

**BEYOND THE LEDGER: A CROSS-PLATFORM  
ANALYSIS OF CRYPTOCURRENCY DYNAMICS**

by

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The cryptocurrency market has experienced rapid growth and dynamic changes, marked by evolving technologies, fluctuating market dynamics, and significant regulatory events. This thesis, 'Beyond the Ledger: A Cross-Platform Exploratory Analysis of Cryptocurrency Data Dynamics,' explores the intricate relationships between cryptocurrencies and online platforms such as Reddit, Discord, and GitHub, which serve as critical channels for community engagement, technical development, and information dissemination; through a multi-coin, multi-platform analysis, this study examines the interconnectedness within the cryptocurrency ecosystem, utilizing Granger causality tests and correlation matrices to identify predictive relationships and patterns across the market. The research delves into significant market events such as the Ethereum Merge and the collapse of FTX, analyzing their impact on cryptocurrency prices, community activity, and technological trends and investigates the roles that different platforms play in fostering community sentiment and technological innovation, revealing that Reddit tends to drive market speculation, Discord offers real-time community interaction, and GitHub reflects longer-term development activities. Furthermore, the study highlights the importance of cross-platform dynamics during market shocks, demonstrating how information flows across various online spaces influence market behavior and development priorities. The findings suggest that while Bitcoin remains a market leader with a relatively independent behavior, other cryptocurrencies like Ethereum, Solana, Polygon, Cardano, and Dogecoin exhibit varied levels of interconnectedness and are influenced by different factors, including social media trends, technological advancements, and external economic conditions. This thesis concludes that understanding the complex socio-technical ecology of the cryptocurrency market requires a multifaceted approach that considers not only financial and technological elements

but also the broader context of community interactions and market shocks; these results contribute to a better understanding of the cryptocurrency ecosystem's dynamics and offer valuable insights for investors, developers, and researchers seeking to navigate the volatile and rapidly evolving world of cryptocurrencies. Further research is recommended to refine predictive models and expand the scope of analysis to improve generalizability and enhance the comprehensiveness of market studies.

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## **Chapter 1**

### **Background and Motivation**

The landscape of cryptocurrency tokens has been characterized by rapid innovation and volatility, especially in recent years marked by the emergence and evolution of various token development models, significant technological transitions, and pivotal market events. This thesis sets out to explore the history of a list of the most popular tokens, by market cap, through the lens of community and development activity in the context of market dynamics such as bubbles, busts, and regulatory milestones; the thesis will highlight the need for more robust cross-platform analyses to understand the impacts of cryptocurrency shocks, which serve as reminders and lessons for further decentralized developments to come as the technology evolves and becomes more widely adopted.

Cryptocurrency tokens are not only financial assets but also representations of the technological ideologies and governance models that are foundational to their creation and maintenance, i.e. the concepts of data sovereignty, security, and decentralization. Since 2017, the crypto landscape has seen an explosion in the number of tokens developed, each following unique routes of development. Forking, where a new project is branched out from the existing codebase, repositories that serve as a hub for collaborative development, and documentation to guide users and developers usage of networks, are fundamental to this ecosystem's growth. These ideas reflect the decentralized, open-source nature of cryptocurrencies and have varying impacts on the security, scalability, and adoption of tokens. Moreover, the crypto market is known for its susceptibility to shocks, such as regulatory changes, technological upgrades, and significant and sudden market movements. By leveraging information gleaned from the aforementioned technological backend and

development histories, more insights can be gained from the comparison to fluctuations in more social data such as what can be found across platforms like Reddit or the very commonly used in crypto communities, Discord.

Cryptocurrency communities utilize a diverse array of online platforms, each serving distinct roles in the ecosystem and demonstrating the hyper online world we inhabit. Discussion forums like Reddit offer spaces for in-depth technical discussions and social community building, while social media platforms such as Discord serve as hubs for more direct community interaction and real-time discussions, including troubleshooting, development updates, and coordination of community-driven projects. Each platform caters to specific aspects of the cryptocurrency community, from developers and enthusiasts to traders and investors, facilitating a complicated conversation that covers technical development, market speculation, and general conversations. This cross-platform presence is essential for the distribution of information, creation of communities, and the overall cohesion of the decentralized and geographically dispersed cryptocurrency community. The cryptocurrency ecosystem is made of a complex socio-technical ecology that intertwines code, community, and transactions; the open-source nature of most cryptocurrency projects encourages a collaborative approach to development, with contributions and discussions happening across multiple online platforms like Github and the aforementioned Reddit and Discord. This integration of social dynamics and technical development fosters a unique environment where technological advancements and community sentiment are closely linked. Moreover, market shocks, such as dramatic price fluctuations or regulatory changes, introduce disturbances into this socio-technical ecology. These shocks can lead to increased activity across online platforms, as community members seek to understand the implications, share updates, and collectively navigate the evolving landscape. The hyperonline nature of cryptocurrency communities and their reliance on cross-platform dynamics become particularly evident during these market shocks as these events lead to a flurry of online activity, ranging from developmental conversations and updates to speculative chatter on a more social level, and the decentralized and open-source foundation of the cryptocurrency movement further highlights these dynamics, as information and sentiment spread rapidly across platforms,

influencing both market behavior and development priorities. Market shocks therefore serve as a compelling focus to study cross-platform dynamics within cryptocurrency communities; they provide insights into how information flows across different online spaces and how these factors interact with the technical aspects of cryptocurrency projects. This interplay between market events and online community dynamics underscores the importance of understanding cross-platform interactions in shaping the trajectory of cryptocurrency ecosystems.

The evolution of the cryptocurrencies Ethereum, Bitcoin, Dogecoin, Solana, Cardano, Polygon, and Binance since the mid 2010s demonstrates a novel journey through many different periods of speculative bubbles, market busts, technological changes, and regulatory milestones. This thesis background section delves into the history of these prominent cryptocurrencies, examining key events and developments that have shaped the digital asset landscape.

Name	Launch	Circulation	Market cap.	Standards	Consensus mechanism
Bitcoin	January 9, 2009	19.68M / 21.00M	\$1.36T	BRC-20	Proof-of-Work (SHA-256)
Ethereum	July 30, 2015	120.07M	\$423.41B	ERC-20, ERC-721, ERC-777, ERC-1155, ERC-4626	Proof-of-Stake
Dogecoin	December 6, 2013	143.82B	\$27.33B	DRC-20	Proof-of-Work (Scrypt)
Solana	March 16, 2020	445.57M	\$76.81B	SPL	Proof-of-History
Cardano	September 27, 2017	35.61B / 45.00B	\$21.56B	CTS	Proof-of-Stake (Ouroboros)
Polygon	April 19, 2017	9.90B / 10.00B	\$8.98B	ERC-20	Proof-of-Stake
Binance	July 14, 2017	149.54M	\$86.50B	BEP-20, BEP-2	Proof-of-Staked Authority

Table 1.1: Comparative Overview of Key Cryptocurrencies: Launch, Supply, and Technology

## 1.1 Bitcoin

Bitcoin, the first and most well-known cryptocurrency, emerged as an idea in the wake of the financial crisis of 2008 with its creation being an attempt to address the limitations and concerns associated with traditional fiat currencies, notably the reliance on central authorities. The pseudonymous creator, Satoshi Nakamoto, introduced Bitcoin in a 2008 white paper titled ‘Bitcoin: A Peer-to-Peer Electronic Cash System.’ This foundational document laid out a decentralized framework for a digital currency that operates independently of central banks, using a distributed ledger technology known as blockchain. The initial appeal of Bitcoin was primarily ideological as

the concepts attracted many individuals who were skeptical of central banks and the control exerted by financial institutions over the economy. Satoshi Nakamoto mined the first block of Bitcoin in January 2009, embedding a message that highlighted the context of its creation: ‘The Times 03/Jan/2009 Chancellor on brink of second bailout for banks.’ This message was a demonstration of Bitcoin’s foundation as an alternative to the traditional banking system, offering a form of money that was free from government manipulation and control [21].

Bitcoin introduced several technological innovations that set it apart from traditional currencies and payment systems. The most notable of these is the blockchain, a public ledger that records all transactions in a secure, transparent, and immutable manner; this innovation not only ensured security and trust for the users but also eliminated the need for a middle man such as a bank, thereby reducing transaction costs; additionally, Bitcoin’s decentralized nature meant that it operated on a peer-to-peer network, further enhancing its appeal to those unhappy with the centralized control of money as the peer-to-peer network meant users were in full control. Despite its revolutionary potential, Bitcoin remained a niche interest for several years after its creation. It was primarily used by technologists and libertarians, with limited use beyond speculative investment and a small number of online transactions. However, several pivotal moments helped to gradually increase Bitcoin’s visibility and acceptance such as the establishment of exchanges like the later seized Mt. Gox which allowed for easier trading and accessibility, while notable incidents, such as the use of Bitcoin on the dark web Silk Road (an online black market), drew public and media attention, although not always for the right reasons [22].

Bitcoin has experienced significant volatility since 2017, marked by several boom and bust cycles. The year 2017 was particularly notable for Bitcoin’s meteoric rise to nearly \$20,000, driven by speculative interest and the burgeoning initial coin offering (ICO) market after more businesses had begun to accept the currency in the years leading up; this was followed by a sharp decline in 2018, a pattern that has been repeated to varying degrees during Bitcoin’s volatile history (see Figure 1.1). Despite these fluctuations, Bitcoin has been increasingly embraced by retail investors, with the launch of Bitcoin futures contracts and the approval of Bitcoin exchange-traded funds

(ETFs), showing an increase in acceptance of cryptocurrencies as a legitimate asset by mainstream financial markets [10].



Figure 1.1: Bitcoin Price History

## 1.2 Ethereum

Ethereum, conceived and brought to life in 2015 by Vitalik Buterin, represented a large step forward in blockchain technology. In contrast to the singular transactional focus of its predecessors like Bitcoin, Ethereum introduced the novel idea of smart contracts; these programmable contracts automatically execute transactions when predetermined conditions are met, without the need for a middle man. This innovation did not just expand the utility of the blockchain; it laid the foundational stone for an entirely new ecosystem of decentralized applications (dApps). Ethereum's

launch began a pivotal shift, proposing a platform where decentralized finance (DeFi) and digital ownership via non-fungible tokens (NFTs) could begin to grow. Through Ethereum, users gained the capability to lend, borrow, and trade assets within a peer-to-peer network, bypassing traditional banking and financial institutions. This opened up global access to financial services, particularly for those previously excluded from the traditional financial system, and the platform's intrinsic support for NFTs also ushered in a new paradigm of digital ownership and value exchange. By providing a means to certify uniqueness and ownership of digital assets, Ethereum has facilitated a novel economy of digital art, collectibles, and utility, empowering artists and creators while establishing a new asset class [11].

One of the largest and most advanced milestones in Ethereum's history is its transition from a Proof of Work (PoW) to a Proof of Stake (PoS) consensus mechanism in November 2022, widely known as 'The Merge.' This was not merely a technical update but represented a fundamental transformation in Ethereum's operational and environmental footprint as Proof of Work, the consensus mechanism utilized by Ethereum since its inception, required computational power to validate transactions and secure the network. This process, while effective in ensuring security and decentralization, was heavily criticized for its energy consumption and environmental impact. The transition to Proof of Stake radically altered the network's validation process. Under PoS, validators are selected to create new blocks based on the quantity of cryptocurrency they hold and are willing to lock up as stake. This method significantly lowers the network's energy requirement, estimated at a reduction of over 99%, making Ethereum a leader in sustainable blockchain technology.

The Merge was a strategic move with profound implications for Ethereum's future; by adopting PoS, Ethereum not only substantially decreased its carbon footprint but also improved its scalability potential by allowing for more throughput with less computational requirements. This transition reflects Ethereum's commitment to addressing environmental concerns and its adaptability to the evolving demands of its community and the broader societal push for sustainability. Furthermore, this shift is poised to enhance network performance and security, laying the ground-

work for subsequent scalability upgrades such as sharding (grouping nodes within the network), which promises to further increase Ethereum's capacity and efficiency [18].

The evolution of Ethereum from its inception to its transformation through The Merge underscores its role as a bedrock technology in the realm of blockchain as Ethereum has not only facilitated the expansion of DeFi and the explosion of NFTs but has also demonstrated a commitment to innovation, sustainability, and scalability. The transition to Proof of Stake with The Merge is a testament to Ethereum's forward-looking vision and responsiveness to environmental and technological challenges. As Ethereum continues to evolve, it stands at the forefront of the blockchain revolution, shaping the future of decentralized technologies and their integration into our digital and economic landscapes.

### 1.3 Dogecoin

Created in December 2013 by software engineers Billy Markus and Jackson Palmer, Dogecoin was initially conceived as a humorous critique of the wild speculation surrounding cryptocurrencies at the time. Markus and Palmer sought to create a peer-to-peer digital currency that could reach a broader demographic than Bitcoin. They chose the popular 'Doge' meme as its mascot, which features a Shiba Inu dog accompanied by multicolored text in Comic Sans font, representing the coin's logo and branding; this decision was instrumental in creating a distinct identity for Dogecoin, setting it apart from the more serious and technologically driven cryptocurrencies. Despite its origins as a joke, Dogecoin quickly amassed an engaged community, and the Dogecoin community became known for its charitable endeavors and crowd-funding activities in 2014, such as raising \$50,000 in Dogecoin to sponsor NASCAR driver Josh Wise and donating \$30,000 in Dogecoin to help fund the Jamaican Bobsled Team's trip to the Sochi Winter Olympics in the same year. These activities not only showcased the currency's utility but also helped build a strong, supportive, and highly active community around it [24].

Important figures in Dogecoin's history include its co-founders, Billy Markus and Jackson Palmer. Markus, who developed Dogecoin's protocol, and Palmer, who helped promote the coin

and engage with the community, played pivotal roles in its initial development and popularization. However, Jackson Palmer has since distanced himself from Dogecoin and the cryptocurrency space at large, citing concerns over the speculative nature and ethical implications of the industry. Despite Palmer's departure, Markus remains an influential figure within the Dogecoin community, often engaging with users on social media and discussing developments in the cryptocurrency space. Too, Elon Musk, the CEO of Tesla and SpaceX, has also emerged as a key player in the evolution of Dogecoin as Musk's tweets and public endorsements of Dogecoin have led to significant price movements, highlighting the impact of social media and high-profile personalities on cryptocurrency markets. Musk's involvement has brought Dogecoin to the attention of a broader audience, contributing to its volatility but also solidifying its status as a cult cryptocurrency with mainstream appeal [27].

As of April 2024, the legacy of Dogecoin reflects a fascinating journey from meme to a mainstream cryptocurrency. Its unique blend of humor, community spirit, and the backing of high-profile individuals like Elon Musk continues to influence its position in the cryptocurrency market. Despite its challenges, including its perception as a less serious asset, Dogecoin's enduring popularity and community engagement highlight its significance as a cultural and financial phenomenon within the digital currency landscape [28].

#### **1.4 Solana**

Solana, launched in March 2020 by Anatoly Yakovenko, has been distinguished by its innovative approach to blockchain technology, specifically through its Proof of History (PoH) consensus mechanism, which is integrated with the Proof of Stake (PoS) system. This unique combination enables Solana to achieve high throughput and fast transaction speeds, positioning it as a formidable competitor to Ethereum, especially in the decentralized applications (dApps), decentralized finance (DeFi), and non-fungible tokens (NFTs) areas. Yakovenko and the Solana Foundation are pivotal to the ecosystem's growth and stability. Yakovenko's background in engineering at Qualcomm provided a strong foundation for conceptualizing and implementing Solana's innovative PoH mech-

anism, which significantly reduces validation times for transactions and smart contracts while the Solana Foundation has been instrumental in assisting in the network's development, engaging with developers, and supporting projects that build on the platform, thereby expanding its infrastructure and use cases [30].

However, Solana's journey has not been without its challenges, particularly concerning network stability as the platform has experienced several high-profile network outages, which have sparked debate within the cryptocurrency community about the trade-offs between scalability, security, and decentralization. Despite these hurdles, Solana has undertaken measures to enhance its network reliability and efficiency as time has gone on, reflecting a commitment to resolving technical vulnerabilities and maintaining its competitive edge in the blockchain space.

As of April 2024, Solana has re-established itself as a leading blockchain platform for dApps, DeFi, and NFTs, largely due to its scalability solutions and low transaction fees, which make it an attractive option for developers and users alike. The live Solana price as of April 2024 is approximately \$186.32 USD, with a market cap of about \$82.84 billion USD, ranking it as the fifth-largest cryptocurrency by market capitalization, according to CoinMarketCap. This reflects a significant recovery and growth, underlining the ecosystem's resilience and the continued faith of its investors and users in the platform's potential. Solana's current standing in the blockchain ecosystem highlights its robust technological foundation, the strength of its community, and the strategic direction provided by its leadership. Ongoing developments and enhancements to its platform are aimed at addressing past challenges and leveraging opportunities within the rapidly evolving blockchain landscape. Despite facing criticism and network outages, Solana's dedication to improving its stability and expanding its user base indicates a promising direction for the future, with the platform positioned to maintain its status as a key contender in the blockchain space [4].

## 1.5 Cardano

Cardano, launched in 2017 by Charles Hoskinson, is notable for its rigorous approach to blockchain technology, emphasizing scalability, security, and sustainability. Its foundational prin-

ciples are rooted in academic peer review and evidence-based development, distinguishing it from other blockchain projects. Hoskinson, a co-founder of Ethereum, aimed to address the limitations he perceived in Ethereum through Cardano's advanced architecture, and this included the introduction of the Ouroboros Proof-of-Stake (PoS) consensus mechanism, which underpins the network's security and efficiency by being able to eliminate some of the bias which can be present in other PoS mechanisms. Throughout its evolution, Cardano has implemented significant upgrades such as the Vasil and Alonzo hard forks; the Vasil hard fork, named in honor of Vasil Dabov, a late Bulgarian mathematician and prominent Cardano contributor, aimed to enhance the network's capacity and smart contract functionality. This upgrade introduced several improvements, including new transaction mechanisms and increased scalability features, promising a more efficient blockchain environment. The Alonzo upgrade, named after American mathematician Alonzo Church, brought programmability to the network by supporting smart contracts and non-fungible tokens (NFTs), positioning Cardano as a direct competitor to Ethereum in hosting decentralized applications (dApps) and financial protocols [17].

Cardano's ecosystem has shown robust growth, particularly in decentralized finance (DeFi) and stablecoin adoption. A report highlighted a 166% quarter-over-quarter increase in Total Value Locked (TVL) in Cardano's DeFi ecosystem, indicating a vibrant and expanding platform for decentralized applications. The platform has also seen a surge in stablecoin use (a cryptocurrency meant to stay stable in price), contributing to its ecosystem's liquidity and facilitating DeFi activities. Technically, Cardano has demonstrated resilience and potential for future growth as the network's price performance and technical analysis suggest continued investor confidence and bullish momentum. Developments like the Hydra and Mithril projects (sidechains to a main blockchain in order to increase efficiency and speed) emphasize Cardano's commitment to innovation, focusing on scalability, transaction throughput, and secure smart contract development. These advancements highlight the network's ongoing efforts to enhance its infrastructure and support a growing ecosystem of applications and services, and as of April 2024, Cardano continues to be a major player in the cryptocurrency space, marked by its rigorous development approach, a strong foundation in

academic research, and a clear vision for creating a more sustainable and interoperable blockchain ecosystem [20].

## 1.6 Polygon

In the landscape of blockchain and cryptocurrency, Polygon (originally Matic Network) represents an advancement towards addressing the inherent scalability issues faced by Ethereum, the leading platform for decentralized applications (dApps). Founded in 2017 by Jayanti Kanani, Sandeep Nailwal, and Anurag Arjun, Polygon was envisioned as a layer 2 scaling solution, a network that runs on top of another blockchain for increased efficiency and scalability. This initiative aimed to enhance transaction speeds and reduce costs without compromising the decentralized focus of blockchain technology. The co-founders brought together a unique blend of expertise, with Kanani focusing on the technical and blockchain aspects, Nailwal on operations and business development, and Arjun on product strategy, making a formidable team that drove Polygon's vision forward [1].

The transition from Matic Network to Polygon marked a strategic evolution, broadening its scope from a single scaling solution to a multi-chain system. This rebranding highlighted Polygon's ambition to create a more interconnected and versatile Ethereum ecosystem, and throughout its journey, Polygon has navigated the volatile crypto market with significant price movements, reflecting the community's confidence in its technology and its pivotal role within the Ethereum infrastructure. Polygon's architecture, leveraging a modified Proof-of-Stake framework, provides an efficient and economical platform for dApps, addressing the fundamental challenge of high transaction fees and slow processing times on the Ethereum mainnet. The project's shift towards a multi-chain system was not just a rebranding moment but a substantial leap towards facilitating a more integrated Ethereum ecosystem. These developments show Polygon's commitment to innovation and its significant contribution to alleviating scalability concerns within the Ethereum ecosystem. As Polygon continues to evolve, it aims to solidify its position as an indispensable infrastructure layer for the expanding dApp market and the broader blockchain community.

## 1.7 Binance

Binance Coin (BNB) was launched in July 2017 through an Initial Coin Offering (ICO), raising significant funding selling BNB at a very low price; this fundraising event marked the beginning of Binance's journey to becoming one of the most significant cryptocurrency exchanges globally. Changpeng Zhao (CZ), a prominent figure in the crypto space with a background that includes time at Bloomberg, founded Binance. Alongside CZ, He Yi co-founded Binance, contributing her experience as a TV anchor and presenter before venturing into the cryptocurrency domain. The utility of Binance Coin rapidly expanded from reducing trading fees to serving as the backbone of the Binance ecosystem, which includes the Binance Chain and Binance Smart Chain (BSC), now known as BNB Chain; this transition signifies Binance's evolution from a mere exchange to a comprehensive crypto ecosystem facilitating a wide range of blockchain-based applications and services [8].

However, Binance's meteoric rise has not been without its challenges, particularly from regulatory bodies across the globe. The exchange has faced scrutiny from regulators in several countries over issues ranging from operating without a license to concerns over its handling of user data and compliance with anti-money laundering standards. These regulatory challenges have led to a more cautious approach by Binance, including drastically increasing its compliance measures and engaging more actively with regulators to ensure its operations align with local laws and regulations – these regulatory issues also led to the ousting of CZ from his position of CEO at Binance. Despite these hurdles, BNB has maintained a strong performance in the crypto market [23].

Throughout its development, Binance has implemented mechanisms such as BNB burning events to manage the token's supply and sustain its value. This deflationary strategy involves periodically removing a portion of BNB from circulation, thus potentially increasing its scarcity and value over time. As of now, Binance and BNB continue to navigate the complex landscape of the crypto market, balancing innovation with regulatory compliance, and the exchange's ability to adapt and grow amid these challenges demonstrates its central role in the cryptocurrency ecosystem

and the ongoing relevance of Binance Coin as a key asset within this environment [9].

## 1.8 Socio-Technical Systems

The cryptocurrency domain represents an example of a socio-technical system where technology and social elements are deeply intertwined; this section provides a comprehensive overview of the ecosystem surrounding the development, maintenance, and promotion of a cryptocurrency coin. We examine the lifecycle of a cryptocurrency from its inception as code on GitHub, through its discussion and evolution on platforms like Discord, to its promotion and hype on social media platforms such as Reddit. This analysis offers insights into the collaborative and often complex processes that are foundational in the cryptocurrency world, setting the stage for a deeper exploration of how activity across these platforms responds to market shocks and events.

At the core of any cryptocurrency is its compute layer, implemented via blockchain technology. This layer hosts the cryptocurrency's ledger, smart contracts, and the virtual machine (VM) that executes these contracts. Crypto VMs, such as the Ethereum Virtual Machine (EVM), play a critical role in ensuring that smart contracts run in a secure, isolated environment, and this environment introduces the concept of Layer 1 (L1) solutions, which refer to the blockchain itself, and Layer 2 (L2) solutions, designed to enhance scalability and efficiency through off-chain transactions or side chains running parallel to the mainnet [16].

GitHub serves as the primary repository for the codebase of cryptocurrency projects. It hosts smart contracts, blockchain protocols, and other critical infrastructure components, facilitating version control, issue tracking, and collaborative development for cryptocurrency developers. The primary purpose and use of GitHub is version control and collaboration as changes to code can be made more easily in the shared repository than other methods. The platform is made up of repositories containing files and folders of files that developers are able to edit via making a commit where they can leave a note of what was changed; this information is then stored in the repository's commit history where the change author, date, and any commit message are recorded (see Figure 1.2). Other features of GitHub commonly used in the cryptocurrency space are branches

and forks where changes can be made and tested without affecting the original repository. Branches allow for developers to work in a contained environment rather than on the public facing repository, this allows for testing prior to release in order to debug and troubleshoot any possible issues and then make a pull request to merge the branch (see Figure 1.3). Forks are a way for developers to clone an original repository and then be able to work on it separately from the original repository – this is commonly done for altcoins in crypto as they clone Ethereum and work off of the same infrastructure (see Figure 1.4).

