The impact of Regulatory, CBDC and Crash Events on Cryptocurrencies and Crypto-Exposed Equities: An Event Study (2020-2024)

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Abstract

Title of thesis: The impact of Regulatory, CBDC and Crash Events on Cryptocurrencies and Crypto-Exposed Equities: An Event Study (2020–2024)
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The aim of this dissertation is to analyze market reactions to major regulatory announcements, Central Bank Digital Currency (CBDC) developments, and crash events in the cryptocurrency ecosystem between 2020 and 2024. Using event study methodology, it examines abnormal returns for five leading cryptocurrencies—Bitcoin, Ethereum, XRP, BNB, and Solana—as well as crypto-exposed equities such as Tesla, MicroStrategy, Nvidia, and Coinbase. A total of 23 events were tested, including global regulatory actions, pilot CBDC launches, and systemic collapses like the Terra and FTX crashes. Results show that regulatory actions and crash events often generate statistically significant abnormal returns, with crash events triggering stronger negative reactions. By contrast, CBDC announcements tend to elicit weaker or insignificant responses. Robustness checks confirm consistency across estimation windows. The findings contribute to growing literature on financial market responses to digital asset shocks and provide practical implications for policymakers, investors, and firms exposed to crypto markets.

Keywords: Bitcoin, Ethereum, XRP, CBDC, regulation, crash events, abnormal returns, event study, crypto-exposed equities

Resumo

Título: O impacto de Eventos Regulatórios, CBDCs e Colapsos nas Criptomoedas e Ações Expostas ao Setor Cripto: Um Estudo de Eventos (2020–2024)

Autor: Rohit Lamba

O objetivo desta dissertação é analisar as reações do mercado a anúncios regulatórios, desenvolvimentos relacionados com moedas digitais de bancos centrais (CBDCs) e eventos de colapso no ecossistema das criptomoedas entre 2020 e 2024. Utilizando a metodologia de estudo de eventos, são analisados os retornos anormais de cinco criptomoedas principais—Bitcoin, Ethereum, XRP, BNB e Solana—bem como ações de empresas com exposição ao setor cripto, como Tesla, MicroStrategy, Nvidia e Coinbase. Foram testados 23 eventos, incluindo decisões regulatórias globais, lançamentos-piloto de CBDCs e colapsos sistêmicos como os casos da Terra e da FTX. Os resultados revelam que anúncios regulatórios e eventos de colapso frequentemente geram retornos anormais estatisticamente significativos, sendo os colapsos os que provocam reações negativas mais intensas. Em contraste, os anúncios de CBDCs tendem a gerar reações fracas ou insignificantes. Verificações de robustez confirmam a consistência dos resultados. As conclusões contribuem para a literatura sobre reações dos mercados financeiros a choques em ativos digitais e apresentam implicações práticas para reguladores, investidores e empresas com exposição ao mercado cripto.

Palavras-chave: Bitcoin, Ethereum, XRP, CBDC, regulação, eventos de colapso, retornos anormais, estudo de eventos, ações expostas ao cripto

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1.Introduction

In May 2025, Bitcoin's market capitalization exceeded $2.2 trillion, making it more valuable than several major national currencies — including the New Taiwan Dollar, Australian Dollar, Canadian Dollar, Russian Ruble, Swiss Franc, and even the Indian Rupee, despite India being the fourth-largest economy globally by GDP (Benzinga, 2025). This rise underscores how deeply embedded cryptocurrencies have become in the global financial system.
Importantly, this valuation was not just symbolic. In December 2024, The Economic Times reported that Bitcoin had surpassed the market capitalization of prominent corporations such as Tesla, Meta (Facebook), and Saudi Aramco. Just five months later, according to Yahoo Finance (May 2025), Bitcoin had overtaken Amazon and Alphabet, placing it just behind Microsoft — the world's most valuable company at the time with a $3.4 trillion market cap. This brief moment in history — where a decentralized digital asset nearly eclipsed the most valuable centralized technology firm — marks a structural turning point in the perception and integration of cryptocurrencies.

Also In May 2025 Bitcoin reached All Time High(ATH) in USD, although it remained below its Euro-denominated peak reached earlier in January 2025. This divergence highlights the impact of foreign exchange dynamics on cross-currency asset valuation, reaffirming the decision to compute all returns in USD throughout this thesis for consistency with global benchmarks .

Yet this ascendance has not been without volatility or systemic stress. Between 2020 and 2024, the digital asset space witnessed a series of disruptive shocks, ranging from catastrophic market crashes (e.g., Terra, Celsius, FTX), to aggressive regulatory crackdowns (e.g., SEC actions, taxation regimes), and the emergence of central bank digital currency (CBDC) initiatives by major economies. Each of these events triggered waves of uncertainty, institutional repositioning, and heightened scrutiny across both retail and institutional segments. While past research has often examined these shocks in isolation, there remains a significant gap in understanding how different categories of crypto-related news affect both decentralized assets and their centralized financial proxies — i.e., crypto-exposed equities.

This thesis addresses that gap by applying an event study methodology to systematically assess how financial markets reacted to three distinct classes of crypto-related shocks: (1) major crash events, (2) key regulatory interventions, and (3) CBDC developments. The analysis spans a transformative five-year period (2020–2024) and includes five of the largest cryptocurrencies by market relevance (Bitcoin, Ethereum, Ripple, Binance Coin, Solana) and four publicly listed crypto-exposed equities (MicroStrategy, Coinbase, Tesla, Nvidia). Abnormal returns are calculated using cumulative abnormal return (CAR) methodology across five event windows, ranging from short-term (±1 day) to long-term (±30 days), with robustness checks to ensure estimation accuracy.

Preliminary findings indicate that crash events produce the most severe and persistent negative market reactions across both asset classes, while regulatory events tend to trigger asset-specific but statistically significant short-term movements — particularly for tokens directly implicated, such as XRP. In contrast, CBDC announcements generate less predictable effects: in some cases, tokens such as Solana responded positively (e.g., ECB's Digital Euro), while in others, like Project Jura, the market reaction was muted or adverse. Interestingly, crypto-exposed equities did not always mirror the tokens they are associated with — for example, MicroStrategy reacted more negatively than Bitcoin itself during the FTX collapse — underscoring the role of firm-specific fundamentals, leverage exposure, and investor sentiment in shaping equity responses.

By jointly analyzing crash, regulatory, and CBDC-related events in a unified empirical framework, this thesis provides novel insight into the evolving dynamics of digital finance. Prior studies often confined themselves to one asset class or shock type, whereas this research bridges those silos using a consistent, academically validated event study structure across 23 high-impact events. In doing so, it contributes to the growing literature on crypto-asset price formation, cross-asset contagion, and policy transmission in decentralized markets.
The remainder of this thesis is organized as follows: Section 2 reviews the relevant literature. Section 3 presents the data sources. Section 4 contains Methodology. Section 5 Gives Empirical Results a discussion of the findings. Section 6 gives Discussion of findings including behavioral and policy implications. Section 7 is Conclusion.

1.1Literature Review

Event study methodology has become a well-established tool for evaluating market responses to significant announcements or shocks. Foundational works such as MacKinlay (1997) emphasize the critical importance of clearly separating the estimation window from the event window to prevent contamination of normal return parameters by event-related volatility. Brown and Warner (1985) further argue that a sufficiently distanced pre-event window enhances the robustness of abnormal return calculations, particularly when market efficiency is uncertain.

These methodological principles have also been carried into the evolving literature on cryptocurrency markets. Chokor and Alfieri (2021), in one of the earliest large-scale event studies on crypto regulation, analyzed 63 events between 2015 and 2019 using an estimation window of –120 to –5, recognizing the need for pre-event distance in the presence of heightened volatility and information asymmetry. Theerthaana and Sheikh Manzoor (2018), while studying Bitcoin's price behavior during India's 2016 demonetization, employed an even deeper estimation window from –182 to –32. Their rationale was to avoid the turbulent lead-up to the policy shock and to ensure clean normal return modeling. Similarly, Shanaev et al. (2019), examining the market effects of 51% attacks on various blockchains, opted for a 30-day pre-event window—again prioritizing estimation window purity in a period when the crypto space was still nascent and often fragmented.

It is noteworthy that all three of these studies were conducted in the pre-2020 era, a time when cryptocurrency markets were far less liquid, institutionally connected, or systematically structured than they are today. Yet even in those earlier phases, the academic consensus leaned toward using deeply non-overlapping estimation windows to maintain validity.
This thesis adopts a –120 to –60 estimation window as a conservative, academically validated approach that ensures sufficient separation from potential pre-event information leakage or price drift. To strengthen methodological rigor, a robustness check using a –105 to –45 window is also implemented for key crash and regulatory events, verifying that the results are not window-specific. Supporting this framework, Leung and Koenraadt (2024) caution against overlapping windows in crypto due to token interdependence and regulatory event

clustering, while Nguyen et al. (2023) argue that the 24/7 nature and global dispersion of crypto markets necessitate longer lead times for news absorption and reaction, especially across retail-heavy segments.

Altogether, this thesis aligns its estimation window design with both classical event study protocols and the best practices of crypto-specific research—ensuring clean abnormal return detection and comparability across heterogeneous events ranging from collapses and court rulings to CBDC rollouts.

Chokor and Alfieri (2021) conducted one of the earliest large-scale event studies on crypto regulation, analysing 63 major regulatory events from 2015 to 2019. Their findings indicate that regulatory announcements — particularly those signalling restrictive oversight — lead to statistically significant negative abnormal returns across cryptocurrencies. They argue that such reactions are rooted in investor concerns that regulation threatens the foundational principles of decentralisation, anonymity, and autonomy that define the crypto ecosystem. Moreover, the study highlights that less liquid tokens, often characterised by higher information asymmetry, react more strongly to regulatory news, revealing the disproportionate vulnerability of smaller or opaque crypto assets.

While their work offers foundational insights, it is based on a period when the crypto market was less institutionalised, with lower participation from traditional financial actors and fewer cross-asset spillovers. In contrast, this thesis explores a later period (2020–2024), when cryptocurrency markets had become more integrated with broader financial systems, were subjected to more formalised regulatory action (e.g., SEC lawsuits, MiCA), and experienced more complex investor reactions. Therefore, this thesis builds upon and extends Chokor and Alfieri's findings by analysing more contemporary and impactful events in a significantly evolved market environment.

Cumming et al. (2024) provide one of the most comprehensive examinations of how cryptocurrency regulations influence asset risk and return characteristics. Analyzing over a thousand listed tokens across 35 major regulatory events between 2018 and 2023, the study finds that while regulatory announcements typically trigger short-term negative abnormal returns, particularly in the case of bans and sweeping frameworks, certain categories—such as tax policies and AML/CFT regulations—are associated with reduced volatility and improved post-event Sharpe ratios. Importantly, the authors show that the regulatory environment's institutional quality significantly moderates these effects. Using their custom Digital Asset Regulatory Strength Index (DARSI), they demonstrate that stronger formal institutions amplify risk reduction, while societies with higher uncertainty avoidance also experience more pronounced regulatory impact. Their findings suggest that well-structured, credible regulation can enhance long-term market stability, offering both policymakers and investors a roadmap for navigating crypto's evolving regulatory landscape.

Yousaf et al. (2023) position the FTX collapse as a high-profile natural experiment to test the vulnerability of traditional markets to crypto-induced spillovers. Their event study evaluates how key asset classes—cryptocurrencies, equities, commodities, and currencies—responded to the FTX failure. While Bitcoin, Ethereum, and Binance Coin experienced significant negative abnormal returns, traditional markets such as equities, energy, and currency assets remained unaffected, suggesting that the bear market phase may have already reduced investor sensitivity to crypto-related disruptions. Interestingly, gold and silver displayed mild positive responses, interpreted as a flight to safety by crypto investors. The study underscores that much of the earlier spillover literature was conducted during a bullish phase for crypto, which may have overstated systemic linkages. In contrast, Yousaf et al. argue that financial markets may be evolving toward greater detachment from crypto shocks, a perspective that frames the FTX episode as a stress test of crypto's systemic relevance. Their framework and findings help contextualize this thesis's approach to evaluating spillover potential and asset-specific sensitivity during major crypto collapse events.

Jarboui and Mnif (2021) investigate the impact of monetary policy announcements—particularly FOMC statements—on major cryptocurrencies during the COVID-19 pandemic using an event study framework. They find that Bitcoin and Ethereum exhibit significant abnormal responses both on the event date and in the days preceding and following the announcements, suggesting that crypto markets began pricing in macroeconomic signals more rapidly during periods of global crisis. Ripple and Litecoin show delayed responses, while

Tether remains largely unaffected. Their study also identifies short-lived speculative bubbles in Bitcoin, Ethereum, and Litecoin, lasting only a few days, which are temporally aligned with key liquidity-related events. These findings underscore the heightened sensitivity of cryptocurrency markets to macro-financial news during systemic shocks and support the relevance of using event-based analysis to detect asset-specific vulnerabilities and behavioral anomalies in extreme environments such as the COVID-19 crash.

Yip (2022) conducts an event study on the May 2022 stablecoin market crash, using the collapse of TerraUSD (UST) as a central case. The study finds that the absence of quality reserve assets and reliance on endogenous algorithmic backing were key contributors to the fragility of UST and its eventual failure. Importantly, the Terra crash produced significant spillover effects not only across the broader crypto market but also into DeFi ecosystems, crypto-collateralized stablecoins, and digital asset firms. Using the Diebold-Yilmaz spillover index, the paper highlights that crypto-backed stablecoins were the major shock receivers, especially those used for leverage in decentralized finance. Stablecoins with higher collateralization ratios experienced less pressure, suggesting that design structure and reserve backing are crucial for resilience. These findings support the thesis's focus on Terra as a crash event with both idiosyncratic and systemic effects and offer a unique perspective on market design vulnerabilities within algorithmic crypto instruments.

