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Bitcoin's Role in Economic Turmoil: Safe Haven or Mirage?

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ABSTRACT

This study investigates three specific research purposes: (1) to analyze the relationship between Bitcoin and gold, (2) to assess Bitcoin's effectiveness as a hedge against the stock market, and (3) to explore the impact of market turmoil on the relationship between Bitcoin and the stock market. The study employs the generalized autoregressive conditional heteroskedasticity (GARCH) model to examine interactions among Bitcoin, gold, and the NASDAQ stock market, with money supply as a control variable to assess its influence on these relationships. The results reveal that Bitcoin does not function as a hedge for stock market, particularly NASDAQ, thus refuting the hypothesis about its hedging capabilities. Additionally, the money supply variable is found to lack significant relevance in elucidating the connection between Bitcoin and both NASDAQ and gold. However, during periods of market turmoil, a notable correlation between Bitcoin and NASDAQ emerged, with stronger associations being observed under such conditions. This validates the hypothesis related to market turmoil. Despite its characterization as "digital gold", the study found no statistically significant relationship between Bitcoin and gold, although both assets exhibited similar price trends.

Keywords: Bitcoin; stock market; NASDAQ; money supply; gold

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INTRODUCTION

Blockchain technology represents a transformative paradigm for the financial industry, garnering attention as an innovation poised to shape the future [1]. As a type of distributed ledger technology (DTL), blockchain ensures secure and transparent data storage and transfer. Transactions are recorded and organized in blocks linked sequentially using cryptography, creating an immutable chain. Since multiple parties or validators hold copies of all transactions, any attempt to tamper with a single copy does not compromise the overall security of the blockchain [2]. Cryptocurrencies are among the most prominent applications of blockchain technology. Defined as decentralized digital currencies that rely on encryption to validate transactions [3], cryptocurrencies emerged as a substitute for and a reaction against central banks manipulation of fiat money [4]. Fiat money, issued by the government, has no intrinsic value.

The rising popularity of cryptocurrencies has led to their classification as investment assets [5]. Among them, Bitcoin (BTC) is the most widely recognized. Created in January 2009, it became the

first decentralized peer-to-peer monetary network, operating without any intermediaries or central authority [6]. This structure allows users to transfer funds directly to each other without incurring high transaction fees imposed by traditional financial institutions. Unlike banks, which charge fees for services such as ATM (automated teller machines) cash withdrawals, credit card transactions, and wire transfers, Bitcoin's transaction fees are based on the data size of the transfer rather than the value of the transaction itself. Thus, users can send large amounts of money with smaller transaction fees. This cost-effectiveness makes Bitcoin an appealing alternative to the traditional banking system. Despite the history of its price volatility, Bitcoin's growing acceptance among investors suggests that it may secure a place in the global financial landscape [6].

Bitcoin is often seen as a hedge against inflation and economic instability, as well as a long-term investment with a potential to deliver high returns [3]. Its fixed supply and low transaction costs contribute to its reputation as a store of value, a medium that can preserve its purchasing power over time and can be readily exchanged for other assets. However, some

critics question Bitcoin's effectiveness as a store of value due to its volatility, young age, and replicability [7]. Despite these concerns, Bitcoin's scarcity, driven by the phenomenon known as halving, continues to increase its value and strengthen its appeal to investors, fueling the people's belief that Bitcoin will be the money of the future. Halving happens approximately every four years and reduces mining rewards, controlling Bitcoin blocks and supply. Investors believe that this phenomenon could lead to a price increase if demand remains stable or grows [6].

The four-year Bitcoin halving cycle has consistently influenced price trends, with notable peaks at each halving event, followed by a significant price correction. The first Bitcoin halving occurred in 2012, when the price of the BTC/USD pair on the Bitfinex exchange chart on <https://www.investing.com/> was around \$5. Within a year, Bitcoin's price rose to nearly \$1,000. Subsequent halvings in 2016 and 2020 led to peaks of over \$18,000 in 2017 and \$60,000 in 2021, respectively. The 4-year cycle of Bitcoin has been a recurring pattern throughout its history,¹ and many investors and experts rely on it in making investment decisions. However, while the halving cycle provides useful insights, it doesn't guarantee future price movements [8].

In terms of price performance, Dyhrberg [9] discovered that Bitcoin exhibits a number of similarities to gold, particularly in hedging capabilities and its symmetric reactions to positive and negative news. This means that their prices tend to rise or fall in the same direction as the type of news. Gold has traditionally been considered an intrinsic currency and wealth reserve, maintaining or even increasing in value during equity market downturns [10]. However, Hoang et al. [11] found evidence that gold's role as a hedge against inflation varies by country, gold market characteristics, and time frame. To demonstrate, prior to 2013, gold functioned as a hedge for the US and European stock markets, but its effectiveness in this role appears to have declined over time [12].

Many people, not just financial experts, have shown more interest in understanding the role of gold as a safe haven during times of economic uncertainty and market turbulence. Likewise, some investors are moving towards Bitcoin due to its hedging and safe

haven characteristics [10]. Given the similarities between Bitcoin and gold, it is worth investigating whether Bitcoin can also act as a safe asset. Despite the growing interest in Bitcoin among investors and its growing market capitalization, currently exceeding \$500 billion, there is still limited knowledge of the connections between cryptocurrencies and other assets [13]. There is still a significant gap in understanding of how returns and volatility spill over from the cryptocurrency markets to other markets. This is an important aspect of risk management, portfolio diversification, and hedging strategies. Understanding these relationships can provide investors with valuable insights to diversify their portfolios and protect themselves from risk.

Bitcoin, as an intangible asset, attracts attention due to its controversial history and lack of association with formal institutions. Despite widespread skepticism about the Bitcoin market, Urom et al. [3] argue that its price is not solely determined by speculation. Factors such as supply and demand, transaction costs, and broader global financial trends also affect Bitcoin's valuation. While the historical volatility of Bitcoin creates doubts, some investors see it as a potential hedging tool or investment vehicle. Shahzad et al. [10] identified Bitcoin as a hedge because it has a negative correlation with the stock market. Similarly, Ji et al. [13] found that investors often turn to Bitcoin during times of uncertainty in the stock market as a way to protect against potential losses. However, despite increasing trading volumes of Bitcoin and other cryptocurrencies, their liquidity remains relatively low compared to traditional financial assets such as stocks [10].

Gold and Bitcoin share notable similarities, including their classification as commodities by the US Commodity Futures Trading Commission, the process of "mining" (albeit through a different mechanism), and their independence from sovereign authorities such as central banks. Both assets also exhibit limited supplies, resulting in a positive relationship between returns and volatility. Furthermore, both gold and Bitcoin are regarded as reliable hedges against persistent inflation and stock market volatility. According to the supply and demand theory, Bitcoin's price tends to rise as long as demand remains stable or grows [10] while its supply decreases due to scarcity.

Based on the above discussion, it is likely that there is a relationship between Bitcoin, gold, and the stock

¹ Blockchain.com. Estimated transaction value (USD). 2023. URL: <https://www.blockchain.com/explorer/charts/estimated-transaction-volume-usd>. (accessed on 01.05.2023).

market. This study will therefore focus on the following research questions:

1. Does Bitcoin's return have a positive relationship with gold's return?
2. Does Bitcoin's return display a negative relationship with the stock market's return, thereby serving as a hedge?
3. Does Bitcoin's return demonstrate a positive correlation with the stock market's return during periods of market turmoil?

LITERATURE REVIEW

Bitcoin

Bitcoin, created by Satoshi Nakamoto and released as open-source software in 2009, was designed to replace the usual physical object of currency with a computer file [14]. It has the potential to provide a more efficient and secure means of payment and a store of value. Bitcoin is considered a temporary store of value and an alternative to rapidly depreciating fiat currencies [15]. Dyhrberg [9] highlights Bitcoin as a pure beneficial store of value and a pure medium of exchange. Ammous [16] attributes Bitcoin's appeal as a store of value to the predictability and credibility of its supply, as well as its resilience and resistance to manipulation. For instance, MicroStrategy Incorporated, a U.S. software company, has embraced Bitcoin as a store of value and become one of the largest Bitcoin holders [17]. As of July 31, 2023, the company held 152.800 Bitcoins [18], considering it to be a hedge against inflation and a reliable reserve of value as well as an asset with superior long-term growth potential compared to cash holdings [19].

Beyond its use as a store of value, Bitcoin is increasingly being used for transferring funds, particularly in cross-border transactions. Traditional payment systems are often costly and inefficient, with high fees, strict regulations, and lengthy processing times. Bitcoin offers a streamlined alternative, enabling direct, low-cost, transparent, and flexible transfers, making it attractive for businesses that manage international payments [20]. However, the cost advantage depends on the companies involved in the transaction, and, in some cases, it may approximate traditional methods [21].

