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Cryptocurrency dynamics during global crises: Insights from Bitcoin's interplay with traditional markets

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ABSTRACT

This study delves into the differences between traditional financial markets, as proxied by their corresponding future contracts, and the cryptocurrency market, focusing on Bitcoin, during major global events: the COVID-19 pandemic, the Russia–Ukraine war, and the Israel–Palestine conflict. It reveals Bitcoin's increased trading volume post-COVID-19, highlighting its appeal as a digital safe haven. This trend persists during subsequent crises, suggesting a strategic shift towards cryptocurrencies as diversification tools. Despite volume fluctuations, Bitcoin's price stability reflects investor confidence in its long-term viability. The significant change in EuroStoxx 50 returns during the Israel–Palestine conflict, highlights localized geopolitical influences on markets. The study underscores the importance of considering both global and regional factors in investment decisions. It emphasizes cryptocurrencies' growing significance in the global financial market, particularly during crises, and suggests further exploration into investor behavior and regulatory effects. Understanding these dynamics is crucial for navigating the evolving financial landscape.

1. Introduction

Financial markets are intricate systems that react dynamically to global shocks. Over the past two decades, crises such as the global financial crash, sovereign debt turmoil, and geopolitical conflicts have underscored the vulnerability of traditional financial instruments. Investors have historically turned to established safe havens like gold and U.S. Treasuries during periods of turmoil, seeking shelter from heightened uncertainty and declining asset valuations (Reinhart & Rogoff, 2009). However, the past decade has seen the emergence of a new class of financial instruments—cryptocurrencies—raising questions about their potential to serve as crisis-resilient assets. Bitcoin, in particular, as the most established and widely traded cryptocurrency, has been subject to increasing scrutiny regarding its role during periods of global stress (Bouri et al., 2017; Urquhart & Zhang, 2019; Zhang et al., 2018).

The motivation behind this study is rooted in the understanding that financial markets are not hermetically sealed entities; rather, they are intricately connected to the broader global landscape (Albulescu, 2021; Bissoondeeal et al., 2023; Harris et al., 2024; Reinhart & Rogoff, 2009; Salisu et al., 2020; Wu et al., 2023). Crises — whether originating from health emergencies, geopolitical tensions, or regional conflicts — transcend borders, impacting economic systems in profound ways. Studying how both traditional

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and cryptocurrency markets respond to such disruptions is not only academically stimulating but also of practical significance for investors, regulators, and financial institutions navigating an increasingly volatile and interconnected financial world.

The outbreak of the COVID-19 pandemic, the escalation of the Russia–Ukraine war, and the eruption of the Israel–Palestine conflict represent distinct crises that tested the resilience and interconnectivity of global financial markets. These events differ in nature — ranging from public health emergencies to prolonged geopolitical disputes — but share one common feature: they triggered acute uncertainty, volatility, and investor reallocation (Albulescu, 2021; Mo et al., 2025).

The COVID-19 pandemic, an unparalleled global health crisis, set in motion a cascade of shocks throughout the global economy. Financial markets experienced significant stress, with volatility indices spiking and sectoral effects diverging. As governments introduced large-scale monetary and fiscal interventions, cryptocurrencies — especially Bitcoin — were increasingly viewed as decentralized alternatives with hedging potential (Bianchi et al., 2023; Cevik et al., 2022; Lyòcsa et al., 2020).

Similarly, the Russia–Ukraine war introduced a major geopolitical shock with global consequences. Traditional markets, especially energy and European equities, reacted sharply to the uncertainty. Meanwhile, crypto assets, detached from national jurisdictions, offered a unique channel for investors.

Finally, the Israel–Palestine conflict highlighted the influence of regional instability on local and global investor sentiment. Middle Eastern financial markets, sensitive to regional tensions, faced volatility, while Bitcoin's decentralized infrastructure and global reach presented a potential refuge for investors amid localized crisis.

While extensive research has analyzed the behavior of traditional markets during such events (Salisu et al., 2020), the literature on how cryptocurrencies respond to these disruptions remains fragmented and largely event-specific. For instance, Conlon and McGee (2020) and Chemkha et al. (2021) document Bitcoin's failure to act as a safe haven during COVID-19, while Khalfaoui et al. (2023) show that Bitcoin's response to the Russia–Ukraine war is highly sensitive to conflict-related attention. Past studies have also found that the relationship between stocks and potential safe haven assets can vary over time (Liu & Yuan, 2024; Wen et al., 2022) and may change in intensity during extreme market conditions (Corbet et al., 2020).

Moreover, much of the existing work focuses solely on return dynamics, often neglecting market participation and liquidity signals such as trading volume. Trading volume has long been recognized as a proxy for investor attention and informational flow (Karpoff, 1987; Kim & Verrecchia, 1991). Recent studies have called for a more nuanced understanding of crypto market behavior that incorporates both price and volume indicators, especially during crisis episodes (Aharon et al., 2022; Sakariyahu et al., 2024). This gap motivates a broader empirical exploration of how Bitcoin behaves not only in terms of valuation, but also investor engagement.

This study aims to contribute to this evolving literature by examining the behavior of Bitcoin and a set of traditional financial futures — representing equities, government bonds, and commodities — across three major global crises: the COVID-19 pandemic, the Russia–Ukraine war, and the Israel–Palestine conflict. We adopt a comparative empirical framework that allows us to test whether Bitcoin behaves differently from traditional assets during these events. Specifically, we focus on both returns and trading volume to capture not only asset price behavior but also investor engagement and confidence (Karpoff, 1987; Kim & Verrecchia, 1991).

We further differentiate across crisis types (health-related vs. geopolitical) and regional spillovers (e.g., EuroStoxx 50 and FTSE 100 responses), acknowledging that Bitcoin's behavior is highly context-dependent (Ameur et al., 2024; Corbet et al., 2020). The integration of multiple crises into a unified framework aligns with recent efforts to understand heterogeneity in market reactions based on crisis characteristics (Umar et al., 2022; Wang et al., 2022).

While much of the prior literature has focused on assessing safe haven or hedging properties of cryptocurrencies in isolation, our contribution lies in offering a unified, descriptive analysis across three very different global crises. By jointly analyzing returns and volume, we provide a broader picture of market dynamics that captures both investor valuation and behavior.

Accordingly, the objectives of this paper are threefold. First, we aim to assess whether Bitcoin experiences shifts in trading activity and returns during major crisis periods, and whether these shifts diverge from traditional financial benchmarks. Second, we explore whether Bitcoin functions more like a safe haven, a diversifier, or a speculative asset in the face of different types of crises. Third, we seek to evaluate how the nature of the crisis — whether global, geopolitical, or regional — shapes investor responses and the role of cryptocurrencies in risk allocation frameworks. These goals respond to recent calls in the literature to understand the evolving behavioral role of cryptoassets during macroeconomic and geopolitical disruptions (Bouri et al., 2020; Mo et al., 2025; Zhang et al., 2018).

To structure our empirical analysis, we formally test the following hypotheses:

H1 : (Volume Engagement Hypothesis): Bitcoin's trading volume increases significantly during crisis periods compared to pre-crisis baselines, suggesting heightened investor attention and market engagement.

H2 : (Return Stability Hypothesis): Bitcoin's price returns remain statistically stable across crisis and non-crisis periods, indicating a low-reactivity return profile.

H3 : (Crisis-Context Sensitivity Hypothesis): Bitcoin's behavior is heterogeneous across crisis types, with stronger engagement observed during regional or non-financial crises (e.g., Israel–Palestine) than during prolonged geopolitical conflicts (e.g., Russia–Ukraine).

To test these hypotheses, we construct a unique panel dataset of daily returns and trading volumes for Bitcoin and five traditional financial futures (S&P 500, FTSE 100, EuroStoxx 50, Gold, and 10-year U.S. Treasury Notes), covering the period from December 2019 to January 2024. We apply a difference-in-differences empirical strategy with asset-specific and crisis-specific interaction terms to isolate the distinct effects of each event on market behavior. This approach allows us to account for underlying trends and attribute deviations to crisis dynamics rather than general volatility.

Our results provide empirical insights into how Bitcoin is perceived and utilized by market participants during times of global uncertainty. By comparing return and volume dynamics across assets and crises, we aim to enrich the understanding of Bitcoin's evolving market role—not just in terms of performance, but also participation, sentiment, and strategic allocation.

This paper makes several contributions to the literature. First, we are the first to systematically analyze Bitcoin's behavior during the Israel–Palestine conflict—a regional crisis largely overlooked in empirical finance. Second, we include both return and trading volume data, offering a dual perspective on price efficiency and investor activity. Third, our unified comparative framework allows for consistent hypothesis testing across diverse crisis types, revealing the context-dependency of Bitcoin's role. Finally, our findings speak to broader debates on cryptocurrency's utility as a safe haven, hedging instrument, or behavioral proxy, with implications for investors, regulators, and researchers alike.

The remainder of the paper is structured as follows. Section 2 presents a comprehensive review of the relevant literature. Section 3 describes the data and variable construction. Section 4 outlines the empirical methodology. Section 5 presents the results and interprets them in the context of existing work. Section 6 discusses policy implications, hypothesis validation, and limitations. Section 7 concludes.

2. Literature review

The literature on Bitcoin's role during financial and geopolitical crises is rich and evolving. While early narratives emphasized its potential as a safe haven or hedge, recent studies highlight a more nuanced and crisis-specific behavior shaped by sentiment, attention, volatility regimes, and systemic interconnections. This review organizes the existing literature into four key themes: (i) safe haven and hedging performance, (ii) volatility spillovers and systemic connectedness, (iii) crisis-specific and geopolitical sensitivities, and (iv) investor sentiment and participation dynamics.

2.1. Safe haven and hedging performance

A significant portion of the literature examines whether Bitcoin and other cryptocurrencies can serve as hedges or safe havens, particularly during crisis periods. The consensus is mixed and highly conditional. Bouri et al. (2017) and Conlon and McGee (2020) find that Bitcoin generally functions as a diversifier rather than a consistent hedge or safe haven. Chemkha et al. (2021) and Dwita Mariana et al. (2021) confirm this inconsistency, showing that Bitcoin and Ethereum fail to protect stock portfolios during periods of severe market stress like the COVID-19 pandemic.

In contrast, Urquhart and Zhang (2019) find intraday evidence that Bitcoin acts as a hedge for select fiat currencies, such as GBP and CHF. Similarly, Ameur et al. (2024) and Mo et al. (2025) provide quantile-based evidence that while Bitcoin may exhibit weak safe haven behavior under certain geopolitical shocks, gold consistently outperforms it. Overall, these studies suggest that the safe haven characteristics of Bitcoin are highly sensitive to the crisis context, asset pairing, and time horizon.

2.2. Volatility spillovers and systemic connectedness

Another strand of literature investigates the integration and connectedness of cryptocurrency markets with traditional financial systems. Andrada-Félix et al. (2020) and Kurka (2019) use volatility spillover models to demonstrate that cryptocurrencies increasingly interact with fiat currencies and traditional financial markets, though spillovers remain asymmetric. Bouri et al. (2020) and Umar et al. (2022) find that during crisis periods, such as the COVID-19 pandemic and the Russia–Ukraine war, Bitcoin and Ethereum act as shock transmitters rather than protective assets.

