A Panorama of the Bitcoin Volatility in the Post Demonetization Era

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Abstract

With the advent of various types of crypto currencies and the growing interest among the investors across the world, Bitcoin still tops the list for being the most preferred choice among all. The era of digitalization and less cash economy with a view to provide both national and global integration and to promote better governance structures, it becomes imperative to have regulation for the new types of financial instruments. This paper gives a Bird's eye view on the Bitcoin market in India and examines the volatility of the same both pre and post demonetization of the Indian rupee. The findings of the EGARCH and TARCH Models along with the BDS test results suggest the presence of rich volatility and hidden underlying structure in the Bitcoin market.

Key words: *Bitcoin, GARCH, Volatility.*

Introduction

Digital or virtual currency is an electronically issued currency, the transferability of which into fiat currency is not guaranteed by the state (European Banking Authority, 2014). The crypto currencies are decentralized digital currencies.

With the approval of the Commodity Futures Trading Commission (CFTC) in 2015 of the temporary listing of an over-the-counter swap product based on the price of aBitcoin gives the proof of Bitcoin's acceptance as a financial product in the US.

Some studies have been carried out on the legal and regulatory aspects of Bitcoin. Negurita (2014) discussed on legal aspects and financial performance of Bitcoin. Demchenko (2017) concentrates on the legal definition of Bitcoin; be it a virtual currency or a financial instrument or a property and how based on the legal definition of Bitcoin in the respective counties, the subsequent regulations be applied. Brandvold et al. (2015) focus on price discovery in the Bitcoin market. Bitcoin is seen as a speculative investment by Yermack (2013).

There have been mixed response among researchers about the value of Bitcoin; from being fundamentally zero (Cheah and Fry, 2015); to something in between gold and American Dollar (Dyhrberg, 2015) and to being digital gold (Popper, 2015).

Few studies also focus on the volatility aspect in the Bitcoin market. Bouri et al. (2016) assess the existence of volatility in the Bitcoin market. Klein et al. (2018) compares the volatility between gold and Bitcoin.

However, the volatility in the Indian Bitcoin market remains unexplored, especially the effect of the recent demonetization of the Indian rupee (i.e. on 8th November 2016) on the volatility. In this paper we try to look into the Bitcoin market and examine the volatility of the same pre and post demonetization of the Indian rupee. This is essential for the policy makers and regulators who are in the process of formulating guidelines for the Bitcoin market.

The rest of the paper is structured as follows. Section 2 gives a genesis of the cryptocurrencies market and Bitcoin. Section 3 discusses the data and econometric model. Section 4 presents the empirical results. Section 5 provides the findings and conclusion.

Review of Literature on Cryptocurrency Market and Bitcoin

The first attempts to use cryptography to build digital currencies date back in the late 1980s. The Internet was the environment that facilitated the creation of significant online communities of people driven by common interests that needed a safe payment system for their online transactions. To this end, Wei Dai (1998) proposed for the first time a cryptocurrency under the name of B-money. Wei Dai based his initiative on the fact that in a community the members exchange ideas and even goods and services. An efficient cooperation among them requires a medium of exchange (money) and a way to enforce contracts. To address these issues Wei Dai considered two protocols. One of them was similar to the Bitcoin protocol, based on an undetectable network of individuals identified by a digital pseudonym.

In 2008, Satoshi Nakamoto was claiming there was a need for a purely peer-to-peer version of electronic cash that would bypass the financial institutions. He mentioned the financial institutions as third parties in commercial transactions were necessary due to the trust issues between buyers and sellers and the cost of this "trust" was high because they were not irreversible and involved mediation costs that made the services even more expensive. Nakamoto proposed an electronic payment system based on cryptographic proof (blockchain) instead of trust (Nakamoto, 2008). Just one year later, the Bitcoin network became functional, now is the most traded cryptocurrency in the world (Table 1).

Table 1 gives the market capitalization for the top five cryptocurrencies as on 1st June 2018. From the table it is clear that Bitcoin dominates the cryptocurrency market.

