# **DEMONETIZATION AND DIGITAL CURRENCY IN INDIA**

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## Abstract

Indian Government ceased the legal tender of Rs.500 and Rs.1000 currency notes in circulation to curb the funding of major anti-social elements such as: terrorism, smuggling, black money. Next attempt was to make the country "cashless". Of course, cash crunch pushed electronic transactions and digital currency at forefront. Prime Minister's intervention decision was bold and it increased the digital transactions dramatically. The volatile character of digital currency clearly indicates that risk associated with it is significantly higher than other Fiet currencies. The main objective of the article is to trace out the inter-linkage between digital currency-Bitcoin and Stock market in India. ADF-Unit Root Test has been employed to investigate the effect of shocks in Bitcoin and Indian Stock Market followed by Granger Causality Test. The test results found a strong evidence of explosive behavior in the Digital currency-Bitcoin and stock market but failed to find any causal relationship between the currency Bitcoin and Stock Market in India. However, digital currencies' weekly trading volume has nearly doubled after the announcement of demonetization and the efforts made for migration towards cashless economy will be a huge gain, as 70 percent of GDP comes from urban areas.

Keywords Digital Currency-Bitcoin, ADF-Unit Root Test, Granger Causality Test.

### Introduction

Indian Government ceased the legal tender of Rs.500 and Rs.1000 currency notes in circulation to curb the funding of major antisuch as: terrorism, social elements smuggling, black money. Next attempt was to make the country "cashless". The tidal waves of advancement in information and communication technology gave birth to technologies such as electronic funds transfer, mobile banking, automated data collection systems, Electronic Data Interchange (EDI), Internet marketing,

inventory management systems, and online transaction, payment and settlement which brought number of innovative as well as complicated social, legal, and economic challenges. Of course, cash crunch due to demonetization of big currency notes pushed electronic transactions and digital currency at forefront. Prime Minister's intervention decision was bold and it increased the digital transactions dramatically.

Conversion Fiat Currency or purchase of ecurrency and loading it into e-wallet for easy payments on transactions is known as prepaid payments. Payment and Settlement Systems, Act was passed in year 2007 and the guidelines for its operation are solely regulated by Reserve Bank of India.

Ali, Barrdear and Clews (2014) stated that "Innovations in payment technologies is the emergence of digital currencies which acts as a store of value, a medium of exchange and a unit of account to facilitate transactions. It is the evidence of historical development of old monetary payment system to modern payment system."

Figure [1]: Taxonomy of Virtual Currencies



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### Source: IMF Staff Discussion Note- 2013

Digital currencies are just what they sound like: currencies transferred and stocked up electronically. One of the first traded digital currencies was E-gold backed by gold and founded in 1996. Another popular digital currency exchange founded in 2006 was

fess of the transaction it let users exchange

Euros or Dollars to Liberty Reserve Euros or Dollars. Direct online payment services namely PayPal (founded 1998), WebMoney (founded 1998) and Google Checkout (founded in 2011) function similarly, based on traditional currency, except with more tions and government compliance (ensuring their survival). Based on offshore

tax havens beloved by the wealthy, corrupts and unscrupulous, early digital currencies gave the industry a bad image. However, few academic thinkers advocated that dealing in digital currency is safe when traded cautionary.

 Table [1]: Market Capitalization of top 5 decentralized virtual currency in US-Dollar.

	Name	Market Capitalization
1.	Bitcoin	\$ 12,101,012,915
2.	Ethereum	\$ 1,679,102,036
3.	Litecoin	\$ 250,822,816
4.	Ripple	\$ 233,231,989
5.	The DAO	\$ 221,661,542

Source: Forbes Magazine

There exists a wide range of virtual currencies across the globe. Table [1] represents market capitalization of top five existing virtual currencies where Bitcoin is the most popular having highest market capitalization among all the virtual currencies since the inception of virtual currencies in 2008. Bitcoin.org was born on August 18, 2008 with a domain registered at ananymousspeech.com, a website allowing the users to register domain name anonymously. Although, as stated earlier prepaid payments are popular in India and it is supervised under Payment and Settlement Act since half decade but there prepaid payments no way related to the digital currency-Bitcoin.