Bitcoin has also emerged as a speculative trading instrument due to its exchange-driven value [22, 23]. Moreover, it serves as an investment asset with

diversification both in normal times and times of turmoil [24]. Dyhrberg [9] identifies Bitcoin as having qualities that make it a potential hedge against stocks on the Financial Times Stock Exchange Index, proposing that investors might use it in conjunction with gold to eliminate or minimize specific market risks.

Despite the advantages, Bitcoin faces criticism for its high volatility and its association with illegal activities. As a decentralized currency beyond government regulation, Bitcoin has attracted criminal use options, such as money laundering and the purchase of illegal goods and services. However, Chainalysis' 2021 report revealed that the criminal share of cryptocurrency activity had been declining in recent years — from 2.1% in 2019 (roughly \$21.4 billion worth of transfers) to 0.34% in 2020 (around \$10.0 billion in transaction volume) [25]. This makes criminal activity, such as drug dealing and blackmail, greater in traditional markets than in Bitcoin. Moreover, Bitcoin transactions are traceable, allowing authorities to track illicit activity when connections between addresses are identified [26]. While its volatility presents challenges, Bitcoin offers substantial profitability during bullish market cycles [27].

Digital Gold

Gold has played a prominent role throughout history, serving as a form of currency for centuries [28]. Although it is no longer considered a currency in today's financial system, its value as a tangible, safe-haven asset remains significant. The relationship between gold prices and inflation has been extensively studied, with research dating back to the 1970s, underscoring its reputation as a reliable asset during economic uncertainty. Dyhrberg [9] finds gold to be an effective hedging tool because of its negative correlation with the US dollar. However, contrasting findings by Hoang et al. [11] suggest gold's hedging capabilities against inflation are more effective in the short term, varying by country and market context. Klein [12] also notes gold's diminishing role as a safe haven after 2013.

Bitcoin and gold have similarities, including a limited supply and potential hedge properties. While gold's supply is naturally constrained, Bitcoin is capped at 21 million units, supporting their perceived roles as stores of value. Both assets have also been examined as potential hedges or safe havens against

financial uncertainty. However, Bitcoin's effectiveness varies depending on market condition and investment horizons [29]. Its status as a safe haven against market volatility has led it to be dubbed "digital gold", "new gold", or "gold 2.0" [30, 31].

Additionally, Bitcoin shares characteristics with both gold and the US dollar, such as its hedging capabilities and its role as a medium of exchange and a hedging asset [32]. Dyhrberg [9] confirms Bitcoin's and gold's similar hedging capabilities, a finding supported by Ghorbel and Jeribi [33, 34], who suggest that both assets serve as safe havens during crises, particularly for Chinese and US investors. However, gold remains a stronger hedge for US investors during downturns. Klein et al. [35] also emphasize gold's superiority as a safe haven asset, while Bitcoin offers minimal protection during market downturns.

Contrasting findings by Trabelsi [32] suggest no significant spillover effects between cryptocurrencies, gold, and traditional financial markets. This indicates Bitcoin's weak integration into the global financial system, implying that it could be viewed as an independent financial instrument with minimal systemic risk. The independence of Bitcoin makes it an attractive diversification tool offering low systemic risk. A study conducted by Bouri et al. [15] indicates that Bitcoin performs poorly as a hedge, but is suitable only for diversification purposes. One year later, Bouri et al. [15] recognized Bitcoin's potential as a hedge during uncertain times. These inconclusive findings highlight the need for further research into the relationship between Bitcoin and gold, particularly in their roles as safe havens and hedge assets.

Relationship Between Bitcoin, Gold, and the Stock Market

Stocks offer returns through capital appreciation and dividends, while their prices are influenced by company performance, economic conditions, industry trends, and investor sentiment. Their diversity across sectors and market capitalizations also allows investors to diversify their portfolios and pursue long-term financial goals. *Table 1* summarizes the previous literature on Bitcoin, gold, and the stock market.

Dyhrberg [9] discovered that Bitcoin and gold share similar hedging capabilities and react symmetrically to both good and bad news. Due to its lack of significant leverage effects, Bitcoin can serve as a tool for risk-

averse investors to anticipate negative market developments. Another study published the same year by Dyhrberg [36] further explored Bitcoin's hedging properties and found that it could effectively hedge against the Financial Times Stock Exchange Index and the US dollar in the short term. As a result, Bitcoin can be considered a complementary instrument for gold and other assets in minimizing risks. However, Bouri et al. [29] concluded that Bitcoin performs poorly as a hedge and is more suitable for diversification. Despite this, they also noted that Bitcoin acts as a strong safe haven against weekly extreme downward movements in Asian stocks. In a subsequent study, Bouri et al. [15] observed that Bitcoin exhibited safe-haven properties prior to the 2013 price crash but lost this characteristic afterwards. Similarly, Bouri et al. [37] found that Bitcoin functions as a hedge in bullish markets but fails to do so in bearish markets, as its returns are negatively impacted by uncertainty.

Shahzad et al. [10], using data from July 20, 2010, to December 31, 2018, found that Bitcoin is the most effective hedging strategy and a safe haven for the Canadian stock index. During periods of lower returns and bearish trends in both the stock and gold markets, gold offered consistent diversification benefits for equity investments in the G7 markets compared to Bitcoin. Conversely, gold was identified as the most effective hedge and safe haven for stock indices in France, Germany, Italy, Japan, the United Kingdom, the United States, and the MSCI G7 index. However, Klein et al. [35], analyzing data from July 1, 2011, to December 31, 2017, concluded that Bitcoin is not a hedge against equity investments. They also noted that Bitcoin behaves in a manner exactly opposite to gold, positively correlating with downward markets. Despite near-similar data frames, the results of Klein et al. [12] and Shahzad et al. [10] studies differed. While Shahzad et al. [10] concluded that both Bitcoin and gold could act as a hedge and safe haven for certain stock indices, Klein et al. [12] argued that Bitcoin was not a hedge against equity investment and behaved contrary to gold. Further, Wu et al. [39] found that neither gold nor Bitcoin acted as effective hedge or safe havens against economic policy uncertainty in extreme bearish or bullish market conditions. However, both assets could provide diversification benefits in normal market conditions.

Ghorbel and Jeribi [33] noted that cryptocurrencies, including Bitcoin, act as diversifiers during stable

Table 1

List of Literature Related to Bitcoin, Gold, and the Stock Market

No.	Title	Data Date	Finding	Methodology
Relationship between Bitcoin and the Stock Market				
1	Hedging capabilities of Bitcoin: Is it the virtual gold? [36]	19 July 2010 – 22 May 2015	Bitcoin serves as a hedge against stocks in the Financial Times Stock Exchange Index. It also acts as a hedge against the American dollar in the short term	GARCH
2	On the hedge and safe haven properties of Bitcoin: Is it really more than a diversifier? [29]	July 2011 – December 2015	Bitcoin is considered a poor hedge and is primarily suitable for diversification purposes only. However, it can act as a strong safe haven specifically against weekly extreme downward movements in Asian stocks	DCC (GARCH)
3	Does Bitcoin hedge global uncertainty? Evidence from wavelet-based quantile-in-quantile regressions [37]	17 March 2011 – 07 October 2016	In the near term, Bitcoin serves as a hedge in bullish markets but fails to do so during bearish periods, as uncertainty negatively affects its returns	Wavelet multiscale decomposition and Quantile Regression Analysis (QRA)
4	Dynamic connectedness and integration in cryptocurrency markets [13]	August 7, 2015 – February 22, 2018	When there is high uncertainty in the stock market, investors may turn to Bitcoin as a hedge to mitigate potential losses in the stock market	(VAR) and forecast-error variance decomposition (FEVD)
5	Safe haven, hedge, and diversification for G7 stock markets: Gold versus Bitcoin [10]	20 July 2010 – 31 December 2018	Bitcoin serves as a safe haven and hedge for the Canadian stock index	GARCH and Conditional diversification benefit (CDB)
6	Bitcoin: An inflation hedge but not a safe haven [38]	21 July 2010 – 31 December 2020	Bitcoin is not a hedge for the stock market, but it can serve as a hedge against inflation	Vector autoregressions model (VAR)
Relationship between Bitcoin and Gold				
1	Bitcoin, gold and the dollar – A GARCH volatility analysis [9]	19 July 2010 – 22 May 2015	Bitcoin is similar to gold and reacts to similar variables, thereby possessing similar hedging capabilities and responding symmetrically to both good and bad news	GARCH
2	Bitcoin is not the New Gold – A comparison of volatility, correlation, and portfolio performance [35]	01 July 2011 – 31 December 2017	Bitcoin is not a hedge against equity investments, as it behaves as the exact opposite of gold and positively correlates with downward markets	GARCH
3	Does gold or Bitcoin hedge economic policy uncertainty? [39]	02 February 2012 – 31 December 2018	Bitcoin and gold may serve as weak hedges and weak safe havens against economic policy uncertainty (EPU) during both extreme bullish and bearish market conditions	GARCH and quantile regression with dummy variables
4	Contagion of COVID-19 pandemic between oil and financial assets: the evidence of multivariate Markov switching GARCH models [33]	17 January 2020 – 10 December 2022	Gold and Bitcoin are safe havens for Chinese investors during the crisis. However, Bitcoin may not serve as a safe haven when investing in crude oil during the global pandemic	GARCH
5	Investigating the relationship between volatilities of cryptocurrencies and other financial assets [34]	01 January 2016 – 01 April 2020	Before the coronavirus crisis, both gold and Bitcoin served as hedges for US investors. However, during the crisis, only gold maintained its role as a reliable hedge	GARCH
6	Can gold and Bitcoin hedge against the COVID-19-related news sentiment risk? New evidence from a NARDL approach [40]	02 January 2020 – 03 June 2022	Gold serves as a hedge against the COVID-19 pandemic in the short term, whereas Bitcoin is considered a relatively good asset against the long-term risks associated with COVID-19	Nonlinear Autoregressive Distributed Lag

