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RESEARCH ARTICLE

The Impact of News Sentiment and the COVID-19 Pandemic on Bitcoin Volatility, Return, and Liquidity

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ABSTRACT: The purpose of this paper is to investigate the effects of both macroeconomic, political, and social news, as well as the COVID-19 pandemic, on Bitcoin's volatility, return, and liquidity using high-frequency data from January 1, 2018, to July 17, 2025. The paper utilizes 263,946 15-minute observations to reduce microstructure noise and capture responses to different types of information. The results indicate that the COVID-19 pandemic has a significant impact on Bitcoin's volatility and liquidity, with no statistically significant effect on its average return. Many different types of news are statistically significantly related to volatility and liquidity, but not to return. These findings underscore the pivotal role of information flow in shaping cryptocurrency market behavior, offering valuable insights for investors, policymakers, and managers.

KEYWORDS: Economics, Finance, Bitcoin, Sentiment, COVID-19.

Introduction

Cryptocurrencies have gained popularity as an alternative investment tool over the past decade due to their transparency, security, and low-cost, cross-border transactions. Bitcoin, the most influential cryptocurrency, shapes investor sentiment, drives overall market trends, and has gained legitimacy through adoption by major corporations and institutional investors.[1]

Volatility is a key indicator in financial markets, playing a crucial role in assessing market risk, guiding investment strategies, and pricing financial derivatives. For traders and investors, understanding volatility is vital for effective risk management and identifying potential opportunities in diverse market conditions.[2]

Bitcoin's volatility is a defining characteristic that both attracts and challenges investors. Its sharp price fluctuations create significant opportunities for short-term traders, while also posing substantial risks for long-term holders. As the largest and most influential cryptocurrency, Bitcoin's volatility often sets the tone for the entire crypto market, influencing investor sentiment and capital flows. Additionally, its price swings reflect the asset's sensitivity to macroeconomic events, regulatory developments, and shifts in market adoption, making volatility analysis essential for understanding and navigating the cryptocurrency ecosystem.[3,5] That's why this paper focuses on the relationship between Bitcoin and news sentiment to give valuable insight into today's rapidly evolving financial world, contributing to a better understanding of market behavior and investor decision-making.

The results show that the COVID-19 pandemic significantly increased bitcoin volatility and liquidity, but had no effect on average return. Google trends data are positively related to both volatility and liquidity but not to return, suggesting that heightened investor attention increases market activity and instability without affecting price direction. News sentiment is positively associated with volatility but negatively related to liquidity, indicating that negative sentiment may trigger greater trading participation. Event-based regression indicates that political, macroeconomic, and social events have a significant effect on Bitcoin market dynamics. These findings highlight the critical role of information flow in shaping cryptocurrency market behavior.

This study contributes to the growing literature on volatility dynamics of digital asset markets by providing comprehensive high-frequency data analytics of how macroeconomic, political, and social news affect Bitcoin's key market indicators. While the prior research has often relied on daily (lower-frequency) data, this paper employs intraday data, enabling more precise characterization of short-term market reactions. Our study takes into account multiple dimensions for information flow, including Google Trends as a proxy for investor attention, news sentiment as a proxy for investor sentiment, and political, macroeconomic, and social news for broader societal attention. These findings have practical implications for traders, investors, and policymakers in understanding volatility patterns.

Literature Review

Various methodologies have been used and applied to investigate the effect of news on Bitcoin price such as regression analysis (Corbet *et al.*[1]; Sapkota *et al.*[2]), HAR-RV (Sapkota *et al.*[2]), AR-CGARCH (Vidal-Tomás and Ibañez[3]), NARDL (Zhu *et al.*[4]), NLP (Karalevicius *et al.*[5]), DCC-GARCH (Mariana *et al.*[7]), TVP-VAR (Elsayed *et al.*[10]), ANN (Arratia *et al.*[11]), Jump Diffusion Model (Philippas *et al.*[12]), Wavelet transformation (Aysan *et al.*[16]), and Quantile Regression (Naifar and Altamimi[18]).

The variables used in the literature often varied, including Bitcoin (Corbet *et al.*[1]), macroeconomic indicators (Corbet *et al.*[1]), news (Sapkota *et al.*[2]), (Zhu *et al.*[4]), S&P 500 (Conlon and McGee[6]), Stock Twits (Bouteska *et al.*[8]), VIX (Elsayed *et al.*[10]), ETH (Oraştean *et al.*[13]), oil prices fake news index (Zhang *et al.*[15]), sentiment news (Aysan *et al.*[16]), COVID-19-related

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variables (Derbali *et al.*[17]), and Google Trends (Aslanidis *et al.*[9]), Gold (Derbali *et al.*[17]).

