

The Impact of U.S. Interest Rates on Gold PricesAuthor: Georges Abou Merhy¹*Affiliation:*

1. *Business School, Holy Spirit University of Kaslik, P.O. Box 446, Jounieh, Lebanon*
2. *CIRAME Research Center, Holy Spirit University of Kaslik, P.O. Box 446, Jounieh, Lebanon*

Abstract:

This study examines whether monthly changes in U.S. interest rates were associated with monthly gold returns from January 2020 through August 2026. The analysis combines monthly gold prices from the World Bank Commodity Price Data with the effective federal funds rate from the Federal Reserve. The merged sample contains 80 monthly observations. Gold returns and federal funds rate changes were calculated from the level series, after which Pearson correlations and ordinary least squares regressions were estimated for a same-month specification and a one-month-lagged specification. The same-month rate-change coefficient was negative but not statistically significant ($\beta = -3.176$, $p = 0.109$). The one-month-lagged coefficient was negative and statistically significant at the 5% level ($\beta = -3.984$, $p = 0.045$; 95% confidence interval: -7.876 to -0.092). This result indicates that a one percentage-point increase in the effective federal funds rate was associated with an estimated 3.984 percentage-point reduction in the following month's gold return. However, the lagged model explained only 5.2% of the variation in monthly returns. Gold prices increased by 182.6% over the full sample, despite substantial changes in monetary policy. The evidence therefore provides limited support for a negative short-delay relationship between U.S. interest-rate changes and gold returns. The findings describe association rather than causation and should be interpreted alongside other determinants of gold prices, including inflation expectations, the U.S. dollar, uncertainty, and central-bank demand.

Keywords:

Gold prices, effective federal funds rate, interest rates, monetary policy, gold returns, time series

Introduction:

1.1 Background and Context

Gold occupies a distinctive position in financial markets. It is a physical commodity, a reserve asset, and an investment that is commonly used to diversify portfolios. Unlike a bond or bank deposit, gold does not pay interest. Its attractiveness can therefore change when market interest rates move. When interest rates rise, investors can earn a higher return from interest-bearing assets, increasing the opportunity cost of holding gold. When rates fall, that opportunity cost declines. This mechanism supports the conventional expectation of an inverse relationship between interest rates and gold prices.

The relationship is more complex in practice because interest rates also convey information about inflation, economic activity, and monetary-policy expectations. Barsky et al. (2021) argue that gold prices reflect inflation expectations, expected long-term real interest rates, and pessimism about future economic conditions. Their evidence indicates that the inverse relationship between real gold prices and long-term real interest rates became especially visible after 2001. As a result, an observed change in the federal funds rate may affect gold directly through opportunity cost and indirectly through changes in inflation expectations, the U.S. dollar, or investor demand for protection.

The period from January 2020 through August 2026 provides an informative setting for examining this relationship. It includes the COVID-19 shock, exceptionally low U.S. policy rates, a rapid tightening cycle, and a later period of declining rates. In the study sample, the monthly effective federal funds rate ranged from 0.05% to 5.33%. Gold also experienced substantial price changes during the same period. These movements make it possible to test whether gold returns were related to policy-rate changes during a period containing both economic stress and large shifts in monetary policy.

1.2 Problem Statement

Financial theory often predicts that higher interest rates should reduce the demand for a non-interest-bearing asset such as gold. Empirical studies, however, do not identify one stable relationship across all periods and measures. Some research reports an inverse relationship between gold and real interest rates, while other work finds that the sign and strength of the relationship depend on the economic regime, country, time horizon, and variables included in the model. Studies of gold as a safe haven also show that its behavior can change during market stress.

This inconsistency creates a practical research problem. Investors and students of monetary policy may expect gold to respond immediately when the Federal Reserve changes rates, yet the response may occur with a delay or may be obscured by other forces. A same-month test alone could therefore miss part of the relationship. This study addresses the problem by estimating both a contemporaneous model and a one-month-lagged model using a consistent monthly dataset.

1.3 Research Question and Objectives

The main research question is: How were monthly changes in the effective federal funds rate associated with monthly gold returns from January 2020 through August 2026?