Source: Compiled by authors from various peer-reviewed journals.

periods, but fail to serve as safe havens for US investors during the COVID-19 pandemic, particularly when investing in crude oil. Similarly, Zeng et al. [41] highlighted Bitcoin's potential for diversification due to its limited correlation with conventional assets. Ghorbel and Jeribi [34], analyzing relationships among the volatility of cryptocurrencies, American indices (S&P 500, NASDAQ, and VIX), oil, and gold, found that Bitcoin acted as a hedge for US investors prior to the COVID-19 pandemic, but lost this capability during the crisis. In contrast, Zhu et al. [40] demonstrated that Bitcoin continued to be effective against long-term risks posed by the COVID-19 pandemic. Harb et al. [42] supported this finding, indicating that Bitcoin could function as both a hedge and a safe haven for investors.

The divergent findings regarding Bitcoin's and gold's hedging or safe-haven properties, particularly before and during the COVID-19 pandemic, underscore the need for further research. Even when analyzing the same time periods, the results have varied significantly [10, 12]. This variability highlights the importance of understanding the dynamics of Bitcoin, gold, and stock markets during crises. The COVID-19 pandemic posed significant risks to businesses and financial systems, with disruptions to digital currencies, stock indices, oil prices, and commodities leading to increased volatility [43]. Harb et al. [42] found that the heightened economic and financial uncertainties during the pandemic significantly impacted the volatility of Bitcoin, Litecoin, and Ethereum. The sharp stock market decline during the pandemic led to margin calls, a situation where an investor's equity in a margin account falls below the required minimum level. Investors were required to deposit additional funds or securities into their brokerage accounts to meet the margin requirements. During the pandemic there was a sudden increase in margin requirements which was correlated with the withdrawal of global liquidity providers. As a result, investors had to sell assets in order to add cash to their brokerage accounts. This liquidity crisis caused the correlation among assets to converge to +1, effectively nullifying their safe haven status.

Drawing from the explanation above, the following research hypotheses are proposed:

H1: Bitcoin returns have a positive relationship with gold returns.

H2: Bitcoin returns act as a hedge, showing a negative relationship with the stock market returns.

H3: During market turmoil, Bitcoin returns have positive relationships with stock market returns.

METHODOLOGY

This study employs an associative quantitative approach, using statistical and mathematical techniques, to examine the relationships between Bitcoin, gold, and the stock market return. A purposive sampling technique was employed, focusing on specific time frames with limited data availability. The Bitcoin price (BTC/USD), obtained from Bitfinex, served as the dependent variable, with Bitfinex selected for its long operating history, high trading volumes and consistent liquidity. The NASDAQ Composite Index (NDX) and XAU/USD represented the stock market and gold as independent variables. The NASDAQ Composite Index represented broad US market performance, particularly in technology and growth stocks, with a reported market capitalization of \$ 20.13 trillion as of May 2023, while XAU/USD was used to capture gold's price movement and historical market trends for analysis and forecasting purposes.²

This research also includes a control variable, the money supply. Data on the money supply is sourced from the Federal Reserve Economic Data, with M2 used as the primary measure. Before May 2020, M2 included M1, savings deposits (including money market deposit accounts), small-denomination time deposits (under \$ 100,000), individual retirement accounts (IRAs), Keogh accounts, and retail money market mutual fund (MMF) balances, excluding IRA and Keogh MMF balances. After May 2020, savings deposits were no longer included in M2.³

The inclusion of money supply as a control variable is justified by *Fig. 1* and *2*, which illustrate that increases in money supply are correlated with rising inflation, driving prices upward. For instance, *Fig. 1* depicts Argentina's money supply data from <https://tradingeconomics.com>. It shows that M0 rose

² GoldPrice. Gold price: Current pricing, prices & rate graph. 2023. URL: <https://goldprice.org/> (accessed on 01.05.2023).

³ Board of Governors of the Federal Reserve System (US) M2 Money Stock [M2NS]. Federal Reserve Bank of St. Louis, FRED. 2023. URL: <https://fred.stlouisfed.org/series/M2NS>. 2023. Release: H.6 money stock measures (accessed on 01.05.2023).

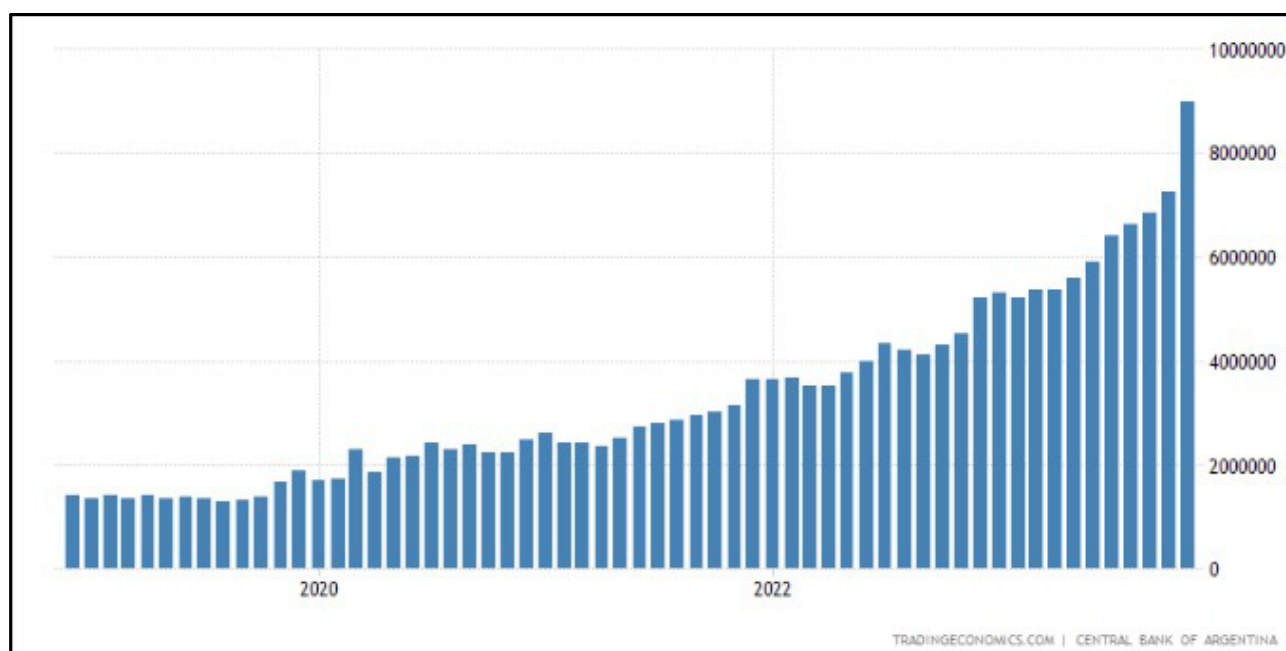


Fig. 1. Money Supply M0 in Argentina

Source: Data compiled by authors from: Trading Economics. Argentina Money Supply M1. 2023. URL: <https://tradingeconomics.com/argentina/money-supply-m1> (accessed on 01.05.2023).



Fig. 2. Argentina Stock Market (MERVAL)

Source: Data compiled by authors from: Trading Economics. Argentina Stock Market (MERVAL). 2023. URL: <https://tradingeconomics.com/argentina/stock-market> (accessed on 01.05.2023).

to 8,973,530 ARS million in November 2023 from 7,237,385 ARS million in October 2023, while M2 increased to 21,875,680 ARS million in September 2023 from 19,801,973 ARS million in August 2023. Concurrently, the main stock market index in Argentina (Merval) rose by 739,745 points or 366.06% since the beginning of 2023, as reported in trading on a contract

for difference (CFD) tracking this benchmark index from Argentina.⁴

Additionally, a moderator variable is introduced, represented by the interaction between the stock

⁴ Trading Economics. Argentina Stock Market (MERVAL). 2023 URL: <https://tradingeconomics.com/argentina/stock-market> (accessed on 01.05.2023).