The studies show that Bitcoin reacts differently depending on the type of news. Corbet *et al.*[1] found that Bitcoin responds to unemployment and durable good news but ignores GDP and inflation. Vidal-Tomás and Ibañez[3] showed that Bitcoin reacts mainly to its own events, not economic news. Sapkota *et al.*[2] and Karalevicius *et al.*[5] highlighted that media sentiment strongly influences Bitcoin volatility.

During the COVID-19 pandemic, findings were mixed. Conlon and McGee[6] stated that Bitcoin did not function as a haven. At the same time, Sapkota *et al.*[2] found that Bitcoin and Ethereum exhibited nonstationary price behavior, with their prices rising as COVID-19 cases and deaths increased. In contrast, Mariana *et al.*[7] provided evidence of Bitcoin's short-term haven properties. Zhu *et al.*[4] suggested that gold effectively hedges negative pandemic news in the short term. In addition, Zhang *et al.*[15], Derbali *et al.*[17], and Naifar and Altamimi[18] found that COVID-19 media coverage drove short-term volatility in crude oil, gold, and Bitcoin, with risk spreading mainly to gold and Bitcoin. At the same time, investor sentiment continued to show short-term Bitcoin returns but weakened during COVID-19 (Aysan *et al.*[16]).

Finally, studies using Google Trends show that search interest is related to price change, confirming the impact of investor attention (Aslanidis *et al.*[9]; Philippas *et al.*[12]). Oraştean *et al.*[13] found that increased search interest often precedes price rises, trading volume spikes, and sentiment shifts. At the same time, Arratia *et al.*[11] argue that it is not consistently reliable, yet Google Trends can still reflect demand.

Unlike prior studies relying on daily data, this paper uses high-frequency intraday data, providing a valuable perspective on news sentiment and the Bitcoin relationship.

■ Methods

Data:

The data consists of intraday data on the closing price of Bitcoin from 01/01/2018 to 17/07/2025. The data obtained from the Kaggle platform resulted in 263,946 observations. To reduce microstructure noise bias, we sample intra-daily returns at a 15-minute frequency.

Google Trends data taken from the Trends web page[20] as an index showing how frequently the keyword "bitcoin" has been searched from 2018 to 2025. It is used as a proxy for investor attention.

The Daily News Sentiment Index data is taken from the Federal Reserve Bank of San Francisco19 as an index showing the high-frequency measure of economic sentiment based on lexical analysis of economics-related news articles. The index is described in Buckman, Shapiro, Sudhof, and Wilson and is based on the methodology developed in Shapiro, Sudhof, and Wilson. It is used as a proxy for investor sentiment to see the effect of many different information inflows.

The political, macroeconomic, and social indices have been constructed by the present paper, based on the events listed in the Appendix. These indices are dummy variables that take the value of 1 on a news day and 0 otherwise.

Model:

$$Y_t = \beta_0 + \beta_1 X_t + \varepsilon_t$$

Where Y_t is the dependent variable for observation t, which refers to realized volatility, average daily return, and average daily liquidity. β_0 is the constant term, representing the expected value of the dependent variable when the independent variable is 0. β_1 is the coefficient for the independent variable, which is a binary dummy variable for the COVID-19 pandemic, which takes 1 during the COVID-19 pandemic and 0 otherwise. The coefficient shows how much the dependent variable changes when the corresponding independent variable changes by 1 unit. ε_t is the error, which represents the difference between the actual value and the predicted value from the model.

■ Results and Discussion

Descriptive Statistics:

Table 1a: Descriptive Statistics for Total Period. This table summarises the descriptive statistics of the total sample. The data indicate that the average returns are low and that the realised volatility is highly dispersed. This indicates that the market is sensitive to periodic shocks over the long run.

Variable	Obs	Mean	Std. Dev.	Min	Max
avgreturn2	2753	.001	.042	-.211	1.203
rvnew	2753	13.264	25.434	.044	464.287
liquidity	2753	5.999	.816	3.392	8.844
NewsSentiment	2752	-.052	.179	-.666	.3

Table 1b: Descriptive Statistics During the COVID-19 Period. This table summarises the descriptive statistics for the pandemic period. The results show that realised volatility reaches its highest average value, while News Sentiment declines to its lowest level. This pattern indicates increased market uncertainty, highlighting the significant stress experienced by financial markets during this period.

Variable	Obs	Mean	Std. Dev.	Min	Max
avgreturn2	839	.002	.04	-.174	.186
rvnew	839	17.474	28.851	.486	464.287
liquidity	839	6.264	.486	4.897	8.007
NewsSentiment	839	-.141	.225	-.666	.198

Table 1c: Descriptive Statistics During Non-COVID-19 Period. This table summarises the descriptive statistics for the non-COVID-19 period. Compared with the COVID-19 period, realised volatility declines, while News Sentiment remains close to a neutral level. This indicates a more stable market environment.

