

# Is Bitcoin Resilient for Indian Investors? The E-GARCH Analysis

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## Abstract

This paper explores the financial asset capabilities and hedge alternative properties of Bitcoin by investigating several aspects of its volatility in relation to Nifty50 and Indian exchange rates (USD/INR & EUR/INR). This study delves into the volatility dynamics of the returns of Bitcoin. An asymmetric GARCH model (E-GARCH) is used to examine whether Bitcoin may play crucial role in risk management and ideal for risk-averse investors in anticipation of leverage effect. This paper also examines Bitcoin as an investment and hedge alternative to Nifty50 and exchange rates. The findings suggest that Bitcoin does not attributes the properties of safe hedge and an investment alternative by Indian investors.

**Keywords:** Bitcoin, E-GARCH, Exchange Rate, Nifty50, Hedge

## 1.Introduction

In the sphere of finance and technology, few innovations have captivated the collective imagination as profoundly as Bitcoin. The general populous became acquainted with bitcoin in 2009. A person or group identifying themselves as Satoshi Nakamoto uploaded a paper titled Bitcoin—A Peer-to-Peer Electronic Cash System to a mailing list devoted to cryptography in 2008. Bitcoin presented the idea of a decentralized, digital currency built on blockchain technology and made incontrovertible digital payments achievable, which are based on an algorithm rather than "third-party trust" (Kayal and Rohilla 2021; Civelek et al. 2021). The imminent impact of Bitcoin on the world's financial system is becoming increasingly apparent as it evolves. By addressing scalability issues and lowering transaction fees, second-layer technologies like the Lightning Network are designed to improve the usability of Bitcoin for routine transactions.

It has impacted conventional financial systems all through the moment, but it has also prompted discussions about the nature of money, the promising potential of blockchain, and the prospects of international trade. Furthermore, ongoing study and development strives to enhance the energy

efficiency and environmental sustainability of the mining process. The socioeconomic effect of bitcoin has also extended beyond financial, igniting debates concerning the future of money, the democratization of finance, and the nature of faith in the digital era. The voyage of Bitcoin is expected to be distinguished by additional innovation, adaptation, and possibly even a broader adoption as a mainstream financial instrument as the globe navigates the developing terrain of cryptocurrencies and blockchain technology.

India is considered as fastest-growing cryptocurrency country and expected to undergo major cryptocurrency adoption, and further considering the current trajectory, more Indians likely to embrace the crypto revolution (Kothari 2022). Moreover with 750 million users and hundreds of millions more slated to join the online world as soon as faster and more widespread internet connection, integration, and digital adoption take place. India has the potential to become a crypto superpower (Murthy, et al. 2022) as a transparent and unambiguous regulatory framework that governs the use of cryptocurrencies (or crypto assets) is not prohibited in India (RBI 2022). Furthermore, any privately held cryptocurrencies will be outlawed by this legislation, with the exception of "certain exceptions to promote the underlying technology of cryptocurrency and its uses. The Global Adoption Index by Chainalysis has ranked India second out of 154 nations in 2021 for cryptocurrency adoption.

The plethora of studies are largely focused on the hedging capabilities of bitcoin, similar to gold against stocks and the dollar (Baur and Lucey 2010; Capie et al. 2005). The studies on the risk diversification of Bitcoin are abundant (Briere et al. 2015; Guesmi et al. 2019; Shahzad et al. 2020; Khan et al. 2020). There have been studies on the confluence of Economics, Technology and Governance, Bitcoin price formation and its political economy (Ciaian et al. 2016; Hendrickson and Luther 2017; Szetela et al. 2020). While the literature has investigated Bitcoin's ability to act as a hedge, a safe haven and as a means of diversification, there is a dearth of studies analysing the how does the return on bitcoin behave compared to the Nifty50 and the exchange rate (USD/INR & EUR/INR) when analyzing the variance of the assets in the Indian context. So, this present study is delved into the asymmetric E-GARCH analysis framework that suggest the economic abilities of bitcoin in risk management, portfolio analysis and currency capabilities in India. Essentially this research will explore if bitcoin behaves like a well-known financial asset by analyzing several aspects of its price volatility. The results will also suggest if any hedging capabilities are observable. The structure of this paper is as follows. The Section 2 comprises the literature review; Section 3 comprises the data and methodology; Section 4 depicts the empirical results and discussion and Section 5 concludes the findings.