Fig. 3. NYSE Margin Debt in \$ Millions

Source: Data compiled by authors from: Financial Industry Regulatory Authority (FINRA). Margin Statistics. 2022. URL: <https://www.finra.org/rules-guidance/key-topics/margin-accounts/margin-statistics> (accessed on 01.05.2023).

market (NASDAQ) and turmoil events. The study includes a dummy variable to indicate the occurrence of a turmoil event, taking a value of 1 during a COVID-19 pandemic or special military operation, and 0 otherwise.

This research utilizes secondary data collected from financial websites, specifically <https://www.investing.com/>, for Bitcoin, gold and the stock market, using a weekly frequency. Bitcoin prices vary across exchanges, but this study uses BTC/USD data from Bitfinex. For instance, as of July 20, 2023 (last update), the Bitcoin's price was \$30,380 on Coinbase, \$30,480 on Binance, and \$30,410 on Bitfinex, while Gold and NASDAQ prices remained consistent across exchanges. This study also incorporates money supply as a control variable. The data is obtained from the Federal Reserve Economic Data covering the period between November 2013 and July 2023 on a weekly basis. Bitcoin's low trading volume prior to 2013 limits its utility as a hedge for the stock market during earlier periods.

The World Health Organization (WHO) declared COVID-19 a Public Health Emergency of International Concern (PHEIC) on January 30, 2020⁵ and a pandemic on March 11, 2020.⁶ However, major financial market

movements occurred before the pandemic declaration. *Figures 4, 5, and 6* illustrate the recovery of asset prices during March 2020. Financial performance does not necessarily align with the WHO's timeline, as there were already significant market movements. For example, the NASDAQ reached a low of \$6,900 in March 2020 but recovered by 45% between March 20, 2020, and June 10, 2020. Additionally, on May 5, 2023, the WHO declared that COVID-19 was no longer a PHEIC.

This interaction between global institutional actions and market behavior underscores how external shocks, whether related to public health governance or economic uncertainty, can amplify financial market volatility, particularly when leveraged trading is involved. As shown in *Fig. 3*, numerous traders or investors employ leverage by borrowing money from brokers to make investments. During times of poor stock market performance, traders or investors may receive margin calls, requiring a cash injection into their brokerage accounts. Failure to meet this requirement prompts the broker's system to automatically sell assets from the account. Consequently, many traders or investors sell off their holdings to meet the margin

⁵ World Health Organization. Coronavirus disease (COVID-19) pandemic. 2023. URL: <https://www.who.int/europe/emergencies/situations/covid-19> (accessed on 01.05.2023).

⁶ World Health Organization. WHO Director-General's opening remarks at the media briefing on COVID-19. 11 March

2020. URL: <https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19-11-march-2020> (accessed on 01.05.2023).

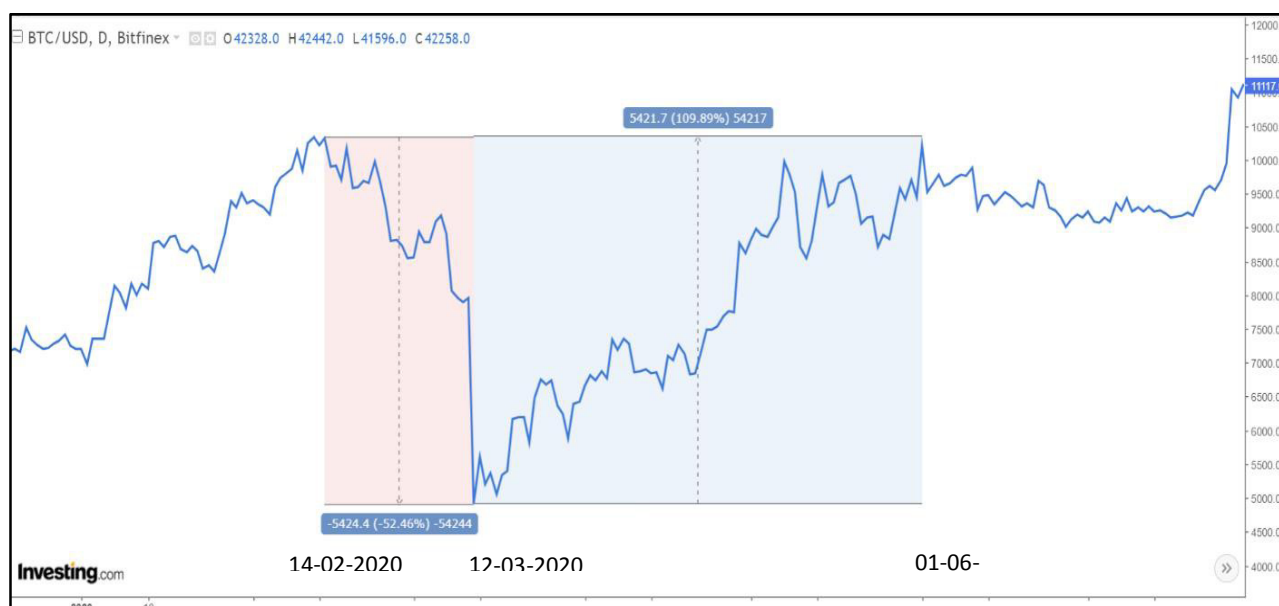


Fig. 4. BTC/USD – Bitcoin US Dollar

Source: Data compiled by authors from: Investing.com. BTC/USD – Bitcoin US Dollar. 2023. URL: <https://www.investing.com/crypto/bitcoin/btc-usd> (accessed on 01.05.2023).

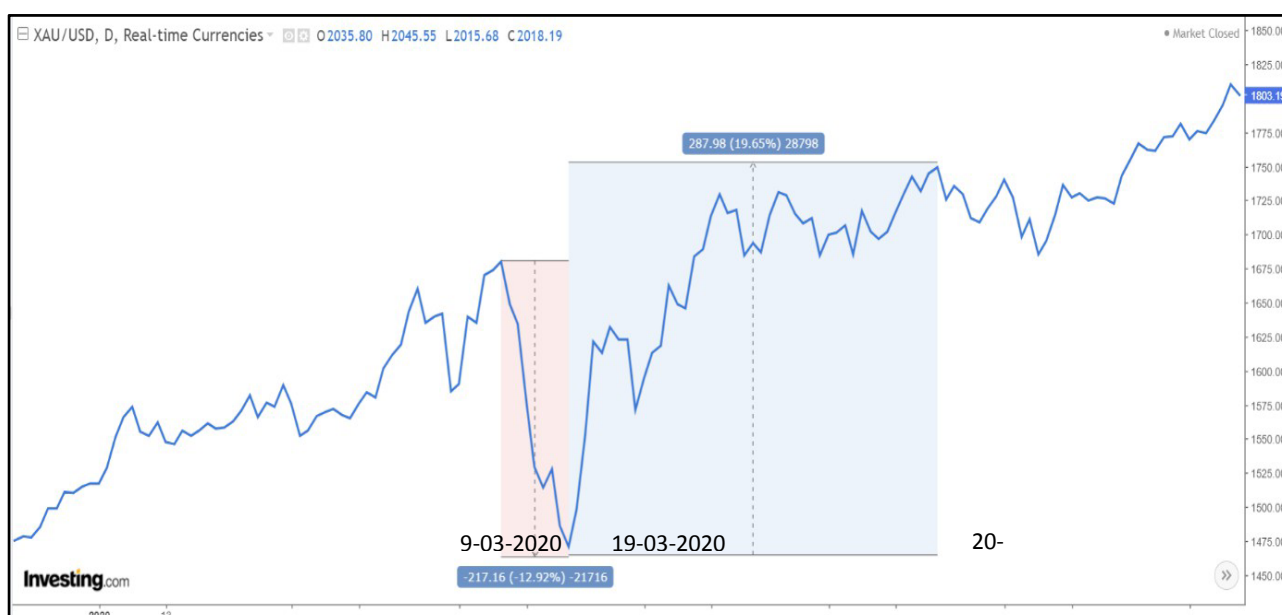


Fig. 5. XAU/USD Streaming Chart

Source: Data compiled by authors from: Investing.com. BTC/USD – Bitcoin US Dollar. 2023. URL: <https://www.investing.com/crypto/bitcoin/btc-usd> (accessed on 01.05.2023).

call, which can temporarily depress prices across gold, stock markets, and cryptocurrencies. While leverage can enhance gains in favorable conditions, it also heightens losses during downturns, affecting investor behavior.

