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# IS BITCOIN A HEDGE OR A HAZARD? THE IMPACT OF POLITICAL UNCERTAINTY ON BITCOIN VOLATILITY DURING THE U.S. PRESIDENTIAL ELECTIONS(2024–2023)

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**Abstract :**

The goal of this research is to analyze political uncertainty's short- and long-term impact on the volatility of Bitcoin throughout the US presidential election period (2023-2024), and test its value as a hedge asset in the face of rising political tensions. The GARCH-MIDAS model used here selects high-frequency daily returns on Bitcoin and low-frequency macroeconomic and political data, such as the Economic Policy Uncertainty Index (EPU), the Volatility Implied Index (VIX), and an irregular dummy variable for political events (POL_EVT).

The empirical evidence depicts how Bitcoin is highly sensitive to political shocks, both sudden (short-run) and institutional (long-run), with its volatility speeding up as uncertainty increases. In contrast to traditional safe-haven securities such as gold or government bonds, Bitcoin does not exhibit hedging behavior during times of political turmoil. Instead, it is a high-risk speculation asset, responding in real-time but destabilizing to evolving political events. Moreover, the GARCH-MIDAS model proved to be outstanding in capturing the time and non-linear impacts of uncertainty compared to standard models, buttressing the importance of including political factors when studying the volatility dynamics of cryptocurrencies.

**Keywords:** Bitcoin; political uncertainty; GARCH-MIDAS
**JEL Classification Codes**: C22, D72, G12, G18 .

## 1. Introduction

In the aftermath of the 2008 financial crisis, Bitcoin offered an unprecedented experiment in decentralized finance, challenging traditional monetary sovereignty and trust concepts. Over the past decade, it has evolved from an obscure encryption protocol to a global money phenomenon, with a market capitalization value of over one trillion dollars at its peak. The blockchain technology underpinning Bitcoin—decentralization, openness, and unalterability—makes it a potential hedge against systemic risk, including inflation, currency devaluation, and geopolitical (Bouri et al., 2020; Dyhrberg, 2016; Nakamoto, 2008; Yermack, 2015). Its proponents argue that its scarcity (capped at 21 million units) and immunity to central manipulation render it a "digital gold," a haven during economic turmoil (Baur et al., 2018; Selgin, 2015). However, the mere price volatility of Bitcoin—often in excess of 10% in daily fluctuations—raises fundamental questions about its validity as a safe asset. Critics bemoan the fact that its highly speculative nature and exposure to regulation changes render it a risk, not a hedge, adding to financial instability instead of reducing it (Cheah & Fry, 2015; Gkillas & Katsiampa, 2018; Jamal Bouoiyour & Refk Selmi, 2017). Such duality comprises the substance of the critical debate: does Bitcoin stabilize investment portfolios during crisis periods, or do its fluctuations dilute its function as a macroeconomic hedge?

The 2023-2024 United States presidential elections provide a telling context to explore the question. This moment has been characterized as one of the most polarizing election periods in modern history, which is marked by profound uncertainties: disagreements surrounding regulation of digital currencies, overhauls of fiscal policy, shifts in energy policy affecting Bitcoin mining, and heightened geopolitical tensions (e.g., American-China trade wars, the war between Russia and Ukraine) (Corbet et al., 2020; Zhang et al., 2023). These tensions produce short-run shocks, such as surprise election outcome shocks or geopolitics flare-ups, and chronic structural perils, such as persistent regulatory changes and shifting energy policy. For an asset that has been so called "non-political," Bitcoin's sensitivity to politics unearths the deep embedding of the asset within systems it seeks to disrupt. The question is whether increased uncertainty increases demand for decentralized assets or the increases volatility due to regulation worries.

Despite increasing scientific focus on the role of Bitcoin in times of crises, massive knowledge gaps remain regarding its connection to political uncertainty. Current studies primarily focus on macroeconomic drivers such as inflation and interest rates, or one-off events such as Brexit or the 2020 U.S. présidentiel élections (Gkillas & Katsiampa, 2018; Baur et al., 2021; Conlon & McGee, 2020). Yet these studies have a tendency to employ political uncertainty as a time-invariant regressor, not discriminating between transitory shocks and permanent structure shifts. Further, traditional volatility models, i.e., GARCH and EGARCH, aggravate these flaws by ignoring the unusual micro-structure of the Bitcoin market, i.e., the 24/7 trading habit, dominance of retail investors, and exposure to real-time sentiment driven by social media and news (Conrad & Loch, 2015; Kyriazis, 2020; Borri & Shakhnov, 2023)). These methodological constraints bar the thorough analysis of the dynamics of Bitcoin during prolonged political turmoil.

To bridge these gaps, this study examines how short-term political shocks and long-term political uncertainties deferentially affect Bitcoin volatility during the 2023-2024 U.S. elections. This study employs the GARCH-MIDAS model (Mixed Data Sampling), a high-level top economic model that unites high-frequency Bitcoin price data (daily returns) with low-frequency measures of political uncertainty, including the Economic Policy Uncertainty (EPU) index and the Market Volatility Index (VIX) (Colacito et al., 2020; Engle et al., 2013). By screening out short-term market responses from long-term macroeconomic trends, this approach facilitates a valid investigation of Bitcoin's asymmetric volatility responses, that is, if negative political shocks have an uneven impact on its price, and distinguishes the contribution of short-term sentiment from long-term structural risks.

This study has several significant contributions. First, it brings the political uncertainty literature to crypto markets in order to advance what is known about how electoral forces shape Bitcoin volatility. Second, this study is the first to deploy GARCH-MIDAS in cryptocurrency research, and as such, this paper serves to help establish empirical methodology for dealing with mixed-frequency data—a matter of some gravity given Bitcoin's hypersensitivity to live news cycles and lumbering policy shocks. Third, this research provides policy practitioners with practical lessons on how to navigate the fine line between fostering innovation and stability within the rapidly evolving digital assets ecosystem. With emphasis on the elections in 2023-2024—a historic geopolitical moment—this research provides timely insights into understanding the significance of Bitcoin within emerging financial systems.

This research article is organized as follows: **Section 2** comprehensively reviews the theoretical framework and related literature. It focuses on the relation between political uncertainty and Bitcoin volatility, following the discourse over Bitcoin's role as a hedge vs. a spéculative asset.

**Section 3** defines the data, methodological framework, and GARCH-MIDAS model formulation, clearly explaining the selection of variables and the timeframe.

**Section 4** delineates the empirical findings, covering descriptive statistics, stability tests, and the estimation of GARCH and GARCH-MIDAS models. It follows a comparaison analysais.

**Section 5** discusses the findings about economic theory and prior empirical research, focusing on Bitcoin's dual behavior under political stress.