This systemic behavior reduces their diversification benefits. Wang et al. (2022) further show that geopolitical risk increases systemic volatility across commodity markets, reinforcing the idea that cryptocurrencies do not decouple from broader financial stress but rather become part of it. These findings collectively point to a dynamic, time-varying relationship between cryptocurrencies and the global financial system.

2.3. Crisis-specific and geopolitical sensitivities

Several studies emphasize that Bitcoin's behavior is shaped by the nature and intensity of specific crises. During the COVID-19 pandemic, Albulescu (2021) reports elevated stock market volatility triggered by case and death counts, while Salisu et al. (2020) observe heightened oil-stock co-movements. Dwita Mariana et al. (2021) show that Bitcoin and Ethereum failed to hedge stock risk during this period.

With geopolitical shocks, Khalfaoui et al. (2023) and Umar et al. (2022) reveal that the Russia–Ukraine war increased downside risk in cryptocurrencies and intensified market connectedness. Mo et al. (2025) find that Bitcoin's reaction to conflict depends on its geographic and political context, and that it tends to underperform in prolonged high-risk situations. These findings suggest that Bitcoin may act as a temporary reallocation asset during localized or early-stage conflicts, but its hedging role diminishes in sustained geopolitical stress.

2.4. Investor sentiment and participation dynamics

A final theme centers on behavioral finance, particularly the influence of investor sentiment and media attention. Aharon et al. (2022) show that Twitter-based economic uncertainty significantly affects crypto returns, especially during downturns. Sakariyahu et al. (2024) find that global sentiment shocks drive cross-token contagion and exacerbate market volatility, particularly following events like the Terra and FTX collapses.

Volume has emerged as a key proxy for investor attention. Drawing from the foundational work of Karpoff (1987), Kim and Verrecchia (1991), several studies now emphasize the joint analysis of price and volume to capture participation dynamics. For instance, surges in trading volume without corresponding price movement may indicate speculative behavior or panic-driven reallocations. This behavioral lens is essential for understanding market reactions to crises and the often sentiment-driven nature of cryptocurrency trading.

Building upon the reviewed literature, our study contributes both theoretically and empirically to the understanding of cryptocurrency dynamics during global crises. Theoretically, we extend the discourse on asymmetry and regime-dependent behavior by highlighting how Bitcoin's market responses — particularly trading volume and return stability — differ across crisis types (health-related vs. geopolitical) and geographic scopes (global vs. regional conflicts). This nuanced behavior aligns with regime-switching theories of asset reallocation, where investors dynamically shift preferences based on the nature and proximity of crises.

Empirically, we offer a unified framework that captures time-varying effects by employing a difference-in-differences methodology across multiple crisis episodes. This approach allows us to isolate crisis-induced deviations in market behavior from underlying trends, providing robust evidence of Bitcoin's evolving role as a context-dependent diversifier rather than a universal safe haven. Moreover, by integrating both price and volume dynamics, our analysis goes beyond traditional return-based assessments, offering a richer understanding of participation asymmetries and attention-driven trading behavior in the crypto market. This dual perspective reveals that investor engagement with cryptocurrencies is often sentiment-driven, intensifying during periods of uncertainty without necessarily translating into significant price reactions. These findings contribute to the ongoing debate on the financialization of crypto-assets and their role within diversified investment strategies during turbulent times.

3. Data

3.1. Data issues

Our dataset comprises of micro data at the level of cryptocurrency and major asset classes, for which volume[1] (in terms of trade value), and closing prices were collected daily, spanning the period from December 12, 2019, to January 5, 2024. All daily data were collected from the Refinitiv Eikon database. The cryptocurrency market is represented by the spot Bitcoin (BTC) and the asset classes (S&P 500, the 10Year US Bond, FTSE100, EuroStoxx 50 and Gold) are tracked by their liquid investable futures contracts for the corresponding periods. Specifically, we utilize the E-mini S&P 500, US 10 Year Treasury Note futures, FTSE 100 Index Futures, EuroStoxx 50 Futures and the COMEX 100oz Gold futures. The exchange rates for Euro/United Dollar and Great Britain Pound/United States Dollar were also downloaded from Refinitiv Eikon. We opted for the corresponding futures contracts, since they are common instruments that provide exposure to the underlying index/asset, which otherwise might not be possible and they are liquid and widely utilized. On the other hand, Bitcoin futures, especially during the COVID-19 period, were not universally known/utilized, moreover a prospective investor can have a direct exposure to the asset directly (in contrast i.e. to the S&P 500).

The choice of BTC as the primary cryptocurrency and the other 5 major asset classes as the main counterpart for this analysis is driven by several considerations that aim to enhance the representativeness, comparability, and relevance of the study. First and foremost, Bitcoin is the most well-established cryptocurrency, holding a dominant position in the cryptocurrency market. Its recognition, widespread adoption, and market capitalization make it a representative choice for studying the broader cryptocurrency ecosystem. Analyzing Bitcoin allows us to capture trends and behaviors that are indicative of the overall performance of the cryptocurrency market. Furthermore, Bitcoin consistently maintains the highest market capitalization among cryptocurrencies. Its liquidity and trading volume are substantial, reducing the likelihood of outliers or distortions in observed data. This ensures that the impact of global events on Bitcoin is reflective of broader trends in the cryptocurrency market.

On the other hand, the S&P 500, FTSE100 and EuroStoxx 50 are the most widely followed and comprehensive benchmarks for the stock market of the western hemisphere. They include a diverse array of large-cap stocks representing various sectors of the largest economies. As broad market indicators, they provide a holistic view of the performance of traditional financial markets, making it a suitable choice for comparative analysis, since they are globally recognized and widely used by investors as a measure of overall market health. Thus, the selection of Bitcoin and those three indices (via their futures contracts) facilitates a meaningful comparative analysis between the cryptocurrency and traditional markets. The contrasting characteristics, including market structure, regulatory frameworks, and investor behaviors, provide valuable insights into how different financial ecosystems respond to major global events. Moreover, both gold and US treasuries are considered safe havens for different market conditions. US treasuries (here represented by the 10 Year Treasury Note futures) act as a shock absorber, while their price premium rises during market turmoil (Adrian et al., 2019) and have negative beta when compared to the stock market (Baele et al., 2020). Hence, during high uncertainty periods like the ones examined here, the behavior of the treasuries are worth examining. As for gold, Baur and McDermott (2010) concluded that can act as a safe haven on a daily basis, especially for developed markets, acting as a panic buy.

[1] The relationship between volume and price change is well documented (Karpoff, 1986, 1987; Kim & Verrecchia, 1991)

Table 1
Descriptive statistics of Spot Bitcoin.

Panel A: COVID-19 period						
	Whole sample		Pre COVID-19		Post COVID-19	
	Volume	Return	Volume	Return	Volume	Return
Observations	180	180	90	90	90	90
Mean	2.7385	0.0027	1.6028	0.0015	3.8743	0.0038
Standard Deviation	1.9315	0.0449	1.0776	0.0283	1.9323	0.0570
1st Percentile	0.4892	−0.16764	0.4171	−0.0711	1.6188	−0.2660
25th Percentile	1.0749	−0.0165	0.7264	−0.0163	2.7739	−0.0167
50th Percentile	2.6734	0.0008	1.0749	0.0005	3.6702	0.0017
99th Percentile	10.3951	0.1542	4.6108	0.0838	11.9312	0.1706
Panel B: Ukraine war						
	Whole sample		Pre Ukraine War		Post Ukraine War	
	Volume	Return	Volume	Return	Volume	Return
Observations	178	178	88	88	90	90
Mean	12.1314	−0.0033	14.5746	−0.0045	9.742517	−0.0021
Standard Deviation	3.2544	0.0333	1.8541	0.0336	2.4554	0.0331
1st Percentile	6.4307	−0.0956	11.6007	−0.1120	6.3591	−0.0956
25th Percentile	9.2640	−0.0161	13.3694	−0.0168	8.3742	−0.0143
50th Percentile	12.8842	−0.0008	14.1099	−0.0009	9.2872	−0.0008
99th Percentile	19.4799	0.0881	19.5945	0.0996	18.5370	0.0881
Panel C: Palestaine						
	Whole sample		Pre Israel Conflict		Post Israel Conflict	
	Volume	Return	Volume	Return	Volume	Return
Observations	181	181	90	90	91	91
Mean	6.6754	0.0022	5.0488	−0.0007	8.2841	0.0052
Standard Deviation	2.1002	0.0200	0.6545	0.0169	1.7707	0.0223
1st Percentile	3.6389	−0.0570	2.5617	−0.0570	4.4265	−0.0615
25th Percentile	5.0270	−0.0070	4.6929	−0.0066	7.2450	−0.0081
50th Percentile	5.8246	−0.0002	5.0455	−0.0013	8.4815	0.0009
99th Percentile	11.7368	0.0616	6.6929	0.0616	12.3602	0.0668

Note: Volume is in Billions of US Dollars.

3.2. Univariate properties of variables

The summary statistics presented in Tables 1–6, which are segmented into three panels (COVID19- Ukraine War- Israel conflict), offer a detailed examination of the statistical properties of the respective asset (E-mini S&P 500, US 10 Year Treasury Note futures, FTSE 100 Index Futures, EuroStoxx 50 Futures and the COMEX 100oz Gold futures). Panel A provides us information for the whole time-sample, but also for the pre COVID-19 era (defined from December 12, 2019, to March 10, 2020) and the post COVID-19 era (defined from March 11, 2020, to June 8, 2020)[2]. Panel B covers the Ukraine war period, November 26th, 2021, through May 24th, 2022, with February 24th, 2022, being the segregating time point, while Panel C demonstrates the descriptive statistics for the Israel conflict (July 9th, 2023, through January 5th, 2024, with segmentation point October 7th, 2023).

During the COVID-19 pandemic, Table 1 indicates that Spot Bitcoin experienced a noticeable increase in both volume and return, especially in the post-COVID19 era, highlighting a surge in trading activity and price resilience. The volume difference in favor of post-COVID19 is remarkable on all percentiles, with returns behaving in an identical manner.

In contrast to Bitcoin, traditional assets like the E-mini S&P 500 futures (Table 2) and FTSE 100 futures (Table 3) displayed significant volatility in returns, reflecting the immediate market reaction to pandemic-induced uncertainties. The mean trading volume of E-minis appears decreased, while percentile wise the behavior is mixed. In terms of returns, it seems that in higher percentiles the threshold for returns is higher, a notion that is followed also by the FTSE 100 futures. Antithetical behavior to FTSE 100 is shown by the EuroStoxx 50, where mean return of its futures is greater in the post-COVID19 era. On the other hand, volume abides by the norm that is already portrayed by the other two futures.

Table 5 focusing on US 10 Year Treasury Note futures, showcases relatively stable volume and minor fluctuations in returns, suggesting bonds' role as a safe haven during the Ukraine war. Meanwhile, Bitcoin's trading volume and returns, as seen in Table 1 for the same period, underscore its volatile yet substantial role in the market, with a marked increase in trading activity suggesting its perceived utility as a diversification tool amidst geopolitical tensions. Urquhart (2016) found that Bitcoin has no association with conventional financial assets, indicating that it may be used as a tool for diversification. Similarly, Bouri et al. (2017) show that Bitcoin is unaffected by larger market shifts since its connection with major stock indices stays near to zero. These results demonstrate how Bitcoin can diversify investments and lower total risk exposure in volatile market environments.