## 2. Literature Review

Bitcoin's viability as a replacement for fiat currencies has been examined (Lo and Wang 2014). As an investment alternative, the benefits and costs of the inclusion of Bitcoin in portfolios have been examined (Moore and Stephen 2016; Symitsi and Chalvatzis 2019). Many studies have also focused on the volatility of digital currencies (Beneki et al. 2019; Fassas et al. 2020). Integrated surveys on cryptocurrency characteristics (Corbet et al. 2020) and the tradability of cryptocurrencies (Wei 2018) have also been conducted. Some studies focus on a detailed view of the hedging capabilities of Bitcoin and its role as a store of value (Dyhrberg 2016; Baur and Dimpfl 2021). Conlon and McGee (2020) investigated the safe haven properties of Bitcoin during the COVID-19 bear market and found that Bitcoin does not shelter investors from market turbulence. A similar study conducted in China by Corbet et al. (2020) bolsters the argument that bitcoins do not act as hedges during financial crises and add that they are amplifiers of contagion.

Some studies have focused on Bitcoin's place in the financial system in terms of its means of exchange characteristics and diversification (Brière et al. 2013; Glaser et al. 2014). Some has identified a potential role for cryptocurrencies in investor portfolios as a significant diversification option for investors, with particular emphasis on Bitcoin and Ethereum (Gil-Alana et al., 2020). While others identified that any probable diversification benefits within cryptocurrencies are most like to be found within intra-week to intra-monthly time horizons for specific market pairs, while the level of inter-market connectedness and volatility interlinkages are identified as being sensitive to both liquidity and volatility (Omane-Adjepong and Alagidede , 2019).

Liu (2019) further identified portfolio benefits from the inclusion of cryptocurrency. When specifically investigating the market relationships between cryptocurrency and other traditional financial variables, Bouri et al. (2017) found that Bitcoin is a poor hedge and is suitable for diversification purposes only, a result that was echoed when considering the S&P500 exchange (Tiwari et al., 2019) and for each of the Eurostoxx 50, the Nikkei 225 and the CSI 300 (Feng et al., 2018). More recently, Conlon and McGee (2020) suggests that Bitcoin was neither a safe haven nor a hedge against the extreme bear market in the S&P500 occasioned by the COVID-19 pandemic.

## 3. Data and Methodology

We specifically investigate the how does the return on bitcoin behave compared to the Nifty50 and the exchange rate (USD/INR & EUR/INR) when analyzing the variance of the assets in the Indian context. For the same purpose daily data of Bitcoin, Nifty50 & exchange rate (USD/INR& EUR/INR) has been

retrieved for period November, 2017 to December, 2022 from Yahoo finance, National Stock Exchange (NSE) and Bloomberg respectively. Further, due to the presence of inherent heteroscedasticity and to rule out the non-stationarity of data which is supposed to be sensitive to random shocks, the data has transformed into log return.

Then descriptive statistics are estimated, synthesizing the attributes of a dataset consisting of mean, standard deviation, Skewness, Kurtosis and Jarque-Bera demonstrating central tendency, variability, and distribution in the time series. The considered series is further examined for heteroskedasticity by employing the Lagrange multiplier (LM) test proposed by Robert Engle (1982), highlighting that the exchange rate series is heteroskedastic as shown in table 2. Further, owing to the exhibit of non-stationary heteroskedasticity and volatility clustering as depicts in exhibit 2 asymmetrical E-GARCH model (equation 1&2) has been devised under study which allows for the leverage response of returns volatility to positive and negative shocks.

