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Federal Reserve Monetary Policy Changes and Short-Term Bitcoin Returns: An Event Study Analysis of FOMC Rate Actions

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Abstract. Bitcoin has evolved from a relatively independent crypto asset into a financial asset highly sensitive to global liquidity and risk appetite, with Federal Reserve policy announcements serving as an important information source for its short-term pricing. This paper investigates 26 Federal Open Market Committee rate change events spanning 2017 2024 and constructs 18 observable monetary policy surprises using 30-day federal funds futures. Adopting the market adjusted event study method, cumulative abnormal returns are calculated for the event day, one day and seven-day windows. Abnormal returns are further regressed on actual rate changes and policy surprises to test their explanatory power. The results indicate average abnormal returns across all events fail standard significance criteria. While rate hikes generate negative seven window average cumulative abnormal returns and rate cuts yield positive ones, subgroup evidence cannot support robust causal inference. This study highlights the importance of differentiating fully priced policy adjustments from unexpected policy news for interpreting Bitcoin's short term price reactions. Empirical findings support viewing Bitcoin as a liquidity sensitive high volatility risk asset and provide a benchmark for future high frequency shock based empirical research with expanded samples.

Keywords: Bitcoin, Federal Reserve monetary policy, FOMC, monetary policy surprise

1. Introduction

As a digital asset with global transactions, 24-hour operation, and no dependence on central issuers, the price formation mechanism of Bitcoin is gradually affected by traditional macro financial factors. Bitcoin is no longer fully independent of the global financial system as institutional investor participation increases and cryptocurrency markets become more connected to stock, bond, and foreign exchange markets. The Federal Reserve's monetary policy can affect the price of financial assets through the risk-free interest rate, dollar liquidity, the discount rate of asset valuation, and investor risk preference, so the Federal Open Market Committee's interest rate decision may also trigger a short-term adjustment in Bitcoin prices. However, the actual operation of raising and cutting interest rates is not equivalent to exogenous policy shocks. If the market has fully digested the expectation of interest rate adjustment before the meeting, the impact of policy actions will be

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reflected in asset prices in advance. Against this practical background, two core research questions are raised: first, whether Federal Reserve rate change announcements generate statistically significant abnormal Bitcoin returns within short term event windows; second, whether monetary policy surprises that are more hawkish than market expectations correspond to lower abnormal returns for Bitcoin.

Existing studies have mainly analyzed the relationship between bitcoin and the Federal Reserve's policy from the perspectives of monetary policy announcements, policy shock identification, and asset price transmission. According to the investigation of the impact of FOMC announcements on different encrypted assets, it can be concluded that the response of different types of digital assets is obviously heterogeneous [1]. The unexpected tightening is related to the decline in bitcoin prices, and the impact may continue to accumulate in the days after the announcement [2]. The impact of monetary policy on special currency has significant time-varying characteristics, and there may even be price reactions in different directions in different periods [3]. The response of bitcoin to monetary policy will be constrained by market environment, sample interval, and policy shock identification method [4]. At the level of quantitative identification of policy shocks, academia generally estimates monetary policy surprises with the help of changes in federal fund futures prices, which lays a methodological foundation for stripping off the expected and unexpected policy adjustment effects [5]. Monetary policy can unexpectedly affect the prices of many types of financial assets through interest rate and risk premium channels [6]. The stock market mainly responds to the unexpected part of policy decisions, not to the change in nominal interest rates itself [7]. Collectively, these studies indicate that analyses of Bitcoin's policy responses should account for policy direction, market expectations, and event windows [8].

Previous research has examined long-run dynamics, volatility spillovers, and individual policy announcements [9]. However, few studies directly compare actual rate changes with policy surprises derived from federal funds futures in one framework [10]. This paper takes 26 FOMC interest rate change announcements as the research event, uses the daily frequency data of bitcoin and the standard Poor's 500 index, constructs abnormal returns through the market adjusted event research method, and calculates the cumulative abnormal returns in the event day, three day and seven-day windows. The analysis also applies the Kuttner method to 30-day federal funds futures [11]. This produces observable policy-surprise measures for 18 events. The paper compares the explanatory power of actual policy direction with that of unexpected policy information. In theory, this paper helps to understand whether bitcoin is closer to an independent digital currency or a highly volatile financial asset sensitive to interest rates, liquidity, and risk appetite. In practice, the results can help investors distinguish between interest rate adjustments that have been priced by the market and real new policy information, so as to more reasonably assess price fluctuations and investment risks during the FOMC announcement.

