EXPLORING MARKET DYNAMICS: ANALYZING THE CORRELATION BETWEEN NON-FUNGIBLE TOKENS, BITCOIN, ETHEREUM GROWTH RATES, AND NASDAQ PERFORMANCE

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Abstract

This study provides a comprehensive analysis of the growth rates and correlations among non-fungible tokens (NFTs), Bitcoin (BTC), Ethereum (ETH), and the NASDAQ Composite Index from 2018 to 2021. Utilizing data from Statista, CoinMarketCap, and Yahoo Finance, this study examines annual growth rates, standard deviations, and Pearson correlation coefficients to understand the dynamics of these diverse markets. The findings reveal significant volatility in the NFT and cryptocurrency markets, with NFTs experiencing an unprecedented growth rate of 5.552 percent from 2018 to 2019, followed by stabilization. In contrast, BTC and ETH exhibit notable fluctuations, reflecting the speculative nature of cryptocurrencies. The NASDAQ Index, representing traditional financial markets, displayed more consistent growth and lower volatility (Nath, 2020). These results suggest a complex interplay between the digital and traditional asset classes (Ante, 2022). This study highlights the importance of understanding market volatility and correlation patterns for investors and policymakers and emphasizes the need for adaptive investment strategies and regulatory frameworks in the evolving landscape of digital assets. Future research should focus on the causal factors influencing these market dynamics and the role of investor behavior in shaping market trends.

Keywords: Market Dynamics, Non-Fungible Tokens, Cryptocurrency, Bitcoin, Ethereum, Digital Asset Volatility

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1. INTRODUCTION

The emergence of non-fungible tokens (NFTs) has introduced a new paradigm in the digital asset landscape, intersecting the worlds of art, technology, and finance (Wu et al., 2023). NFTs, unique digital assets verified on blockchain technology, have not only captivated the interests of investors and collectors but also raised intriguing questions about their impact on and relationship with traditional financial markets and established cryptocurrencies such as Bitcoin (BTC) and Ethereum (ETH) (Ante, 2022). This study explores these dynamics by examining the growth rates and correlations between the NFT market and established financial entities.

The rapid ascent of NFTs, especially in art and collectible space, has been paralleled by significant fluctuations in the cryptocurrency market. BTC and ETH, the two most prominent cryptocurrencies, have experienced their own volatility and growth trajectories (Beneki et al., 2019). Understanding the relationship between these markets is crucial because it can provide insights into investor behavior, market sentiment, and the interplay between emerging digital assets and traditional financial systems. A comparison with the NASDAQ Composite Index, a benchmark for the stock market's overall performance, offers a perspective on how these novel asset classes align or diverge from the traditional market trends (Fooeik et al., 2022).

This study contributes to the growing body of literature on digital assets by quantitatively analyzing the growth rates of the NFT market, BTC, ETH, and NASDAQ Composite Index. This analysis aimed to uncover patterns and correlations that could shed light on the broader implications of the rise of NFTs and their place within the global financial ecosystem (Liao et al., 2024). The findings of this study are intended to inform investors, market analysts, and enthusiasts about the evolving dynamics of NFTs in relation to established financial markets. As the digital asset landscape evolves, it becomes imperative to understand the dynamics between emerging and traditional markets.

This leads to the following pivotal research question:

RQ: What is the nature of the relationship between the growth rates of the NFT market and established financial markets, specifically BTC, ETH, and the NASDAQ Composite Index?

By addressing this question, this study aims to provide insights into the correlation between the growth rates of these markets. Are NFTs moving in tandem with traditional financial markets represented by the NASDAQ or do they align more closely with the volatile nature of cryptocurrencies? Understanding these relationships can provide valuable insights into investors' behavior, the risk profile of these markets, and the potential impact of digital assets on traditional financial systems.

While this could not dismiss the growing interest in the correlation of digital assets with traditional financial markets, there is largely an approach that happens to be a one-size-fits-all, without deep analysis into the interplay that exists between emerging digital assets, such as NFTs, and established cryptocurrencies like BTC and ETH, along with more established stock indices such as NASDAQ. In large measure, research has also remained highly centered on either the volatility of individual assets or the correlation between these cryptocurrencies and therefore does not cover precisely how specially NFTs relate to both cryptocurrencies and traditional financial benchmarks. This paper fills this gap by analyzing cross-market dynamics from 2018 to 2021 and sheds light on potential diversification benefits, unveiling how NFTs interact in a subtle way within the broader financial ecosystem.

The primary aim of the study is to analyze the dynamic relationship and correlations between the NFTs and prominent cryptocurrencies, such as BTC and ETH, and the NASDAQ Composite Index, to understand how these digital assets interact among themselves and with traditional financial markets. Precisely, the present study explores annual growth rates, volatility, and correlation coefficients between these markets for the period of 2018–2021 in search of trends that could help shape investor and regulator approaches.