The study has four objectives. First, it describes the movements and distribution of gold prices, gold returns, and the effective federal funds rate during the sample period. Second, it measures the

same-month association between changes in the federal funds rate and gold returns. Third, it tests whether the previous month's rate change is associated with the current month's gold return. Fourth, it evaluates the statistical significance and explanatory power of both specifications.

1.4 Research Hypotheses

The first hypothesis states that monthly increases in the effective federal funds rate are associated with lower gold returns during the same month. The second hypothesis states that monthly increases in the effective federal funds rate are associated with lower gold returns in the following month. For each model, the corresponding null hypothesis is that the rate-change coefficient equals zero.

1.5 Significance and Scope

The study contributes a focused examination of a recent period that differs from the long historical samples used in much of the literature. Its use of public monthly data also makes the analysis transparent and reproducible. The same-month and lagged specifications provide a direct comparison between an immediate response and a short, delayed response.

The scope is deliberately narrow. The interest-rate measure is the nominal effective federal funds rate, not a long-term real yield, and the dependent variable is the monthly return on the World Bank's gold-price series. The regressions do not control for inflation, exchange rates, uncertainty, or gold-market demand. The results therefore show whether the two selected variables moved together; they do not establish that Federal Reserve rate changes caused the observed gold returns.

Literature Review:

2.1 Theoretical Relationship Between Interest Rates and Gold

The standard opportunity-cost explanation predicts a negative relationship between interest rates and gold. Because gold does not produce an interest payment, a higher return on safe financial assets makes holding gold relatively less attractive. Higher rates may also raise financing and storage costs for commodity positions. Conversely, lower rates reduce the return forgone by holding gold and may support demand for the metal. This mechanism is strongest when real, inflation-adjusted interest rates are used, because real rates measure the purchasing-power return available on alternative assets.

Gold can also respond to the information contained in interest-rate decisions. A rate increase may signal tighter monetary policy and lower expected inflation, both of which can reduce demand for gold as an inflation hedge. At the same time, the effect can be offset if the decision increases recession concerns or financial-market stress. Ghosh et al. (2004) distinguish between a long-run inflation-hedging relationship and short-run disturbances. Their model identifies the real interest rate, the gold lease rate, convenience yield, default risk, and the dollar exchange rate as factors that can generate short-run gold-price volatility.

Broader commodity research supports several of these channels. Using structural vector autoregressions, Akram (2009) found that declines in real interest rates and the value of the U.S. dollar contributed to higher commodity prices. Although that study examined commodity groups rather than a single gold-price equation, it shows why the interest-rate effect cannot always be separated from dollar movements and global activity.

2.2 Gold as an Inflation Hedge and Safe Haven

The literature frequently studies gold as an inflation hedge, a portfolio hedge, and a safe haven. These concepts are related but not identical. Baur and Lucey (2010) define a hedge as an asset that is uncorrelated or negatively correlated with stocks or bonds on average, while a safe haven is uncorrelated or negatively correlated with those assets during severe market declines. Their analysis of the United States, United Kingdom, and Germany found that gold hedged stocks on average and served as a safe haven during extreme stock-market conditions, although the safe-haven effect was short-lived.

International evidence indicates that the role of gold varies across markets. Baur and McDermott (2010) found stronger safe-haven evidence for several developed markets than for major emerging markets (Beainy & Kamel, 2026). This result suggests that investor behavior, currency exposure, and market structure influence gold's performance during stress. It also cautions against treating gold's safe-haven status as permanent.

Research on inflation protection reaches a similarly qualified conclusion. Ghosh et al. (2004) found support for a long-run relationship between gold and the general price level, but their model also allows substantial short-run deviations. Erb and Harvey (2013) concluded that gold may preserve purchasing power over extremely long horizons but is an unreliable inflation hedge over horizons that are more relevant to most investors. Interest rates can therefore matter even when investors hold gold partly because of inflation concerns.

2.3 Empirical Evidence on Interest Rates and Gold

Several studies connect monetary conditions to gold prices or volatility. Batten et al. (2010) modeled the monthly volatility of gold, silver, platinum, and palladium and found that monetary variables helped explain gold volatility. The finding supports the inclusion of interest-rate conditions in gold-market analysis, but it also shows that monetary factors may influence volatility rather than generate a stable one-for-one price response.

