

The Bitcoin Cryptocurrency: How Does It Work

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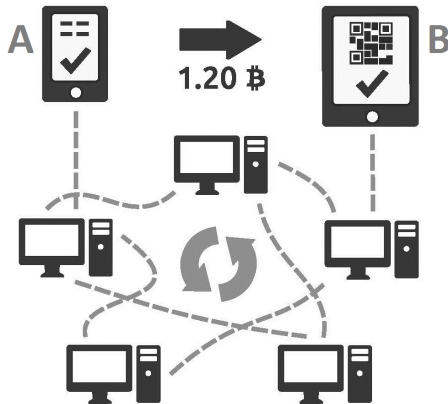
The Visionary

"One thing that's missing but will soon be developed is a reliable e-cash, a method whereby on the Internet you can transfer funds from A to B without A knowing B or B knowing A - the way I can take a \$ 20 bill and hand it over to you, and you may get that without knowing who I am."

Milton Friedman, winner of Nobel prize in economics, 1999

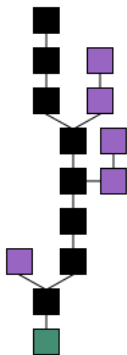


A Peer-to-peer Electronic Cash System, Satoshi (2009)



What is Bitcoin?

- A digital or virtual currency
its basis is cryptography (encoding messages)
- “Bitcoin”: the network and the technology
all transactions appear in a shared **public ledger**
called the **block chain**
- “bitcoin” (or BTC): the on-line currency
uses digital codes instead serial numbers



Features

- No central government
- Distributed network
- Fixed supply of money
- (Pseudo) anonymous
- Low transactions costs (for now)
- Fast transactions across borders



Outline

1. Motivation ✓
2. Mining
3. Money
4. (i)Mitate
5. Meditor Meditatus



Mining. A Competitive Lottery

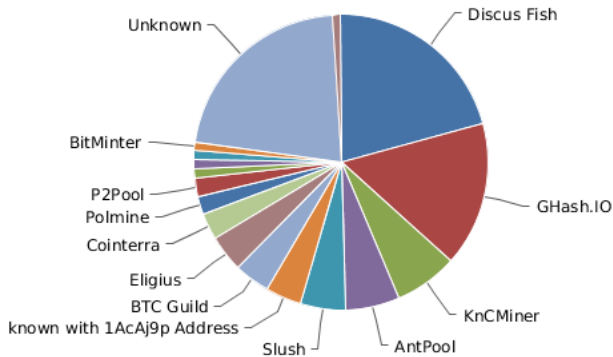
Miners

- compete with each other to add new blocks
- solve cryptographic puzzles (deliberately difficult)
- incentives: winner is rewarded in bitcoins

- as competition for mining goes up difficulty becomes higher
- in order to increase statistical odds of finding a block people join their computational power in mining pools



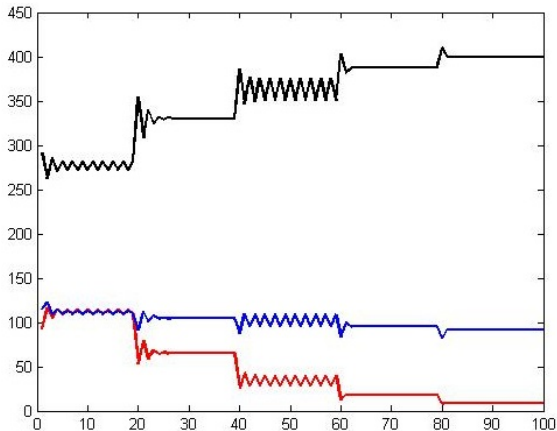
Centralization of the Mining Network



Estimated hashrates amongst the largest mining pools. www.blockchain.info



Agent-Based Simulation



Solo-miners, **pool-miners** and **non-miners**. Teo (2014), "Emergence, growth and sustainability of Bitcoin: the network economics perspective"