The theoretical framework is underpinned by the modern portfolio theory and the efficient market hypothesis. From these hypotheses, the research paper looks to see whether digital assets such as NFTs and cryptocurrencies can provide diversification benefits to an investment portfolio normally composed of traditional stock indices like the NASDAQ (Bakar & Rosbi, 2018). This allows for an indication as to whether digital assets move independently and uncorrelated with investments or their behavior is linked to broader macro-economic trends that other more traditional markets would also be vulnerable to.

This study is significant as it addresses the ever-evolving role that digital assets like NFTs and cryptocurrencies play in global financial markets, therefore, allowing for a view of their possible value in portfolio diversification and risk management. Gaining insight into the relationship of these assets with traditional indices, such as the NASDAQ, will help investors and policymakers adjust strategies to meet the emergence of digital finance. The methodological resorting is to quantitative analysis; thus, it calculates the rate of growth, standard deviations, and Pearson correlation coefficients by means of data provided by Statista, CoinMarketCap, and Yahoo Finance. This rigorous approach gives a clear, data-driven insight into the perspectives on market dynamics, volatility, and cross-asset correlations from 2018 to 2021.

This paper is organized as follows. Section 1 is the introduction which provides an overview of the rapid emergence of digital assets, a class of NFTs, and their unique positioning in financial markets, along with other well-established assets such as BTC, ETH, and the NASDAQ Index. Section 2 provides an overview of the relevant literature on NFT growth and volatility, together with cryptocurrencies and traditional financial markets, and the correlations among these assets. Section 3 describes the methodology, including how data was gathered from Statista, CoinMarketCap, and Yahoo Finance, and the statistical analysis-standard deviation and Pearson correlation coefficients that were applied to evaluate market dynamics. Section 4 presents the results of the growth rate and volatility analyses, which emphasize the main findings and interdependencies between asset classes. Section 5 elaborates on these findings by providing an insight into how assets are related among themselves and how markets may function. Finally, Section 6 concludes with implications for investors and policymakers, some possible limitations, and recommendations for future research.

2. LITERATURE REVIEW

Non-fungible tokens (NFTs) have recently gained widespread interest owing to instances of high selling prices at the height of their popularity. As the name implies, NFTs are non-fungible, meaning that each token is unique and cannot be easily exchanged for or replaced by another

equivalent NFT (Shah, 2022). In contrast, popular cryptocurrencies such as BTC and ETH are fungible; any individual BTC or ETH token can substitute for another, identical one in financial transactions or exchanges. Similarly, most corporate stocks are fungible. For example, any single share of Meta (Facebook) common stock confers ownership rights identical to any other share, including equal financial valuation and voting rights per share at shareholder meetings. NFTs tend to behave as distinctive assets analogous to collectibles, conventional cryptocurrencies, and stocks, exemplifying fungible financial instruments interchangeable with one another. Fungibility remains an important differentiator across emerging digital asset classes for researchers and policymakers.

The interrelationship between emerging digital assets, such as NFTs and cryptocurrencies, and traditional financial markets represented by the NASDAQ has become increasingly relevant in the current economic landscape. As decentralized blockchain-based technologies continue to gain adoption across borders, regulators are globally grappling with the implications of digital assets that operate independently from centralized financial systems and governance models (Vartanian et al., 2022). Understanding the growth trajectories and correlations between novel asset classes, such as NFTs, established cryptocurrency markets, and stock indexes, can inform more effective policies and frameworks for investor protection, risk management, taxation, and fostering responsible innovation. Beyond policymaking, these insights also provide strategic value for investment managers, researchers, and consumers navigating the rapid proliferation of digital currencies and tokenized assets against the backdrop of legal financial systems. Analyzing the market dynamics between NFTs, BTC, ETH, and the NASDAQ offers data-driven perspectives on the evolving interplay between emerging decentralized technologies and traditional institutions amid the growing mainstream adoption of blockchain-powered innovation (BenMabrouk et al., 2024).

2.1. Evolution and growth of cryptocurrencies

Cryptocurrencies emerged in 2008 with the BTC whitepaper released by Satoshi Nakamoto (Disparte, 2021). BTC introduced several groundbreaking innovations, including a decentralized ledger powered by blockchain technology and a consensus mechanism based on computational "mining" to validate transactions without reliance on a central authority (Squarepants, 2022). In the years following BTC's launch, alternative cryptocurrencies built on similar principles began gaining traction. One prominent example is ETH, proposed in 2013 by Vitalik Buterin and launched in 2015 (CoinMarketCap, 2021).