[2] We define the breaking point for the pre and post COVID-19 eras on March 11, 2020, in accordance with the timeline that World Health Organization (WHO) has provided regarding the outbreak of the COVID-19 pandemic

Table 2
Descriptive statistics of E-mini futures.

Panel A: COVID-19 period						
	Whole sample		Pre COVID-19		Post COVID-19	
	Volume	Return	Volume	Return	Volume	Return
Observations	122	122	60	60	62	62
Mean	6.7930	0.0006	7.1259	−0.0013	6.4708	0.0024
Standard Deviation	3.2030	0.0258	3.4723	0.0170	2.9111	0.0322
1st Percentile	1.5768	−0.0941	1.0046	−0.0696	3.7146	−0.0985
25th Percentile	4.8046	−0.0082	4.7750	−0.0046	4.8046	−0.0126
50th Percentile	5.7307	0.0012	5.9257	0.0011	5.6297	0.0025
99th Percentile	17.9200	0.0869	17.9200	0.0408	18.9050	0.0915
Panel B: Ukraine war						
	Whole sample		Pre Ukraine War		Post Ukraine War	
	Volume	Return	Volume	Return	Volume	Return
Observations	124	124	61	61	63	63
Mean	9.0099	−0.0012	9.6221	−0.0016	8.4171	−0.0009
Standard Deviation	2.8458	0.0138	3.2725	0.0116	2.2308	0.0157
1st Percentile	4.3911	−0.0345	3.7708	−0.0225	4.9384	−0.0375
25th Percentile	6.9515	−0.0103	7.5218	−0.0101	6.6902	−0.0117
50th Percentile	8.6556	−0.0011	9.2517	−0.0016	8.0965	−0.0007
99th Percentile	17.8250	0.0242	19.3258	0.0232	15.3949	0.0286
Panel C: Palestaine						
	Whole sample		Pre Israel Conflict		Post Israel Conflict	
	Volume	Return	Volume	Return	Volume	Return
Observations	126	126	64	64	62	62
Mean	7.9046	0.0004	7.7110	−0.0005	8.1044	0.0012
Standard Deviation	2.4102	0.0073	2.0623	0.0070	2.7259	0.0074
1st Percentile	3.3237	−0.0146	4.9311	−0.0167	2.6645	−0.0146
25th Percentile	6.4146	−0.0041	6.4391	−0.0046	6.3798	−0.0025
50th Percentile	7.6064	0.0008	7.2601	−0.0002	8.0314	0.0014
99th Percentile	17.2620	0.0185	17.2620	0.0142	17.9340	0.0192

Note: Volume is in Billions of US Dollars.

The period of the Israel-Palestine conflict highlighted in Table 6 shows gold futures experiencing a steady volume and slight variations in returns, reinforcing gold's position as a traditional safe haven. Correspondingly, Bitcoin's behavior during this period, illustrated in Table 1, demonstrates a parallel movement with gold in terms of volume trends, indicating a growing perception of Bitcoin as an alternative asset during times of crisis (Gandal et al., 2018).

Across all three events, the tables collectively elucidate a pattern of divergent market responses between traditional and cryptocurrency markets. Bitcoin, in particular, exhibits a unique profile of increased trading volume and resilience in returns, distinguishing it from traditional financial assets that show broader swings in response to global crises. This distinct behavior highlights the cryptocurrency's dual function as both a speculative investment and a potential safe haven, reflecting its evolving integration into the global financial landscape.

Overall, the summary statistics provide a nuanced understanding of the differential impacts of global crises on various asset classes, showcasing Bitcoin's unique market dynamics in contrast to traditional financial markets. These insights contribute to a deeper comprehension of the intricate relationships and investor behaviors characterizing the financial ecosystem during times of significant global upheaval.

3.3. Graphical illustration

In order to enhance the impact, the communication and clarity of the above results a graphical depiction is provided in Figs. 1 to 6. We will present a pair of graphs (volume and price) for each respective investigation period, that each has 5 panels, one for each asset (S&P 500, the 10Year US Bond, FTSE100, EuroStoxx 50 and Gold) in comparison to Bitcoin. A new index is constructed from the daily returns of all assets, for demonstration purposes.

In Fig. 1, it appears S&P 500 volume in $ terms is greater to Bitcoin's up to the segregation point of COVID19, where they start to converge and almost reach the same level. The compounded return (Fig. 2) initially is higher, then it collapses and reach similar levels around the threshold date, while it ends again in a higher place by the end of the period. Similar behavior to S&P 500 is displayed by EuroStoxx 50 on both figures. The US 10-year treasury is relatively steady in both terms of $ volume, moving in parallel to Bitcoin and indexed returns. Furthermore, gold had a steady ascension return wise during this turmoil, while their volumes seem to divert. Lastly, FTSE100 moved similarly volume wise with Bitcoin up until the segmentation point and then they started to diverge.

Table 3
Descriptive statistics of FTSE 100 futures.

Panel A: COVID-19 period						
	Whole sample		Pre COVID-19		Post COVID-19	
	Volume	Return	Volume	Return	Volume	Return
Observations	117	117	58	58	59	59
Mean	1.3612	−0.0091	1.6115	−0.0031	1.1152	−0.0150
Standard Deviation	1.2689	0.0954	1.4896	0.0157	0.9569	0.1338
1st Percentile	0.1751	−0.0959	0.1751	−0.0732	0.4723	−0.0959
25th Percentile	0.7533	−0.0089	0.8497	−0.0067	0.6672	−0.0175
50th Percentile	0.9233	0.0017	1.0202	0.0002	0.8064	0.0085
99th Percentile	7.6579	0.0494	8.3587	0.0268	5.5972	0.0864
Panel B: Ukraine war						
	Whole sample		Pre Ukraine War		Post Ukraine War	
	Volume	Return	Volume	Return	Volume	Return
Observations	115	115	56	56	59	59
Mean	1.3694	0.0001	1.3449	0.0001	1.3926	0.0001
Standard Deviation	1.2368	0.0119	1.1191	0.0099	1.3483	0.0136
1st Percentile	0.5041	−0.0334	0.2425	−0.0334	0.6062	−0.0365
25th Percentile	0.8725	−0.0043	0.8711	−0.0033	0.8746	−0.0044
50th Percentile	1.0349	0.0000	1.0262	−0.0007	1.0452	0.0009
99th Percentile	7.1687	0.0281	6.6715	0.0187	8.8983	0.0386
Panel C: Palestaine						
	Whole sample		Pre Israel Conflict		Post Israel Conflict	
	Volume	Return	Volume	Return	Volume	Return
Observations	122	122	60	60	62	62
Mean	1.1431	0.0004	1.1633	0.0004	1.1223	0.0003
Standard Deviation	0.9990	0.0069	1.0135	0.0071	0.9920	0.0067
1st Percentile	0.3505	−0.0154	0.6379	−0.0155	0.2868	−0.0145
25th Percentile	0.7601	−0.0037	0.7847	−0.0038	0.7172	−0.0036
50th Percentile	0.8749	0.0006	0.8598	0.0009	0.8911	−0.0007
99th Percentile	5.8942	0.0198	6.7185	0.0199	5.8942	0.0193

Note: Volume is in Billions of US Dollars.

Fig. 3 presents the period which is segregated by the invasion of Ukraine in February of 2022. This period includes the previous All Time Highs of Bitcoin during November of 2021 and the afterwards downtrend. Unsurprisingly, in regard to volume in $ amount, it either dominates the other assets (US 10 year treasury/gold/FTSE100) or while retaining higher levels, the main stock indexes (S&P 500 and EuroStoxx 50) close the gap and commence to concur. On the other hand, the vast downtrend of Bitcoin's returns (Fig. 4) is evident, losing half of its price during those 6 months, supporting the notion that volume is positively related to the magnitude of price change (Karpoff, 1987) and justify the behavior in Fig. 3 compared to the other assets. Gold retains the characteristic as a shock absorber, with the US 10-Year treasury acting in similar manner.

Figs. 5 and 6 illustrates the assets' behavior prior and post the beginning of the conflict in Israel. In regards of volume, Bitcoin continues to move in parallel with both the 10 Year treasury and gold, while performance wise those two assets are relatively flat. S&P 500 begins the period on a higher level $ volume, with Bitcoin covering the divergence after the segmentation point of the dataset and co-moving with the index. In the matter of returns, the period again coincides with the rising to new All Time Highs for both assets, while it is noticeable that Bitcoin doubled in price during this period, explaining the higher volume. EuroStoxx 50 begins to diverge after the separation point of the dataset in terms of volume, with returns mapping those of S&P 500. The other stock market (FTSE100) is relatively stable, hence the disparity with Bitcoin increases over time.

4. Methodology

Our empirical methodology combines insights from cross-sectional comparisons and before-after analyses, focusing on the impact of three significant events — the COVID-19 pandemic, the Russia–Ukraine war, and the Israel-Palestine conflict — on traditional and cryptocurrency markets. This study extends the framework to investigate two crucial metrics: volume and price return. The core of our methodology is examining the differential impact of each event on the two types of markets. This approach allows us to capture the causal effects of crises on market behaviors, providing a nuanced understanding of risk and crisis management. One of the simplest applications of this methodology is through a set up where the outcomes of two different groups are observed throughout two time periods, t=0,1 where 0 indicates a time period before the event, and 1 indicates the time period after the event.

Table 4
Descriptive statistics of EuroStoxx 50 futures.

Panel A: COVID-19 period						
	Whole sample		Pre COVID-19		Post COVID-19	
	Volume	Return	Volume	Return	Volume	Return
Observations	112	112	54	54	58	58
Mean	6.2754	0.0000	7.0208	−0.0045	5.5813	0.0042
Standard Deviation	4.0681	0.0268	3.9774	0.0170	4.0622	0.0330
1st Percentile	2.3901	−0.0798	2.9264	−0.0798	1.9109	−0.1130
25th Percentile	3.7041	−0.0084	3.8725	−0.0082	3.2119	−0.0112
50th Percentile	4.7028	0.0017	5.0687	−0.0009	4.1828	0.0096
99th Percentile	19.1797	0.0548	16.9814	0.0186	19.7612	0.0974
Panel B: Ukraine war						
	Whole sample		Pre Ukraine War		Post Ukraine War	
	Volume	Return	Volume	Return	Volume	Return
Observations	118	118	57	57	61	61
Mean	4.8229	−0.0015	4.6526	−0.0023	4.9820	−0.0007
Standard Deviation	2.9436	0.0169	2.5344	0.0149	3.2936	0.0187
1st Percentile	1.6579	−0.0427	1.4360	−0.0427	2.1764	−0.0480
25th Percentile	3.1278	−0.0111	3.1415	−0.0107	3.1278	−0.0117
50th Percentile	3.8126	−0.0016	4.2572	−0.0017	3.7485	−0.0015
99th Percentile	15.5570	0.0410	14.7772	0.0313	19.7928	0.0625
Panel C: Palestaine						
	Whole sample		Pre Israel Conflict		Post Israel Conflict	
	Volume	Return	Volume	Return	Volume	Return
Observations	124	124	64	64	60	60
Mean	4.2507	0.0005	4.2293	−0.0005	4.2734	0.0015
Standard Deviation	2.5522	0.0081	2.3573	0.0088	2.7648	0.0073
1st Percentile	1.9654	−0.0153	2.4116	−0.0178	1.6748	−0.0152
25th Percentile	2.9691	−0.0036	2.9824	−0.0083	2.9161	−0.0025
50th Percentile	3.6359	0.0006	3.6188	0.0001	3.6359	0.0014
99th Percentile	14.9935	0.0230	14.5890	0.0236	16.1775	0.0230

Note: Volume is in Billions of US Dollars.