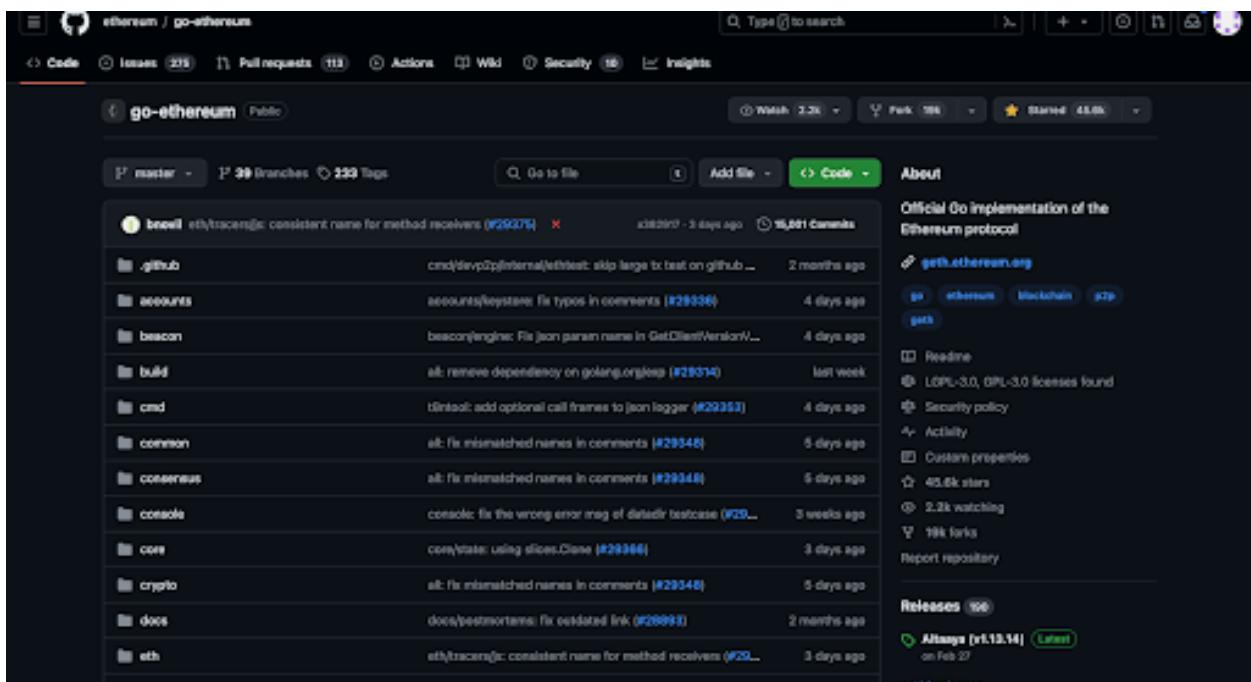


Figure 1.2: GitHub Repository Structure

The screenshot shows the GitHub repository branches page for 'ethereum/go-ethereum'. At the top, there are navigation links for Code, Issues (275), Pull requests (113), Actions, Wiki, Security (18), and Insights. Below these are tabs for Overview, Active, Draft, and All. A search bar allows searching for branches. The main section is titled 'Default' and lists the 'master' branch, which was updated 3 days ago, has a check status of 2/3, and is marked as Default. Below this is a section for 'Active branches' containing four entries: 'website' (updated 3 days ago, 109/109), 'website-fix-list-margin' (updated 4 days ago, 4/4), 'release/1.13' (updated 3 days ago, 0/0), and 'latest-bin-with-shapella' (updated 2 months ago, 214/0).

Figure 1.3: GitHub Repository Branches

The screenshot shows the GitHub repository forks page for 'ethereum/go-ethereum'. On the left, there is a sidebar with links for Pulse, Contributors, Community Standards, Comments, Code frequency, Dependency graph, Network, and Forks. The main area is titled 'Forks' and lists seven forked repositories: 'flashbots/mew-goeth' (starred 701, 0 forks, 32 issues, 21 pull requests, created 4 years ago, updated 3 days ago), 'scroll-tech/go-ethereum' (starred 428, 0 forks, 10 issues, 25 pull requests, created 3 years ago, updated 12 hours ago), 'ethersumpow/go-ethereum' (starred 207, 0 forks, 8 issues, 11 pull requests, created 2 years ago, updated 2 years ago), 'berachain/polaris-goeth' (starred 201, 0 forks, 0 issues, 1 pull request, created 2 years ago, updated 2 months ago), 'talkosys/talko-goeth' (starred 177, 0 forks, 4 issues, 11 pull requests, created 2 years ago, updated 3 days ago), 'ubiq/go-ubiq' (starred 163, 0 forks, 0 issues, 10 pull requests, created 8 years ago, updated 5 days ago), and '0x2mey/mewxyz' (starred 163, 0 forks, 1 issue, 11 pull requests, created 2 years ago, updated 3 weeks ago). There are also buttons for 'Switch to tree view', 'Period: 2 years', 'Repository type: Active +1', 'Sort: Most starred', and 'Save Defaults'.

Figure 1.4: GitHub Repository Forks

Discord channels dedicated to cryptocurrency projects offer a real-time platform for developers, investors, and enthusiasts to collaborate, troubleshoot, and discuss the future direction of the project. Discord is a digital distribution platform designed for creating communities; it allows users to communicate with voice calls, video calls, text messages, media, and files in private chats or as part of communities called servers. A server on Discord is a space where communities can gather, divided into text and voice channels focused on various topics or activities. Users are then able to join a particular Discord server, typically go through some form of bot verification, and communicate textually or by voice with other users in the different channels present in the server (see Figure 1.5). This is a common method of community building and general communication for cryptocurrency communities due to the real-time information sharing capabilities both by users sending and receiving messages and by bots being able to give market updates (see Figure 1.6).

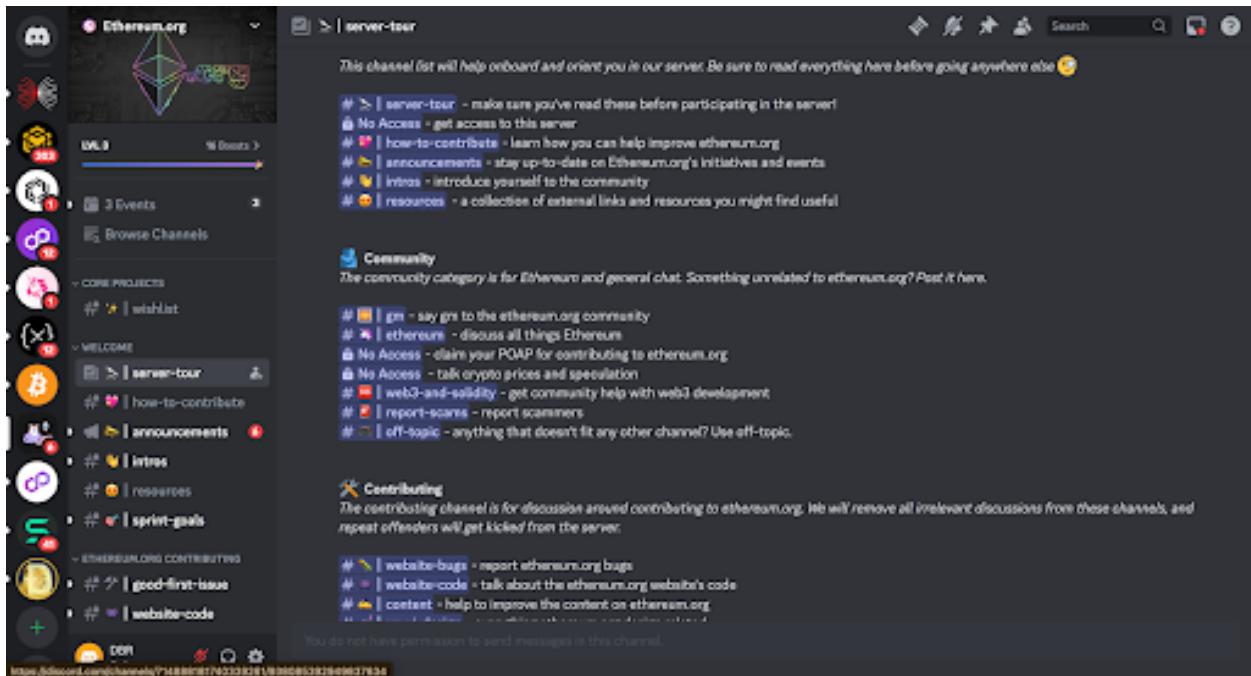


Figure 1.5: Discord Server Welcome/Landing Page on Joining

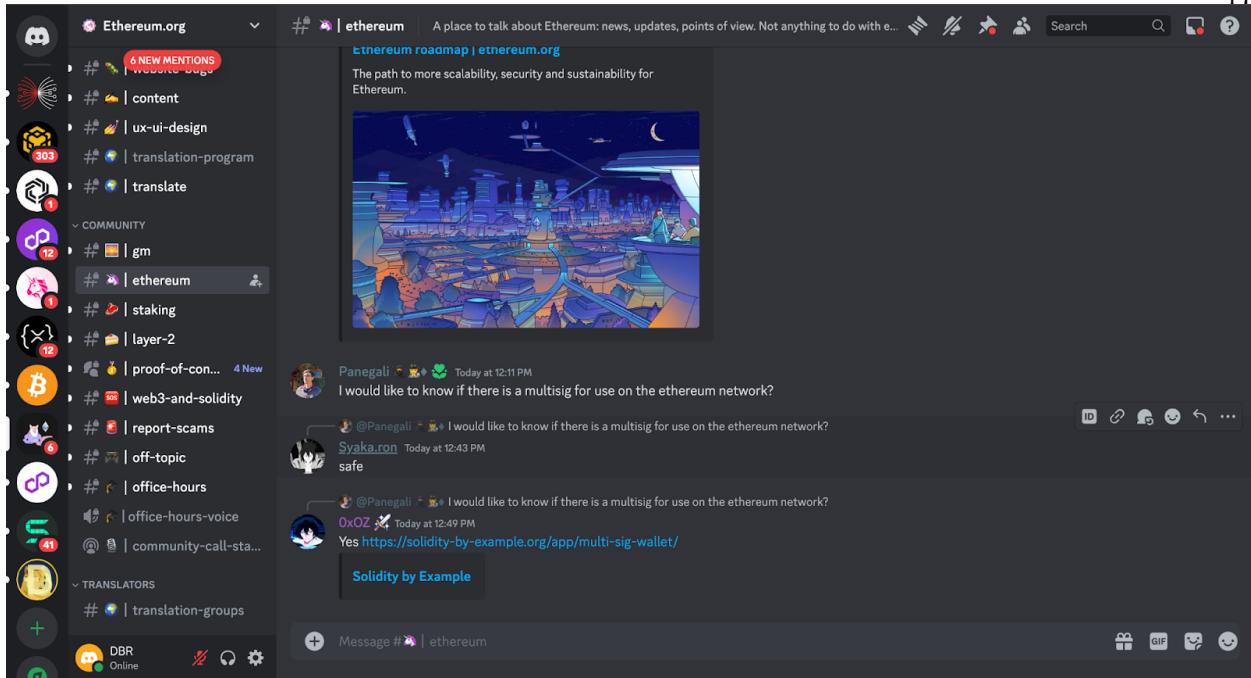


Figure 1.6: Discord Channel for Messaging

Reddit plays a pivotal role in the promotion and hype around cryptocurrency projects. Subreddits dedicated to specific coins or the broader cryptocurrency community act as a space for announcements, investment discussions, and speculation. This widely used platform has users interact with it by joining a community's subreddit and being able to view different posts from other users in the community (see Figure 1.7). Users are then able to make posts themselves or view others' and leave comments; these posts and comments are both able to be upvoted or downvoted by other users similarly to a like or dislike button giving insight into what the other community members think of a post or comment (see Figure 1.8). Unlike Discord, Reddit does not allow for real-time updates in the same manner, but the platform is effective at advertising and for longer form community news updates.

Figure 1.7: Subreddit Landing Page

Figure 1.8: Post and Comments Within Subreddit

This section has outlined the complex socio-technical ecosystem that go hand in hand with cryptocurrency projects, highlighting the crucial roles played by GitHub, Discord, and Reddit. By understanding how these platforms contribute to the development, maintenance, and promotion of cryptocurrencies, we can better grasp the collaborative and complicated nature of this domain.

### 1.9 Shocks as Attractors or Repulsors

External shocks are interesting natural experiments that provide causal insight into phenomena that might otherwise be unethical to run; these shocks can cause people to come together at times such as in times of crisis like natural disasters, social movements, or online collaborations with platforms like Wikipedia or open source software. However, shocks can also cause people to split up such as declining support for a software, self-fulfilling prophecies, or fear contagion where people see no light at the end of the tunnel, post-shock. With this in mind, not all shocks are the same and oftentimes different shocks lead to different outcomes depending on the size and circumstances of the situation; in the cryptocurrency landscape there have been many shocks – not all of which had the same effects (see Figure 1.2).

Event	Date	Explanation
Mt. Gox Hack	2014	One of the earliest and largest Bitcoin exchanges, Mt. Gox, filed for bankruptcy after losing 850,000 BTC due to a hack.
The DAO Hack	2016	The DAO, a decentralized autonomous organization on Ethereum, was hacked, leading to the theft of 3.6 million Ether and ultimately resulting in a hard fork of Ethereum.
China Bans ICOs	2017	China's government declared Initial Coin Offerings (ICOs) illegal, causing a significant drop in cryptocurrency market values.
Bitcoin Crash	Dec 2017	After reaching an all-time high of nearly \$20,000, Bitcoin's price crashed, losing about 50% of its value by February 2018.
Facebook Bans Crypto Ads	Jan 2018	Facebook announced a policy to ban all cryptocurrency and ICO advertising, contributing to market instability.
SEC Cracks Down on ICOs	2018	The U.S. Securities and Exchange Commission (SEC) increased its scrutiny and enforcement on ICOs for failing to register as securities.
Terra Luna Collapse	May 2022	The Terra (LUNA) and its stablecoin TerraUSD (UST) experienced a catastrophic crash, erasing billions in market value and shaking confidence in stablecoins.
FTX Collapse	Nov 2022	FTX, once the third-largest cryptocurrency exchange, filed for bankruptcy amid liquidity issues and allegations of misuse of customer funds, leading to widespread market turmoil.

Table 1.2: Notorious Market Shock Events in History

Looking at these market shocks that have occurred over the young history of cryptocurrencies, we can see that some of the events have led to attractor-like responses and some have led to repulsor-like responses as the size of the shock, immediate repercussions, timing, and eventual outcomes vary. Regarding attractor-like responses to these market shocks, the first was the DAO hack in 2016 as

this event led to a hard fork of Ethereum, creating Ethereum and Ethereum Classic. This hard fork was an attractor-like response as it showed the community's resilience and ability to come together to make a decisive action for the health and future of the Ethereum network. Too, the eventual outcome has proven to be successful as the growth of Ethereum has skyrocketed since it has been able to achieve more technological developments than Ethereum Classic with the Merge event where Ethereum moved to Proof-of-Stake whereas Ethereum Classic has remained using a Proof-of-Work consensus mechanism. Along with the 2016 hack, the SEC cracking down on ICOs in 2018 was also an attractor-like response; the SEC's increase in scrutiny and enforcement has been a net attractor as time has gone on due to this steering the market towards transparency and legitimacy. With ICOs being more regulated, the ecosystem's overall stability has improved, and more investors have been attracted to the ecosystem as they can proceed with more caution as opposed to a legal and financial wild west.

Although there have been attractor-like responses to cryptocurrency market shocks, there have also been repulsor-like responses as seen through events such as the Terra Luna Collapse in 2022. This bank-run event for the TerraUSD stablecoin led to massive investor losses as the currency collapsed with billions of dollars of market value being erased causing tragedy for those over-invested; too, this event led to major loss of confidence for the broader cryptocurrency market as people lost trust in other stable coins leading to other sell offs and a new perspective on trust. With the severity and size of this market shock, there was a heavy repulsor-like response from regulators, investors, and the public with aggressive increases in scrutiny legally and losses in investor confidence with a new skepticism, especially for stablecoins, being introduced. Moreover, another recent market shock which was a repulsor was the collapse of FTX in 2022. Because of the misuse and misplacement of user funds within the FTX centralized cryptocurrency exchange, FTX faced a liquidity crunch when withdrawals were made, leading to an eventual declaration of bankruptcy in November of 2022. This repulsor-like event caused issues that were far-reaching as many cryptocurrency assets saw price drops as investor confidence was heavily shaken, particularly for users who manage their cryptocurrency in a custodial wallet. Too, regulators worldwide were

alarmed by the event, leading to calls for more consumer protections and transparency in the crypto sector along with legal repercussions for FTX's founder, Sam Bankman-Fried, and other executives.

With the previously mentioned platforms which are actively used in the cryptocurrency landscape and the idea of market shock events and attractor or repulsor responses in mind, the goal is to look at these socio-technical dynamics across platforms to develop a framework to understand variance in response to shocks.

## **Chapter 2**

### **Case Studies**

#### **2.1 Overview**

This chapter presents detailed case studies that explore specific market shocks and their implications for the cryptocurrency ecosystem; the first case study examines the Ethereum Merge, a significant event that marked Ethereum's transition from Proof of Work (PoW) to Proof of Stake (PoS). It discusses the preparatory phases, community engagement, and the challenges faced during the transition, and the study analyzes the impact of the Merge on market dynamics, community activity, and environmental considerations. The second case study focuses on the collapse of FTX, one of the largest cryptocurrency exchanges, and its ripple effects across major cryptocurrencies. The chapter delves into the consequences of these shocks, highlighting the interconnectedness of the cryptocurrency market and the broader regulatory scrutiny that followed.

#### **2.2 Case Study 1: Single-Coin Shock**

The Ethereum Merge, marking the transition from Proof of Work (PoW) to Proof of Stake (PoS), stands as a pivotal event in blockchain technology, with far-reaching effects across the cryptocurrency landscape. This case study explores the comprehensive shift to PoS, highlighting its significance not only for technological innovation but also for its impact on market dynamics, community engagement, and environmental considerations. The motivation for moving away from PoW towards PoS centered around several key factors: enhancing environmental sustainability by reducing the blockchain's carbon footprint, improving network scalability and efficiency through

increased transactions per second and reduced transaction costs, and improving security measures to deter malicious activities via economic incentives such as staking [19].

The preparatory phase for the Merge involved extensive community discussions and consensus building, and Ethereum Improvement Proposals (EIPs) were crucial for outlining the technical specifications of the transition, soliciting feedback from developers, validators, and the broader community. Platforms like Reddit, Twitter, and Ethereum forums facilitated wide-ranging discussions, while developer conferences and meetups offered opportunities for deeper technical engagement and live Q&A sessions. The implementation and testing process was thorough, utilizing testnets to simulate the PoS mechanism, alongside shadow forks to practice the transition in conditions mirroring the mainnet. This approach allowed for stress testing under various scenarios, bug identification, and performance optimizations, supported by continuous monitoring and feedback loops to refine the transition process and ensure things went smoothly [5].

Analyzing the data across platforms pre and post-Merge reveals interesting insights into the transition's effects. The study examines changes in Discord messages, Reddit posts, and GitHub commits during the months leading up to and after the Merge which occurred on September 15, 2022. Beginning with Discord messages, one can see that the Discord activity had been high in the beginning of June due to Ethereum plummeting in price due to the Nasdaq 100 also crashing, and, as the Merge approached, the activity on Discord continued to increase after the spike and fall off from the market price crashing (see Figure 2.1). This growth in message activity steadily continued until large leaps began to occur at the end of August into large peaks in September as users flocked to the Discord channels to discuss the Merge event and the implications of what would be to come. Many communities came together in excitement during this time due to the significant development in technology being very promising for decentralized opportunities in the future [6].

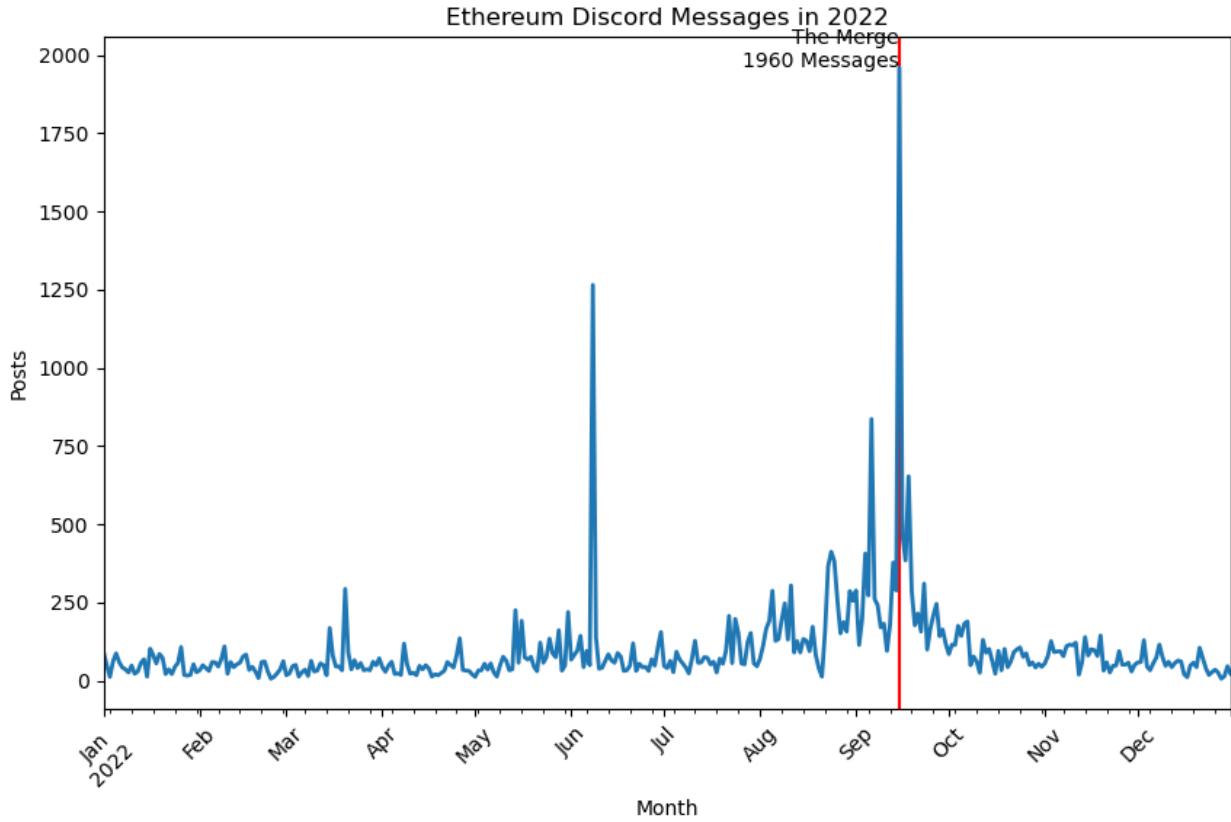


Figure 2.1: Ethereum Discord Messages in 2022

During this same time period, Reddit was seeing stagnated Ethereum activity averaging 50 to 100 posts per day; however, once the Merge occurred in September 2022 there was an increase in posts related to Ethereum in the days leading up to and on the day of the market shock event (see Figure 2.2). This activity then decreased for the remainder of the year, signaling that this spike in activity was more than likely related to the Merge event and demonstrates Reddit's ability to capture insight on these dynamics. Given the most significant increase in activity prior to the end of the year was the day of the Merge, it is apparent that users were more active on Reddit that day making posts and discussing Ethereum's latest development which would alter the broader cryptocurrency landscape.

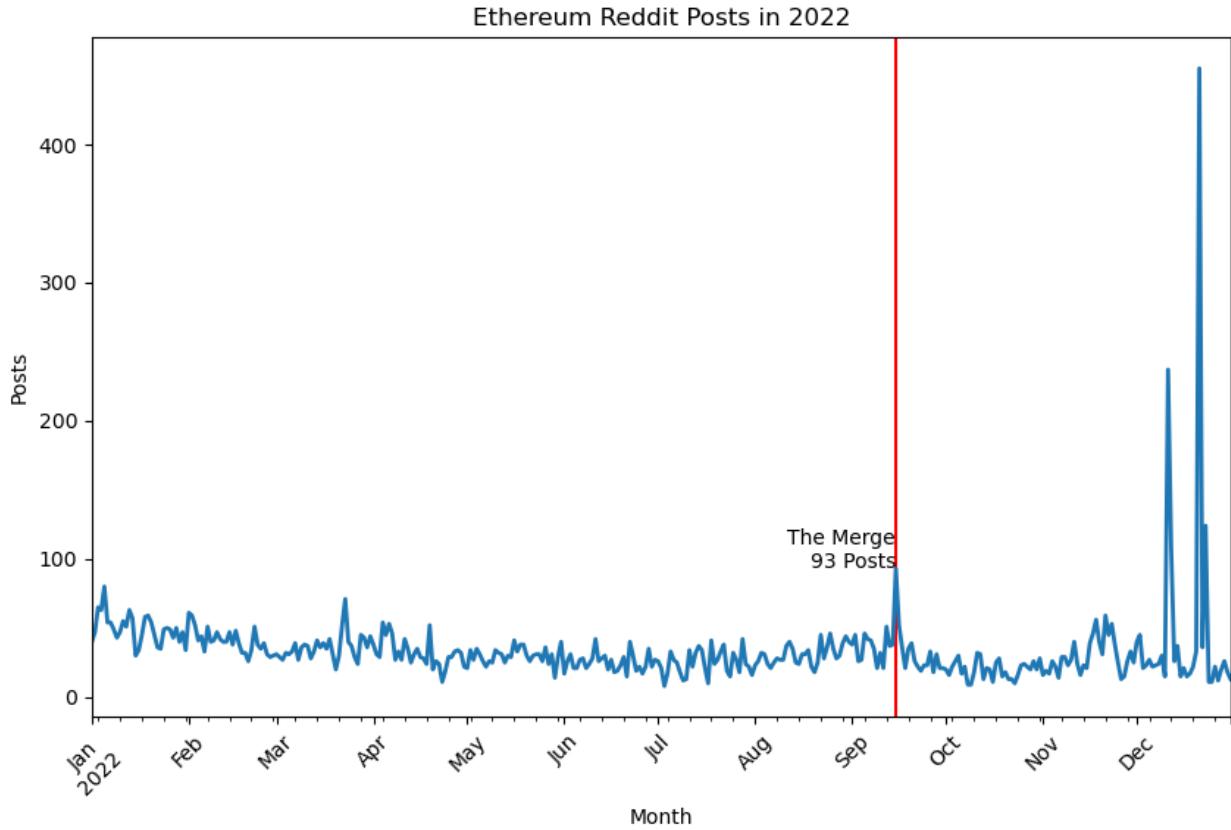


Figure 2.2: Ethereum Reddit Posts in 2022

Lastly, regarding GitHub, there was a mostly consistent frequency of commits being made with some spikes such as April 2022 which, interestingly, correlates with the last time that Ethereum has hit a price of \$3000 (see Figure 2.3). The other spikes in GitHub activity seem to correlate with positive market movements – this data seems to indicate that the testnets or branches were more critical in developing for the Merge than the primary repository. Too, the lack of GitHub commit activity, particularly after the Merge, indicates the massive success of the complex transition; developers having little activity outside of private development spaces shows how the preparatory phases leading up to the Merge were done effectively and efficiently to not cause any large issues with such a large change as altering the underlying foundation of one of the most used and largest decentralized networks.