This research will examine whether Bitcoin functions as a safe haven asset. The data period spans from the earliest available data on November 24, 2013,

to July 30, 2023. Figure 4 shows Bitcoin's 52% price drop (indicated by the red area) on February 14, 2020, reaching its lowest point of around \$4,880 on March 12, 2020. However, it began to recover by 109% (shown in the blue area) from March 12, 2020, to June 1, 2020.

In comparison, as shown in Fig. 5, gold prices declined but not as sharply as Bitcoin. On March 9, 2020, gold prices fell by around 12% to their lowest

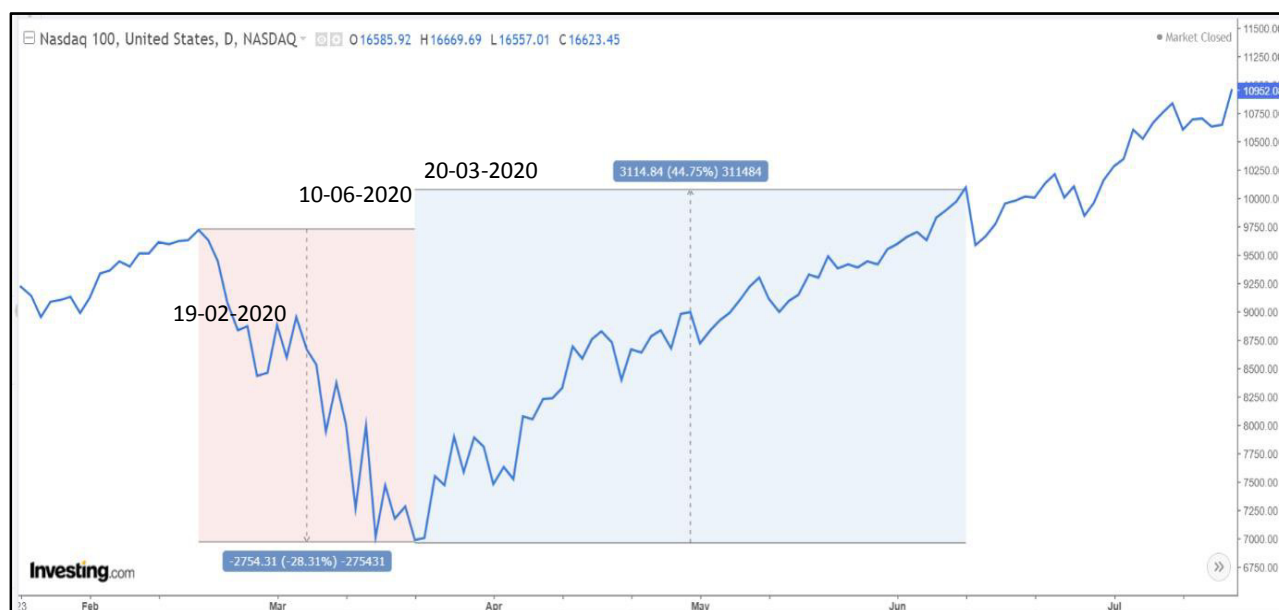


Fig. 6. NASDAQ Streaming Chart

Source: Data compiled by authors from: Investing.com. BTC/USD – Bitcoin US Dollar. 2023. URL: <https://www.investing.com/crypto/bitcoin/btc-usd> (accessed on 01.05.2023).

point on March 19, 2020. However, then gold prices began to recover on March 19, 2020, and rose by around 19% by May 20, 2020.

Similarly, the price of the NASDAQ fell by 28% (red area) on February 19, 2020, as shown in Fig. 6. It then began to recover between March 20, 2020 and June 10, 2020, rising around 44% (blue area). Among all the variables, Bitcoin experienced the sharpest drop (52%) but the fastest recovery. Gold had the smallest decline (12%) and the NASDAQ had the slowest recovery, starting on March 20, 2020, but eventually rebounding significantly by 44.75%. Following the guidance of the World Health Organization (WHO), the monetary value of gold, Bitcoin, and the stock market underwent significant changes. It is important to note that the financial field had already witnessed numerous events before the WHO's pandemic declaration on March 11, 2020. Therefore, this research will cover the longest time frame for the COVID-19 pandemic, covering the period from February 16, 2020, to June 07, 2020.

This study incorporates data from turmoil periods, including the COVID-19 pandemic (February 16, 2020, to June 7, 2020) and the special military operation (February 27, 2022, to August 14, 2022). As shown in Fig. 7, Bitcoin fell by 52% between February 28, 2022 and June 13, 2022, exhibiting signs of recovery in August 2022, with an increase of around 31%. However, as of

August 2022, the Bitcoin price has not fully recovered to its pre-downturn levels.

Meanwhile, gold prices rose by about 9% between February 25, 2022 and March 08, 2022, when the special military operation started, as shown in Fig. 8. This increase can be attributed to the perception of gold as a safe haven instrument. However, as indicated in the chart, the gold price began to decline, experiencing a 21% drop until July 2022.

Similarly, NASDAQ prices fell by 22% between February 28, 2022 and June 16, 2022, and rebounded by 23% by August 15, 2022 (Fig. 9).

As the chart data is based on a daily frequency, whereas the test data is weekly, adjustments were made to ensure consistency. Consequently, the turmoil data for this research will encompass the pandemic period, starting from February 16, 2020, to June 07, 2020, and the special military operation period from February 27, 2022, to August 14, 2022.

Quantitative Data Analysis Tools

The research analysis begins with downloading historical data for all variables from www.investing.com. For NASDAQ, the data includes date, price, open, high, and low values, while data for the other variables consists of price and percentage change. Once the data is collected, the stationarity of the dataset is tested using the Augmented Dickey-Fuller (ADF)

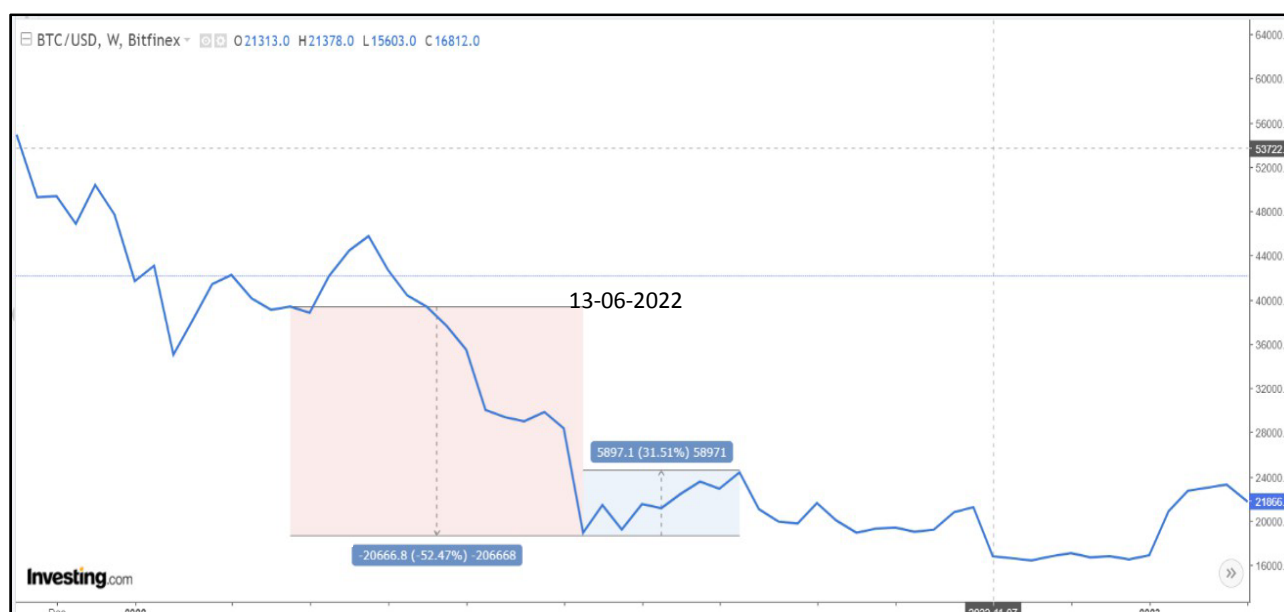


Fig. 7. BTC/USD – Bitcoin US Dollar

Source: Data compiled by authors from Investing.com. BTC/USD – Bitcoin US Dollar. 2023. URL: <https://www.investing.com/crypto/bitcoin/btc-usd> (accessed on 01.05.2023).