Variable	Obs	Mean	Std. Dev.	Min	Max
avgreturn2	1914	.001	.044	-.211	1.203
rvnew	1914	11.419	23.554	.044	424.254
liquidity	1914	5.883	.9	3.392	8.844
NewsSentiment	1913	-.013	.137	-.43	.3

Tables 1a, 1b, and 1c provide descriptive statistics for average return, realized volatility, liquidity, and news sentiment for the total period, the COVID-19 period, and the Non-COVID-19 period, respectively. The average return remains the same for all periods. There is a slight increase during the COVID-19 period. However, realized volatility is notably higher during the COVID-19 period, confirming the market uncertainty. Liquidity also increases during the COVID-19 period, indicating heightened trading activity and market participation. The news sentiment was negative during the COVID-19 pandemic; this confirms that the pandemic increased uncertainty and pessimism in the news.

COVID-19 Analysis:

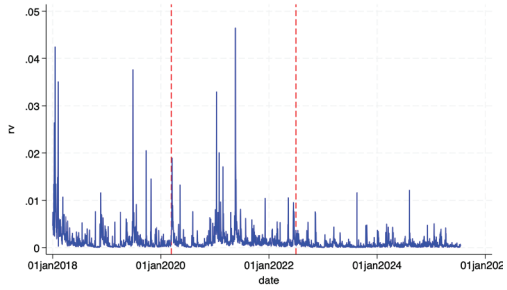


Figure 1: RV during the COVID-19 pandemic. Figure 1 shows Bitcoin's volatility before, during, and after the COVID-19 pandemic, with red dashed lines representing the beginning and end of the pandemic. Compared to non-COVID times, realised volatility increased significantly. Volatility decreases and stabilises around the end of the pandemic, indicating market normalisation.

Figure 1 shows the realized volatility of Bitcoin before, during, and after the COVID-19 period. Red dashed lines indicate the start and the end of COVID-19. The figure clearly illustrates a significant spike in realized volatility during the COVID-19 period compared to non-COVID-19 periods. Especially at the end of the pandemic, volatility remained relatively low and stable, indicating standard market conditions.

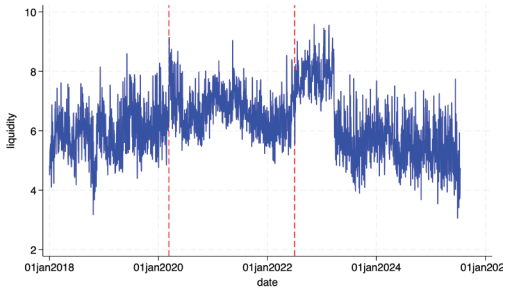


Figure 2: Average liquidity during the COVID-19 pandemic. Figure 2 shows market liquidity before, during, and after the COVID-19 pandemic. Results show that pandemic liquidity increased significantly compared to pre-COVID. Liquidity remains high following COVID-19, suggesting persistent trading activity despite market uncertainty.

Figure 2 indicates market liquidity before, during, and after the COVID-19 period. The graph indicates that market liquidity increased notably during the COVID-19 period compared to the pre-COVID period. Interestingly, liquidity remained relatively high immediately after the COVID-19 period.

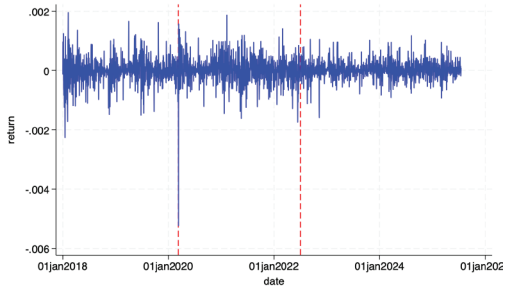
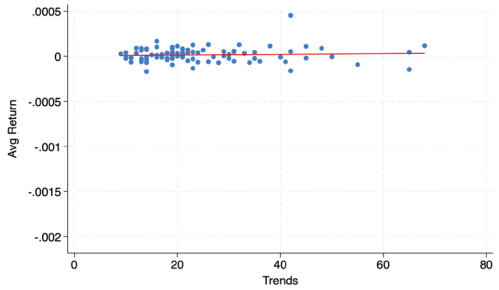


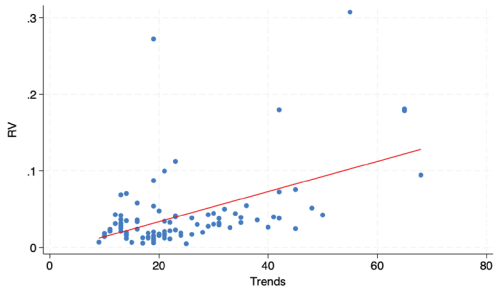
Figure 3: Average return during the COVID-19 pandemic. Figure 3 shows average returns before, during, and after COVID-19. There is no clear difference between the pre-COVID and COVID-19 periods. However, average returns decline noticeably in the post-pandemic period, indicating weaker market performance after the pandemic period.