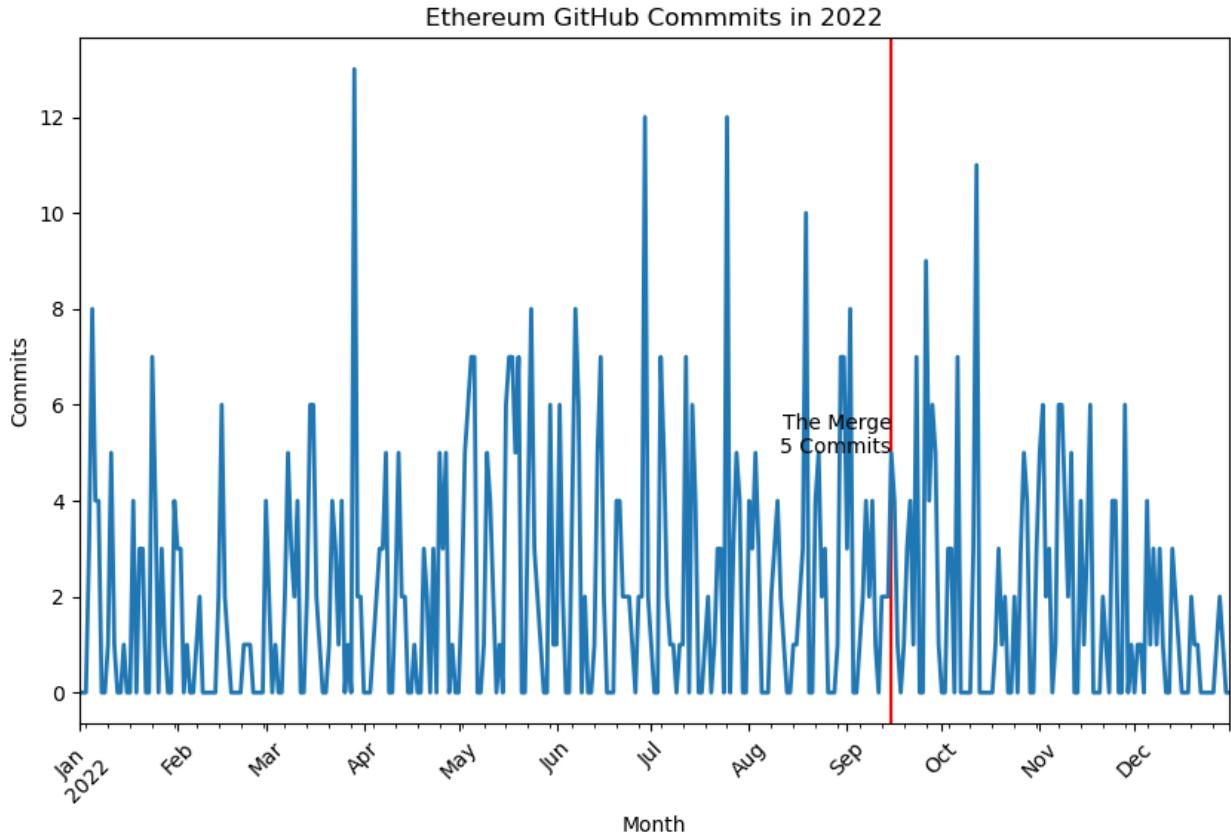


Figure 2.3: Ethereum GitHub Commits in 2022

### 2.3 Case Study 2: Multi-Coin Shock

The dramatic collapse of FTX, once a titan in the cryptocurrency exchange landscape, serves as a pivotal case study in understanding market shocks within the digital asset space. This event not only underscored the vulnerabilities inherent in the cryptocurrency market but also catalyzed significant repercussions for leading exchanges like Binance and a wide spectrum of cryptocurrencies, including Bitcoin, Solana, Cardano, Polygon, and Dogecoin. This analysis delves into the specifics of these impacts, tracing the shockwaves from the epicenter at FTX to the broader ecosystem.

Binance, founded in 2017, quickly ascended to the top of the cryptocurrency exchange world where it acts as a middle man for users to streamline cryptocurrency transactions. Its comprehensive suite of services, including trading, asset management, and initial coin offerings (ICOs), coupled

with a robust security framework and user-friendly interface, attracted a vast global user base. The platform's significance is not only in its size but also in its role as a barometer for the cryptocurrency market's health and sentiment. Despite the foundation of direct peer-to-peer transactions, the volatility and complexity of the cryptocurrency market necessitated the emergence of exchanges for some users to feel comfortable. These platforms facilitate liquidity, enable price discovery, and provide a semblance of stability in a notoriously turbulent market. However, this centralization brings its own set of vulnerabilities, especially to regulatory interventions and can cause other security and ownership issues given the user's wallet being managed by a centralized institution as opposed to self-managed (i.e. custodial vs non-custodial wallets, respectively where the institution controls your private keys) [29].

The unraveling of FTX on November 11, 2022 was brought to light by revelations concerning the mishandling of customer funds and risky financial practices tied to its affiliate, Alameda Research. The crisis was exacerbated when Binance, signaling an initial intention to acquire FTX, retracted the offer upon closer inspection of FTX's compromised financial state and potential regulatory entanglements. This withdrawal marked the beginning of the end for FTX, culminating in its bankruptcy and a profound market shockwave. Binance's aborted acquisition attempt of FTX, while a practical move, thrust the exchange into a tailspin of market and regulatory scrutiny. In the immediate aftermath, Binance saw an uptick in user migration from FTX, seeking refuge in its perceived stability and security. However, the incident has also heightened regulatory vigilance globally, with Binance facing increased scrutiny over its operational and compliance protocols. This has led to a strategic recalibration by Binance, focusing more intensely on compliance and transparency to solidify trust and ensure long-term sustainability as previously mentioned in Chapter 1 [13].

## **2.4 Spillover Effects on Cryptocurrencies**

Despite being the flagship cryptocurrency, Bitcoin experienced heightened volatility in the wake of the FTX collapse, and its price decreased significantly after a large selloff just prior to the market shock, staying low until the end of the year. Bitcoin's market activity in the face of such

turmoil reaffirmed the volatile nature of cryptocurrency, even for established assets, and this can be shown through the Discord message activity increasing heavily during and in the wake of FTX's collapse (see Figure 2.5). This is demonstrative of how one of the founding cryptocurrencies is still a central hub for many members of the crypto market; users likely flocked to these message channels to discuss the market shock occurring either as partially involved members or full investors due to Bitcoin being well known by more individuals generally than other cryptocurrencies. The quick decline back to more regular Discord activity numbers also indicates that this spike was because of the collapse of FTX and the ensuing market movements – reaffirming the fact Bitcoin's foundational position in the cryptocurrency landscape causes users to tend to flock to larger communities in times of shock for social interactions and information exchange. Too, this demonstrates Discord's place in the cryptocurrency landscape being an outlet for investors and speculators to come together and discuss during market shocks; investors likely came together to panic over the selloff in the days prior to the bankruptcy declaration and discuss financial outlooks, and speculators likely came together to be an observer to the panic and have conversations on the broader ecosystem with such a large entity as FTX collapsing.

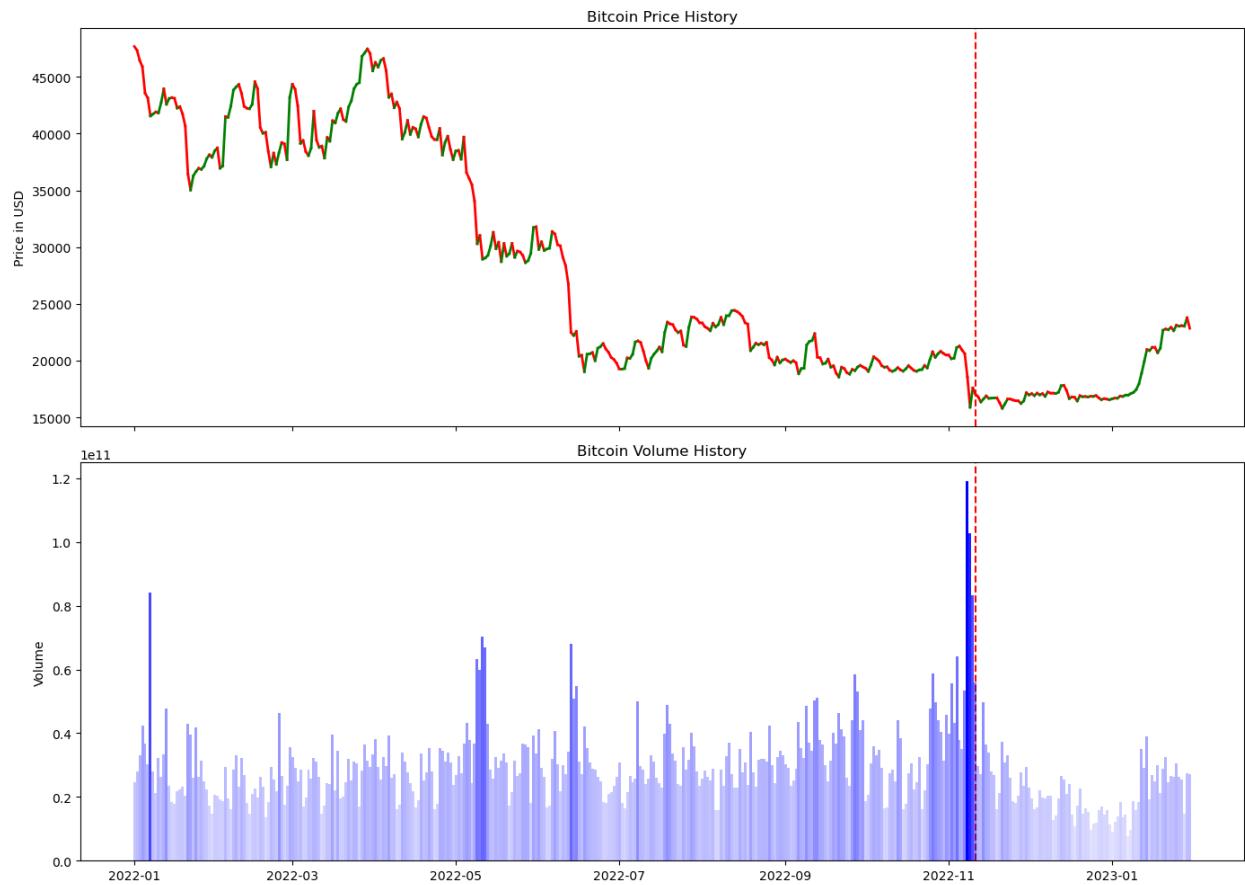


Figure 2.4: Bitcoin Price and Volume History in 2022

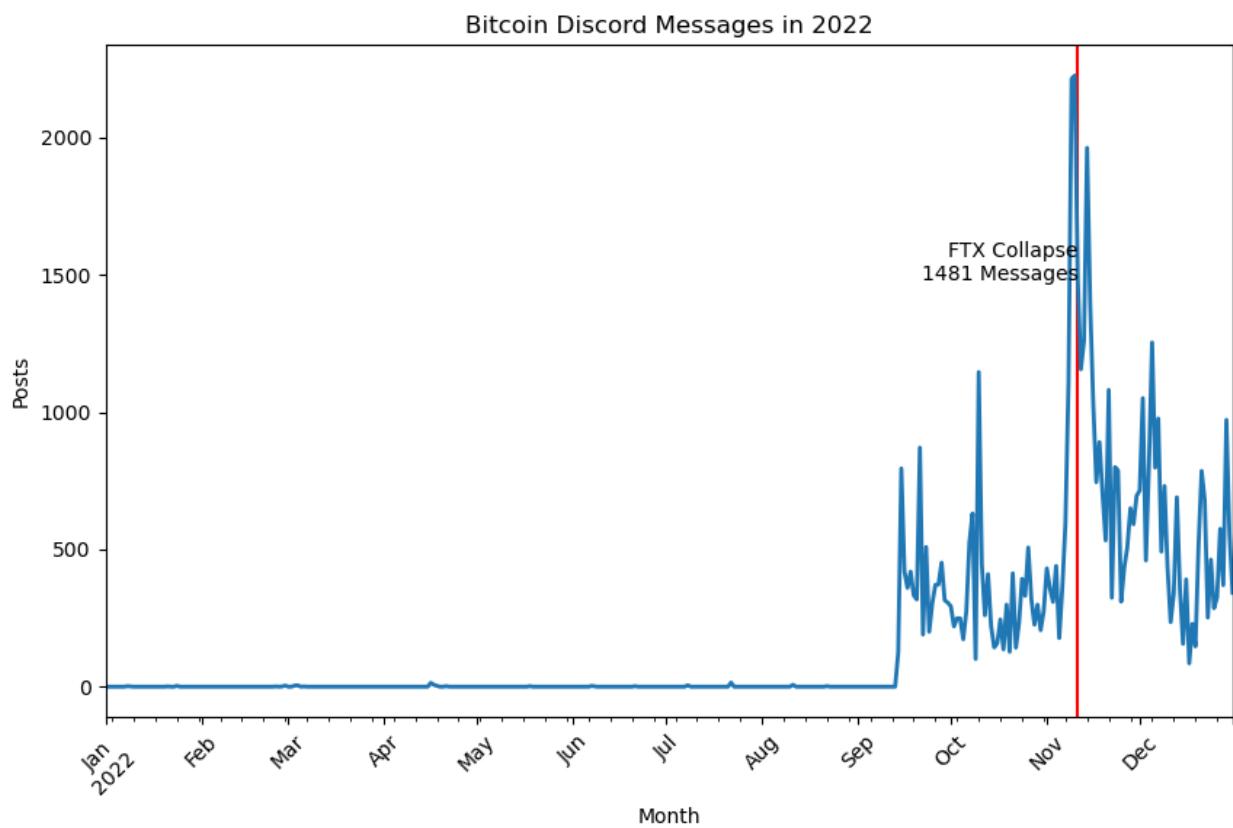


Figure 2.5: Bitcoin Discord Messages in 2022

Solana (SOL) was among the hardest-hit cryptocurrencies, given its close association with FTX; Alameda Research was a significant holder of SOL, and the collapse led to a mass liquidation, causing Solana's price to plummet [25]. Between the price movements of SOL and the consequences of FTX's collapse on the trust and perspective of the landscape, Solana's Reddit activity began to increase significantly in November after decreasing since September (see Figure 2.6). This could be an indication that investors were concerned and more discussive about recent events and the future. Too, this pattern of Reddit data almost exactly matches the movements seen in price and volume during the same time frame; the matching of movements across the market and Reddit activity shows that users could have also been more active due to the price decrease and sell off taking place before and during the collapse of FTX, early in November 2022. These graph depictions highlight how Solana's community experienced a repulsor-like response to the market shock as the financial metrics declined as well as the social metrics after the community came together in panic and lost confidence as more news came to light.

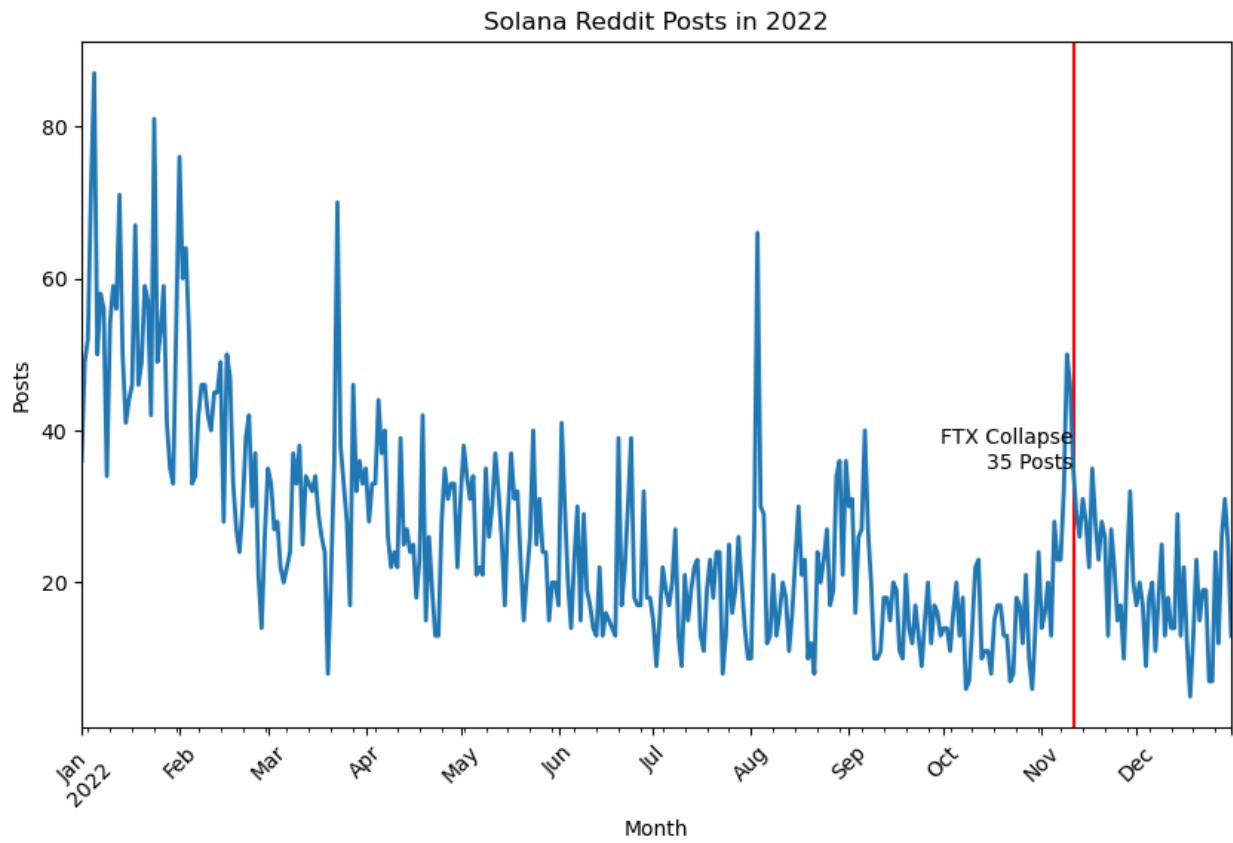


Figure 2.6: Solana Reddit Posts in 2022

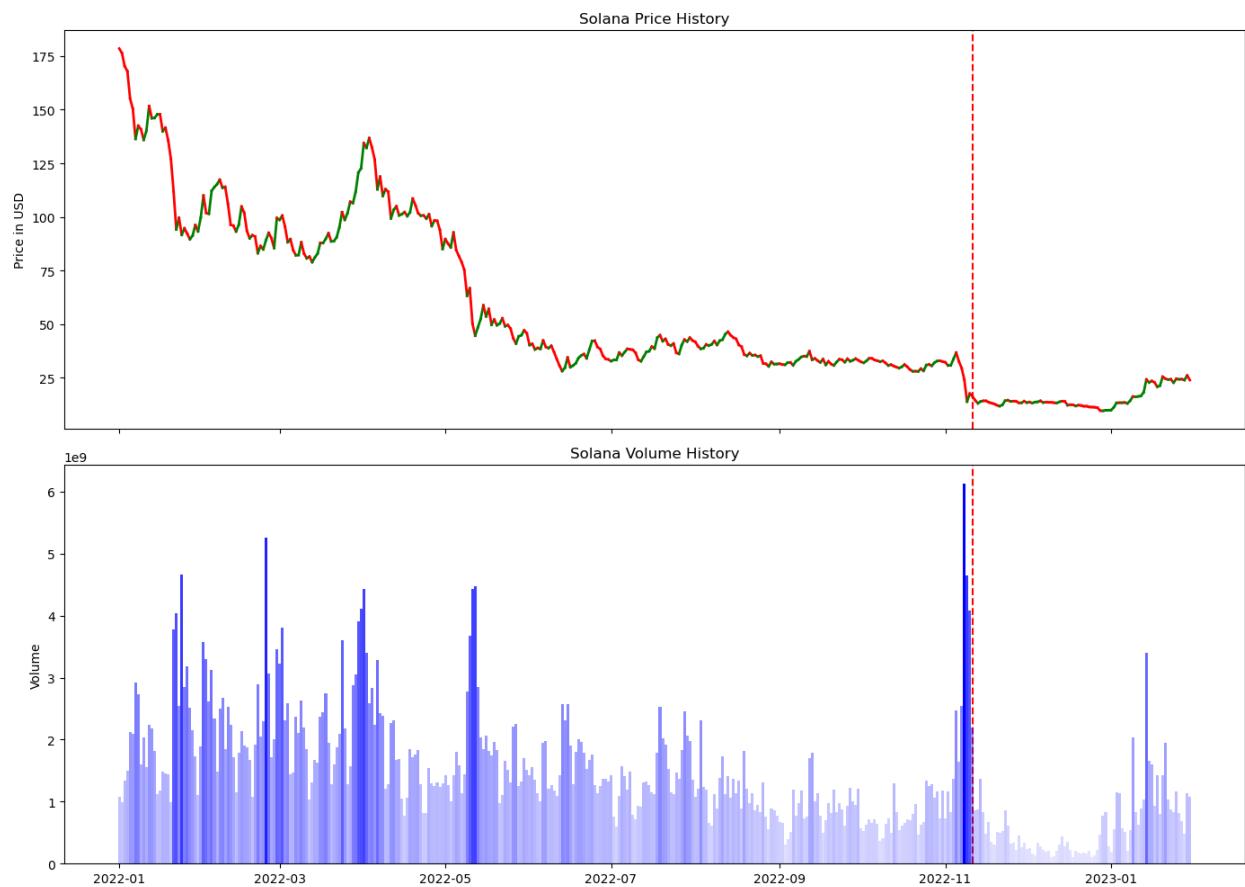


Figure 2.7: Solana Price and Volume History 2022

The collapse of FTX significantly impacted the cryptocurrency market, including Cardano and Polygon, primarily by undermining investor confidence and triggering a market-wide value decrease, with Polygon taking a more significant hit than Cardano (see Figure 2.8). This event led to a more fear driven investment climate, potentially affecting liquidity and funding for projects within the Cardano and Polygon ecosystems, and development might have faced delays due to increased risk aversion and scrutiny. This is exemplified by the selloff leading up to the collapse in the graph where volume spikes and the price decreases as the market has a repulsor-like response to the market shock of FTX declaring bankruptcy. Although the market data for Polygon and Cardano during this market shock reflect a communal response, the social and development platforms did not demonstrate any recognizable patterns in activity leading up to, during, or after the collapse. This could be an indication of users being active in other spaces during this time, such as larger communities like Bitcoin's Discord which saw activity increases from this event, or referencing these assets less due to other news being the focal point and not as commonly related.