Khan et al. (2023) explore the transmission of crash risk from major cryptocurrencies to the stock markets of G-7 countries and China, using an empirical Bayes estimation framework. The study constructs a comprehensive measure of crash risk using three key metrics: the relative frequency of crash days, negative skewness of returns, and down-to-up volatility. The findings reveal that Bitcoin, Cardano, and XRP have a statistically significant positive relationship with stock market crash risk, lending support to the contagion hypothesis. This implies that crashes in these cryptocurrencies can spill over into broader equity markets, potentially acting as early warning signals for systemic stress. In contrast, Ethereum and Binance Coin exhibit either negative or statistically insignificant associations, suggesting that not all cryptocurrencies transmit risk uniformly. Furthermore, the study finds that lagged values of most cryptocurrencies (except Ethereum) also predict stock market crash risk, highlighting the persistence of crypto-related shocks over time. While the analysis focuses on national indices rather than individual equities, the observed cross-market fragility reinforces the importance of examining how digital asset disruptions may affect traditional financial systems—an issue particularly relevant in the context of crash events like the FTX and Terra Luna collapses examined in this thesis.

Mzoughi et al. (2022) investigate the direct impact of central bank digital currency (CBDC) launches on the Bitcoin market using an event study methodology. Analysing market responses to two official CBDC rollouts — the Bahamas' SANDDollar and Nigeria's eNaira — the study finds that Bitcoin returns were more strongly affected by the Bahamas launch. The authors attribute this to the Bahamas being the first mover, with its CBDC perceived as safer and more convertible than decentralized cryptocurrencies, thereby attracting investor trust. Their results suggest that CBDC launches can generate competitive pressures on major cryptocurrencies like Bitcoin, especially when accompanied by strong institutional backing and convertibility features. These findings support the idea that retail CBDC adoption, even in smaller economies, can signal regulatory legitimacy and shift investor behaviour away from speculative crypto assets. This thesis builds on that approach by incorporating CBDC-related event studies for larger jurisdictions — such as India's retail and wholesale pilots, the China–Hong Kong cross-border initiative, and the Eurozone's Digital Euro project — thereby extending the scope to assess how such announcements affect both crypto assets and crypto-related equities in global markets.

Bolt, et al. (2022) highlight the evolving tension between public and private forms of money in an increasingly digital financial ecosystem. They argue that while public money (like CBDCs) provides trust and stability, private innovations such as cryptocurrencies and stablecoins drive technological progress. However, they warn that unregulated or mass-adopted private money—especially stablecoins issued by large tech platforms—could pose systemic risks to payment stability. Their work underscores the regulatory imperative for central banks to ensure convertibility and equilibrium between private and public money. Crucially, the authors frame CBDCs not as displacers of commercial bank deposits but as a necessary "digital update" of public money to safeguard monetary sovereignty. This supports the inclusion of CBDC announcements as major events in this thesis, where the comparative market reaction of crypto assets and crypto-related equities is empirically examined. The authors' emphasis on the systemic importance of CBDC design and regulation echoes broader concerns in the literature about financial stability, investor confidence, and the disruptive potential of digital currencies.

2.Data

This study uses daily log return data from 1 July 2019 to 30 March 2025. This timeline was chosen to ensure complete empirical coverage of major events from the March 2020 COVID-19 crypto crash to the full implementation of the MiCA regulatory framework on 30 December 2024. Among all Crypto Assets only for Solana data starts around April 2020 as this was the beginning for this token. The dataset includes cryptocurrencies, crypto-exposed equities, and was compiled from multiple high-integrity financial data sources.

Cryptocurrency Prices and Returns:
Closing Prices for seven major cryptocurrencies — BTC, ETH, XRP, BNB, SOL, LUNA (Terra Classic), and FTT — were collected from CoinMarketCap, with CoinGecko used exclusively to supplement missing data for Terra Luna during its collapse period. All crypto prices were manually transformed into continuously compounded log returns in Excel to standardize returns across the sample. Since crypto markets operate 24/7, all calendar days were retained without trading-day filtering.

Crypto Market Proxy:
The CIC30 Index was used as a benchmark for market model regressions. It provides a diversified representation of the top 30 cryptocurrencies and was preferred over Bloomberg Galaxy and Royalton CRIX due to institutional access restrictions. The CIC30 was especially useful in modelling market-adjusted returns during regulatory shocks and crash episodes.

Asset	Obs	Mean	Std. Dev.	P1	P99	Skew	Kurt
BTC	2100	.00097	.034	-.093	.096	-1.23	22.47
ETH	2100	.00087	.043	-.125	.114	-1.20	18.97
XRP	2100	.00080	.054	-.133	.172	.520	23.13
BNB	2100	.00139	.045	-.111	.122	-.242	28.47
SOL	1814	.00279	.066	-.168	.183	-.237	9.87
NVDA	1437	.00242	.032	-.078	.081	.146	6.84
TSLA	261	.00154	.033	-.084	.082	.383	6.64

MSTR	1142	.00261	.059	-.170	.168	-.122	6.39
COIN	696	.05491	.055	-.129	.146	.108	5.49

Table 1: Summary Statistics of Daily Log Returns for Cryptocurrencies and Crypto-Exposed Equities

Crypto-Exposed Equities (Stocks):
Four publicly traded firms were selected based on varying degrees of cryptocurrency involvement:
MicroStrategy (MSTR) – Direct Bitcoin holdings starting from August 2020 onwards
Coinbase (COIN) – Pure crypto trading platform, IPO on 14th April 2021,
Tesla (TSLA) – Temporarily held BTC and enabled BTC payments mainly during the year 2021 and after that sold off BTC from Balance Sheet
Nvidia (NVDA) – Hardware linked to crypto mining and DeFi since 2017

Daily closing price data for these equities were sourced from Refinitiv.
To estimate expected returns for these stocks, the Fama-French four-factor (FF4) model was implemented using:
Market excess return (MKTRF)
Size factor (SMB)
Value factor (HML)
Momentum factor (UMD)

The FF4 factor data were retrieved from Wharton Research Data Services (WRDS), and the risk-free rate was merged from Kenneth French's data library. Since FF4 factor datasets had occasional missing rows, a VLOOKUP-based alignment process was conducted in Excel to remove non-overlapping dates across assets and factor variables. This ensured clean estimation windows and consistent regression structures.

Software and Preprocessing:

All data preprocessing, including log return calculations, dataset alignment, and regression-ready formatting, was done in Microsoft Excel. The full dataset was then imported into Stata 18.5, where all event study analyses, regressions, and t-statistic calculations were executed using consistent code templates. For the initial event (11 March 2020) Covid-19 Crypto Crash , both Excel and Stata outputs were matched line-by-line to ensure methodological accuracy before automating the pipeline for all remaining events. A standard code structure was applied for every asset and every event, starting from regression then calculating Cumulative abnormal returns and importing Cumulative Abnormal Returns and T-statistics to excel with proper name and date of the event. All estimation and event windows were manually calculated to leave no scope for error.

3.Methodology

This research adopts a structured event study methodology to test the effects of major crypto-related announcements on cryptocurrencies and crypto-exposed equities. The design centers on identifying statistically significant abnormal returns across different categories of events: regulatory, crash-related, and CBDC-linked developments.

3.1Hypotheses and Model Framework

This study tests the following hypotheses:

H1: Major regulatory events cause significant abnormal returns in cryptocurrencies.

H2: CBDC announcements cause milder or statistically insignificant abnormal returns in comparison to regulatory or crash events.

H3: Crypto-exposed equities (e.g., MSTR, COIN, TSLA, NVDA) show distinct return behavior from direct crypto assets.

H4: Major crypto crashes (e.g., Terra, FTX) lead to severe and persistent negative abnormal returns in both cryptocurrencies and crypto-related equities.

These hypotheses are grounded in the premise that different event types affect market participants' expectations in varying ways. Crash events are expected to trigger fear and contagion effects, while regulatory and CBDC developments may be absorbed with less volatility depending on clarity, scope, and jurisdiction.

3.2 Econometric Techniques

This thesis applies an event study methodology to analyze the effects of major regulatory announcements, CBDC developments, and crash events on the prices of cryptocurrencies and crypto-exposed equities. In accordance with the canonical frameworks of MacKinlay (1997) and Brown and Warner (1985), abnormal returns (ARs) are computed as the difference between realized returns and expected returns estimated via a market model. These ARs are then aggregated across five standard event windows to obtain cumulative abnormal returns (CARs), with associated t-statistics used to assess statistical significance.

To ensure methodological rigor and minimize bias in expected return estimation, the thesis adopts a fixed estimation window of –120 to –60 trading days prior to each event. This design choice aligns with a broad consensus in the literature on the importance of maintaining non-overlapping windows. Chokor and Alfieri (2021), for instance, employed a –120 to –5 window to avoid pre-event volatility contamination, while Theerthaana and Sheikh Manzoor (2018) used a much deeper –182 to –32 range to avoid the turbulent lead-up to India's demonetization shock. Similarly, Shanaev et al. (2019) prioritized estimation window purity in their analysis of 51% attacks on blockchains, despite operating in a still-developing crypto landscape.

Building on this precedent, the estimation window in this thesis is intentionally distanced from the event window to avoid anticipatory trading effects, structural volatility, or signal leakage. This is particularly important in cryptocurrency markets, which operate 24/7 and exhibit high levels of cross-asset correlation and event clustering. As Leung and Koenraadt (2024) warn, overlapping estimation and event periods can seriously bias abnormal return calculations in the presence of concurrent regulatory developments or token interdependence. Nguyen, Li, and Davé (2023) further emphasize the need for longer lead times in crypto markets, especially where information diffusion is gradual due to global dispersion and retail dominance.

This thesis also explicitly addresses the issue of temporal clustering by ensuring no overlap across event windows or estimation windows. A case in point is the proximity between the Terra (LUNA) crash on May 11, 2022, and the Celsius Network collapse on June 13, 2022—just 32 days apart. To avoid cross-contamination, each of these events is assigned a completely discrete testing cycle, with no reuse of estimation data or event return periods across nearby dates.

Robustness checks are conducted for selected high-impact events using an alternative estimation window of –105 to –45, following the practice of earlier studies such as Theerthaana and Sheikh Manzoor (2018). This allows for validation of the sensitivity of abnormal return metrics to the choice of estimation range, reinforcing the reliability of results. Together, these methodological choices ensure that abnormal returns are attributed to the events in question rather than to structural volatility, model error, or residual contamination from nearby shocks—ultimately aligning this thesis with best practices in both traditional financial economics and the emerging crypto-finance literature.

The primary empirical model employed is the market model, which estimates expected returns based on historical relationships between an asset and the market proxy (CIC30 for cryptocurrencies). Abnormal returns (ARs) are the residuals from this regression.

$R_{it} = \alpha_i + \beta_i * R_{mt} + \varepsilon_{it}$

Where:

R_{it}: return of asset *i* at time *t*

R_{mt}: market return (CIC30 index)

ε_{it}: abnormal return component

Abnormal returns are calculated as:

$AR_{it} = R_{it} - (\hat{\alpha}_i + \hat{\beta}_i * R_{mt})$

And cumulative abnormal returns (CARs) are obtained by summing ARs over a given window:

$CAR_i[\tau_1, \tau_2] = \sum_{t=\tau_1}^{\tau_2} AR_{it}$

Significance is tested using:

$t(CAR_i) = CAR_i / (\sigma(AR_i) \times \sqrt{N})$

Where:

CAR_i: Cumulative abnormal return for asset *i* over the event window

$\sigma(AR_i)$: Standard deviation of abnormal returns for asset *i* estimated over the pre-event estimation window

N: Number of trading days in the event window (e.g., 3 for ±1D, 7 for ±3D, 11 for ±5D, 31 for ±15D, 61 for ±30D)

For crypto stocks (MSTR, COIN, TSLA, NVDA), Fama-French 4-Factor regressions were conducted to isolate performance by controlling for market, size, value, and momentum factors. These regressions are used to supplement and validate market model-based CAR results.

$R_{it} = \alpha_i + \beta_{mkt} \cdot R_{mt} + \beta_{sm\beta} \cdot SMB_t + \beta_{hml} \cdot HML_t + \beta_{um d} \cdot UMD_t + \varepsilon_{it}$

Where,

R_{it} = Return on asset *i* on day *t* (e.g., TSLA, MSTR, COIN, NVDA)
R_{mt} = Market return on day *t*
SMB_t = "Small Minus Big" factor captures size premium (small vs large firms)
HML_t = "High Minus Low" factor captures value premium (value vs growth stocks)
UMD_t = "Up Minus Down" (Momentum factor): captures tendency of past winners to continue outperforming
$\boldsymbol{\alpha_i}$ = Asset-specific intercept term (abnormal performance not explained by factors)
$\boldsymbol{\varepsilon_{it}}$ = Error term on day *t* (residual return)

Abnormal returns are calculated as:

$AR_{it} = R_{it} - (\alpha_i + \beta_{mkt} * R_{mkt,t} + \beta_{sm\beta} * SMB_t + \beta_{hml} * HML_t + \beta_{mom} * MOM_t)$

And cumulative abnormal returns (CARs) are obtained by summing ARs over a given window:

$CAR_i[\tau_1, \tau_2] = \sum_{t=\tau_1}^{\wedge}\tau_2\ AR_{it}$

Significance is tested using:
$t(CAR_i) = CAR_i / (\sigma_{(}AR_{i)} \times \sqrt{N})$
Where:
CAR_i: Cumulative abnormal return for asset *i* over the event window

$\sigma(AR_i)$: Standard deviation of abnormal returns for asset *i* estimated over the pre-event estimation window

N: Number of trading days in the event window (e.g., 3 for ±1D, 7 for ±3D, 11 for ±5D, 31 for ±15D, 61 for ±30D)

Estimation and Event Windows

All assets use a fixed estimation window from −120 to −60 days prior to each event. For robustness checks, an alternate window of −105 to −45 days was also applied to key crash and regulation events.