Table 1.Top 5 Cryptocurrencies Market Capitalizations on the 1st of June 2018

Rank	Name	Market cap ($)	Price ($)	Volume (24h) ($)	Circulation supply
1	**Bitcoin**	$126,934,399,900	$7,436.90	$5,087,530,000	17,068,187 BTC
2	**Ethereum**	$57,412,422,571	$575.26	$2,038,650,000	99,802,563 ETH
3	**Ripple**	$24,006,128,565	$0.612558	$274,328,000	39,189,968,239 XRP *
4	**Bitcoin Cash**	$16,874,030,182	$983.35	$577,481,000	17,159,688 BCH
5	**EOS**	$10,797,517,040	$12.08	$1,112,850,000	894,056,226 EOS *

Source: Coinmarketcap.com, 2018

The cryptocurrencies are to the tune of 1640 with a market capitalization of $328,656,284,409 with penetration across 11,161 markets and with Bitcoin dominance of 38.6 % (Coinmarketcap.com, June 1, 2018). With internet connecting the markets across the globe the use of digital currency has substantially increased.

The primary driver for the emergence of cryptocurrencies according to Vigna and Casey (2016) is the current bias towards decentralised models "that bypass middlemen gatekeepers". People embrace these models realising the possibility to avoid intermediaries when searching for goods or services. On the other hand, young people see Bitcoin as a means to invest or save money. For them, it makes more sense to acquire these new currencies than to invest in gold, or bonds or any other liquid assets.

So far as India is concerned Bitcoin have been in existence as a financial instrument. However, after the recent demonetization of 2016 there is an upsurge of participants in the Bitcoin market. One of the reasons for the rise in the Investors' interest could be the demonstration effect which is attached with the Bitcoin, which has not just grown significantly in the advanced nations like the US and Australia but also in the most tumultuous times in nations like Cyprus (Liu, 2013).

The future of Bitcoin in India is unpredictable now as the RBI has not yet given the Green signal for its full acceptance. However, in the economic downturn Investors have shown interest in the cryptocurrencies and especially Bitcoin across the globe.

Research Methodology

Data and Econometric Model

We use daily returns on Bitcoin from March 21, 2013 to May 10, 2018, calculated as the log differences in prices multiplied by 100. The data is compiled from coinmarketcap.com. The database for the entire period (1,877 daily observations) covers the demonetization period from November 08, 2016 to December 30, 2016 and thus allows us to examine how the volatility of Bitcoin was affected as a result.

Accordingly, the pre-demonetization period (1321 daily observations) and the post demonetization period (556 daily observations) are defined.

Figures 1 and 2 give the daily closing prices and daily return respectively of Bitcoin prices in Indian Rupee denominations. Figure 2 clearly shows that large changes in prices tend to cluster together, resulting in persistence of volatility.

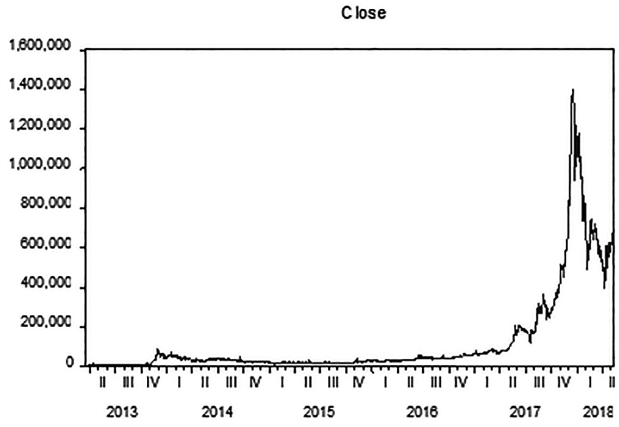

Figure 1.Bitcoin Daily Closing Prices

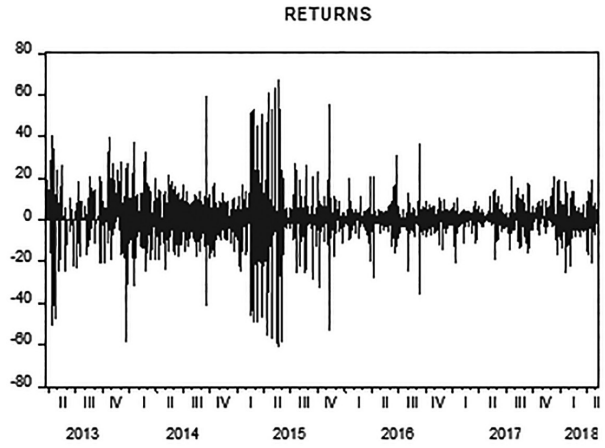

Figure 2.Bitcoin Daily Returns

The first step was to check for stationarity using Unit root test. Here Break point Unit root test was applied and the break date was found to be 9th April 2013.

