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Crypto Signals in Macro Trends

Correlations and How to Trade Gold Nasdaq and Bitcoin

Abstract

This paper conducts a comprehensive study of three asset classes: gold, the Nasdaq Index (encompassing both the Composite and Nasdaq-100), and Bitcoin (BTC). It aims to explore their return characteristics, volatility clustering phenomena, evolving correlations, and the applicability of various trading strategies under different macroeconomic conditions. The research integrates static (Pearson correlation coefficient), dynamic (rolling correlation), and event-driven correlation analyses, complemented by Granger causality tests to fully examine the interlinkages and drivers among these assets.

Key Findings:

- BTC exhibits high price volatility and is strongly driven by sentiment and speculation. While its long-term correlation with traditional assets (such as gold and the Nasdaq) remains low, its short-term correlation with the Nasdaq rises sharply during periods of intense Federal Reserve policy shifts, particularly during tightening cycles.
- Gold consistently displays safe-haven characteristics, often rising in price when BTC and the Nasdaq experience heightened volatility, thereby serving as an effective hedge.
- The Nasdaq Index demonstrates a significant Granger causal relationship with BTC, indicating its movement can serve as a leading indicator for BTC, offering valuable trading insights.

Based on the empirical analysis above, the paper proposes four viable trading strategies: the Nasdaq leading indicator strategy, the volatility clustering cycle strategy, the gold safe-haven hedging strategy, and the cross-asset arbitrage strategy.

Tags:

Research, Bitcoin, Macro, Quantitative, Finance, Trading

Gate Research: Crypto Signals in Macro Trends

Correlations and How to Trade Gold Nasdaq and Bitcoin

1 Research Background

In global financial markets, gold, the Nasdaq Index (Nasdaq Composite & Nasdaq 100), and BTC each play distinct roles and are jointly influenced by market liquidity, investor sentiment, and macroeconomic policies. However, the nature of their interrelationships and how these relationships evolve across different market environments remain focal points for both market participants and researchers.

Table 1: Comparison of Characteristics –Gold, Nasdaq Index, and Bitcoin

Asset Class	Characteristics	Potential Influencing Factors
Gold	A traditional safe-haven asset. Historically, it performs steadily during periods of economic uncertainty, rising inflation, and financial crises. Serves as a store of value.	- U.S. Federal Reserve monetary policy (rate hikes/cuts) - U.S. Dollar Index (DXY) - Inflation expectations - Market risk-off sentiment - Futures market activity & ETF fund flows
Nasdaq Index	Represents the overall performance of the global technology sector, including companies like Apple, Microsoft, Google, and Tesla. Considered a high-risk, growth-oriented asset.	- Market liquidity - Federal Reserve policy changes (rate hikes/cuts) - Global economic growth outlook - Corporate earnings performance & investor sentiment
Bitcoin (BTC)	A flagship asset representing blockchain technology has evolved from a payment network narrative to being seen as "digital gold" by some investors. Increasingly regarded as a hedge against inflation.	- Market liquidity & institutional capital inflows - Global macroeconomics (inflation/ Federal Reserve policy) - Cryptocurrency market cycles & regulatory environment - Investor risk appetite

As the global economic landscape continues to shift, market investors have shown a strong interest in the correlations, interlinkages, and trading strategies among key asset classes. Particularly in light of the U.S. Federal Reserve's ongoing adjustments to interest rate policy, heightened inflation risks, and high volatility in the cryptocurrency market, a deeper examination of the relationships between gold, the Nasdaq Index, and Bitcoin (BTC), along with the underlying driving factors, is critical for investors aiming to optimize asset allocation and develop effective hedging strategies.

2 Data Sources and Notes

- Gold prices are based on historical futures price data from Investing.com, primarily using closing prices. [1]
- Nasdaq index data is sourced from Investing.com, covering both the Nasdaq Composite Index [2] and the Nasdaq-100 Index, also primarily using closing prices. [3]
- BTC price data is obtained from CoinGecko. [4]
- U.S. Dollar Index data is taken from Macromicro. [5]
- The timeline of historical Fed events and other significant economic events is also from Macromicro. [6]
- The data range spans from March 31, 2020, to March 13, 2025.
- As some indicators like gold futures and the Nasdaq index lack data on certain dates (e.g., weekends), the ”forward-fill” method is used to handle missing data—i.e., using the previous trading day’s data to fill gaps.

3 Return Analysis

3.1 Understanding Asset Characteristics of Gold, Nasdaq, and BTC Through Return Analysis

Before exploring the correlations and constructing trading strategies involving gold, the Nasdaq Index, and BTC, analyzing returns is crucial. Return analysis directly reflects asset price trends and volatility characteristics, making it a key metric for assessing risk and return. It also lays the groundwork for studying asset correlations and formulating investment strategies.

This article employs logarithmic return calculations to eliminate discrepancies resulting from absolute price differences between assets, thereby making their returns more comparable. The formula used is:

$$\text{Log Return} = \ln\left(\frac{P_t}{P_{t-1}}\right)$$

For example, if BTC rises from $40,000 on Day 1 to $41,000 on Day 2, the daily log return for BTC is:

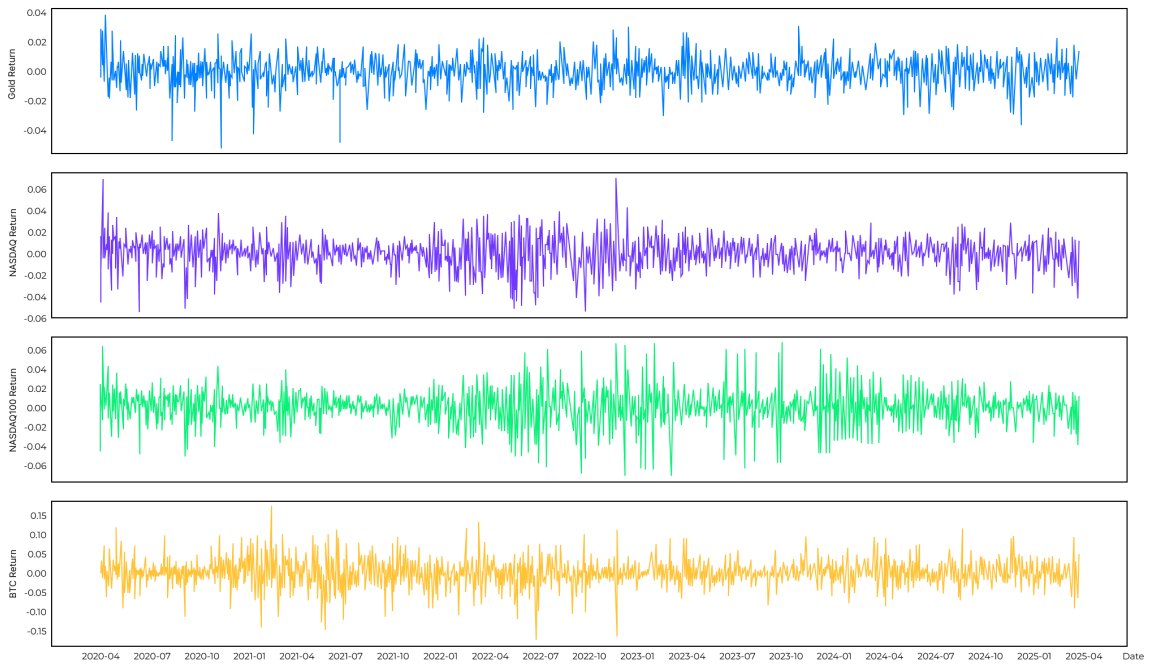
$$\ln\left(\frac{41000}{40000}\right) \approx 0.0247$$

This indicates a daily gain of approximately 2.47% for BTC.