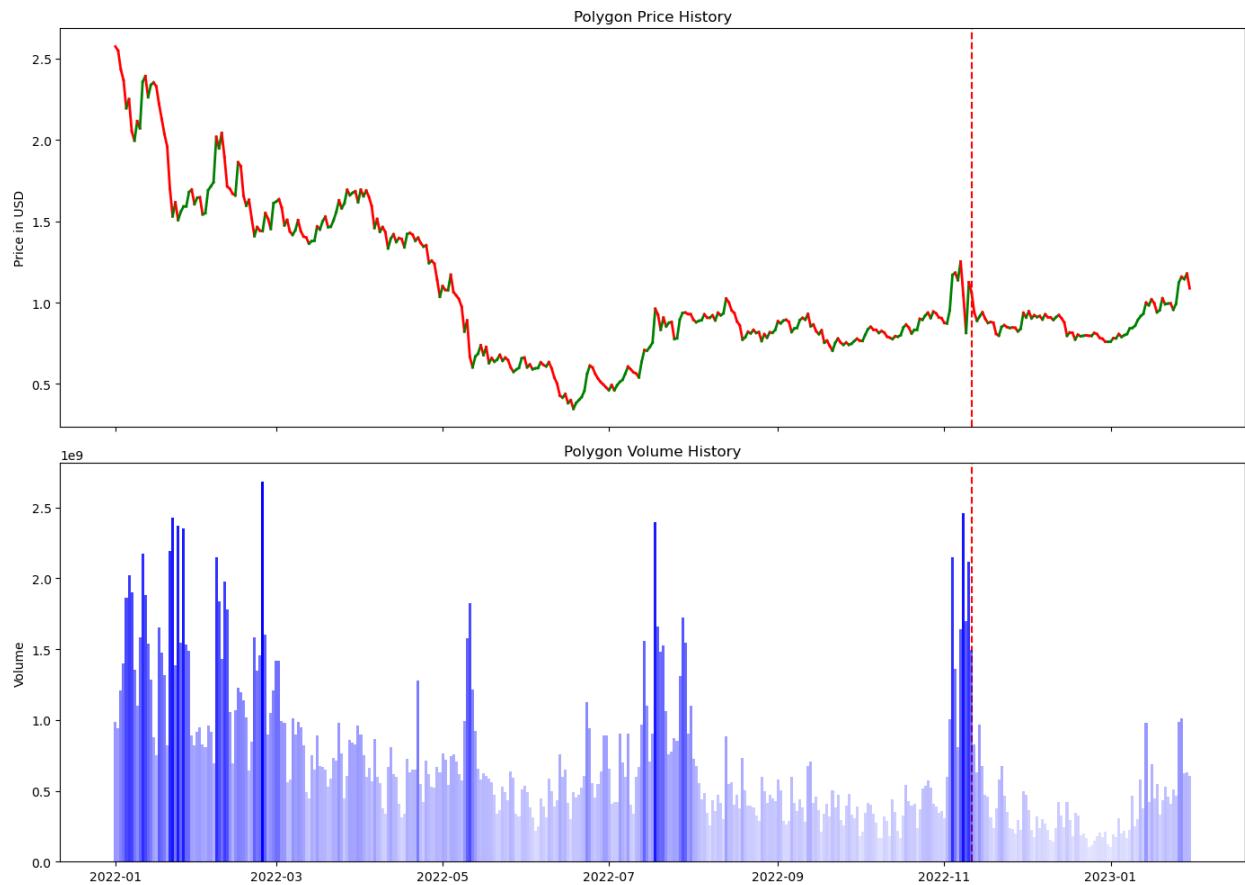


Figure 2.8: Polygon Price and Volume History 2022

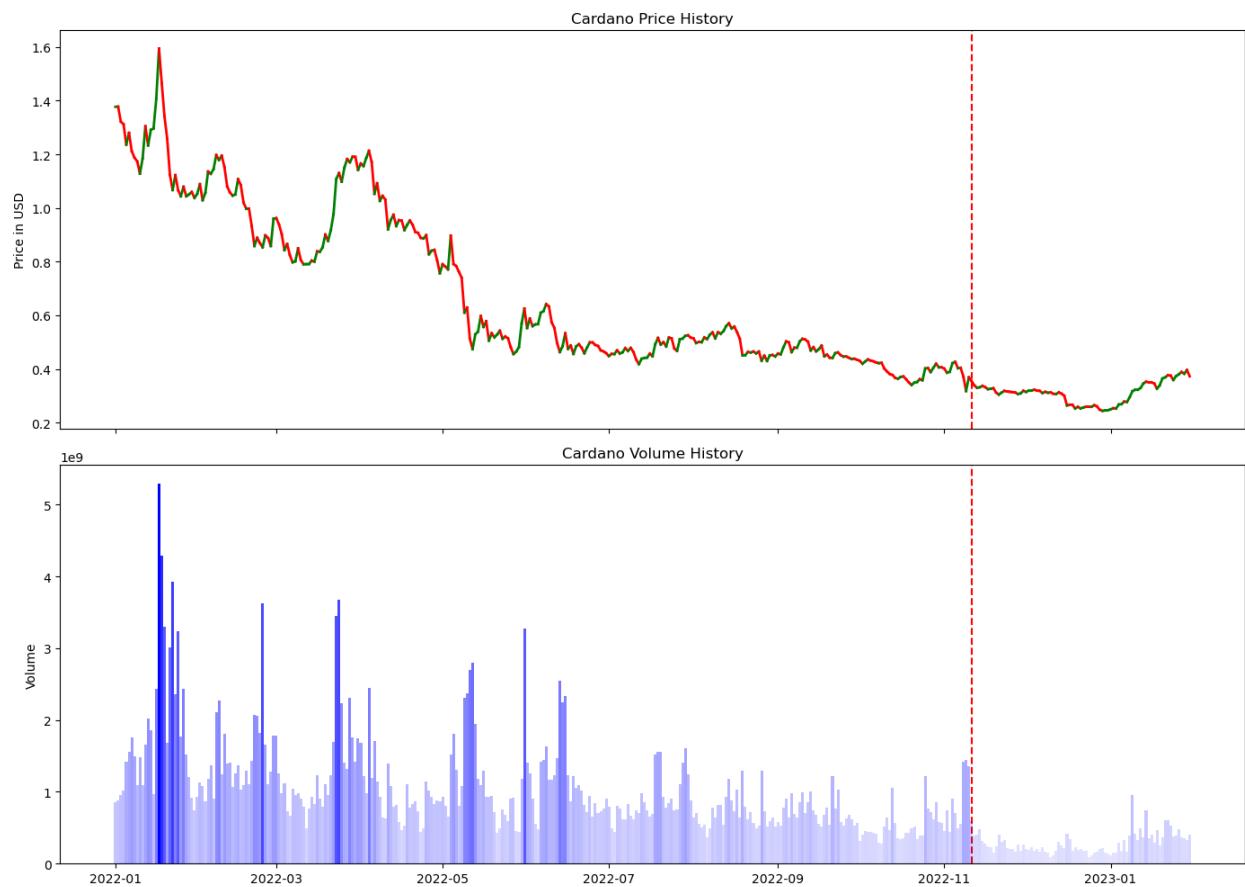


Figure 2.9: Cardano Price and Volume History 2022

Dogecoin's reaction to the FTX collapse was demonstrative of the broader altcoin market's vulnerability to sentiment-driven shifts. As a meme coin, DOGE is particularly susceptible to market sentiment, and the news of the impending FTX incident led to a major decrease in price just prior to the market shock event with massive selloffs happening just before and at the beginning of November 2022 (see Figure 2.10). This quick series of market movements then led to Dogecoin crashing in price and volume in the days leading up to the collapse, and the cryptocurrency would end up staying in that pit until the end of the month. The beginning of December 2022 is when investor's likely returned to the asset after ensuring it would not continue crashing in the wake of FTX's dilemma; this is shown through the price and volume increasing post collapse until the end of the year. The following decrease in price with little change in volume in the market goes on to demonstrate the lasting effects of the market shock event on the broader cryptocurrency landscape – assets continued to lose value due to regulatory and investor scrutiny after such a large collapse despite not being directly involved or collapsing itself. This pattern is somewhat reflected in the Discord activity data as well with a large spike occurring in the few days prior to FTX's collapse; the influx of messages on the platform can likely be attributed to discussion surrounding the current events and what was going to come from the exchange's implosion. The price regrowth is also reflected in the Discord activity as in the weeks after the market event the activity stayed low compared to the historical data, but at the end of the year, when the price of Dogecoin began to recover, the Discord activity began to increase as community members rebuilt their confidence, and the damage from the November collapse would slowly heal, regarding the broader ecosystem.



Figure 2.10: Dogecoin Price and Volume History 2022

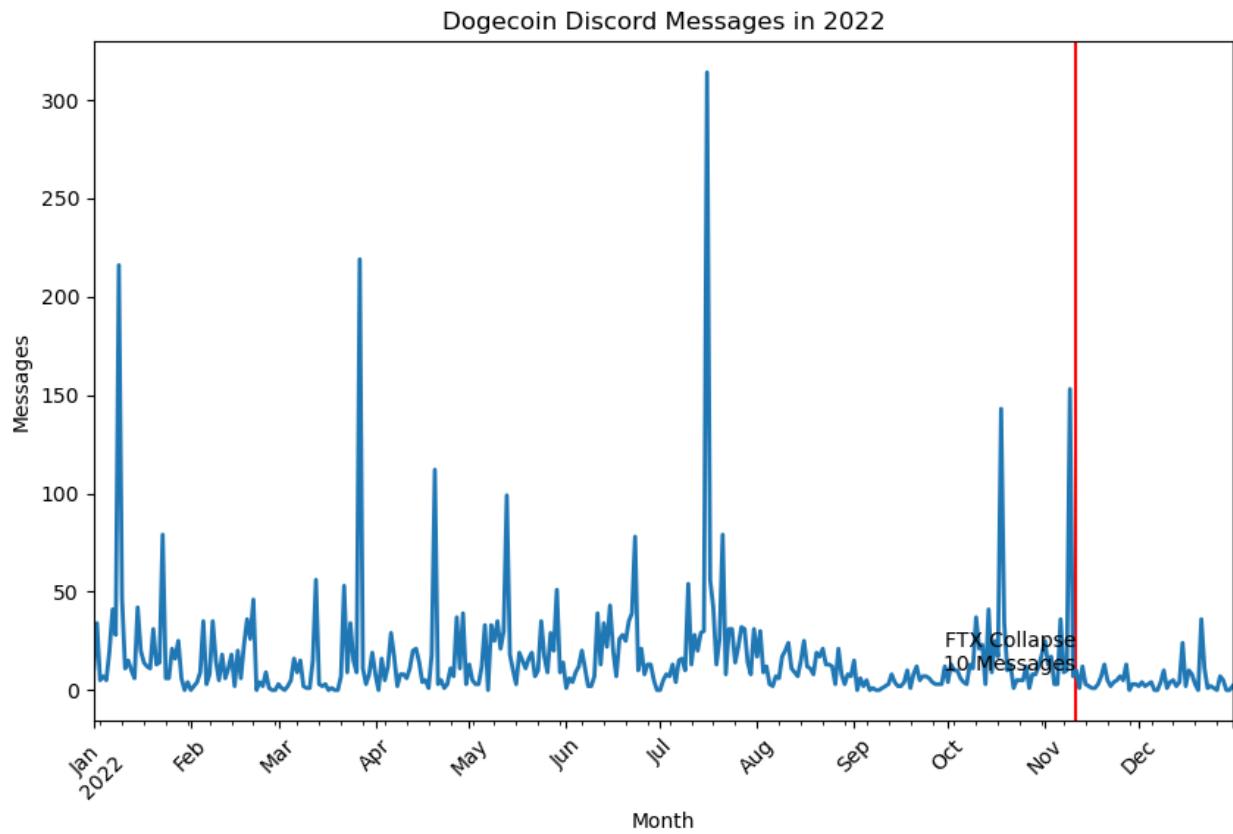


Figure 2.11: Dogecoin Discord Messages in 2022

The FTX collapse constitutes a watershed moment for the cryptocurrency industry, spotlighting the need for rigorous oversight, enhanced transparency, and improved operational integrity. For Binance and other exchanges, the incident has led to a strategic introspection, pivoting towards enhanced compliance and user protection measures; moreover, the diverse impacts on Bitcoin, Solana, Cardano, Polygon, and Dogecoin reveal the complex reliances and varying degrees of resilience within the cryptocurrency ecosystem. This event not only serves as a cautionary tale but also as a demonstration of the way these coins can be simultaneously affected by market shock events across platforms.

## **Chapter 3**

### **Single-Coin Multi-Platform Analysis**

#### **3.1 Overview**

In this chapter, the analysis shifts to individual cryptocurrencies and their activity across multiple platforms, Reddit, Discord, and GitHub. It explores how social and development platforms correlate with market performance, focusing on price and volume trends. Too, the chapter examines the relationships between platform activities and market behavior, identifying patterns and providing insights into the complex socio-technical ecosystem of cryptocurrencies. The results reveal varying levels of correlation between platform activity and market dynamics, demonstrating the influence of community discussions and development activity on cryptocurrency trends which sheds light on the broader impact of these platforms in shaping investor sentiment and market movements.

#### **3.2 Data**

The first dataset collected for this analysis was the Reddit data which came from Academic Torrents; specifically the dataset was the top 40,000 subreddits' historical data from June 2005 to December 2023. Out of these subreddits, the ones pertaining to the cryptocurrencies being analyzed were selected and downloaded from the torrent using qBittorrent. With these files downloaded, the next step was analyzing the ZSTs with Glogg, an application for searching through long, complex files, due to their size and finding the appropriate fields to have as columns in the CSV files they would be changed to. These fields included: subreddit, author, title, score, created\_utc, and selftext,

and the Zstandard python library was then used to create a script which converted the ZST files to usable CSVs. Another script was then made to combine these CSVs into one which would serve as the whole of the Reddit data.

Next was the Discord data where an application called DiscordChatExporter by Tyrrrz on GitHub was used to collect the different servers' message data. An account was created and joined the eight cryptocurrencies' most official and active servers; the account's token was then used with the application where remote access was gained and one is able to click through and download the channels they desire from each server. In this case, the most active and general channels were taken to capture where the most conversations were being had in each server. The same steps were then taken where a script was created to combine these downloaded CSV files in order to have all Discord data in one place.

The final dataset obtained was from GitHub; for this data the command line interface was used to clone into each of the cryptocurrencies' most official and active repositories. From there, git commands allowed for the download of each repository's commit history, and the same step was taken where a script was used to combine the CSVs for a master GitHub data file. All three files (Discord, Reddit, and GitHub which had all been combined) were then combined to create a master data frame for analysis.



Figure 3.1: Bitcoin Price and Volume History (All Time)

The first within-token cross-platform analysis conducted was on the data pertaining to Bitcoin. This data was taken and a line graph was created for messages over time since each platform's beginning. From each platform's graph, the first note was Discord not being very similar to either other platform movement wise, capturing little activity until mid 2022 when Bitcoin's price fell in the wake of a market shock event where TerraUSD and Celsius collapsed sending shockwaves through the cryptocurrency landscape (see Figure 3.2). Too, the spike leading up to and into 2024 can be attributed to the Bitcoin ETF approval where the SEC allowed types of securities which track the underlying performance of the Bitcoin cryptocurrency (CFTC Bitcoin Futures ETF, n.d.). The next platform was GitHub which did share a spike in commit activity with Reddit posts near the beginning of 2021; this spike in both datasets is most likely attributed to Bitcoin having hit its all-time high price in early 2021. This would naturally lead to more discussions being held on Reddit, which is reflected in the data, and it seems that with the price increases the developers were rolling out more commits within their repository (see Figure 3.4). Lastly, Reddit demonstrates the same spike as GitHub as well as large spikes during its beginning period and its 2018 spike was due to Bitcoin going from an all-time high in December 2017 to an extreme crash throughout 2018 [3]. Based on these observations, Reddit and GitHub appear to have the strongest relationships due to both platforms demonstrating an attractor-like response to the all-time high price in 2021. This is likely due to the inactivity of Discord at the time as a community tool, and with the large price increases Reddit would naturally become ground for discussion and speculation of the market shock event while developers may have made more commits to keep up with any technological issues or advancements in the wake of increased activity online and in the market. Regarding the platform activity versus the market data, Bitcoin's price and volume only seem to be correlated with Reddit activity with 2018 and 2021 showing very clear patterns of mentions increasing in parallel with the price and volume as opposed to the young Discord not having as much activity and the GitHub following a development cycle that appears independent from market performance metrics (see Figure 3.3). The 2018 instance appears to be a time where Reddit led to the market performance increase as the Reddit activity had been steadily increasing for some time prior to the

price and volume spike – this was during the time of the 2017-2018 crypto boom and bust where performance improved drastically across the market before falling; the 2021 instance then seems to be the opposite where the price and volume began increasing and spiking, leading to an influx of Reddit activity due to excitement over the market performance and speculation.

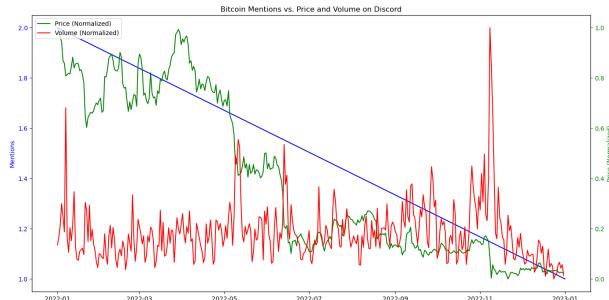


Figure 3.2: Bitcoin Discord Mention History vs Price and Volume (All Time)

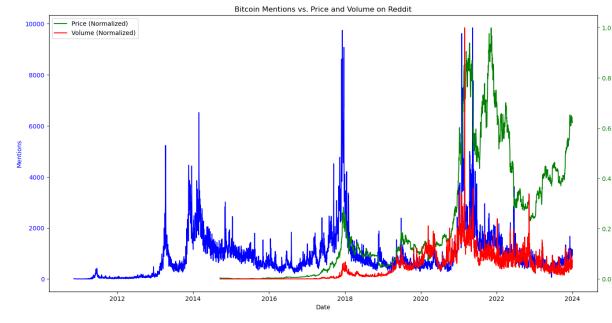


Figure 3.3: Bitcoin Reddit Mention History vs Price and Volume (All Time)

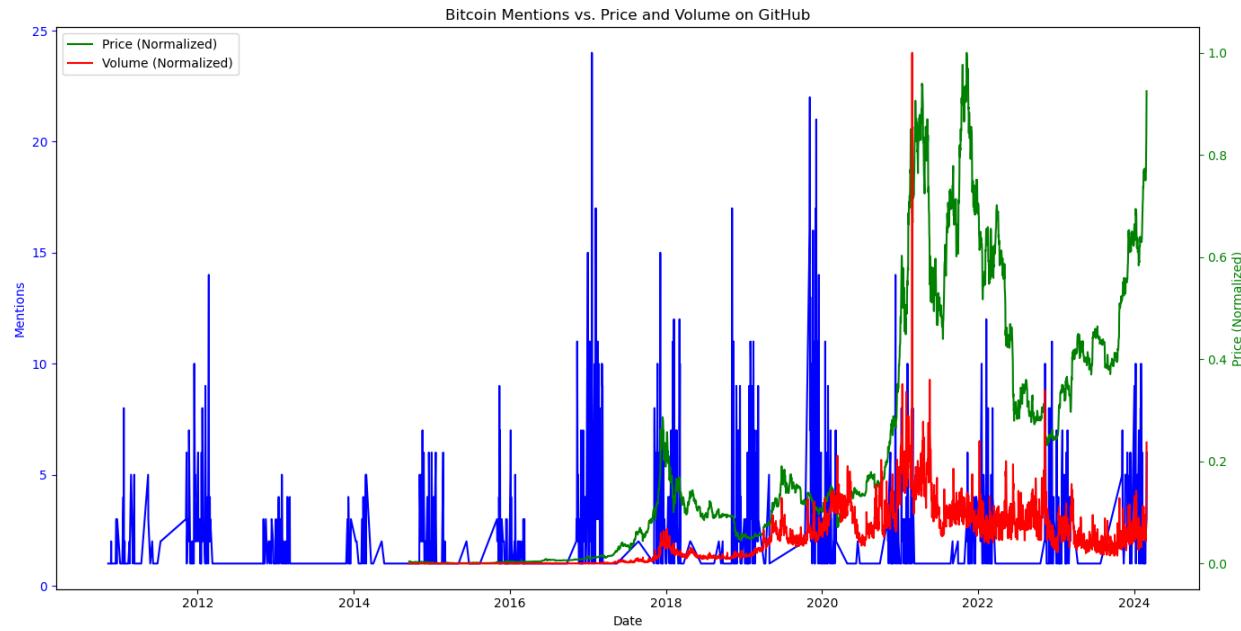


Figure 3.4: Bitcoin GitHub Mention History vs Price and Volume (All Time)

### 3.3 Ethereum

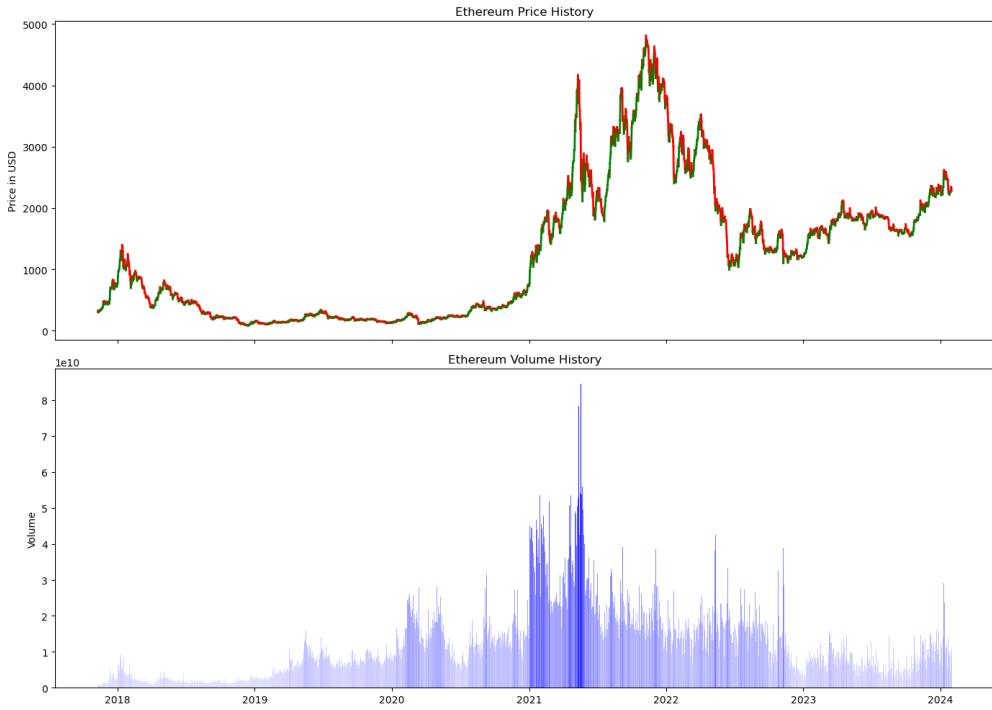


Figure 3.5: Ethereum Price and Volume History (All Time)

Moving to Ethereum's various platform data, the first observation was GitHub having its own shape in comparison to the other two, signaling that developer activity may not be corresponding to social activity as often. The activity shows that there were many commits being made from 2014 to mid 2015 before they tapered off and stayed consistent until today (see Figure 3.8). This would represent the initial building period for the project given that it aligns with Ethereum's launch date of July 2015 where activity declines quickly due to less work being done post-release. Regarding Ethereum's Discord activity, there is a massive spike in 2020 due to the COVID-19 pandemic's effects on sell-offs; after hitting a very low price in the beginning of 2020, Ethereum rose the rest of the year at a rapid rate. This would align with increased Discord activity as investors would be more communicative about the asset and the speculation surrounding it (see Figure 3.6). Too, the spike in 2022 in Discord activity represents increased messaging during the Merge period. This was likely Ethereum users and investors going to the Discord to ask questions and discuss where more in depth

information is typically provided in cryptocurrency communities. Last was the Ethereum Reddit data, which has the strongest relationship with Discord compared to the other platform pairs. The Reddit data also reflects the 2020 spike that Discord did; however, where Discord activity began to trend down in 2021 Reddit activity went even higher as the price of Ethereum continued climbing into the beginning of the year reaching record prices with the increase in popularity of digital assets that year between NFTs and cryptocurrencies themselves (see Figure 3.7) (Ethereum Price History, 2022). This is an interesting split given both platforms being social facets of the Ethereum community, but Reddit stayed active for longer before tapering down. Moreover, the Reddit data also reflected an increase in activity at the end of 2022 in response to the market shock of the Merge event, as well as the price with the price drop reversal and increase prior to 2023. Both Discord and Reddit capturing this market shock event demonstrates a possible connection between social platforms having increased activity during market shocks in the cryptocurrency landscape. Like Bitcoin, Ethereum's Reddit activity and its market performance seem highly related as opposed to GitHub where commit activity is on an observable cycle unrelated to the market and Discord where there is not a clear relationship between messages and price or volume apart from some instances of increased messaging during times of declining volume. Ethereum's Reddit activity seems to mimic the volume and price as seen through all three metrics decreasing together in 2018 during the crypto bust and increasing in 2021 when the market was flourishing during the COVID-19 pandemic and NFTs became a social phenomenon. These patterns are sensible given the history, the 2018 bust drove many investors away given the large losses suffered by some leading to a decrease in online activity for the landscape overall; the 2021 instance is then because of a large increase in investors during the pandemic joining in on the bolstering of cryptocurrency prices at the time. The monetary success of Ethereum led users to join the community and get involved, leading to increased Reddit activity and an increase in volume given the new investors entering the scene.

