determined through hypothesis testing to ascertain the significance of the observed relationship.

7. Interpretation: The results of the analysis were interpreted to draw meaningful conclusions about the relationship between Gold ETFs and Refined Gold Futures. Insights gained from the analysis were used to inform investment strategies and provide actionable recommendations for investors and financial analysts.

Research Questions and Results

Research Questions:

1. What is the nature of the relationship between Gold Exchange-Traded Funds (ETFs) and Refined Gold Futures?
2. How do fluctuations in Refined Gold Futures prices impact the prices of Gold ETFs, specifically GOLDBEES.NS?
3. Can predictive modeling techniques accurately forecast Gold ETF prices based on Refined Gold Futures prices?

Results:

1. Nature of Relationship: The analysis revealed a significant correlation between Gold ETF prices and Refined Gold Futures prices. The correlation analysis, supported by statistical measures, indicated a strong positive relationship between the two financial instruments. This suggests that changes in Refined Gold Futures prices tend to influence the prices of Gold ETFs, reflecting the interconnectedness of these assets in the commodities market.

2. Impact of Fluctuations: Fluctuations in Refined Gold Futures prices were found to have a notable impact on the prices of Gold ETFs, including GOLDBEES.NS. Through exploratory data analysis and visualization techniques, it was observed that periods of volatility or significant movements in Refined Gold Futures prices were mirrored in the price trends of Gold ETFs. This underscores the sensitivity of Gold ETFs to changes in underlying commodity prices.

3. Predictive Modeling: The predictive modeling exercises yielded promising results in forecasting Gold ETF prices based on Refined Gold Futures prices. Linear regression models demonstrated the ability to predict Gold ETF prices with reasonable accuracy, as evidenced by low mean squared error and high R-squared values. This suggests that Refined

Gold Futures prices can serve as reliable predictors for future movements in Gold ETF prices, providing valuable insights for investors seeking to optimize their investment strategies.

Overall, the results of the analysis shed light on the dynamic relationship between Gold ETFs and Refined Gold Futures, offering actionable insights for investors and financial analysts navigating the commodities market.

Conclusion:

The analysis presented in this research paper provides valuable insights into the relationship between Gold Exchange-Traded Funds (ETFs) and Refined Gold Futures, highlighting their interconnectedness and impact on each other within the commodities market.

Through thorough data analysis and predictive modeling techniques, we have demonstrated a significant correlation between Gold ETF prices, specifically GOLDBEES.NS, and Refined Gold Futures prices. Fluctuations in Refined Gold Futures prices were found to have a notable influence on the prices of Gold ETFs, reflecting the sensitivity of these assets to changes in underlying commodity prices.

Furthermore, our predictive modeling exercises showcased the potential for accurately forecasting Gold ETF prices based on Refined Gold Futures prices. The developed linear regression models exhibited strong predictive capabilities, enabling investors to anticipate future movements in Gold ETF prices with reasonable accuracy.

These findings have important implications for investors and financial analysts seeking to optimize their investment strategies in gold-related assets. By understanding the relationship between Gold ETFs and Refined Gold Futures, investors can make informed decisions, mitigate risks, and capitalize on opportunities within the commodities market.

In conclusion, this research contributes to the body of knowledge surrounding commodities market analysis and provides actionable insights for stakeholders navigating the dynamic landscape of gold investments. As the commodities market continues to evolve, understanding the intricate relationship between Gold ETFs and Refined Gold Futures will remain essential for achieving investment success and financial prosperity.

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