Analyzing the return data for gold futures, the Nasdaq index, and BTC (see Figure 1) reveals the following insights:

- Gold returns are relatively low and stable, mostly fluctuating within ±2%, which demonstrates its typical safe-haven asset characteristics.
- The Nasdaq Composite and Nasdaq-100 indexes exhibit significantly higher volatility than gold, with most fluctuations within ±3%, and occasional extreme moves up to ±6%, reflecting the tech sector’ s sensitivity to market sentiment and liquidity changes.
- BTC returns show extreme volatility, frequently experiencing swings beyond ±5%, and sometimes even exceeding ±15%, highlighting its speculative nature and susceptibility to market sentiment.

Figure 1: Volatility Chart of Returns for Gold Futures, Nasdaq Index, Nasdaq-100 Index, and BTC Prices



Gate Research, Data from: Investing,coingecko,macromicro

3.2 Volatility Clustering Analysis

Volatility clustering refers to the phenomenon where periods of high or low volatility in asset returns tend to cluster together over time. Understanding volatility clustering is significant because it reveals the persistence of price fluctuations and the cyclical nature of market risk. Persistent volatility implies that the impact of market sentiment or macroeconomic factors is not fleeting but tends to last for a certain duration. Meanwhile, the cyclical nature of market risk suggests that it tends to recur during specific economic cycles, policy shifts, or event-driven periods. Studying volatility clustering enables investors to better understand market behavior, accurately identify periods of elevated risk, and formulate more effective risk management and investment strategies.

This study uses a 90-day rolling volatility approach to analyze volatility clustering in gold, the Nasdaq Index, and BTC (Figure 2), while overlaying U.S. Federal Reserve policy events. The 90-day rolling volatility method is a dynamic way to measure asset volatility. It uses a fixed time window (e.g., 90 trading days) that rolls forward continuously, calculating the volatility of returns within each window in real time. Compared to static methods, rolling volatility captures the evolving nature of market risk and clearly illustrates volatility clustering patterns. This method is particularly effective for revealing how markets respond during specific macroeconomic or policy-driven events. The calculation is as follows:

1. First, calculate the standard deviation (σ) of daily returns for each asset:

$$\sigma = \sqrt{\frac{\sum_{i=1}^{n}(r_i - \overline{r})^2}{n-1}}$$

   n is the number of trading days in the sample period

2. Then, use a 90-day rolling window to compute the standard deviation of returns within each window —this gives the rolling volatility:

$$\text{rolling volatility } = \sqrt{\frac{\sum_{i=1}^{90}(r_i - \overline{r})^2}{90-1}}$$

   t is the end date of each rolling window

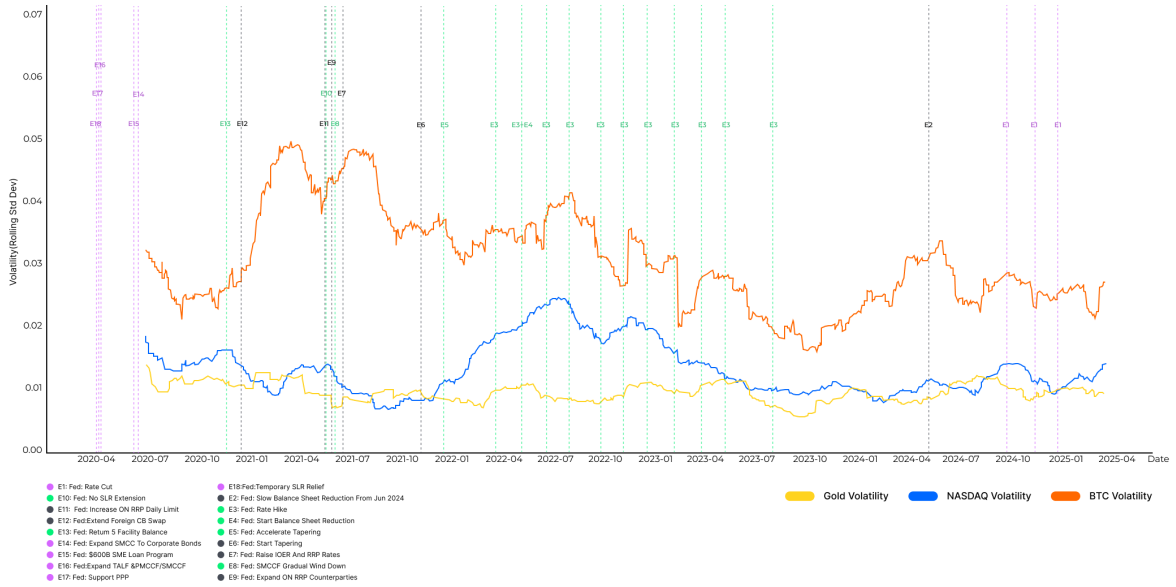
Based on this analysis, the findings are as follows:

– Gold shows no significant volatility clustering during market turbulence. Even during the Fed's rate hikes and balance sheet reduction phases in 2022, volatility increased only slightly and quickly returned to normal, reaffirming gold' s safe-haven characteristics.

– The Nasdaq Index displays pronounced volatility clustering, particularly during the Fed's tightening cycle from 2022 to early 2023. Volatility exceeded 3% at its peak, indicating that tech stocks, as risk assets, are susceptible to market liquidity and economic expectations.

– BTC exhibits strong volatility clustering characteristics. From early 2021 to early 2023, and again in 2024, BTC's volatility often exceeded 4%, peaking near 7%. These surges closely align with major Fed policy events, reflecting BTC's high sensitivity to market changes and speculative nature.

Figure 2: Volatility Clustering Analysis of Gold Futures, Nasdaq Index, Nasdaq-100 Index, and BTC Prices



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This analysis reinforces the insights from the return analysis and provides a deeper understanding of the persistence and cyclical nature of market risk. It also clarifies the distinct market characteristics and policy sensitivities of gold, the Nasdaq Index, and BTC, offering valuable insights and theoretical grounding for the subsequent correlation analysis and trading strategy development.