**Section 6** performs robustness checks and model validation tests.

**Section 7** concludes the study by presenting policy implications and Future research directions.

## 2. Literature review:

The relationship between political uncertainty and financial market volatility has been widely addressed in the academic literature, with Bitcoin emerging as an interesting asset due to its decentralized nature. This review aims to provide a comprehensive overview of relevant academic contributions, highlighting temporal developments and insights that illustrate how political factors affects Bitcoin and the associated investment strategies.

Early years (2013-2017) witnessed studies aimed at understanding the fundamentals linking political events and market volatility. A study by (Goodell & Vähämaa, 2013) showed that presidential elections in the U.S. increase financial market volatility as policy expectations change. At the same time, (Kostakis, 2015)authored that despite its decentralized nature, Bitcoin is in no way insulated from the broader fears that affect mainstream markets. The Brexit referendum and the U.S. elections 2016 were stark instances of the same; studies such as (Jamal Bouoiyour & Refk Selmi, 2017) and (Smales, 2017) established that political uncertainty is contributing to higher volatility in cryptocurrency as well as conventional markets. This is because higher information asymmetry leads to low liquidity and widening spread between demand and supply, according to studies by (Box & Griffith, 2016). These results indicate that Bitcoin, in spite of its claimed autonomy, is still vulnerable to macroeconomic stresses.

When the time (2018-2020) began, studies began to use more precise measures to measure political uncertainty, such as the Geopolitical Risk Index (GPR) and Economic Policy Uncertainty (EPU). Studies by (L. Fang et al., 2018)indicated that global economic policy uncertainty negatively influences Bitcoin volatility, a sign that investors do not want to incur risks during periods of unrest. Likewise, in the same context, (Huynh et al., 2019) research established the relationship between growing uncertainty and the decline in Bitcoin trading volumes, confirming its status as a hedging instrument during crisis. However, there have been other studies, such as (Ajmi & Arfaoui, 2020), doubting the performance of Bitcoin as a safe haven, displaying lower returns in Bitcoin prior to the U.S. 2016 elections. On the other hand, studies like (Al Mamun et al., 2020) and (Paule-Vianez et al., 2020) emphasized the potential use of Bitcoin as a hedging asset along with gold. Its success, however, was highly based on market factors. Based on a study done by (Yen & Cheng, 2020), partisan conflict in America could be indicative of volatility in Bitcoin, suggesting its potential usage in political risk hedging.

In the recent years (2023-2024), research has gravitated towards advanced approaches in identifying the nonlinear relationship of Bitcoin with political uncertainty. During global crises like the Russian-Ukrainian war and the COVID-19 pandemic, the research by (Buthelezi, 2024) and

(Ghani et al., 2023) revealed that Bitcoin reacts differently depending on the system present: its volatility lessened in low-price systems but rose to unprecedented levels in high-price systems. Studies by (Y. Fang et al., 2024)confirmed that extreme geopolitical events induce intensified Bitcoin volatility just like speculative assets but inversely for gold. In contrast, studies by (Mahjoubi & Henchiri, 2024) indicated that Bitcoin is capable of hedging economic and political uncertainty but to a lesser extent in the case of climate uncertainty. A study by (Theiri, 2024) identified diversification with Bitcoin during crises periods, while a study by (Wang et al., 2023) distinguished the effect of fiscal and monetary policies on the volatility of Bitcoin. Their findings indicated that Bitcoin is positively correlated with fiscal policy uncertainty but negatively correlated with monetary policies. On a different note, research by (Bouazizi, 2023) illustrated how investor emotions during times of crisis feed into Bitcoin volatility, necessitating dynamic models in grasping such sophisticated dynamics.

Additionally, research in the area of the impact of policy announcements on Bitcoin volatility has moved from investigating macroeconomic impact to gauging regulatory surprise and global interconnectedness. In the early literature (2014-2016), works such as (Krol, 2014) and (Lutz, 2014) implied that unconventional monetary policies, such as quantitative easing, indirectly affect Bitcoin by raising market uncertainty. The paper by (Ortisi, 2016) pointed out the structural flaws in the Bitcoin system, such as the volatility of miners' revenues, which increases price volatility. Studies by 2017 were focused on the response of Bitcoin to policy and macroeconomic news. The paper by (Corbet et al., 2017) indicated that central bank announcements lead Bitcoin volatility by a considerable extent, against the perception of its complete independence from traditional systems. Recent years (2022-2024) have focused on the effect of regulatory actions, such as the China 2021 mining ban and pronouncements from the Securities and Exchange Commission. The work of (Su et al., 2021) found that policy uncertainty reduces the return of Bitcoin, while the work of (Elsayed & Sousa, 2024) found insignificant effects between monetary policy and cryptocurrencies with the exception of the case of unconventional policies such as stimulus because of the pandemic.Despite the notable developments in the economic literature regarding the interaction between political uncertainty and Bitcoin volatility, most current studies remain limited to traditional methodologies (such as GARCH or ARIMA models), which lack a precise distinction between short-term effects (such as sudden political events) and long-term effects (such as sustained geopolitical tensions). Furthermore, a comprehensive literature review reveals an evident deficiency in studies linking Bitcoin volatility to specific political contexts, such as major electoral events that are key sources of financial disruptions. In this context, this study presents a pioneering scientific contribution by applying the GARCH-MIDAS model to analyze Bitcoin volatility during the U.S. presidential election period (2023–2024), aiming to understand the effects of short- and long-term political uncertainty (as measured by indicators such as political and economic uncertainty and market VIX) on the cryptocurrency market. The study also assesses the role of Bitcoin as a hedging tool or additional source of risk, amid the rising global reliance on digital assets and the impact of the dominant U.S. economy and the dollar as a primary reserve currency. The scientific value of this study is highlighted through its multivariate quantitative analysis (political and economic), It clarifies the nonlinear intricacies of Bitcoin volatility and offers useful resources to help investors and decision-makers evaluate risks and create adaptable plans that take into account the growing significance of digital assets in the global financial system.

In order to distinguish between short-term shocks from sudden political events and long-term volatility associated with structural political and economic risks, this study attempts to examine the compounding impacts of political uncertainty on Bitcoin volatility throughout the 2023–2024 US election cycle.

It seeks to determine how Bitcoin's behavior coincides with the assumed characteristics associated with hedging assets in high-stress political contexts, without directly comparing it to traditional assets. The research used a GARCH-MIDAS model that integrates high-frequency daily Bitcoin return data with low-frequency explanatory variables, including the EPU and VIX indexes, together with a variable for irregular political events, to deliver a precise and non-linear temporal evaluation of market volatility. The study aims to address a research gap in the literature by offering an applied framework that clarifies the complex relationship between politics and economics, alongside the behavior of digital assets.