Figure 3 displays the average return before, during, and after the COVID-19 period. Especially at the beginning of COVID-19, there was a dramatic, huge negative response. Moreover, there appears to be no significant difference between before the pandemic and during the pandemic period. However, returns have noticeably decreased in the post-pandemic period.

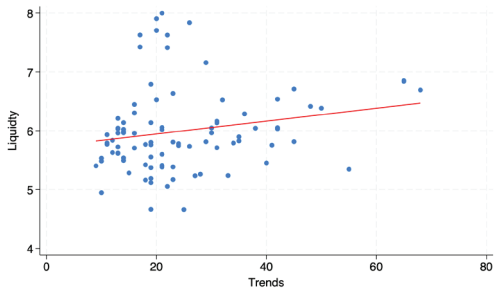
Bitcoin Trends Analysis:



Panel a: Return vs Trends.



Panel b: RV vs Trends.



Panel c: Liquidity vs Trends.

Figure 4: Relationship between average return, realized volatility, and liquidity with the Bitcoin trend. Figure 4 shows scatter plots of average return, realised volatility, and liquidity against Bitcoin trends. The results indicate an overall positive relationship, suggesting that stronger Bitcoin trends are associated with higher realised volatility and increased liquidity.

Figure 4 presents the scatter plot illustrating the relationship between average return, realized volatility, and liquidity with the Bitcoin trend. The figure shows an overall positive correlation among these variables, suggesting that Bitcoin trends have a positive effect on realized volatility and liquidity.

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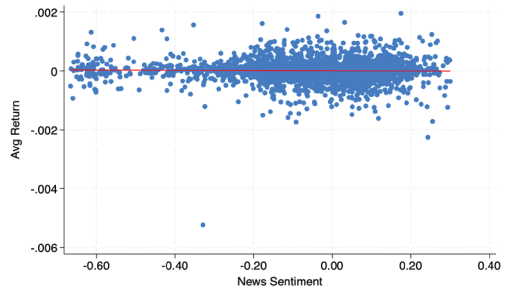
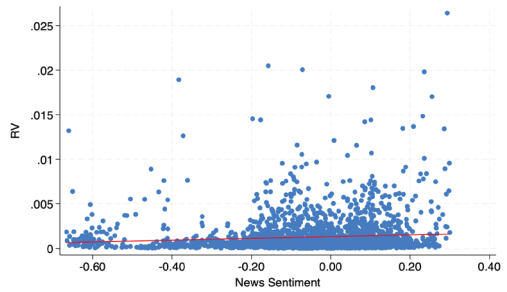
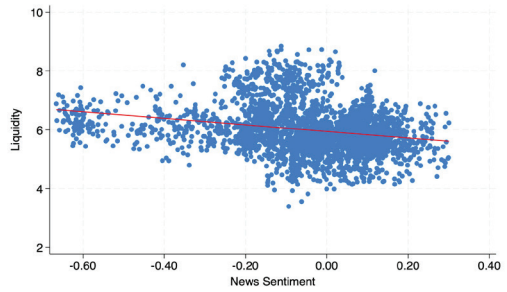


Panel a: Return vs News Sentiment.



Panel b: RV vs News Sentiment.



Panel c: Liquidity vs News Sentiment.

Figure 5: Relationship between average return, realized volatility, and liquidity with news sentiment. Figure 5 shows scatter plots of the average return, realised volatility (RV), and liquidity against News Sentiment. Panel (a) indicates no significant relationship between average return and news sentiment. Panel (b) reveals a weak positive association between RV and news sentiment, suggesting that higher sentiment scores are linked to increased volatility. Panel (c) shows a negative relationship between news sentiment and liquidity, indicating that higher news sentiment is associated with lower market liquidity.

Figure 5 presents the scatter plot illustrating the relationship between average return, realized volatility (RV), and liquidity with news sentiment. The figure indicates an overall positive correlation between RV and news sentiment, and a negative correlation between liquidity and news sentiment, suggesting that news sentiment has a statistically significant effect on both realized volatility and liquidity.

The relationship between bitcoin return, realized volatility, and liquidity with Google Trends is represented in Figure 4 in Panels a, b, and c, respectively. The scatterplot Panel a. shows no clear relationship between average return and news sentiment, suggesting that changes in trends do not systematically correspond to changes in average return. The scatterplot Panel b. shows an interesting connection between RV and trends data. It is clear that trend data positively correlated with RV, suggesting that the higher level of searching for Bitcoin online contributes to higher volatility. The scatterplot Panel c. shows an interesting connection between liquidity and trend data. It is clear that trend data positively correlated with liquidity, suggesting that the higher level of searching for Bitcoin online contributes to higher liquidity.