Firstly, Mean equation has modelled as:

$$\Delta \ln B_t = \delta_0 + \delta_1 Nifty_{t-1} + \delta_2 USD_{t-1} + \delta_3 EUR_{t-1} + \varepsilon_t \quad \text{Eq. 1}$$

Then, variance equations estimated as shown below:

$$\ln(\sigma_t^2) = \vartheta_t + \vartheta_1 Nifty_{t-1} + \vartheta_2 USD_{t-1} + \vartheta_3 \delta_2 EUR_{t-1} + \theta \left( \frac{\varepsilon_{t-1}}{\sigma_{t-1}} \right) + \omega \left( \left| \frac{\varepsilon_{t-1}}{\sigma_{t-1}} \right| - \sqrt{\frac{2}{\pi}} \right) + \tau \ln(\sigma_{t-1}^2) \quad \text{Eq. 2}$$

## 4. Empirical Result and Discussion

### 4.1 Descriptive Statistics

Table 1 specified the distributional properties of the log-returns of Bitcoin, Nifty50 & exchange rate (USD/INR & EUR/INR) series. It indicates that Bitcoin has the highest mean value, followed by Nifty50, EUR/INR & USD/INR series. The Bitcoin registered the highest volatility return and a greater degree of associated risk, whereas USD/INR turned out to have the lowest volatility return. Further, the skewness coefficient of Bitcoin&Nifty has experienced negative connotations. In contrast, USD/INR and EUR/INR have shown positive connotations. The kurtosis statistic has remarked that all the considered series are sharply peaked and leptokurtic. Moreover, the Jarque Bera test proclaimed the exhibition of a non-normality distribution pattern in all the considered time series and the presence of heteroscedasticity in series.

**Table 1. Descriptive Statistic**

	D_BITCOIN	D_USD	D_EUR	D_NIFTY
Mean	0.002657	0.000132	0.000136	0.000529
Std. Dev.	0.042577	0.004195	0.005474	0.011520
Skewness	-0.813272	0.443642	0.172579	-1.581656
Kurtosis	14.91683	6.953209	4.886642	25.48566
Jarque-Bera	9420.753	1064.932	239.4125	31688.62
Probability	0.000000	0.000000	0.000000	0.000000