4 Correlation Analysis

4.1 Pearson Correlation Coefficient –Static Correlation Analysis

In portfolio construction and risk management, asset correlation is a critical consideration. The lower the correlation between assets, the greater the potential for risk diversification. To gain a clear understanding of the overall relationships among gold, the Nasdaq Index, Nasdaq-100 Index, and BTC prices, we begin with the Pearson Correlation Coefficient analysis. The formula is:

$$p_{x,y} = \frac{\text{Cov}(X, Y)}{\sigma_x \sigma_y}$$

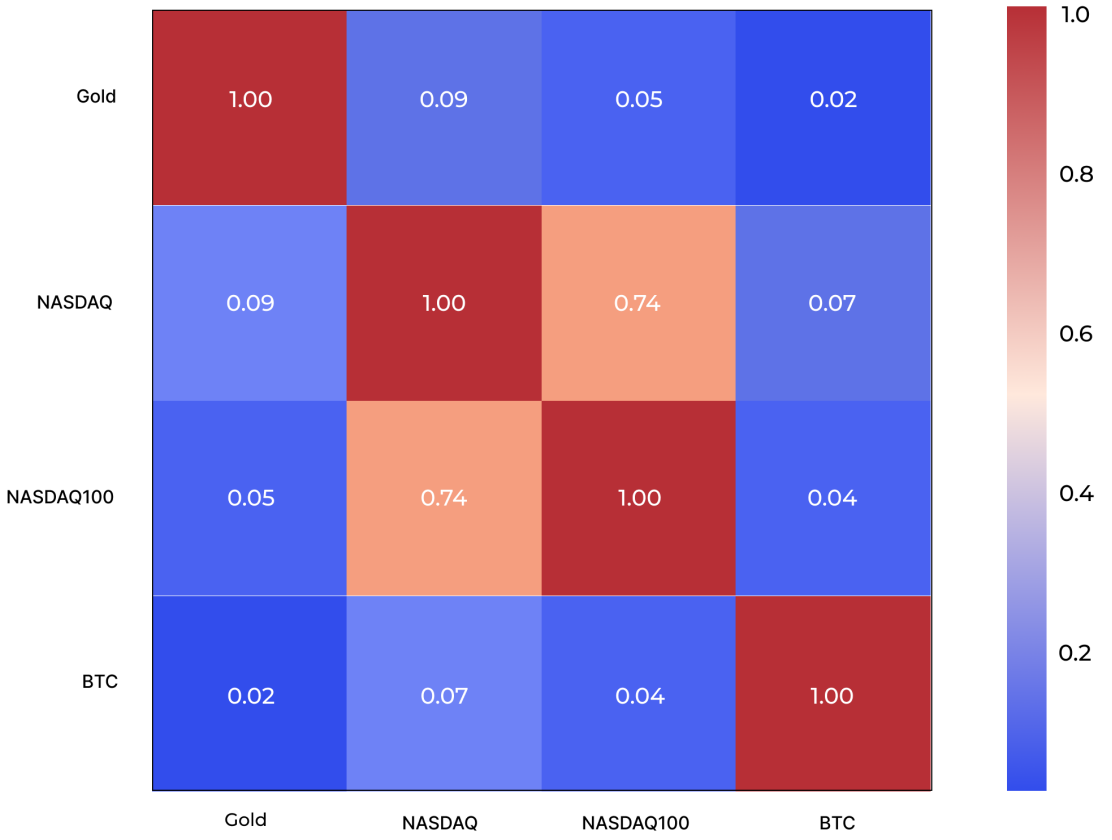
Where:

- Cov(X, Y) is the covariance of the returns of assets X and Y;
- σ_X and σ_Y are the standard deviations of the returns of assets X and Y, respectively;
- The correlation coefficient ranges from -1 to 1. A value of 1 indicates a perfect positive correlation, -1 indicates a perfect negative correlation, and 0 indicates no correlation.

Based on the Pearson correlation coefficient analysis of the returns of gold, the Nasdaq Index, Nasdaq-100 Index, and BTC, the following conclusions can be drawn (see Figure 3):

1. The Nasdaq Index and the Nasdaq-100 Index show a high positive correlation (correlation coefficient = 0.74). This aligns with market understanding, as the Nasdaq-100 is a subset of the broader Nasdaq Index, primarily comprising the largest technology companies by market capitalization.
2. BTC shows very low correlation with other assets. The correlation between BTC and the Nasdaq Index is just 0.07, with Nasdaq-100 it’ s 0.04, and with gold it’ s only 0.02. This indicates that BTC’s price movement is largely independent of traditional financial markets.
3. BTC has not fully evolved into a shadow of tech stocks, nor has it become a true ”digital gold.” If BTC were highly correlated with gold, it would imply that markets consider it a hedge during risk-off sentiment. However, current data does not support this assumption.

Figure 3: Pearson Correlation Coefficient



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4.2 Rolling Correlation Analysis –Dynamic Correlation Analysis

Earlier, we used the Pearson correlation coefficient to assess the overall correlation between gold, the Nasdaq Index, and BTC, concluding that BTC's long-term correlation with the Nasdaq is relatively low. However, the Pearson coefficient is a static, long-term metric—it only provides an average correlation over the study period and cannot capture time-varying relationships. In real markets, asset correlations are not constant. They fluctuate in response to market sentiment, economic conditions, liquidity levels, and monetary policies.

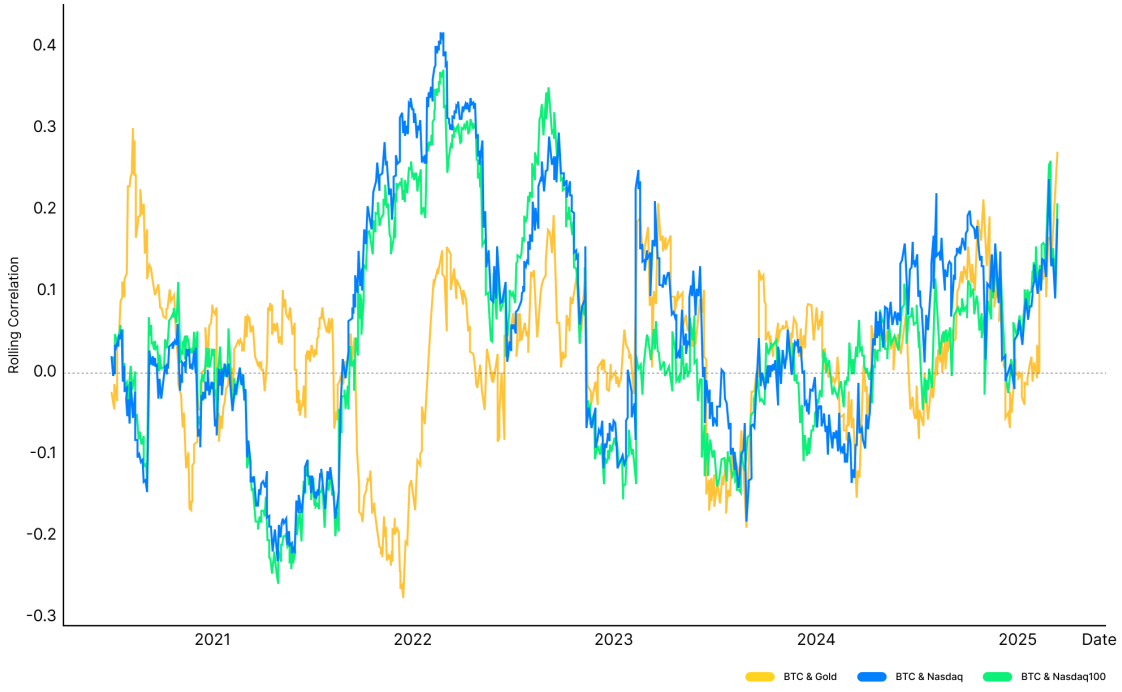
To address this limitation, we apply the **90-day Rolling Correlation** method, which uses a rolling window of 90 trading days to continuously compute and track the evolving correlation between assets. This approach dynamically reflects changes in asset relationships due to shifting market sentiment, economic cycles, or policy actions.