Mining Models

- ▣ insights on the amount of centralization in the network
- ▣ ways to test/predict different reward structures
- ▣ determine what causes centralization

Mining methods

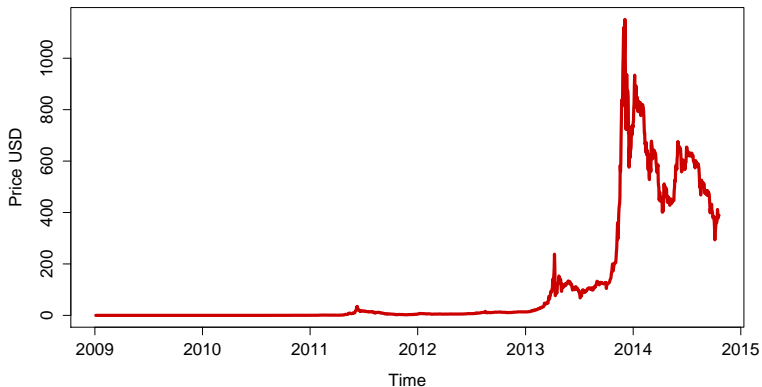
- ▣ proof-of-work
- ▣ proof-of-stake
- ▣ proof of burn



One of the World's Largest Bitcoin Mines



Bitcoin Price



Source: www.blockchain.info



Bitcoin Price Studies

- Ciaian, Rajcaniova and Kancs (2014), “The Economics of BitCoin Price Formation”
- Kristoufek (2014), “What are the main drivers of the Bitcoin price? Evidence from wavelet coherence analysis”
- Bouoiyour and Selmi (2014), “What Does Crypto-currency Look Like? Gaining Insight into Bitcoin Phenomenon”
- Bouoiyour, Selmi and Tiwari (2014), “Is Bitcoin business income or speculative bubble? Unconditional vs. conditional frequency domain analysis”



What Drives the Price of Bitcoin?

Fundamental drivers

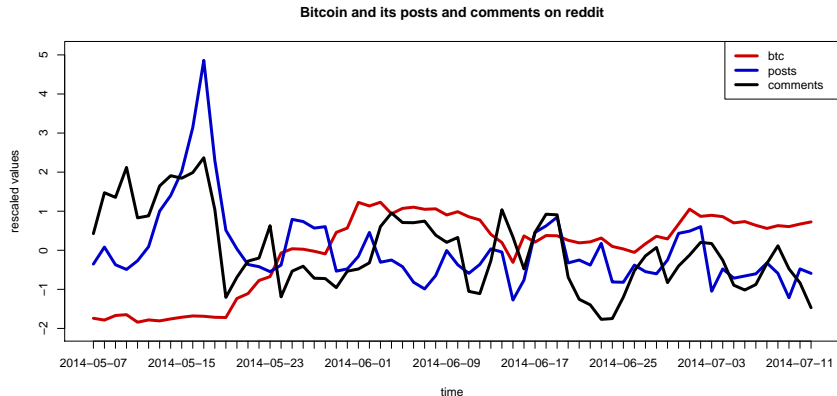
- ▣ demand-side: the size of Bitcoin economy, velocity of bitcoin circulation, usage in trade

Speculative drivers

- ▣ investors' interest: nr. of views, new posts, comments



Bitcoin and Social Media



Trimborn and Härdle (2014), "Index for Cryptocurrencies"



Network Complementary Variables

- **Network metrics:** intensity of ties, density of network, local/geographical characteristics, decentralization, complexity
- **Social network effects:** word of mouth, market penetration (e.g. Facebook likes, Twitter news)
- **Market integration/segregation:** local/regional/global markets (e.g. Singapore, Asia vs. U.S. or Europe)
- **Network ecosystem:** early vs. later adopters; socioeconomic makeup (primarily educated and affluent young men)