Barsky et al. (2021) examined inflation expectations, expected long-term real rates, and adverse economic conditions as drivers of the real gold price. They report that the expected inverse relationship between the real gold price and the real ten-year U.S. Treasury yield is especially apparent after 2001. This evidence matches the opportunity-cost channel, but it concerns a long-term real yield rather than the short-term nominal policy rate used in the present study.

Other evidence demonstrates that the sign can depend on the model and economic regime. Apergis et al. (2019) used a Bayesian Markov-switching vector error-correction model for the G7 from 1975 to 2016 and found a positive association between gold prices and real interest rates. They also reported that gold provided hedging benefits against real-rate movements mainly during recessions. Their findings differ from the conventional inverse relationship and show that nonlinear behavior and regime changes can materially affect empirical estimates.

2.4 Gold During the COVID 19 Period

The COVID-19 period is directly relevant to the sample because it combined severe uncertainty with rapid monetary-policy responses. Salisu et al. (2021) found that gold retained safe-haven potential during the pandemic and performed better as a safe haven than U.S. stocks and several other precious metals. Their results also showed that models incorporating uncertainty produced better forecasts than models that ignored it.

Akhtaruzzaman et al. (2021) reached a more time-dependent conclusion. Gold acted as a safe haven for major stock markets during the first phase of the COVID-19 crisis but lost that status during the second phase, even as investors increased their gold allocations. Taken together, these studies indicate that relationships observed during crisis periods can change within weeks or months. Monthly estimates covering 2020 onward should therefore be interpreted as averages across distinct market conditions.

2.5 AI instead of Gold

Currently, investments are going towards AI, because the latter can improve firm performance (Khalife et al., 2024), it also have positive externalities on sectors such as Audit (Sawaya et al., 2026), investments and pricing (Khalife et al., 2025), and in some case economic growth on a macro-level (Athari et al., 2026). In a data-driven culture, AI seems a logical investment (Azoury et al., 2024) if properly used by firms (Bejjani et al., 2024), however for leveraging it full potential, individuals must gain experience in the use of technology (Chaanine et al., 2023). AI has allowed smarter decisions (Subrahmanyam & Beainy, 2027), AI technology and digitalization has also been proven to increase stakeholder engagement according to a recent study by Kamel et al. (2026).

Finally, it is worth noting that AI's return on investment ROI is still negative, with strong future potential while in actuality, gold has provided one of highest ROI on both the medium and the long-term.

2.6 Research Gap and Study Contribution

The existing literature provides strong reasons to expect interest rates to matter for gold, but it does not support one universal coefficient. Results differ across nominal and real rates, short- and long-term yields, countries, crisis phases, and econometric methods. Much of the literature uses long historical samples or focuses on gold's relationship with stocks, inflation, or uncertainty rather than a recent sequence of U.S. policy-rate changes.

This study narrows the question to the effective federal funds rate and monthly gold returns from January 2020 through August 2026. It contributes a transparent comparison of contemporaneous and one-month-lagged effects during a period that contains both near-zero policy rates and rapid tightening. The simple model does not replace the broader multivariable approaches in the literature. Instead, it establishes the direction, timing, and strength of the bivariate relationship that appears in this specific recent sample.

Methodology:

3.1 Research Design

This study uses a quantitative time-series design to examine the relationship between changes in U.S. interest rates and monthly gold returns. The unit of analysis is one calendar month. The study tests whether changes in the effective federal funds rate are associated with gold returns during the same month and during the following month. The design measures statistical association and does not claim that interest-rate changes alone cause movements in gold prices.

3.2 Data Sources and Sample

The sample contains monthly observations from January 2020 through August 2026. Monthly gold prices were obtained from the World Bank Commodity Price Data, commonly known as the Pink Sheet (World Bank, 2026). The series reports the monthly spot price of gold in nominal U.S. dollars per troy ounce, calculated from daily rates. The effective federal funds rate was obtained from the Board of Governors of the Federal Reserve System through the Federal Reserve Economic Data database under series code FEDFUNDS (Board of Governors of the Federal Reserve System, 2026). The rate is reported as the monthly average of daily observations in percentage terms.