**Bitcoin:** Bitcoin is a decentralized digital currency and it is independent from Central Bank, Nationalized Banks or any monetary authority. First code based algorithm is identified by Satoshi Nakamoto in his self authored paper. Bitcoin is an open source software representing a set of digital data of transaction namely Bitcoin abbreviated as BTC decentralized, digital, private currency

powered by peer to peer (person-to-person) payment system network.

Each transaction is coded on a decentralized public ledger known as "*blockchain*" that is visible to all computers on the network, but does not reveal any personal information about the involved parties. The public ledger records details of each and every transaction, in a manner to allow user's computer to verify the validity of transactions. **Literature Review**:

#### A. International Literature:

**Nakamoto (2008)** Identified first code based algorithm in his self authored paper. In his paper he introduced Bitcoin, how it is traded, networks and nodes, simplified payment verification, privacy and algorithm based calculations. He also stated that a digital signature provides strong control on ownership and claimed it is computationally impractical for a hacker to alter it.

**Meiklejohn et.al (2013)** explored the unique property of Bitcoin i.e. anonymous ownership of money where the flow is globally visible. Using heuristic clustering to group Bitcoin wallets based on evidence of shared authority, re-identified attacks and classified the operators of those clusters. They shed light on structure of Bitcoin, how it is used and the organizations participating to it.

**Yermack (2013)** empirically examined the relationship of Bitcoin virtual currency with widely used currency (Euro, Japanese Yen, British Pound) and gold. The results exhibited zero correlation among the variables and found it a speculative investment as compared to other currencies. He concluded that there is no way to hedge the risk of Bitcoin against other currencies. It has proven vulnerable to fraud, theft, and subversion by skilled computer hackers.

**Papp** (2014) envisaged that criminal and financial risk is neither associated with the mining activity nor peer-to-peer exchange networks. Hence, while creating new Bitcoin the regulators need not to focus on the system itself but on the speculative investments in it.

**Rogojanu and Badea (2014)** worked on the issue of competing currencies: A Case Study on Bitcoin. They aimed on the adjustment of digital currency *"Bitcoin"* toward the challenges of the economic environment, taking into account both the opportunities and the threats to which it is subject, and the records emphasized by the history of economic thought and adapted to the current reality. Rogojanu and Badea still were inconclusive for the life of Bitcoin and future consent of economies to adopt it.

Malhotra and Maloo (2014) empirically examined existence of speculative bubble in Bitcoin Exchange Market using Unit Root Test (ADF and PP). They investigated whether shocks in Bitcoin-USD exchange have a permanent/ transitory effect by allocating the structural breaks.

**Kubát (2015)** made a comparative analysis on the characteristics of Bitcoin against its commonly used definitions. In second part of study he compared historical volatility of Bitcoin with currencies, gold and shares.

**Maftel** (\_n.a\_) looked into the proliferation of technological innovation of payment methods, highlighted the role of virtual currency and channels of payments through digital coins. Maftel discussed the difference between Bitcoin (BTC) and other legal currencies and concluded that lack of regulations can cause number of criminal activities and risk associated with it.

**Ciaian, Rajcinova and Kancs (2016)** studied on Bitcoin price formation by considering digital currency factors i.e. Bitcoin attractiveness for investors and users, and traditional determinants (demand and supply) of currency. Ciaian et.al tested the Null Hypothesis: Market forces of Bitcoin supply and demand does not have any impact on Bitcoin prices using ADF and ARDL approach. Their empirical findings suggested that arrival of new information impact positively on Bitcoin costs.

#### **B.** Indian Literature:

Shah, Shah and Trivedi (2014) analyzed the scope of Bitcoins in India and suggested that Bitcoin is potent to be a magnet for significant players of finance in the nation. Furthermore, because it is anonymous and decentralized it may hatred by government. Even though Bitcoins are presently don't have any legal status in India, it is possible that all these benefits coupled with the potential of its growth in India will force the government to make it legal.

Silakari and Jain (2015) concluded in their research paper that Bitcoin is unpredictable in character and engages high level of threats. It is not backed by any legal support. However, it trims down operational expenses, saves times, allows the expansion and provides safety associated with physical delivery.