Five symmetric event windows are used to test immediate and persistent effects:

- ±1 Day
- ±3 Days
- ±5 Days
- ±15 Days
- ±30 Days

3.3 Asset Coverage

This methodology was applied to:

- Cryptocurrencies: Bitcoin (BTC), Ethereum (ETH), Ripple (XRP), Binance Coin (BNB), Solana (SOL)
- Crypto-exposed equities: MicroStrategy (MSTR), Tesla (TSLA), Nvidia (NVDA), Coinbase (COIN)

Terra Classic (LUNA) and FTX Token were analyzed solely for their respective crash events and excluded from cross-event generalizations.

4.Empirical Results

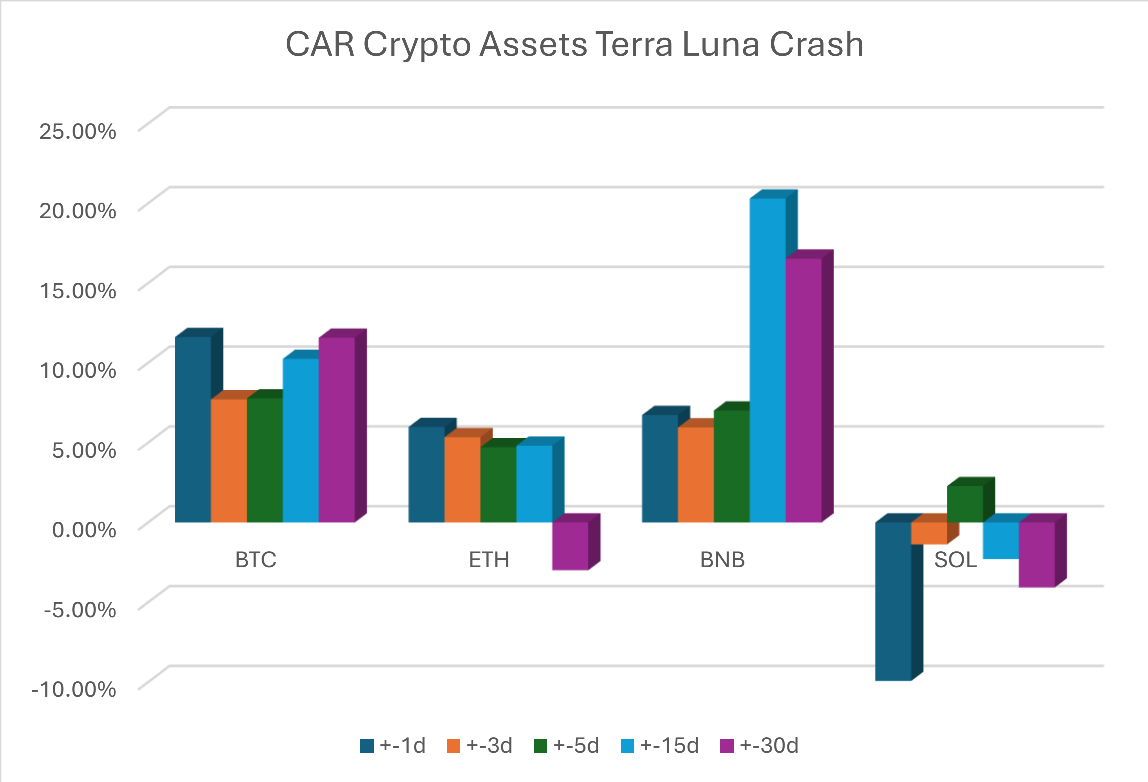

Figure 1: Cumulative Abnormal Return (CAR) OF Major Cryptocurrencies- Terra Luna Crash Event

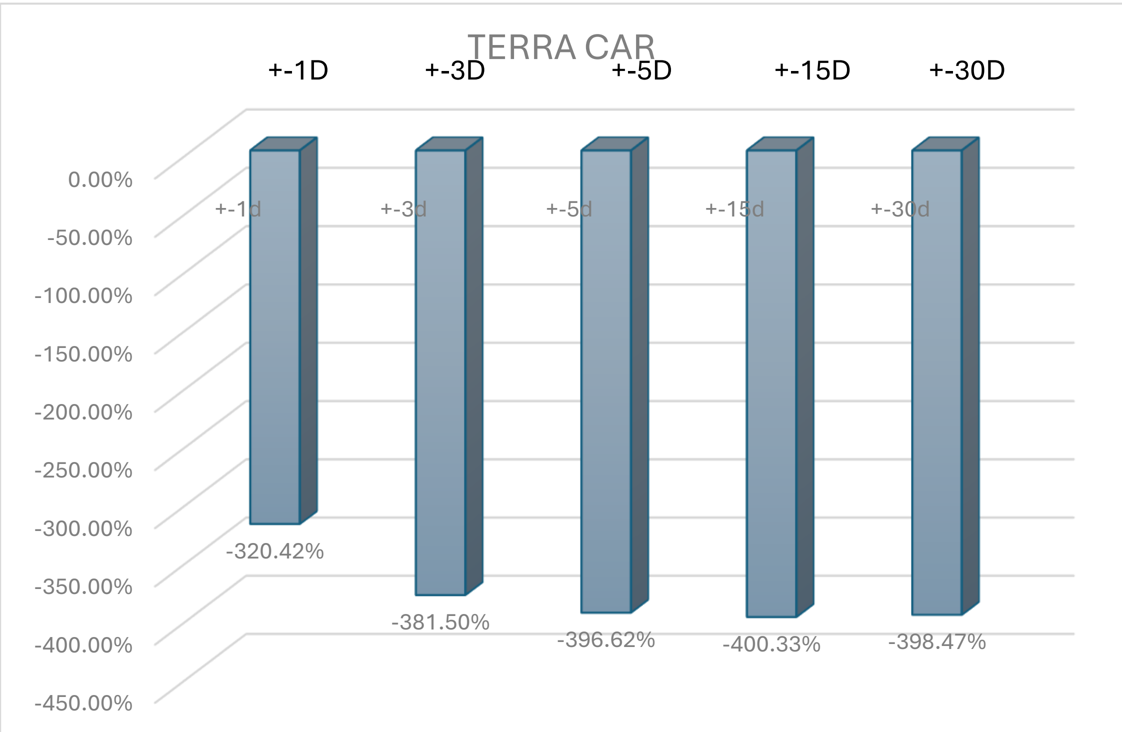

Figure 2: Cumulative Abnormal Return (CAR) of Terra Luna for Terra Luna Crash Event

The collapse of Terra (LUNA) in May 2022 represented a watershed moment in the evolution of decentralized finance, triggering sharply divergent responses across crypto assets and crypto-linked equities. While LUNA itself witnessed extreme abnormal losses consistent with its near-total collapse, the broader crypto ecosystem responded in complex and layered ways.

ASSETS	+-1D	+-3D	+-5D	+-15D	+-30D
BTC	4.84***	2.10**	1.69*	1.32	1.06
ETH	2.91***	1.70*	1.19	0.72	-0.32
BNB	2.29**	1.32	1.34	2.15**	1.24
SOL	-2.27**	-0.206	0.272	-0.163	-0.207
TERRA	-37.06***	-28.88***	-23.95***	-14.40***	-10.22***
MSTR	-2.99***	-2.37**	-2.11**	-1.48	-0.972
COIN	-5.78***	-4.74***	-3.80***	-2.33**	-2.76***

Table 2: T-Statistics of all crypto assets and crypto-exposed equities for Terra Luna crash event, *Note:* *** = statistically significant at the 1% level; ** = 5% level; * = 10% level

Bitcoin and Ethereum posted statistically significant positive abnormal returns in the immediate aftermath (±1D window), suggesting that during crisis episodes, investors may shift capital into legacy cryptocurrencies perceived as relatively safer or more fundamentally secure. These gains were short-lived, fading across longer windows, which is consistent with a temporary “flight to quality” within the crypto universe. BNB’s positive reaction further reinforces this trend, likely driven by market confidence in Binance’s centralized oversight and risk management capabilities.

Solana, with deeper ties to the DeFi sector, suffered immediate losses, reflecting contagion concerns within smart contract platforms. However, its quick recovery implies that markets differentiated between structural and sentiment-driven risks.

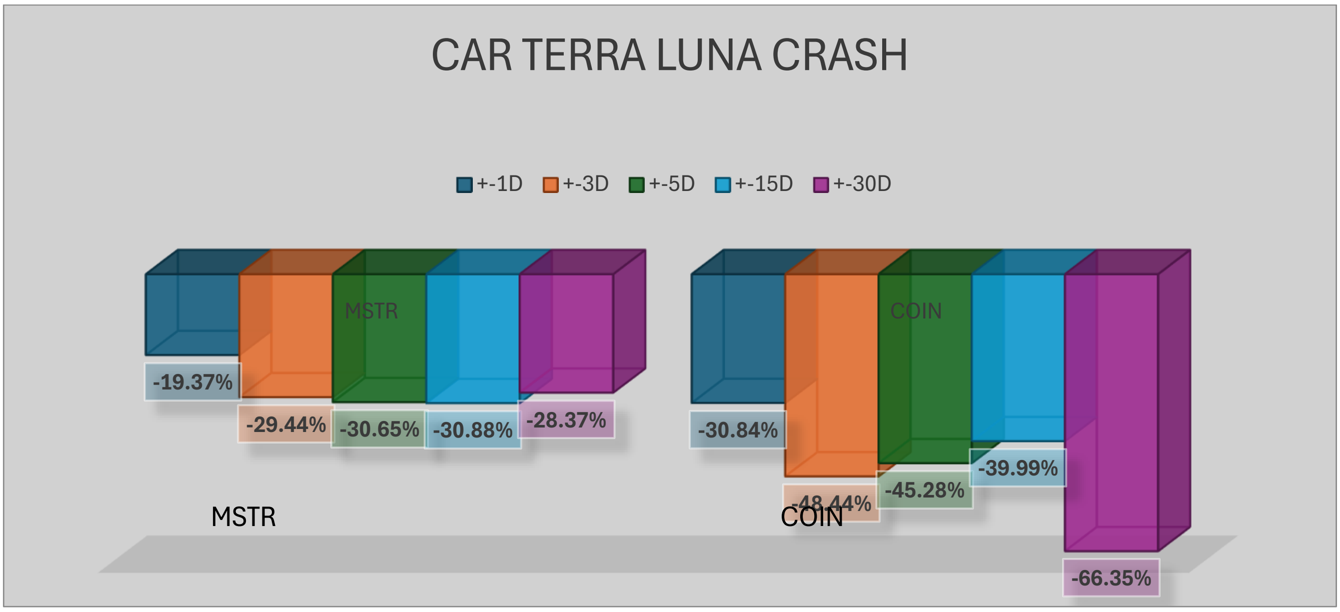

Figure 3: Cumulative Abnormal Return (CAR) of Microstrategy (MSTR) and Coinbase (COIN) for Terra Luna Crash Event

MicroStrategy's consistent negative abnormal returns, despite its significant Bitcoin holdings, underscore a critical market distinction: while Bitcoin was briefly seen as a safe asset, MSTR's leveraged balance sheet and operational exposure made it more vulnerable to risk-off sentiment. Investors likely anticipated liquidity concerns or devaluation risks in firms heavily reliant on volatile digital reserves.

Coinbase was the most adversely affected, with abnormal losses across all windows. As a publicly traded exchange directly tied to retail trading volume and overall market health, it was especially exposed to sharp drops in investor participation and rising fear.

These results provide strong evidence for Hypothesis 4, showing that major crashes lead to significant, asymmetric abnormal returns across crypto assets and crypto-related equities, with market participants carefully distinguishing between technological resilience and business model fragility.

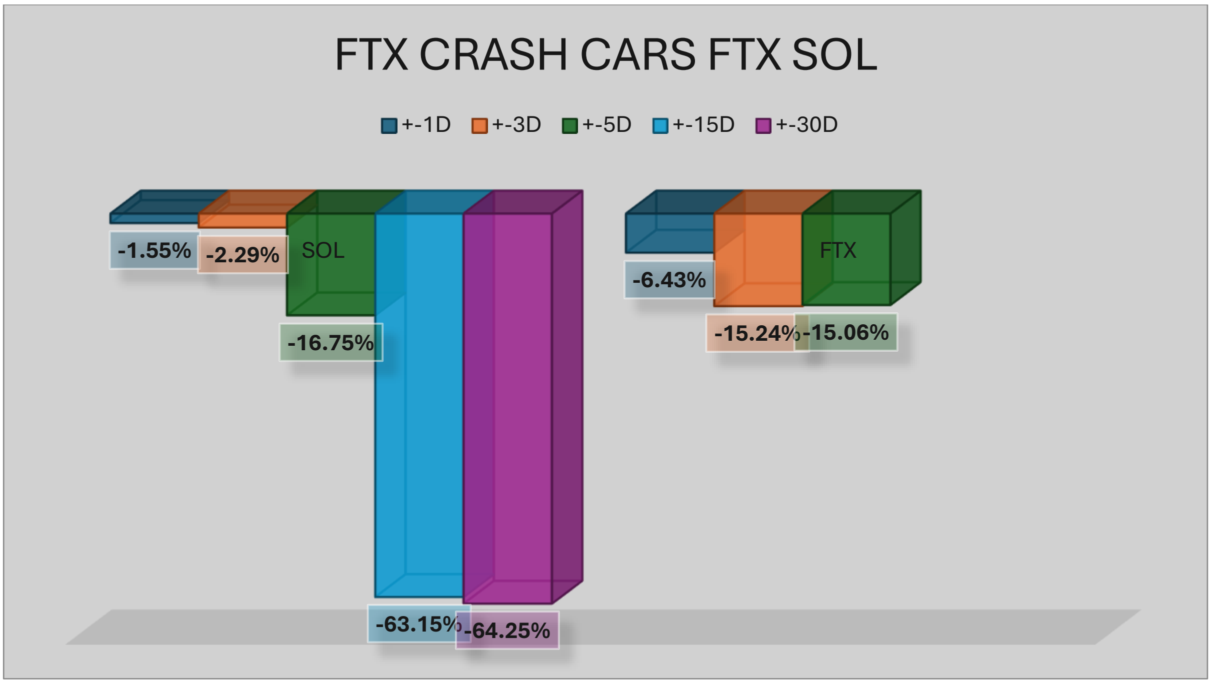

Figure 4: Cumulative Abnormal Return (CAR) of FTX and Solana (SOL) for FTX Crash Event

The statistical evidence from the FTX collapse highlights a clear divide between structurally exposed crypto assets, sentiment-sensitive equities, and peripheral infrastructure firms. The native FTX token unsurprisingly saw immediate and statistically significant negative abnormal returns in the shortest windows, consistent with market recognition of the platform's collapse and the near-total erosion of its token's value. The absence of longer-window data reflects a breakdown in trading activity following the bankruptcy.