The two series were matched by calendar month. No interpolation or estimated replacement was required because all months in the selected period had observations in both sources. The merged dataset contains 80 observations in levels. Calculating monthly changes reduces the usable sample to 79 observations, and applying a one-month lag reduces it to 78 observations.

3.3 Variable Definitions

Table 1 Variable Definitions and Measurement

Variable	Symbol	Measurement	Role in analysis
Gold price	GoldPrice	Monthly average spot price in USD per troy ounce	Source variable
Federal funds rate	Rate	Monthly average effective federal funds rate in percent	Source variable
Monthly gold return	GoldReturn	Percentage change in the gold price from the previous month	Dependent variable
Rate change	Delta Rate	Current month's rate minus the previous month's rate, in percentage points	Independent variable in Model 1
Lagged rate change	Lagged Delta Rate	Previous month's change in the federal funds rate	Independent variable in Model 2

Note. A percentage-point change is an arithmetic change in the interest rate. For example, an increase from 4.00% to 4.25% equals 0.25 percentage points.

3.4 Data Preparation

The observations were ordered chronologically and checked for missing months and nonnumeric values. The source values were preserved without winsorization, smoothing, or removal of extreme observations. Gold prices and interest rates were first summarized in levels. The main tests then used monthly gold returns and monthly interest-rate changes so that the analysis compared changes rather than two series that both moved over time.

$$GoldReturn_t = 100 \times \left(\frac{GoldPrice_t}{GoldPrice_{t-1}} - 1 \right)$$

$$\Delta Rate_t = Rate_t - Rate_{t-1}$$

$$Model\ 1: GoldReturn_t = \alpha + \beta_1 \Delta Rate_t + \varepsilon_t$$

$$Model\ 2: GoldReturn_t = \alpha + \beta_1 \Delta Rate_{t-1} + \varepsilon_t$$

Note. Subscript t denotes the current month, while $t - 1$ denotes the previous month.

3.5 Statistical Analysis

The analysis was completed in three stages. First, descriptive statistics were calculated for the gold price, federal funds rate, and monthly gold return. Second, Pearson correlation coefficients were calculated for the price levels, the same-month changes, and the one-month-lagged changes. The correlation between the two level series was treated as descriptive because a shared time trend can produce a misleading relationship. Statistical inference therefore focuses on monthly returns and rate changes.

Third, ordinary least squares regression was used to estimate two models. Model 1 relates the monthly gold return to the federal funds rate change in the same month. Model 2 relates the monthly gold return to the rate change in the previous month. The lagged specification tests whether the association appears with a short delay. In both models, the coefficient β_1 measures the percentage change in the monthly gold return associated with a one percentage-point change in the federal funds rate.

A two-sided significance level of 5% was used. Each regression reports the number of observations, intercept, rate-change coefficient, standard error, p-value, R-squared, and 95% confidence interval. A p-value below 0.05 was treated as statistically significant. R-squared measures the proportion of monthly gold-return variation explained by the interest-rate variable in each model.

3.6 Analytical Tools and Reproducibility

The data preparation and statistical calculations were performed in Python, while the complete monthly dataset, transformed variables, descriptive statistics, correlations, regression results, and charts were organized in an Excel workbook. The workbook preserves the date, original values, monthly return, same-month rate change, lagged rate change, and predicted return for each

observation. This structure allows the analysis to be checked and reproduced from the original monthly series.

3.7 Methodological Limitations

The models contain only one explanatory variable and therefore do not control for inflation, the U.S. dollar exchange rate, geopolitical risk, central-bank gold purchases, or other factors that can influence gold prices. Monthly averages can also conceal short-term market reactions around Federal Reserve announcements. In addition, the sample includes unusual periods such as the COVID-19 shock and rapid monetary-policy changes. The findings should therefore be interpreted as evidence of association rather than proof of causation.