ETH expanded BTC's model by enabling decentralized applications (dApps), smart contracts, and self-executing agreements encoded on the blockchain. This opened up possibilities for cryptocurrencies to power more complex financial transactions and decentralized computing functions beyond peer-to-peer payments. As a result, ETH grew to become the second-largest cryptocurrency behind

BTC in terms of market capitalization, cementing its status along with BTC as a leading pioneer in the cryptocurrency space (Nath, 2020).

Both BTC and ETH adoption accelerated greatly starting around 2016, as cryptocurrency exchanges expanded and options for buying, selling, and trading digital assets continued to improve in sophistication and user-friendliness (Nath, 2020). This supported the increased integration with mainstream finance, including large banks, payment processors, and investment firms developing cryptocurrency offerings and services. For example, PayPal added the ability for users to buy, sell, and hold BTC and other cryptocurrencies starting in 2020 (PayPal Holdings, Inc., 2020). Leading stock exchanges like NASDAQ and CBOE began BTC futures trading as far back as 2017, allowing speculators to bet on BTC prices without directly handling the asset.

These developments have opened cryptocurrency investments in more significant consumer markets beyond technologists and early adopters. Further milestones adding legitimacy include El Salvador adopting BTC as a legal tender in 2021 (Bibi, 2023). More recently, major financial institutions, such as Mastercard, announced support for selecting cryptocurrencies on their networks (Dhamodharan, 2021). Despite volatility, the overall market value of prominent coins, such as BTC and ETH, demonstrated impressive growth before cooling in 2022, sparking increased calls for regulation globally. Understanding the evolution of foundational cryptocurrencies, such as BTC and ETH, and their integration into mainstream finance and payment systems provides a helpful context for their complex, interdependent relationship with traditional institutions.

2.2. Historical context and evolution of digital assets

The development of digital assets, especially NFTs, BTC, and ETH, was an important turn in financial markets, all over attracting high interest among institutional and individual investors remarkably. BTC was the first cryptocurrency in which blockchain technology introduced decentralized transactions and thus laid a foundation for further digital assets (Bakar & Rosbi, 2018). ETH expanded BTC's concept by adding smart contracts to create a host for dApps (Stuermer et al., 2016). These innovations paved the way for NFTs, unique digital assets that contributed to increasing diversity in the digital finance ecosystem. Unlike other classes of financial assets that usually follow correlations within wider economic indicators, digital assets such as NFTs and cryptocurrencies are showing behaviors subjected mostly to high volatility, irrespective of traditional market movements. Although this volatility is risky, at the same time, it is attractive for portfolio diversification under modern portfolio theory and thus offers investors the potential for risk reduction when combined with traditional assets. The unique characteristics of mainstream digital assets' adoption suggest that they may become intrinsic to modern investment strategies — things are not that easy, given volatility concerns and regulatory challenges.

2.3. Regulatory challenges and market implications

Despite the rapid evolution of the regulatory landscape for digital assets, particularly cryptocurrencies, and NFTs, different global authorities are seeking a balance between innovation on one hand and market stability — investor protection on the other. In this sense, Elmelki et al. (2022) note that the integration of cryptocurrencies in traditional financial markets is complex, as a variety of regulatory approaches across countries impact both the adoption and volatility of such assets. They also highlight that regulatory uncertainty can trigger price swings, which make the integration of digital assets into traditional portfolios difficult.

Alshater et al. (2024) go on to conduct a highly detailed overview of the regulatory challenges of NFTs, emphasizing how their format as a form of digital collectibles creates a gray area in law — in intellectual rights and asset classification. Such a growing market can be slowed in wider acceptance and integration into traditional financial systems by a lack of standardized regulation. Shanaev et al. (2020), present more general regulatory implications for the market of cryptocurrency. They note how the policy regulation of taxation and anti-money-laundering regulation may have a great influence on market dynamics and investor sentiment. They hence note that while some forms of regulations — namely, those promoting transparency and security — are essential, too much regulation in the digital asset realm stifles innovation. The findings from these studies realign the need for a balanced regulatory approach in support of growth in digital assets while protecting investors and further contributing to market integration with traditional finance.

2.4. Non-fungible tokens segments

The world of NFTs is vast and diverse, encompassing various segments from collectibles and art to gaming, metaverse, and utility tokens. Each segment exhibits unique characteristics and market dynamics, contributing to the rich tapestry of the NFT ecosystem.

Collectibles: NFTs have revolutionized the collectible market by introducing digital scarcity and verifiable ownership. Popular examples include digital art pieces, trading cards, and virtual pets, with some items fetching high prices at auctions due to their rarity and the reputation of their creators.