2. Data sources and variable definitions

The sample covers 1 January 2017 to 31 December 2024. FOMC event dates and changes in the federal funds target rate are obtained from the Federal Reserve's official website. A monetary policy event is defined as an FOMC announcement that explicitly raises or lowers the federal funds target range. Meetings that leave the rate unchanged are excluded. This rule identifies 26 rate-change events: 18 rate hikes and 8 rate cuts. Actual rate changes are measured in basis points. Rate hikes are recorded as positive values and rate cuts as negative values. The two emergency rate cuts in March 2020 are retained because they had substantial economic importance during the pandemic.

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Daily Bitcoin closing prices come from the Coinbase Bitcoin Price series CBBTCUSD in Federal Reserve Economic Data. Daily S&P 500 closing prices come from the FRED SP500 series. The 30-day federal funds futures data used to construct monetary policy surprises come from CME and are accessed through Databento's GLBX.MDP3 historical database. During data cleaning, the Bitcoin, S&P 500, and FOMC event datasets are matched by date. Because Bitcoin is traded around the clock, while the standard Poor's 500 index is traded only on stock market trading days, this paper takes the common trading day with effective observations in both markets as the benchmark and does not linearly interpolate the missing stock market prices. The emergency interest rate cut on March 15, 2020, occurred on Sunday, so its policy announcement date was retained, but the first subsequent common trading day, March 16, 2020, was set as the event date.

At the level of outliers and missing values, this paper does not directly exclude bitcoin extreme yield samples. The reason is that such sharp price fluctuations are likely to be real market feedback brought about by major policy events or market shocks, and mechanical removal of extreme samples will weaken the ability of event research to identify market price responses. For price missing values, this observation is retained only if the adjacent prices needed to calculate the yield are available. Seven events are excluded from the policy-surprise sample because federal funds futures prices are unavailable around the meeting date. The meeting on 31 July 2019 occurred at month-end. No days remained in the month, so the current-month contract could not be used for Kuttner-style scaling. The actual rate-change analysis therefore contains 26 events, while the policy-surprise regressions contain 18 valid events. Table 1 summarizes the sample and variable construction.

Table 1. Sample and variable construction

Item	Sample or data source	Purpose
FOMC rate-change events	2017–2024; 26 events	Event study; hikes positive and cuts negative
Daily Bitcoin closing price	FRED CBBTCUSD	Calculate daily Bitcoin log returns
Daily S&P 500 closing price	FRED SP500	Market benchmark and abnormal returns
Monetary policy surprise	CME ZQ via Databento	Kuttner-style measure for 18 complete events

3. Research method

3.1. Model specification

This paper uses a market model to estimate normal Bitcoin returns in the absence of an FOMC policy event. The S&P 500 return is used as a proxy for the overall market return. For each FOMC rate-change event, the estimation window runs from the 30th to the 4th trading day before the event. Historical data in this window are used to estimate the normal relationship between Bitcoin returns and equity-market returns. The estimated relationship is then used to calculate expected Bitcoin returns during the event window. The difference between actual and expected returns is the abnormal return. The paper calculates the event-day abnormal return, the cumulative abnormal return from one day before to one day after the event, and the cumulative abnormal return from three days before to three days after the event.

The market model accounts for Bitcoin's empirical sensitivity to broad stock market volatility and mitigates disturbances stemming from concurrent aggregate market movements. It reduces the

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influence of market-wide changes and helps identify the short-term effect of FOMC policy information on Bitcoin returns. The paper proposes two hypotheses. First, FOMC rate-change announcements generate non-zero abnormal Bitcoin returns over short event windows. This hypothesis tests whether the market systematically reprices Bitcoin around policy announcements without imposing a direction on the average response. Second, monetary tightening is negatively associated with abnormal Bitcoin returns. A larger rate increase or a more hawkish policy surprise should therefore be associated with lower abnormal returns on the event day and over short cumulative windows.