Results:

4.1 Sample and Descriptive Statistics

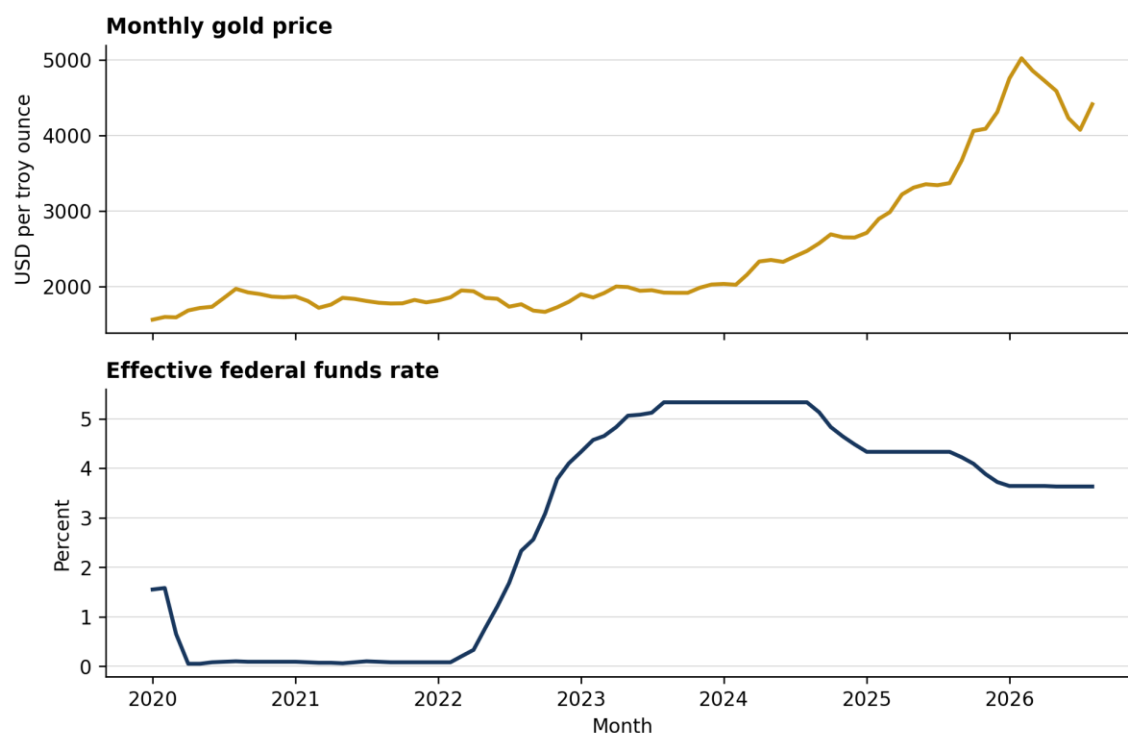
The analysis covers 80 monthly observations from January 2020 through August 2026. The mean gold price was \$2,429.47 per troy ounce, with a minimum of \$1,561 and a maximum of \$5,020. The effective federal funds rate averaged 2.84% and ranged from 0.05% to 5.33%. The mean monthly gold return was 1.39%.

Table 2 Descriptive Statistics

Variable	N	Mean	Std. Dev.	Minimum	Maximum
Gold price (USD per troy ounce)	80	2,429.47	950.15	1,561.00	5,020.00
Effective federal funds rate (%)	80	2.84	2.13	0.05	5.33
Monthly gold return (%)	79	1.39	3.82	-7.83	10.63

Note. Gold prices are monthly averages in U.S. dollars per troy ounce. Interest rates are monthly averages in percentage terms.

Across the full period, the monthly average gold price increased from \$1,561 in January 2020 to \$4,411 in August 2026, a total increase of 182.6%. Figure 1 shows that gold and interest rates followed different paths over the sample rather than moving together in a stable one-to-one pattern.

Figure 1 Monthly Gold Prices and the Effective Federal Funds Rate**Gold prices and U.S. interest rates from January 2020 to August 2026**

Note. Gold price source: World Bank Commodity Price Data (Pink Sheet). Interest-rate source: Federal Reserve Board series FEDFUNDS through FRED.