## 3. Data and Methodology

This study aims to analyze the impact of political uncertainty during the US election period 2023-2024 on Bitcoin volatility, through the GARCH-MIDAS (Generalized Autoregressive Conditional Heteroskedasticity-Mixed Data Sampling) model, which is one of the modern models designed to incorporate variables with different frequencies. The study is grounded on the daily bitcoin price, as well as political and economic factors such as the Political Uncertainty Index and other explanatory factors. The model elucidates the determinants of the variables' long-run and short-run determinants in the Bitcoin market.

### 3.1 Data

Four key variables were selected to approximate the relationship between political uncertainty and Bitcoin volatility for the 2023-2024 US election period. The dependent variable is Bitcoin Returns (BTCR), the daily percent return of Bitcoin's closing prices, and is used as a leading indicator to approximate the volatility of the cryptocurrency market. The first independent variable is the Economic Policy Uncertainty Index (EPU) which estimates the degree of political uncertainty according to the content analysis of news coverage. The daily index was used for this. The second independent variable in this study is the Financial Markets Implied Volatility Index (VIX). This index measures market expectations about the volatility of the US stock market and is used as a measure of anxiety or tension in the financial markets. The last variable is irregular political events (POL_EVT), which includes irregular political events as as debates, conferences, official statements, and election results. These events have been converted into a binary time variable that takes the value of 1 on the day of the event and 0 on other days, to include them in the model in a manner consistent with the daily frequency of the rest of the variables. This allows these events to be included as explanatory inputs into the model without disturbing the structure of the daily data, which allows for estimating their direct impact on Bitcoin volatility.

Table 1 below includes each variable's definition, code, time frequency, and source.

**Table 1: Study Variables and Their Sources**

| Variable | Acronym | definition | Frequency | Source |
|---|---|---|---|---|
| Bitcoin Return | BTCR | Represents the daily percentage change in Bitcoin's closing Prices. | daily | CoinMarketCap |
| Economic Policy Uncertainty | EPU | An index that measures the degree of uncertainty in economic policy is based on an analysis of news media coverage. | daily | Economic Policy Uncertainty Index – Daily Data |
| Implied Volatility Index | VIX | A measure of market expectations about future volatility in the US stock | daily | Chicago Board Options Exchange (CBOE) |

| | | | | |
|---|---|---|---|---|
| | | market indicates market stress or panic. | | |
| Irregular Political Events | POL_EVT | They represent aperiodic events associated with the political process, including debates, party conventions, election announcements, and voting results. These events were converted into a binary time variable (1 when the event occurs, 0 on other days). | Irregular (processed in a daily time frame) | Reliable media sources (CNN ‹ Reuters ‹TIME Election Calendar ‹ Politico) |

Source: Prepared by the authors.

### 3.2. Study Period

This study covers the period from January 2023 to December 2024, characterized by its prominent political and economic characteristics, as it coincides with the preparations, campaigns, and conduct of the US presidential elections and the subsequent critical political and economic developments. This period was chosen based on scientific and methodological justifications, as the US presidential election is one of the most important political events that deeply affect global financial markets, including the markets of digital assets such as Bitcoin. This period witnesses a higher frequency of irregular political events and sharp fluctuations in political and economic uncertainty indicators, making it a suitable timeframe to test the dynamics of the relationship between these influences and Bitcoin volatility. This timeframe allows monitoring and analyzing the short-term and long-term interactions of financial volatility under political events with cross-border impact, which enhances the explanatory power of the model, used and gives the study a new applied dimension that allows providing comprehensive and accurate insights into how Bitcoin reacts to major political tensions during a strategically important period.

### 3.3 Model Specification

This study aims to estimate the relationship between Bitcoin volatility and political uncertainty during the US election period 2023-2024, relying on two models: the classical GARCH model and the GARCH-MIDAS model. These models were developed to analyze the short- and long-term volatility components.

**a- Classical GARCH model (GARCH (1,1))**

This model is a baseline framework for analyzing the conditional variance of Bitcoin returns without incorporating any low-frequency explanatory variables. It is used here as a reference model for comparison.

- **Returns equation:**

$$r_t = \mu + \varepsilon t, \qquad \varepsilon t \sim N(0, ht)$$

- **Conditional variance equation:**

$$h_t = \omega + \alpha * \varepsilon^2{}_{t-1} + \beta * h_{t-1}$$

Where:

$r_t$: financial asset returns at time t

$h_t$: Conditional variance at time t

ω, α, β: GARCH model parameters

$\varepsilon_t$: Error term (Return shock)

**b- GARCH-MIDAS Model**

The GARCH-MIDAS (Generalized Autoregressive Conditional Heteroskedasticity-Mixed Data Sampling) model is an advanced model that allows combining short-term changes in financial markets with low-frequency macroeconomic variables (e.g., inflation, interest rate, or political uncertainty indices). It was developed to enhance the ability of traditional GARCH-type models to explain the behavior of financial volatility in both the short and long term.

General structure**:**

The general formulation of the GARCH-MIDAS model (Ghysels et al. (2006), Conrad & Loch (2015)):

$$r_{i,t} = \mu + \sqrt{\sigma_{i,t}} . \varepsilon_{i,t} \quad ; \quad \varepsilon_{i,t} \sim N(0,1)$$

Where:

- $ri$, Daily return of the financial asset under investigation.
- $\sigma_{i,t}$ The two-part conditional variance (short and long term).
- The conditional variance is written as follows: $\sigma_{i,t} = \tau_t * g_{i,t}$
- $\tau t$: The long-term component derived from low-frequency data and estimated using the MIDAS function.
- $gi,t$: Short-term component (estimated via GARCH (1,1))
- $\varepsilon$, $t$ Error term, assumed i.i.d. N (0,1).

Short-term component:

Estimated using the GARCH (1,1) specification :

$$g_{i,t} = (1 - \alpha - \beta) + \alpha . \frac{(r_{i,t-1} - \mu)^2}{\tau_t} + \beta . g_{(i,t-1)}$$

- α: Measures the impact of past shocks (squared residuals) on current volatility. A higher α implies a stronger reaction to recent market news.
- β: Captures volatility persistence. A value close to 1 indicates clustering and prolonged volatility effects.