Assets	+-1D	+-3D	+-5D	+-15D	+-30D
SOL	-0.49	-0.48	-2.79***	-6.27***	-4.55***
FTX	-2.54**	-3.94***	-3.10***	N/A	N/A
NVDA	3.79***	2.63***	2.73***	2.80***	2.75***
MSTR	1.94*	-1.47	-3.26***	-2.50**	-1.24

COIN	0.69	-1.44	-2.85***	-2.48**	-1.39

Table 3: T-Statistics of all crypto assets and crypto-exposed equities for FTX crash event, *Note:* *** = statistically significant at the 1% level; ** = 5% level; * = 10% level

Solana, though deeply tied to FTX through technical backing and token integration, showed a delayed but ultimately significant decline. While its short-term movements were statistically insignificant, the losses became meaningful in wider windows, indicating that the market took time to fully reassess Solana's exposure and future viability post-FTX.

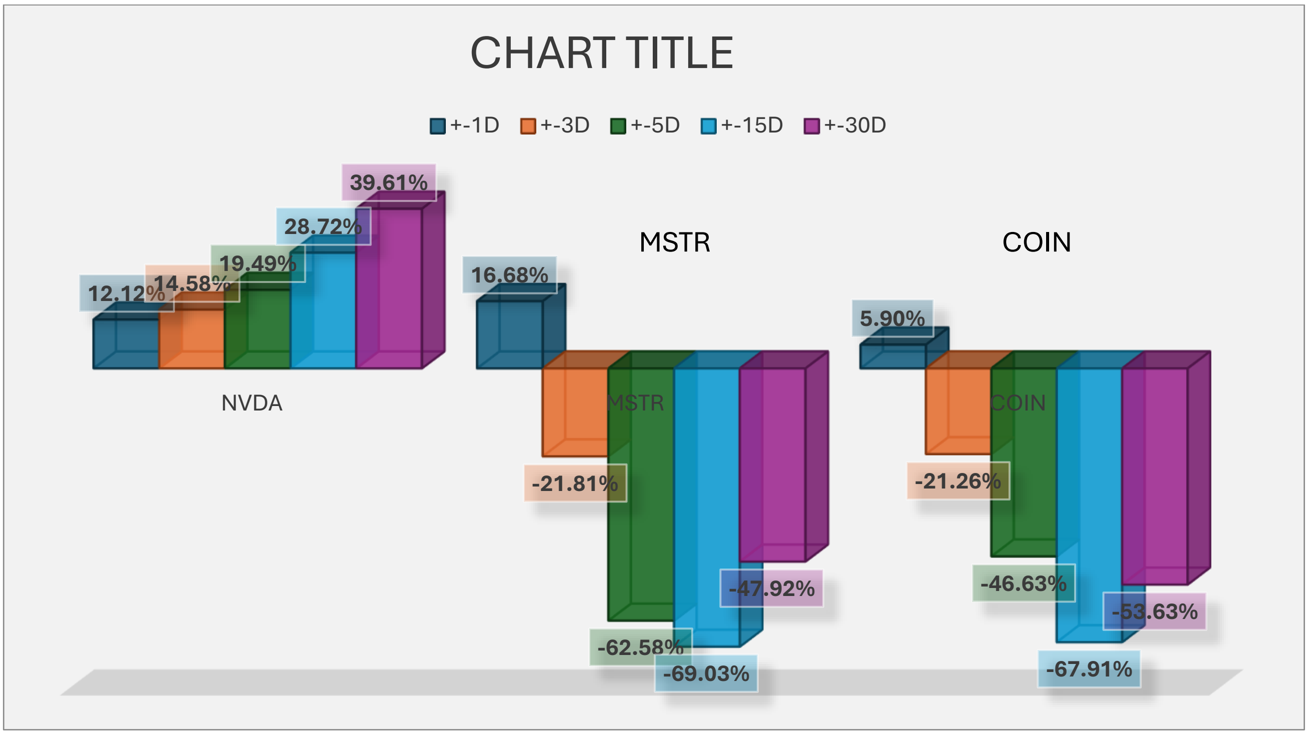

Figure 5: Cumulative Abnormal Return (CAR) of Crypto Exposed Stocks for FTX crash event

Among equities, MicroStrategy and Coinbase were notably affected. Although neither reacted significantly on the first day, both recorded statistically significant negative abnormal returns in the mid-range windows. This suggests that investor concerns intensified as the full scale of the contagion became clearer. MicroStrategy likely suffered due to fears of indirect crypto market instability undermining its Bitcoin-backed strategy, while Coinbase, as a direct market participant, faced scepticism over exchange safety, regulatory overhang, and reduced user activity. The reaction timing implies that risk repricing in listed equities is slower but ultimately sharper once sentiment shifts.

NVIDIA also posted statistically significant positive returns across all windows. However, the broader market context must be considered. Tech stocks were rising overall during this period due to macro-level optimism, and NVIDIA's strength likely reflects both that momentum and its positioning as a lower-risk tech infrastructure firm — not a direct beneficiary of FTX's collapse. Its inclusion adds contrast but should not be overinterpreted in isolation. Together, these reactions underscore that statistical significance tends to emerge where economic logic, business model fragility, and investor sentiment intersect, and that timing matters as much as magnitude in contagion events.

The SEC's lawsuit against Ripple on 22 December 2020 triggered one of the sharpest asset-

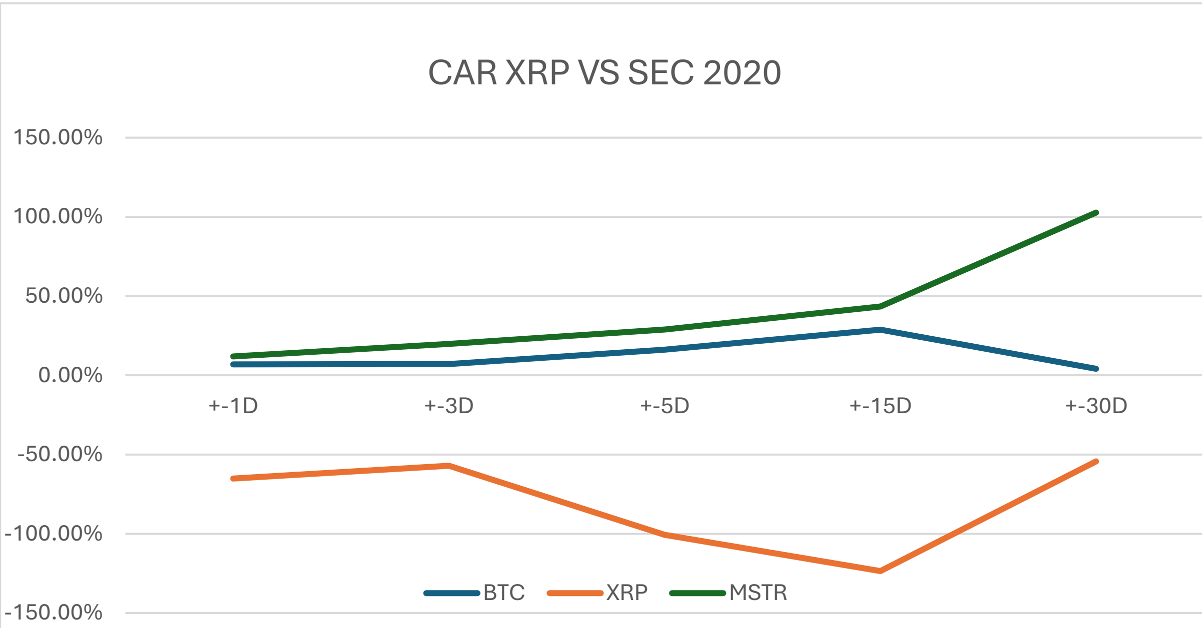

Figure 6: Cumulative Abnormal Return (CAR) of Bitcoin (BTC), Ripple(XRP) and Solana (SOL)

specific shocks observed in this thesis. XRP experienced extreme and statistically significant negative abnormal returns across all event windows, reaching a CAR of –123.53% by ±15D (T-stat: –20.10) and –65.13% even within ±1D (T-stat: –34.06). In stark contrast, Bitcoin recorded short-term positive abnormal returns with T-stats of 3.84 (±1D) and 4.92 (±15D), suggesting capital rotated into BTC as a perceived regulatory-safe alternative. MicroStrategy

Assets	+-1D	+-3D	+-5D	+-15D	+-30D
BTC	3.84***	2.58***	4.64***	4.92***	0.50
XRP	-34.06***	-19.51***	-27.47***	-20.09***	-6.29***
NVDA	-1.10	-1.67*	-1.70*	-2.06**	-3.17***
MSTR	2.65***	2.30**	2.87***	3.00***	5.06***

(MSTR), often seen as a Bitcoin proxy at the time, also exhibited strong statistically significant gains in every window — culminating in a +102.72% CAR at ±30D (T-stat: 5.06). These results support the idea of selective capital reallocation during token-specific enforcement actions.

Table 4: T-Statistics of crypto assets and crypto-exposed equities for XRP vs SEC 2020 event, *Note:* *** = statistically significant at the 1% level; ** = 5% level; * = 10% level

Meanwhile, NVIDIA registered negative but statistically insignificant or borderline T-values (e.g., –3.16 at ±30D), likely influenced by broader tech or equity market factors rather than the XRP case itself. Overall, this event shows how markets differentiated sharply between the directly impacted asset (XRP), indirect beneficiaries (BTC, MSTR), and unrelated tech equities.

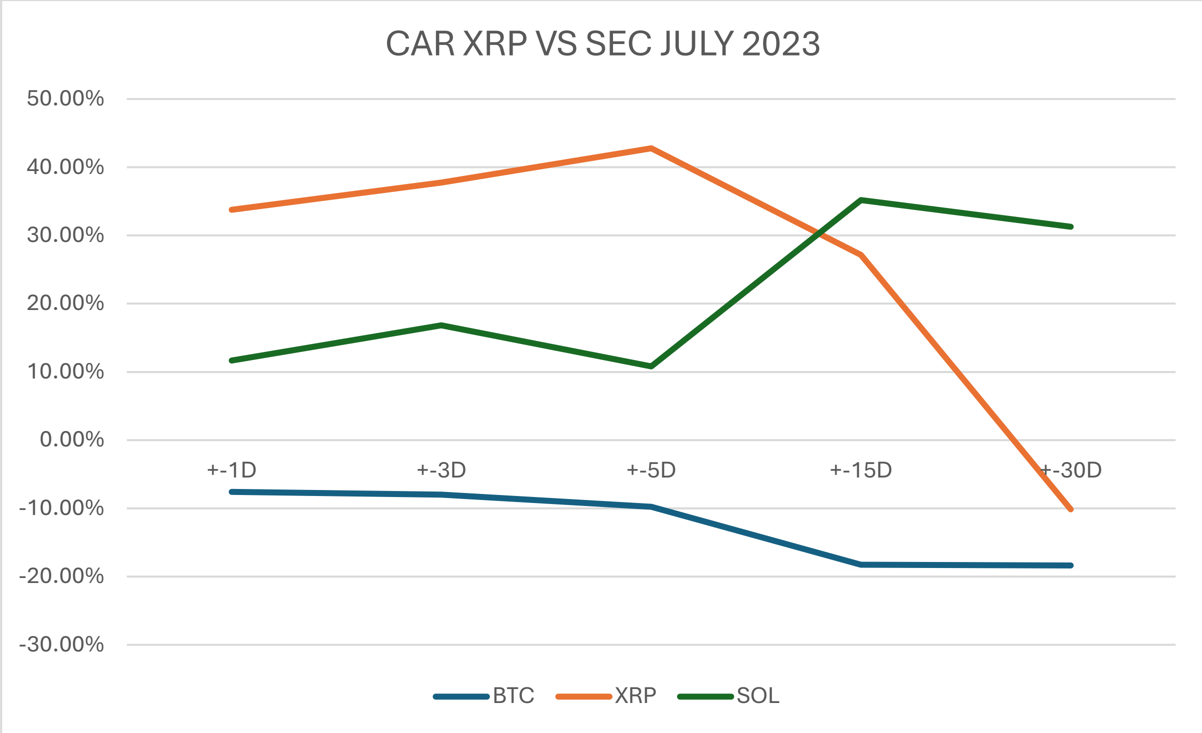

Figure 7: Cumulative Abnormal Return(CAR) of Bitcoin (BTC), Ripple (XRP) and Solana (SOL) for the XRP vs SEC 2023 event

The July 2023 court ruling that XRP was not a security for retail investors triggered a short-lived but statistically significant rally in XRP. Within ±1D, XRP surged +33.77% (T-stat: 5.92), peaking at +42.78% by ±5D (T-stat: 3.92). However, the rally reversed sharply in the long run, with CAR turning negative to –10.14% by ±30D and T-stat falling to –0.39, indicating no sustained statistical support. Solana (SOL) mirrored XRP's early momentum with a +11.68% return at ±1D (T-stat: 3.17) and continued rising until ±15D (+35.19%, T-stat: 2.97), suggesting broader altcoin enthusiasm.