4.2 Correlation Results

The correlation between the gold-price level and the federal funds rate level was positive ($r = 0.389$, $p < .001$). Because both variables changed substantially over time, this level correlation is reported descriptively and is not treated as evidence that higher interest rates caused higher gold prices. The main analysis therefore uses monthly gold returns and monthly changes in the federal funds rate.

The same-month correlation between the gold return and the rate change was -0.182 ($p = 0.109$). The correlation between the gold return and the previous month's rate change was -0.228 ($p = 0.045$). Both coefficients were negative, although only the lagged relationship reached the 5% significance level.

Table 3 Pearson Correlation Results

Comparison	Correlation	p-value	Result at 5% level
Gold-price level and rate level	0.389	< .001	Significant; descriptive only

Comparison	Correlation	p-value	Result at 5% level
Gold return and same-month rate change	-0.182	0.109	Not significant
Gold return and previous-month rate change	-0.228	0.045	Significant

Note. Pearson correlations are two-sided. Monthly-change observations equal 79; the lagged comparison contains 78 observations.

4.3 Regression Results

In the same-month model, the coefficient on the federal funds rate change was -3.176 (standard error = 1.961, $p = 0.109$). The model R-squared was 0.033. The coefficient was negative, but it was not statistically different from zero at the 5% level.

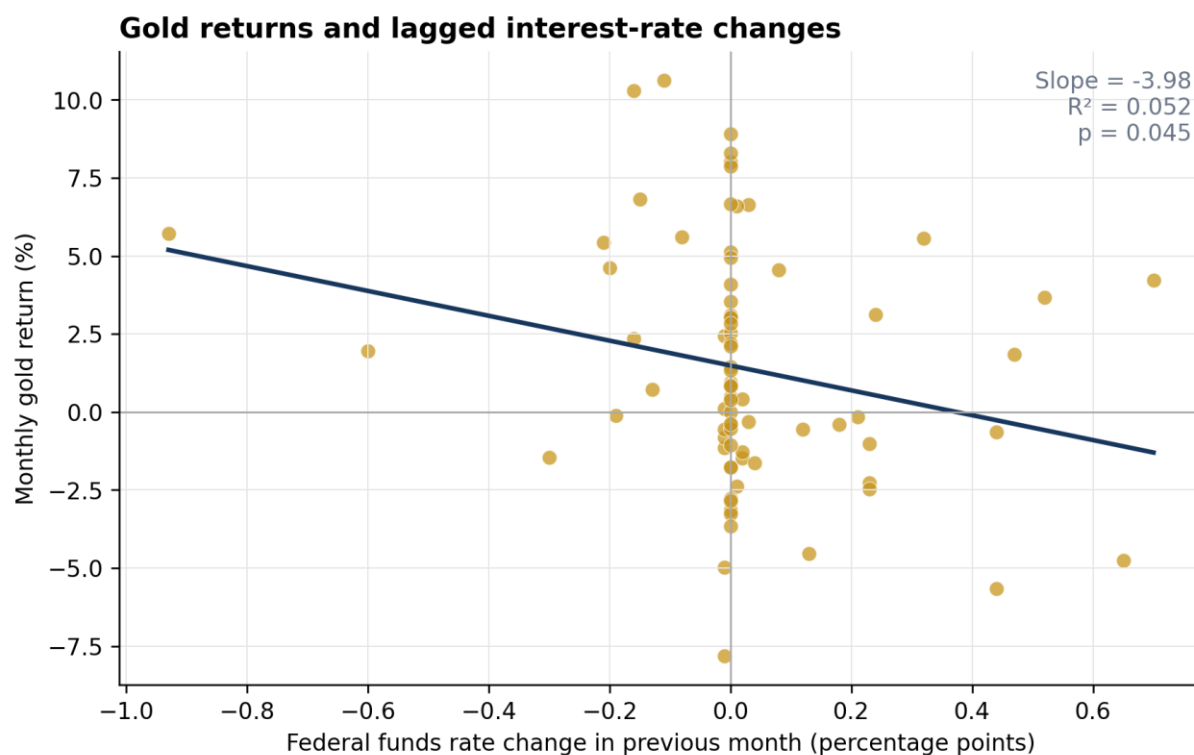
In the one-month-lagged model, the coefficient was -3.984 (standard error = 1.954, $p = 0.045$). Its 95% confidence interval ranged from -7.876 to -0.092. A one percentage-point increase in the federal funds rate was therefore associated with an estimated 3.984 percentage-point lower gold return in the following month.