The relationship between Bitcoin return, realized volatility, and liquidity with News Sentiment is represented in Figure 5 in Panels a, b, and c, respectively. The scatterplot Panel a. shows no clear relationship between average return and news sentiment. The scatterplot Panel b. shows a slightly significant positive correlation between RV and news sentiment, suggesting that a higher sentiment score is linked to higher volatility. The scatterplot Panel c. shows an interesting connection between liquidity and news sentiment data. It is clear that news sentiment data negatively correlated with liquidity, suggesting that a higher score of news sentiment is associated with lower liquidity.

Regression Analysis:

Table 2: Regression analysis: the effect of the COVID-19 pandemic on average return, realized volatility, and liquidity. This table shows the regression results. There is no significant effect on average returns. However, the pandemic significantly increased volatility and liquidity, suggesting higher uncertainty and more trading activity during the crisis.

	(1)	(2)	(3)
VARIABLES	avgreturn2	rv2	liquidity
covidd	0.0003	6.055***	0.381***
	(0.002)	(1.132)	(0.027)
Constant	0.001	11.419***	5.883***
	(0.001)	(0.538)	(0.021)
Observations	2,753	2,753	2,753
R-squared	0.0001	0.012	0.046

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2 presents the results of three different regression models, where the dependent variables are average return, realized volatility, and liquidity, respectively. Each column represents a distinct model that explains the variable as COVID-19 Pandemic Dummy, which takes 1 from the start of the COVID-19 Pandemic in this case, March 11, 2020, to July 1, 2022. If the results are statistically significant at 1% level, as indicated by (***), the 5% level, as indicated by (**), and the 10% level, as indicated by (*). In Model 1, there is no statistically significant relationship between average return and the COVID-19 pandemic. Short-term returns are influenced by a wide range of global factors, not just the pandemic. In model 2, the COVID-19 pandemic is positively associated with realized volatility, confirming that Bitcoin became substantially more volatile during the crisis. This result is consistent with Elsayed *et al.* (2022), who documented strong volatility spillovers from Bitcoin to traditional assets, but contrasts with Mariana *et al.* (2021), who found temporary safe-haven properties. Such divergence highlights the sensitivity of the results to the data frequency and methodology employed. In Model 3, the COVID-19 pandemic is consistently positively associated with liquidity, suggesting that the liquidity of Bitcoin increased dramatically after the start of the COVID-19 pandemic. During the pandemic, in-

vestors were likely seeking alternative investment options. These findings indicate that Bitcoin is one of the alternative options for a haven.

Table 3: Regression analysis: the effect of trends on average return, monthly realized volatility, and liquidity. This table shows the regression results. Google Trends has no significant effect on returns, but has a strong positive effect on volatility and liquidity. This suggests that higher investor attention increases market uncertainty while also boosting trading activity.

	(1)	(2)	(3)
VARIABLES	avgreturnmonth2	rvmonth2	liquiditymonth
trends	0.00004	0.197***	0.011***
	(0.00009)	(0.054)	(0.004)
Constant	0.0004	-0.576	5.727***
	(0.002)	(1.178)	(0.131)
Observations	91	91	91
R-squared	0.004	0.253	0.039

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3 presents the results of three different regression models, examining how Google Trends (used as a proxy for investor attention for public interest) affects the monthly average return, monthly realized volatility, and monthly liquidity of Bitcoin. In model 1, the coefficient for trends is not statistically significant, meaning changes in public interest do not have a significant impact on the average monthly return of Bitcoin. In model 2, the positive relationship between Google Trends and volatility suggests that increased investor attention amplifies market instability. This aligns with Philippas *et al.* (2019), who also emphasized the destabilizing role of media attention, but challenge Arratia *et al.* (2021), who argued that search trends are not consistently reliable predictors. Our high-frequency evidence strengthens the case for attention-driven volatility. In model 3, the result showed a positive and significant relationship between trends and liquidity, which might suggest that more attention might lead to more trading activity.

Table 4: Regression analysis: the effect of news sentiment on average return, realized volatility, and liquidity. This table presents the regression results. News sentiment has no significant effect on returns, but it significantly increases realised volatility and decreases liquidity. This suggests that sentiment-driven news heightens market uncertainty while influencing trading conditions.

	(1)	(2)	(3)
VARIABLES	avgreturn	rv	liquidity
NewsSentiment	-0.001	12.55***	-1.098***
	(0.005)	(3.276)	(0.065)
Constant	0.002	13.917***	5.943***
	(0.001)	(0.571)	(0.015)
Observations	2,752	2,752	2,752
R-squared	0.001	0.008	0.058

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4 presents the results of three different regression models, examining the impact of news sentimenHigher values indicate more positive sentiment, and lower values indicate more negative sentiment.