From the 90-day rolling correlation chart (Figure 4), we observe the following:

1. The dynamic correlation between BTC and the Nasdaq/Nasdaq-100 Index fluctuates significantly. While the Pearson coefficient suggests low long-term correlation, the rolling correlation reveals periods of heightened linkage. Notably, during the Fed’ s aggressive rate hikes and balance sheet reductions in 2022 (a period of significant liquidity tightening), the correlation between BTC and the Nasdaq rose sharply—peaking around 0.4. This indicates that during these times, BTC was increasingly viewed as a risk asset, with price movements closely mirroring tech stocks. A similar correlation spike re-emerged from 2024 to early 2025, suggesting that when markets anticipate liquidity shifts or economic downturns, BTC tends to move more in sync with tech stocks.

2. The correlation between BTC and gold is more erratic and generally weak. While the overall rolling correlation remains low (within ±0.2), it does show short-lived spikes or dips, indicating occasional brief periods where BTC displays safe-haven characteristics. However, these moments are inconsistent and do not support BTC as a stable alternative to gold for long-term risk hedging.

Figure 4: 90-Day Rolling Correlation of BTC with Gold and Nasdaq Index



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The 90-day rolling correlation analysis revealed results that differ from the Pearson correlation coefficient analysis, particularly regarding the correlation between BTC and the Nasdaq Index. The root cause of this discrepancy lies in the nature of the Pearson coefficient, which only measures the average correlation over the entire study period. It fails to capture the fluctuations

in asset correlations driven by changes in market conditions and economic cycles. In contrast, rolling correlation offers a dynamic, time-sensitive perspective, enabling the detection of short- and mid-term shifts in market behavior.

As an emerging asset, BTC experiences pronounced shifts in its correlation with traditional assets as market sentiment, liquidity, and policy environments evolve. The Nasdaq Index, being a representative risk asset, shows considerable short-term correlation fluctuations with BTC, influenced by changes in monetary policy, liquidity levels, and investor risk appetite.

Therefore, although the long-term average correlation between BTC and the Nasdaq Index appears low (as shown by the Pearson coefficient), short-term correlation (captured via rolling analysis) often spikes significantly. These short-term fluctuations tend to be masked when relying solely on long-term average measures.

4.3 Event-Driven Correlation Analysis –Investigating the Impact of Federal Reserve Policy Events

While the 90-day rolling correlation analysis has already illustrated the dynamic interconnections among assets, especially during major shifts in market environments, policy cycles, and risk sentiment, it still has limitations. Specifically, it lacks the precision to pinpoint the exact impact of specific events and suffers from a lag effect. The relatively long rolling window can obscure the effects of short-term yet highly influential events due to averaging, thereby reducing the sensitivity and accuracy of the analysis.

To overcome these limitations and more precisely identify key drivers behind market shifts, we turn to Event-Driven Correlation Analysis. This method focuses on specific market events, such as U.S. Federal Reserve monetary policy changes, major economic announcements, or periods of extreme market behavior, and examines how short-term correlations between asset returns change before and after these events.

In the following analysis, we calculate the correlation between BTC and the Nasdaq Index returns within a 30-day window before and after major Federal Reserve policy events (see Figure 5). The formula is:

$$P_{XY,\text{event}} = \frac{\text{Cov}(X,Y)}{\sigma_X \sigma_Y} = \frac{\sum_{i=1}^{n}(X_i - \overline{X})(Y_i - \overline{Y})}{\sqrt{\sum_{i=1}^{n}(X_i - \overline{X})^2}\sqrt{\sum_{i=1}^{n}(Y_i - \overline{Y})^2}}$$

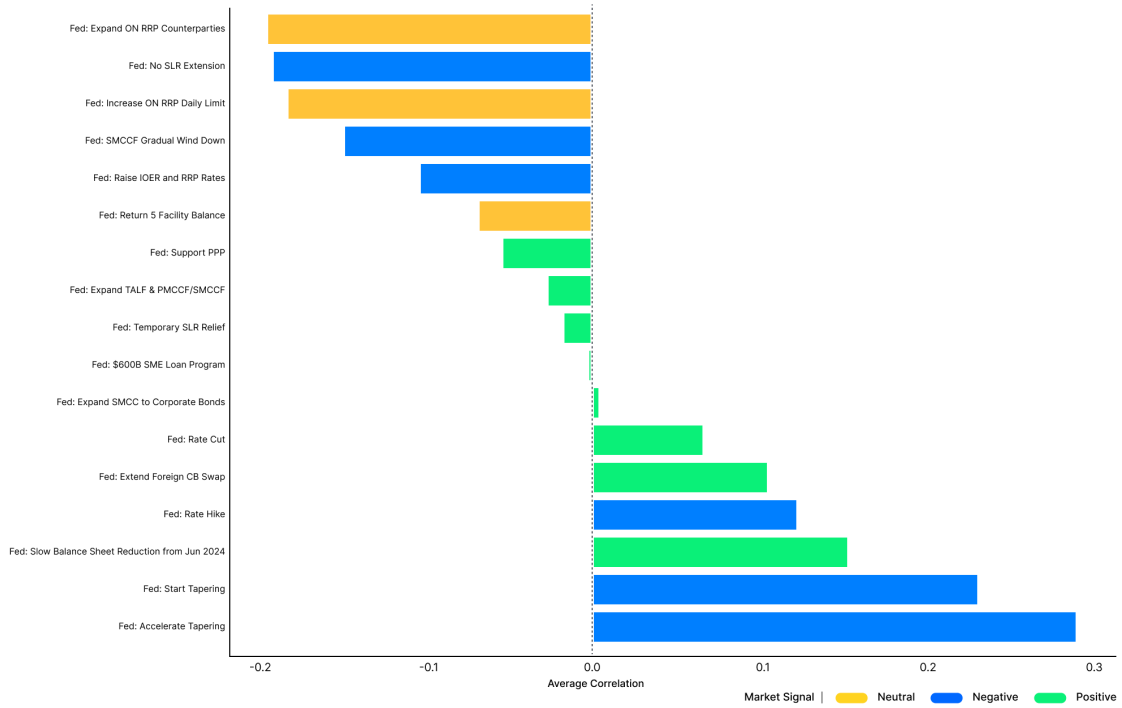
Where:

- X and Y represent the returns of the two assets (BTC and Nasdaq Index) within the 30-day event window (before and after the event),
- **Cov(X, Y)** is the covariance of the returns,
- **σ_X** and **σ_Y** are the mean returns of assets X and Y during the event window, respectively.