4.1. Market size disparity

Traditional markets, comprising well-established stock exchanges such as the NYSE, dwarf the cryptocurrency market in terms of trading volume. The sheer magnitude of traditional market size provides a robust benchmark against which the impact on the relatively smaller cryptocurrency market can be assessed (Cheah & Fry, 2015; Ciaian et al., 2016). This substantial difference in size ensures that any observed variations in market metrics are less likely to be solely attributed to market scale but rather to the unique characteristics and responses inherent to each market. Moreover, by utilizing the futures contracts of the assets, we narrow down this gap.

4.2. Global economic integration

Traditional markets are deeply integrated into the global economic system, representing a broad spectrum of industries, sectors, and geographic regions (Obstfeld, 2021). Events such as the COVID-19 pandemic, the Russia-Ukraine war, and the Israel-Palestine conflict have pervasive effects on the global economy, influencing traditional markets across various dimensions. By designating traditional markets as the control group, we acknowledge and capture the interconnectedness of these events with the broader economic landscape.

4.3. Established regulatory framework

Traditional markets operate within a well-established regulatory framework, overseen by regulatory bodies and institutions that provide stability and oversight. This contrasts with the cryptocurrency market, which operates in a relatively nascent and less-regulated environment (Narayanan et al., 2016). The control group, in this context, acts as a stable baseline against which the potentially more dynamic and unregulated nature of the cryptocurrency market can be assessed.

4.4. Investor behavior and sentiment

Investors in traditional markets often exhibit more established and predictable patterns of behavior, influenced by traditional financial indicators, economic reports, and institutional strategies (Gabaix et al., 2006). On the other hand, the cryptocurrency

Table 5
Descriptive statistics of US Ten Year Bond Futures.

Panel A: COVID-19 period						
	Whole sample		Pre COVID-19		Post COVID-19	
	Volume	Return	Volume	Return	Volume	Return
Observations	122	122	60	60	62	62
Mean	0.2576	0.0005	0.3034	0.0010	0.2133	0.0000
Standard Deviation	0.1832	0.0043	0.2209	0.0038	0.1238	0.0048
1st Percentile	0.0518	−0.0126	0.0512	−0.0126	0.0825	−0.0145
25th Percentile	0.1541	−0.0014	0.1759	−0.0010	0.1497	−0.0024
50th Percentile	0.1983	0.0007	0.2366	0.0016	0.1796	−0.0002
99th Percentile	0.9770	0.0125	1.2034	0.0105	0.8826	0.0167
Panel B: Ukraine war						
	Whole sample		Pre Ukraine War		Post Ukraine War	
	Volume	Return	Volume	Return	Volume	Return
Observations	124	124	61	61	63	63
Mean	0.2378	−0.0006	0.2374	−0.0004	0.2381	−0.0007
Standard Deviation	0.1277	0.0044	0.1341	0.0034	0.1224	0.0052
1st Percentile	0.0717	−0.0110	0.0616	−0.0079	0.1059	−0.0112
25th Percentile	0.1836	−0.0034	0.1743	−0.0025	0.1896	−0.0044
50th Percentile	0.2134	−0.0007	0.2134	0.0000	0.2135	−0.0012
99th Percentile	0.8477	0.0099	0.8477	0.0104	0.8583	0.0099
Panel C: Palestaine						
	Whole sample		Pre Israel Conflict		Post Israel Conflict	
	Volume	Return	Volume	Return	Volume	Return
Observations	126	126	64	64	62	62
Mean	0.2215	0.0001	0.2061	−0.0005	0.2374	0.0007
Standard Deviation	0.1270	0.0046	0.1168	0.0041	0.1358	0.0051
1st Percentile	0.0887	−0.0092	0.1027	−0.0100	0.0449	−0.0092
25th Percentile	0.1511	−0.0037	0.1430	−0.0038	0.1776	−0.0032
50th Percentile	0.1945	0.0000	0.1741	−0.0003	0.2069	0.0005
99th Percentile	0.7244	0.0123	0.7244	0.0090	0.9062	0.0137

Note: Volume is in Billions of US Dollars.

market is characterized by a more diverse and dynamic range of participants, including retail investors and technologically inclined individuals. Recent research has suggested several potentially important behavioral factors that influence the determination of cryptocurrency returns and the trading volume (Drobetz et al., 2019; Papadamou et al., 2021; Zhang et al., 2019). The control group thus offers a benchmark for understanding how traditional investors, with different motivations and risk appetites, respond to the crises compared to their counterparts in the cryptocurrency space.

In summary, the choice of traditional markets as the control group is grounded in the pragmatic acknowledgment of their overwhelming market size, global economic integration, regulatory maturity, and established investor behavior. This decision ensures that observed variations in market metrics during and after crises can be attributed more reliably to the unique characteristics of the cryptocurrency market, shedding light on its distinctive responses to global events.

Based on the previous discussion we utilize the following specification for each of the two variables (volume and price return) under scrutiny.

$$\ln(Volume)_{i,t} = a_1 + \beta_1 Asset_{i,t} + \gamma_1 COVID19_{i,t} + \delta_1(Asset_{i,t} \times COVID19_{i,t}) + u_{1i,t} \tag{1}$$

$$Return_{i,t} = a_2 + \beta_2 Asset_{i,t} + \gamma_2 COVID19_{i,t} + \delta_2(Asset_{i,t} \times COVID19_{i,t}) + u_{2i,t} \tag{2}$$

where $COVID19_{i,t}$ is a dummy variable for time period taking the value 0 for the pre COVID-19 era and 1 for the post COVID-19 era. The dummy variable $Asset_{i,t}$ attains the value 0 for traditional assets and 1 for cryptocurrencies. The coefficients of interest, $\delta's$, capture the impact of the interaction term $Asset_{i,t} \times COVID19_{i,t}$, which identifies the post COVID-19 impact on cryptocurrencies. Finally, $u_{ji,t}$, denotes error terms.

Expanding the empirical methodology to investigate the impact of the Russia-Ukraine war on financial markets, we extend the variable specifications for the two key metrics.

$$\ln(Volume)_{i,t} = a_1 + \beta_3 Asset_{i,t} + \gamma_3 UkraineWar_{i,t} + \delta_3(Asset_{i,t} \times UkraineWar_{i,t}) + u_{3i,t} \tag{3}$$

$$Return_{i,t} = a_2 + \beta_4 Asset_{i,t} + \gamma_4 UkraineWar_{i,t} + \delta_4(Asset_{i,t} \times UkraineWar_{i,t}) + u_{4i,t} \tag{4}$$

where $UkraineWar_{i,t}$ is a dummy variable for time period taking the value 0 for the pre Ukraine/Russia war era and 1 for the post Ukraine/Russia war era. The dummy variable $(Asset_{i,t})$ attains the value 0 for traditional assets and 1 for cryptocurrencies.

Table 6
Descriptive statistics of Gold futures.

Panel A: COVID-19 period						
	Whole sample		Pre COVID-19		Post COVID-19	
	Volume	Return	Volume	Return	Volume	Return
Observations	122	122	60	60	62	62
Mean	0.5520	0.0013	0.6382	0.0021	0.4687	0.0006
Standard Deviation	0.2627	0.0153	0.2866	0.0102	0.2077	0.0191
1st Percentile	0.2272	−0.0463	0.2119	−0.0463	0.2272	−0.0463
25th Percentile	0.3437	−0.0057	0.3957	−0.0016	0.3217	−0.0119
50th Percentile	0.4714	0.0022	0.5943	0.0032	0.4112	0.0005
99th Percentile	1.3004	0.0559	1.3801	0.0313	1.1504	0.0595
Panel B: Ukraine war						
	Whole sample		Pre Ukraine War		Post Ukraine War	
	Volume	Return	Volume	Return	Volume	Return
Observations	124	124	61	61	63	63
Mean	0.4174	0.0004	0.3862	0.0011	0.4476	−0.0003
Standard Deviation	0.1747	0.0097	0.1723	0.0079	0.1731	0.0111
1st Percentile	0.1892	−0.0249	0.1606	−0.0200	0.2226	−0.0266
25th Percentile	0.2958	−0.0049	0.2598	−0.0032	0.3412	−0.0082
50th Percentile	0.3709	0.0016	0.3273	0.0019	0.3823	0.0014
99th Percentile	0.9173	0.0226	0.8790	0.0193	1.0837	0.0232
Panel C: Palestaine						
	Whole sample		Pre Israel Conflict		Post Israel Conflict	
	Volume	Return	Volume	Return	Volume	Return
Observations	126	126	64	64	62	62
Mean	0.4096	0.0005	0.3786	−0.0008	0.4416	0.0018
Standard Deviation	0.1328	0.0077	0.1199	0.0060	0.1386	0.0090
1st Percentile	0.2132	−0.0161	0.2132	−0.0152	0.1760	−0.0226
25th Percentile	0.3103	−0.0038	0.2854	−0.0042	0.3345	−0.0032
50th Percentile	0.3794	0.0001	0.3464	−0.0007	0.4351	0.0013
99th Percentile	0.8341	0.0242	0.7930	0.0129	0.8504	0.0311

Note: Volume is in Billions of US Dollars.

The coefficients of interest, $\delta's$, capture the impact of the interaction term, $Asset_{i,t} \times UkraineWar_{i,t}$, which identifies the post Ukraine/Russia war impact on cryptocurrencies. Finally, $u_{ji,t}$, denotes error terms.

Finally, extending the analysis to the Israel-Palestine conflict, the variable specifications for the two metrics are as follows:

$$\ln(Volume)_{i,t} = a_1 + \beta_5 Asset_{i,t} + \gamma_5 Israelconflict_{i,t} + \delta_5(Asset_{i,t} \times Israelconflict_{i,t}) + u_{5i,t} \tag{5}$$

$$Return_{i,t} = a_2 + \beta_6 Asset_{i,t} + \gamma_6 Israelconflict_{i,t} + \delta_6(Asset_{i,t} \times Israelconflict_{i,t}) + u_{6i,t} \tag{6}$$

where $Israelconflict_{i,t}$ is a dummy variable for time period taking the value 0 for the pre Israel/Palestine conflict era and 1 for the post Israel/Palestine conflict era. The dummy variable $(Asset_{i,t})$ attains the value 0 for traditional assets and 1 for cryptocurrencies. The coefficients of interest, $\delta's$, capture the impact of the interaction term, $Asset_{i,t} \times Israelconflict_{i,t}$, which identifies the post Israel/Palestine conflict impact on cryptocurrencies. Finally, $u_{ji,t}$, denotes error terms.

5. Empirical results

The empirical analysis of our study is structured to assess the differential impacts of major global events on traditional markets versus Bitcoin, with a focus on trading volume and price return behavior. The results provide valuable insight into how investors respond to systemic and geopolitical crises by reallocating risk and are presented in Tables 7, 8, and 9, drawing on models (1) to (6) to encapsulate the dynamics surrounding the COVID-19 pandemic, the Russia-Ukraine war, and the Israel-Palestine conflict.