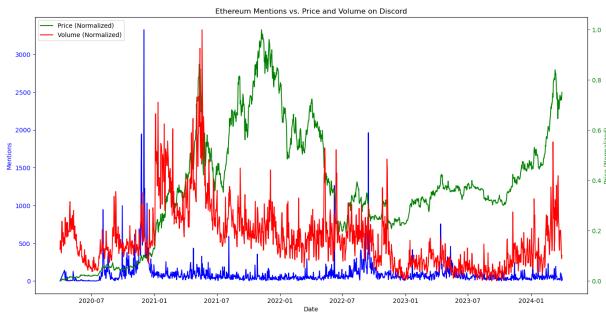


Figure 3.6: Ethereum Discord Mention History vs Price and Volume (All Time)

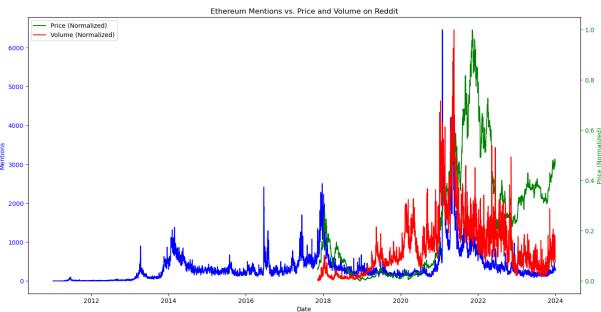


Figure 3.7: Ethereum Reddit Mention History vs Price and Volume (All Time)

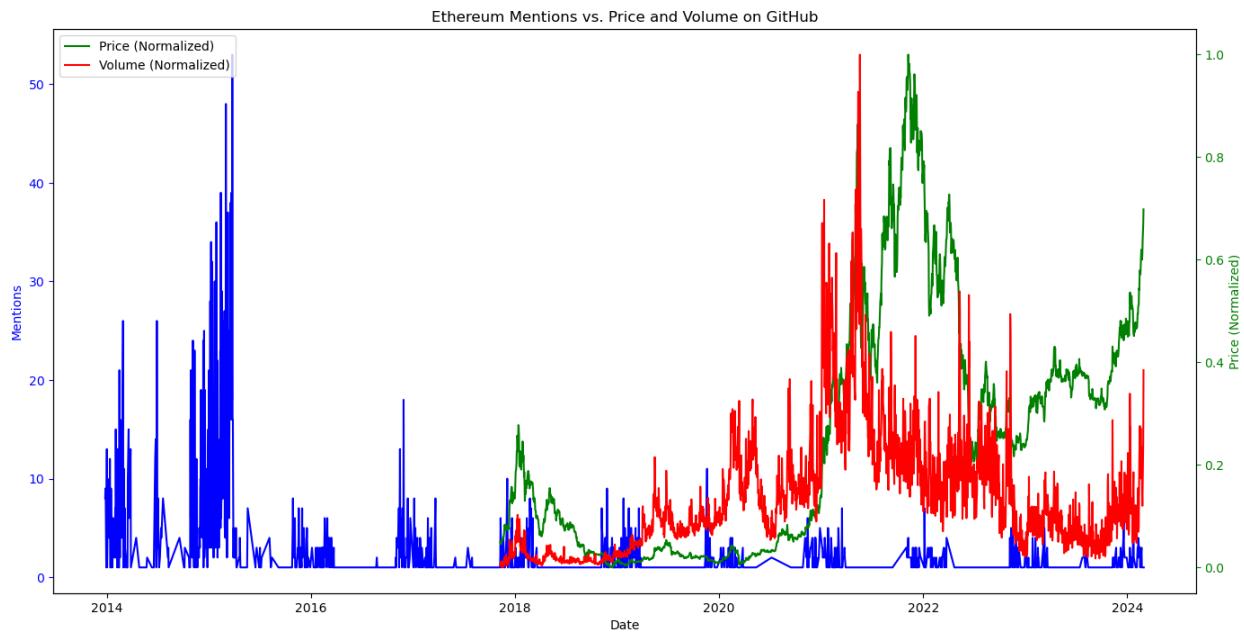


Figure 3.8: Ethereum GitHub Mention History vs Price and Volume (All Time)

### 3.4 Dogecoin

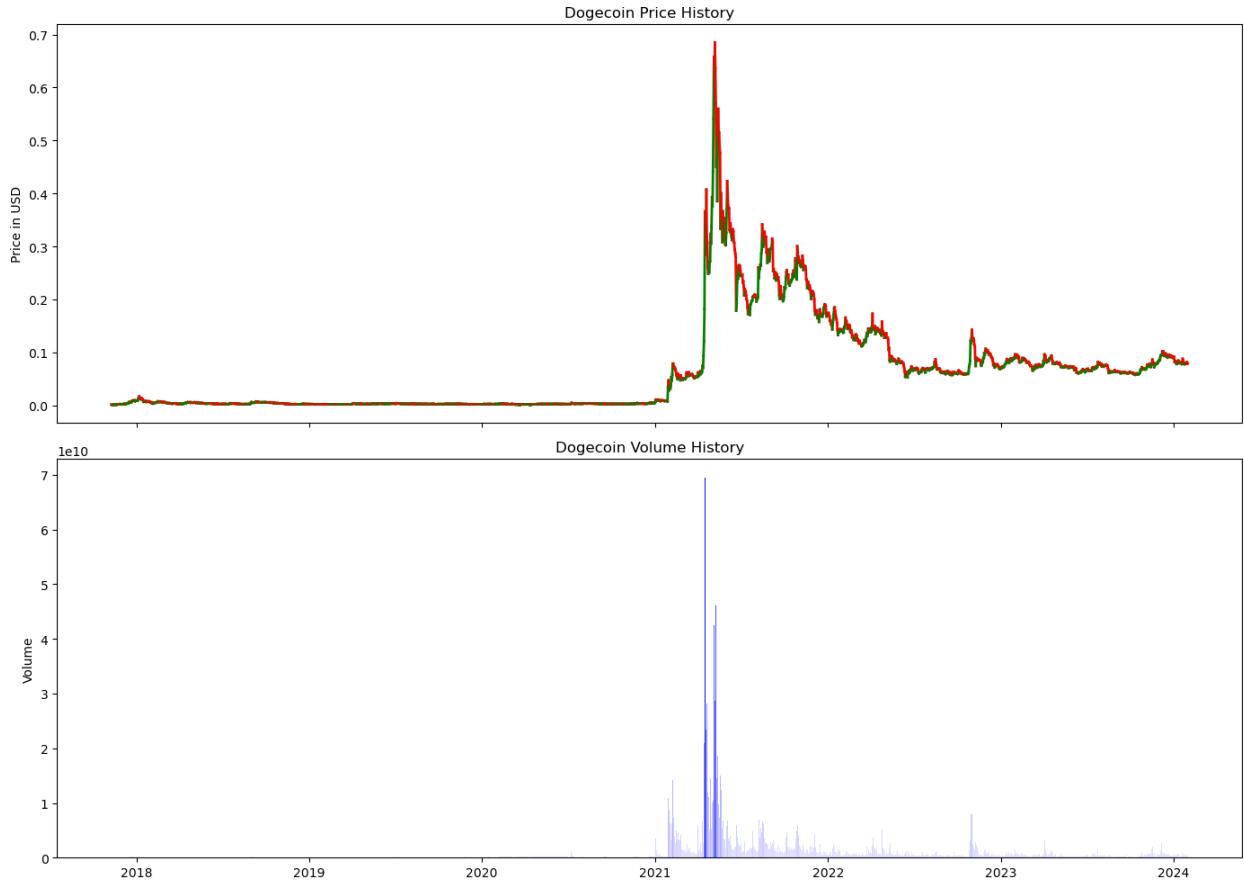


Figure 3.9: Dogecoin Price and Volume History (All Time)

For Dogecoin's data across platforms, the first set was Reddit where the activity spikes at the beginning of 2014 and twice in quick succession during 2021 (see Figure 3.11). The 2014 spike was likely due to more discussions with Dogecoin as the subject due to the launch of a crypto tipping service which utilized Dogecoin as well as Dogecoin being used to raise money for charitable causes. In 2021, Dogecoin started the year seeing massive price increases until it hit an all-time high in May of that year; this would likely be why there was such an increase in activity on Reddit related to Dogecoin as investors and speculators were heavily promoting and discussing the asset and how high the prices would go. The next set of data from Discord where the first spike came with the

server's genesis in 2016 as well as when Dogecoin's price was increasing after stagnation prior to the looming cryptocurrency bubble, the cause of the second, more minor, spike in 2018. The next small increase in activity in the middle and end of 2020 can be attributed to the price beginning to surge after a bad start to the year – this was also the time of the pandemic where cryptocurrencies as a whole began to surge as more investors participated [7]. The two back to back large spikes in Discord activity come from the price continuing to increase into 2021 with lots of attention being put on it by the public and investors online; however, the sharp fall seen around mid 2021 would likely be because of the significant price drop the asset faced after Elon Musk made remarks about Dogecoin on Saturday Night Live after it's recent massive gains in the market (see Figure 3.9 and Figure 3.10). This led to a massive sell off where Dogecoin went down about 30%, leading to a loss in investor confidence and more skepticism of the humorous asset [26]. Lastly, the GitHub data reflects early increases in development beginning in 2009-2010 and leading up to a massive peak prior to 2013. This reflects Dogecoin's prerelease development phase as the project was not released until December 2013. The commit activity then went on to decrease with some fluctuations up and down as the cryptocurrency evolved and improved technologically until 2017 when the cryptocurrency bubble burst. The sudden and sharp decrease in commits from 2017 likely came from the crypto burst leading to developers slowing down or stopping working on projects that may have seemed hopeless [3]. From there the right side of the graph from 2021 to 2023 represents the reactivation, in a sense, of the project as the asset began to gain traction online again with the pandemic cryptocurrency market and online support (see Figure 3.11). Among this data, the GitHub graph represents almost an opposite narrative than Reddit and Discord; the GitHub data shows that the development activity via commits was very active before and for the first few years after the project was released, but the Discord and Reddit data show increases in activity for market shocks exclusively. This demonstrates that social platforms may be more likely to mimic each other than development platforms. Too, it is apparent that all three platforms seem to relate in some way to the market data with each one following Dogecoin's price and volume increases from 2021 to today. This is a logical observation for Discord and Reddit given Dogecoin's status as a meme coin, making

those online platforms the primary investor and community drivers where members speculate and come together for organized instances of price manipulation efforts to achieve a common goal. For example, going back to Dogecoin's history where they used online communities to raise the asset to donate to different charitable endeavors highlights the data below as these platforms serve as powerhouses behind Dogecoin. Regarding the GitHub activity, this finding of matching the market data is interesting given the observable development cycles being unrelated for other tokens. The increase and decrease of activity as the volume and price rise and fall from 2021 on is indicative of the developers being more responsive in development rather than having a consistent cycle being followed. This is logical given the nature of Dogecoin being a meme coin, maybe the development team is less professionally organized as more large and advanced cryptocurrencies like Ethereum or Bitcoin. This could also be demonstrating issues with the underlying technology as the volume increased leading to developers having to fix issues that were previously unknown with the lower prices and volumes.

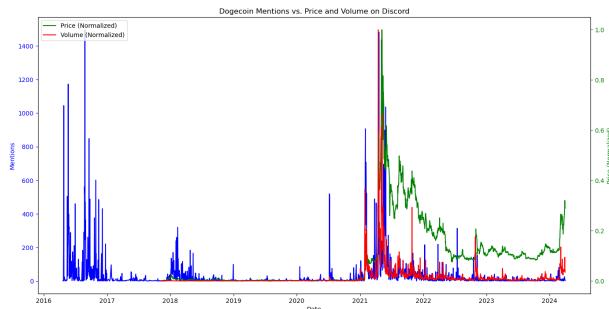


Figure 3.10: Dogecoin Discord Mention History vs Price and Volume (All Time)

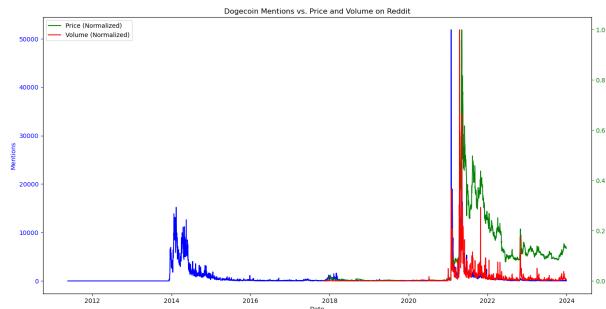


Figure 3.11: Dogecoin Reddit Mention History vs Price and Volume (All Time)

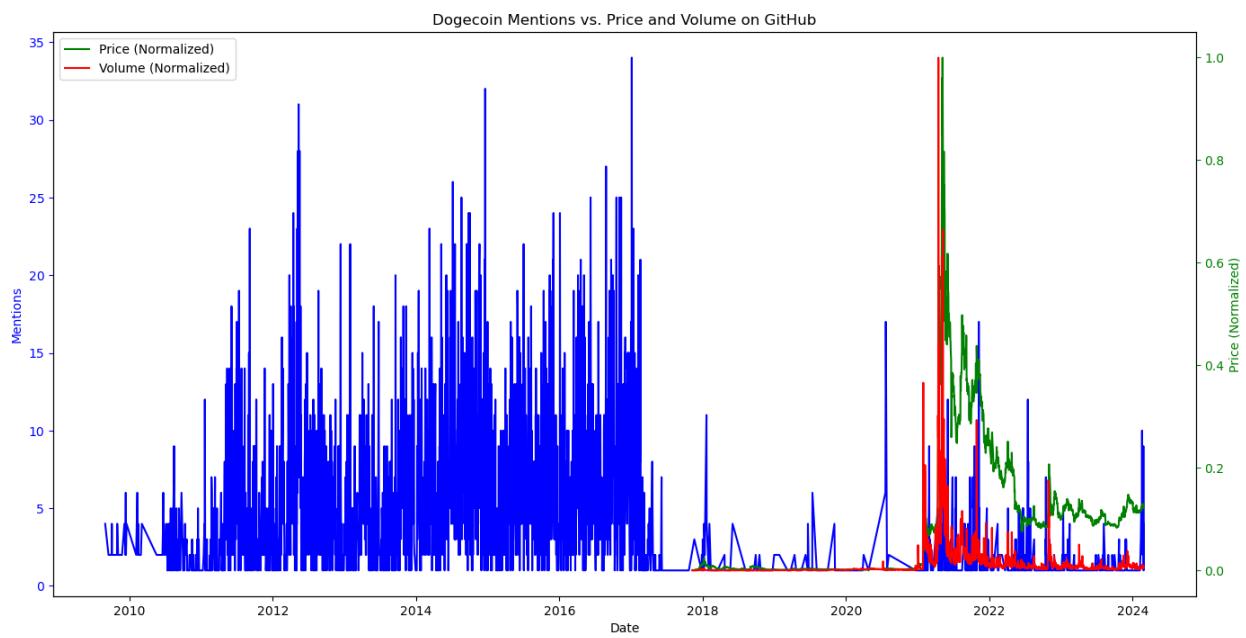


Figure 3.12: Dogecoin GitHub Mention History vs Price and Volume (All Time)

### 3.5 Solana



Figure 3.13: Solana Price and Volume History (All Time)

Beginning with Solana's GitHub data, the graph shows a large jump in commit activity in January 2022 but is followed by a sharp decline and consistently less commits going forward. With Solana being a key player in decentralized finance and NFTs, the asset had seen immense growth in 2021 as the communities Solana was involved with began to take off and the NFT market was booming [14]. This could be the cause of increased development efforts as the developers were starting the new year having to evolve with the decentralized finance ecosystem to keep up, and Solana had reached an all-time high price in January 2022 with the activity spike (see Figure 3.16). It is also apparent that the development activity decreased during the end of 2022 as FTX collapsed

leading to Solana price drops; this then reverses itself, likely to begin rebuilding and evolving in order to come back from the crash caused by the collapse. The Discord data reflects that the server started in 2018 as the messages go from 0 to a peak of activity before falling to normal levels (see Figure 3.14). From then until 2021 there are mostly consistent fluctuations in messages, which could be indicative of scheduled events on the Discord such as ask me anything sessions. Some of these also line up with the expected events as well such as 2020 with the pandemic market conditions. The Discord activity then begins to ramp up in 2021 as the price skyrocketed to an all-time high before crashing in 2022 (see Figure 3.13); this series of events is likely the cause of increased activity due to excitement when the price was high and panic as it crashed. Lastly, the activity spike in 2023 is likely due to the market shock of continually increasing prices as Solana has become a stronger competitor to Ethereum in the decentralized finance space [20]. The last dataset for Solana, Reddit, shows Solana’s launch in 2013 with the activity beginning to increase (see Figure 3.15). From there, the 2018 activity spike is likely caused by the crypto bubble beginning to burst as people began to speculate and discuss on the forums. Then, the massive increase in activity in 2021 aligns with the market shock of the NFT hype period where decentralized finance saw a large surge of finances and attention – Solana being a primary Ethereum competitor in that space profited immensely from the surge leading to this observed increase in Reddit activity [14]. The drop off after this rally period for Solana then falls in line with the collapse of FTX as Solana was largely involved given how much of their asset was held by the bankrupt company, FTX sold off massive amounts of SOL leading to losses and a loss of consumer confidence until recently as they rebuild and activity begins to increase again. With these observations, all three datasets have a strong relationship in dynamics around the collapse of FTX: GitHub commits slowed significantly before the rebuild began, Discord messages saw a rise and fall at the end of 2022 showing an initial panic with people sending more messages before likely exiting the situation, having a repulsor-like response, and the Reddit activity shows a decline during the time, possibly indicating interest being lost as the price crashed and other news took the spotlight. Overall, this is another indication of social platforms sharing similar dynamics, with GitHub having more similarities as well. In terms of Solana’s market data, the

price and volume seem only to loosely relate to the Reddit activity; the Discord activity shares one spike of messages and volume with a price increase after at the end of 2021, but otherwise the message frequencies seem mostly consistent and random compared to the market data movements. The GitHub activity shares the same characteristics as Discord. However, the Reddit activity is an interesting precursor to the large volume and price movements at the end of 2021 during the height of the thriving pandemic cryptocurrency landscape. In the months leading up to the financial increases, the Reddit activity increased substantially before dwindling down in the days before the large rise and fall and remaining low as the price and volume decreased until the beginning of 2024. This finding is surprising as most other patterns of movement have matched dates almost exactly whereas the market response was delayed from the Reddit explosion. This could be due to news of Solana developments being released where the information was then disseminated across Reddit with users discussing and speculating about the upcoming changes. This was also during a time when Solana was mutually invested with FTX with both entities seeing major success during the good market times which could have been part of the news that drove so many users to be active on Reddit.

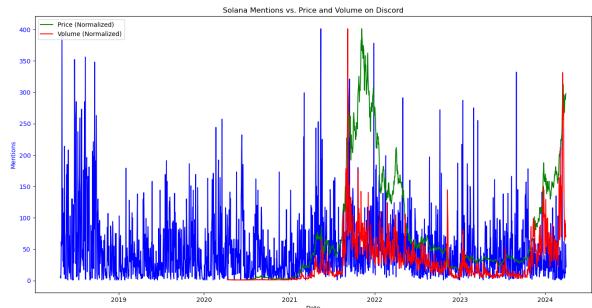


Figure 3.14: Solana Discord Mention History vs Price and Volume (All Time)

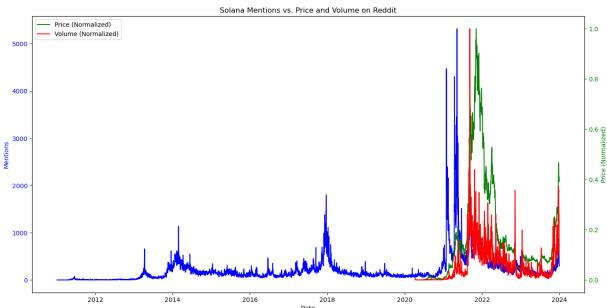


Figure 3.15: Solana Reddit Mention History vs Price and Volume (All Time)

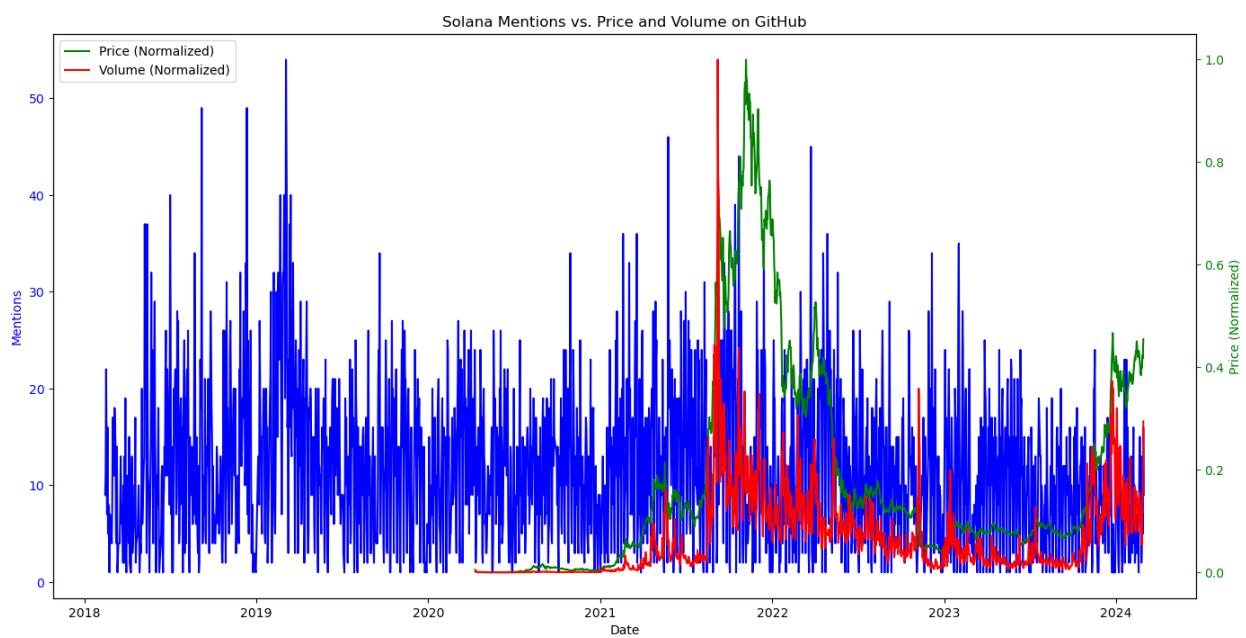


Figure 3.16: Solana GitHub Mention History vs Price and Volume (All Time)

### 3.6 Cardano

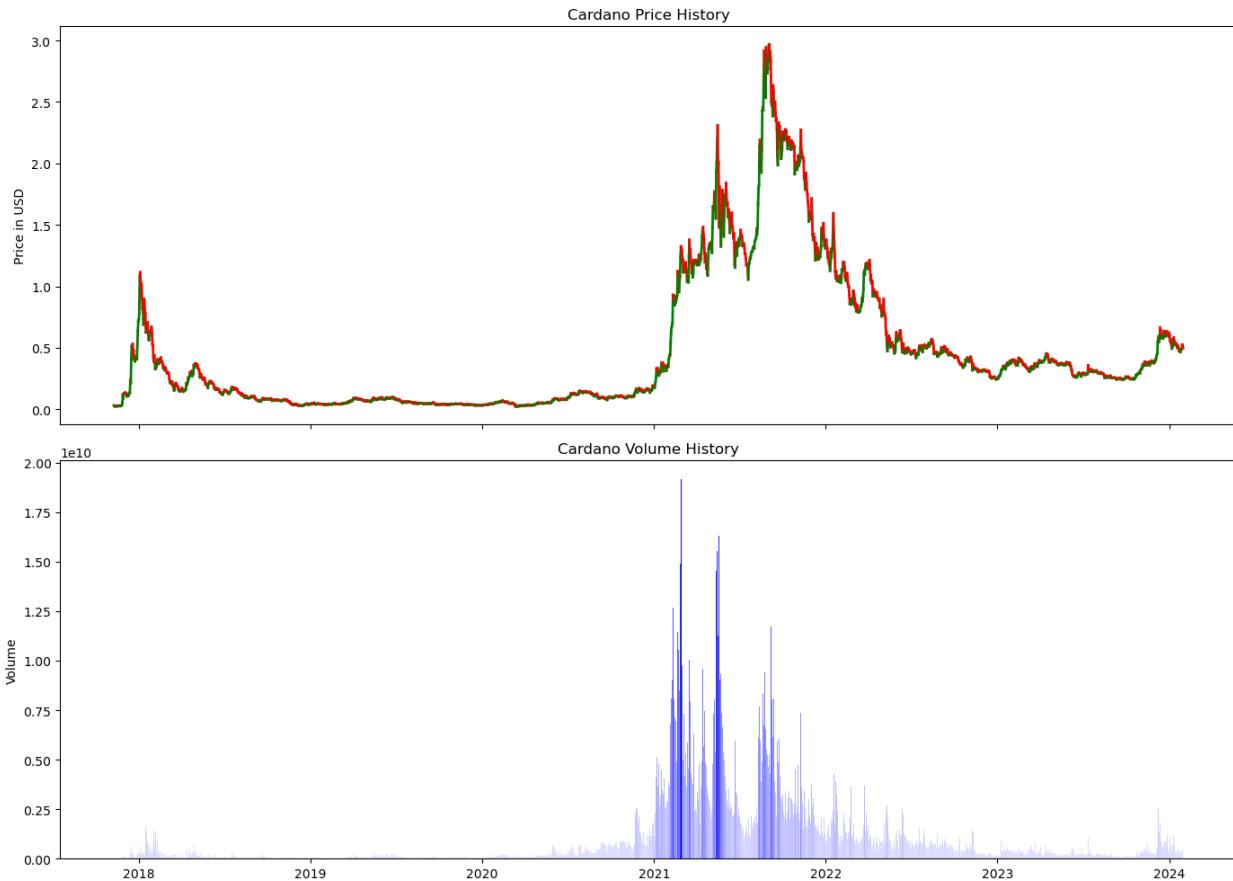


Figure 3.17: Cardano Price and Volume History (All Time)

Starting with Cardano's Discord data, the activity began in 2020 and activity increased quickly, likely due to initial community growth as well as the excitement surrounding the cryptocurrency market circa 2021 with price increases until 2022 (see Figure 3.18). The activity then quickly dies down with the price decrease market shock, and from there it seems to have been consistently low – this is most likely due to the community migrating from Discord to Telegram as that is another platform used by cryptocurrency communities commonly. The next data from GitHub shows the repository being created in 2019 with activity increasing from the start as the project began (see Figure 3.18). There is then a large increase in activity with more developers

being active in 2020 until development slowed down to a somewhat consistent development cycle with peaks and falls that do not necessarily line up with the market shock events apart from 2022 price decreases and increased development. The final data from Reddit then shows early discussions and community building until the 2017 launch when more traction was gained in terms of online attention. This discussion surrounding Cardano on Reddit then dropped off with the 2018 crash and remained somewhat consistently low until the market explosion for digital assets in 2021; from there, the Reddit activity decreased with the price decreases in 2022 and has once again remained consistent and lower (see Figure 3.17 and Figure 3.19). Regarding relationship strength between these platforms surrounding Cardano, there is not a discernible connection between dynamics most likely because of the time frames of when the Discord and GitHub repository were made or stopped being used. The market data for Cardano is then seemingly loosely related to Discord and very intertwined with Reddit activity. The Discord activity is mostly detached from the price and volume movements, but during 2022 as the price declined, if it reversed and spiked briefly the Discord messages seemed to also spike as users discussed the asset and the future of its price, most likely. The Reddit data then matches up almost exactly with the 2018 boom/bust being represented by the Reddit activity increasing with the price and volume; this was then repeated for the pandemic during the times of a successful cryptocurrency market as well where the activity and volume increased significantly first before the price followed suit as the volume and activity tapered off once the massive increase had hit a ceiling. This is an interesting finding as it appears that the Reddit activity was a key player in the price increase as the discussions appeared to have impacted volume which later impacted the price. This would likely be because of the novel excitement and financial gains that new investors were achieving and seeing during the pandemic and rise of NFTs along with cryptocurrencies.