Asset	+-1D	+-3D	+-5D	+-15D	+-30D
BTC	-3.75***	-2.60***	-2.52**	-2.81***	-2.01**
XRP	5.92***	4.33***	3.92***	1.48	-0.39
SOL	3.17***	3.00***	1.53	2.97***	1.88*

Table 5: T-Statistics of crypto assets and crypto-exposed equities for XRP vs SEC 2023 event, *Note:* *** = statistically significant at the 1% level; ** = 5% level; * = 10% level

Meanwhile, Bitcoin consistently declined across all windows, with a CAR of –7.59% at ±1D (T-stat: –3.75) and a continued drop to –18.37% at ±30D. These results highlight a temporary shift of investor confidence toward altcoins following the regulatory clarity, followed by partial correction — particularly for XRP — as initial optimism tapered off.

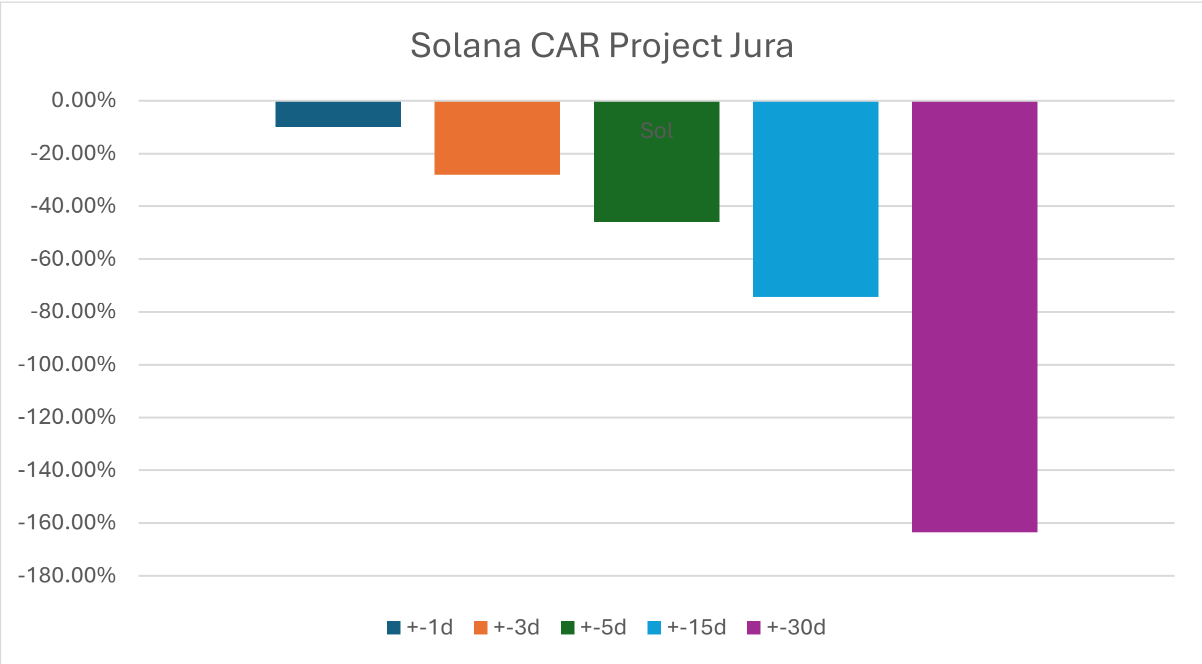

Figure 8: Cumulative Abnormal Return (CAR) of Solana for Project Jura

The Project Jura announcement, which explored wholesale cross-border CBDC transactions between the Bank for International Settlements, Banque de France, and Swiss National Bank, coincided with sharply negative market reactions for Solana. Cumulative Abnormal Returns (CARs) for SOL grew progressively more negative with time: –9.93% on the 1-day window, –28.05% over 3 days, –45.97% over 5 days, and a substantial –163.55% over 30 days. This pattern suggests a persistent decline in investor sentiment following the announcement.

Asset	+-1D	+-3D	+-5D	+-15D	+-30D

SOL	-0.84	-1.55	-2.02**	-1.95*	-3.05***

Table 6: T-Statistics of Solana (SOL) for Project Jura event, *Note:* *** = statistically significant at the 1% level; ** = 5% level; * = 10% level

The corresponding t-statistics confirm statistical significance in both medium and longer horizons (t = –2.02 for +5D and t = –3.05 for +30D), suggesting the market may have interpreted the institutional-level CBDC initiative as a threat to decentralized platforms like Solana. The response reflects investor concerns that successful cross-border CBDC infrastructures could reduce reliance on public blockchain-based solutions for international settlements

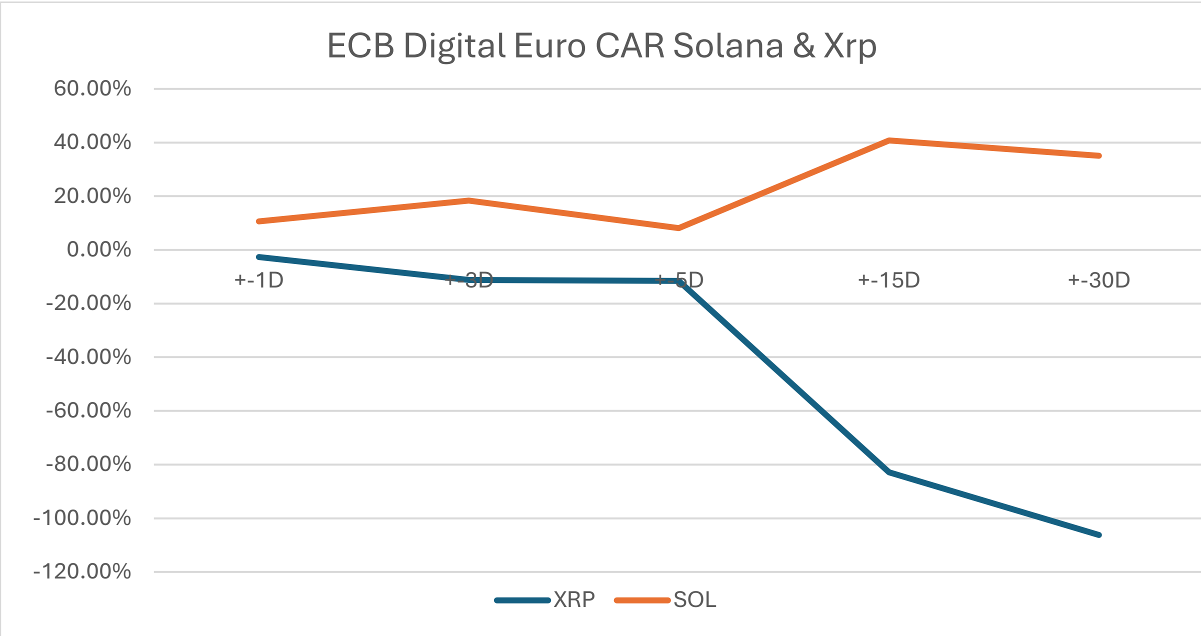

Figure 9: Cumulative Abnormal Return (CAR) of Solana (SOL) and Ripple(XRP) for ECB Digital Euro Event

Following the ECB’s digital euro announcement, XRP and Solana showed starkly diverging patterns. XRP recorded increasingly negative cumulative abnormal returns across all windows, reaching –106.24% at +30D, although none of these returns were statistically significant.

In contrast, Solana posted strong and statistically significant positive reactions in the +1D and +3D windows, peaking at +40.80% over the +15D window. This suggests investors viewed Solana's ecosystem — possibly due to its scalability and relevance for tokenized payments — as compatible or complementary to Europe's evolving digital finance landscape.

Asset	+-1D	+-3D	+-5D	+-15D	+-30D
XRP	-0.35	-0.97	-0.80	-3.40***	-3.11***
SOL	2.41**	2.74***	0.96	2.88***	1.76*

Table 7: T-Statistics of Solana (SOL) for ECB Digital Euro event, *Note:* *** = statistically significant at the 1% level; ** = 5% level; * = 10% level

The sharp divergence between the two assets supports the idea that CBDC events have asymmetric effects, with reactions highly dependent on how the market perceives an asset's utility, competitive threat, or integration potential in the emerging digital currency architecture.

4.1 Robustness Check

Robustness checks were conducted using an alternative estimation window (-105 to -45) across seven major crypto events and two stock events. Results were found to be consistent, confirming the reliability of the main findings, selected examples are presented.

Asset	+-1D	+-3D	+-5D	+-15D	+-30D
BTC	6.18***	3.24***	2.78***	2.56***	1.99**
ETH	2.51**	1.23	0.68	0.13	-0.95
BNB	2.03**	1.03	1.06	2.33**	1.75*
SOL	-2.79***	-0.49	-0.01	-0.78	-0.97
TERRA	-37.29***	-28.98***	-23.93***	-13.93***	-9.78***

Table 8: T-Statistics of all cryptos with Alternative Window of -105 to -45 for Terra Luna Crash Event, *Note:* *** = statistically significant at the 1% level; ** = 5% level; * = 10% level

T-statistics with the alternative estimation window of −105 to −45 days produced results that were consistent with, and in some cases more robust than, those under the primary window of −120 to −60 days. This was particularly evident for Bitcoin, where all event windows showed statistically significant positive abnormal returns. The enhanced robustness of results across short-, medium-, and long-term windows strengthens confidence in the initial findings. The only divergence under the primary window was in short-term BTC windows, which are now confirmed as statistically significant with the alternate window.

ASSETS	+-1D	+-3D	+-5D	+-15D	+-30D
BTC	4.84***	2.10**	1.69*	1.32	1.06

ETH	2.91***	1.70*	1.19	0.72	-0.32
BNB	2.29**	1.32	1.34	2.15**	1.24
SOL	-2.27**	-0.206	0.272	-0.163	-0.207
TERRA	-37.06***	-28.88***	-23.95***	-14.40***	-10.22***

Table 9: T-Statistics of all cryptos with Normal Window of -120 to -60 for Terra Luna Crash Event, *Note:* *** = statistically significant at the 1% level; ** = 5% level; * = 10% level

Below is another robustness check T-statistics this time for crypto exposed equities for the event FTX crash using alternative window of -105 to -45 days

Asset	+-1D	+-3D	+-5D	+-15D	+-30D
NVDA	4.02***	3.24***	3.54***	3.23***	3.64***
MSTR	2.80***	-1.69*	-4.33***	-2.38***	-0.49
COIN	0.61	-1.67*	-2.73***	-2.24**	-1.30

Table 10: T-Statistics of all crypto-exposed stocks with Alternative Window of -105 to -45 for FTX Crash Event, *Note:* *** = statistically significant at the 1% level; ** = 5% level; * = 10% level

To assess the robustness of results for crypto-related equities during the FTX crash, the analysis was repeated using an alternative estimation window of −105 to −45 days. Compared to the original window of −120 to −60, the alternative window yielded even stronger statistical significance, particularly for NVIDIA, where t-statistics exceeded the 3 threshold across all windows and basically significant at 99% confidence interval. MicroStrategy also exhibited heightened significance in the short-term windows, with the ±1D and ±5D t-statistics rising to 2.80 and 4.33 respectively, compared to 1.94 and 3.26 in the original window. Coinbase retained consistent directional effects, with the ±5D and ±15D windows remaining significant under both windows. These results reinforce the robustness of the original findings and confirm that the observed abnormal returns are not artifacts of the estimation window specification.

Asset	+-1D	+-3D	+-5D	+-15D	+-30D
NVDA	3.79***	2.63***	2.73***	2.80***	2.75***
MSTR	1.94*	-1.47	-3.26***	-2.50**	-1.24
COIN	0.69	-1.44	-2.85***	-2.48**	-1.39

Table 11: T-Statistics of all cryptos with Normal Window of -120 to -60 for FTX Crash Event, *Note:* *** = statistically significant at the 1% level; ** = 5% level; * = 10% level

To confirm that the robustness of results extends beyond market crash events, we re-estimated the XRP vs SEC lawsuit (22 December 2020) using the alternative estimation window of –105 to –45 days. The overall results remained statistically consistent.

Asset	+-1D	+-3D	+-5D	+-15D	+-30D
BTC	2.39**	1.32	2.48**	2.30**	-0.57

XRP	-32.74***	-18.63***	-18.64***	-18.71***	-8.84***
NVDA	-0.951	-1.816*	-1.712*	-1.838*	-2.934***
MSTR	2.498**	2.727***	3.116***	2.489**	4.303***

Table 12: T-Statistics of all assets with Alternative Window of -105 to -45 for XRP vs SEC 2020 Event, *Note:* *** = statistically significant at the 1% level; ** = 5% level; * = 10% level

XRP continued to exhibit strong and persistent negative abnormal returns across all windows under both estimation schemes, reaffirming the impact of regulatory shocks. While BTC's T-statistics weakened under the alternate window, they retained significance in short-term windows (+1D, +5D), preserving directional coherence.

For MicroStrategy, the alternative estimation window led to slightly stronger significance in selected windows, although not uniformly across the entire horizon. These findings reinforce the robustness of our event study methodology and demonstrate its applicability beyond crash scenarios, extending confidently into regulatory event contexts.