Art: The art world has embraced NFTs, offering artists a new medium for expression and monetization. Digital art NFTs provide artists with more control over their work, including the ability to receive royalties for secondary sales, which is a significant departure from traditional art market practices.

Gaming: NFTs in gaming have led to the emergence of "play-to-earn" models, where players can earn tangible rewards, often in the form of cryptocurrencies or other NFTs, for participating in the game. This has opened new economic models within the gaming industry, allowing players to own, buy, sell, and trade in-game assets across platforms.

Metaverse: In virtual worlds and metaverses, NFTs are used to represent ownership of digital real estate, virtual goods, and other assets. This led to the creation of entirely new digital economies and experiences within these virtual spaces.

Utility tokens: Beyond collectibles and art, utility NFTs have emerged as a significant segment. These tokens provide functional use such as access to services or events, memberships, and other digital rights or privileges.

Each segment contributes to the overall growth and evolution of the NFT market. As the technology and applications of NFTs continue to develop, they are likely to intersect with and influence traditional financial markets and industries.

2.5. Cryptocurrencies and traditional financial markets

2.5.1. Interaction with traditional assets like S&P 500

The relationship between cryptocurrencies and traditional financial markets, particularly assets such as the S&P 500, is a subject of increasing interest among investors and researchers. Cryptocurrencies such as BTC and ETH have shown varying degrees of correlation with traditional stock markets (Maouchi et al., 2024). In some periods, cryptocurrencies moved independently, suggesting that they could be a diversification tool in a broader investment portfolio. Conversely, during market stress or economic uncertainty, they have shown a higher correlation with traditional assets, behaving similarly to risk-on-assets such as stocks.

Recent studies have explored the impact of major economic events on both cryptocurrencies and stock markets. For instance, during the COVID-19 pandemic, both markets experienced significant volatility, although the recovery trajectory for cryptocurrencies was notably different from that for traditional stocks (Yang et al., 2023). This divergence offers insights into how digital assets might respond to global economic shocks compared with established financial markets.

2.5.2. Comparative analysis of market behaviors

A comparative analysis of market behaviors between cryptocurrencies and traditional assets, such as the S&P 500, reveals intriguing dynamics. Cryptocurrencies are known for their high volatility, which can be attributed to several factors including regulatory news, technological advancements, and changes in investor sentiment (Maouchi et al., 2024). In contrast, traditional stock markets, while also subject to volatility, are generally more influenced by economic indicators, corporate earnings, and monetary policies (Maouchi et al., 2022).

The liquidity and market depth of cryptocurrencies differ significantly from those of the traditional markets. The around-the-clock trading nature of digital assets, retail investor participation, and the cryptocurrency market's relative youth contribute to distinct market behaviors. These differences can lead to unique opportunities and risks for investors and require different analytical approaches to understand market movements and trends (Yang et al., 2024).

The interaction between cryptocurrencies and traditional financial markets, particularly assets such as the S&P 500, is complex and multi-faceted. Understanding these relationships involves analyzing correlations, market behaviors, and the impact of

external economic events. This comparative analysis is crucial for investors seeking to navigate digital and traditional asset classes effectively.

2.6. Correlations between cryptocurrencies and traditional markets

The correlation of cryptocurrencies with more traditional stock markets, such as the S&P 500 and NASDAQ, becomes increasingly popular in relation to those economic events that may strongly influence asset co-movements. In this respect, Youssef notes that main economic shocks, such as the COVID-19 pandemic, influenced the stock indices and cryptocurrencies, showing increased volatility and heightened correlations in periods of economic unrest. This therefore points to a pattern indicative that, though cryptocurrencies are considered alternative assets with autonomous prices, they might follow the trend of traditional markets in response to global economic shocks and reflect investor risk aversion across asset classes.

Agrawal (2024) extends this further by investigating the contemporaneous relationship between the crypto market and conventional stock indices. His findings suggest that cryptocurrencies such as BTC and ETH, while mostly uncorrelated, show a diversified correspondence to stock performance, especially in periods of market crisis. In another thread, Elmelki et al. (2022) utilized wavelet coherence analysis to examine in detail the dynamic correlation of BTC with the S&P 500 synchronous series, stating that the short-run market fluctuations tend to create temporary alignments, while the long-run associations are much looser. These studies therefore show that the correlation between cryptocurrencies and stock markets is not fixed but instead vulnerable to external economic conditions — a sign of complex interplay between emerging and established markets.