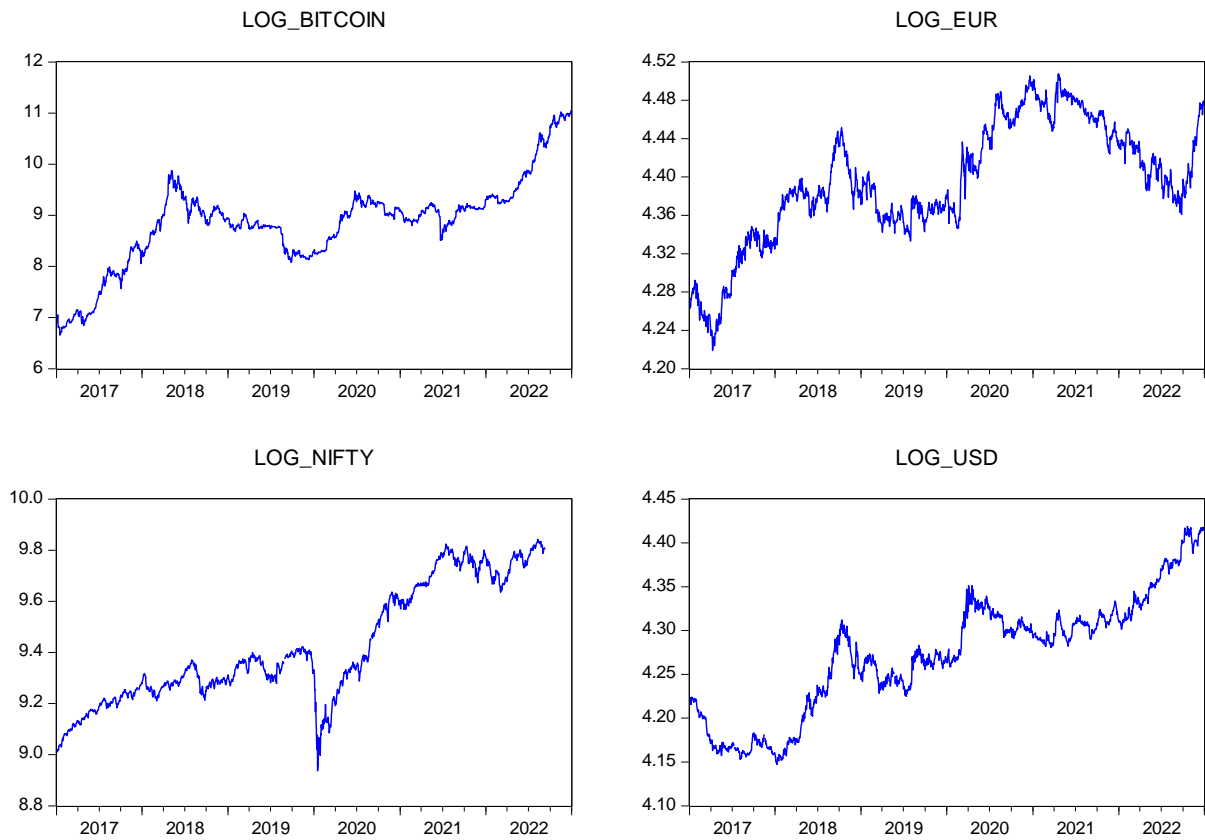
Source: 1 Author’s Computation

The evidence concerning random walk and heteroscedasticity is also apparent in exhibit 1 and 2 respectively. The inference is further validated by ARCH LM (Table 2) test statistics, which reject the null hypothesis that there is no ARCH effect. This visual exploration explains that the series tends calm and volatile episodes where a set of high returns approached the high returns and a set of low returns approached the low returns.

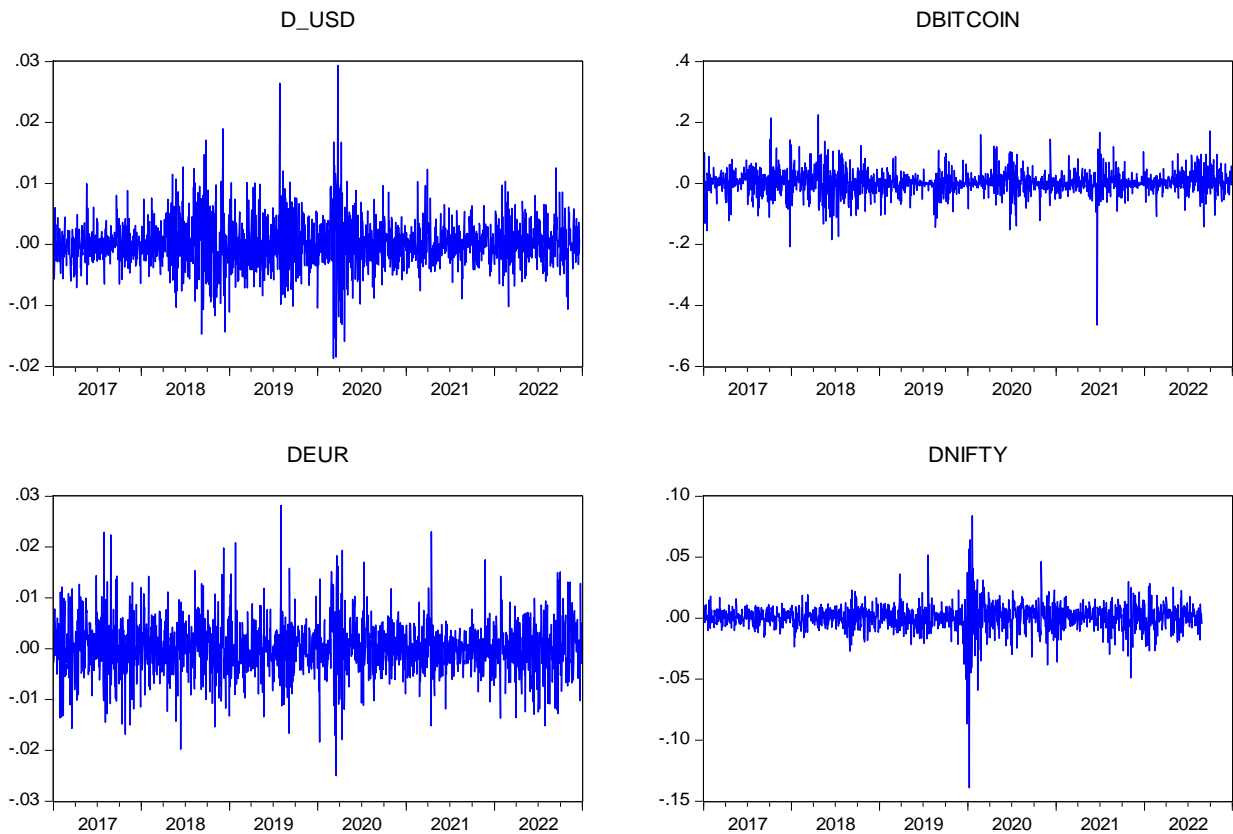
**Table 2. Heteroskedasticity Test: ARCH**