3.2. Returns and event windows

The paper uses log returns and applies a market-adjusted method to construct abnormal returns. Equation (1) subtracts the S&P 500 return from the Bitcoin return. This procedure eliminates partial co movement with broad risk assets. The approach is parsimonious and well suited for small sample event study applications. However, it cannot fully remove common shocks from the US dollar, market volatility, or regulatory news.

$$r_t = ln(P_t/P_{t-1}), \quad AR_t = r_t^{BTc} - r_t^{sP500}, \quad CAR[a,b] = \Sigma_{t=a}^{b} AR_t \tag{1}$$

Three complementary measures are reported. AR (0) captures the immediate response on the trading day linked to the announcement. CAR [-1, +1] captures information adjustment from one day before to one day after the announcement. CAR [-3, +3] captures delayed responses over a wider window. Using several windows helps determine whether the result is driven by only one trading day. Wider windows also increase contamination from other news. The seven-day cumulative return should therefore be interpreted as a short-term association rather than a pure policy effect.

3.3. Monetary policy surprises and regression specification

Thirty-day federal funds futures prices reflect the monthly average federal funds rate. Changes in implied rates around FOMC meetings can identify market perceived unexpected policy components. In Equation (2), D denotes total calendar days within the month, while d denotes the calendar day of the meeting. The scaling factor translates rate shifts affecting only the remaining days of the month into target rate policy surprises. Positive values represent more hawkish than expected, and negative values represent more dovish.

$$Surprise_i = [D/(D-d)](f_i, after - f_i, before), \quad Return_i = \alpha + \beta X_i + \varepsilon_i \tag{2}$$

In separate regressions, X represents either the actual rate change or the policy surprise. The dependent variables are the three abnormal-return measures. Due to the lack of historical ZQ observations, only 18 events can have the complete policy accident calculated. July 31, 2019, is at the end of the month; D-D is equal to zero, current month scaling cannot be defined, and it does not enter the policy unexpected return. This paper reports the coefficient, correlation coefficient, determination coefficient, and P value, and explains the statistical significance and economic direction separately.

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4. Empirical analysis

4.1. Average responses over the event windows

Table 2 shows that the mean AR (0) for the 26 events is 0.25%. The mean CAR [-1, +1] is 0.84%, and the mean CAR [-3, +3] is 0.71%. Their p-values are 0.706, 0.490, and 0.797, respectively. All three mean values are positive, but the null hypothesis of zero average abnormal return cannot be rejected. The subgroup results show that the average seven-day cumulative abnormal return is −2.60% for rate hikes and 8.14% for rate cuts. This difference is consistent with the mechanism through which looser liquidity conditions support risk assets. However, the rate-cut group contains only eight events and has a p-value of 0.113. The evidence is therefore not strong enough to be described as statistically significant.

Table 2. Event-study and monetary policy surprise regression results

Estimation	Measure	Estimate	R or mean-test p	R^2	N
A All-event mean	AR (0)	0.25%	0.706	—	26
A All-event mean	CAR [-1, +1]	0.84%	0.490	—	26
A All-event mean	CAR [-3, +3]	0.71%	0.797	—	26
B Surprise coefficient	AR (0)	-0.00405	-0.393	0.154	18
B Surprise coefficient	CAR [-1, +1]	-0.00571	-0.387	0.150	18
B Surprise coefficient	CAR [-3, +3]	-0.00815	-0.237	0.056	18

Table 2 shows that the estimated policy-surprise coefficients are negative in all three return windows. The AR (0) coefficient is −0.00405, with a p-value of 0.107. The CAR [-1, +1] coefficient is −0.00571, with a p-value of 0.112. The CAR [-3, +3] coefficient is −0.00815, with a p-value of 0.344. The common direction shows that the more hawkish the policy information received by the market, the lower the abnormal return of bitcoin. None of the three p-values crossed the traditional significance threshold and could not be written as a confirmed significant negative causal effect. The scale of the coefficients also requires caution. Policy surprises are measured in basis points, and the linear estimates describe only the relationship within the 18-event sample. Extreme policy periods and event heterogeneity in the sample may make the results more sensitive to individual observations.

4.2. Directional differences between rate hikes and rate cuts

Figure 1 presents the seven-day window, which shows the largest economic difference. The average of the interest rate hike group was lower than zero, while the interest rate cut group was significantly higher than zero. It shows that there are directional differences in short-term earnings performance after grouping according to the actual policy direction. Nevertheless, the figure only reports subgroup averages and fails to control for pandemic effects, market cycles, or meeting specific information content. The three coefficients in the actual rate-change regressions are negative. The coefficient for CAR [-3, +3] is −0.00102, with a p-value of 0.108 and an R^2 of 0.104. The coefficients for AR (0) and CAR [-1, +1] are close to zero and clearly insignificant. This shows that the explanatory power of the actual interest rate hike or interest rate cut on the immediate response is weak and further shows that it is necessary to distinguish the expected components.