We estimate our models using panel regression with Driscoll–Kraay standard errors. This approach is robust to heteroskedasticity, autocorrelation, and cross-sectional dependence—three issues commonly encountered in financial panel data. It is especially suitable for our dataset, which includes a moderate time dimension (T ≈ 300 per model) and multiple correlated assets exposed to common global shocks. Compared to traditional fixed-effects or cluster-robust methods, the Driscoll–Kraay correction provides more reliable inference when residuals are potentially correlated both across time and across assets.

To verify the statistical adequacy of our model, we perform a series of post-estimation diagnostics. The Jarque–Bera (JB) tests strongly reject the null hypothesis of normally distributed residuals for all models (p-values < 0.001 across the board), confirming the presence of skewness and/or excess kurtosis. Moreover, the serial correlation test results are mixed: while some specifications (e.g., E-mini and US Ten Year returns) reject the null of no autocorrelation (p-values < 0.05), others do not. This validates the use

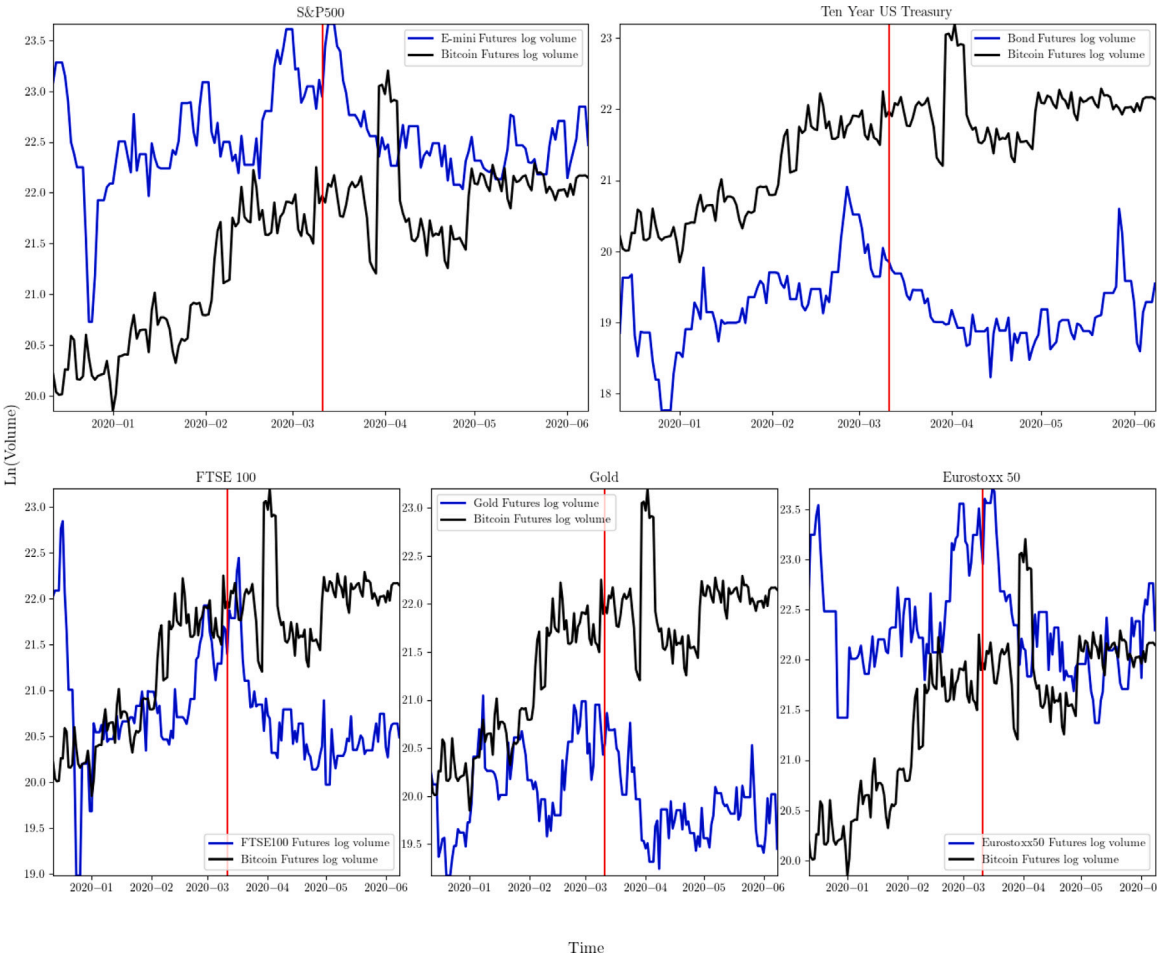

Fig. 1. Ln(Volume) of Bitcoin Vs Assets for the COVID19 period.

Table 7
Covid 19.

Variables	E-mini		US Ten Year		EuroStoxx 50		Gold		FTSE 100	
	$Volume_{i,t}$	$Return_{i,t}$	$Volume_{i,t}$	$Return_{i,t}$	$Volume_{i,t}$	$Return_{i,t}$	$Volume_{i,t}$	$Return_{i,t}$	$Volume_{i,t}$	$Return_{i,t}$
$Asset_{i,t}$	−1.590***	0.00291	1.652***	0.000526	−1.539***	0.0416	0.802***	−0.000507	0.0392	0.00469*
	(0.134)	(0.00249)	(0.108)	(0.00309)	(0.162)	(0.0253)	(0.141)	(0.00298)	(0.188)	(0.00262)
$COVID19_{i,t}$	−0.0424	0.00376	−0.246	−0.00101	−0.244	0.0273	−0.285**	−0.00152	−0.271	−0.0119
	(0.131)	(0.00400)	(0.164)	(0.000656)	(0.163)	(0.0309)	(0.127)	(0.00292)	(0.178)	(0.0168)
$Asset_{i,t} \times COVID19_{i,t}$	1.057***	−0.00149	1.260***	0.00327	1.259***	−0.0250	1.300***	0.00379	1.286***	0.0142
	(0.171)	(0.00611)	(0.149)	(0.00594)	(0.216)	(0.0314)	(0.184)	(0.00535)	(0.231)	(0.0168)
a_j	22.57***	−0.00134	19.32***	0.00104**	22.51***	−0.0401	20.17***	0.00207	20.94***	−0.00312
	(0.111)	(0.00213)	(0.144)	(0.000513)	(0.119)	(0.0255)	(0.103)	(0.00142)	(0.142)	(0.00243)
Observations	302	302	302	302	292	292	302	302	297	297
R-squared	0.625	0.002	0.828	0.002	0.553	0.023	0.729	0.001	0.463	0.010
Jarque–Bera	4.0e−12	6.6e−08	2.4e−10	8.6e−09	2.7e−12	8.8e−14	3.1e−09	1.0e−06	2.0e−14	1.4e−10
Serial Correlation	0.1014	0.0133	0.1132	0.0211	0.0161	0.1344	0.1835	0.0252	0.0334	0.2580

Driscoll–Kraay standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1, $Volume_{i,t}$ is the ln of the traded volume.

of Driscoll–Kraay standard errors, which accommodate both forms of dependence and do not require normally distributed errors. These diagnostics strengthen confidence in our modeling framework and help ensure the robustness of our empirical conclusions.

For the COVID-19 pandemic period, the empirical results in Table 7 highlight a significant increase in the trading volume of Bitcoin relative to traditional markets. The interaction parameter δ_1, representing the COVID-19-period differential effect on volume, is positive and statistically significant at the 1% level across all specifications. This suggests that Bitcoin's trading volume rose substantially more than that of traditional assets following the onset of the pandemic. The economic implication is that investors

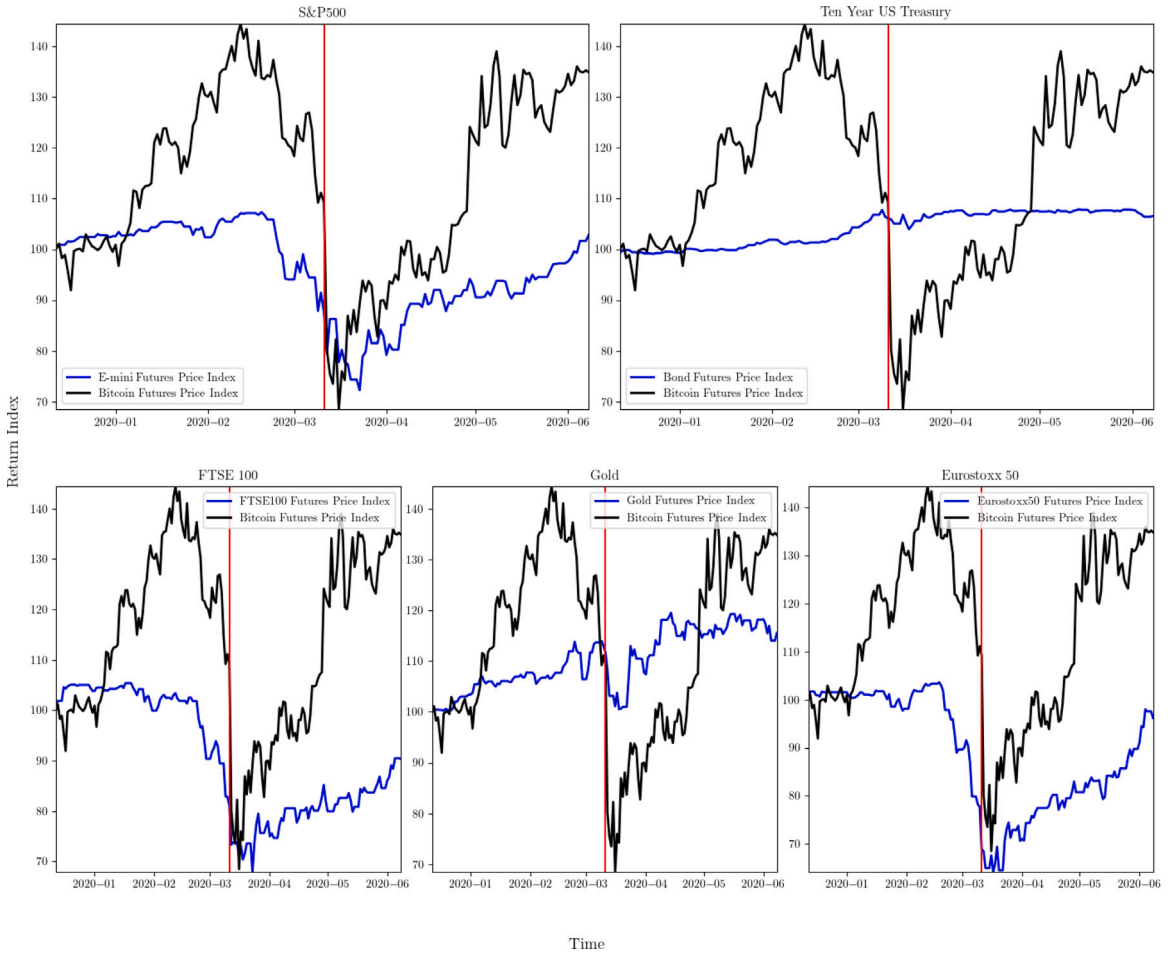

Fig. 2. Indexed Price of Bitcoin Vs Assets for the COVID19 period.

Table 8
Ukraine.