Long-Term Component (MIDAS Term):

The long-term component can be determined via a weighted Beta polynomial applied to low-frequency independent macroeconomic variables (such as the Economic Policy Uncertainty Index (EPU) and the Volatility Index (VIX) in this study), in keeping with the framework established by Engle, Ghysels, and Sohn (2013). These variables constitute explanatory factors affecting long-term volatility dynamics according to the GARCH-MIDAS framework.

$$\tau_t = m + \theta \sum_{k=1}^{K} \varphi_k(\omega_1, \omega_2) . X_{t-k} \ )$$

$$X_t = \sum_{i=1}^{N_t} r_{i,t}^2$$

Where:

- $Xt{-}k$: Value of the macroeconomic variable (low-frequency independent variable) at lag k
- $\varphi k(\omega_1, \omega_2)$: MIDAS weighting function based on the Beta distribution
- $\omega_1$ و $\omega_2$: Shape parameters of the Beta function

Beta weighting function:

$$\varphi_k(\omega_1, \omega_2) = \frac{(k/K)^{(\omega_1-1)}\ (1 - k/K)^{(\omega_2-1)}}{\sum_{k=1}^{K}(k/K)^{(\omega_1-1)}\ (1 - k/K)^{\omega_2-1}}$$

The GARCH-MIDAS model enables a more flexible modelling of volatility dynamics by incorporating long-term economic effects. Unlike traditional GARCH models that assume stationarity and rely only on higher-frequency data, the GARCH-MIDAS model considers persistent economic shocks and structural changes, making it suitable for periods characterized by high levels of uncertainty, such as election periods or financial crises.

It should be noted that the model is estimated using the Maximum Likelihood Estimation method, where the optimal values of the parameters are obtained by maximizing the conditional likelihood function of the data.

## 4. Results

According to the defined goals and the nature of the problem, this section presents an adopted methodological framework for analyzing the relationship between political uncertainty and Bitcoin volatility during the U.S. presidential election period (2023–2024). This is done by describing the data used, identifying the selected political and economic indicators as sources of uncertainty, and presenting the GARCH-MIDAS model as the most suitable framework for integrating variables with different time frequencies. This section also presents the adopted estimation steps, the criteria for model selection, and the statistical justifications that support the use of this approach in light of the nature of the studied variables.

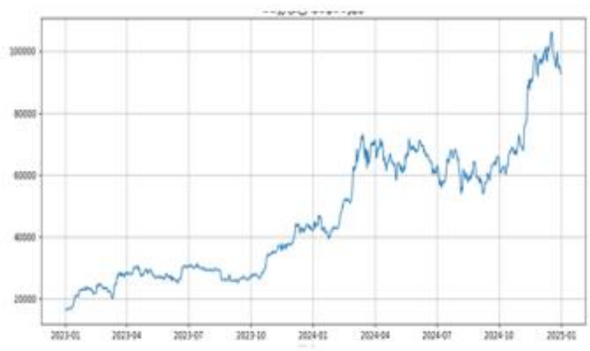
### 4.1 Descriptive and Exploratory Analysis

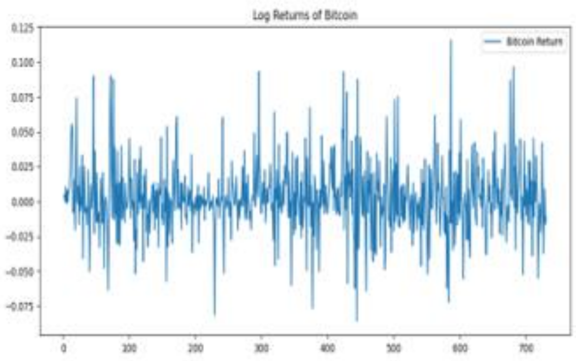
In this section, we seek to explore the data through visual analysis, a supportive tool for standard analysis. Visual analysis is based on graphical representations that connect and explore the primary relationships between variables and illustrate structural and temporal changes in their data. This section will review and analyze a set of illustrative graphs that reflect the behavior of the variables under study and their interactions during the study period. This is followed by analyzing their descriptive statistics.

#### 4.1.1. Exploratory Analysis

Figure 1 shows the general trend of Bitcoin prices from January 2023 to December 2024, coinciding with a series of important political and economic events associated with the US presidential election. This figure illustrates the volatile nature of the Bitcoin price, where periods of sharp rises followed by significant price corrections can be observed, reflecting the sensitivity of this digital asset to changes in the environment of political and economic uncertainty. It also shows that some strong price movements have been associated with the dates of key political events, as as debates, the announcement of election results, or surprising statements by candidates, highlighting the potential role of political variables in shaping market dynamics. This figure can be considered a visual input to understand the structural changes in Bitcoin prices during the study period, which will be explained later by the standard model.

**Figure 1: Bitcoin Prices During the Study Period** **Figure 2: Bitcoin Returns During the Study Period**

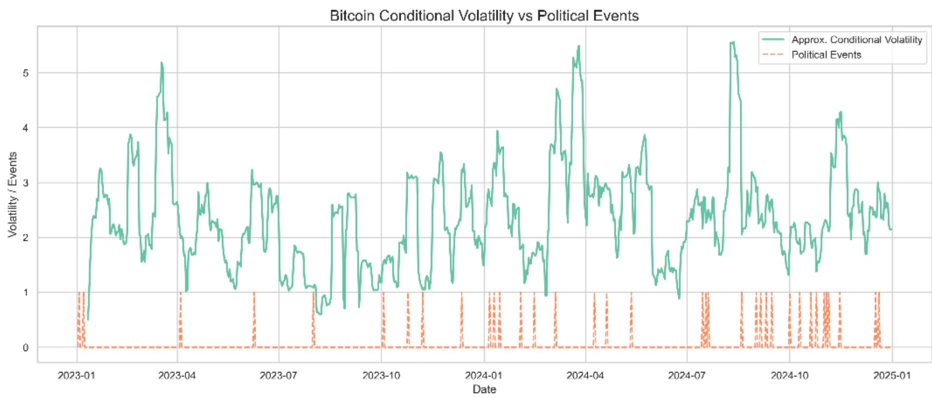





Source: Prepared by the authors using Python

Figure 2 shows the changes in daily Bitcoin returns during the study period, coinciding with the US presidential elections. The sharp fluctuations in the data reflect Bitcoin's sensitivity to major economic and political events .