Assets	+-1D	+-3D	+-5D	+-15D	+-30D
BTC	3.84***	2.58***	4.64***	4.92***	0.50
XRP	-34.06***	-19.51***	-27.47***	-20.09***	-6.29***
NVDA	-1.10	-1.67*	-1.70*	-2.06**	-3.17***

MSTR	2.65***	2.30**	2.87***	3.00***	5.06***

Table 13: T-Statistics of all assets with Normal Window of -120 to -60 for XRP vs SEC 2020 Event, *Note:* *** = statistically significant at the 1% level; ** = 5% level; * = 10% level

5.Discussion

The earliest event in this thesis timeline unfolds on the day the World Health Organization formally declared COVID-19 a global pandemic. On 11 March 2020, global financial markets experienced a sharp repricing of risk, and cryptocurrencies were no exception. In fact, the crash in crypto assets that occurred on the very same day strongly coincided with the pandemic declaration and preceded the infamous "Black Thursday" stock market collapse on 12 March. This unique alignment provides a clear window into the behavior of digital assets during the onset of systemic global panic.

Rather than serving as a hedge or safe haven, Bitcoin witnessed negative abnormal returns, revealing that in the face of an unexpected macro crisis, even decentralized assets are quickly liquidated in favor of cash. Ethereum showed even more acute reactions, which could be attributed to its central role in decentralized finance infrastructure. As global uncertainty surged, confidence in the broader DeFi ecosystem may have rapidly deteriorated, amplifying price declines.

XRP also declined sharply, particularly in the immediate aftermath, but the reaction seemed to fade sooner than other assets. This could be due to differences in market composition or the historical resilience of XRP investors to regulatory and legal disruptions. BNB, meanwhile, showed consistent negative reactions across various windows, likely due to its utility nature and dependence on exchange activity, which tends to shrink during market panic.

Solana had not yet been launched at this time and is therefore excluded from the analysis for this event. However, the available evidence clearly establishes that cryptocurrencies were not immune to global shocks in the early days of the pandemic. Instead, they moved in tandem with broader financial markets, challenging the narrative that they behave as uncorrelated or defensive assets during extreme systemic events. Behavior of Cryptos in this particular event is in line with our Hypothesis four.

Despite the broader equity and crypto markets posting steep losses around the COVID-19 shock, NVIDIA stands out as a notable exception. NVIDIA recorded abnormal gains in every tested window. This divergence is particularly striking, given that NVIDIA was the only crypto-exposed stock in the dataset at that time, owing to its role in providing GPU hardware vital for crypto mining.

One plausible explanation lies in the market's forward-looking belief in hardware demand resilience. As global lockdowns pushed digital transformation and home computing demand, NVIDIA may have been seen not just as a chipmaker, but as a strategic backbone for decentralized networks and data-intensive applications. Its crypto exposure, rather than being a liability during crisis, was perhaps viewed as a long-term asset — especially relative to tokens and platforms suffering liquidity runs. These findings signal that the nature of exposure (hardware vs direct crypto-holdings) may yield radically different investor reactions under stress. It partially supports Hypotheses number three.

The collapse of Terra (LUNA) in May 2022 marked a pivotal breakdown in crypto markets, sending a strong wave of fear across the ecosystem. As a major algorithmic stablecoin project, Terra's failure did not just wipe out investor confidence in the asset itself but also raised serious doubts about the credibility of decentralized financial protocols built on similar uncollateralized models.

Terra experienced the most extreme negative abnormal returns across the sample, which is consistent with its near-total collapse and the inability of its ecosystem to withstand pressure without external backstops. The market’s reaction was not limited to Terra alone — it spilled over to other major assets, but with more nuanced responses.

Bitcoin and Ethereum both posted statistically significant positive abnormal returns. This suggests a flight to perceived relative safety within the crypto market itself. These assets — particularly Bitcoin — continue to benefit from their dominant status, broader institutional recognition, and deeper liquidity. Rather than triggering an indiscriminate sell-off, the Terra crash seemed to accelerate a reallocation away from experimental DeFi assets toward more “blue-chip” cryptocurrencies.

BNB also showed statistically significant positive performance during the crash period. This outcome likely reflects the centralized governance and strategic influence of Binance, which may have been perceived as a stabilizing anchor amid decentralized turmoil. Binance’s ecosystem, while exposed to broader crypto sentiment, does not rely on fragile algorithmic models, and its strong brand control may have reassured investors.

Solana registered a short-term negative reaction but did not display persistent weakness over longer horizons. This may be attributed to Solana’s exposure to DeFi narratives and its integration with multiple decentralized applications, which likely led to initial sell pressure. However, the lack of sustained negative reaction implies that markets quickly distinguished Solana’s architecture and risk profile from that of Terra.

A key contrast in this episode is MicroStrategy’s performance, which diverged meaningfully from Bitcoin. While BTC posted positive returns, MSTR saw statistically significant losses. This divergence suggests that during high-volatility market collapses, investor concerns around leverage, equity volatility, and financial fragility of crypto-exposed firms become more pronounced. Interestingly, MSTR had responded positively during a prior regulatory shock — the 2020 SEC lawsuit against XRP — indicating that investors treat crashes and regulatory developments as fundamentally different in nature. Crashes evoke liquidation risk and contagion fears, whereas regulatory events often involve interpretive uncertainty and delayed enforcement timelines. It again supports the hypotheses three and four both.

Coinbase also experienced significant losses, likely due to its role as a publicly listed gateway to crypto markets. Panic phases often prompt lower trading volumes, operational stress, and institutional outflows — all of which disproportionately affect centralized intermediaries like COIN.

In summary, the Terra collapse triggered a layered and selective response across the market. Established assets acted as temporary safe havens, while DeFi-linked tokens and firms with structural exposure to crypto assets were penalized. These results illustrate the evolving sophistication of investor behavior — one that is increasingly capable of differentiating between levels of risk, exposure, and resilience within the digital asset landscape.

The Celsius Network freeze was the second in a series of major crypto crises in 2022, coming just weeks after the Terra collapse. On June 12th, Celsius abruptly halted withdrawals, swaps, and transfers between accounts, citing "extreme market conditions." The platform, once a poster child for high-yield crypto lending, was found to be overexposed to volatile DeFi strategies and deeply entangled with Terra-linked assets. This sudden freeze sent shockwaves through the already fragile crypto markets, further eroding investor trust in centralized platforms.

Among the five cryptocurrencies analyzed, Ethereum again bore the brunt of the panic. ETH registered statistically significant negative abnormal returns in both short- and medium-term windows. Its sensitivity can be attributed to its role as the backbone of most DeFi protocols—Celsius's failure reinforced broader concerns about systemic weaknesses in the Ethereum-based financial stack.

BNB also reacted with significantly negative abnormal returns, particularly in immediate and medium-term windows. Its ecosystem's reliance on yield-driven services may have spooked investors in the wake of another centralized yield platform's downfall. BTC, while directionally negative, showed limited significance, consistent with its perception as a relative safe-haven within the crypto landscape.

Interestingly, Solana exhibited a positive and statistically significant reaction in the short term. This may reflect investor rotation into alternative Layer-1s amid Ethereum's DeFi contagion fears, or a temporary decoupling as Solana was not as directly linked to the Celsius exposure. XRP showed a mild reaction, not central to the narrative. Confirms Hypotheses four.

The divergence in asset behavior highlights how market reactions during systemic events are not always uniformly negative. Even in crisis, differential exposure and evolving investor narratives shape the direction and significance of abnormal returns. The Celsius event didn't exist in isolation—it formed part of a broader 2022 collapse sequence: first Terra, then Celsius, and finally FTX. Whether one interprets this as a domino effect or serial implosions of fragile entities, the cumulative damage to centralized finance credibility in crypto was immense.

The ripple effects of the Celsius Network freeze extended into publicly traded crypto-exposed firms, albeit with more muted and delayed market responses compared to direct cryptocurrencies. Both MicroStrategy (MSTR) and Coinbase (COIN) exhibited directionally negative abnormal returns across most windows, but statistical significance emerged primarily in the long-term window. Here again suppor

This lagged market response suggests that equity investors initially processed the Celsius freeze as a sector-specific issue confined to crypto lending platforms. However, as market sentiment deteriorated and further cracks appeared in the centralized finance (CeFi) narrative, broader concerns began to weigh on companies with material crypto exposure.

MicroStrategy, due to its aggressive Bitcoin treasury strategy, and Coinbase, as a publicly listed exchange directly affected by reduced trading volumes and investor confidence, were particularly vulnerable. The significance of long-horizon t-statistics implies that traditional equity markets were slower to react but eventually priced in the broader implications of the Celsius freeze for the crypto sector's credibility and future revenues.

In short, while the initial market reaction was concentrated within the crypto asset class, the aftershocks gradually reached equities, reaffirming the interconnected nature of digital asset markets and crypto-exposed public firms.

The FTX collapse triggered a decisive shake-up in the crypto ecosystem. Solana faced the steepest declines among the core assets, which reflects its close association with the FTX–Alameda network. Investors appeared to price in not only direct exposure but also broader doubts about project sustainability post-FTX.

The FTT token itself, unsurprisingly, nosedived. The absence of longer-window data points to an evaporation of market liquidity as the platform unraveled. It became effectively untradeable—a clear signal of market breakdown.

In contrast, Bitcoin, Ethereum, XRP, and BNB remained relatively stable. Their muted response suggests either lower dependence on centralized entities like FTX or the perception that they could weather the systemic fallout.

Among equities, NVIDIA moved in the opposite direction, posting gains. This likely reflects investor decoupling, with the market reassessing NVIDIA through a tech-sector lens rather than crypto sensitivity. Meanwhile, MicroStrategy and Coinbase declined over time. For MicroStrategy, the downturn may have been driven by concern over its Bitcoin-heavy strategy during extreme volatility. Coinbase, being a regulated exchange and public face of centralized crypto infrastructure, likely bore the brunt of reputational and regulatory fears as FTX collapsed.

The event highlighted a key divide—projects structurally linked to FTX faced immediate damage, while others experienced lagged reactions as investors reassessed risk and exposure across the ecosystem.

The SEC's 22 December 2020 lawsuit against Ripple Labs—alleging XRP to be an unregistered security—served as a landmark moment in crypto regulation. XRP, unsurprisingly, absorbed the brunt of the shock. Its abnormal returns turned sharply negative immediately after the announcement and remained deeply in the red across all event windows. This suggests investors rapidly reassessed both the legal standing and future viability of XRP in light of potential delistings and exchange-related restrictions.

Interestingly, Bitcoin recorded statistically significant positive abnormal returns in all but the longest window, highlighting a potential flight to perceived safety. BTC's performance suggests that investors viewed it as legally more insulated and thus repositioned capital away from XRP toward the market leader. Ethereum, while less pronounced, also showed a positive short-term response, reinforcing the idea of portfolio rotation within the crypto space rather than across asset classes. These dynamics reflect investor behavior under regulatory stress—preferring tokens with either clearer use cases or stronger institutional narratives.

In contrast, BNB turned negative in the longer windows, despite initial neutrality. This delayed response could reflect the market's concern over Binance's exposure to XRP through trading pairs and listings. The regulatory uncertainty possibly signaled elevated platform risk, especially as exchanges themselves became regulatory focal points in later years. BNB's long-window decline suggests that spillovers may not be immediate, but can intensify as legal implications ripple outward.

This event reveals a layered structure in investor reaction: while XRP collapsed under direct pressure, BTC and ETH benefited from relative regulatory clarity, and BNB, as an exchange token, faced delayed vulnerability. The episode illustrates how the market differentiates between regulatory targets, substitutes, and facilitators—each reacting according to its proximity to perceived legal heat.

Among equities, MicroStrategy's response closely tracked that of Bitcoin, delivering increasingly positive abnormal returns over longer horizons. This pattern reinforces the perception that MicroStrategy was viewed by investors as a de facto Bitcoin proxy during this period, benefiting from capital rotation into BTC amidst the regulatory crackdown on XRP. In contrast, NVIDIA experienced negative abnormal returns in the mid-to-longer windows. However, its trajectory likely reflects a blend of factors, as NVIDIA's crypto exposure is only partial and largely indirect stemming from its role in supplying GPUs used in blockchain mining rather than holding crypto assets directly. As such, the observed investor reaction may have been shaped more by broader market volatility and sentiment spillovers than any perceived regulatory threat specific to the firm's operations. This contrast underscores how equity responses to crypto regulation depend not just on crypto exposure, but also on the nature and directness of that exposure.

Later in the timeline, the announcement by El Salvador to adopt Bitcoin as legal tender marked a historic moment in cryptocurrency policy. Surprisingly, however, Bitcoin itself showed minimal reaction around this event, suggesting that the market had either anticipated the news or interpreted the development as more symbolic than materially impactful. In contrast, Solana recorded statistically significant gains in the short-term windows, particularly within the first few trading days. This suggests that investor enthusiasm may have spilled over into altcoin ecosystems, with Solana potentially benefiting from a renewed optimism around broader crypto adoption. The market's differentiated response reflects how flagship policy shifts may not always translate into immediate price effects for the primary asset involved but can still energize other parts of the crypto space perceived as innovative or better poised for growth.

A landmark regulatory moment unfolded in July 2023 when a U.S. court ruled that XRP was not a security in the context of retail trading. This decision injected legal clarity into an otherwise uncertain regulatory landscape and was broadly perceived as a partial legal victory for Ripple. Unsurprisingly, XRP rallied across multiple event windows following the verdict, as investors interpreted the outcome as a reduction in legal overhang and a green light for continued exchange listings. Interestingly, Solana also posted consecutive short-term gains. This spillover suggests that traders may have extrapolated broader optimism to other altcoins, anticipating that legal clarity for one token could serve as a precedent or a signaling device for others facing similar scrutiny.