Variables	E-mini		US Ten Year		EuroStoxx 50		Gold		FTSE 100	
	$Volume_{i,t}$	$Return_{i,t}$	$Volume_{i,t}$	$Return_{i,t}$	$Volume_{i,t}$	$Return_{i,t}$	$Volume_{i,t}$	$Return_{i,t}$	$Volume_{i,t}$	$Return_{i,t}$
$Asset_{i,t}$	0.466***	−0.00285	4.228***	−0.00398	1.268***	0.0317	3.712***	−0.00557	2.553***	0.0300
	(0.0752)	(0.00307)	(0.0948)	(0.00367)	(0.0983)	(0.0235)	(0.0963)	(0.00367)	(0.108)	(0.0238)
$Ukraine\ War_{i,t}$	−0.107	0.000688	0.0509	−0.000295	0.0602	0.0354	0.177	−0.00146	0.0276	0.0179
	(0.0898)	(0.00232)	(0.105)	(0.000771)	(0.145)	(0.0231)	(0.109)	(0.00153)	(0.150)	(0.0293)
$Asset_{i,t} \times Ukraine\ War_{i,t}$	−0.314***	0.00159	−0.473***	0.00257	−0.482***	−0.0331	−0.598***	0.00374	−0.449***	−0.0156
	(0.101)	(0.00399)	(0.0986)	(0.00513)	(0.136)	(0.0238)	(0.119)	(0.00520)	(0.148)	(0.0290)
a_j	22.93***	−0.00157	19.17***	−0.000448	22.13***	−0.0361	19.68***	0.00114	20.84***	−0.0344
	(0.0756)	(0.00147)	(0.0954)	(0.000422)	(0.103)	(0.0230)	(0.0856)	(0.000847)	(0.108)	(0.0242)
Observations	302	302	302	302	296	296	304	304	293	293
R-squared	0.474	0.003	0.978	0.004	0.717	0.024	0.974	0.006	0.917	0.014
Jarque–Bera	4.0e−14	2.3e−11	1.8e−13	9.0e−11	8.6e−11	6.0e−06	2.6e−13	3.5e−07	5.8e−13	4.9e−10
Serial Correlation	0.2092	0.0786	0.0948	0.0267	0.1400	0.2816	0.0437	0.1099	0.1248	0.0531

Driscoll–Kraay standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1, $Volume_{i,t}$ is the *ln* of the traded volume.

may have turned to Bitcoin as a diversification or hedging tool—potentially due to its digital and decentralized nature, which contrasts with traditional markets constrained by pandemic-related shutdowns. By contrast, the return-based interaction term δ_2 is statistically insignificant across all models, suggesting that Bitcoin's return profile remained stable during the crisis.

These results provide support for Hypothesis 1, which posits that Bitcoin's trading volume increases significantly during crisis periods. The observed rise in trading activity during COVID-19 may reflect increased speculative participation (Zhang et al., 2018) or heightened attention triggered by uncertainty shocks (Aharon et al., 2022; Sakariyahu et al., 2024). This surge underscores Bitcoin's growing role as a sentiment-driven asset. In contrast, Hypothesis 2, concerning return stability, is only partially supported.

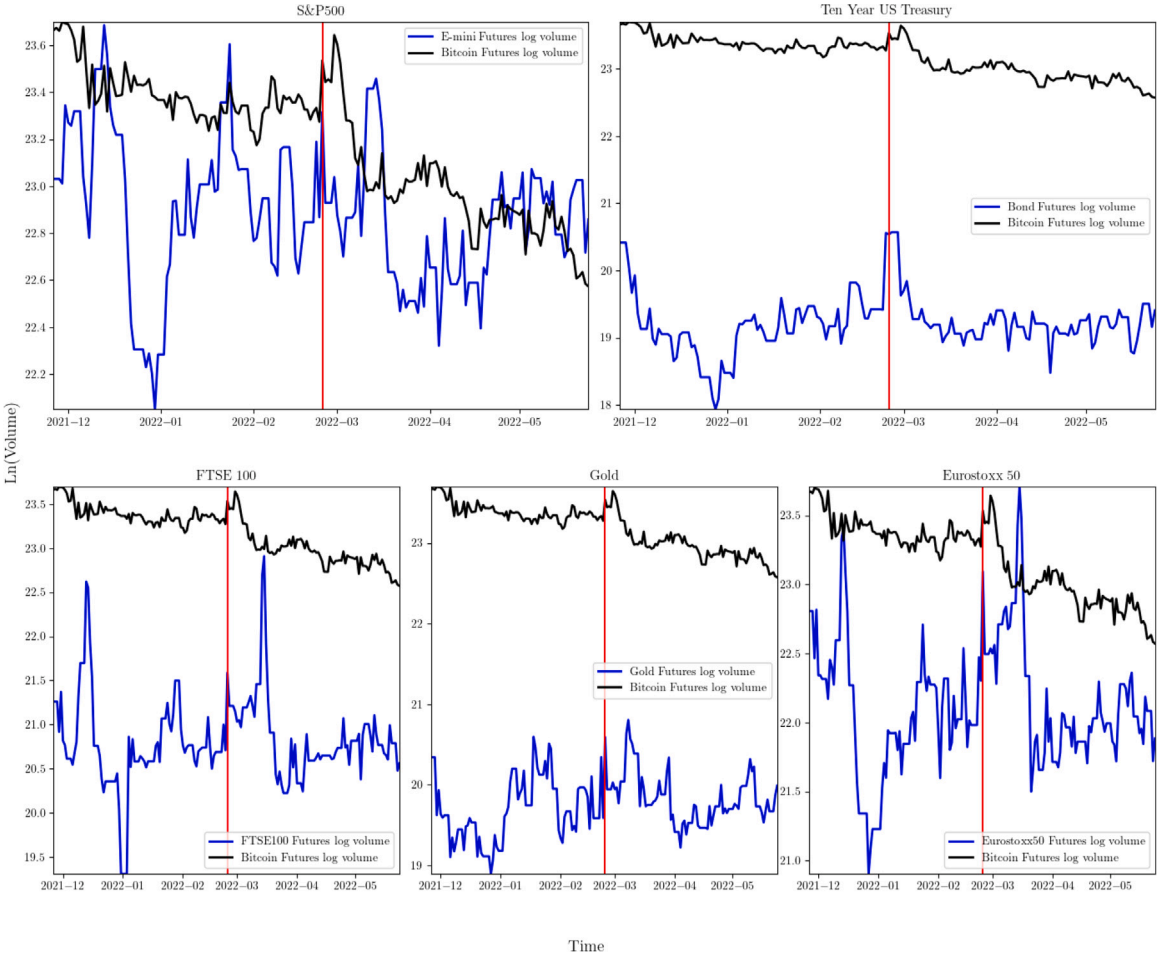

Fig. 3. Ln(Volume) of Bitcoin Vs Assets for the Ukraine war period.

Table 9
Israel.

Variables	E-mini		US Ten Year		EuroStoxx 50		Gold		FTSE 100	
	$Volume_{i,t}$	$Return_{i,t}$	$Volume_{i,t}$	$Return_{i,t}$	$Volume_{i,t}$	$Return_{i,t}$	$Volume_{i,t}$	$Return_{i,t}$	$Volume_{i,t}$	$Return_{i,t}$
$Asset_{i,t}$	−0.404***	−0.000253	3.287***	−0.000186	0.584***	−0.00418***	2.626***	5.11e−05	1.612***	0.0148
	(0.0544)	(0.00156)	(0.0846)	(0.00154)	(0.0676)	(0.00123)	(0.0568)	(0.00174)	(0.0997)	(0.0161)
$Israel\ conflict_{i,t}$	0.0265	0.00170	0.125	0.00127*	0.270***	0.00432**	0.151*	0.00258*	−0.0702	0.0158
	(0.0780)	(0.00145)	(0.119)	(0.000749)	(0.0630)	(0.00177)	(0.0800)	(0.00141)	(0.146)	(0.0158)
$Asset_{i,t} \times Israel\ conflict_{i,t}$	0.453***	0.00424	0.354**	0.00467	−0.0731**	0.00591***	0.328***	0.00336	0.549***	−0.00990
	(0.0948)	(0.00339)	(0.136)	(0.00298)	(0.0369)	(0.00143)	(0.0977)	(0.00331)	(0.147)	(0.0163)
a_j	22.74***	−0.000471	19.05***	−0.000538	21.93***	−0.00160	19.71***	−0.000775	20.72***	−0.0155
	(0.0433)	(0.000903)	(0.0781)	(0.000436)	(0.0676)	(0.00123)	(0.0593)	(0.000833)	(0.0963)	(0.0158)
Observations	307	307	307	307	305	305	307	307	303	303
R-squared	0.436	0.025	0.968	0.027	0.435	0.021	0.971	0.026	0.885	0.015
Jarque–Bera	5.7e−18	5.0e−13	7.e-150	2.4e−60	0.0000	7.e-159	1.e-137	0.0000	2.4e−91	8.e-153
Serial Correlation	0.0107	0.3745	0.0377	0.0044	0.0459	0.1589	0.2574	0.0100	0.1100	0.0416

Driscoll–Kraay standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1, $Volume_{i,t}$ is the *ln* of the traded volume.

While Bitcoin's return profile appears muted relative to traditional assets, prior studies have documented considerable volatility and inconsistent safe haven behavior during crises (Bouri et al., 2020; Chemkha et al., 2021). Thus, Bitcoin may function more as a reactive or opportunistic asset than a consistently stable one.

During the Russia–Ukraine war period, results presented in Table 8 show that the interaction parameter δ_3 is negative and statistically significant at the 1% level. This suggests a contraction in the gap between Bitcoin's trading volume and that of traditional markets, which might be indicative of a flight to liquidity or a reallocation towards traditional safe havens like gold or government