In model 1, the coefficient for news sentiment is negative but not statistically significant. This means changes in news sentiment do not have a significant impact on the average monthly return of Bitcoin. In Model 2, there is a strong positive relationship between news sentiment and monthly realized volatility. This suggests that more positive economic news positively affects volatility. In model 3, interestingly, news sentiment is negatively associated with liquidity, indicating that negative sentiment stimulates higher trading activity. This finding is in line with Sapkota (2022), who documented sentiment-induced volatility, but it diverges from Karalevicius *et al.* (2017), who emphasized a stronger effect on prices rather than liquidity. This contrast highlights the novel contribution of our study, which incorporates liquidity as a channel of market reaction.

To get more robust evidence, the present paper also estimates three additional models, including political, macroeconomic, and social indices, in which the events in Appendix 2 are used.

The news indices used in these models were constructed based on the events listed in the Appendix. In the political, macroeconomic, and social indices, news days are assigned a value of 1 while all other days are assigned a value of 0. It is obvious that political, macroeconomic, and social news have a significant effect on average return, realized volatility, and liquidity. The detailed estimation result of the regression analysis is presented in Attachment 2. Event-based regression demonstrates the significant effect of political, macroeconomic, and social events on bitcoin return, volatility, and liquidity, respectively. These findings highlight how information flow characterizes the behavior of the cryptocurrency market.

Appendix:

Index	Event	Date
Political Index	Withdrawal of the USA from the Iran Nuclear Deal	May 8, 2018
Political Index	Beginning of the US-China Trade War	July 6, 2018
Political Index	Brexit Upends British Politics	December 12, 2019
Political Index	First Announcement of the COVID Pandemic	December 31, 2019
Political Index	Historic Oil Price Crash and OPEC Agreement	April 20, 2020
Political Index	The election of Joe Biden	November 3, 2020
Political Index	Spread of COVID-19 Vaccines	January 1, 2021
Political Index	US Infrastructure Bill Passed	November 15, 2021
Political Index	US's Withdrawal from Afghanistan	August 31, 2021
Political Index	Russia-Ukraine War	February 24, 2022
Political Index	US Expands Sanctions on China	June 5, 2023
Political Index	New Tensions on the Ukraine-Russia War	September 21, 2023
Political Index	European Parliament AI Regulation Decision	July 20, 2023
Political Index	The Start of the War Between Hamas and Israel	October 7, 2023
Political Index	Donald Trump Wins the U.S. Presidential Election	November 5, 2024
Political Index	Israel invades southern Lebanon	October 1, 2024
Political Index	Fall of the Essad Regime	December 8, 2024
Political Index	Sixth European Political Community Summit	May 16, 2025
Political Index	Iran-Israel War	June 13, 2025
Political Index	Trump Takes Office for a Second Term	January 20, 2025

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Macroeconomic Index	Tax Cuts are Implemented	01/01/2018
Macroeconomic Index	"Volmageddon" hits markets	February 5, 2018
Macroeconomic Index	U.S. raises tariffs on $200B of Chinese goods	May 10, 2019
Macroeconomic Index	U.S. Federal Reserve cuts interest rates	July 31, 2019
Macroeconomic Index	IMF lowers global growth forecast	January 21, 2019
Macroeconomic Index	IMF forecasts "Great Lockdown" recession	April 14, 2020
Macroeconomic Index	WTI oil futures go negative	April 20, 2020
Macroeconomic Index	U.S. inflation hits 6.8%	December 10, 2021
Macroeconomic Index	U.S. bans Russian oil imports	March 8, 2022
Macroeconomic Index	U.S. signs the Inflation Reduction Act	August 16, 2022
Macroeconomic Index	Fed raises rates by 75 bps	June 15, 2022
Macroeconomic Index	Silicon Valley Bank (SVB) collapses	March 10, 2023
Macroeconomic Index	U.S. CPI falls to 4%	June 13, 2023
Macroeconomic Index	Saudi Arabia & Russia extend oil production cuts	September 5, 2023
Macroeconomic Index	G20 Summit	November 18, 2024
Macroeconomic Index	U.S. imposes blanket 10% tariff	April 2, 2025
Macroeconomic Index	Iran threatens to close the Strait of Hormuz	June 22, 2025
Social Index	March for Our Lives Protests	March 24, 2018
Social Index	Greta Thunberg's Climate Protests	August 20, 2018
Social Index	Fridays for Future School Strike	May 24, 2019
Social Index	WHO Declared COVID-19 a Global Pandemic	March 11, 2020
Social Index	Start of Black Lives Matter Protests	June 6, 2020
Social Index	Elon Musk Became the Richest Person	January 7, 2021
Social Index	Musk Bought Twitter	October 28, 2022
Social Index	Release of ChatGPT	November 30, 2022
Social Index	No Kings on Presidents Day Protests	February 17, 2025

Table 5: Regression analysis: the effect of political, macroeconomic, and social news on volatility. This table examines the impact of news on realized volatility. Most news categories exhibit a statistically significant relationship with volatility. Among them, macroeconomic news (Model 2) shows the highest explanatory power, indicating that macroeconomic news is a key driver of market volatility.