2.7. Risks and regulatory challenges

2.7.1. Volatility and security concerns

The volatility of digital assets, particularly cryptocurrencies, is well-documented. According to Katsiampa et al. (2018), extreme price fluctuations in cryptocurrencies such as BTC and ETH present significant risks for investors. These fluctuations are attributed to factors such as market sentiment, investor behavior, and regulatory news. Furthermore, security concerns, particularly in the realm of NFTs and cryptocurrencies, are a major issue. Guo and Yu (2022) highlighted the risks associated with cyber-attacks and the theft of digital assets, emphasizing the need for robust security measures in blockchain technology.

2.7.2. Regulatory landscape and its impact

The regulatory landscape of digital assets is evolving continually. Foley et al. (2019) discuss the challenges regulators face in keeping up with the rapid development of cryptocurrency markets. They argue that the lack of a unified regulatory framework leads to uncertainty and poses challenges to both investors and authorities. In addition, the impact of regulations on market dynamics is significant.

Dwyer (2022) noted that regulatory actions in various countries have led to notable shifts in cryptocurrency markets, affecting their valuation and adoption.

2.8. Societal and ecological impacts

2.8.1. Societal implications

The societal implications of digital assets, particularly NFTs, extend beyond financial considerations. NFTs redefine digital ownership and create new forms of digital interaction and value. This transformation has implications for how society perceives value and ownership in the digital context. Furthermore, Catalini and Gans (2020) discussed the broader societal impact of blockchain technology, emphasizing its potential to create more transparent and efficient systems for various societal transactions.

2.8.2. Environmental concerns related to energy consumption

Environmental concerns, particularly regarding the energy consumption of blockchain technologies and cryptocurrencies, are increasingly prominent. Krause and Tolaymat (2018) analyzed the energy consumption of BTC mining, highlighting its significant environmental impact. They argued that the energy-intensive process of mining cryptocurrencies challenges global efforts to reduce carbon emissions. Similarly, Truby (2018) called for regulatory frameworks to address the environmental impact of blockchain technology, suggesting that sustainable practices should be integrated into the development of digital assets.

2.9. Future trends and potential solutions

2.9.1. Emerging trends in the crypto and NFT market

The landscape of cryptocurrencies and NFTs is evolving rapidly, with new emerging trends that could shape the future of these markets. Khan et al. (2024) explore the increasing institutionalization of cryptocurrencies, suggesting a trend toward mainstream acceptance and stability in the crypto market. Ante (2022) discussed the growing diversification of NFT applications beyond digital art, including real estate and intellectual property, indicating a broadening scope and potential for NFTs.

2.9.2. Potential solutions to current challenges

Addressing the challenges in crypto and NFT markets requires innovative solutions. Cong and He (2019) proposed blockchain-based solutions to enhance transparency and security in digital asset transactions, potentially mitigating some of the risks associated with these markets. Additionally, Tapscott and Tapscott (2017) suggested that developing new regulatory frameworks and technological advancements could provide more stability and security for investors and users in the digital asset space.

Exploring the digital asset landscape, particularly cryptocurrencies and NFTs, has uncovered a rapidly evolving field. The literature reveals significant risks and regulatory challenges, highlighted by the volatility and security concerns discussed by Katsiampa et al. (2018). The evolving regulatory landscape, explored by Foley et al. (2019), adds a layer of complexity, impacting market dynamics and investor confidence. In addition, the societal implications of these technologies, as indicated by Catalini and Gans (2020), suggest a transformative shift in digital ownership and value creation.

Environmental concerns, particularly regarding the energy consumption of blockchain technologies, are a critical aspect of this landscape. Krause and Tolaymat (2018) and Truby (2018) emphasized the need for sustainable practices and regulatory interventions to address these concerns. In the future, the literature suggests a trend toward increasing institutionalization and diversification within these markets. Potential solutions to current challenges, as proposed by Cong and He (2019) and Tapscott and Tapscott (2017), include technological advancements and regulatory reforms that could stabilize and secure these markets. As the field continues to evolve, it is likely to be shaped by technological innovation, regulatory actions, and societal perception and adoption shifts.

3. RESEARCH METHODOLOGY

3.1. Data collection

This study conducted a quantitative analysis of the growth rates of NFTs, BTC, ETH, and the NASDAQ Composite Index from 2018 to 2021. The data are sourced from Statista, CoinMarketCap, and Yahoo Finance. The year-over-year growth rate for each market was calculated based on the changes in market capitalization.

3.2. Data analysis

The analysis involved two main statistical methods: calculation of the standard deviation and Pearson correlation coefficients using Microsoft Excel. In this study, we conduct a comprehensive analysis of market dynamics by utilizing historical market capitalization data for NFTs sourced from Statista (n.d.), alongside data for BTC and ETH from CoinMarketCap (n.d.), and data for the NASDAQ Composite Index from Yahoo Finance (2024). This approach provides a multifaceted view of the market trends from 2018 to 2021.