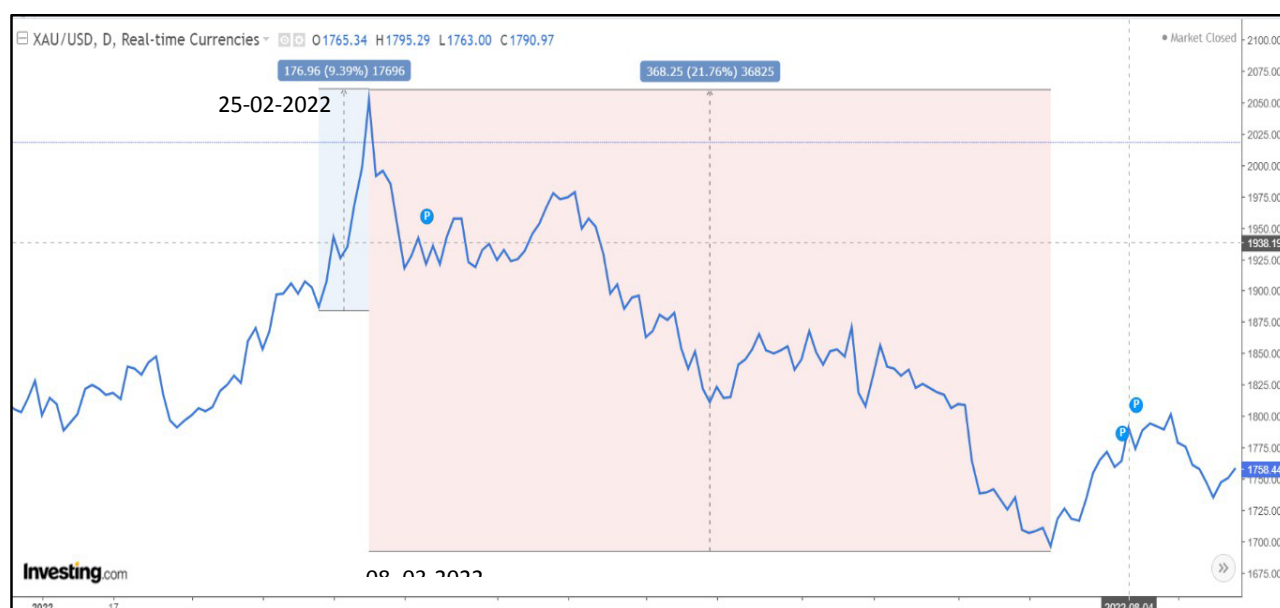


Fig. 8. XAU/USD Streaming Chart

Source: Data compiled by authors from Investing.com. BTC/USD – Bitcoin US Dollar. 2023. URL: <https://www.investing.com/crypto/bitcoin/btc-usd> (accessed on 01.05.2023).

test, executed via the Stata command 'dfuller'. If the p-value of the ADF test exceeds 0.05, then the data is deemed non-stationary. Since this study requires stationary data, the price log return for each variable must be calculated. The log return represents the weekly percentage change in prices and is computed by taking the natural logarithm of the price variable. The difference between the logarithm of the current

price and the logarithm of the previous price is then calculated. Following this, the ADF test is rerun to confirm the stationarity of the data.

After confirming the stationarity of the variables, a regression analysis incorporating independent, control, dummy, and mediator variables is conducted. Before estimating the regression, the mediator variable is calculated as the product of the stock market

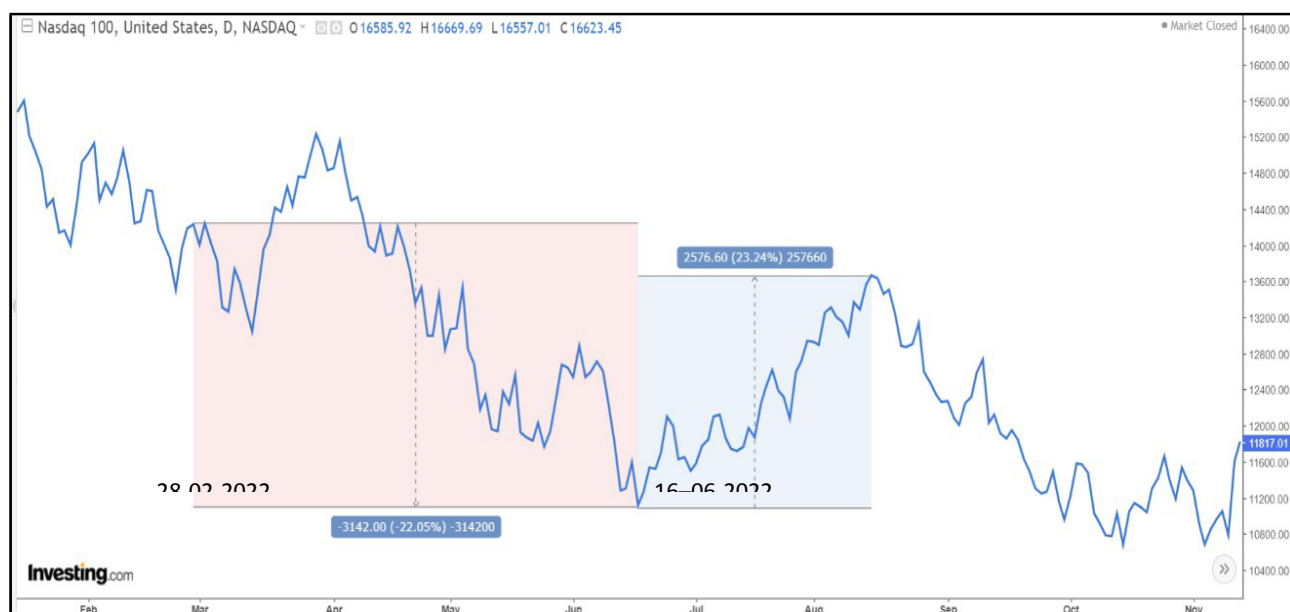


Fig. 9. NASDAQ Streaming Chart

Source: Data compiled by authors from: Investing.com. BTC/USD – Bitcoin US Dollar. 2023. URL: <https://www.investing.com/crypto/bitcoin/btc-usd> (accessed on 01.05.2023).

and turmoil variables, as well as gold and turmoil variables. A GARCH test is conducted to determine if the regression suggests using a GARCH model or not. ARCH effects are identified when the residual variance depends on the size of previous residuals, rather than remaining constant. The null hypothesis (H_0) states “no ARCH effects”, while the alternative hypothesis (H_1) posits “ARCH(p) disturbance”. If the value of $\text{Prob} > \chi^2$ is less than 0.05, then the null hypothesis is rejected, indicating the presence of GARCH effects in the data.

If GARCH effects are detected, the optimal number of lags is determined using a correlogram to address serial correlation. The correlogram reports autocorrelations, partial autocorrelations, and portmanteau (Q) statistics, as well as a graphical representation of autocorrelation and partial autocorrelation. Autocorrelation generates a correlogram (a graph of autocorrelations) with pointwise confidence intervals according to Bartlett’s formula for MA(q) processes. Meanwhile, partial autocorrelation creates a partial correlogram with confidence intervals derived from the standard error of $1/\sqrt{n}$.⁷ The selected lag length is then used in the GARCH regression analysis.

⁷ StataCorp. Stata Statistical Software: Release 18 [Internet]. College Station, TX: StataCorp LLC; 2023. URL: <https://www.stata.com/manuals/tscorrrgram.pdf> (accessed on 01.05.2023).

During financial crises or major global events, GARCH (Generalized Autoregressive Conditional Heteroskedasticity) models are invaluable for analyzing and forecasting volatility changes in financial markets, such as stocks and bonds. By capturing volatility clustering and changes in market risk, they help to explain turbulent price movements and provide insight in potential future market movements. Below is the regression that was used in this research:

$$X_t = \alpha_1 + \alpha_2 Z_t + \alpha_3 M + \alpha_4 (Z_t \cdot \text{Tur}) + \alpha_5 \text{Tur} + \varepsilon_{t,1},$$

$$X_t = \beta_1 + \beta_2 \log Y_t + \beta_3 M + \beta_4 (Y_t \cdot \text{Tur}) + \beta_5 \text{Tur} + \varepsilon_{t,1},$$

where X_t – Log return of Bitcoin; Y_t – Log return of Gold; Z_t – Log return of NASDAQ; α , β – Constant term or the intercept; M – Log return of Money supply; Tur – Turmoil; ε – Error term.

ANALYSIS AND DISCUSSION

Table 2 provides a summary of the average value, maximum value, minimum value, and standard deviation of the variables.

The stationary test results indicate that all variables are non-stationary at their levels. Consequently, the study calculates logarithmic returns for all variables and performs another stationary test after completing logarithmic return calculations.

Table 2

Statistic Summary for All Variables

Title	Bitcoin	NASDAQ	Gold	Money Supply
Average	12,672	8,157	1,470	15,676
Maximum	64,406	16,573	2,035	22,051
Minimum	210	3,447	1,058	10,941
Standard deviation	15,744	3,854	283.463	3,664

Source: Data processed and analyzed by the authors.