	(1)		(2)		(3)
	rv		rv		rv
Pol 1	-0.000***	Mac 1	0.003***	Soc 1	0.001***
	(0.000)		(0.000)		(0.000)
Pol 2	-0.001***	Mac 2	0.016***	Soc 2	-0.001***
	(0.000)		(0.000)		(0.000)
Pol 3	-0.001***	Mac 3	-0.000***	Soc 3	-0.000***
	(0.000)		(0.000)		(0.000)
Pol 4	-0.001***	Mac 4	-0.001***	Soc 4	0.000
	(0.000)		(0.000)		(0.000)
Pol 5	-0.000***	Mac 5	-0.001***	Soc 5	-0.001***
	(0.000)		(0.000)		(0.000)
Pol 6	-0.000***	Mac 6	-0.001***	Soc 6	0.005***
	(0.000)		(0.000)		(0.000)
Pol 7	-0.000***	Mac 7	-0.000***	Soc 7	-0.001***
	(0.000)		(0.000)		(0.000)
Pol 8	-0.001***	Mac 8	0.001***	Soc 8	-0.000***
	(0.000)		(0.000)		(0.000)
Pol 9	-0.001***	Mac 9	-0.000***	Soc 9	-0.001***
	(0.000)		(0.000)		(0.000)
Pol 10	0.004***	Mac 10	-0.001***		
	(0.000)		(0.000)		
Pol 11	-0.001***	Mac 11	0.008***		
	(0.000)		(0.000)		
Pol 12	-0.001***	Mac 12	0.000***		
	(0.000)		(0.000)		
Pol 13	-0.001***	Mac 13	-0.001***		
	(0.000)		(0.000)		
Pol 14	-0.001***	Mac 14	-0.001***		
	(0.000)		(0.000)		
Pol 15	-0.001***	Mac 15	0.000		
	(0.000)		(0.000)		
Pol 16	-0.000***	Mac 16	0.000***		
	(0.000)		(0.000)		
Pol 17	-0.001***	Mac 17	-0.000***		
	(0.000)		(0.000)		
Pol 18	-0.001***				
	(0.000)				
Pol 19	-0.001***				
	(0.000)				
Pol 20	0.004***				
	(0.000)				
Constant	0.001***	Constant	0.001***	Constant	0.001***
	(0.000)		(0.000)		(0.000)
Observations	2,753	Observations	2,753	Observations	2,753
R-squared	0.003	R-squared	0.019	R-squared	0.002

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6: Regression analysis: the effect of political, macroeconomic, and social news on liquidity. This table examines the impact of news on market liquidity. Most news categories exhibit a statistically significant relationship with liquidity. While much political and social news negatively affects liquidity, several macroeconomic news displays positive effects on liquidity.

	(1)		(2)		(3)
	liq		liq		liq
Pol 1	-0.550***	Mac 1	-1.587***	Soc 1	-0.205***
	(0.016)		(0.016)		(0.016)
Pol 2	-0.530***	Mac 2	0.298***	Soc 2	0.122***
	(0.016)		(0.016)		(0.016)
Pol 3	-0.157***	Mac 3	-0.249***	Soc 3	0.065***
	(0.016)		(0.016)		(0.016)
Pol 4	-0.626***	Mac 4	-0.233***	Soc 4	0.540***
	(0.016)		(0.016)		(0.016)
Pol 5	0.538***	Mac 5	-0.777***	Soc 5	-0.306***
	(0.016)		(0.016)		(0.016)
Pol 6	0.483***	Mac 6	0.432***	Soc 6	1.113***
	(0.016)		(0.016)		(0.016)
Pol 7	0.202***	Mac 7	0.521***	Soc 7	1.844***
	(0.016)		(0.016)		(0.016)
Pol 8	-0.198***	Mac 8	0.162***	Soc 8	1.932***
	(0.016)		(0.016)		(0.016)
Pol 9	0.130***	Mac 9	0.191***	Soc 9	-1.052***
	(0.016)		(0.016)		(0.016)
Pol 10	0.900***	Mac 10	1.900***		
	(0.016)		(0.016)		
Pol 11	0.112***	Mac 11	1.430***		
	(0.016)		(0.016)		
Pol 12	-0.404***	Mac 12	2.653***		
	(0.016)		(0.016)		