**Figure 3: Conditional Volatility of Bitcoin Returns in Response to Political Events**

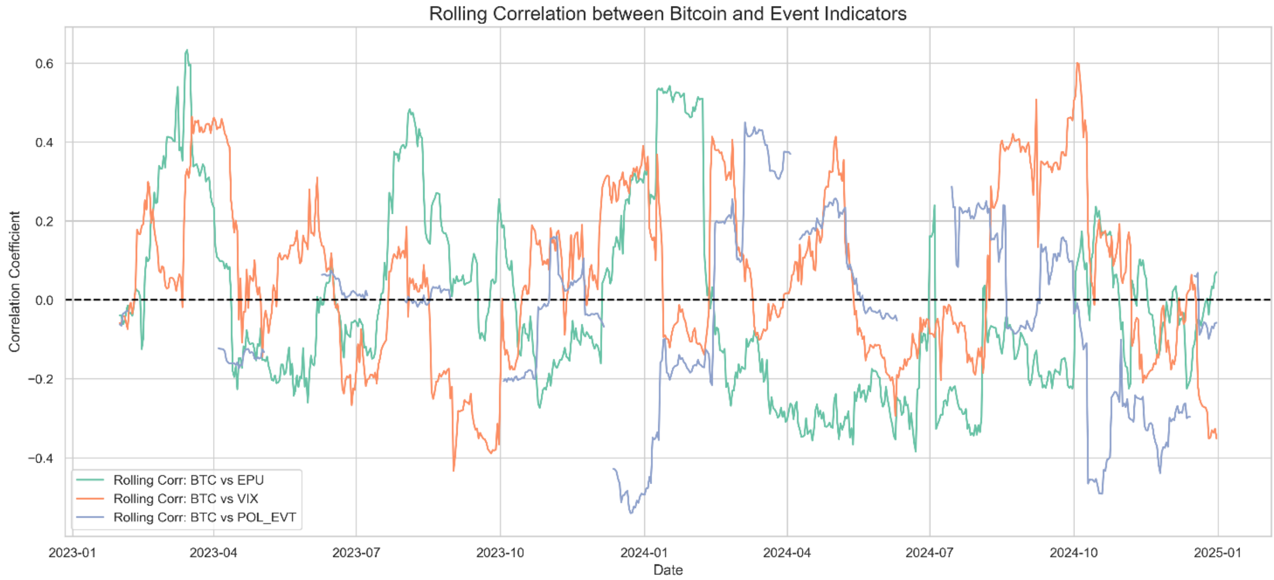



Source: Prepared by the authors using Python

Figure 3 shows the evolution of the conditional volatility of Bitcoin returns, approximated by the moving standard deviation, in conjunction with the dates of occurrence of irregular political events. Most significant political events coincide with significant spikes in volatility, reflecting an immediate impact of these events on investor behavior. This can be interpreted as Bitcoin reacting not only in terms of price but also in terms of perceived risk-taking, reflecting the resilience of the digital market to political shocks. This result reinforces the assumption that political uncertainty is the primary driver of volatility in the Bitcoin market, both through investors' psychological factors and through a change in the patterns of financial flows.

Figure 4 shows the dynamic relationship between Bitcoin returns and the Economic Uncertainty Index (EPU), the Volatility Index (VIX), and the Political Irregular Events Variable (POL_EVT) using the Rolling Correlation coefficient.

**Figure 4: Rolling Correlation Between Bitcoin Returns and Each Independent Variable**




Source: Prepared by the authors using Python

Figure 4 shows that the relationship between Bitcoin and political uncertainty is not constant over time but changes depending on the political and economic context. For example, the correlation between Bitcoin returns and the VIX appears stronger during some periods, while the correlation is weaker or negative in others. These dynamic changes reflect that Bitcoin may be a hedge against political uncertainty in some periods but may turn into a high-risk asset in other periods, which benchmark estimates will more accurately verify.

It appears that investors are reacting to rapid political developments because times around significant political events, such presidential debates and the declaration of election results, are accompanied by sharp increases and decreases in returns. Bitcoin volatility and political and economic changes are clearly correlated, but this relationship is not stable over time; it is influenced by cyclical changes and particular occurrences.

These graphs provide an initial insight into the interactive relationships between the variables and support the need for a GARCH-MIDAS model that allows for the analysis of the impact of long-term (political uncertainty) and short-term (irregular events) factors on Bitcoin's volatility.

**4.1.2. Descriptive statistics**

Descriptive data analysis is an essential primary step in understanding the characteristics of the variables included in the study model before embarking on the estimation process. Table 2 shows the descriptive characteristics of the four dependent variables.

Table 2 provides descriptive statistics that reflect the basic characteristics of the variables during the study period (January 2023 to December 2024).

**Table 2: Descriptive Statistics of Study Variables**

| | Count | Mean | Std | Min | 25% | 50% | 75% | Max |
|---|---|---|---|---|---|---|---|---|
| BTCR | 730 | 0,268 | 2,542 | -8,236 | -0,981 | 0,039 | 1,357 | 12,267 |
| EPU | 731 | 131,016 | 91,083 | 10,92 | 73,165 | 108,35 | 156,71 | 1026,38 |
| VIX | 731 | 16,182 | 3,276 | 11,86 | 13,54 | 15,39 | 18,385 | 38,57 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| POL_EVT | 731 | 0,049 | 0,217 | 0 | 0 | 0 | 0 | 1 |

Source: Prepared by the authors using Python

The returns of Bitcoin (BTCR) indicate a significant variation, with returns ranging from a low of -8.23% to a high of 12.26%, which shows the high sensitivity of the Bitcoin market to external variables. The average value was 0.268%, indicating that the market achieved slight positive returns, despite the high risk.

Bitcoin returns during the study period were characterized by high volatility, with a high standard deviation of 2.54. This reflects the high volatility of prices and indicates unstable behavior in the cryptocurrency market.

The Economic and Political Uncertainty Index (EPU) shows an average of 131.016 with a standard deviation of 91.083, indicating varying periods of political and economic uncertainty, especially under the impact of major political events. The minimum index was only 10.92, while the maximum reached 1026.38, indicating periods of extreme uncertainty caused by some major political events, which can directly affect Bitcoin's volatility.

The Financial Markets Implied Volatility Index (VIX) reflects the expected volatility level in the US stock market, averaging 16.1824 with a standard deviation of 3.2760. Although the average is relatively low, the high standard deviation indicates a state of moderate stress in the US financial markets. The index values ranged from 11.86 to 38.57, with higher values reflecting periods of market panic and anxiety, while lower values indicate relative stability.

Irregular Political Events (POL_EVT) is a binary indicator that reflects the occurrence of political events. The mean value was 0.049, indicating that about 5% of the days coincided with influential irregular political events. The standard deviation of this variable was 0.216, which reflects the variability in the timing of these events and their relative infrequency within the study period (731 days).

- The GARCH-MIDAS model, which can analyse the impact of long-term economic and political variables like EPU and VIX as well as short-term ones like irregular political events, is crucial because it can handle time differences between the independent variables and the dependent variable (Bitcoin volatility). These results show that the study variables have asymmetric distribution characteristics and large dispersion.

**4.2 Estimation Results**

Before estimating the model, we conduct stability tests on all the variables entered into it to check whether they can be used directly in standard dynamic models or need specific transformations to straighten them out.

**4.2.1 Testing the stability of the time series of the variables**

Before proceeding with the estimation of the model, stationarity tests were carried out on all variables entered into the model using the Augmented Dickey-Fuller (ADF) test and the Phillips-Perron (PP) test to determine whether the time series contains unit roots. Table 3 below shows the results of the ADF and PP tests for each variable.