Table 3

Stationary for The Levels of Log Return from Variables

Variable	t-stat	1% Critical Value	5% Critical Value	10% Critical Value	Mackinnon approximate p-value for Z(t)
Bitcoin	-23.251	-3.430	-2.860	-2.570	0.0000
NASDAQ	-22.383	-3.430	-2.860	-2.570	0.0000
Stock Market	-24.181	-3.430	-2.860	-2.570	0.0000
Money Supply	-19.959	-3.430	-2.860	-2.570	0.0000

Source: Data processed and analyzed by the authors.

After recalculating the logarithmic returns and conducting a second stationary test (*Table 3*), the results reveal that the log returns of all variables are stationary, as evidenced by p-values < 0.05 for all variables.

Regression Analysis of Bitcoin on NASDAQ

To further analyze the data, the study employs a GARCH (Generalized Autoregressive Conditional Heteroskedasticity) test and a correlogram. The GARCH test is a statistical test used in time series analysis and econometrics to detect the presence of heteroskedasticity, which refers to the varying volatility over time. In the Stata program, the command used for the GARCH test is “estat-archlm”. The ARCH test is conducted after running a simple regression for each case. *Table 4* presents the output of the GARCH test for the regression of Bitcoin’s impact on NASDAQ, money supply 2, and turmoil.

The null hypothesis (H_0) for this test is “no ARCH effects”, while the alternative hypothesis (H_1) is “ARCH(p) disturbance”. The column “Prob > chi2” provides the p-value. In *Table 4*, the “Prob > chi2” is 0.0000. Since the p-value is less than 0.05, the null

hypothesis is rejected, confirming the presence of GARCH effects in the data. Once the GARCH test is completed, the next step is to create line plots of the residuals, using the tsline command in Stata. *Figure 10* shows the residuals from the regression of Bitcoin’s log returns on NASDAQ, money supply 2, the multiplication variable (NASDAQ and turmoil), and turmoil.

To determine the optimal number of lags for the regression, the study uses a correlogram, generated with the “corrgram” command in Stata. *Figure 11* illustrates the correlogram results.

From *Fig. 11*, the partial autocorrelation coefficients diminish significantly after the second lag. Based on this, the regression model includes the first and second lags. With the lag lengths identified, the regression analysis proceeds. *Table 5* outlines the GARCH model results applied to the regression of Bitcoin log returns on NASDAQ log returns, control variables for money supply 2, turmoil Nasdaq (a multiplication variable), and turmoil (dummy variables) using the first and second lags suggested by the correlogram.

In *Table 5*, the variable names are shown. “Lrbtc” represents Bitcoin’s log returns, “Lrnasdaq” represents

Table 4

GARCH Test Result for Regression of Bitcoin on NASDAQ, Money Supply 2, a Multiplication Variable (Between NASDAQ and Turmoil), and Turmoil

. estat-archlm LM test for autoregressive conditional heteroskedasticity (ARCH)			
lags (p)	chi2	df	Prob > chi2
1	25.935	1	0.000
H0: no ARCH vs. H1: ARCH(p) disturbance			

Source: Data processed and analyzed by the authors.

NASDAQ's log returns, and "Lrm2" corresponds to money supply 2's log returns. "Nasdaqturmoil" is a multiplication variable combining NASDAQ and turmoil. The variable "turmoil" is a dummy variable; if either the COVID-19 pandemic or the special military operation occurs, it will be assigned a value of "1", and if no turmoil takes place, it will be assigned a value of "0".

The relationship between Bitcoin's log returns and NASDAQ's log returns has a coefficient of 0.5527 with a p-value of 0.000, indicating a statistically significant positive correlation between the log returns of Bitcoin and NASDAQ. This implies that Bitcoin's returns increase when NASDAQ's returns rise, and decrease when NASDAQ's returns fall, negating Bitcoin's role as a hedge for NASDAQ. On the contrary, the coefficient of Bitcoin's log returns and money supply 2 is -0.8381

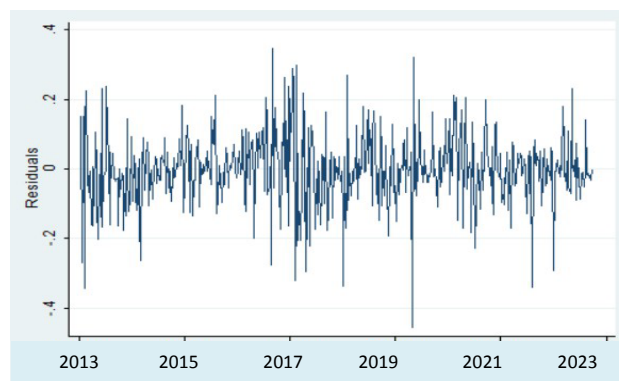


Fig. 10. Residuals from Regression of Bitcoin on Nasdaq, Money Supply 2, A Multiplication Variable, and Turmoil

Source: Data processed and analyzed by the authors.

with a p-value of 0.359, indicating a negative but statistically insignificant relationship. The coefficient for the multiplication variable (NASDAQ and turmoil) is 1.3764, with a p-value of 0.000, signifying that the correlation between Bitcoin and NASDAQ intensifies during periods of turmoil. Lastly, the coefficient between Bitcoin's log return and turmoil is -0.0376, with a p-value of 0.038, indicating a significant negative relationship between Bitcoin's log returns and turmoil.

Overall, the results demonstrate statistical significance, with a p-value of less than 0.05 (significance level is 5%) for almost all variables, except for money supply. This implies that the regression effectively explains a significant portion of the variation in the volatility of the time series. When examining

LAG	AC	PAC	Q	Prob>Q	-1 0 1 [Autocorrelation]	-1 0 1 [Partial Autocor]
1	0.2267	0.2268	26.11	0.0000		
2	0.1773	0.1337	42.115	0.0000		
3	0.1374	0.0785	51.745	0.0000		
4	0.0992	0.0436	56.773	0.0000		
5	0.0756	0.0247	59.7	0.0000		
6	0.0690	0.0289	62.141	0.0000		
7	0.0729	0.0345	64.876	0.0000		
8	0.0809	0.0420	68.249	0.0000		
9	0.1125	0.0712	74.779	0.0000		
10	0.0558	-0.0059	76.391	0.0000		

Fig. 11. Correlogram for Regression of Bitcoin on Nasdaq, Money Supply 2, Multiplication Variable (NASDAQ and Turmoil), and Turmoil

Source: Data processed and analyzed by the authors.

Table 5

Regression Result of Bitcoin on NASDAQ, Money Supply 2, NASDAQ Turmoil (Multiplication Variable between NASDAQ and Turmoil) and Turmoil

Variable Name	Coef.	P > z
Lrbtc		
Lnasdaq	.5527163	0.000
Lrm2	-.8381466	0.359
Nasdaqturmoil	1.376361	0.000
Turmoil	-.0376397	0.038
ARCH L1	.2697663	0.000
ARCH L2	-.2535719	0.000
GARCH L1	1.402332	0.000
GARCH L2	-.4249412	0.010

Source: Data processed and analyzed by the authors.

Table 5, we see that the sum of ARCH and GARCH coefficients is less than 1, signifying that volatility is not explosive. The ARCH and GARCH coefficients for the first lag are both statistically significant. However, the GARCH model is not significant at the conventional 5% significance level for the second lag. Yet, considering a significance level of 10%, the second lag of the GARCH model attains significance.

Regression Analysis of Bitcoin on Gold

Applying the same method used for the regression of Bitcoin on the stock market, a GARCH test was performed for Bitcoin's log returns regressed on gold. The test included control variables for money supply 2, a multiplication variable for gold and turmoil, and dummy variables for turmoil, the result of which is displayed in Table 6.

In Table 6, the Prob > chi2 column provides the p-value for the test. In this case, the Prob > chi2 is 0.0000, rejecting the null hypothesis and confirming the presence of GARCH effects in the data. Residual line plots are shown in Fig. 12.

Following the regression analysis, which indicated the need for GARCH modeling, a correlogram was performed to determine the suggested number of lags for the model. The results of this procedure are presented in Fig. 13, illustrating the autocorrelation

Table 6

GARCH Test Result for Regression of Bitcoin on Gold, Money Supply 2, A Multiplication Variable (Total Multiplication of Gold), and Turmoil

. estat-archlm LM test for autoregressive conditional heteroskedasticity (ARCH)			
lags (p)	chi2	df	Prob > chi2
1	20.069	1	0.000
H0: no ARCH vs. H1: ARCH(p) disturbance			

Source: Data processed and analyzed by the authors.