Bitcoin	<ul> <li><u>Origin and History Of Bitcoin</u></li> </ul>
2007	<ul> <li>Satoshi Nakamoto started working on the Bitcoin and published his concept on Bitcoin in 2008.</li> </ul>
2008	<ul> <li>Kin, Oksman, and Bry file an application for an encryption patent &amp; Bitcoin.org got registered.</li> <li>Nakamoto Published a white paper that describes the Bitcoin currency.</li> </ul>
2009	•An exchange rate is established by using computer run equation, where US\$1 = 1309.03 BTC
	•10,000 Bitcoin offered for a Pizza on Bitcoin forum,
2010	<ul> <li>Mobile transaction, First call option contract took place.</li> </ul>
2011	<ul> <li>Bitcoin reaches parity with US dollar, first market for the exchange of Bitcoins Brasil opened.</li> <li>BTC/USD exchangerate reaches and passes parity with the Euro and the British Sterling Pound.</li> </ul>
	•FBI report leaked, Bitcoinica hacked, Bitfloor hacked.
2012	<ul> <li>WordPress.com accepted Bitcoin payment for upgradation, BitInstant plans introduced transfer service through debit cards.</li> </ul>
	<ul> <li>BitInstant hacked, loses \$12,000, Bitcoin Crashed, Bitcoin Central hacked, BitcoinTalk.org hacked.</li> <li>China's Central Bank bans Bitcoin transactions.</li> </ul>
2013	<ul> <li>The Financial Crimes Enforcement Network (FinCEN) of the US Department defines stance on Bitcoin.</li> </ul>
	- The US government seizero 29,000 ottoon from Silkroad an illegal online marketplace, Bitinstant CEU charged with money laundering.
2014	<ul> <li>Microsoft started accepting bitcoin payments.</li> </ul>
2015	<ul> <li>New York Released Final BitLicense, the bitcoin and blockchain industry finally saw the passage of the first state-specific licensing.</li> </ul>

BlockChain: As every Bitcoin is spend, that Bitcoin transaction is recorded permanently in a public distributed ledger,

is called block chain. As a block is added to the block chain it is published or broadcasted to all network nodes. The block chain is the only place where the Bitcoin exist.

Kapil. V, (2014) stated that "Blockchain restricts conflicts in transactions otherwise people would be able to sign the same Bitcoin to two different receiver; it is like we are writing a cheque more than amount in current account."

Mining: The system is designed so that there is a slow release of additional coins into the system, through a process known as 'mining'. Mining is a process of solving complicated mathematical problem and Bitcoin Mining is maintaining of Blockchain. Anyone with an internet connection can participate in it. There is also a hard limit on the number of coins that can ever be created in the system.

Transactions: All Bitcoin users have an ewallet over the control of particular pair of keys, which gives them an electronic identity and address. Directly, payments or transactions can be made by directing payments through e-wallet. Only the person associated with the transfer of Bitcoin can control the key pairs by using his/her own digital signature for directing payments for a purchase, any transaction, payment of debts or gifts. Moreover once the transfer is done it is irrecoverable.

According to Rhys Bollen (2013) "Unlike previous digital coin system, Bitcoin is not actually a packet of data (i.e. a series of binary digits) kept by the owner on their computer and itself transferred to the new owner in the course of the payment. Instead the payment involves reallocating a coin in the various registers from the payer to payee as set out below."

# An illustrative example of distributed ledger system similar to Bitcoin (Blockchain)



Payment from A to B:

- Copies of transaction records (ledgers) are kept in multiple computers in the network and visible to anyone.
- The transaction is settled by a multitude of individual nodes (miners), providing computing resources to the network.
- Miners solve a cryptographic puzzle as part of validation process. Miners need to show proof of doing this work to the network (called a "proof-of-work" system), which is costly (computing and energy resources).
- Only the miner who finds the solution faster than any others receives newly minted Bitcoins as reward for their service.
- "Trust" is created by making tampering attempts prohibitively expensive. If a miner wants to record a false transaction, she needs to compete against other miners who are acting honestly (or trying to fake a different transaction).<sup>1</sup>

1/ This mechanism could break down for example if a person or a group takes up 51 percent of the network (mining share), called a "51 percent attack." Some argue that strategic refinement could bring down this threshold to a much lower level (Garrat and Hayes, 2014). Even if a majority is required, the trust machine may break down if some of the miners gain a disproportionally large share of the system (for example, using military or state funds, Swanson, 2015).