**Table (3): Augmented Dickey-Fuller (ADF) and Philips Peron (PP) Test Results**

| Variable | ADF Stat | p-value | PP Stat | p-value | Decision |
|---|---|---|---|---|---|
| BTCR | -18,02 | 0.00 | -27,3368 | 0.00 | Stationary (I(0)) |
| EPU | -6,01 | 0.00 | -25,1469 | 0.00 | Stationary (I(0)) |

| | | | | | |
|---|---|---|---|---|---|
| VIX | -6,80 | 0.00 | -13,3206 | 0.00 | Stationary (I(0)) |
| POL_EVT | -10,16 | 0.00 | -28,5517 | 0.00 | Stationary (I(0)) |

Source: Prepared by the authors using Python

The results in Table 3 of the Augmented Dickey-Fuller test (ADF) and Phillips-Perron test (PP) showed that all variables used in the study are stable series at I(0), meaning that there are no unit roots in the variables. This confirms their suitability for direct use in standard dynamic models such as GARCH (1,1) and GARCH-MIDAS without the need for transformations to orthogonalize the data.

After confirming the variables' stability, the GARCH (1.1) model was adopted to estimate the short-term volatility component. This model has been used extensively in financial studies since it is simple to implement and accurately estimates the conditional variance of financial returns. We only point out that the GARCH (1,1) formulation was tested as it showed the lowest AIC and BIC values on the same model for different lags.

### 4.2.2 Model Estimation Results

This part seeks to report the results of an estimation of a GARCH-MIDAS model that combines the short-run and long-run components of the volatility of Bitcoin returns within the US election cycle of 2023-2024 based on political and economic uncertainty indices (EPU VIX) and sporadic political events (POL_EVT). The maximum likelihood approach was used to estimate parameters based on daily return data.

The estimation was carried out in the following steps:

-Modelling the long-term volatility component (τ) with a beta weight function based on the macroeconomic variables.

-Adjusting the daily return series by dividing it by the square root of the long-term component.

-Applying the GARCH(1,1) model to the adjusted series to estimate the short-term volatility component.

To compare and validate the effectiveness of the model, the following models (five models) were estimated:

a. The classical GARCH model without long-term variables.
b. GARCH-MIDAS models for each long-term variable separately, EPU, VIX, and POL_EVT.
c. The joint GARCH-MIDAS model that incorporates all long-term variables into the τ component.

Below is a table summarizing the estimation results of these models, including key parameters and associated statistics:

**Table 4: Estimation results of the different GARCH and GARCH-MIDAS models**

| | Mode 1 | | | | Mode 2 | | | | Mode 3 | | | | Mode 4 | | | | Mode 5 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model | GARCH Classic | | | | GARCH-MIDAS EPU | | | | GARCH-MIDAS VIX | | | | GARCH-MIDAS POL_EVT | | | | GARCH-MIDAS Combined | | | |
| Parameter | μ | ω | α | β | μ | ω | α | β | μ | ω | α | β | μ | ω | α | β | μ | ω | α | β |
| Estimate | 0,23 | 1,11 | 0,09 | 0,74 | 0,19 | 1,06 | 0,09 | 0,75 | 0,19 | 1,06 | 0,09 | 0,75 | 0,23 | 1,11 | 0,09 | 0,74 | 0,0021 | 0,0002 | 0,11 | 0,64 |
| Std. Error | 0,09 | 0,59 | 0,04 | 0,11 | 0,09 | 0,65 | 0,04 | 0,12 | 0,09 | 0,65 | 0,04 | 0,12 | 0,09 | 0,59 | 0,04 | 0,11 | 0,009 | 0,001 | 0,06 | 0,21 |

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T-stat | 2,62 | 1,87 | 2,06 | 6,73 | 2,16 | 1,63 | 1,97 | 6,25 | 2,16 | 1,63 | 1,97 | 6,25 | 2,62 | 1,87 | 2,06 | 6,73 | 2,29 | 1,55 | 1,80 | 3,09 |
| P-value | 0,01 | 0,06 | 0,04 | 0,00 | 0,03 | 0,10 | 0,05 | 0,00 | 0,03 | 0,10 | 0,05 | 0,00 | 0,01 | 0,06 | 0,04 | 0,00 | 0,02 | 0,12 | 0,07 | 0,00 |
| T (Long-term component (mean)) | --- | | | | 122.19 | | | | 15.82 | | | | 0.0381 | | | | Multivariate combination | | | |

Source: Prepared by the authors based on Python

**Note:** The last line in Table 4 shows the average estimated values of the long-term component τ (tau) extracted from each economic/political indicator. These values ranged from 0.0138 to 122.19, reflecting the different cumulative effects of each indicator on volatility dynamics.

The results in Table 4 illustrate the dynamic behavior of Bitcoin volatility during the US election period 2023-2024 by analyzing the estimated coefficients of both the classical GARCH and GARCH-MIDAS models. The economic meaning of the parameters α, β, ω, and μ is revealed, which enables the explanation of the cryptocurrency market's behavior under political and economic uncertainties.

**a. Parameters α and β reflect the reaction to shocks and the persistence of volatility**

The estimated value of the α coefficient (around 0.09 across the five models) indicates that the Bitcoin market exhibits a moderate immediate response to daily shocks. New shocks, such as political news or sudden changes in indices, directly affect the conditional variance. The β coefficient was high in all models (ranging from 0.74 to 0.75), indicating a high degree of Volatility Clustering, a characteristic of digital markets characterized by instability and frequent periods of high volatility.

**b. Parameter ω reflects the underlying volatility of the market**

All models showed that the value of the parameter ω, which expresses the level of shock-independent fundamental volatility, was relatively low, especially in the classical model. This indicates that volatility in the Bitcoin market is primarily driven by shocks and sudden events rather than sustained structural volatility. In contrast, the value of ω was slightly higher in the joint GARCH-MIDAS model (0.0021), indicating that incorporating long-term political and economic variables reveals a fundamental dimension in the structure of volatility that was not apparent in the classical model.

**c. Parameter μ represents the average return**

The value of μ in most models was around 0.19 to 0.23, a positive value indicating a slightly positive return for Bitcoin on the daily average, even under political uncertainty, enhancing its attractiveness as a speculative financial asset despite its high risk.

**d. Long-term component (τ) in GARCH-MIDAS models**

The results of the three GARCH-MIDAS models show that the long-term component τ generated by the variables EPU, VIX, and POL_EVT clearly influences the conditional variance. It is observed that:

- EPU has a long-term effect on volatility, suggesting that rising political and economic tensions gradually increase Bitcoin's volatility.

- The VIX index reflects the general anxiety in financial markets, and its positive correlation with τ shows the relationship between fear in the traditional market and Bitcoin volatility.

Irregular political events (POL_EVT) directly and rapidly affect the short-term component, but they are also partially reflected in τ, reflecting the market's reaction to sudden political changes.