The Model

Based on the minimum SIC and AIC model selection was done and it was found to be a MA(1) Process.

The asymmetric-GARCH model of Glostenet al.(1993) is used to capture volatility. The conditional mean of Bitcoin returns is calculated using Eq. (1) and the conditional variance of Bit coin returns is calculated using Eq. (2) as follows:

$$R_t = \mu + \varepsilon_t \quad (1)$$

$$h_t = \omega + \alpha(\varepsilon_{t-1}^2) + \beta(h_{t-1}) + \gamma(\varepsilon_{t-1}^2)I(\varepsilon_{t-1} < 1) \quad (2)$$

In Eq. (2), is the constant volatility,represents the ARCH term which measures the impact of past innovations on current variance,represents the GARCH term which measures the impact of past variance on current variance ,ε is the error term and captures any potential symmetric effect of lagged shocks on the volatility of Bitcoin.

Empirical Results and Discussion

Table 2. Summary statistics of Bitcoin daily returns

	Mean	Standard Deviation	Skewness	Kurtosis
Entire period (21/3/2013 to 10/5/2018)	0.273641	10.43330	0.046922	13.47257
Pre-demonetisation period (21/3/2013 to 31/10/2016)	0.190808	11.80526	0.077793	11.53290
Post-demonetisation period (01/11/2016 to 10/5/2018)	0.470444	6.035670	-0.288407	5.361546
Period of demonetization (8/11/2016 to 30/12/2016)	0.558674	4.386874	-0.640295	4.872233

As reported in Table 2, Bitcoin returns during the all the periods are positive, but has increased in the post-demonetization period. The volatility of Bitcoin is highest during the pre-demonetization periodand lowest during the post-demonetization period. The return distribution is negatively skewed in the post-demonetization period. The return distribution for all periods is more peaked than a normal distribution. Results from Engle's ARCH test justify the appropriateness ofusing a GARCH framework to model the conditional volatility.

Table 3 Coefficient estimates of the TARCH and EGARCH MODEL

	Constant	ARCH	GARCH	Asymmetry	EGARCH
Entire period (21/3/2013 to 10/5/2018)	1.820787* (0.0000)	0.156142* (0.0000)	0.854905* (0.0000)	-0.030262** (0.0655)	0.024847* (0.0127)
Pre-demonetisation period (21/3/2013 to 31/10/2016)	2.749102* (0.0000)	0.139613* (0.0000)	0.867557* (0.0000)	-0.048269* (0.0047)	0.036427* (0.0005)
Post-demonetisation period (01/11/2016 to 10/5/2018)	1.839455* (0.0001)	0.206594* (0.0000)	0.760511* (0.0000)	0.007747 (0.8542)	-0.012004 (0.6416)

***at 1% and 5% level of significance and ** at 10%level of significance**

Coefficient estimates are reported in Table 3. Based on the Schwarz information criterion and log likelihood value the asymmetric-GARCH (1,1) or TARCH or GJR-GARCH model is found to be the best fit. Furthermore, there is no evidence of conditional heteroscedasticity in the squared residuals.

Across all Panel estimates, the ARCH and GARCH terms are highly significant, with the GARCH term dominating the ARCH term, indicating that the volatility of Bitcoin is highly persistent. Over the entire period and Pre-demonetisation period the coefficient for the asymmetric term (γ) is negative and is positive in the post-demonetisation period, but is significant in the pre-demonetisation period only i.e. in the pre-demonetisation period, it is negatively significant.

Before the demonetization of 2016, Bitcoin was characterized by an inverse asymmetric volatility phenomenon, meaning that shocks to return were positively correlated with shocks to volatility. **If γ is significantly negative, then a positive shock generates more volatility than a negative shock of the same magnitude.**

In the post demonetisation period, however, the inverse asymmetric effect disappeared, suggesting that the demonetisation has ended the safe-haven capabilities of Bitcoin.

Results of the BDS Test

We ran the BDS test to test for dependence in the log returns and results were significant (*p=0.0000*) and are suggestive of some hidden underlying structure. Such hidden nonlinearity, and hidden nonstationarity or other type of structure is often interpreted to mean that the system may be approaching a critical transition. This means speculative bubbles might be hidden.

In this subsection, we examine the robustness of our main findings.