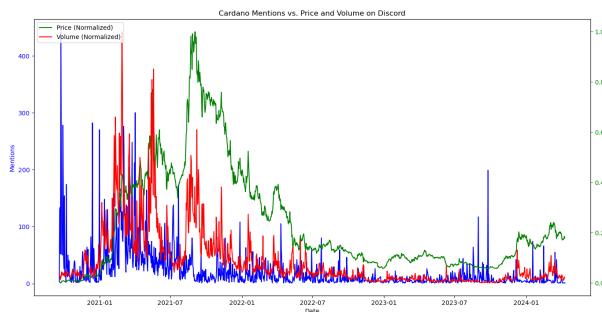


Figure 3.18: Cardano Discord Mention History vs Price and Volume (All Time)

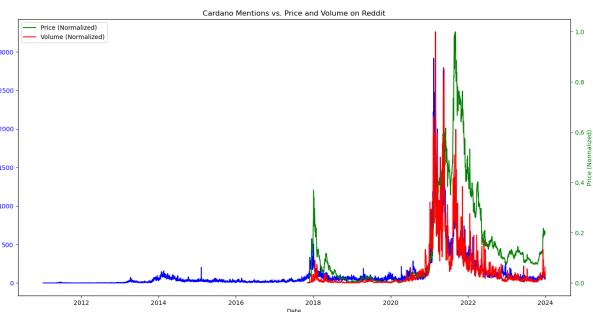


Figure 3.19: Cardano Reddit Mention History vs Price and Volume (All Time)

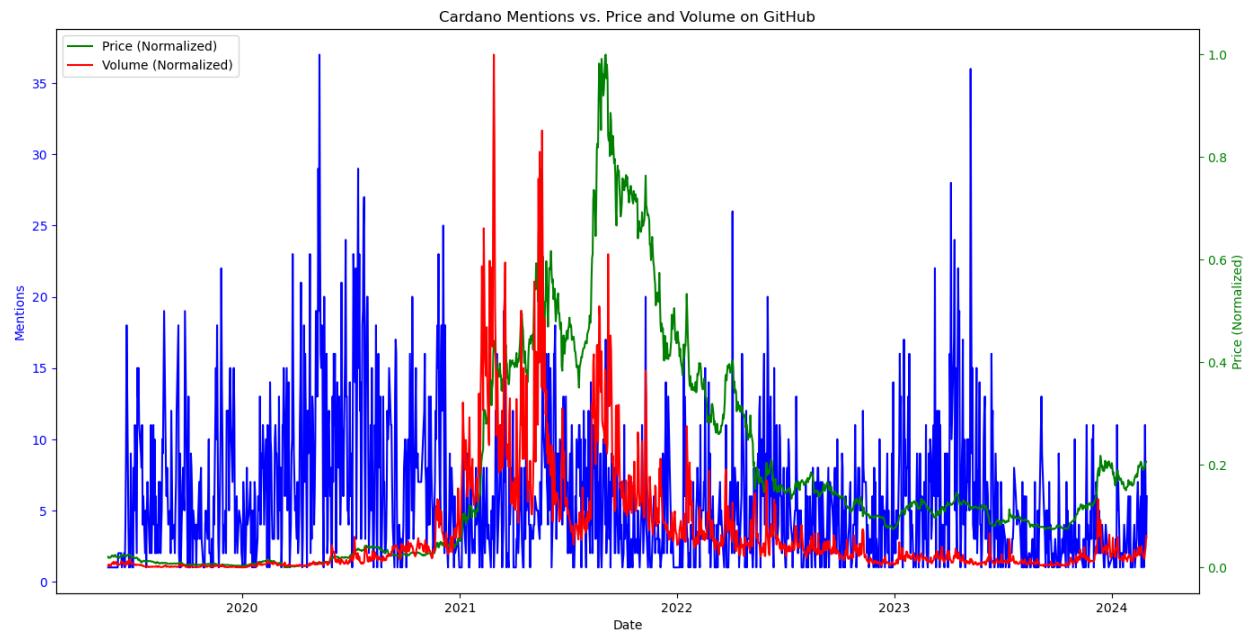


Figure 3.20: Cardano GitHub Mention History vs Price and Volume (All Time)

### 3.7 Polygon

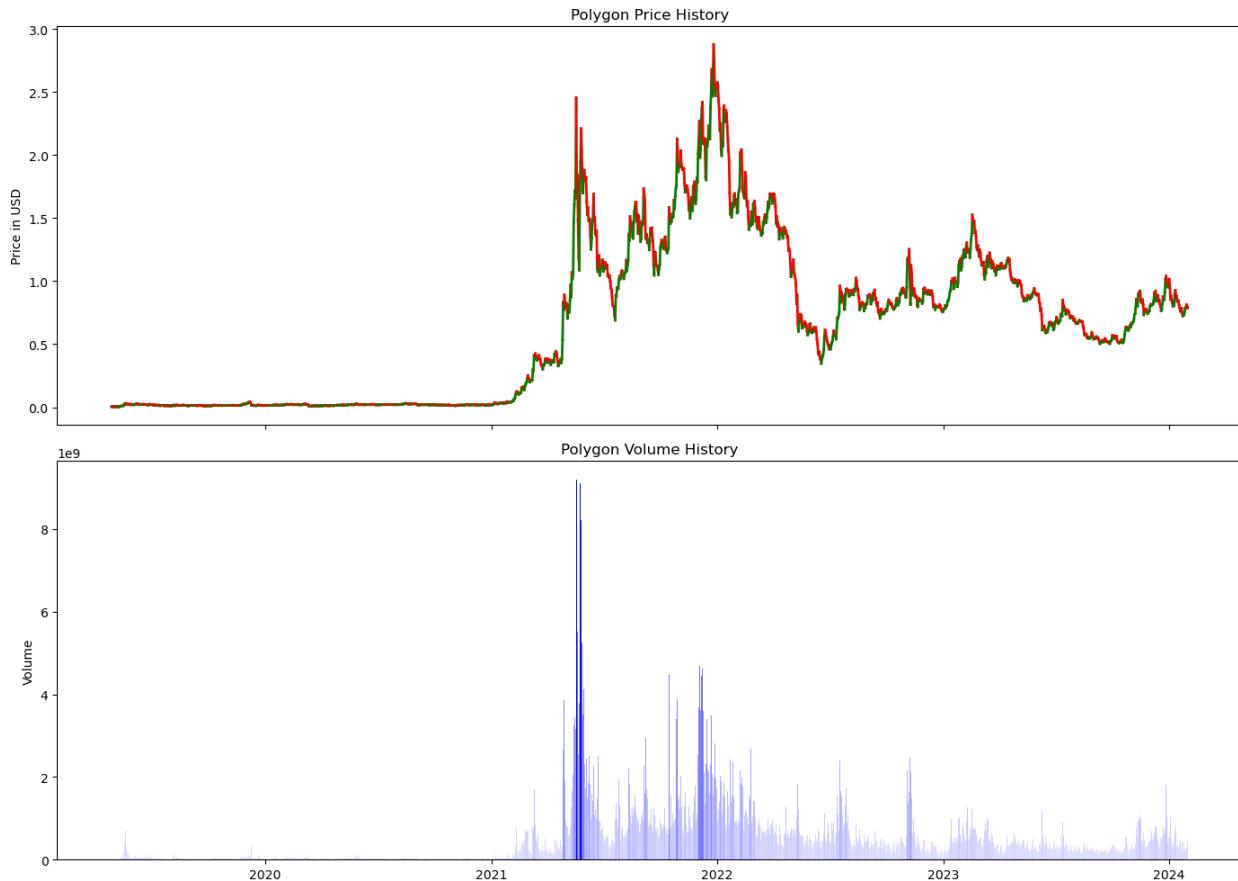


Figure 3.21: Polygon Price and Volume History (All Time)

Polygon's GitHub data is indicative of early development prior to its 2017 launch as the developers, who had previously worked on Ethereum, made thousands of commits over time (see Figure 3.24). However, once the project was released, and for nearly a year before, the GitHub commit activity has significantly decreased and found a consistent pattern. The Discord data, on the other hand, is far more interesting demonstrating a strange pattern of activity spikes followed by nearly no activity. Like many other cryptocurrencies, Polygon also experienced success in the bull run in 2021, demonstrated by the increase in Discord activity near May 2021 until the market started to slow down and crash in 2022 (see Figure 3.21 and Figure 3.22). The next spike in

2023 is then likely because of steady prices and price increases throughout the year, securing more investor confidence and more Discord activity as the community builds. The Reddit data then shows some early activity as the project was being built prior to 2017 – early community building and discussions as the project progressed (see Figure 3.23). It is then apparent that as 2017 went on after the project launched, more interest was gained and Reddit activity went on to increase until the crypto bubble burst in 2018. From there, 2021 demonstrates Polygon’s participation in the crypto bull run as heavy interest was gained shown through the massive increase in Reddit activity which tapers off as prices go back down in 2022. Based on the activity data, the strongest relationship lies between Reddit and GitHub in an inverse fashion; as the Reddit data decreased with the repulsor-like reaction to the price decreases after 2021’s exciting market, the GitHub commit activity increased. This possibly shows that as social dynamics turn more negative, development dynamics may increase in response. Polygon’s market data reflects a relationship with Discord and Reddit activity as there are some patterns which align with each metric. The GitHub data, however, is seemingly unrelated to any of the market movements. Regarding Discord, the first observation is the spike of message activity after a massive volume and price increase in 2021 when Polygon gained more public attention after rebranding from their old naming of Matic Network. This is likely due to users not having been a part of the server already and joining after the financial success of the asset took off with new revelations of the future and direction of Polygon Network. The activity then follows the volume metric somewhat as the price fluctuated causing increased message activity during price dips. This observation only seems to apply to 2021-2022 in this visualization as the server experienced times of inactivity in between time periods and now status mostly consistent with peaks on price drops. The Reddit data, like the other tokens, then matches very well but with an interesting delay between a spike in activity in 2021 and the price and volume skyrocketing in the following months. This activity is very likely attributed to technical developments which occurred in 2021 leading to heavy consumer interest in Polygon’s future along with the rebranding catching attention. It is likely the Reddit spike is from the actual rebranding market shock before the activity tapered off to normal levels and began to match the price and volume movements on

a smaller scale.

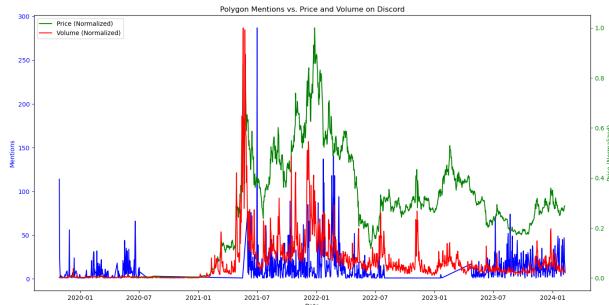


Figure 3.22: Polygon Discord Mention History vs Price and Volume (All Time)

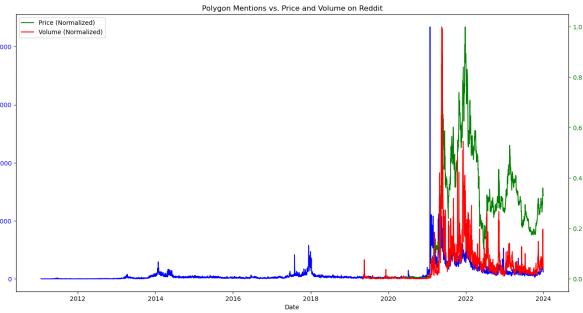


Figure 3.23: Polygon Reddit Mention History vs Price and Volume (All Time)

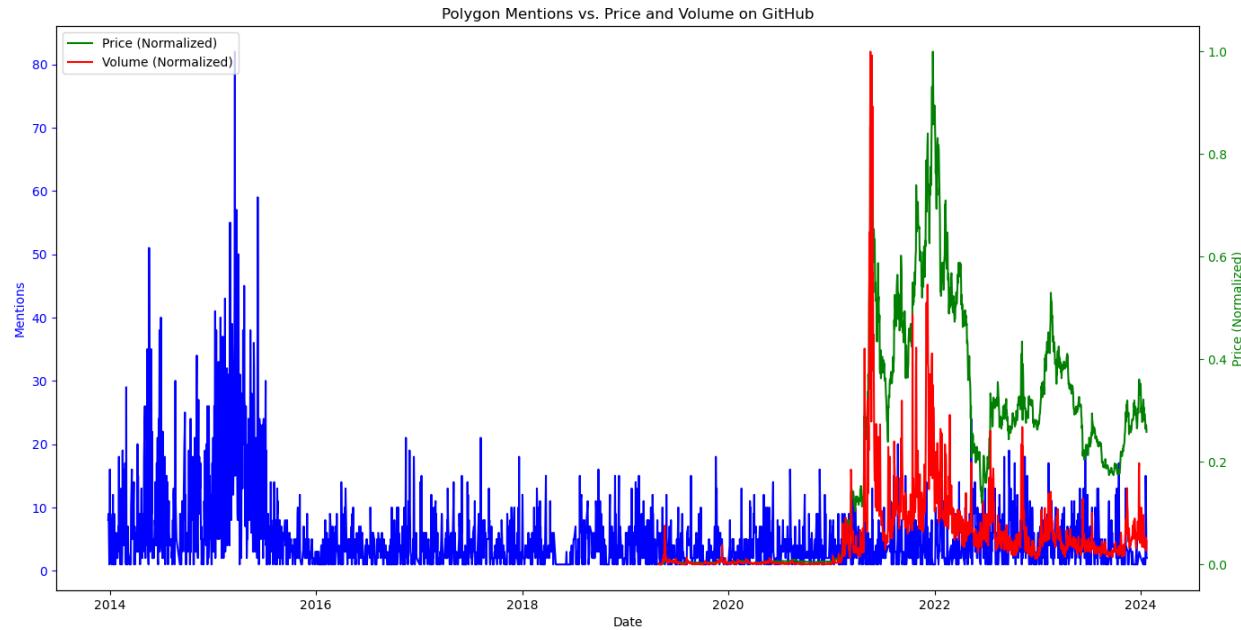


Figure 3.24: Polygon GitHub Mention History vs Price and Volume (All Time)

### 3.8 Binance

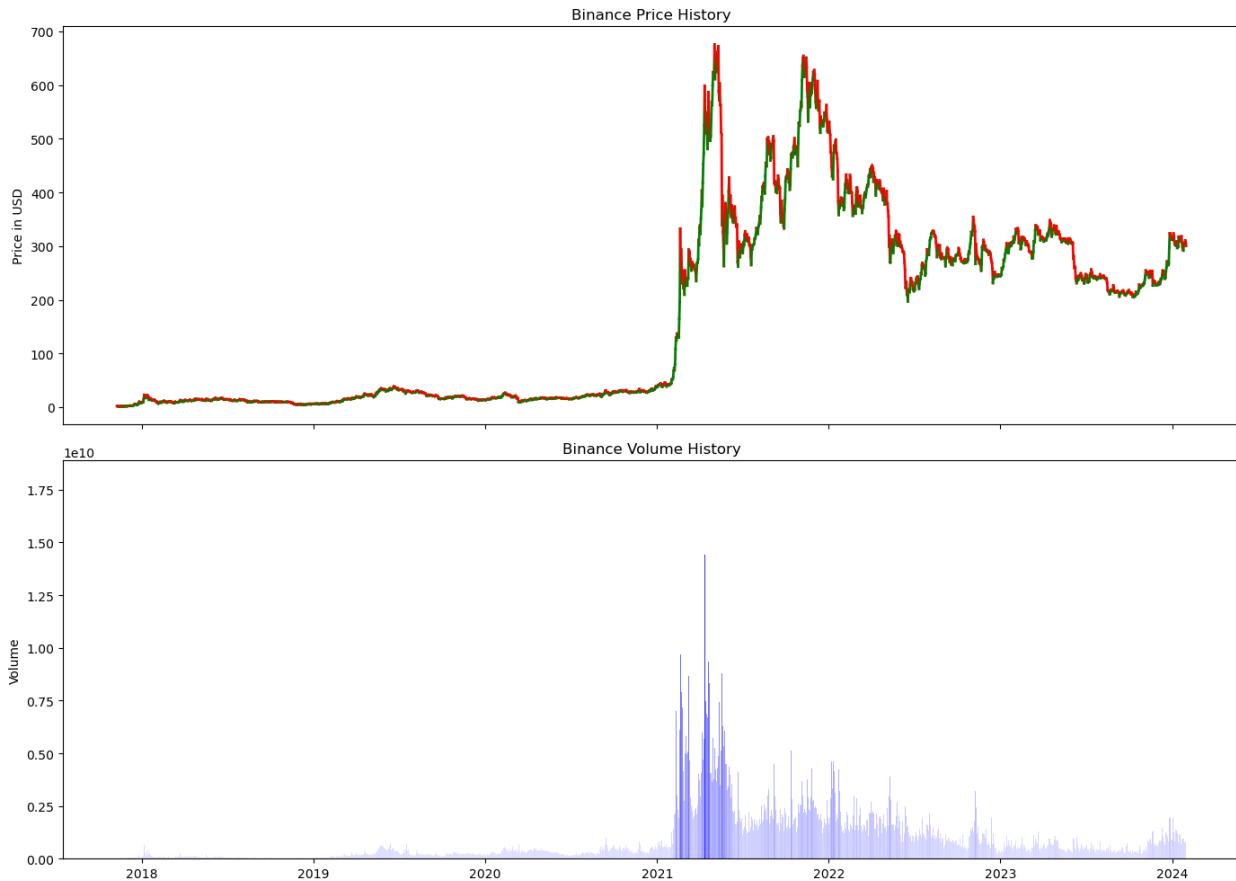


Figure 3.25: Binance Price and Volume History (All Time)

To start, Binance's Reddit data indicates the genesis of Binance as the project began in July 2017, immediately becoming the largest cryptocurrency exchange with the money behind them and a lack of competition at the time. This spike and fall is likely due to a heavy increase in interest and discussion about Binance given it being brand new and quickly showing signs of success in a short period of time before there was less to talk about, so to speak. From 2018 to 2021 Binance saw mostly consistent Reddit activity with significant news not circulating around the project. Then, in 2021, Binance heavily benefited from the massive increase in investor interest in digital assets [15]. Being a cryptocurrency exchange, Binance directly benefited from more consumers coming in and

using the services to buy and trade crypto assets. It is then observable that the Reddit activity began decreasing with a slight peak and continued to decrease with Binance's involvement in FTX's collapse at the end of 2022 (see Figure 3.27). This controversy led to more scrutiny from investors and led to losses and increased regulatory scrutiny from regulators as time went on. Next, Binance's Discord data shows that the server either did not start or was re-created just before 2022 leading to a slow increase in activity as the server grew in numbers, most likely (see Figure 3.26). From then on, the activity has continued to increase as the server builds and confidence in Binance begins to return after the regulatory issues experienced recently, with a significant increase towards the end of the year as Binance experienced a large swell in user base numbers [12]. Too, the significant spike in 2023 could be related to a regrowth of confidence among investors as it was soon after that Binance finalized its settlement with regulators [2]. Binance's GitHub data gives some insight into more recent developments with repositories starting at the end of 2020 (see Figure 3.28). The commit activity then slowly increased until spring 2022 when more developers began committing changes in the wake of FTX's collapse; this could potentially be a sign of former FTX developers moving to Binance development. After this there is a consistent development cycle that seems to be taking place as a few months will pass followed by a spike in commits without significant news. In this case, the data does not show a strong relationship between the social platforms, this is likely due to the recent creation of the Discord server limiting the data. However, some sentiment insight can be insinuated based on the inverse relationship between Discord and Reddit activity in 2023; with Binance controversy simmering down, Reddit posts that are angry or talking about Binance being in the news may decrease as Discord messages with new users or users with rebuilt trust increase. Regarding Binance's online activity versus the market metrics of price and volume, Binance only seems to have a relationship between Reddit activity and volume. During the 2021 bull run for the cryptocurrency market featured in almost every token's data, the Reddit activity spiked first alongside the volume prior to the online activity dying off and the price continuing to rise for a period of time. With the growth of cryptocurrencies, NFTs, and decentralized applications during this pandemic era, this explosion of activity makes sense as people become aware and interested in

different decentralized avenues. This led to massive growth for Binance in 2021-2022 as being one of the already established and largest cryptocurrency exchanges meant that most new investors were flocking to use their network for cryptocurrency purchases, transactions, and storage as Binance made decentralized wallets available for those who did not want to manage it themselves. Because of the nature of Binance as an exchange, many users who were new to cryptocurrency were likely going to Reddit for information as the market began to take off and investors would experience a fear of missing out.

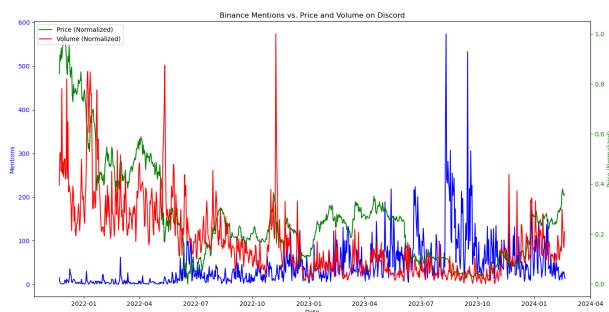


Figure 3.26: Binance Discord Mention History vs Price and Volume (All Time)

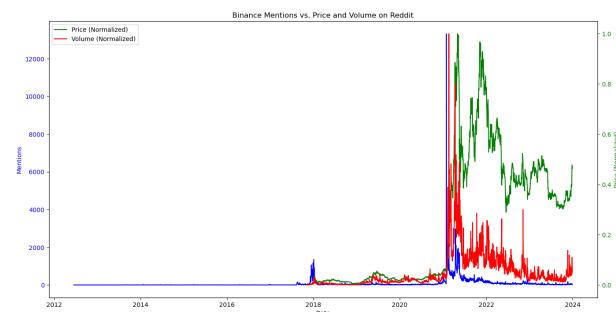


Figure 3.27: Binance Reddit Mention History vs Price and Volume (All Time)

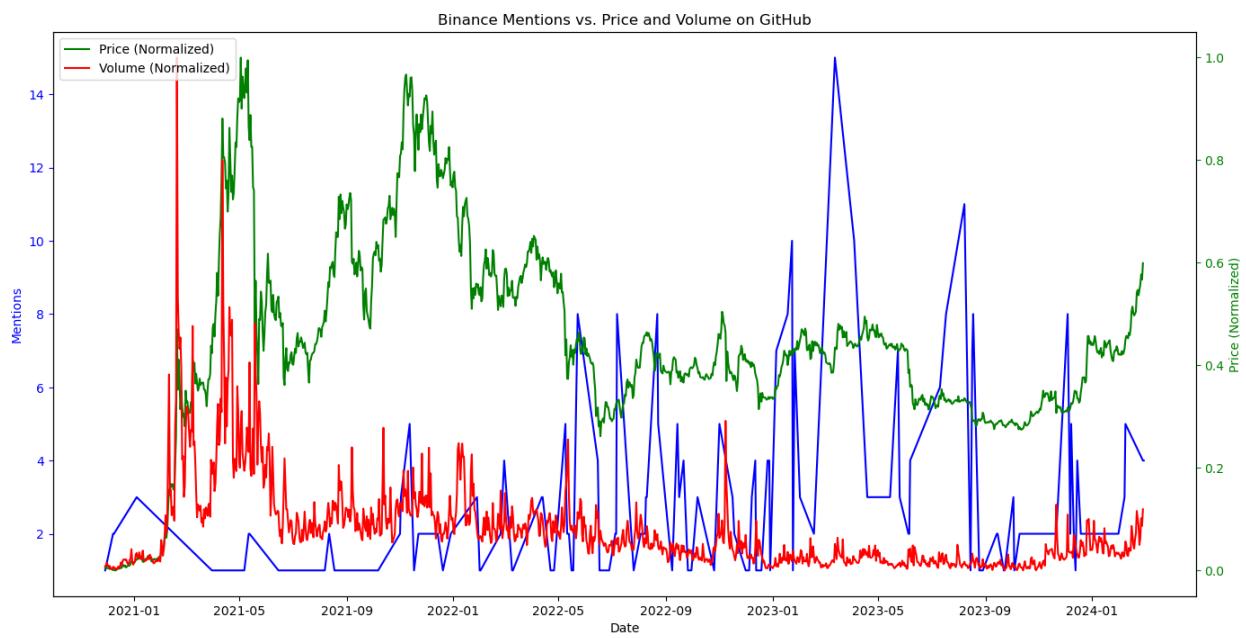


Figure 3.28: Binance GitHub Mention History vs Price and Volume (All Time)

### 3.9 Discussion

Coin	Market	Platform	Correlation	Strength
<i>Bitcoin</i>	Price	Reddit	0.36	Weak
		GitHub	0.19	Weak
		Discord	0.40	Moderate
	Volume	Reddit	0.38	Weak
		GitHub	0.28	Weak
		Discord	0.23	Weak
<i>Ethereum</i>	Price	Reddit	0.42	Moderate
		GitHub	-0.06	Weak
		Discord	0.10	Weak
	Volume	Reddit	0.61	Strong
		GitHub	0.02	Weak
		Discord	0.22	Weak
<i>Dogecoin</i>	Price	Reddit	0.45	Moderate
		GitHub	0.29	Weak
		Discord	0.36	Weak
	Volume	Reddit	0.81	Strong
		GitHub	0.13	Weak
		Discord	0.43	Moderate
<i>Solana</i>	Price	Reddit	0.29	Weak
		GitHub	0.08	Weak
		Discord	0.10	Weak
	Volume	Reddit	0.29	Weak
		GitHub	0.12	Weak
		Discord	0.07	Weak
<i>Cardano</i>	Price	Reddit	0.65	Strong
		GitHub	-0.09	Weak
		Discord	0.32	Weak
	Volume	Reddit	0.91	Strong
		GitHub	0.00	Weak
		Discord	0.47	Moderate
<i>Polygon</i>	Price	Reddit	0.43	Moderate
		GitHub	0.05	Weak
		Discord	0.28	Weak
	Volume	Reddit	0.50	Moderate
		GitHub	0.08	Weak
		Discord	0.19	Weak
<i>Binance</i>	Price	Reddit	0.21	Weak
		GitHub	-0.06	Weak
		Discord	0.20	Weak
	Volume	Reddit	0.43	Moderate
		GitHub	-0.06	Weak
		Discord	-0.06	Weak

Figure 3.29: Within-Token Cross-Platform Correlation Analyses

The influence of online platforms on cryptocurrency markets, as evidenced by the data, presents a complex web of interactions where the medium of communication can significantly affect market dynamics. This phenomenon is observed through platforms like Reddit, GitHub, and Discord, each contributing differently based on its user base and the nature of interactions it supports.