### e. GARCH-MIDAS Combined Model

When all long-term variables were combined into a single model, all parameters retained their economic and statistical significance. This indicates that volatility in the Bitcoin market is cumulatively and integrally affected by political and economic factors, both sudden (short-term) and non-sudden (long-term).

## 5. Discussion

In light of the statistical results given by the GARCH and GARCH-MIDAS model estimates, there is a need for a deeper discussion of these results from both a theoretical and empirical perspective to understand the dynamic behavior of Bitcoin under the influence of political and economic shocks. This section attempts to explain the nature of this behavior under conditions of uncertainty, linking the results to relevant theoretical models and comparing them with previous studies that addressed the relationship between political risks and the volatility of digital assets.

### 5.1 Discussion and Theoretical Implications

When the empirical results derived from the estimation of GARCH and GARCH-MIDAS models are discussed, there must be a better review of the related economic and theoretical literature.

Our findings reveal that Bitcoin does not act like a conventional hedging tool in the face of political instability but, instead, behaves speculatively and is extremely sensitive to short-term and long-term political and economic shocks. This summarizes the 'High-Sensitivity Assets' concept of economic literature that depicts assets as not being steady during crisis times but amplifying the market's reaction to shock sudden changes (Smales, 2019; Bouri et al., 2017).

This phenomenon is consistent with the principles of the Asset Repositioning under Uncertainty theory, which asserts that assets lacking traditional fundamentals, like cryptocurrencies, are more susceptible to volatility under heightened political or economic uncertainty based on changes in investor behavioral expectations (Conrad & Loch, 2015; Dyhrberg, 2016). The findings of this research imply that the volatility of Bitcoin is the result of both direct market shocks and the subtle interaction between political news and investor expectations of the future, reinforcing the utility of the GARCH-MIDAS model to understand such multi-frequency temporal processes (Engle et al., 2013).

By extension, then, the response of Bitcoin in times of uncertainty is not in line with the profile of 'safe havens' as suggested by some traditional hedging theories (for instance, gold or government bonds), but instead displays a sort of pattern more in tune with what has been termed a Shock-Responsive Asset, which responds quickly and strongly to abrupt events, in line with the apparent high statistical influence of the POL_EVT variable in the models in question (Fang et al., 2019; Ajmi & Arfaoui, 2020).

### 5.2 Comparison with previous studies

Relating the results of this study to the previous literature, we find that the model estimated using multivariate GARCH-MIDAS showed a significant impact of political and economic uncertainty indicators (EPU, VIX, POL_EVT) on the dynamics of Bitcoin volatility during the 2023-2024 US presidential election, which is consistent with the findings of studies such as(Ajmi & Arfaoui, 2020; L. Fang et al., 2018; Huynh et al., 2019), all confirmed the significant impact of political and economic turmoil on the behavior of Bitcoin as a financial asset highly sensitive to market volatility.

However, these results also show that this effect was not always of a hedging nature and was associated with an increase in volatility rather than a decrease, which contradicts the notion of a safe haven that is supposed to provide stability in times of crisis. This is confirmed by the results of our study, which showed that Bitcoin returns remained subject to high volatility even as indicators of political tension increased, supporting what (Paule-Vianez et al., 2020) and (Mahjoubi & Henchiri,

2024) argued about the limited effectiveness of Bitcoin as a hedging tool compared to traditional assets such as gold or sovereign bonds.

This finding is also consistent with (Bouazizi, 2023) and (Theiri, 2024) that Bitcoin reflects the characteristics of high-risk assets rather than a hedging asset. Its behavior oscillates between hedging and speculation, depending on the nature of the political event and the type of shock associated with it. This is confirmed by including the POL_EVT variable, which showed an immediate and strong effect on the conditional variance. On the other hand, the VIX index had a positive relationship with long-term volatility, indicating that Bitcoin is exposed to macro-financial stress rather than being a shield against them.

The classical GARCH model coefficients, especially β, reflected a trend towards sustainability in volatility, suggesting that Bitcoin is not a 'defensive asset' but rather a speculative asset that reacts instantaneously to unexpected news and surprises, especially during periods such as the US election campaigns.

Compared to other papers, our results disagree with Selmi et al. (2018), whose attempts were made to validate the hypothesis that Bitcoin can act as a safe haven against volatility in world markets and oil prices. However, based on our study, such a function is reduced in a political high-risk environment like the US election.

On the other hand, our evidence is in line with (Bouri et al., 2017) and (L. Fang et al., 2019), which show that Bitcoin reacts strongly to political and economic uncertainty indexes but does not provide complete protection for investors, especially in the short term.

This contrast highlights the disparity in explanation of Bitcoin's behavior amidst political instability. It can show that its safe-haven value is not absolute but rather dependent and based on the time context, the type of risk, and the type of shock. It also lends support to the worth of using non-linear and dynamic models like GARCH-MIDAS in understanding the changing relationship of Bitcoin with complex political factors.

### 5.3 Strengths and limitations of the model

GARCH-MIDAS can distinguish volatility into two aspects: short-term, including market response to day-to-day issues, and long-term, including the effect of low-frequency economic and political issues. This is a model strength, enabling the precise capturing of the effect of political uncertainty over time, particularly when using a mix of indices such as EPU, VIX, and POL_EVT. The model can effectively manage time-frequency variability among variables, thus making it have a greater explanatory power than in common models.

However, the model has some drawbacks which must be kept in mind. One of the most important concerns is its reliance on selecting the Beta Function, which can influence the outcome if not precisely established. The model considers a basic linear relationship among low-frequency variables and long-term volatility, which might not always represent the intricate economic picture. Moreover, the estimation of the model demands clean and consistent data, thereby constraining its viability in cases where data are sparse or disorganized.

## 6. Robustness Checks

Having presented the major outcomes of the estimated models, their statistical significance and predictive efficiency strength must be verified. Now, here in this part, we conduct a series of diagnostic and robustness tests to verify the validity and reliability of the GARCH-MIDAS model by cross-checking the probability distribution of the residuals, heteroscedasticity and autocorrelation of the time series test, and relative performance comparison of the models on statistical fit measures.

### 6.1 Model adequacy and diagnostic checks

We conducted several diagnostic and adequacy tests like ARCH-LM, Ljung-Box, and Jarque-Bera to ensure the robustness and forecasting ability of the GARCH-MIDAS models.

These tests included the Jarque-Bera test for testing the type of probability distribution of the residuals, the ARCH test for testing the presence of variance heterogeneity of the residuals, and the Ljung-Box test for testing the autocorrelation of the residuals and their squares.