F-statistic	11.91221	Prob. F(1,1471)	0.0006
Obs. R-squared	11.83258	Prob. Chi-Square(1)	0.0006

Source: 2 Author’s Computation



**Exhibit 1 Log Return of series**



**Exhibit 2 Volatility Clustering of Series**

#### 4.2 Asymmetrical E-GARCH Analysis

The empirical analysis of the E-GARCH (1,1) has reported in Table 3, revealing that the coefficient of GARCH is 0.924177 is greater than the ARCH coefficient i.e., 0.253872 which implying that the conditional variance of Bitcoin is highly sensitive to its past values rather than the past value of its squared error suggesting the persistence of volatility. Further, the summation of ARCH & GARCH coefficient has found greater than one, which connotes that Bitcoin series is highly volatile in nature, and the volatility shocks are supposed to persist over time. The asymmetrical coefficient (-0.057323) has found negative and significant, implying negative shocks have a more substantial impact on series volatility than positive fluctuations of the identical magnitude. However, this finding is not in line with non-validation of A.H. Dyrberg (2015) & Dyrberg (2016) by arguing that Bitcoin has significant leverage effect bitcoin is not good investment in anticipation of bad news for risk averse investors.

Further, Table 3 demonstrates that positive volatility shock to USD/INR increases the variance of Bitcoin returns, revealing that Bitcoin may not be reckoned as a safe alternative asset. The high variance of an asset does not instill confidence amongst investors. In other words, it is anathema for risk-averse investors. But in contrary, the variance equation depicts that a positive volatility shock to the Nifty50 decreases the variance of the Bitcoin returns and vice-versa, indicating that Bitcoin can be considered as an alternative by investors. Moreover EUR/INR exchange rate has documented the insignificant impact on the variance of Bitcoin returns.

**Table 3. Summary Statistic of E-GARCH (1,1)**

Variable	Mean Equation		Variance Equation	
	Coefficient	Probability	Coefficient	Probability
Constant	0.001825	0.0760	-0.663065	0.0000
Nifty50	-0.109655	0.1560	-2.523726	0.0318
USD/INR	0.231693	0.3409	17.61951	0.0000
EUR/INR	0.580572	0.0007	2.307721	0.4956
ARCH	*	*	0.253872	0.0000
Asymmetrical	*	*	-0.057323	0.0000
GARCH	*	*	0.924177	0.0000

Source: 3 Author's Computation

## 5. Conclusion

The evolution of Bitcoin from a treatise to a digital asset acknowledged worldwide the world has proved unbelievably remarkable. Its influence on business, technology, as well as society at large cannot be denied. The core principles of decentralization, transparency, and financial inclusivity continue to guide the development of Bitcoin and the larger cryptocurrency ecosystem despite ongoing difficulties and uncertainty. As time goes on, it becomes increasingly obvious that Bitcoin's tale is far from finished and that it will continue to have an impact on the development of digital currency as well as how we see value and transactions.

This study provided insight into Bitcoin's properties, how Indian investors perceive it, and its potential for portfolio management. It also aided to research on the volatility of Bitcoin in lieu of Nifty50 and the Indian Rupee exchange rate (USD/INR & EUR/INR) is also aided by this study. The findings claimed the presence of the leverage effect which revealed that the volatility of Bitcoin returns increases more with bad news. Given that volatility is a risk indication, it is recognized that investors do not perceived Bitcoin as a secure investment or a mature asset.

Its further document that Bitcoin has not considered a safe hedge and an investment option by Indian investors during the study period. This is in line with the results of studies conducted in the US (Conlon and McGee 2020), China (Corbet et al. 2020) and India (Murty et al. 2022).

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