Based on the above calculation method, the following conclusions can be drawn:

1. Different types of Federal Reserve policy events have significantly varying impacts on the correlation between BTC and the Nasdaq Index. Notably, negative signal events, such as ”accelerated balance sheet reduction,” had the most pronounced effect, increasing the correlation by approximately +0.29 on average. In contrast, the impact of ”rate hikes” was more moderate, around +0.13.
2. Technical or institutional policy adjustments (e.g., changes to the SLR or RRP mechanisms) tend to significantly weaken the short-term linkage between BTC and tech stocks. For example, the discontinuation of SLR relief and the expansion of ON RRP participants had the largest dampening effects, reducing correlation by approximately -0.18 to -0.23.
3. Positive signals, such as slowing down balance sheet reduction or rate cuts, also had strong effects in raising the correlation.

Figure 5: Event-Driven Correlation Analysis



To better visualize the impact of these events, the analysis above has been summarized in the following table:

Table 2: Impact of Federal Reserve Events on the Correlation Between BTC and Nasdaq Index

Event Type	Policy Event	Avg. Change in Correlation	Market Implication
Negative	Fed: Accelerate Tapering (Fed confirms accelerated tapering)	0.29	Fed's tightening policies significantly increase the correlation between BTC and Nasdaq, indicating BTC behaves like a risk asset.
Negative	Fed: Start Tapering (Fed announces official start of tapering)	0.17	The start of asset purchase reduction rapidly tightens market liquidity, enhancing BTC's linkage with tech stocks.
Positive	Fed: Slow Balance Sheet Reduction from Jun 2024	0.15	Slower balance sheet reduction reduces tightening pace; risk appetite improves, boosting BTC-Nasdaq correlation.
Negative	Fed: Rate Hike (U.S. interest rate increase)	0.13	Interest rate hikes raise funding costs, increasing linkage among risk assets; BTC affected by market fear.

Event Type	Policy Event	Avg. Change in Correlation	Market Implication
Positive	Fed: Extend Foreign CB Swap (extension of liquidity swaps with foreign central banks)	0.12	Enhances global USD liquidity, strengthening BTC's linkage with tech stocks.
Positive	Fed: Rate Cut (U.S. interest rate reduction)	0.09	Eases liquidity; slight increase in BTC-tech stock correlation with moderate market reaction.
Positive	Fed: Expand SMCC to Corporate Bonds	0.01	Corporate bond purchases slightly increase liquidity and BTC-tech stock correlation.
Positive	Fed: $600B SME Loan Program	≈ 0	Eases lending for businesses, slightly boosts risk appetite, but correlation remains largely unchanged.
Positive	Fed: Temporary SLR Relief	0	Temporary easing of SLR improves bank leverage in short term; minimal impact on overall market linkage.
Positive	Fed: Expand TALF & PMCCF/SMCCF	-0.03	Expanded asset purchases have no notable impact on BTC-Nasdaq correlation.
Positive	Fed: Support PPP (Payroll Protection Program)	-0.05	Employment support via PPP does not significantly affect BTC-tech stock correlation.
Neutral	Fed: Return 5 Facility Balance	-0.06	Technical withdrawal of emergency liquidity slightly decreases BTC-Nasdaq correlation.
Negative	Fed: Raise IOER and RRP Rates	-0.12	Raises short-term interest rates, slightly tightening liquidity and mildly decreasing correlation.
Negative	Fed: SMCCF Gradual Wind Down	-0.15	Gradual exit from SMCCF tightens liquidity and notably reduces BTC-tech stock correlation.
Neutral	Fed: Increase ON RRP Daily Limit	-0.18	Temporarily tightens liquidity via technical changes, significantly reducing correlation.
Negative	Fed: No SLR Extension	-0.19	Ends eased leverage regulations; reduced bank capital supply leads to lower market liquidity and sharp correlation drop.
Neutral	Fed: Expand ON RRP Counterparties	-0.2	Broadens market participant access to ON RRP; structural shift in liquidity significantly lowers BTC-tech stock correlation.

In summary, the events that most significantly influenced the correlation between the Nasdaq Index and BTC include rate hikes, the start of balance sheet reduction, the slowdown of balance sheet reduction, rate cuts, and the extension of overseas central bank liquidity swap and repo tools (which increased USD liquidity).

Note: This section, as well as the following Granger causality analysis, does not address the correlation between gold and BTC, since prior Pearson and rolling correlation analyses have consistently shown that gold has a relatively weak correlation with BTC.

5 Granger Causality Analysis

While the event-driven correlation analysis has clarified how different Fed policy actions significantly affect the short-term correlation between BTC and the Nasdaq Index, all prior methods—Pearson correlation, 90-day rolling correlation, and event-driven correlation—share a common limitation: they only reveal the presence of a linkage between asset prices. They do not clarify the direction of the relationship. In other words, these methods cannot determine whether fluctuations in the Nasdaq Index drive changes in BTC prices, whether BTC movements influence the Nasdaq, or whether there is mutual influence.

This directional understanding is crucial for constructing practical trading strategies. For instance, if the Nasdaq Index significantly influences BTC price trends, then it could be used as a leading indicator or trading signal for BTC. Conversely, if BTC drives Nasdaq movements, we need to monitor BTC for potential impacts on tech stocks. If the relationship is mutual, strategy development must be approached with greater caution.

To further explore the directionality of asset price interactions and assist investors in making more accurate decisions, this study introduces a more rigorous statistical method: Granger Causality Analysis.

Granger Causality is an econometric technique widely used in economic and financial data analysis. It is designed to test whether one time series can statistically predict another—i.e., whether past values of variable X help predict the future movements of variable Y. Importantly, Granger causality does not imply actual causality in the everyday sense; rather, it identifies whether historical data from one variable has statistically significant predictive power over another variable's future behavior.

The null hypothesis in Granger causality analysis is:

$$H_0 = X \text{ Granger } Y$$

This hypothesis is typically tested using an F-test or Sum of Squared Residuals (SSR) test, and results are interpreted based on the p-value for statistical significance:

– If p-value < 0.05, the null hypothesis can be rejected, meaning that Variable X Granger-

causes Variable Y in a statistically significant way—i.e., past values of X help predict future fluctuations in Y.