**Table 5: Diagnostic Tests for GARCH and GARCH-MIDAS Models**

| | Jarque-Bera test | | ARCH test | | Ljung-Box test on residuals and their squared values | | | |
|---|---|---|---|---|---|---|---|---|
| Model | JB Stat | JB p-val | ARCH LM Stat | ARCH p-val | Ljung-Box Stat (Resid) | LB p-val (Resid) | Ljung-Box Stat (Resid²) | LB p-val (Resid²) |
| GARCH Classic | 194,482 | 0.00 | 20,906 | 0,0218 | 8,932 | 0,5385 | 24,708 | 0,0059 |
| GARCH-MIDAS EPU | 198,58 | 0.00 | 10,963 | 0,3604 | 9,773 | 0,4607 | 12,681 | 0,2421 |
| GARCH-MIDAS VIX | 211,763 | 0.00 | 33,456 | 0,0002 | 11,244 | 0,3388 | 41,459 | 0.0000 |
| GARCH-MIDAS POL_EVT | 220,465 | 0.00 | 19,512 | 0,0342 | 9,205 | 0,5128 | 22,965 | 0,0109 |
| GARCH-MIDAS Combined | 233,648 | 0.00 | 27,024 | 0,0026 | 12,984 | 0,2246 | 33,617 | 0,0002 |

Source: Prepared by the authors using Python

Table 5 presents the result of the Jarque-Bera test, where residuals for all models do not strictly follow a normal distribution, but this is very common in financial volatility models and will not adversely affect the quality of the estimate as long as the error variance is regulated. The results of the ARCH test were more significant, showing that the GARCH-MIDAS model that relies only on the EPU index was the best in terms of the absence of heteroskedasticity, as reflected by the high level of statistical significance of the ARCH test compared to the rest of the models.

The Ljung-Box test on the residual squares showed that most models retain some autocorrelation in the variance. Still, the combined GARCH-MIDAS model shows a relative improvement in reduced autocorrelation strength in the residuals, supporting its explanatory power despite some shortcomings in its basic structure.

## 6.2 Estimated Models Comparison

The estimated models were compared using Log Likelihood, AIC, and BIC criteria to highlight their comparative performance to identify the model that best explains Bitcoin's volatility under political uncertainty during the US election period.

**Table 6: Model Comparison Table**

| Model | Log Likelihood | AIC | BIC |
|---|---|---|---|
| GARCH Classic | 1662.495 | -3316.9899 | -3298.6177 |
| GARCH-MIDAS EPU | 1641.6066 | -3275.2133 | -3256.8411 |
| GARCH-MIDAS VIX | 1641.0002 | -3274.0004 | -3255.6282 |
| GARCH-MIDAS POL_EVT | 1649.7119 | -3291.4237 | -3273.0515 |
| GARCH-MIDAS Combined | 1624.7998 | -3241.5995 | -3223.2274 |

Source: Prepared by the authors using Python

Table 6 shows that the GARCH-MIDAS model using the POL_EVT indicator achieves relatively better performance in terms of AIC and BIC values than the rest of the models, indicating the importance of sudden political events in explaining Bitcoin volatility.
While the classical GARCH model achieves the highest Log-Likelihood, its failure to incorporate long-term factors limits its explanatory power.
The GARCH-MIDAS Combined model, while having a lower Log-Likelihood, combines all three indicators and shows the cumulative effect of political variables in the long and short term.

## 7. Conclusion

Based on the presented results and previous theoretical analyses, this section aims to provide conclusions regarding the relationship between political uncertainty and Bitcoin volatility during the U.S. election period. It also seeks to present the most significant practical implications of the results, whether for investors or policymakers, and suggest future research directions that enhance the scientific understanding of digital asset behavior in politically and economically unstable environments.

### 7.1 Summary of results

This study makes a qualitative contribution to the economic and financial literature by employing a GARCH-MIDAS model to analyze the relationship between political uncertainty and Bitcoin volatility during a highly sensitive electoral period, namely the 2023-2024 US presidential election. The statistical estimation results proved that Bitcoin is clearly and directly affected by political and economic uncertainty levels, both in the short and long term, reflecting this digital asset's complex and dynamic nature.
However, despite Bitcoin's responsiveness to political indicators, the results show that it does not provide the safe-haven characteristics of traditional assets such as gold or government bonds. Its behavior in periods of political tension indicates its high-risk and speculative nature. This reinforces the argument that the role of Bitcoin in investment portfolios should be carefully considered and cannot be relied upon as a hedging tool in all circumstances.

On a methodological level, this study highlights the importance of using models that combine different time frequencies to understand complex economic phenomena. The GARCH-MIDAS model showed a more significant ability of capturing compounding effects than traditional models. It also fills an existing research gap in analyzing the connection between digital policy and macroeconomics from a joint time perspective.

This study is therefore a prerequisite to subsequent research on a broader level to identify the mechanisms of contagion of political risk to cryptocurrency markets and to develop more sophisticated quantitative tools for predicting volatility in an increasingly volatile and complex economic environment.

This study attempts to ascertain whether Bitcoin is an effective hedging tool during an environment of political uncertainty by using the GARCH-MIDAS model on data that embodies Bitcoin returns and various political indicators during the 2023-2024 US presidential election.

The results show that Bitcoin reacts sensitively to short-term political events, i.e., debates and unanticipated announcements, and long-term uncertainty indicators (such as EPU and VIX) have a combined effect in powering its volatility dynamics over the overall time period. The model showed that Bitcoin does not possess the traditional safe-haven characteristic because it was associated with the apparent volatility magnification in times of political crises, and therefore, it was a risky asset rather than a hedge.

Furthermore, the GARCH-MIDAS model effectively disentangles the time effect of political variables, and it is discovered that volatile political events induce immediate volatility. Nevertheless, the effect of long-run political uncertainty is encapsulated within general volatility trends.

**Policy Implications**

Based on the obtained results, a set of political indications emerges that can help guide the decisions of investors and policymakers in the digital asset markets.

- Cryptocurrency investors should be cautious in interpreting Bitcoin's behavior during political tension and not rely on it as a hedging asset in defensive portfolios.
- Financial policymakers should recognize the increasing influence of political rhetoric and attitudes on digital markets, especially Bitcoin, which calls for more stable communication and guidance policies.
- The study recommends that major financial institutions include non-linear temporal models such as GARCH-MIDAS in their analytical tools to monitor multiple time-horizon market responses.

### 7.3 Future research directions

This study opens up several directions for future research of academic and practical value. First, the estimated model can be generalized to other periods and various political events (such as geopolitical crises or major legislative changes) to test the stability of the results. Second, exploring the relationship between Bitcoin volatility and alternative uncertainty indicators, such as geopolitical indicators (GPR) or AI-based non-structural news indicators, would be useful.

The study is also suggested to extend to other cryptocurrencies (such as Ethereum or Ripple) to compare their response to political uncertainty. Finally, non-linear models, or regime-switching models, can be employed to measure dynamic effects that vary by market phase and level of volatility, enhancing the accuracy of the scientific understanding of digital asset behavior in political crisis contexts.

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