Source: IMF Staff Discussion Note- 2013

## Indian Scenario:

Satoshi Nakamoto created Bitcoin in 2009 and it gained popularity across the globe. India remained untouched with the virtual currency but some financial enthusiasts started involving in Bitcoin. First Bitcoin exchange service namely "Unocoin" launched on trail basis in India, a result of well attended Global Bitcoin conference in Banglore in 2013. For regulatory compliance PAN (permanent Account Number) was required for financial transactions. In response to excitement of investors toward Bitcoin, on 24<sup>th</sup> December 2013, Reserve Bank of India cautioned its holders about the risk associated with it and warned Bitcoin traders operating without regulatory approval. After govt. pressure to shut down trading in Bitcoin few traders left their trading. Few days later, RBI stated that it had no intentions of regulating Bitcoin or virtual currencies.

A number of participants such as Bitgem, Catcoin, Unobtanium and Sexcoin, entered into the market on the scene even as regulators across the world grapple with risks posed by such currencies and transactions conducted through them. February 2014, numbers of active users of Bitcoin crossed over 1,000 members and in December 2015, Sunny Ray, Co-founder of Bangalore based Bitcoin entrepreneur claimed that it has more than 11,000 registered users in India.





Source: Data Compiled by Author

With over 8 million users worldwide and 94,000 transactions per day, the value of one Bitcoin rose from about \$0.30 to \$266 in April 2013, peaking at an all-time high of \$1,242 in November of the same year. Many large business houses, including Microsoft, Dell, PayPal, Dish Network, Expedia, NewEgg, and TigerDirect, have adopted it. By the end of Q1 2015, 1,10,000 merchants started accepting Bitcoin. At present there are more than 7,000,000,000 consumers of Bitcoin, most of whom make multiple economic transactions each day, 15,000 Bitcoin transactions per day involve the purchase of a product or service. According to a report published in TOI 30,000 users owe Bitcoin currency in India and around 50,000 are enthusiasts planning to jump into the market of digital currency. It is around 1 percent of around 12 million Bitcoins in global circulation

Bitcoin: Indian Scenario				
December 24, 2013	Worrying about taxation and money laundering and the security risk (hacking, loss of password, malware attack etc.) Reserve Bank of India cautioned users, holders and traders of Virtual Currencies in India to suspend their operations. In response, few traders shut their trading in Bitcoin but after some time, regulators seeked clarity on ways to regulating digital currencies.			
January 15, 2014	According to Press Release of "NDTV Venture" few Bitcoin operators resumed operations in India. According to the report, new entrant dealers of Bitcoin (India BitQuick.in, Unocoin.com, buysellbitco.in) offered a platform for sale and purchase of Bitcoins.			
December 31, 2014	In an Interview with NDTV, RBI Governer Raghuram Ji Rajan said that the digital currency i "fascinating" despite apparent drawbacks. Bitcoin would be helpful in the transaction toward a cashles society -he added.			
April 3, 2015	Economic Times Bureau documented on its press release that venture capitalists and angle investors approached the experts, lawyers and startups to follow the formation of Bitcoin alliance India.			
August 25, 2015	Deputy Governor of Reserve Bank of India stated that finance sector watchdogs are closely watching emerging virtual instruments like Bitcoin and overfunding, as they are seeking regulation free operation.			
December 26, 2015	On December 24, 2013, exactly two year before, RBI cautioned about the risk associated with Bitcoin. Going against the caution RBI has come around to appreciate the strength of " <i>blockchain</i> " technology which records all the transactions and is only the proof of existence of Bitcoin.			

Source: Collected from different newspapers and Compiled by author.

### 4. Data

The study focuses on causal relationship on bilateral exchange rates between Bitcoin and

Indian Rupee (BTC/INR) and stock market in India. The time series daily data of Bitcoin-Rupee exchange rate has been downloaded from database maintained by Quandl.com and Reserve Bank of India. Daily data of S&P CNX Nifty has been downloaded from database of National Stock Exchange India Limited as a proxy of Indian Stock Market. The data sample ranges from April, 2013 to March, 2016 summing up to a total of 740 observations.