Standard deviation: This measure assesses the volatility of each market and provides insights into the variability of each market's growth rates around their mean. A higher standard deviation indicates greater market volatility and investment risk, whereas a lower standard deviation suggests greater stability.

Correlation coefficients: The Pearson correlation coefficients, calculated using Excel's CORREL function, determined the strength and direction of the linear relationships between the growth rates of NFT, BTC, ETH, and the NASDAQ Composite Index. Values close to +1 or -1 indicate strong positive or negative linear relationships, respectively, whereas values around zero suggest no linear relationship.

3.3. Statistical methods justification

The study uses Pearson's correlation coefficients to depict the strength and direction of linear relationships that may exist in growth rates experienced between NFTs, BTC, ETH, and the NASDAQ Index. It is a good statistical choice because it offers a clear measure of how closely these asset classes co-move, thereby suggesting potential diversification benefits. Additionally, it has used standard deviation to measure each market's volatility, therefore putting on display the barometer for the level of risk faced by investors. Other methods might involve regression analysis when trying to assess cause-and-effect relationships or wavelet coherence, which uncovers dynamic correlations over time and could give further temporal detail across these rapidly changing markets.

3.4. Confidence levels for correlation data

The introduction of the confidence intervals for the Pearson correlation coefficients greatly enhances the reliability of the results in the current study by indicating the precision of every estimate of the correlation. Confidence intervals give the range within which the true correlation would most likely fall, which is very useful since digital assets are highly volatile. This would be further enhanced, for example, by providing the calculation of 95% confidence intervals, which would serve to quantify the uncertainty of the observed correlations and, through that, permit more informed interpretations. Such an addition would give support to robust conclusions and minimize the danger of overestimation of relationships between market movements in these dynamic financial environments.

3.5. Ethical considerations

Given that this study involved secondary data from publicly available sources, ethical concerns related to data privacy and participant consent were not applicable. The study adhered to ethical standards of accuracy and reliability in data reporting and analysis.

4. RESULTS

4.1. Growth rate analysis

The analysis of the annual growth rates revealed significant fluctuations across markets. In the NFT market, an extraordinary growth rate of 5.552% was observed from 2018 to 2019, followed by a substantial increase of 139.6% from 2019 to 2020. However, 2020 to 2021 showed a marginal decline of approximately -0.12% (see Table 2).

The BTC market experienced a decrease of -46.9% in growth rate from 2018 to 2019, followed by a sharp increase of 306.7% from 2019 to 2020, and a decrease of -46.0% from 2020 to 2021. The ETH market has shown a consistent increase in growth rates over the years, with a notable surge of 608.6% from 2020 to 2021. The NASDAQ Composite Index was more stable, with growth rates of 48.5%, 30.7%, and 47.7%, respectively (Table 2).

4.2. Standard deviation analysis

Standard deviation analysis indicates varying levels of volatility across markets. The NFT market exhibited the highest volatility with a standard deviation of 2776.45%, followed by ETH at 295.67%. The BTC market showed a standard deviation of 176.85%, while the NASDAQ Composite Index demonstrated the least volatility with a standard deviation of 8.85% (Table 3).

4.3. Correlation analysis

The Pearson correlation coefficients revealed diverse relationships between the market growth rates. There was a moderate negative correlation between NFT and BTC growth rate (r = -0.4827) and a strong negative correlation between NFT and ETH growth rate (r = -0.8959). Interestingly, a moderate positive correlation was observed between NFT growth rates and the NASDAQ Composite Index (r = 0.5153). BTC growth rates showed an extremely strong negative correlation with the NASDAQ Composite Index (r = -0.9993), indicating almost inverse movements (Table 4).

Table 1. Market capitalization data (2018–2021)

Year	NFT market cap (million USD)	BTC market cap (billion USD)	ETH market cap (billion USD)	NASDAQ Composite Index (trillion USD)
2018	2.5	276.63	13.8	6.8
2019	141.3	146.9	15.6	10.1
2020	338.7	597.2	67.4	13.2
2021	338.3	322.44	477.7	19.5

Note: Market capitalization data for NFT, BTC, ETH, and NASDAQ from 2018 to 2021.
Source: Market capitalization data for NFTs from 2018 to 2021 are sourced from Statista (n.d.). Data for BTC and ETH market capitalizations for the same period were sourced from CoinMarketCap (n.d.). NASDAQ Composite Index data from 2018 to 2021 were obtained from Yahoo Finance (2024).