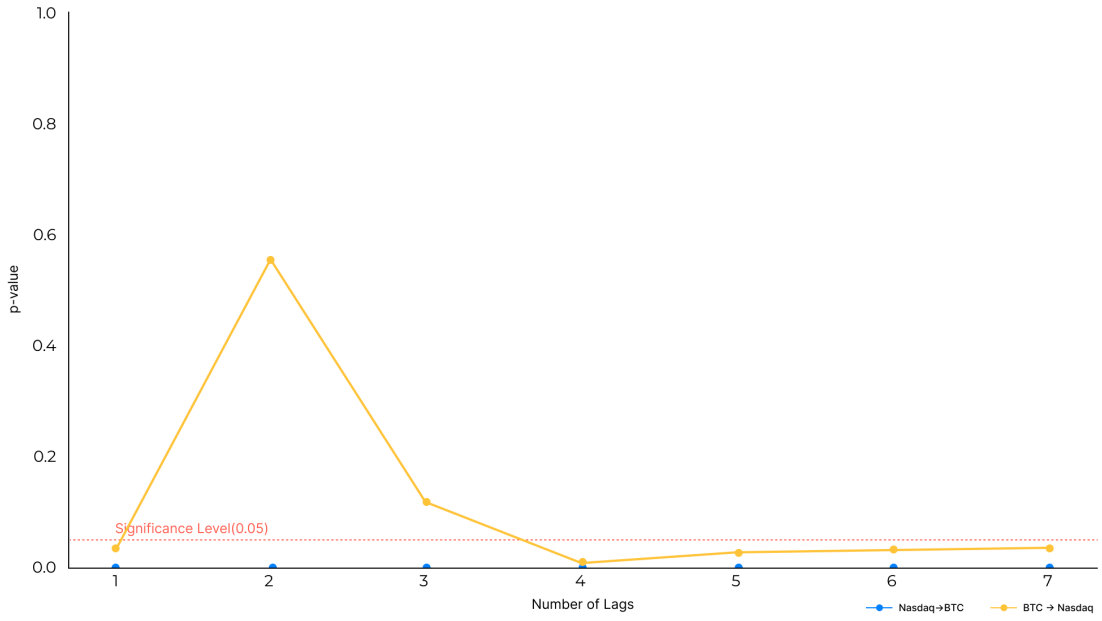
– If p-value ≥ 0.05, the null hypothesis cannot be rejected, implying that Variable X does not Granger-cause Variable Y—i.e., past values of X do not significantly predict future changes in Y.

Based on the Granger causality analysis between BTC and the Nasdaq Index returns, the following conclusions are drawn (see Figure 6):

1. The Nasdaq Index has a highly significant predictive influence on BTC ($p \approx 0$). As shown in Figure 6, the Nasdaq return series consistently demonstrates strong predictive power for BTC returns across all observed lags (from 1-day to 7-day delays). This finding aligns with the prevailing market perception that ”BTC is a risk asset that follows tech stock trends.” It also implies that the Nasdaq Index can be used as a reliable reference indicator for developing BTC trading strategies.

2. BTC’s influence on the Nasdaq Index is only present in very short-term periods (e.g., 1-day lag), and its predictive power rapidly diminishes beyond that, showing no significance at 2-day lag and beyond. This suggests that BTC’s impact on the Nasdaq is more likely due to brief market sentiment shifts or transient volatility, rather than a stable, predictive relationship.

Figure 6: Granger Causality Analysis Between BTC and Nasdaq Index



In summary, Granger causality analysis clearly indicates that the price movements of BTC are significantly influenced and predicted by the Nasdaq Index. Therefore, the Nasdaq Index can be considered a reliable reference indicator for BTC investment decisions. On the other hand, BTC’ s ability to predict Nasdaq trends is unstable and only occasionally effective in the very short term, making it a weak indicator for broader market predictions.

6 Trading Strategy

Through a comprehensive analysis of the returns and correlations among gold, the Nasdaq Index, and Bitcoin (BTC), we have gained clear and in-depth insights into asset characteristics and market interrelations. The returns analysis highlights gold’ s stability as a traditional safe-haven asset, the Nasdaq Index’s high sensitivity to market liquidity and economic expectations as a risk asset, and BTC’s pronounced speculative nature and sensitivity to market sentiment. Further analysis of volatility clustering and event-driven correlations emphasizes the cyclical nature and policy sensitivity of asset price fluctuations, particularly the short-term linkage between BTC and the Nasdaq Index during periods of dramatic market liquidity shifts.

Granger causality analysis ultimately confirmed that the Nasdaq Index has a strong and consistent predictive power over BTC price fluctuations, whereas BTC’ s impact on the Nasdaq Index is limited to short-term market sentiment swings. This key finding provides crucial theoretical support and empirical evidence for developing subsequent trading strategies.

Based on the above findings, the next section will focus on specific trading strategies, including how to use the Nasdaq Index as a leading indicator for BTC price movements, how to adjust portfolio allocations in response to changes in the policy environment, and risk management strategies under different market conditions. These are designed to help investors better capture market opportunities, mitigate investment risks, and achieve long-term, stable asset appreciation.

It is important to note that the trading strategies discussed in this report do not constitute any investment advice. Given the high volatility of the markets, investors should develop their own investment strategies tailored to market conditions and personal risk preferences.

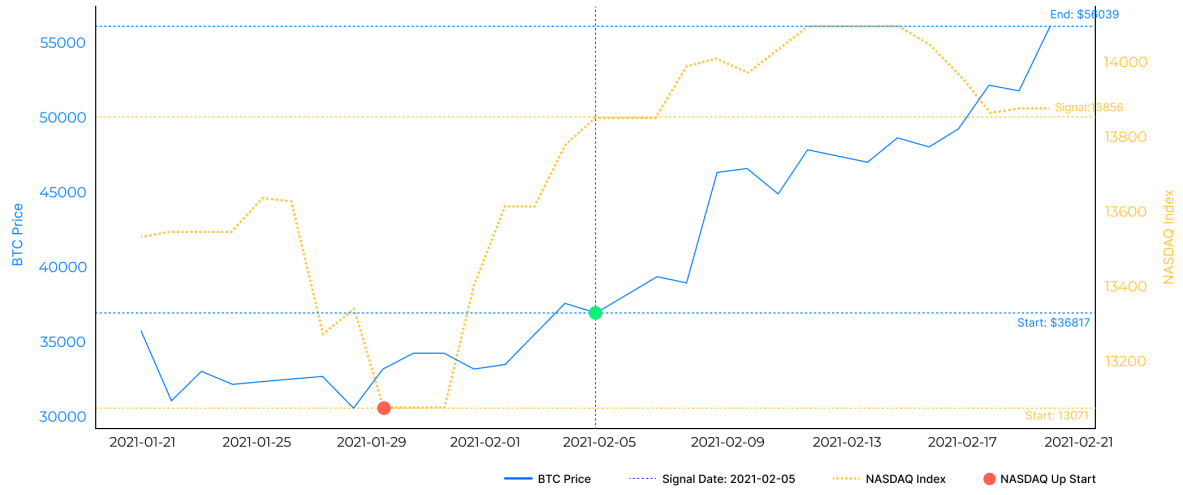
6.1 Nasdaq Leading Indicator Strategy

As previously analyzed, the Nasdaq Index demonstrates clear and consistent predictive capabilities for BTC price movements. The core logic of this strategy is to treat the Nasdaq Index as a leading indicator for BTC price volatility, thereby enabling investors to position themselves early in the BTC market. When the Nasdaq Index shows a continuous upward trend, it generally reflects rising market risk appetite and increasing liquidity, creating favorable conditions for a BTC price rally.