Bitcoin Supply and Demand

Deterministic coin supply

- unexpected changes in coin demand are reflected in coin prices
- this increases volatility and discourages the use of coin as medium-of-exchange

Coin demand

- transactional
- speculative



The Search for a Stable Cryptocurrency

Price stability (unit of account)

- ▣ Ametrano (2014), “Hayek Money: The Cryptocurrency Price Stability Solution”

Purchasing power preservation (store of value)

- ▣ Morini (2014), “Investor/Saver Wallets and the Role of Financial Intermediaries in a Digital Currency”
- ▣ Robert Sams (2014), “A Note on Cryptocurrency Stabilization: Seigniorage Shares”



Growing Market for Cryptocurrencies

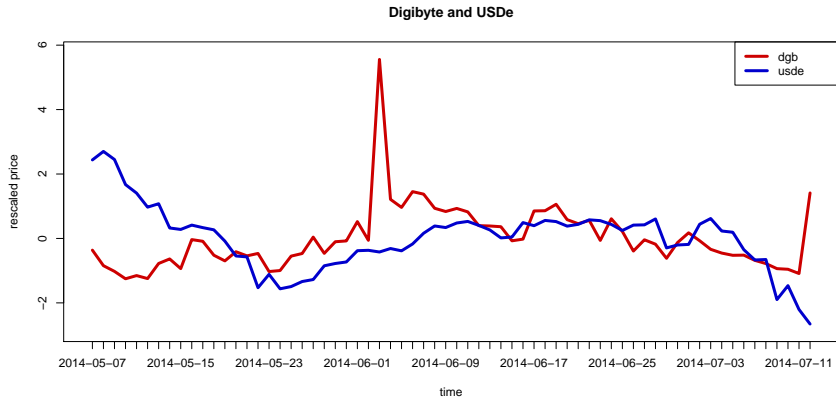
- ▣ \$5.62 bn (\$5.12 bn Bitcoin) market capitalization
- ▣ To date 567 different coins (www.coinmarketcap.com)
- ▣ Coinfloor, London bitcoin exchange, opened to new currencies
- ▣ More merchants accept altcoins (PayPal, Dell)
- ▣ Investment possibilities increase

Features

- ▣ Bitcoin clones
- ▣ Technology innovations
- ▣ Market niche



Time Series Analysis of Cryptocurrencies



Trimborn and Härdle (2014), "Index for Cryptocurrencies"



Life Cycle Analysis of Cryptocurrencies

Grith and Teo, “A Behavioral Approach to the Cryptocurrencies’ Life Cycle”

- What are the factors that determine a coin to take off, be adopted, reach a critical mass, grow?
- What are the incentives for the creation of new coins (e.g. speculation, storage of value, investment in technological innovation)?



Is Virtual Currency Moving into the Mainstream?

Main challenges

- expand its use in trade and commerce
- payment tool and transfer of value
- investment asset, storage of value, safe haven
- good driver for business and social activities (e.g. crowd funding)

... it's a matter of trust



The Cryptocurrency Enthusiasts

“What technology am I talking about? Personal computers in 1975, the Internet in 1993, and - I believe - Bitcoin in 2014.”

Marc Andreessen, co-founder of Andreessen Horowitz venture capital firm

“Bitcoin is the Internet equivalent of cash. Bitcoin is to cash what e-mail is to proper mail. ”

Balaji Srinivasan, founder of Stanford Bitcoin Group

“I dont know whether or not the Bitcoin will ultimately be successful, but there is most certainly a future market for cryptocurrencies on the whole. ”

Ted Jenkin, co-CEO and founder of oXYGen Financial



Teaser: Bitcoin Data

“Compared to the standard currencies such as the US dollar, the euro, the Japanese yen and others, bitcoin shines due to an unprecedented data availability. It is completely unrealistic to know the total amount of the US dollars in the worldwide economy on a daily basis. However, bitcoin provides such information on daily basis, publicly and freely.”

Ladislav Kristoufek, Charles University in Prague



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