Table 2. Annual growth rates for NFT, BTC, ETH, and NASDAQ (2019–2021)

Year	NFT market cap growth (%)	BTC market cap growth (%)	ETH market cap growth (%)	NASDAQ growth (%)
2019	5552	-46.9	13.0	48.5
2020	139.6	306.7	332.1	30.7
2021	-0.1	-46.0	608.6	47.7

Note: This table shows the year-over-year growth rates in percentages for NFT, BTC, ETH, and the NASDAQ Composite Index from 2019 to 2021. Growth rate calculated as (Current Year Value – Previous Year Value) / Previous Year Value × 100% (Current Year Value – Previous Year Value) / Previous Year Value × 100%.

Table 3. Mean growth rates and standard deviations for NFT, BTC, ETH, and NASDAQ (2018–2021)

Market	Mean growth rate (%)	Standard deviation (%)
NFT	1845.83	2776.45
BTC	71.27	176.85
ETH	318.23	295.67
NASDAQ	42.30	8.85

Note: This table presents the mean growth rates and standard deviations, calculated as percentages, for the annual growth rates of NFT, BTC, ETH, and NASDAQ from 2018 to 2021. The mean growth rate represents the average annual growth, whereas the standard deviation indicates the volatility of the growth rates for each market.

Table 4. Pearson correlation coefficients among NFT, BTC, ETH, and NASDAQ growth rates

Variable	BTC growth	ETH growth	NASDAQ
NFT growth	-0.4827	-0.8959	0.5153
BTC growth	NA	0.0435	-0.9993
ETH growth	NA	NA	-0.0810

Note: This table displays Pearson's correlation coefficients (r) between the annual growth rates of NFT, BTC, ETH, and NASDAQ from 2018 to 2021. Values range from -1 to +1, where values close to +1 or -1 indicate strong positive or negative linear relationships, respectively, and values around 0 suggest no linear relationship.

One primary factor is market sentiment, shifts in investor confidence due to economic events or regulatory announcements often influence asset classes similarly, especially during periods of market uncertainty. For instance, global economic downturns or positive earnings in tech-heavy indices such as the NASDAQ may simultaneously impact traditional and digital assets as investors reassess risk tolerance.

Another possibility is the flow of liquidity across markets; this would explain the short-run correlations, from time to time, when institutional or retail investors move between asset classes, especially as digital assets start to link with mainstream finance. Besides, advancements and innovations in technology within the blockchain space may also independently fuel demand in NFTs and cryptocurrencies, thereby influencing their correlations with traditional markets. This might also include the changing regulatory environment; for instance, cryptocurrency policies or NFT taxation that can lead to changes in investor behavior across all asset classes and influence correlations as the markets adjust to changing compliance requirements.

5. DISCUSSION

5.1. Interpretation of growth rates

The extraordinary growth rate observed in the NFT market from 2018 to 2019 (5.552%) suggests a burgeoning interest in this new asset class, potentially driven by its novelty and the growing popularity of digital art and collectibles. The slight decline in the growth rate in 2021 (-0.12%) may indicate market saturation or normalization following the initial surge of interest (Bouteska, 2020). In contrast, the BTC and ETH markets exhibit significant volatility. The sharp fluctuations in BTC growth rates, with notable decreases in 2019 and 2021, align with previous findings on cryptocurrencies' susceptibility to market sentiment and regulatory news (Parekh et al., 2022). ETH's consistent growth, culminating in a 608.6% increase in 2021, may reflect its increasing utility and adoption, particularly in decentralized finance (DeFi) and NFT transactions (Musleh et al., 2019).

The NASDAQ Composite Index showed more stable growth, underscoring its nature as an established and diversified market. The comparative stability of the NASDAQ suggests that traditional financial markets, while not immune to fluctuations, are less volatile than relatively new cryptocurrency markets.

5.2. Volatility and market dynamics

The high standard deviation in the NFT market indicates its high volatility, which can be attributed to the market's nascent stage and ongoing development. This finding is crucial for investors and market analysts, as it highlights the riskier nature of investing in NFTs compared to more established markets, such as NASDAQ, which exhibited the lowest standard deviation (Li et al., 2024).

5.3. Correlation insights

The negative correlation between NFT growth rates and BTC and ETH growth rates, and particularly the strong negative correlation with ETH, is intriguing. This suggests that growth in the NFT market may occur independently or at the expense of established cryptocurrencies, possibly due to shifting investor focus or speculative trading behavior (Kamolsareeratana & Kouwenberg, 2023). The moderate positive correlation between NFT growth rates and the NASDAQ Composite Index is unexpected, indicating that, despite being a novel asset class, NFTs may still be influenced by broader economic factors that affect traditional stock markets.

6. CONCLUSION

This study embarked on an exploratory journey to understand the dynamic interplay between emerging digital assets such as NFTs and established financial markets, including cryptocurrencies, and the NASDAQ Composite Index. The findings reveal a complex landscape in which traditional financial principles intersect with novel characteristics of digital assets.