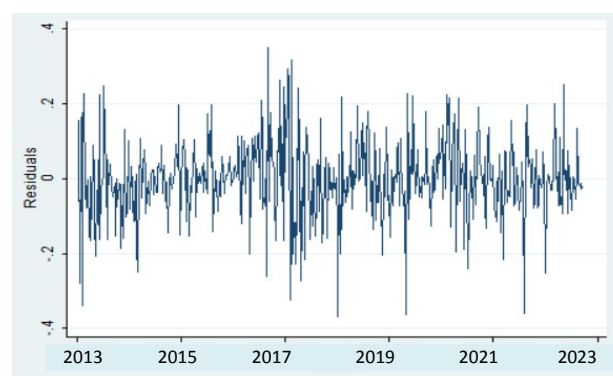


Fig. 12. Residuals for Regression of Bitcoin on Gold, Money Supply 2, and Turmoil

Source: Data processed and analyzed by the authors.

coefficients of the squared residuals of a GARCH family regression at various lags.

Figure 13 illustrates the correlogram results, showing that partial autocorrelation coefficients diminish after the second lag. Consequently, the regression includes the first and second lags. After determining the suggested number of lag lengths, the next step is to execute the regression test. This regression includes control variables for money supply 2, gold turmoil (a multiplication variable), and turmoil (dummy variables), along with the first and second lags, as suggested by the correlogram.

In Table 7, the variable names are displayed. "Lrbtc" represents Bitcoin's log return, "Lrgold" represents gold's log return, and "Lrm2" represents money supply 2's log return. The variable "goldturmoil" is a multiplication variable between gold and turmoil. The variable "turmoil" is a dummy variable; it is assigned a value of "1" if either the COVID-19 pandemic or the special military operation occurs, and "0" if no turmoil takes place.

```
. corrgram uhat2_squared
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LAG	AC	PAC	Q	Prob>Q	-1	0	1	-1	0	1
					[Autocorrelation]			[Partial Autocor]		
1	0.1994	0.1995	20.199	0.0000						
2	0.2317	0.2011	47.519	0.0000						
3	0.1688	0.1016	62.059	0.0000						
4	0.1180	0.0441	69.177	0.0000						
5	0.0864	0.0161	73.003	0.0000						
6	0.0708	0.0173	75.575	0.0000						
7	0.0697	0.0245	78.072	0.0000						
8	0.1082	0.0716	84.105	0.0000						
9	0.1238	0.0770	92.017	0.0000						
10	0.0725	0.0018	94.735	0.0000						

Fig. 13. Correlogram for Regression of Bitcoin on Gold, Money Supply 2, A Multiplication Variable (Gold and Turmoil), and Turmoil

Source: Data processed and analyzed by the authors.

The coefficient between Bitcoin's log returns and gold's log returns is 0.2065 with a p-value of 0.328, indicating a positive but statistically insignificant relationship. The coefficient between Bitcoin's log returns and money supply 2 is -0.5161 , with a p-value of 0.599, reflecting a negative but insignificant relationship — consistent with the results of the first regression. The coefficient between the log return of Bitcoin and the log return of multiplication variable (resulting from the multiplication of gold and turmoil) is 2.290, with a p-value of 0.000, indicating a significant positive relationship. Lastly, the coefficient for turmoil is -0.0226 with a p-value of 0.177, indicating a negative but statistically insignificant relationship. The sum of the ARCH and GARCH coefficients exceeds 1, indicating that the volatility is not explosive. As shown in Table 7, only the ARCH effect is significant at the first lag with a significance level of 5%, while the second lag for the ARCH effect is insignificant. Meanwhile, the GARCH effect is not significant at any lag.

DISCUSSION

Bitcoin and NASDAQ log returns moved in the same direction, indicating that Bitcoin did not act as a hedge or safe haven asset against NASDAQ during 2013–2023. Therefore, hypothesis 2 is not supported. This finding is consistent with Choi & Shin [38], who found that Bitcoin prices increased following positive stock market shocks, and with Ghorbel & Jeribi [34], who reported that Bitcoin did not provide a safe haven for

Table 7
Regression Result of Bitcoin on Gold, Money Supply 2, a Multiplication Variable Between Gold and Turmoil, and Turmoil

Variable Name	Coef.	P > z
Lrbtc		
Lrgold	.2064855	0.328
Lrm2	-.516078	0.599
Goldturmoil	2.28986	0.000
Turmoil	-.0226284	0.177
ARCH L1	.1724688	0.001
ARCH L2	.101713	0.600
GARCH L1	.2609502	0.797
GARCH L2	.1363278	0.824

Source: Data processed and analyzed by the authors.

US investors during the COVID-19 pandemic. Bouri et al. [15] similarly found that Bitcoin lost its safe haven properties following the 2013 price crash. However, these results differ from those of Charfeddine et al. [4] and Kajtazi & Moro [44], who identified diversification benefits from including cryptocurrencies in traditional portfolios. While Koshelev [45] highlighted the growing investment attractiveness of cryptocurrencies within the expanding digital asset market, the present findings

show that this attractiveness does not necessarily imply reliable hedge or safe haven properties.

Bitcoin returns also show a weak negative and statistically insignificant relationship with money supply, indicating that the control variable has limited explanatory power and does not materially improve the model's predictive ability. There is a significant positive relationship between Bitcoin returns and the NASDAQ — turmoil interaction term, while turmoil itself is negatively associated with Bitcoin returns. This indicates that Bitcoin tends to decline during crises, and that market turmoils strengthen its positive co-movement with the NASDAQ. Therefore, hypothesis 3 is supported, suggesting that Bitcoin behaves more like a risky asset than a safe haven during periods of market stress. This context-dependent behavior is consistent with Volkova [46], who emphasizes the distinct economic characteristics of cryptocurrencies in financial markets.

Bitcoin and gold returns move in the same direction, but their relationship is weak and statistically insignificant. Therefore, hypothesis 1 is not supported, despite Bitcoin's frequent characterization as "digital gold" [30]. This finding is consistent with Choi & Shin [38], who observed differences in the price dynamics of Bitcoin and gold, and with Klein et al. [35], who found that Bitcoin behaves differently from gold during periods of market distress. Money supply again shows a weak negative and statistically insignificant relationship with Bitcoin returns, conforming its limited explanatory role.

During periods of turmoil, including the COVID-19 pandemic and the special military operation, the return on Bitcoin tends to decline, providing little evidence of a reliable safe haven asset. However, there is a significant positive correlation between gold and turmoil indicating that the co-movement between Bitcoin and gold strengthens during crises.

To assess the robustness, additional regressions were conducted by replacing money supply 2 (M2) with money supply 1 (M1) or CPI (Consumer Price Index), excluding periods with low Bitcoin trading volumes, and using weekly or monthly data. The results remained largely consistent, indicating that the model was robust to alternative specifications and data frequencies. Overall, Bitcoin did not function as a hedge for NASDAQ, while its positive relationship with gold was statistically insignificant. Both M1, M2, and CPI also showed limited explanatory power. During periods of turmoil, both the Bitcoin and the NASDAQ became stronger, further confirming hypothesis 3.

CONCLUSION AND LIMITATION

This study examines three hypotheses concerning the relationship between Bitcoin and gold returns, the role of Bitcoin as a hedge for the stock market, and the effect of turmoil on Bitcoin and stock market returns. Using a GARCH model, the findings show that Bitcoin does not serve as a hedge for NASDAQ, rejecting hypothesis 2. The money supply is statistically insignificant, while turmoil significantly affects Bitcoin returns and strengthens the Bitcoin-NASDAQ relationship, supporting hypothesis 3.

Although Bitcoin and gold tend to move in the same direction, their relationship is weak and statistically insignificant, providing insufficient support for Bitcoin as "digital gold" or a reliable safe haven asset. Money supply also plays an insignificant role in explaining the Bitcoin-gold relationship, although their co-movement increases during periods such as the COVID-19 pandemic and the special military operation. Nevertheless, the relationship remains too weak to establish Bitcoin as a dependable safe haven.

Several limitations should be noted. Weekly CPI data are limited, restricting the analysis of its effect on Bitcoin returns. Reliable Bitcoin and monetary data before 2013 are also scarce, limiting the examination of Bitcoin's early market development. In addition, the selected periods used to define turmoil, particularly the COVID-19 pandemic and the special military operation, may influence the results.

Future research could incorporate broader macroeconomic and liquidity variables, longer datasets, and more granular methods to assess Bitcoin's response to specific global events. Further investigation of its behavior during economic instability may provide deeper insight into its role in portfolio diversification and global financial markets.

Overall, the findings challenge Bitcoin's role as both a stock market hedge and a gold-like safe haven. During market turmoil, Bitcoin tends to move with NASDAQ, indicating characteristics more consistent with speculative risk assets. For investors, this suggests that Bitcoin's volatility and speculative nature should be taken into account when constructing portfolios. For regulators and financial institutions, the findings highlight the importance of monitoring Bitcoin, its related volatility, and its potential implications for financial stability.

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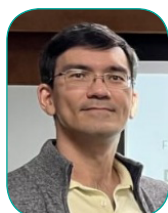
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