Table 4 Ordinary Least Squares Regression Results

Model	N	Intercept	Rate coefficient	Std. error	p-value	R ²
Same-month rate change	79	1.478	-3.176	1.961	0.109	0.033
Previous-month rate change	78	1.489	-3.984	1.954	0.045	0.052

Note. Dependent variable: monthly gold return in percentage terms. The rate coefficient measures the change in monthly gold return associated with a one percentage-point change in the federal funds rate.

The lagged model explained 5.2% of the variation in monthly gold returns. The statistically significant coefficient therefore represents a modest relationship rather than a complete explanation of gold-price movements.

Figure 2 Monthly Gold Returns and Previous-Month Interest-Rate Changes

Note. Each point represents one month. The fitted line corresponds to the one-month-lagged regression model.

4.4 Summary of Findings

The results provide limited support for a negative relationship between U.S. interest-rate changes and gold returns. The same-month association was negative but not statistically significant. The one-month-lagged association was negative and statistically significant, indicating that the response of gold returns may occur with a short delay. However, the low R-squared shows that changes in the federal funds rate accounted for only a small share of the monthly variation in gold returns during the sample period.

Discussion and Conclusion:

5.1 Interpretation of the Main Results

The analysis produced two related but different findings. The same-month coefficient was negative, which agrees with the expected direction of the opportunity-cost relationship, but the estimate was not statistically significant. The data therefore do not provide sufficient evidence that changes in the effective federal funds rate were associated with gold returns within the same calendar month. The first research hypothesis is not supported at the 5% significance level.

The one-month-lagged coefficient was also negative and was statistically significant. A one percentage-point increase in the effective federal funds rate was associated with an estimated 3.984 percentage-point reduction in the following month's gold return. This finding supports the second research hypothesis and suggests that the relationship may appear with a short delay. A delayed response is plausible because the monthly series average daily observations. Investors may also take time to revise inflation expectations, portfolio allocations, and views about future monetary policy after a rate change.

Statistical significance does not imply that the lagged model provides a complete explanation of gold returns. The 95% confidence interval for the coefficient was wide, ranging from -7.876 to -0.092, and the model R-squared was only 0.052. Federal funds rate changes therefore explained 5.2% of the monthly variation in gold returns. The coefficient identifies a modest bivariate association within this sample, while most of the variation remained related to factors outside the model.

5.2 Comparison With Previous Research

The negative lagged relationship is consistent with the conventional view that higher interest rates raise the opportunity cost of holding a non-interest-bearing asset. It also broadly agrees with Barsky et al. (2021), who documented an inverse relationship between the real gold price and expected long-term real interest rates after 2001. Akram (2009) similarly found that lower real interest rates and a weaker U.S. dollar contributed to higher commodity prices. These studies use different interest-rate measures and model specifications, but they support the economic mechanism behind the negative sign estimated in this study.

The weak explanatory power is also compatible with research showing that gold responds to several monetary and financial variables. Batten et al. (2010) found that monetary factors helped explain gold volatility, while Ghosh et al. (2004) identified real interest rates, the dollar exchange rate, convenience yield, and default risk as possible sources of short-run gold-price movements. The present model includes only the effective federal funds rate, so its low R-squared is not unexpected.

The findings do not match every study. Apergis et al. (2019) reported a positive relationship between gold prices and real interest rates in a regime-switching analysis of the G7. The difference may reflect the use of real rather than nominal rates, a much longer 1975-2016 sample, country-level comparisons, and a nonlinear econometric model. This contrast reinforces the conclusion that the sign and strength of the gold-rate relationship depend on the period, rate measure, and method used.