The extraordinary growth observed in the NFT market, particularly between 2018 and 2019, underscores the rapid pace at which digital assets can capture market interest. However, the subsequent stabilization in growth rates suggests a maturing market that aligns more closely with traditional market behaviors. In contrast, the volatility observed in the BTC and ETH markets reaffirms the speculative nature of cryptocurrencies, influenced by a myriad of factors, ranging from regulatory changes to technological advancements and investor sentiment.

The correlation analysis provided insightful results. The negative correlation between NFT growth rates and those of BTC and ETH might suggest a diversification trend among digital asset investors, in which the rise of one asset class does not necessarily bolster the others. Conversely, the positive correlation between NFTs and the NASDAQ Composite Index suggests an intriguing connection between digital assets and traditional financial markets, possibly driven by broader economic factors.

These findings have significant implications for investors, market analysts, and policymakers. For investors, the high volatility in digital asset markets, especially NFTs, calls for cautious investment strategies that emphasize the importance of diversification and risk assessment. Understanding the correlation patterns between these diverse asset classes is crucial for market analysts to provide accurate market forecasts and investment advice. Policymakers and regulators face the challenge of adapting existing financial regulations to accommodate the unique characteristics of digital assets while ensuring market stability and investor protection.

The limitations of this study include the mere four-year time frame from 2018 to 2021, which may inadequately represent long-run trends in digital and traditional asset interactions. The second limitation is the reliance on secondary data obtained from specific sources; such a predisposition may lead to some shallowness in the obtained insights, given the volatility and changing nature of digital assets. The sample size, in the last instance, is bound to key assets like NFTs, BTC, ETH, and NASDAQ, which might not reflect the general dynamics of broader markets.

Our findings have several implications for future research. For investors, understanding volatility and correlation patterns can inform portfolio diversification and risk-management strategies. For regulators, insights into market dynamics can guide the development of frameworks that ensure investor protection, while fostering innovation.

Future research could explore the causal factors behind these markets' volatility and growth patterns, particularly by examining the impact of technological advancements, market regulations, and macroeconomic factors. Additionally, qualitative studies can provide deeper insights into investor behavior and sentiment in these markets.

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APPENDIX. ANNUAL GROWTH RATES OF NFT, BTC, ETH, AND NASDAQ COMPOSITE INDEX (2018–2021)

This appendix provides detailed calculations of the annual growth rates for NFT market capitalization, BTC market capitalization, ETH market capitalization, and the NASDAQ Composite Index from 2018 to 2021. The growth rate is calculated using the formula: *(Current Year Value – Previous Year Value) / Previous Year Value × 100% (Current Year Value – Previous Year Value) / Previous Year Value × 100%.*

Table A.1. Annual growth rates: NFT market capitalization growth rate

Year	Growth rate
2018 to 2019	Growth rate = (141.3 – 2.5) / 2.5 x 100 = 5,552%
2019 to 2020	Growth rate = (338.7 – 141.3) / 141.3 x 100 ≈ 139.6%
2020 to 2021	Growth rate = (338.3 – 338.7) / 338.7 x 100 ≈ -0.12%

Source: Statista (n.d.).

Table A.2. Annual growth rates: BTC market capitalization growth rate

Year	Growth rate
2018 to 2019	Growth rate = (146.9 – 276.63) / 276.63 x 100 ≈ -46.9%
2019 to 2020	Growth rate = (597.2 – 146.9) / 146.9 x 100 ≈ 306.7%
2020 to 2021	Growth rate = (322.44 – 597.2) / 597.2 x 100 ≈ -46.0%

Source: CoinMarketCap (n.d.).

Table A.3. Annual growth rates: ETH market capitalization growth rate

Year	Growth rate
2018 to 2019	Growth rate = (15.6 – 13.8) / 13.8 x 100 ≈ 13.0%
2019 to 2020	Growth rate = (67.4 – 15.6) / 15.6 x 100 ≈ 332.1%
2020 to 2021	Growth rate = (477.7 – 67.4) / 67.4 x 100 ≈ 608.6%

Source: CoinMarketCap (n.d.).

Table A.4. Annual growth rates: NASDAQ Composite Index growth rate

Year	Growth rate
2018 to 2019	Growth rate = (10.1 – 6.8) / 6.8 x 100 ≈ 48.5%
2019 to 2020	Growth rate = (13.2 – 10.1) / 10.1 x 100 ≈ 30.7%
2020 to 2021	Growth rate = (19.5 – 13.2) / 13.2 x 100 ≈ 47.7%

Source: Yahoo Finance (2024).