Pol 13	-0.314***	Mac 13	-0.221***		
	(0.016)		(0.016)		
Pol 14	-1.181***	Mac 14	-0.771***		
	(0.016)		(0.016)		
Pol 15	-0.419***	Mac 15	-0.073***		
	(0.016)		(0.016)		
Pol 16	-0.279***	Mac 16	-0.448***		
	(0.016)		(0.016)		
Pol 17	-1.140***	Mac 17	-0.710***		
	(0.016)		(0.016)		
Pol 18	-1.117***				
	(0.016)				
Pol 19	-0.754***				
	(0.016)				
Pol 20	0.472***				
	(0.016)				
Constant	6.000***	Constant	5.998***	Constant	5.998***
	(0.016)		(0.016)		(0.016)
Observations	2,753	Observations	2,753	Observations	2,753
R-squared	0.006	R-squared	0.010	R-squared	0.005

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7: Regression analysis: the effect of political, macroeconomic, and social news on return. This table examines the impact of news on average returns (avgreturn). Most news categories exhibit statistically significant coefficients, although their magnitudes remain relatively small. Macroeconomic news again demonstrates the strongest effect on returns compared to political or social news.

	(1)		(2)		(3)
	avgreturn		avgreturn		avgreturn
Pol 1	-0.000***	Mac 1	-0.000***	Soc 1	-0.000***
	(0.000)		(0.000)		(0.000)
Pol 2	0.000***	Mac 2	-0.002***	Soc 2	-0.000***
	(0.000)		(0.000)		(0.000)
Pol 3	-0.000***	Mac 3	0.000***	Soc 3	0.000***
	(0.000)		(0.000)		(0.000)
Pol 4	-0.000***	Mac 4	0.001***	Soc 4	0.000***
	(0.000)		(0.000)		(0.000)
Pol 5	0.000***	Mac 5	-0.000***	Soc 5	0.000***
	(0.000)		(0.000)		(0.000)
Pol 6	0.000***	Mac 6	0.000***	Soc 6	0.001***
	(0.000)		(0.000)		(0.000)
Pol 7	0.000***	Mac 7	-0.000***	Soc 7	0.000***
	(0.000)		(0.000)		(0.000)
Pol 8	-0.000***	Mac 8	-0.000***	Soc 8	0.000***
	(0.000)		(0.000)		(0.000)
Pol 9	0.000	Mac 9	0.000***	Soc 9	-0.000***
	(0.000)		(0.000)		(0.000)
Pol 10	0.000***	Mac 10	0.000***		
	(0.000)		(0.000)		
Pol 11	-0.001***	Mac 11	0.000***		
	(0.000)		(0.000)		
Pol 12	-0.000***	Mac 12	-0.000***		
	(0.000)		(0.000)		
Pol 13	-0.000***	Mac 13	-0.000		
	(0.000)		(0.000)		
Pol 14	-0.000	Mac 14	-0.000***		
	(0.000)		(0.000)		
Pol 15	0.000***	Mac 15	0.000***		
	(0.000)		(0.000)		
Pol 16	-0.000***	Mac 16	-0.000***		
	(0.000)		(0.000)		
Pol 17	0.000***	Mac 17	-0.000***		
	(0.000)		(0.000)		
Pol 18	-0.000***				
	(0.000)				
Pol 19	0.000***				
	(0.000)				
Pol 20	0.000***				
	(0.000)				
Constant	0.000*	Constant	0.000*	Constant	0.000*
	(0.000)		(0.000)		(0.000)
Observations	2,753	Observations	2,753	Observations	2,753
R-squared	0.003	R-squared	0.008	R-squared	0.002

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Conclusion

This paper provides robust empirical evidence on the relationship between information flow and Bitcoin market behavior using high-frequency data. The empirical evidence shows that the COVID-19 pandemic did not significantly affect short-term returns but increased realized volatility and liquidity, reflecting heightened uncertainty and increased market activity. Google Trends is a significant driver of both volatility and liquidity. News sentiment also has a significant impact on both volatility and liquidity, but the effect on liquidity is in the opposite direction.

By incorporating political, macroeconomic, and social events, the study further demonstrates that external news events can significantly affect cryptocurrency market dynamics. These findings contribute to a better understanding of how Bitcoin reacts to different types of information. Our findings also suggest that regulators should consider the destabilizing role of news sentiment when designing crypto market policies, particularly as cryptocurrencies become more integrated into global financial systems.

Future research could examine whether similar patterns hold for other major cryptocurrencies such as Ethereum, Binance, and Ripple. Future studies could incorporate alternative sentiment from social media. In addition, instead of regression analysis, future studies can use machine learning as a tool to examine such cryptocurrencies' behavior.

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