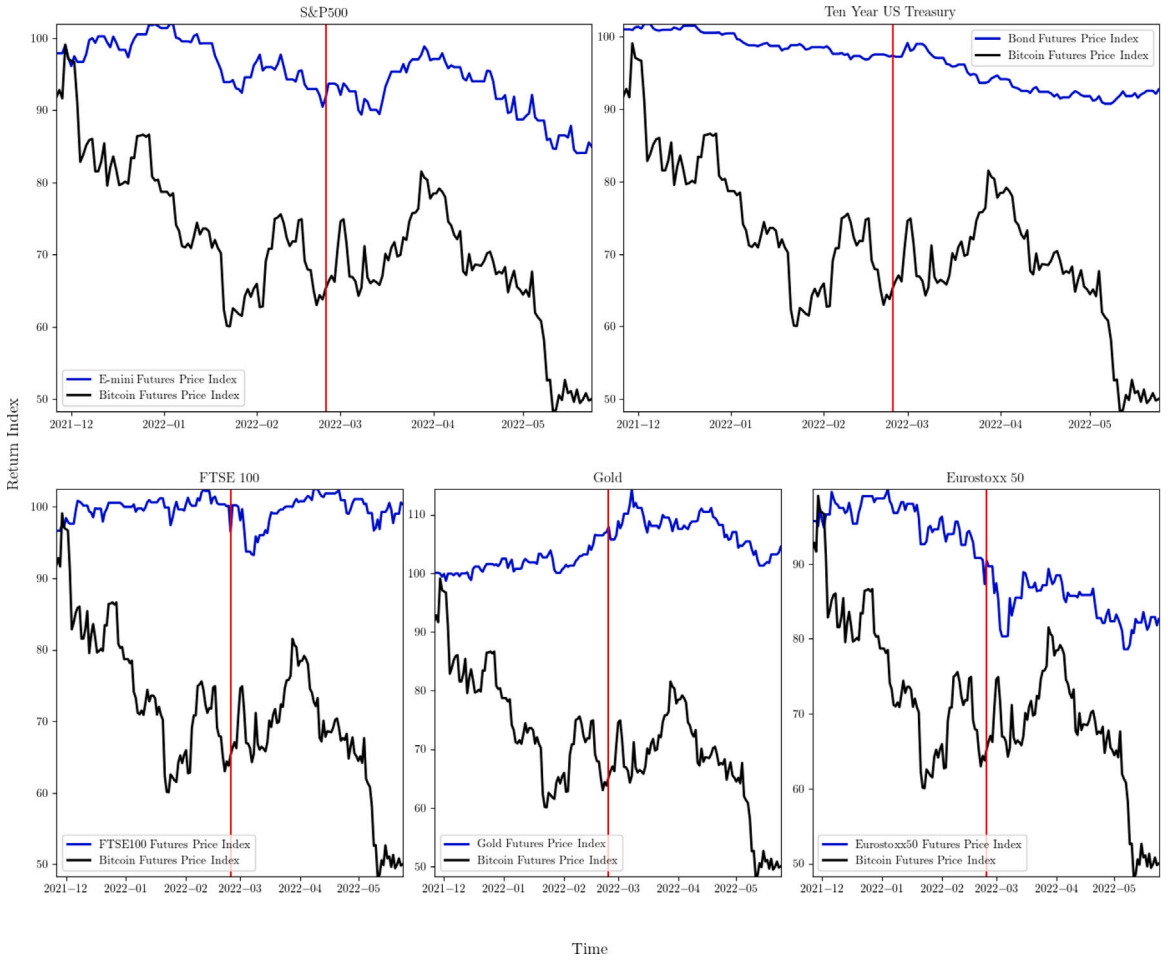

Fig. 4. Indexed Price of Bitcoin Vs Assets for the Ukraine war period.

bonds in times of geopolitical uncertainty. The economic takeaway here is the nuanced investor behavior that leans towards conservatism in crisis periods, questioning the extent to which cryptocurrencies like Bitcoin can serve as true safe havens. However, similar to the COVID-19 findings, the price return impact parameter δ_4 remains statistically insignificant, indicating that Bitcoin's returns were stable even as trading volume declined. This may reflect the market's resilient perception of Bitcoin's value proposition even in times of geopolitical strife.

In this case, Hypothesis 1 is not supported. The decrease in Bitcoin's trading volume during the Russia–Ukraine conflict, in contrast with traditional safe-haven flows, suggests that geopolitical crises of this scale may erode rather than enhance Bitcoin's appeal as a reallocation target. This behavior aligns with literature pointing to Bitcoin's inconsistent haven-like qualities in times of sustained conflict (Khalfaoui et al., 2023; Umar et al., 2022; Wang et al., 2022). Meanwhile, Hypothesis 2 is partially supported, as the return series for Bitcoin remain relatively stable. The lack of significant price fluctuations implies continued valuation resilience, consistent with studies suggesting that investor participation may fluctuate without triggering pronounced price responses (Andrada-Félix et al., 2020; Mo et al., 2025).

In the context of the Israel–Palestine conflict, the findings shown in Table 9 reveal that the interaction parameter δ_5 is positive and statistically significant at the 1% level. This indicates a notable increase in Bitcoin's trading volume relative to traditional markets in the post-conflict era, underscoring a potential shift towards cryptocurrencies during periods of regional instability. This rise could point towards the global, decentralized appeal of cryptocurrencies during regional conflicts, where traditional market exposures may be deemed riskier. Economically, it suggests a strategic shift among investors towards leveraging the borderless nature of cryptocurrencies to hedge against region-specific risks. Interestingly, the price return parameter δ_6 shows significance only for the EuroStoxx 50, suggesting that while trading volumes for Bitcoin increased, the price return dynamics saw a significant change only in the context of European stock markets. This exception may illustrate how localized geopolitical tensions can disproportionately affect nearby markets, causing divergent investor responses that favor global over regional assets for risk mitigation.

The Israel–Palestine case clearly supports Hypothesis 1, as the strong and significant increase in Bitcoin's trading volume indicates heightened investor activity during the crisis. This suggests that Bitcoin may play a role as a reallocation or hedging vehicle during

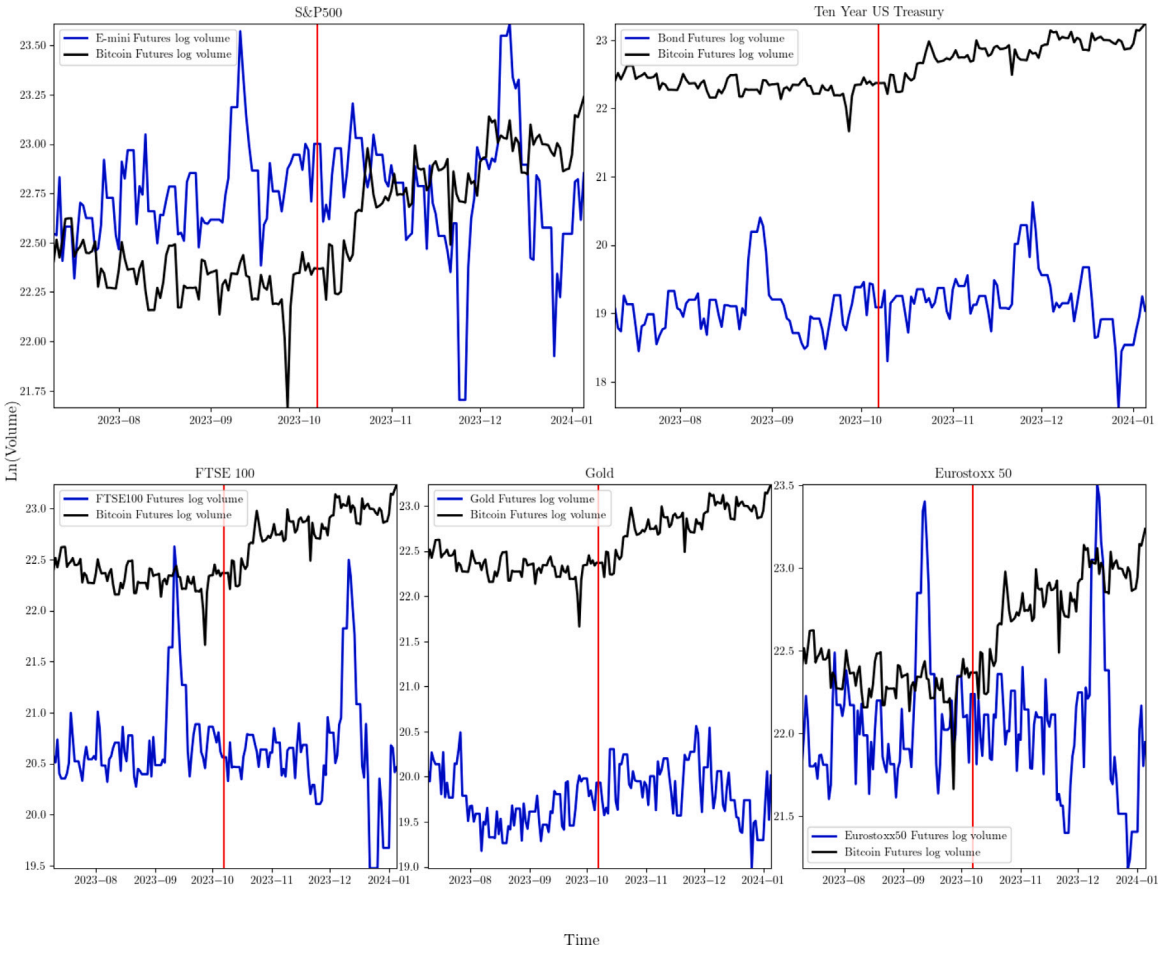

Fig. 5. Ln(Volume) of Bitcoin Vs Assets for the Israelian conflict period.

localized geopolitical events—consistent with the decentralization narrative and regional sensitivity observed in Aharon et al. (2022), Mo et al. (2025) and Sakariyahu et al. (2024). Hypothesis 2 is again supported, since Bitcoin's price returns remain stable and statistically insignificant, echoing its muted response in prior crises. Notably, when the results of all three events are compared, the differentiated response of Bitcoin — active during COVID-19 and the Israel–Palestine conflict, passive during the Russia–Ukraine war — partially validates Hypothesis 3, which anticipates crisis-type heterogeneity. These results reinforce that Bitcoin's role during crises is not universal but context-specific, shaped by regional scope, investor sentiment, and the nature of the crisis itself.

Overall, the empirical findings reveal nuanced patterns in investor behavior. The consistent increase in Bitcoin's trading volume during selected crisis periods points to its growing relevance in financial markets. Coupled with stable return dynamics, this suggests that Bitcoin is increasingly viewed as a portfolio diversifier during uncertain times. By using robust panel estimation methods that correct for serial correlation, heteroskedasticity, and cross-sectional dependence, we ensure that these results are not artifacts of misspecification but reflect genuine shifts in market dynamics. These insights contribute to ongoing debates around the financialization of crypto-assets and their evolving role in crisis-period asset allocation strategies.

6. Policy implications

The empirical findings of this study reveal that Bitcoin displays asymmetric behavior across crisis types: trading volumes rise significantly during certain global events such as the COVID-19 pandemic and the Israel–Palestine conflict, while remaining subdued or even contracting during others, like the Russia–Ukraine war. Meanwhile, its return profile remains remarkably stable across all three crises examined. These results carry substantial implications for regulators, institutional investors, and policymakers seeking to understand the evolving role of cryptocurrencies in global financial systems.