The sample's crisis component provides another reason for caution. Salisu et al. (2021) found that gold retained safe-haven potential during COVID-19, while Akhtaruzzaman et al. (2021) showed that its safe-haven behavior changed between phases of the crisis. These results indicate that uncertainty and market conditions can alter gold's response over short intervals. The coefficients estimated from January 2020 through August 2026 should therefore be understood as average relationships across several distinct market regimes.

5.3 Practical Implications

For investors, the results suggest that a change in the federal funds rate should not be used as a stand-alone signal for buying or selling gold. The lagged coefficient indicates that policy-rate changes may contain useful information about the direction of the following month's return, but the low R-squared means that the signal is weak relative to the total variation in gold prices. A decision based only on the policy rate would ignore most of the forces affecting the market.

A broader assessment should consider real Treasury yields, inflation expectations, the U.S. dollar, financial stress, geopolitical uncertainty, and changes in official-sector demand. Barsky et al. (2021) emphasize real rates and inflation expectations, while Akram (2009) demonstrates the importance of the dollar alongside interest rates. These variables can reinforce or offset the effect associated with the federal funds rate.

For monetary-policy analysis, the results also show that timing matters. The absence of a significant same-month coefficient does not mean that rates were unrelated to gold throughout the period. The significant lagged result indicates that monthly data may capture adjustment after the initial policy change. This finding should be treated as evidence of delayed association rather than a reliable forecasting rule.

5.4 Limitations and Future Research

The main limitation is the bivariate design. Inflation, long-term real yields, the U.S. dollar, market uncertainty, geopolitical risk, and central-bank gold purchases were not included. Omitting these variables can leave the rate coefficient exposed to confounding influences. The study also uses a short and unusual sample that contains the COVID-19 crisis, near-zero rates, rapid tightening, and later easing. Results from this period may not generalize to more stable monetary environments.

Monthly averages improve consistency but can hide reactions around individual Federal Open Market Committee announcements. The effective federal funds rate is also a nominal overnight policy rate, whereas much of the literature emphasizes real or long-term yields. Finally, the simple ordinary least squares models do not test for structural breaks, nonlinear responses, or different effects during tightening and easing periods.

Future research should estimate a multivariable model that includes a real Treasury yield, inflation, a broad U.S. dollar index, and an uncertainty measure. The sample can also be divided into low-rate, tightening, and easing regimes to test whether the coefficient changes across monetary conditions. Daily event-study data around Federal Reserve announcements would help distinguish immediate market reactions from the monthly adjustment identified here. Robust standard errors, residual diagnostics, and alternative lag lengths would provide additional checks on the stability of the result, and consider sustainability as the latter is becoming an increasingly important subject (Kaspard et al., 2026).

5.5 Conclusion

This study examined how monthly changes in the effective federal funds rate were associated with monthly gold returns from January 2020 through August 2026. The same-month relationship was negative but not statistically significant. The one-month-lagged relationship was negative and statistically significant, with a coefficient of -3.984 and a p-value of 0.045. The evidence therefore supports a short delayed negative association, but it does not support a reliable immediate relationship.

The lagged model explained only 5.2% of the variation in monthly gold returns. Interest-rate changes were one part of the market environment rather than the main explanation of gold-price movements. The results are consistent with the opportunity-cost mechanism discussed in earlier research, but the low explanatory power and the unusual sample period require cautious interpretation. The study answers the research question with limited evidence of a negative lagged association and no claim of causation.

5.6 Recommendations

First, investors should treat the federal funds rate as one input rather than a complete gold-trading signal. The significant lagged coefficient may help explain part of the following month's return, but it is not strong enough to support decisions without additional market information.

Second, analysis of gold should combine policy rates with real Treasury yields, inflation expectations, the U.S. dollar, and measures of financial or geopolitical uncertainty. The literature and the low R-squared in this study both indicate that these factors are necessary for a fuller explanation.

Third, analysts should allow for delayed adjustment when evaluating the effect of monetary-policy changes. Comparing immediate and lagged responses is more informative than assuming that the full market reaction occurs within the same month.

Finally, future studies should expand the sample, test several lag lengths, separate tightening from easing periods, and use multivariable or regime-dependent models. These extensions would show whether the negative lagged relationship remains stable after controlling for other drivers of gold returns.

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