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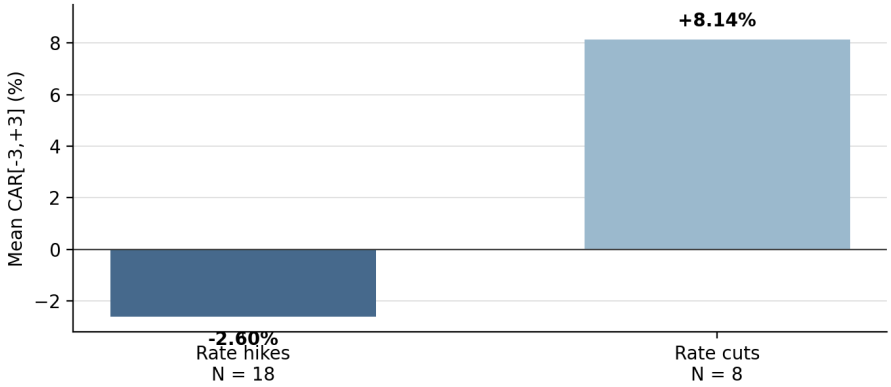


Figure 1. Mean seven-day cumulative abnormal Bitcoin returns (picture credit: original)

4.3. Results and discussion

The results are more consistent with the interpretation of Bitcoin as a highly volatile and liquidity-sensitive risk asset. When the policy is tighter than expected, risk-free interest rates and dollar financing costs rise. Investors' risk tolerance has declined. Given that Bitcoin generates no steady cash flows, it may face heightened valuation pressure. The same direction of the unexpected coefficient of the three policies is the main evidence of this mechanism in the sample. The difference between the rate-hike and rate-cut groups in the seven-day window is also consistent with this mechanism. However, actual policy direction also reflects economic conditions. Rate cuts usually occur during periods of slowing growth or rising financial pressures. The emergency cuts in 2020 were accompanied by the pandemic shock. A rise in Bitcoin around rate cuts does not therefore prove that the cuts caused the rise. The policy-surprise measure improves identification, but it cannot fully separate the multidimensional information contained in policy statements, economic projections, and the Chair's communication.

The primary limitation relates to sample size. Regressions for policy surprises include merely 18 valid events, yielding large standard errors and rendering ordinary least squares estimates susceptible to individual extreme observations. Future research could recover the missing historical ZQ data. It could also report sensitivity tests that exclude pandemic events, winsorise extreme observations, and remove one event at a time. The second limitation comes from frequency and benchmark selection. Daily prices cannot be aligned precisely with the release time of the policy statement. Market adjustment using the S&P 500 removes only part of the common risk component. Future studies can use minute bitcoin and futures quotations before and after the announcement. It could separately identify target-rate, policy-path, and information shocks. Changes in the US dollar index, VIX, and Treasury bonds could also be included as robustness controls.

5. Conclusion

This paper examines short-term Bitcoin returns around 26 Federal Reserve rate-change events from 2017 to 2024. Average abnormal returns lack statistical significance across the event day, three day, and seven-day windows, implying that Bitcoin exhibits no stable average reaction surrounding every rate adjustment announcement. When events are grouped by policy direction, the average seven-day cumulative abnormal return is negative for rate hikes and positive for rate cuts. It shows that easing and tightening events may correspond to different short-term market performance. The analysis then uses federal funds futures to construct policy surprises for 18 events. All three regression

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coefficients are negative. More hawkish information relative to market expectations tends to be associated with lower abnormal Bitcoin returns. The evidence supports the direction of the negative sensitivity. However, limited statistical power prevents a significant and stable causal conclusion.

The main contribution of this paper is to put the change of real interest rate and the unexpected policy shock of the market into the same event research framework. Observing a rate hike or a rate cut is not enough to describe the information received by financial markets. Such differentiation facilitates more prudent risk assessment of policy announcements for investors and delivers a testable baseline for interpreting Bitcoin as a liquidity-sensitive risk asset. The study is limited by the small policy-surprise sample, the coarse daily measurement, and the difficulty of fully excluding concurrent macroeconomic news. Future research should complete the futures dataset and use minute-level event windows. It should separate target-rate, forward-guidance, and central-bank information shocks. Robustness should also be assessed by excluding pandemic events, using alternative market benchmarks, and conducting influence-point diagnostics.

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