First, these findings challenge conventional frameworks that seek to classify financial assets along a binary safe haven–speculative asset spectrum. Bitcoin's behavior suggests that it occupies a context-dependent role, acting as a diversifier or attention-sensitive instrument rather than a traditional hedge or safe haven. This observation aligns with recent empirical work (Bouri et al., 2017;

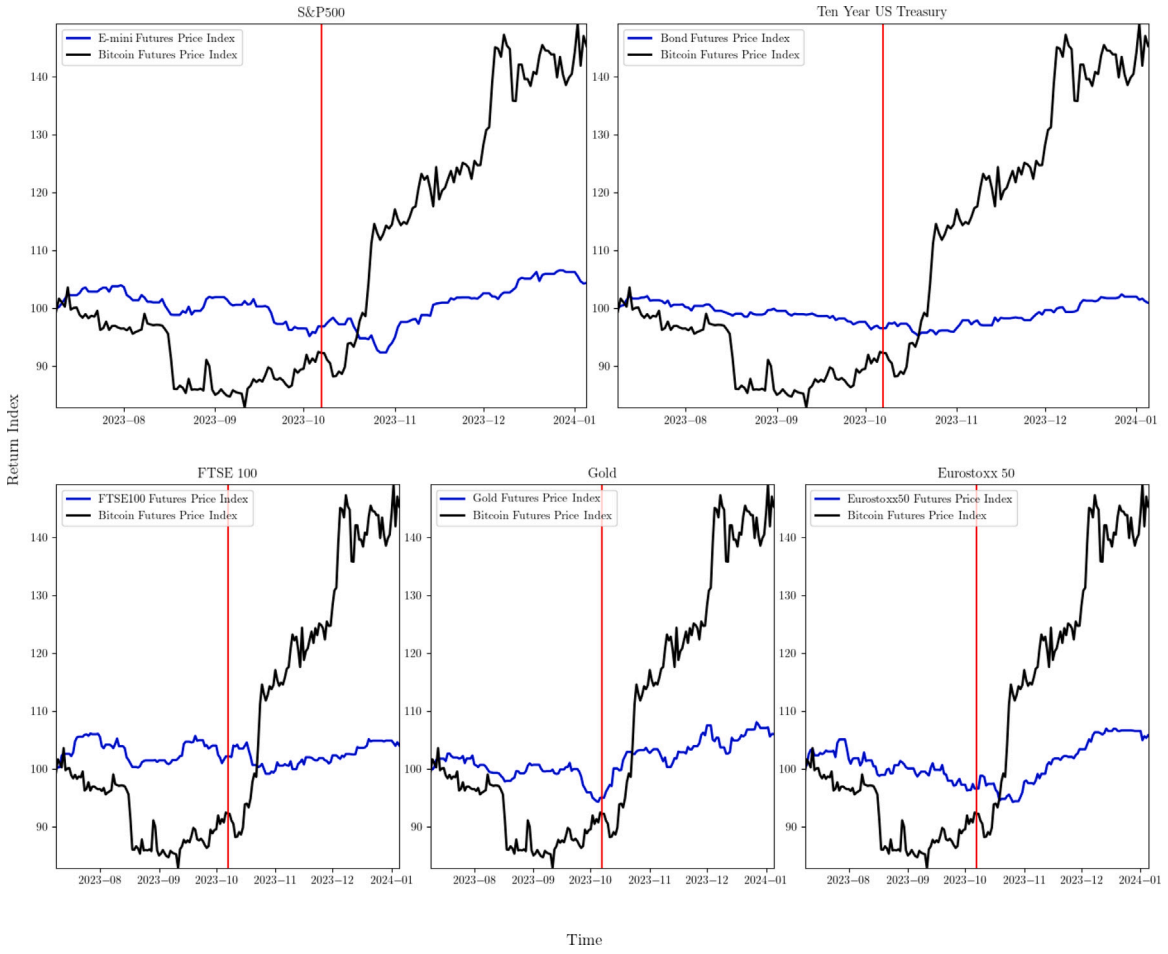

Fig. 6. Indexed price of Bitcoin Vs Assets for the Israelian conflict period.

Urquhart & Zhang, 2019), and it is reinforced by research documenting Bitcoin's varying performance across distinct types of crises (Ameur et al., 2024; Mo et al., 2025).

The increase in trading volume, especially during health-related and regional conflicts, underscores the need for enhanced surveillance of crypto market activity during crises. Sudden spikes in volume may reflect shifts in investor sentiment or panic-driven reallocations, particularly among retail investors. Research by Sakariyahu et al. (2024) links such volume changes to behavioral contagion and sentiment shocks. Given that a large proportion of Bitcoin trading is conducted on unregulated or lightly regulated exchanges, this pattern raises concerns about market manipulation, thin liquidity, and contagion risk during stress periods (Karpoff, 1987; Kim & Verrecchia, 1991; Zhang et al., 2018). Regulators should therefore consider integrating crypto asset metrics—such as trading volume and exchange-based wallet flows—into early warning systems and systemic risk dashboards, as advocated by the (FSB, 2023).

From a market integrity and investor protection standpoint, volume surges without corresponding price volatility may also indicate information asymmetry or speculative participation. These dynamics, explored in Fang et al. (2019), pose a risk especially to retail investors who often dominate activity during volatile periods. Social media-driven uncertainty transmission, as demonstrated by Aharon et al. (2022), further intensifies the need for oversight. Regulatory agencies such as the SEC and ESMA should enhance disclosure standards, explore volume-based thresholds for additional transparency, and potentially deploy crypto-specific circuit breakers during abnormal market activity. The observed return neutrality of Bitcoin across all crises, while limiting its safe haven status, implies that it may still serve as a low-correlation asset in multi-asset portfolios. For institutional investors, this raises the question of whether cryptocurrencies should be incorporated into strategic asset allocation models. Studies such as Andrada-Félix et al. (2020) and Bouri et al. (2020) argue that while cryptocurrencies often fail to hedge against downside risk, they may still function as weak hedges or speculative diversifiers. Our findings support a conditional inclusion strategy, subject to stress testing and tail-risk scenario modeling.

The asymmetrical and regime-dependent behavior of Bitcoin identified in our study has important implications for regulatory frameworks and financial stability oversight. Our findings suggest that cryptocurrencies cannot be treated as static safe-haven assets;

instead, their role evolves dynamically based on crisis characteristics, investor sentiment, and geographic proximity of shocks. Regulators should thus adopt time-varying surveillance mechanisms that monitor crypto markets not only during systemic global events but also in response to localized geopolitical tensions, where shifts in participation dynamics are more pronounced. Furthermore, the observed participation asymmetries — where volume surges occur without corresponding price volatility — highlight the need for real-time monitoring of market microstructure indicators, such as exchange-level liquidity, trading concentration, and sentiment-driven flows. These behavioral patterns, if left unmonitored, could amplify market distortions and contagion risks during crisis periods. Consequently, regulatory bodies should prioritize the development of early-warning systems that incorporate regime-switching models and volume-based triggers, ensuring that the unique crisis-sensitive dynamics of cryptocurrencies are integrated into broader macroprudential stress-testing frameworks.

From a macroeconomic and monetary policy perspective, Bitcoin's heightened trading activity during localized conflicts (Israel–Palestine) highlights its potential to facilitate capital reallocation or even capital flight. In politically unstable or sanctioned regions, the decentralized nature of cryptocurrencies may allow investors to bypass controls and exit local currency exposures. This behavior has implications for monetary sovereignty, tax enforcement, and capital account regulation (Reinhart & Rogoff, 2009; Wang et al., 2022). Authorities should consider monitoring crypto flows alongside conventional macroprudential indicators to capture evasive capital mobility during periods of heightened geopolitical tension.

Moreover, this study emphasizes the potential for cryptocurrencies to contribute to systemic risk amplification. Leveraged positions, margin calls, and cross-market contagion — particularly during high-volatility periods — could transmit shocks to traditional markets, as discussed by Khalfaoui et al. (2023) and Umar et al. (2022). These risks are heightened by the high interconnectivity and volatility observed in crypto markets (Kurka, 2019; Zhang et al., 2018), as well as the dominance of retail trading. Policymakers should thus incorporate crypto market metrics into macroprudential stress test frameworks and assess crypto's interaction with shadow banking and alternative finance channels.

Lastly, the fragmented nature of global crypto regulation creates enforcement gaps and arbitrage opportunities. While some jurisdictions embrace innovation, others impose blanket bans—resulting in regulatory asymmetry. As recommended by international bodies like the (FSB, 2023) and researchers, coordinated cross-border standards are essential. This includes unified rules on taxation, custody, disclosures, and systemic surveillance. Regulatory design should move beyond static classifications (e.g., security vs. commodity) and adopt a function- and behavior-based approach that is adaptive to market dynamics.

In summary, Bitcoin's differentiated behavior across crises — as evidenced in this study — offers a nuanced foundation for policy thinking. While the asset may not yet pose a systemic risk in terms of return contagion, its increasing volume sensitivity during global shocks, combined with its broad retail penetration and regulatory ambiguity, creates both opportunities and vulnerabilities. A forward-looking regulatory architecture must balance innovation with investor protection and systemic resilience—an imperative as digital assets continue to reshape the contours of modern finance.

7. Conclusions

This paper has investigated how Bitcoin behaves relative to traditional financial futures across three major global crises: the COVID-19 pandemic, the Russia–Ukraine war, and the Israel–Palestine conflict. Using a panel dataset and a difference-in-differences framework with interaction terms, we jointly examined both return and trading volume dynamics for Bitcoin and a set of benchmark assets, including equity indices, gold, and government bonds. The empirical results reveal important asymmetries. We find that Bitcoin's trading volume increases significantly during certain crises — most notably the COVID-19 pandemic and the Israel–Palestine conflict — suggesting heightened investor interest and engagement during periods of uncertainty. In contrast, Bitcoin's price returns exhibit remarkable stability across all three crises, showing no statistically significant changes. This divergence between volume and return dynamics implies that Bitcoin may not serve as a traditional safe haven in terms of price protection, but may act as a sentiment-driven diversifier, particularly during crises marked by regional or non-financial uncertainty. The behavior of Bitcoin also varies by crisis type, supporting the notion of context-dependent performance: its response to regional geopolitical instability differs from its behavior during global systemic events.

From a practical and policy perspective, these findings challenge static classifications of cryptocurrencies. Bitcoin is neither a pure safe haven nor a speculative anomaly—it occupies a flexible, contingent position that may shift based on crisis characteristics, investor sentiment, and geographic context. This underscores the importance of incorporating crypto market indicators into financial surveillance systems, particularly during times of stress. The strong trading volume surges observed in specific crisis periods further highlight the need for enhanced market monitoring, investor protection frameworks, and improved regulatory clarity—especially around disclosures, custody risks, and retail market safeguards. Policymakers must recognize that while Bitcoin may not yet be systemically important on its own, its crisis-time behavior could signal evolving investor preferences and new channels of market sentiment transmission.

On a theoretical level, this study contributes to the expanding literature on cryptocurrency market dynamics by introducing a comparative, multi-crisis, and multi-asset perspective. While previous studies have often treated crises as isolated events or focused solely on return behavior, our framework emphasizes both price and participation signals—capturing not only how assets are valued but also how they are used. Furthermore, our differentiation across crisis types offers a more nuanced understanding of when and how Bitcoin diverges from traditional financial markets. The evidence supports a conceptual repositioning of Bitcoin as a "crisis-sensitive alternative asset" whose role is better understood through empirical heterogeneity rather than normative labels.

Despite these contributions, this study is not without limitations. First, while we analyze three major crises, the number of events remains limited, and our results may not generalize to other types of shocks such as monetary tightening, cybersecurity threats, or

supply chain disruptions. Second, our use of futures data offers comparability but may not fully reflect spot market behaviors or retail trading environments. Third, the empirical strategy, though robust, focuses on average treatment effects and may mask intra-crisis variation or nonlinear dynamics. Future studies could expand the set of crisis episodes, incorporate high-frequency data, or explore additional crypto assets beyond Bitcoin to test the generalizability of these findings.

In terms of future research directions, further inquiry should explore the microstructure of crypto markets during crisis periods, including the roles of stablecoins, exchange liquidity, and leverage. Additionally, investigating how institutional and retail investors respond differently to crisis signals in the crypto space would offer valuable insights into the behavioral dimensions of market segmentation. Finally, there is a growing need for interdisciplinary research that integrates financial economics, behavioral science, and regulatory theory to fully understand how digital assets function in complex, evolving crisis environments.

In conclusion, this study provides timely and policy-relevant evidence on Bitcoin's evolving role in global finance. Its behavior during crises is neither passive nor uniform—it is participatory, resilient, and selectively responsive, offering both opportunities and challenges for investors, regulators, and scholars alike.

Data availability

Data will be made available on request.

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