Reddit stands out for its strong correlations with cryptocurrency metrics, particularly in trading volumes and price fluctuations. Platforms like Reddit accelerate the virality of content due to their structural mechanisms, such as upvotes, which push popular discussions to the forefront; this rapid information dissemination can lead to pronounced market reactions, as seen with Cardano's trading volume correlation on Reddit (0.91) and Dogecoin's (0.81). These figures suggest a highly engaged community whose collective actions can lead to significant market shifts. Historically, pivotal moments in cryptocurrency, like the sudden rise in Dogecoin's value, have often been precipitated by viral campaigns on Reddit, where speculative enthusiasm and strategic postings can generate substantial trading volumes within hours, something seen through Dogecoin's past charitable endeavors as previously mentioned. The nature of Reddit as a platform for emotional and speculative discussions also plays a critical role. The emotional resonance within these communities can draw increased responses to news, rumors, or even memes, leading to immediate and significant market reactions. The correlation of Cardano's price with Reddit activity (0.65) exemplifies how positive sentiments or endorsements from the community can rapidly increase buying pressure, inflating prices in the process with Reddit acting as such a central hub to cryptocurrency communities.

In contrast to Reddit, GitHub shows a very different pattern of influence on cryptocurrency markets. As a platform predominantly used for code sharing and development discussion, its correlations with immediate market metrics are weaker or even negative, as seen with Ethereum (-0.06) and Cardano (-0.09). This suggests that while the developments on GitHub are vital for the long-term viability and innovation of a cryptocurrency, they do not typically result in immediate market reactions; this can be attributed to the nature of the content on GitHub being technical

discussions and code updates that are more relevant to developers than traders. The impact of such updates unfolds over a longer period as they gradually build investor confidence and contribute to the foundational strength of the cryptocurrency, rather than sparking rapid market movements. Historical observations indicate that significant technological milestones discussed on GitHub, like Ethereum's transition to proof-of-stake, have had long-term impacts but did not cause immediate price surges or drops.

Discord, recognized for its real-time, informal communication style, exhibits relatively weak correlations with cryptocurrency market metrics, suggesting a nuanced influence that does not directly translate into substantial market movements. The platform's subtle impact can be attributed to several historical and structural factors. Firstly, the ephemeral nature of Discord's chat-based interactions means that information is rapidly replaced and can be lost in the flow of continuous conversation, making it difficult for any single piece of information to have a sustained impact without being pinned by a moderator. Additionally, Discord servers are often segmented into numerous channels, each catering to different topics or aspects of a cryptocurrency, which could dilute the impact of any single discussion by reducing the potential for a unified market response if a central channel is not utilized. Too, Discord's primary role has historically been about fostering community and providing a platform for enthusiasts to share ideas and strategies rather than acting as a direct catalyst for market movements. Its impact, while significant within its user base, tends to manifest in more subtle and less observable ways compared to platforms like Reddit, which can drive market metrics through broader and more visible network effects. Furthermore, Discord allows for more niche discussions among smaller groups, which can include insider conversations that might not be accessible or of interest to the broader market. This means that while impactful insights and strategies may be shared within Discord, they do not always reach beyond these groups to influence wider market trends.

However, Discord's impact varies across different cryptocurrencies, hinting at nuanced roles that the platform plays in community dynamics. Certain currencies like Dogecoin and Polygon demonstrate higher correlations, suggesting a more pronounced influence in these contexts. For in-

stance, Dogecoin's volume correlation with Discord activity (0.43) and Polygon's price correlation (0.28) are relatively higher compared to other currencies on the same platform. These variances can be attributed to community characteristics and engagement patterns. Dogecoin, known for its meme-origin and a highly engaged community, benefits from platforms that support real-time, casual interaction, and the relatively moderate correlation in Dogecoin's volume with Discord activity may reflect the influence of real-time hype and coordinated actions, which are common in communities focused on meme coins. For cryptocurrencies like Polygon, which offer specific technological advantages and attract a more tech-savvy audience, Discord serves as a crucial platform for sharing insights, strategies, and technical discussions. The moderate correlation in Polygon's trading price with Discord activity indicates a more focused use of the platform for coordinating trading activities or discussing market conditions. Additionally, the role of insider information and rapid response is significant, as cryptocurrencies with active development communities or those subject to speculative trading often use Discord as a venue for quickly sharing insider information among community members. This can lead to rapid, although temporary, market responses as traders on Discord can react quicker than the broader market to unconfirmed information or speculative content.

In conclusion, the cross-platform analysis of cryptocurrencies and market dynamics demonstrates the varying influences that different online platforms have on cryptocurrency markets. Reddit emerges as a powerful platform for immediate market movements due to its ability to amplify viral content and provoke substantial community engagement, resulting in sharp fluctuations in trading volumes and prices as information is spread. On the other hand, GitHub, while less impactful in the short-term, plays a crucial role in shaping the long-term development and credibility of cryptocurrencies through technical updates and discussions, which gradually solidify investor confidence. Discord, with its real-time interaction and community-centric approach, offers a more nuanced impact that, while significant within specific communities, generally does not translate into immediate or pronounced market changes. Each platform contributes uniquely to the market dynamics of cryptocurrencies, reflecting the diverse nature of interactions and the varied responses

from the market based on the type of content and the characteristics of each platform's user base. This intricate web of influence highlights the complexity of market dynamics and highlights the importance of understanding platform-specific nuances when analyzing the broader cryptocurrency market.

	Volume		Mentions	
	Pre-Spike	Post-Spike	Pre-Spike	Post-Spike
<i>Bitcoin</i>	0.57	0.23	6.57	6.29
<i>Ethereum</i>	0.50	0.20	3.43	3.00
<i>Cardano</i>	0.28	0.08	7.43	3.57
<i>Dogecoin</i>	0.20	0.09	1.43	1.29
<i>Binance</i>	0.28	0.13	2.29	1.86
<i>Solana</i>	0.53	0.11	3.86	9.14
<i>Polygon</i>	0.70	0.22	5.00	9.00

Figure 3.30: Market Volume vs Online Mentions (Discord, Reddit, and GitHub) (Normalized Averages) Before and After the FTX Collapse

In the analysis of these cryptocurrencies, certain assets demonstrated intriguing results, specifically when considering fluctuations in their prices, trading volumes, and mentions on online platforms. Solana, for example, witnessed a severe price reduction from a normalized average of 0.35 to 0.09 USD within the time frame of six months before and six months after the FTX collapse market shock event, accompanied by a substantial decline in average normalized volume from 0.53 to 0.11. Interestingly, despite these downturns, mentions of Solana on Discord, Reddit, and GitHub saw a significant rise from 3.86 to 9.14; this anomaly suggests an increase in public interest or concern during a period of notable market volatility, possibly due to discussions about the cryptocurrency's potential recovery and speculation about the reasons for its decline. This data aligns with the details of the event given Solana being very involved with FTX prior to the bankruptcy, leading to a massive sell off of Solana from FTX which then led to other investors also exiting their positions.

Similarly, Polygon experienced a noteworthy price drop from 0.64 to 0.47 USD and a decline in volume from 0.70 to 0.22, yet it also saw an increase in online activity, with mentions rising from

5.00 to 9.00. This pattern might indicate that despite the falling price and volume, the visibility or discussion within the community or media has intensified, potentially due to ongoing developments, new partnerships, or active community initiatives that have yet to impact its market price but have increased engagement. This observation also indicates that, like Solana, the volume saw a very sharp decline likely due to a loss of investor confidence as the entire market was affected by the market shock given FTX's large position as a cryptocurrency exchange – none of the tokens analyzed saw an increase in volume, only large decreases. Too, this online resilience could be a result of active and transparent communication from the Polygon development team regarding ongoing projects or new partnerships, which, despite not immediately impacting the price, may have maintained or even bolstered community trust and engagement during the market downturn. These dynamics demonstrate the importance of strong community relations and continuous development activity in sustaining investor interest during volatile periods.

Regarding Binance and Dogecoin, the two cryptocurrencies had similar responses to the event seeing a significant drop in market volume. However, the two of these projects saw a slight decline in online mentions, but not to a very significant degree in comparison to the large increases experienced by other tokens. This occurrence is most likely due to investors generally leaving the market or being less active for a period of time after the market shock as the collapse of FTX was an alarming crisis for investors and regulators alike. Too, the lack of online activity change is surprising for Binance given their involvement in the FTX situation, but this is something that would later change as the project ran into regulatory issues in the wake of this collapse. Dogecoin's steadiness of online activity despite suffering market repercussions is less surprising in this case as the community around Dogecoin is more niche and active with the volatility of the crypto market; it is somewhat surprising that there was not more of a response with FTX being an exchange where Dogecoin would have been available leading to users who held their assets with FTX losing their funds.

Lastly, Bitcoin and Ethereum had similar, more neutral responses to the market shock event seeing a significant decrease in market volume, but also seeing little change in online mentions as

opposed to the drastic increases for Solana and Polygon and the decreases among other tokens like Cardano which saw a change of -3.86 with -0.20 volume down to a normalized average of -0.08 in the six months after the collapse. This is an interesting finding given Ethereum and Bitcoin being the largest cryptocurrencies on the market; despite them experiencing the volume and price decreases that most of the market experienced, online mentions remained consistent demonstrating their positions as foundational projects in the cryptocurrency ecosystem. This shows that the two cryptocurrencies have established investors with more confidence leading to online mentions not significantly increasing, alluding to less panic and speculative discussions surrounding Bitcoin and Ethereum after the market shock as opposed to smaller projects. Too, this is historically sound given the previously mentioned foundational status of both assets being the largest, most well-known, and, arguably, the most stable. The decrease in Cardano's activity and the slight decrease in Bitcoin and Ethereum's activity shows that these projects may have investors with more confidence who did not mention the tokens after the event as well as a general decrease in market size as other investors lose confidence in the ecosystem and withdraw. This lack of mentions is likely due to the conversation being centered around more impacted cryptocurrencies, the event itself, or the exiting of investors with a new scrutiny immediately following the collapse.

These patterns across different cryptocurrencies illustrate investor behavior, community engagement, and market sentiment in response to significant market shocks. The varied responses to the FTX collapse reveal not only the vulnerabilities and resilience within the cryptocurrency market but also highlight the crucial role of continuous development, transparent communication, and strong community support in navigating through periods of crisis; this analysis gives excellent insight into the way tokens, platforms, and online mentions interact during important periods of time for the broader cryptocurrency landscape.

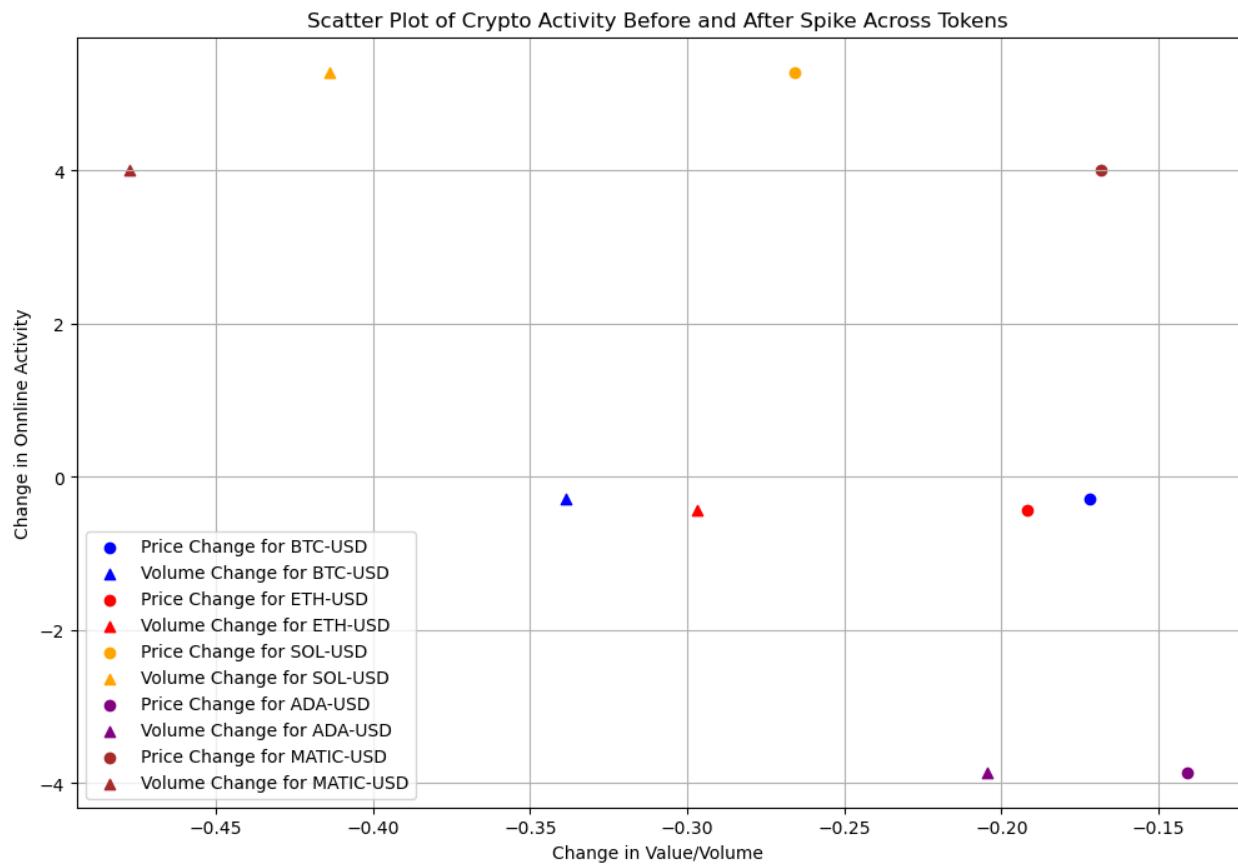


Figure 3.31: Cross-Token Analysis Before and After FTX Collapse

## **Chapter 4**

### **Multi-Coin Multi-Platform Analysis**

#### **4.1 Overview**

This chapter delves into the predictive relationships among cryptocurrencies across platforms, using Granger causality tests to explore the interconnectedness of the cryptocurrency ecosystem. This analysis reveals how activities related to one cryptocurrency can forecast those of another, indicating significant relationships among tokens. Too, the chapter provides a correlation matrix offering insights into digital engagement and interconnectivity among various tokens, showing how changes in discourse or activities in one token can influence others. Significant findings include Bitcoin's positive correlation with Binance and its negative correlation with Cardano, indicating varied market interests and influences. Ethereum's synergy with platforms like Polygon, Solana, and Cardano demonstrates moderate correlations, suggesting technological and market commonalities among these tokens, and the analysis identifies that the relatively unique nature of Dogecoin, driven by community sentiment and social media, differentiates it from more technology-focused cryptocurrencies.

## 4.2 Granger Causality Tests

### Cryptocurrency Granger Causality Relationships

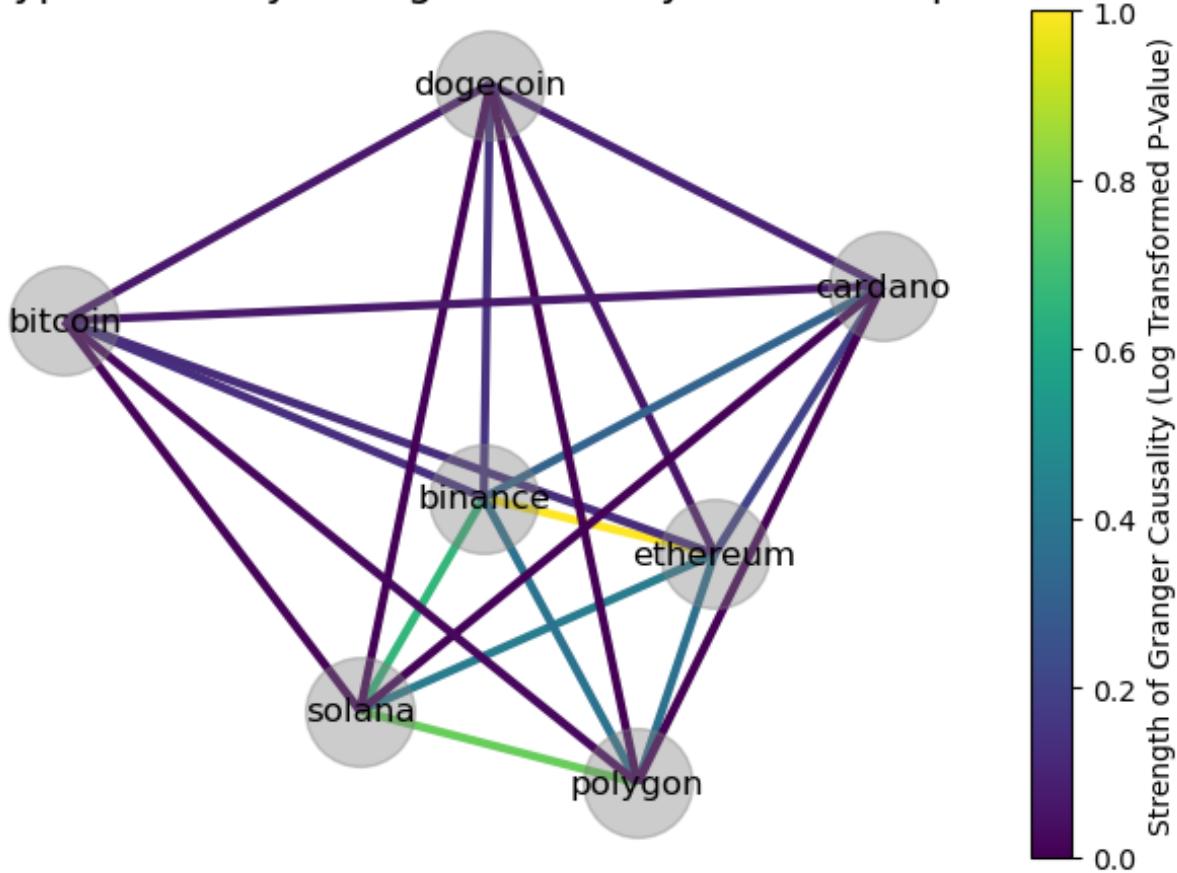


Figure 4.1: Multi-Coin Granger Causality Network Diagram

Granger causality tests are statistical methods used to investigate whether one event or variable tends to occur before another, suggesting a potential cause-and-effect relationship. Despite the term causality, it is important to note that this test does not establish direct causation; instead, it examines if one variable can predict another based on patterns over time. The test begins by analyzing time series data, which involves a sequence of data points recorded over time, such as stock prices or cryptocurrency trading volumes. The key question is whether past values of one variable can help predict future values of another variable. To explore this, the test examines a

lagged relationship, meaning it looks at a specified number of past observations to identify patterns. First, one determines the optimal number of lags to consider; this step requires balancing between including enough past data to detect meaningful patterns without overfitting the model. Overfitting occurs when a model is too closely aligned with the specific dataset, which can lead to inaccurate predictions for new data. Next, the Granger causality test creates two predictive models. The first (the restricted model) uses only past values of Y to predict future values of Y, and the second (the unrestricted model) incorporates past values of X and Y to predict Y. If the unrestricted model provides a significantly better prediction of Y, it suggests that X might have a predictive relationship with Y. To assess the effectiveness of these models, the test uses an F-test, a statistical method that measures whether the unrestricted model is significantly better than the restricted one. If the F-test indicates that including past values of X improves the prediction of Y, then X is said to Granger cause Y. This does not mean X directly causes Y, but it does suggest a predictive relationship. In this context, these tests are useful for exploring relationships within complex systems like cryptocurrencies as Granger causality tests can help determine if online platform activity, such as discussions on Reddit or commits on GitHub, has a predictive relationship with cryptocurrency market movements. This information can provide insights into market dynamics and interconnectedness, helping researchers understand how different events or variables might be related.

The pair of Ethereum and Binance, with a minimum p-value of  $< 0.001$  and t-value of 0.95, suggests an extraordinarily strong predictive relationship, indicating that changes in the discourse or activities surrounding Ethereum have a significant forecasting power over those related to Binance; this could be attributed to Ethereum's foundational role in the crypto market and Binance's position as a leading exchange, where developments in Ethereum's ecosystem (such as upgrades or decentralized finance app activities) might directly influence trading behaviors on Binance. Too, Ethereum and Binance have a natural connection given Binance's position as one of the largest cryptocurrency exchanges for consumers to use; with Ethereum being one of the largest cryptocurrencies, they would likely share patterns of activity as market shocks occur. Similarly, the pairs

involving Solana and Polygon (p-value  $\leq 0.001$ , t-value of 5.17), and Solana with Binance (p  $\leq 0.001$ , t-value of 1.99), show exceedingly low p-values, highlighting Solana's emerging significance within the crypto narrative and its potential impact on other cryptocurrencies and platforms. Solana's innovative consensus mechanism and its emphasis on high throughput and low transaction costs could be driving factors behind its predictive influence on Polygon and Binance, reflecting broader market trends towards scalability and efficiency. Solana, Polygon, and Binance also share the characteristics of being Ethereum alternatives, putting them in similar categories as networks focused on making changes or improvements that differ from the Ethereum network.

The relationship between Ethereum and Solana (p-value  $\leq 0.001$ , t-value of 2.94), and between both of these cryptocurrencies and Polygon, further demonstrates the interconnected nature of technological advancements and market perceptions across the cryptocurrency landscape; these relationships, with p-values indicating strong statistical significance, may reflect shared investor interest, technological synergies, or complementary ecosystem developments. This is logical due to the nature of each project with Ethereum being a foundational network in crypto, Polygon being a scaling solution built on Ethereum, and Solana being a designated alternative attempting to improve upon the systems used by Ethereum's network. However, it is surprising Cardano is not included with these relationships with a lesser Granger causality strength as it also has a role as an Ethereum alternative. Next, the predictive relationships between Dogecoin and Binance, and between Dogecoin and Cardano, though less statistically significant than the earlier pairs, still demonstrate the impact of community-driven sentiment and social media buzz on trading activities and market dynamics. Dogecoin's lack of connection to other cryptocurrencies is an expected finding as the asset is very different in community and function than others being a meme coin with a focus on social movements and speculation; it is also expected that Dogecoin's strongest relationship was with Binance given the exchange being a platform where Dogecoin is bought, sold, and traded. In pairs where Bitcoin is involved, the results indicate its broad influence across the cryptocurrency market, albeit with varying degrees of predictive power. This reflects Bitcoin's role as a market leader, where its movements and the sentiments around it can have a wide-ranging

impact on other cryptocurrencies. Bitcoin's lack of strong relationships shows its independence in the cryptocurrency market being the oldest and largest asset; there is also a large difference in technological ideologies between Bitcoin and networks like Ethereum or Polygon where consensus mechanisms and security goals differ. However, Bitcoin is still impacted by broader market shocks despite its lack of direct relation to other cryptocurrencies, as seen in the previous chapter.

Through these Granger causality test outcomes, the analysis shows the complex relationships that exist across different tokens, and it highlights the necessity of adopting a multifaceted approach to understanding cryptocurrency markets, one that considers not just financial or economic factors, but also technological developments, social dynamics, and the flow of information across various platforms. These insights provide a solid foundation for further exploration into the predictive models that can capture the nuanced relationships between different cryptocurrencies, offering valuable perspectives for investors, developers, and researchers alike.

### 4.3 Correlation Matrix

The correlation matrix of cryptocurrency tokens across Reddit, Discord, and GitHub activities presents intriguing insights into the digital engagement and interconnectivity among various tokens. By examining these correlations in greater depth, we can discover potential implications and understand the nuances of cross-platform cryptocurrency engagement.

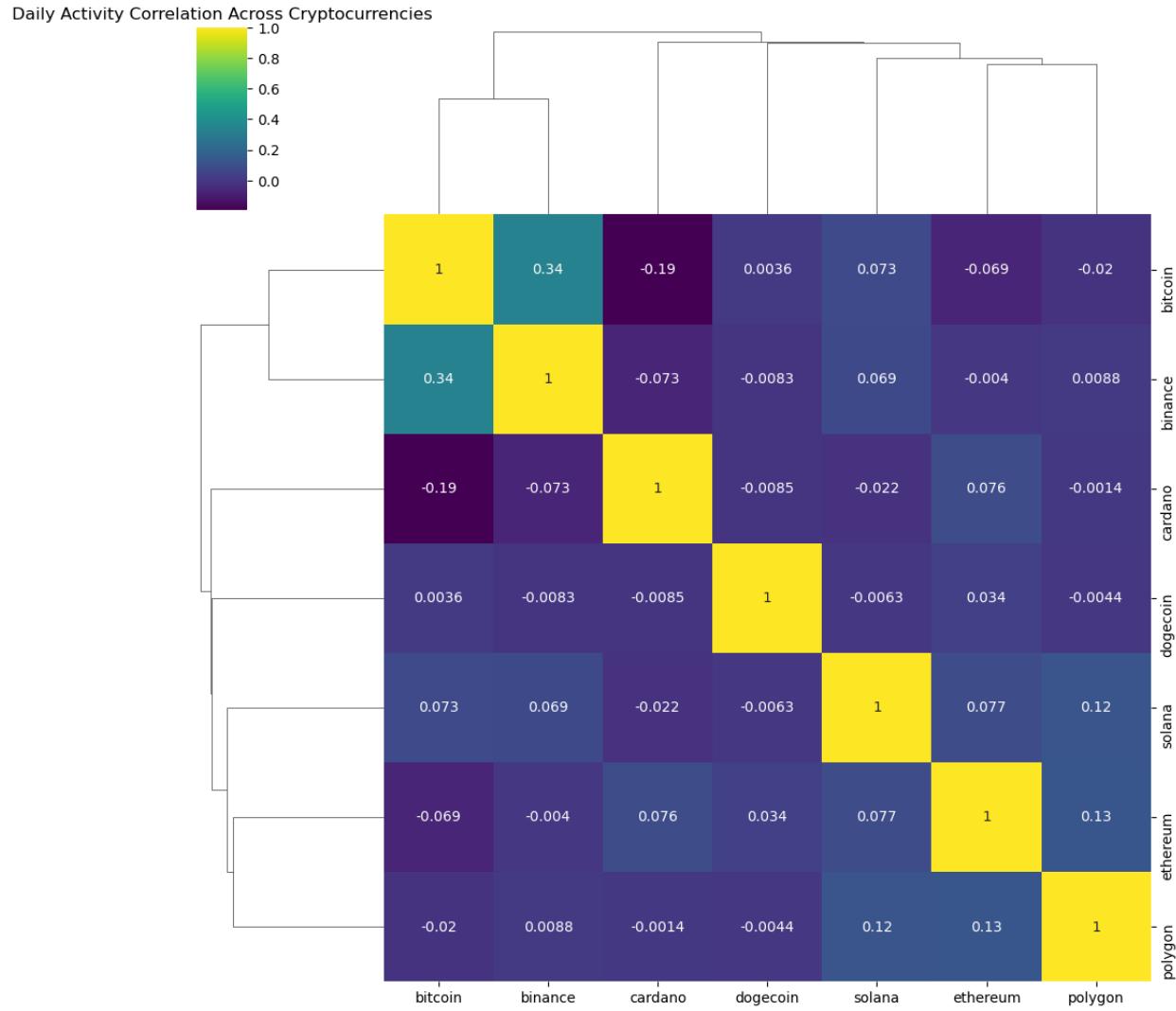


Figure 4.2: Multi-Coin Correlation Clustermap

#### 4.4 Bitcoin's Market Dynamics with Binance and Cardano

The positive correlation between Bitcoin and Binance (0.34) is significant, reflecting several key interactions between the cryptocurrency and the exchange; Binance, as one of the largest global cryptocurrency exchanges, handles a substantial volume of Bitcoin trades, which makes Bitcoin's price particularly sensitive to the trading dynamics on Binance. Large buy or sell orders on Binance can directly influence Bitcoin's market price due to the platform's high liquidity and accessibility.