In contrast, both Bitcoin and Ethereum saw modest but consistent declines across nearly all observation windows. These reactions may reflect capital rotation away from dominant incumbents toward altcoins newly perceived as legally de-risked. Alternatively, the ruling's narrow application—protecting XRP only in retail contexts—might have rekindled fears of continued regulatory ambiguity for other tokens, especially those awaiting their own classification. The fact that BTC and ETH did not benefit from the legal momentum enjoyed by XRP reinforces the idea that market participants are attuned to fine distinctions in regulatory language. This event illustrates how crypto markets react not only to direct outcomes, but to perceived relative positioning within the evolving legal framework.

Equity responses during the 2023 XRP vs SEC ruling reflect a shift in how markets differentiate between direct exposure, historical positioning, and regulatory ripple effects. Notably, Coinbase exhibited a statistically significant positive reaction only in the immediate aftermath, while MicroStrategy, despite its earlier alignment with BTC and a notable positive reaction during the 2020 SEC filing event, remained broadly unresponsive across all windows this time.

This divergence could be attributed to Coinbase's operational link to XRP, having previously delisted the token under regulatory pressure. The favorable ruling likely reopened speculative discussion on XRP's potential relisting or broader market implications for listed assets. However, the market's enthusiasm seemed short-lived, suggesting skepticism about how far-reaching the court's decision would be in redefining token classifications across the board.

In contrast, MicroStrategy's muted response reinforces the interpretation that its performance is more tightly coupled with Bitcoin’s trajectory. Since Bitcoin itself reacted negatively across all windows during this event, MSTR’s neutrality may indicate investor detachment from non-Bitcoin-specific developments. Unlike in 2020, where the lawsuit created broad legal anxiety, the 2023 ruling appeared more token-specific and structurally isolated.

This episode reflects growing investor maturity in segmenting legal and operational exposure, as well as increasing clarity in market expectations from crypto-equity interaction

The announcement of India’s 30% flat tax on cryptocurrency gains on February 1, 2022, was a landmark policy move that introduced immediate legal recognition while simultaneously tightening the economic burden on traders and investors. Surprisingly, most major assets—including Bitcoin, Ethereum, and Binance Coin—showed no significant market reaction across any window. However, XRP diverged from this pattern, registering statistically significant positive abnormal returns only in the medium and long-term windows following the announcement.

This delayed but distinct movement suggests that markets took time to process the implications for XRP specifically. One plausible explanation lies in XRP’s historical role in facilitating cross-border payments and remittances—areas of high relevance to India. As the announcement brought regulatory clarity, some investors may have interpreted this as a step toward legitimizing compliant crypto operations, especially those with utility-focused use cases like XRP.

The fact that abnormal returns became significant only in the longer post-event windows indicates that the market’s interpretation of the tax announcement was not immediately optimistic, but gradually shifted as participants reassessed the risks and opportunities under the new legal framework. XRP’s reaction, therefore, may not reflect enthusiasm about taxation per se, but rather a recognition that clarity—even if strict—can favor tokens with functional value in regulated financial services.

On 23 March 2023, the U.S. Securities and Exchange Commission released an investor alert cautioning the public about potential risks associated with investing in "crypto asset securities." Unlike more aggressive actions such as lawsuits or enforcement crackdowns, this alert was advisory in nature. Yet, XRP initially reacted with a slight negative abnormal return on the first trading day, suggesting the market may have momentarily feared renewed legal pressure on Ripple Labs. However, this initial concern quickly faded, and XRP exhibited sustained positive abnormal returns across every wider event window thereafter. This sharp reversal could reflect growing investor confidence that the alert lacked specific legal force and did not signal an imminent new case against XRP. It may also indicate that market participants interpreted the alert as targeting newer or less established tokens, rather than those like XRP that had already been extensively tested through litigation. Once the market reassessed the implications, XRP's price movement aligned more with relief than anxiety, reinforcing its recurring sensitivity to SEC-related communications—whether direct or indirect. This event again underscores XRP’s unique regulatory burden among major crypto assets, and how the market processes even ambiguous signals in its context. Partial support of hypotheses one as not every asset showed significant abnormal return.

On 15 June 2021, local government authorities in China began paying salaries to public sector employees using the digital yuan (e-CNY), marking a notable real-world application of central bank digital currencies. Following this announcement, Bitcoin began exhibiting upward movement in the days that followed. Rather than interpreting the initiative as a threat to decentralized cryptocurrencies, the market appeared to view the development as a broader endorsement of the digital asset ecosystem. The fact that a major economy was moving ahead with sovereign digital currency deployment may have reinforced Bitcoin’s position as a legitimate digital store of value operating outside centralized monetary systems. This response suggests that investors perceived space for coexistence between decentralized and centralized digital currencies, especially when the latter helped normalize digital payment frameworks in public discourse. Chinese digital yuan supports hypotheses two.

In the case of Project Jura, launched on December 8, 2021, the market's reaction was strikingly negative—particularly for Solana. This cross-border CBDC experiment, led by the BIS and involving the central banks of Switzerland and France, was a landmark step in sovereign digital currency development. Yet instead of viewing this institutional experimentation as an endorsement of blockchain applications, the market appeared to respond with caution, especially in relation to altcoins like Solana. Price behaviour suggests that investors may have interpreted the event as signalling a shift in credibility and attention away from decentralized ecosystems and toward tightly controlled state-backed solutions.

Unlike the digital yuan salary event or the India CBDC pilots, Project Jura didn't offer retail or public integration—it was purely wholesale and state-centric. Solana, which tends to attract retail-driven, innovation-focused sentiment, may have been disproportionately affected as investors reassessed the long-term role of open-source platforms in a future increasingly shaped by government-led CBDC frameworks. The sustained downtrend over the weeks following the announcement reflects this deeper anxiety about displacement and relevance in an institutionalized digital currency world. It supports hypotheses two almost strongly as out of 5 assets only one reacted and that too almost mildly compared to crash or regulatory events.

The European Central Bank's formal announcement of the Digital Euro on 1 November 2023 revealed starkly divergent responses within the crypto asset landscape. XRP experienced persistent and worsening negative returns following the announcement, suggesting that markets perceived the institutional move toward a centralized digital currency as a potential long-term threat to assets with semi-regulatory ambiguity like XRP. This may reflect growing investor concerns over how increasing CBDC adoption could marginalize or crowd out certain tokens in terms of utility or legal clarity.

In contrast, Solana posted strong and consistent gains throughout the post-announcement period. This rally may have stemmed from Solana's positioning as a scalable infrastructure layer, potentially seen as complementary to institutional digital currency initiatives rather than threatened by them. The bullish response indicates that investors may view some Layer-1 protocols not merely as currency competitors, but as platforms that could benefit from increased blockchain adoption and integration spurred by state-backed digital currencies. This event also strongly supports hypotheses two.

Overall, the results of this thesis reveal a complex and heterogeneous landscape of market reactions to key events across the cryptocurrency ecosystem. While sharp crashes like Terra, Celsius, and FTX provoked predictable contagion and deep losses across both tokens and crypto-exposed equities, other events—particularly regulatory decisions and CBDC development elicited more selective and asset-specific responses. XRP emerged as the most regulation-sensitive asset, consistently reacting to SEC-related announcements, while Solana displayed idiosyncratic behavior, at times diverging significantly from broader trends.

Interestingly, the sweeping ban by China on all crypto trading and mining, announced on 24 September 2021, did not result in any substantial or statistically significant price responses across the core cryptocurrencies analyzed. This muted market reaction possibly reflects the increasing resilience of crypto markets to jurisdiction-specific bans, especially from countries that had already imposed earlier restrictions. Altogether, these variations underscore that investor reactions are not merely driven by the direction or category of news, but also by the perceived exposure, utility, and narrative role of each asset within the market. This event-level granularity adds depth to our understanding of how different segments of the digital asset space internalize and respond to real-world policy, legal, and institutional developments.

5.1Comparison With Existing Literature

The findings of this thesis both align with and extend existing literature on cryptocurrency market reactions to regulatory and crash events. Prior studies such as Chokor and Alfieri (2021) and Cumming, Fuchs, and Momtaz (2024) consistently report negative abnormal returns following major regulatory announcements, particularly those implying restrictive oversight. This pattern is partially supported in our results, especially for assets like Ethereum and Bitcoin, which showed vulnerability during events like the SEC vs XRP ruling of 2023 or the Celsius Network collapse. However, the reactions are far more nuanced and asset-specific than previously reported. XRP stands out as a notable outlier across multiple events: it was positively affected by India's 30% crypto tax policy, the SEC's March 2023 investor alert, and the 2023 court ruling clarifying its status for retail investors. These outcomes indicate that regulatory developments may, in certain contexts, reinforce investor confidence when they resolve ambiguity or signal institutional recognition. This departs from the assumption that regulation uniformly depresses prices and underlines the importance of the regulatory content and the asset's legal entanglement.

When comparing crash events, the results largely corroborate observations from Yousaf, Riaz, and Goodell (2023), who used the FTX collapse as a stress test and found limited spillovers into traditional financial markets. While our thesis does not focus on traditional assets, we observed that core assets like Bitcoin and Ethereum did not exhibit statistically significant negative abnormal returns during the FTX crash, suggesting growing resilience or desensitization. In contrast, FTX's native token and Solana—one of its heavily backed ecosystems—were notably affected in long-term windows, revealing that direct exposure plays a crucial role in contagion transmission. Similarly, the Terra and Celsius collapses displayed severe yet asset-specific impacts. Interestingly, NVIDIA, the only crypto-exposed equity in our sample during the COVID-19 crash, posted unexpected positive abnormal returns, possibly due to its broader sectoral tailwinds, further affirming that not all assets respond to crypto crashes uniformly.

Moreover, while prior studies such as Khan, Ozcan, and Ibrahim (2023) emphasize contagion risk from crypto to broader equity markets, our evidence shows that spillovers into crypto-related equities like Coinbase, MicroStrategy, and NVIDIA were often limited to longer windows and highly contingent on the nature of the event. Notably, MicroStrategy, which closely mirrored Bitcoin's trajectory during earlier periods such as the SEC lawsuit against XRP in 2020, showed no strong response in later regulatory episodes—suggesting that asset-specific sensitivity may evolve over time.

CBDC-related events in this thesis also offer an important contribution to literature. Mzoughi, Benkraiem, and Guesmi (2022) report that early CBDC launches such as the Bahamas' SANDDollar had measurable impacts on Bitcoin. Our broader CBDC event set, including announcements from India, China, and the European Central Bank, yielded only modest or mixed reactions. Bitcoin showed some positive movement following China's action paying public workers in digital yuan, but there were few strong or consistent reactions elsewhere. Notably, Solana exhibited recurring sensitivity across multiple CBDC announcements—showing visible declines around both Project Jura and the ECB Digital Euro communication. This consistency may reflect investor perception of CBDCs as a potential challenge to DeFi ecosystems, where Solana plays a prominent infrastructural role. Its price behaviour during these events reinforces the idea that blockchain platforms focused on decentralised applications may be particularly reactive to news involving sovereign digital currency design and adoption.

Overall, these findings underscore the maturing nature of cryptocurrency markets, where investor reactions have become more differentiated, grounded in contextual understanding, and less uniformly reactive than in earlier periods. This thesis adds empirical nuance by demonstrating that not only the type of event, but also the asset's narrative, legal clarity, and structural exposure, govern how market participants interpret shocks—whether regulatory or fundamental.

5.2 Limitations

Despite the analytical rigor and systematic approach of this thesis, several limitations must be acknowledged, spanning both methodological considerations and data constraints.

First, the use of the event study methodology rests on the assumption of semi-strong form market efficiency — that markets incorporate publicly available information instantly and rationally. While this framework has proven robust across financial studies, its application to the cryptocurrency market has limitations. The crypto ecosystem is still evolving, often driven by heterogeneous investor behavior, low liquidity in some assets, and pronounced speculation. Therefore, attributing price movements entirely to event shocks within fixed windows may mask the influence of concurrent factors or delayed responses, especially in highly sentiment-driven assets.

Second, to ensure methodological consistency, the thesis applied a uniform estimation window of –120 to –60 days across all events and assets, with standardized event windows ranging from immediate (±1 day) to medium-term (±30 days). While this enhances comparability, it imposes rigidity that may not suit the nuanced nature of all events or asset reactions. A robustness check using an alternative estimation window of –105 to –45 days was conducted on selected events to mitigate this concern. Results remained largely consistent, but future work could incorporate asset-specific or volatility-adjusted estimation windows to allow for greater adaptability.

Third, although deliberate steps were taken to avoid contamination between adjacent events — such as excluding overlapping windows between the Terra and Celsius crashes (separated by just 32 days) or isolating India's retail CBDC pilot from the subsequent FTX collapse — full separation of market sentiment is not always feasible. Crypto markets are globally integrated, and investor memory can persist across events, making clean attribution of impact challenging.

Fourth, in terms of asset scope, the study focused on five major cryptocurrencies (BTC, ETH, XRP, BNB, and SOL) and four crypto-related equities (Tesla, MicroStrategy, Coinbase, and NVIDIA). These were selected based on relevance, liquidity, and consistent data availability. However, this choice excludes altcoins, DeFi tokens, and stablecoins that may exhibit different sensitivity patterns, as well as publicly listed miners or payment platforms with significant crypto exposure. Importantly, for crypto-exposed equities, only the seven most impactful and statistically relevant events (out of 23 total) were analyzed to preserve clarity and avoid overfitting. This event filtering strengthens focus but may overlook smaller cumulative effects.

Fifth, while the analysis captured short- and medium-term abnormal returns, long-run implications of the tested events — such as regulatory credibility, business model shifts, or institutional adoption trajectories — remain outside the scope. Including post-event drift, buy-and-hold returns, or multi-year analyses would be necessary for a complete understanding of structural impact.

Lastly, the thesis focused solely on price-based measures. Spillover effects through volatility, trading volume, or liquidity shocks were not incorporated. Nor were advanced econometric models like GARCH, VAR, or the Diebold-Yilmaz spillover index used to assess systemic transmission, which could complement event study results in future research.