First, we assess whether our findings are robust to the choice of the asymmetric GARCH model. We therefore compare the estimated asymmetric-GARCH model with its symmetric-GARCHcounterpart to indicate the preferred GARCH model according to the log-likelihood function.

Intuitively, the asymmetric-GARCH model has larger values for the log-likelihood function in all the sample periods under study, suggesting that asymmetric-GARCH model outperforms thesimple symmetric-GARCH model and explains better the conditional volatility of Bitcoin returns.

Second, we estimate the Exponential-GARCH, an alternative to the asymmetric-GARCH model of Glosten et al. (1993), for the entire period and two sub-periods. Results indicate that the asymmetric term of the Exponential-GARCH model is positive and significant in the pre-demonetisation period. This finding, which is consistent with the inverse asymmetric effect as positive return shocks in the Bitcoin market generate more volatility than negative shocks of the same magnitude, shows that the volatility asymmetry is not affected by the choice of the asymmetric-GARCH model.

Findings and Conclusion

Using a different methodological approach to prior studies, this paper focuses on the safe-haven property of Bitcoin and its relationship to the demonetization of December 2016. Based on an asymmetric-GARCH framework, the main results indicate that in the pre-demonetization period, Bitcoin has a safe-haven property somewhat similar to gold. After the demonetization however, this safe-haven property disappears. The results also indicate that the volatility asymmetry is not

affected by the choice of the asymmetric-GARCH model.

Post demonetisation and the stringent norms against accepting Bitcoin has led to the disappearance of the inverse asymmetric effect and safe haven capabilities of Bitcoin.

References

1. Bohme, R., Christin, N., Edelman, B. , Moore, M. , 2015. Bitcoin: economic, technology and governance. J. Econ. Perspect 29 (2), 213– 238.
2. Bouri, Elie; Azzi, Georges; Haubo Dyhrberg, Anne 2016. On the return-volatility relationship in the Bitcoin market around the price crash of 2013, Economics Discussion Papers, No. 2016-41, Kiel Institute for the World Economy (IfW), Kiel
3. Brandvold, M., Molnar, P.,Vagstad, K. and Valstad, O.C.Andreas.,2015. Price Discovery on BitcoinExchanges. Journal of International Financial Markets, Institutions & Money 36, 18–35.
4. Cheah, Eng – Tuck and Fry,J., 2015. Speculative bubbles in Bitcoin markets? An empirical investigation into the fundamental value of Bitcoin. Economic Letters 130, 32-36.
5. Demchenko, Olena., 2017. Bitcoin: Legal Definition and Its Place in Legal Framework.Journal of International Trade. Logistics and Law. Vol. 3 (1), 23-42.
6. Dyhrberg, H., Anne., 2016. Bitcoin, gold and the dollar –A GARCH volatility analysis.Finance Research Letters 16, 85–92.
7. Glosten, Lawrence, Ravi Jagannathan,David E Runkle. 1993 On the Relation between the Expected Value and the Volatility of the Nominal Excess Return on Stocks, The Journal of Finance, Vol. 48, No. 5,pp. 1779-1801
8. Klein, Tony., Hien Pham Thu, Thomas Walther, 2018. Bitcoin is not the New Gold – A Comparison of Volatility, Correlation, and Portfolio Performance, Working Paper Version 2 - May 21
9. Liu, M.L., Ji, Q. and Fan, Y. (2013). How does oil market uncertainty interact with other markets? An empirical analysis of implied volatility index. Energy 55: 860–868. URL: http://www.sciencedirect.com/science/article/pii/S0360544213003484
10. Nakamoto, S. (2008).Bitcoin: A Peer-to-Peer Electronic Cash System. URL: https://bitcoin.org/bitcoin.pdf.
11. Nathaniel Popper., 2015.Digital Gold-Bitcoin and the Inside Story of the Misfits and Millionaires Trying to Reinvent Money.
12. Negurita, Octav., 2014. Bitcoin – Between Legal and Financial Performance.Contemporary Readings in Law and Social Justice. Volume 6(1), 242–248.
13. Paul Vigna and Michael J. Casey (2016). The Age of Cryptocurrency: How Bitcoin and Digital Money are Challenging the Global Economic Order, New York: St. Martin's Press. 2015
14. W. Dai, 1998 . "b-money," http://www.weidai.com/bmoney.txt
15. Yermack, D., 2013. Is Bitcoin a Real Currency? An Economic Appraisal.National Bureau of Economic Research.