Furthermore, news about Binance, whether it concerns regulatory developments, changes in trading fees, or technological upgrades, tends to impact Bitcoin disproportionately. This is because both institutional and retail investors use Binance as a primary platform for Bitcoin transactions, and positive or negative news can lead to increased buying or selling activity due to the custodial wallet. Conversely, the negative correlation between Bitcoin and Cardano (-0.19) illustrates a divergence in market dynamics and investor interests as Bitcoin is often considered a store of value or ‘digital gold,’ attracting investors looking for asset preservation in times of economic uncertainty. In contrast, Cardano is perceived more as a utility token within its decentralized platform, appealing to investors interested in technological applications and potential growth from network adoption. As the crypto market matures, investment flows may shift between these two types of assets. For instance, bullish sentiment in the crypto market might lead investors to diversify into emerging technologies like those offered by Cardano, potentially at the expense of traditional assets like Bitcoin. In bear markets, there might be a flight to safety back to Bitcoin, negatively impacting correlations with altcoins like Cardano. Additionally, as Cardano progresses in its roadmap and introduces new features, it might attract investment away from Bitcoin, particularly among those looking for yield or usage beyond Bitcoin’s relatively simpler blockchain. The ideological and practical differences between the communities surrounding Bitcoin and Cardano also contribute to their divergent market movements, with each community focusing on different principles and applications, influencing how these currencies correlate in market activities.

#### **4.5 Ethereum’s Ecosystem Synergy with Polygon, Solana, and Cardano**

The correlation between Ethereum and Polygon at 0.13 is not merely numerical but reflects the symbiotic relationship between the two platforms with Polygon existing as a platform which extends the capabilities of Ethereum by providing a secondary scaling solution. This relationship becomes particularly vital during instances of high network congestion on Ethereum, which historically leads to increased interest and movement towards Polygon. As a result, discussions about Ethereum’s scalability concerns often involve Polygon, heightening the correlation between their

respective activities. Ethereum's moderate correlations with Solana (0.08) and Cardano (0.08) indicate a shared interest within the broader scope of decentralized applications. All three platforms are key players in this arena, with significant developer activity and investor interest; Ethereum is well-established as the pioneering smart contract platform, while Solana and Cardano are newer entrants that offer alternative approaches to achieve scalability and efficiency. Solana's claim to high transaction throughput at lower costs appeals to a segment of the market prioritizing performance, whereas Cardano attracts those interested in its research-driven approach to blockchain development and its promise of high security and sustainability. These moderate correlations suggest that while the platforms are distinct in their technological propositions and target audiences, there is a level of overlap in the communities of investors and developers. This overlap likely comes from a common pursuit of optimized blockchain solutions, where discussions often compare the technical merits, ecosystem development, and future potential of each platform. The correlations are a testament to the dynamic nature of the blockchain industry, where despite differences, there remains a foundational interconnectedness among platforms that are all vying to push the envelope in decentralized applications' capabilities and blockchain technology.

#### **4.6 Dogecoin's Distinct Market Behavior and Social Media Influence**

Dogecoin's position within the cryptocurrency market is quite distinct, as indicated by its overall low correlation with other cryptocurrencies, such as a slight positive with Ethereum (0.03). Unlike more technology-oriented cryptocurrencies, Dogecoin's value and discussion volume are heavily influenced by social media trends, viral marketing, and sometimes whimsical celebrity endorsements, which can lead to rapid, often short-lived, increases in price and trading volume. This phenomenon creates patterns of activity for Dogecoin that are not consistently in step with the more fundamental market movements seen in other cryptocurrencies. These sporadic and sentiment-driven fluctuations in Dogecoin's market activity set it apart from other cryptocurrencies that typically have more robust technological advancements and clearer use cases; for instance, while Ethereum's activities often revolve around its development community and usage in decentralized

finance or non-fungible tokens, Dogecoin's discussions may spike due to a tweet or a mention by a public figure, which doesn't necessarily coincide with any substantive technological progress or ecosystem developments. Therefore, its correlations with other cryptocurrencies are not strongly pronounced, as the factors influencing Dogecoin's popularity and value differ significantly from those affecting other assets in the crypto space. The very nature of Dogecoin's creation—originally as a joke and a light-hearted alternative to Bitcoin—embeds a cultural and psychological aspect into its trading behavior that is less prevalent in more technologically grounded cryptocurrencies. Its community often rallies around the token in a more playful and less serious manner, leading to market behaviors that can be erratic and not aligned with the broader trends observed in the crypto market, resulting in very low correlations with other cryptocurrencies.

#### **4.7 Binance's Impact on Bitcoin and Varied Influence on Other Cryptocurrencies**

The substantial correlation between Binance and Bitcoin at 0.34 underscores Binance's significant influence in the cryptocurrency market, especially regarding Bitcoin's trading dynamics and liquidity. Binance, being one of the most prominent exchanges globally, acts as a major gateway for Bitcoin trading, and its high trading volume makes it a barometer for Bitcoin's market sentiment. This correlation suggests that Binance's trading environment can have a sizeable impact on Bitcoin's price movements. For instance, policy changes on Binance regarding Bitcoin trading fees, withdrawal limits, or security measures can lead to immediate and noticeable responses in Bitcoin's trading volume and price, as both retail and institutional investors react to the new exchange landscape. Moreover, Binance's operational status – such as the exchange's availability, performance, and updates – can create waves in Bitcoin's market activity. A technical outage on Binance could lower Bitcoin's liquidity momentarily, leading to price volatility. Conversely, positive developments like the addition of new Bitcoin trading pairs or improved transaction efficiency could attract more traders to the platform, thereby increasing Bitcoin's liquidity and stabilizing its price. The weaker correlations with Ethereum and even weaker with tokens like Polygon can

be interpreted through the lens of market segmentation and token use cases. Ethereum, while also a major asset on Binance, has a broader utility beyond just being an investment vehicle; it is the backbone of a vast ecosystem of decentralized applications. As such, its price is influenced by a wider array of factors, including network upgrades (like the Ethereum 2.0 Merge), decentralized finance trends, and NFT market dynamics. These factors may not always be as closely tied to exchange-specific events, leading to a less pronounced correlation. For niche tokens like Polygon, their more specialized use cases mean that their trading activity on Binance is influenced by a different set of market participants. The trading patterns for such tokens are often more closely aligned with developments within their specific ecosystems, such as updates to the Polygon network or partnerships that directly utilize its scaling solutions, rather than the broader trading trends on an exchange like Binance. In essence, the correlation levels reflect the extent to which the activity surrounding a particular cryptocurrency on Binance reflects or drives its overall market activity. For Bitcoin, Binance plays a critical role in shaping market perceptions and liquidity, while for Ethereum and Polygon, their broader ecosystem developments have a more significant impact on their market activity, thus diluting the direct influence of exchange-specific factors.

#### **4.8 Cardano and Solana's Technological Divergence and Market Segmentation**

The near-zero correlation between Cardano and Solana indicates that these two blockchain platforms, despite both being positioned as alternatives to Ethereum, tend to operate within distinct segments of the cryptocurrency market. Cardano's approach is methodical and academic, prioritizing a peer-reviewed development process and focusing on creating a highly secure and sustainable blockchain ecosystem; this philosophy attracts a particular type of investor and developer interested in the long-term vision and rigorous foundation of Cardano's technology. Too, the platform's advancements, such as the gradual rollout of smart contract capabilities and its focus on solving scalability through its Ouroboros consensus mechanism, tend to draw discussions and investments from those who value methodical progress and academic credibility. On the other

hand, Solana is architected for speed and efficiency, boasting high transaction throughput with low costs, thanks to its innovative proof-of-history consensus combined with proof-of-stake. This performance-centric design appeals to users and developers who prioritize immediate scalability and are interested in supporting or developing applications that require rapid transaction processing, such as decentralized exchanges, gaming, and high-frequency trading bots. The minimal correlation reflects the differing priorities and consequent market behaviors surrounding each platform. For instance, news or developments in Cardano may lead to increased activity among its supporters but might not resonate with the Solana community, which is focused on completely different technological milestones and performance metrics. Similarly, when Solana experiences significant updates or faces challenges, like network congestion or outages, it primarily affects the communities and markets directly invested in or using Solana's technology. Furthermore, the differing technological underpinnings and roadmaps of Cardano and Solana mean that they do not seem to share common triggers for price movements or community engagement. While both are part of the broader conversation around Ethereum alternatives, they rarely compete for the same headlines or investor attention at any given moment, resulting in their near-independent behavior as reflected in the correlation coefficient. This divergence emphasizes the varied nature of investment strategies and community interests within the crypto ecosystem, where different value propositions attract distinct groups with little crossover.

#### **4.9 Polygon's Role in Blockchain Scalability as Reflected in Its Correlations with Ethereum and Solana**

Polygon's correlation with Ethereum at 0.13 underscores the interconnected nature of their relationship, given that Polygon serves as a complementary scaling solution for Ethereum. This moderate correlation is reflective of the intrinsic link between the performance of Ethereum and the adoption of Polygon, especially when Ethereum's network is congested and transaction fees are high. During such times, the activity related to Polygon tends to increase as users seek more cost-effective alternatives for executing transactions, and this dynamic is also visible in the development

community where Ethereum's limitations become talking points that lead to discussions about and movements towards Polygon's technology, as it offers a practical solution through its commitment to a multi-chain Ethereum ecosystem. The correlation between Polygon and Solana at 0.12 suggests that both networks are often considered in conversations regarding blockchain scalability and efficiency, despite their independent functionalities and underlying technologies. Solana, with its high throughput capabilities, represents a different approach to scalability by offering a blockchain solution that is fast and low-cost from the ground up. Meanwhile, Polygon provides a framework for building interconnected blockchain networks, thereby enhancing the scalability of Ethereum which, by itself, could struggle under heavy demand. This shared focus on scalability leads to a moderate correlation because as the crypto market and its users become more sophisticated, the demand for efficient transaction processing increases. As a result, discussions within communities that are keen on exploring the forefront of blockchain technology frequently involve both Solana, as a stand-alone scalable blockchain, and Polygon, as a scalability platform for Ethereum. Developers, investors, and users are increasingly interested in platforms that not only provide advanced functionalities but can also sustain a high volume of transactions. Hence, developments in either Solana or Polygon are likely to resonate within the communities interested in the other, due to the common goal of optimizing blockchain utility; the correlation between Polygon and these two cryptocurrencies reflects a growing recognition in the market that efficient and scalable blockchain solutions are critical for the future of crypto adoption. It also highlights the ongoing dialogue within the crypto space where the integrity and achievements of different scalability solutions are regularly assessed, compared, and debated among stakeholders who are eager to support or leverage these advancing technologies.

#### **4.10 Discussion**

This study on multi-coin multi-platform analysis of cryptocurrencies presents a detailed examination of the dynamics between different tokens and platforms, emphasizing the critical role of predictive relationships established through Granger causality tests and correlation matrices,

and the analysis uncovers some possibly predictive relationships, particularly between Ethereum and Binance and Solana with other tokens like Polygon and Binance, highlighting their substantial roles within the cryptocurrency ecosystem. For example, Ethereum's developments have a predictive impact on Binance's trading behaviors, showcasing Ethereum's foundational role and Binance's central position as a leading exchange. This predictive power is crucial for understanding how developments in one token can affect another, pointing to a broader market dynamic. Similarly, Solana's emerging significance is highlighted through its impact on cryptocurrencies like Polygon and Binance, emphasizing its role in promoting market trends toward scalability and efficiency. These relationships, marked by low p-values and high t-values, demonstrate robust predictive connections, highlighting Solana's technological innovations and their broader market influence. Furthermore, the unique position of Dogecoin within the market illustrates how community sentiment and social media buzz significantly influence trading activities and market dynamics; this reflects a split from the more technology-driven dynamics of other cryptocurrencies, highlighting the impact of non-traditional factors such as social movements and meme-driven market participation.

The correlation matrix provided in the chapter deepens our understanding of digital engagement and interconnectivity among various tokens across platforms like Reddit, Discord, and GitHub. Significant correlations, such as Bitcoin's positive correlation with Binance and its negative correlation with Cardano, illustrate how tokens can be influenced by their operational environments and strategic focuses. These correlations underscore the complex interplay between market perceptions, technological developments, and platform-specific dynamics. Moreover, moderate correlations between Ethereum and other platforms like Polygon, Solana, and Cardano suggest shared interests and competitive dynamics within the realm of decentralized applications. This interconnectivity is vital for grasping how technological advancements in one platform can ripple across the ecosystem, affecting market trends and investment behaviors. The chapter's insights are invaluable for stakeholders within the cryptocurrency market, including investors, developers, and platform operators. For investors, understanding these predictive relationships and correlations can aid in developing more informed investment strategies that consider potential ripple effects across the

market. Developers and platform operators can leverage these insights for strategic planning and positioning their projects in relation to dominant players and emerging technologies.

Looking forward, this chapter suggests areas for future research, such as exploring the broader implications of technological innovations across cryptocurrencies and conducting longitudinal studies to understand how these dynamics evolve over time given the youth of the cryptocurrency market. Too, examining the impact of regulatory changes on these relationships could provide deeper insights into how external factors influence market dynamics. In summary, this chapter enriches the understanding of the complex web of interactions that define the cryptocurrency market, emphasizing the need for a multifaceted approach to analyzing these digital assets. The insights gained not only enhance academic and practical perspectives but also lay the groundwork for developing robust predictive models and strategic frameworks for market participation. This comprehensive analysis highlights the importance of technological, social, and economic factors in shaping market behavior, setting a solid foundation for further exploration into the predictive models that can capture the nuanced relationships between different cryptocurrencies and online platforms, offering valuable perspectives for investors, developers, and researchers alike.

## **Chapter 5**

### **Conclusions**

#### **5.1 Overview**

This chapter outlines the conclusions drawn from the analysis, discussing the benefits and drawbacks of various analytical approaches and summarizes the single-coin, multi-coin, single-platform, and multi-platform analyses, highlighting the pros and cons of each approach. The chapter also emphasizes the importance of multi-coin, multi-platform analyses to understand the broader dynamics and interdependencies within the cryptocurrency market, and the conclusions suggest that further research is needed to expand temporal and platform data to improve the generalizability of findings and refine predictive models for cryptocurrency markets. A broader scope of analysis is proposed to better capture the dynamics of the cryptocurrency ecosystem and its evolving technological landscape. Ultimately, the chapter points toward future research avenues that could enhance our understanding of market dynamics, improve predictive models, and offer insights for stakeholders in the cryptocurrency ecosystem.

	<b>Single-Coin</b>	<b>Multi-Coin</b>
<b>Single-Platform</b>	<i>Pro:</i> Clear focus on specific behaviors. <i>Con:</i> Misses interactions across platforms and tokens.	<i>Pro:</i> Enables direct comparison under controlled variables. <i>Con:</i> Does not capture cross-platform effects.
<b>Multi-Platform</b>	<i>Pro:</i> Rich insights into a coin's ecosystem across contexts. <i>Con:</i> More complex data integration and analysis required.	<i>Pro:</i> Comprehensive view of market dynamics and interdependencies. <i>Con:</i> High complexity and requires advanced analytical techniques.

Figure 5.1: 2x2 Matrix Analysis of Single/Multi-Coin and Single/Multi-Platform

## 5.2 Single-Coin, Single, and Multi-Platform Analyses

Chapter 3 details the procedures for data extraction from these platforms, highlighting the technical methods and tools used to convert the data into a manageable format for analysis; the main analysis included a cross-platform study of Bitcoin's data trends on Reddit, Discord, and GitHub. Each platform's data reflected the market movements of Bitcoin during key events such as price drops and regulatory changes. For instance, Discord showed less correlation with the other platforms until a significant drop in Bitcoin's price in 2022, while Reddit and GitHub data exhibited synchronous spikes, especially around Bitcoin's all-time high in 2021. For Ethereum, the analysis showed a divergence between developer activity on GitHub and discussions on Discord and Reddit, which were more aligned with each other. Discord and Reddit data for Ethereum spiked during significant events like the COVID-19 pandemic and the Ethereum Merge, reflecting the community's response to market changes. Dogecoin's analysis emphasized the impact of viral events and community-driven campaigns on platform activity, particularly on Reddit and Discord, and Dogecoin spikes in activity corresponded with market highs and significant public events affecting its valuation. Solana, Cardano, and other cryptocurrencies were also analyzed, with data showing how discussions on these platforms correlate with price movements and community interest.

By examining a single cryptocurrency across multiple platforms, such as Ethereum's activity in the first case study of Chapter 2, researchers can better understand how different types of in-

teractions (e.g., development activities vs. community discussions) correlate with trading patterns. This method can reveal the influence of technological developments and community sentiment on the coin’s market behavior. This approach demonstrates the complex nature of cryptocurrencies, where not just financial activities but also technological advancements and community engagement can significantly influence market behavior. Granger causality tests applied to Ethereum across platforms have shown that activities on one platform can statistically predict changes in another, revealing a complex web of influence.

Analyses focusing on a single coin within a single platform can provide detailed insights into how specific events or discussions within a single community affect the market perception and trading behavior of that coin. For example, studying Bitcoin’s fluctuations and the sentiment of users on Reddit during periods of high volatility reveals how users’ perceptions can rapidly change, potentially influencing short-term market movements. This approach allows for focused, in-depth exploration of the interaction between community sentiment and market prices within a narrow scope. However, it has limited ability to generalize across the broader cryptocurrency ecosystem because it does not capture the interactions and dependencies that could influence other coins or trading platforms.

### **5.3 Multi-Coin, Single & Multi-Platform Analyses**

Chapter 4 delved into the predictive relationships among cryptocurrencies across platforms using Granger causality tests. These tests reveal how activities related to one cryptocurrency can forecast activities of another, highlighting the interconnectedness within the cryptocurrency ecosystem. The analysis found strong predictive relationships, notably between Ethereum and Binance and Solana with other cryptocurrencies, suggesting how changes in discourse or activities surrounding one can influence another significantly; the chapter also examines a correlation matrix that provides insights into the digital engagement and interconnectivity among various tokens. Notable findings included Bitcoin’s significant positive correlation with Binance, indicative of the exchange’s influence on Bitcoin’s market dynamics, and a negative correlation with Cardano,

highlighting divergent market interests. Moreover, the analysis of Ethereum's ecosystem synergy with platforms like Polygon, Solana, and Cardano revealed moderate correlations, indicating shared technological and market interests, and, in contrast, Dogecoin exhibits unique market behaviors driven by community sentiment and social media, differentiating it from more technology-oriented cryptocurrencies. The results suggest that understanding these predictive relationships and correlations is crucial for investors, developers, and platform users, aiding in strategic outlook and investment.

The most comprehensive approach, analyzing multiple coins across several platforms, provides a holistic view of the cryptocurrency market. This method can identify how developments in one coin or platform can ripple through to others, influencing overall market dynamics. This approach is valuable for understanding the interconnected nature of the cryptocurrency market. However, it requires sophisticated data handling and analysis techniques due to the complexity and volume of data involved. Such analyses have shown how interactions between coins and platforms can predict changes in market behaviors, as seen in the relationships between Ethereum, Solana, and Binance.

Analyzing multiple cryptocurrencies on a single platform enables the comparison of how different coins react under similar external conditions. This approach can identify unique behavioral patterns and assess the impact of platform-specific events or policies on various coins. While useful for comparative analysis, this method may overlook broader market dynamics that only become apparent when observing multiple platforms. For instance, an economic crisis might affect platforms differently, which in turn affects the coins traded on those platforms in diverse ways.

## 5.4 Time Series Analysis and Market Shocks

Time series analyses, such as those employing Granger causality tests, are powerful in detecting causal relationships and predicting market behavior over time. By analyzing how past market shocks, like the collapse of a major platform, affect cryptocurrency prices and trading volumes, it is possible to develop models that forecast future market movements. This approach treats market shocks as natural experiments, providing clear data points that can be used to refine economic and financial theories in the context of cryptocurrency markets.

## 5.5 Leveraging Data from Multiple Coins and Platforms

Combining data from various coins and platforms gives a more comprehensive view of the market dynamics. This integrated approach can help uncover patterns and interactions that are not apparent when analyzing coins or platforms in isolation. By synthesizing information across the ecosystem, researchers can capture the complex interplay of factors that drive market behaviors. This comprehensive view is crucial for developing robust predictive models and understanding the broader economic implications of blockchain technology and cryptocurrencies. It is also critical to have data with similar or, ideally, matching temporal characteristics between data types and time periods; doing time series analysis on data with mismatched time frames makes comprehension and observations to be difficult to obtain within the context of online platform data and cryptocurrency market data.

## 5.6 Limitations

The analysis of a single coin on a single platform provides an intricate look into specific interactions, but it significantly limits the broader application of findings. However, this approach can isolate variables and overlook broader market forces and multi-coin interactions, which can lead to misconceptions about a coin's true market behavior and risk profile in the larger ecosystem. This inherent limitation highlights the need for a diversified analytical approach. Conversely, analyzing

a single coin across multiple platforms introduces complexities such as managing incompatible data types and managing biases toward the opinions of more vocal, perhaps not representative, platform users, or platforms as a whole as seen through Reddit having more activity generally; these biases might color the analytical outcomes, making them less reflective of the overall market sentiment. When extending the analysis to multiple coins on a single platform, insights are shaped by the unique user base and engagement style of that platform, potentially missing the nuances that other platforms could reveal. These analyses fail to capture how different platforms might influence or reflect varying aspects of each coin's use and community engagement, highlighting a gap in market comprehension. The broadest analytical scope, multi-coin, cross-platform analysis, although providing the most comprehensive insights, faces challenges such as analytical complexity and the need for advanced computational resources. The variance in how platforms measure and report data adds another layer of complexity, requiring extensive data normalization to ensure comparability.

Along with these limitations among the analyses, the data itself faced challenges as combining and scaling the data proved difficult given the varying availability of temporal data. With some tokens having platform or market activity going back further than others, it makes it more difficult to bring these sources together to create a more robust analysis for those interested in the data dynamics of the cryptocurrency landscape in order to understand the market and communities moving forward. However, investing to make this data more accessible moving forward, particularly with online platform data which as of recently has become purposefully harder to obtain which hurts transparency and research, would bring immense value to the cryptocurrency and broader online communities allowing investors and skeptics of varying levels alike to have access and insight into the dynamics of the market in relation to online communities. This data accessibility could also prove beneficial to the trust and general understanding of the cryptocurrency ecosystem as skeptics and journalists would be able to investigate the workings of the market and communities under a microscope and evaluate risk, premonitions, and other metrics of stability, erasing some of the fear those on the outside may feel about decentralized assets. Having access to more complete timelines

of data would make the analysis of cryptocurrencies versus the market and online platforms broader and more comprehensive, allowing for a better understanding of this novel landscape as it continues to evolve in the years to come.

## 5.7 Conclusion

This study has provided a nuanced exploration of cryptocurrency market behaviors through various analytical frameworks: single-coin and multi-coin approaches on both single and multiple platforms. Each method has illuminated different aspects of how market dynamics and community interactions impact cryptocurrency prices and volumes. Focused single-coin, single-platform studies reveal the granular impacts of community sentiments on market behavior, particularly during periods of volatility. Multi-platform analyses of a single coin, like Ethereum, underscore how technological developments and community engagement across different platforms can influence market dynamics. Comparative studies across multiple coins on a single platform have highlighted the differential impacts of external conditions, offering insights into platform-specific market behaviors. Most comprehensively, multi-coin, multi-platform analyses demonstrate the interconnectivity of the cryptocurrency ecosystem, highlighting how developments in one area can resonate through the entire network, affecting prices and trading volumes across various platforms and coins.

The complexity and rapid evolution of the cryptocurrency market demand further research. Future studies should aim to expand temporal and platform data to enhance the generalizability of findings, develop more advanced methodologies for integrating and analyzing data across diverse platforms and coins to better capture the dynamics of the market, focus on the impact of new blockchain technologies and decentralized finance applications on market dynamics, and refine predictive models to forecast market behaviors more accurately using machine learning techniques that can handle the vast datasets available. These were places where this analysis was limited given data size constraints and modeling that can be further optimized. Too, going back to the addition of temporal data, more complete data would have been beneficial to have the exact same time periods for each platform and token in order to paint a more complete and comprehensive

picture of the dynamics of cryptocurrency data across online platforms.

In conclusion, this study highlights the intricate web of cryptocurrency markets, driven by a complex web of technological advancements, community interactions, attractor and repulsor-like responses, and external economic factors. By advancing analytical techniques and broadening the scope of these investigations, future research can provide even deeper insights into this rapidly evolving field, offering valuable information for investors, regulators, and participants in the cryptocurrency ecosystem on how these data manifest and operate in online spaces. This will not only enhance the understanding of market dynamics but also contribute to the development of novel, decentralized economic theories in the digital age.

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