Accordingly, investors may consider increasing their allocation to BTC assets to capitalize on the impending upside. Conversely, if the Nasdaq Index shows a consistent downward trend, it may signal a shift in market sentiment toward caution or pessimism. As a risk-sensitive asset, BTC may then experience significant price declines, and investors should consider reducing their BTC holdings in a timely manner to avoid potential losses. This strategy can be validated through data backtesting. The condition used is that within a 7-trading-day period, the Nasdaq Index rises by more than 5%, with more down days than up days. BTC’ s performance over the following 15 calendar days is then analyzed.

As shown in Figure 7, from January 29 to February 5, 2021, the Nasdaq Index rose from 13,200 to 13,856 points, an increase of 5.57%. During the same period, BTC increased from $36,817 to $56,039 in half a month, marking a 35.92% gain.

Figure 7: Nasdaq Leading Indicator Data Backtest



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6.2 Volatility Clustering Cycle Strategy

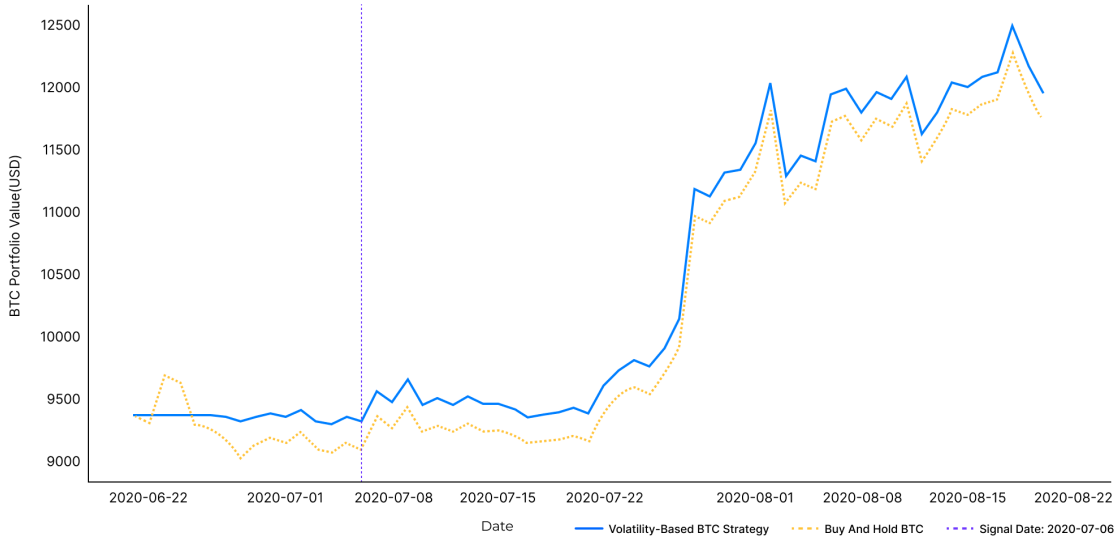
Market volatility often exhibits clustering characteristics, meaning that periods of high and low volatility tend to persist over specific timeframes. The previous analysis of volatility clustering revealed that BTC, the Nasdaq Index, and gold each display distinct volatility patterns under varying market conditions. Particularly during U.S. Federal Reserve policy shifts, swings in market sentiment, and transitions in economic cycles, volatility tends to cluster noticeably. By leveraging this volatility clustering, investors can manage market risk more effectively and adjust their positions cyclically to enhance returns.

The core concept of this strategy is to use a 90-day rolling volatility measure to determine the current phase of the market volatility cycle and adjust trading strategies accordingly. When the market enters a high-volatility phase (e.g., when the 90-day rolling volatility consistently rises above a certain threshold), it typically signals heightened market anxiety. Investors may reduce their positions in BTC and the Nasdaq Index to mitigate the risk of losses caused by sharp market swings. Conversely, in low-volatility phases, where market sentiment tends to stabilize, investors can gradually increase their BTC positions to capture potential rebound opportunities.

Additionally, short-term arbitrage opportunities may arise by capitalizing on volatility clustering. For instance, in high-volatility environments, investors can apply a volatility breakout strategy —buying after short-term pullbacks or selling after brief surges—to exploit short-term price discrepancies. In contrast, during low-volatility periods, a trend-following strategy may be more appropriate, gradually building positions and waiting for market trends to develop for potentially larger gains.

This strategy is exemplified by selecting a signal point where BTC’s annualized volatility drops from above 60% to below 60% (July 6, 2020), and implementing a model for gradually increasing BTC holdings daily thereafter (Figure 8). Backtesting results show that the stepwise accumulation strategy triggered by easing volatility significantly outperformed a simple ”buy-and-hold” approach, yielding higher cumulative returns within approximately 40 days post-signal, with peak outperformance approaching 10%. This validates the strategy’s logic: when markets shift from high to low volatility, sentiment stabilizes and risk declines, allowing investors to increase exposure to risk assets and achieve superior returns under controlled risk conditions.

Figure 8: Volatility Clustering Cycle Strategy Backtest



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The volatility clustering cycle strategy helps investors effectively avoid risks from extreme market fluctuations, while also identifying potential trading opportunities as markets stabilize, thereby optimizing overall investment returns.

6.3 Gold Safe-Haven Hedging Strategy

As a traditional safe-haven asset, gold typically exhibits a stable store of value during economic turbulence, heightened market risk, or liquidity tightening. Previous analysis has shown that gold's 90-day price volatility is significantly lower than that of BTC and the Nasdaq Index, providing certain hedging benefits during periods of major market fluctuations. Hence, incorporating gold into an investment portfolio as a hedge against the high volatility of BTC and the Nasdaq Index represents a sound risk management approach.