6.Conclusion

This thesis sets out to systematically examine how cryptocurrency markets and crypto-exposed equities respond to a spectrum of impactful events, including regulatory interventions, central bank digital currency (CBDC) initiatives, and major market crashes. Drawing upon 23 carefully selected events between 2020 and 2024, the study applied a consistent event study framework across five leading cryptocurrencies and a subset of equities with varying degrees of crypto market exposure.

Main findings were Crash Events produce the strongest reactions among both crypto assets and crypto exposed equities, after that Certain Regulation events and Ripple being most affected by the regulatory events, CBDC events produce mild or insignificant reactions and only on specific assets. And Crypto and Crypto-exposed stock can differ in reaction even if in a certain point of time the crypto-exposed stock acted as its proxy.

A key contribution of this work lies in its comprehensive structure, which integrates three distinct event categories into a unified empirical design. While previous literature often focused on a single event type in isolation, this thesis brings together crash-driven contagion episodes, regulatory shocks such as SEC lawsuits or tax announcements, and policy-driven events like CBDC launches or digital currency frameworks. This allowed for a more holistic comparison of how crypto markets and related equities process different sources of information under different contexts.

Another important dimension is the granularity with which both crypto assets and equities are analysed. Rather than focusing solely on Bitcoin or aggregate indices, the thesis disaggregates effects across major tokens—Bitcoin, Ethereum, XRP, Binance Coin, and Solana—each of which exhibits distinct patterns of reaction across time. Likewise, for equities, MicroStrategy was found to behave almost like a Bitcoin proxy in certain events, such as the XRP vs SEC 2020 lawsuit, where it mirrored the rise in BTC. However, this link did not hold during broader collapses like the FTX crash, where MicroStrategy declined while Bitcoin itself showed no significant movement. These asset-level findings add depth to existing work and offer nuanced insight into investor perception of crypto-linked risk.

Methodologically, the study contributes by adhering to rigorous design choices widely endorsed in academic literature. A uniform estimation window of –120 to –60 days was applied to ensure comparability across events and assets. At the same time, robustness checks were carried out using an alternate estimation window of –105 to –45 days for a selected subset of events to assess sensitivity to window structure. Multiple event windows were also employed to capture not just immediate price reactions but also short- and medium-term adjustments, offering a more layered view of how markets absorb information over time.

Looking ahead, several directions emerge for future research. While this thesis applies a consistent window structure for comparability, future studies could adapt estimation and event windows dynamically to suit the nature of each event. For example, CBDC announcements may have delayed effects and may benefit from longer post-event observation periods, whereas sharp regulatory crackdowns or exchange failures may show impact almost instantly. Additionally, further research could incorporate behavioral and sentiment metrics such as on-chain activity, social media sentiment, or Google Trends to explore investor psychology around major news. The role of stablecoins, DeFi protocols, and spillovers into traditional asset classes like sovereign bonds or emerging market currencies also remains underexplored and could enrich our understanding of systemic connectivity.

Ultimately, this thesis adds to the growing body of literature by offering a detailed and post-2020 perspective on market behavior. It reflects the growing institutionalization of crypto, the increasing frequency and scale of regulatory action, and the maturing investor response to various event types. By combining methodological rigor with a broad spectrum of events, the work contributes meaningful empirical evidence to ongoing debates about how digital assets interact with policy, risk, and the broader financial ecosystem.

7.References

MacKinlay, A. Craig. "Event studies in economics and finance." *Journal of economic literature* 35.1 (1997): 13-39.

Brown, S. J., & Warner, J. B. (1985). Using daily stock returns: The case of event studies. *Journal of financial economics*, *14*(1), 3-31.

Chokor, A., & Alfieri, E. (2021). Long and short-term impacts of regulation in the cryptocurrency market. *The Quarterly Review of Economics and Finance*, *81*, 157-173.

Cumming, D. J., Fuchs, J., & Momtaz, P. P. (2024). Market Reactions to Cryptocurrency Regulation: Risk, Return, and the Role of Enforcement Quality. *Return, and the Role of Enforcement Quality (September 23,2024)*

Theerthaana, P., & Manzoor, A. K. (2018). Is bitcoin gaining cash during cashless times in India? An event study approach.

Shanaev, S., Shuraeva, A., Vasenin, M., & Kuznetsov, M. (2019). Cryptocurrency value and 51% attacks: evidence from event studies. *The Journal of Alternative Investments*, *22*(3), 65-77.

Koenraadt, J., & Leung, E. (2024). Investor reactions to crypto token regulation. *European Accounting Review*, *33*(2), 367-397.

Nguyen, N., Li, Y., & Davé, S. (2023). How Event Studies Can Be Applied To Crypto Markets.

Yousaf, I., Riaz, Y., & Goodell, J. W. (2023). What do responses of financial markets to the collapse of FTX say about investor interest in cryptocurrencies? Event-study evidence. *Finance Research Letters*, *53*, 103661.

Jarboui, A., & Mnif, E. (2021). Cryptocurrency bubble risk and the FOMC announcements during COVID-19 black swan event. *Journal of Investment Compliance*, *22*(1), 95-108.

Yip, R. (2022). *An event study on the May 2022 stablecoin market crash* (Research Memorandum No. 09/2022). Hong Kong Monetary Authority.

Ozcan, R., & Ibrahim, M. M. (2024). Unravelling crash risk transmission: Cryptocurrency impact on stock markets in G-7 and China. *Pakistan Journal of Commerce and Social Sciences (PJCSS)*, *18*(4), 848-871.

Mzoughi, H., Benkraiem, R., & Guesmi, K. (2022). The bitcoin market reaction to the launch of central bank digital currencies. *Research in International Business and Finance*, *63*, 101800.

Bolt, W., Lubbersen, V., & Wierts, P. (2022). Getting the balance right: Crypto, stablecoin and CBDC.

8.Appendices

8.1Appendix A: All Events

Crash Events

Event Name	Event Date
Terra Collapse	11 May 2022
FTX Collapse	3 November 2022
COVID Black Day Crash	11 March 2020
Celsius Network Collapse	12 June 2022

CBDC Events

Event Name	Event Date
Project Jura	8 December 2021
ECB Digital Euro Announcement	1 November 2023
India Retail CBDC Launch	1 December 2022
India Wholesale CBDC Launch	1 November 2022
China Local Government Salary in e-CNY	15 June 2021
Hong Kong–China Cross-Border e-CNY Pilot	12 May 2024

Regulatory Events

Event Name	Event Date
SEC vs XRP Filing	22 December 2020
SEC vs XRP Ruling	13 July 2023
SEC Investor Alert	23 March 2023
SEC Charges Kraken	9 February 2023
ProShares BTC Futures ETF Approval	18 October 2021
Chinese Crypto Ban	24 September 2021
El Salvador Legalizes Bitcoin	7 September 2021
US Executive Order on Crypto	9 March 2022
India 30% Crypto Tax	1 February 2022
EU MiCA Regulation Phase 1	3 October 2023
EU MiCA Final Approval	20 April 2023
SEC Crypto Investor Alert	22 March 2023
EU MiCA Full Integration	30 December 2024

8.2Appendix B:Sample Stata Code for Crypto Using market Model and CIC 30 as Proxy

```
* Step 1: Regression for expected returns

regress Log_ReturnsBTC Log_ReturnsCIC if inrange(date, td(01aug2024), td(31oct2024))

predict yhatBTC

gen AR_BTC = Log_ReturnsBTC - yhatBTC


* Step 2: Std. deviation of abnormal returns

summarize AR_BTC if inrange(date, td(01aug2024), td(31oct2024)), detail

scalar sigmaBTC = r(sd)

display sigmaBTC
```

```
* Step 3: Define event date

local event_date = td(30dec2024)


* ±1D: 29–31 Dec

gen win_pm1d = inrange(date, td(29dec2024), td(31dec2024))

egen temp_car_pm1d = total(AR_BTC) if win_pm1d

gen CAR_BTC_pm1d = .

replace CAR_BTC_pm1d = temp_car_pm1d if date == `event_date'

drop win_pm1d temp_car_pm1d


* ±3D: 27 Dec – 2 Jan

gen win_pm3d = inrange(date, td(27dec2024), td(02jan2025))

egen temp_car_pm3d = total(AR_BTC) if win_pm3d

gen CAR_BTC_pm3d = .

replace CAR_BTC_pm3d = temp_car_pm3d if date == `event_date'

drop win_pm3d temp_car_pm3d


* ±5D: 25 Dec – 5 Jan

gen win_pm5d = inrange(date, td(25dec2024), td(05jan2025))
```

```
egen temp_car_pm5d = total(AR_BTC) if win_pm5d

gen CAR_BTC_pm5d = .

replace CAR_BTC_pm5d = temp_car_pm5d if date == `event_date'

drop win_pm5d temp_car_pm5d


* ±15D: 15 Dec – 14 Jan

gen win_pm15d = inrange(date, td(15dec2024), td(14jan2025))

egen temp_car_pm15d = total(AR_BTC) if win_pm15d

gen CAR_BTC_pm15d = .

replace CAR_BTC_pm15d = temp_car_pm15d if date == `event_date'

drop win_pm15d temp_car_pm15d


* ±30D: 30 Nov – 29 Jan

gen win_pm30d = inrange(date, td(30nov2024), td(29jan2025))

egen temp_car_pm30d = total(AR_BTC) if win_pm30d

gen CAR_BTC_pm30d = .

replace CAR_BTC_pm30d = temp_car_pm30d if date == `event_date'

drop win_pm30d temp_car_pm30d


* Step 4: T-Statistics
```

```
gen Tstat_BTC_pm1d = CAR_BTC_pm1d / (sigmaBTC * sqrt(3)) if date == `event_date'

gen Tstat_BTC_pm3d = CAR_BTC_pm3d / (sigmaBTC * sqrt(7)) if date == `event_date'

gen Tstat_BTC_pm5d = CAR_BTC_pm5d / (sigmaBTC * sqrt(11)) if date == `event_date'

gen Tstat_BTC_pm15d = CAR_BTC_pm15d / (sigmaBTC * sqrt(31)) if date == `event_date'

gen Tstat_BTC_pm30d = CAR_BTC_pm30d / (sigmaBTC * sqrt(61)) if date == `event_date'
```

8.3 Appendix C: Sample Stata Code for a crypto-exposed equity using FF4 model

```
* Step 1: Regression for expected returns

regress logret_coin MKTRF SMB HML UMD if inrange(DATE, td(13may2022),
td(10aug2022)), robust

predict yhat_coin

gen AR_coin = logret_coin - yhat_coin


* Step 2: Std. deviation of abnormal returns

summarize AR_coin if inrange(DATE, td(13may2022), td(10aug2022)), detail

scalar sigma_coin = r(sd)

display sigma_coin
```

```
* ±1D: 2–4 Nov

gen win_coin_pm1d = inrange(DATE, td(02nov2022), td(04nov2022))

egen temp_car_coin_pm1d = total(AR_coin) if win_coin_pm1d

gen CAR_coin_pm1d = .

replace CAR_coin_pm1d = temp_car_coin_pm1d if DATE == event_date

drop win_coin_pm1d temp_car_coin_pm1d


* ±3D: 31 Oct – 8 Nov

gen win_coin_pm3d = inrange(DATE, td(31oct2022), td(08nov2022))

egen temp_car_coin_pm3d = total(AR_coin) if win_coin_pm3d

gen CAR_coin_pm3d = .

replace CAR_coin_pm3d = temp_car_coin_pm3d if DATE == event_date

drop win_coin_pm3d temp_car_coin_pm3d


* ±5D: 27 Oct – 10 Nov

gen win_coin_pm5d = inrange(DATE, td(27oct2022), td(10nov2022))

egen temp_car_coin_pm5d = total(AR_coin) if win_coin_pm5d

gen CAR_coin_pm5d = .

replace CAR_coin_pm5d = temp_car_coin_pm5d if DATE == event_date
```

```
drop win_coin_pm5d temp_car_coin_pm5d

* ±15D: 13 Oct – 25 Nov
gen win_coin_pm15d = inrange(DATE, td(13oct2022), td(25nov2022))
egen temp_car_coin_pm15d = total(AR_coin) if win_coin_pm15d
gen CAR_coin_pm15d = .
replace CAR_coin_pm15d = temp_car_coin_pm15d if DATE == event_date
drop win_coin_pm15d temp_car_coin_pm15d

* ±30D: 29 Sep – 9 Dec
gen win_coin_pm30d = inrange(DATE, td(29sep2022), td(09dec2022))
egen temp_car_coin_pm30d = total(AR_coin) if win_coin_pm30d
gen CAR_coin_pm30d = .
replace CAR_coin_pm30d = temp_car_coin_pm30d if DATE == event_date
drop win_coin_pm30d temp_car_coin_pm30d

* Step 4: T-Statistics
gen Tstat_coin_pm1d = CAR_coin_pm1d / (sigma_coin * sqrt(3)) if DATE == event_date
gen Tstat_coin_pm3d = CAR_coin_pm3d / (sigma_coin * sqrt(9)) if DATE == event_date
gen Tstat_coin_pm5d = CAR_coin_pm5d / (sigma_coin * sqrt(11)) if DATE == event_date
```

```
gen Tstat_coin_pm15d = CAR_coin_pm15d / (sigma_coin * sqrt(31)) if DATE == event_date

gen Tstat_coin_pm30d = CAR_coin_pm30d / (sigma_coin * sqrt(61)) if DATE == event_date


* Final listing

list DATE CAR_coin_pm1d Tstat_coin_pm1d CAR_coin_pm3d Tstat_coin_pm3d
CAR_coin_pm5d Tstat_coin_pm5d CAR_coin_pm15d Tstat_coin_pm15d CAR_coin_pm30d
Tstat_coin_pm30d if DATE == event_date
```