## Methodology:

Unit Root Test: Economists and researchers often use time series data for forecasting economic indicators. Briefly speaking time series data is popularly bifurcated into two broad categories; first is stationary data and second is non-stationary data. Forecasting on the basis of non-stationary data set may cause spurious results. Therefore the nonstationary data need to be transformed into Empirical Findings:

Figure [2]: BTC/INR Volume traded

stationary data. Unit root test diagnoses a non-stationary term in time series which can mislead statistical behavior and can cause quandary in inferences. *Augmented Dickey-Fuller (ADF) Test* is a tool to test the null hypothesis: The series has unit root and the alternate hypothesis is the series does not contain unit root i.e. the series is non-stationary.

**Granger Causality Test**: Granger Causality test statistically traces the usefulness of one time series variable on forecasting another. Based on the concept of *Cause effect* Clive W.J. Granger developed a test "Granger Causality Test" assuming that:

- Future value can't cause past values but.
- Past values can influence present/future and

"If series Y is better predicted by the complete universe of past information than by the universe less the X, then X Granger causes Y. According to this definition the information set on conditioning is defined includes all possibly relevant variables and is infinitely extended back into time"

Granger Causality test are lag sensitive hence, minimum of AIC or SIC value has been taken as for lag length selection.



Source: Data Compiled by Author

**Unit Root Test:** Results of BTC/USD exchange rate and proxy of Indian Stock market S&P Nifty 50 are shown in Table [2] respectively. The null hypothesis "The series has Unit Root" is tested to explore the behavior of BTC/INR and IP.

Unit Root Test		At Level		At First Difference	
		Intercept	Trend & Intercept	Intercept	Trend & Intercept
BTC/INR	P-Value	0.2432	0.5484	0.0000	0.0000
	T-Statistics	-2.1042	-2.0982	-21.4983	-21.4855
IP	P-Value	0.4984	0.8576	0.0000	0.0000
	T-Statistics	-1.5682	-1.4101	-24.4163	-24.4282

Table [2]: Unit Root Test: At level and at First Difference

The p-value results (see. Table-2) are evident for the presence of unit root in time series (both BTC/INR and IP) at "intercept" and "intercept and trend" implying that BTC/INR and IP both are non-stationary at level but stationary at first difference.

**Granger Causality Test:** Granger causality test needs a stationary time series, BTC/INR and IP (share prices) found non-stationary in Unit Root Test and transformed into stationary data by taking first difference. Table [3]: Granger Causality Test

Tuble [5]. Shanger Sausanity Test				
Null Hypothesis:	Observations	Prob. Value		
BTC does not Granger Cause Stock Market in India	740	0.5794		
Stock Market in India does not Granger Cause BTC	740	0.2679		

Granger Causality Test tests the presence of causal relationship among the variables and also describes about the direction of causality. Null hypothesis:

H<sub>0</sub>1: BTC does not Granger Cause Stock Market in India

H<sub>0</sub>2: Indian stock market does not granger causes BTC.

The results showed in Table [3] indicate that there is no causal relationship between BTC/INR and IP. As regards the p-value of both the null hypothesis is insignificant and failed to reject the null. Existence of any direction from either side of variable cannot be confirmed.

### **Conclusion:**

Shock of demonetization to Indian currency amplified the process of digitalization pushing the cashless transactions. The decentralized digital currency Bitcoin is juxtaposition with the Fiet and digital currency. Although "*Bitcoin*"- the most popular virtual currency is in nascent stage but it has potential to come to exhibit at least some of the functions of money over time (Ali, Barrdear and Clews, 2014). There are episodes of excessive fluctuation in BTC/INR exchange rate (see Figure-1) suffering from speculative attacks. At global context Bitcoin poses a risk factor to monetary as well as financial stability.

This article, explored the scope of Bitcoin in India by checking the behavior of BTC/INR and IP. After testing the presence of unit root behavior in the time series data it was found that both the variables are non-stationary at level but stationary at first difference. Even though the number of enthusiasts and Bitcoin traders are increasing at augmented rate especially after demonetization of big currency notes but results of Granger causality failed to find any causal relationship among Indian Stock market and Bitcoin of India meaning that any increase in volatility in Bitcoin does not forecast in Indian Stock Market.

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