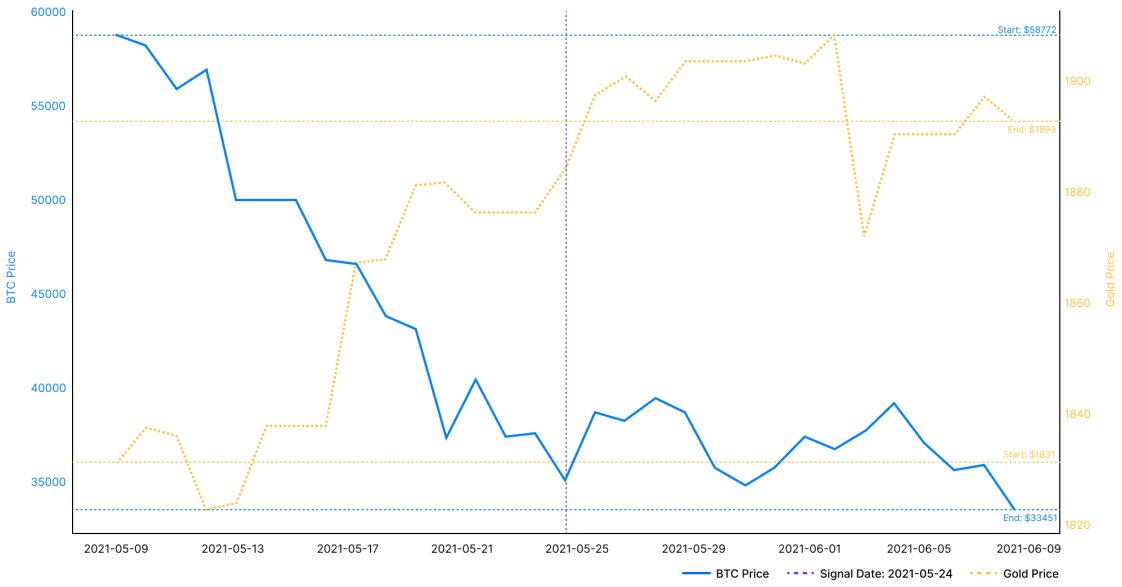
The essence of this strategy is to increase gold allocations when market risks rise, in order to hedge against potential systemic risk. For example, when the Federal Reserve implements tightening measures (such as interest rate hikes or balance sheet reduction) or when the VIX spikes to high levels, investors may consider raising their gold allocations to lower the overall volatility of their investment portfolios. Conversely, when the market environment turns accommodative and liquidity improves, reducing gold holdings may enhance the portfolio' s return potential.

Furthermore, the gold hedging strategy can be dynamically adjusted in conjunction with the volatility profiles of BTC and the Nasdaq Index. For instance, when the correlation between BTC

and the Nasdaq Index increases significantly amid growing market risk, investors may reduce their BTC exposure and increase gold holdings to mitigate the portfolio's overall risk exposure. On the other hand, when market conditions stabilize and risk appetite rebounds, reducing gold and increasing allocations to risk assets may be more appropriate.

To further substantiate gold's role as a hedge against BTC volatility, Figure 9 presents a backtest from May 9 to June 9, 2021. During this period, BTC fell sharply from nearly $58,000 to around $33,000—a 15-day decline of over -43.08%. In contrast, gold rose from $1,831 to $1,893 per ounce, marking a 3.37% gain.

Figure 9: Gold Safe-Haven Hedging Strategy Backtest



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Through data backtesting, it is evident that the gold safe-haven hedging strategy can effectively reduce the risks posed by extreme market volatility. It also offers a stable store of value during periods of market uncertainty, thereby making the investment portfolio more resilient.

6.4 Arbitrage Trading Strategy

The core logic of the arbitrage trading strategy lies in capturing short-term abnormal fluctuations in correlation and price misalignments among different assets, such as gold, the Nasdaq Index, and BTC under specific market conditions. As previously discussed, while BTC and the Nasdaq Index generally have low long-term correlation, their short-term correlation tends to spike during

periods of market turbulence, rapid shifts in risk appetite, or major monetary policy adjustments by the Federal Reserve. These temporary spikes in correlation are often accompanied by disjointed price movements, such as BTC lagging or moving counter to a rapid drop in the Nasdaq Index, creating arbitrage opportunities.

In practice, when investors observe a significant short-term increase in BTC-Nasdaq correlation, they can initiate a hedged trading pair by going long on one asset and short on the other, aiming to profit from the eventual price normalization. Although some investors view BTC as a safe-haven asset or ”digital gold,” empirical research shows that its long-term correlation with gold is relatively low. Occasionally, a surge in market risk aversion may cause a brief spike in BTC-gold correlation, presenting additional arbitrage opportunities.

For instance, if gold prices rise rapidly on a wave of risk-off sentiment while BTC lags behind, investors may increase long positions in BTC while shorting gold to exploit the expected convergence. Conversely, if BTC rallies sharply while gold remains stagnant, an inverse trade can be established to capitalize on the expected correction.

To further refine the strategy’ s accuracy and execution, investors can integrate multiple indicators such as the VIX (Volatility Index), technical indicators (e.g., RSI, Bollinger Bands), and implied volatility from the options market. These tools can help identify precise trading signals and optimal entry and exit points.

The strength of arbitrage trading strategies lies in their market-neutral approach—profiting from price differentials between assets rather than relying on a single directional move. However, they typically involve higher trading frequency and require strong sensitivity to market movements. As such, investors must remain closely attuned to changes in volatility and adhere strictly to disciplined risk management protocols.

7 Research Conclusion

Through an in-depth analysis of the return characteristics, market volatility, and interrelationships among gold, the Nasdaq Index, and BTC, this study provides a clear view of how these three asset classes behave differently and interact under varying economic cycles, changes in market liquidity, and policy adjustments.

As an emerging asset, BTC exhibits distinct market characteristics, notably its extremely high volatility and extreme sensitivity to market sentiment. Although BTC shows low long-term static

correlation with traditional assets, suggesting a degree of market independence, 90-day rolling correlation analysis reveals that in specific macroeconomic environments, especially during periods of U.S. Federal Reserve monetary tightening, BTC’s short-term correlation with the Nasdaq Index increases significantly. This indicates that BTC has yet to establish a stable market identity and more often behaves as a risk asset rather than a safe haven, with its price heavily influenced by liquidity conditions and economic expectations.

Furthermore, the event-driven analysis accurately captured how various Federal Reserve policy events impact the correlation between BTC and the Nasdaq Index. Tightening policies such as interest rate hikes and accelerated balance sheet reductions significantly enhance the linkage between these assets, offering investors clear guidance on market sentiment and risk management. Granger causality analysis further revealed the directionality of this linkage—specifically, that the Nasdaq Index has strong predictive power over BTC price fluctuations, while BTC’s influence on the Nasdaq is limited to short-term sentiment reactions.

Based on these findings, the report proposes several trading strategies: the Nasdaq Leading Indicator Strategy, Volatility Clustering Cycle Strategy, Gold Safe-Haven Hedging Strategy, and Arbitrage Trading Strategy. These strategies aim to help investors better capture market trends, manage risk, and diversify portfolios to achieve stable returns under various market conditions.

In conclusion, this study provides a comprehensive examination of the complex and dynamic relationships among gold, the Nasdaq Index, and BTC, encompassing asset performance, interconnectivity, and strategy development. The results not only deepen the understanding of each asset’s role in the market but also provide a robust theoretical and empirical foundation for developing more precise and effective investment strategies. Future research could further explore the interplay among macroeconomic variables, policy developments, and market sentiment to understand better the rules governing asset interaction, thereby enhancing the foresight and efficacy of investment decisions.

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8 References

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