The Impact of Blockchain on Entrepreneurship, Innovation, and Finance

Fabio BERTONI

Intro

- What is the impact of Blockchain on Entrepreneurship, Innovation, and Finance?

- Hard to answer:
  - Technology is in the early stages of development
  - Everyone seems to have an opinion on the matter
  - Opinions range widely…

Economist Nouriel Roubini Says 'Blockchain Is Useless, All ICOs Are Scams'

Naeem Aslam Contributor ⓘ

Markets

I cover commodities, FX, equities in developing & emerging markets.

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🐦 blockchain is the future

🐦 If a bank throws a small amount of capital on testing a new technology, it doesn't mean they are going to adopt it

What happens in Vegas stays in Vegas. That's the well-known saying but it doesn't hold if you are talking about Dr. Doom and Gloom. Nouriel Roubini, known for his pessimistic views about the crypto markets, was in Vegas and what he said created a lot of anger among blockchain believers around the globe.

Will Blockchain Make Poverty Obsolete? What Is The Root Of All Evil?

Natalia Karayaneva Contributor ⓘ

Crypto & Blockchain

My passions lie in blockchain, real estate and sustainability.

Will Blockchain Make Poverty Obsolete?

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My contribution to the debate

- Sharing some ideas about:
  - What makes blockchain interesting
  - What we know from academic studies
  - Where blockchain *could* go next

Agenda

- What's a blockchain?
- The governance of a blockchain
- Economic impact of blockchains
- Tokens and ICOs
- Regulation
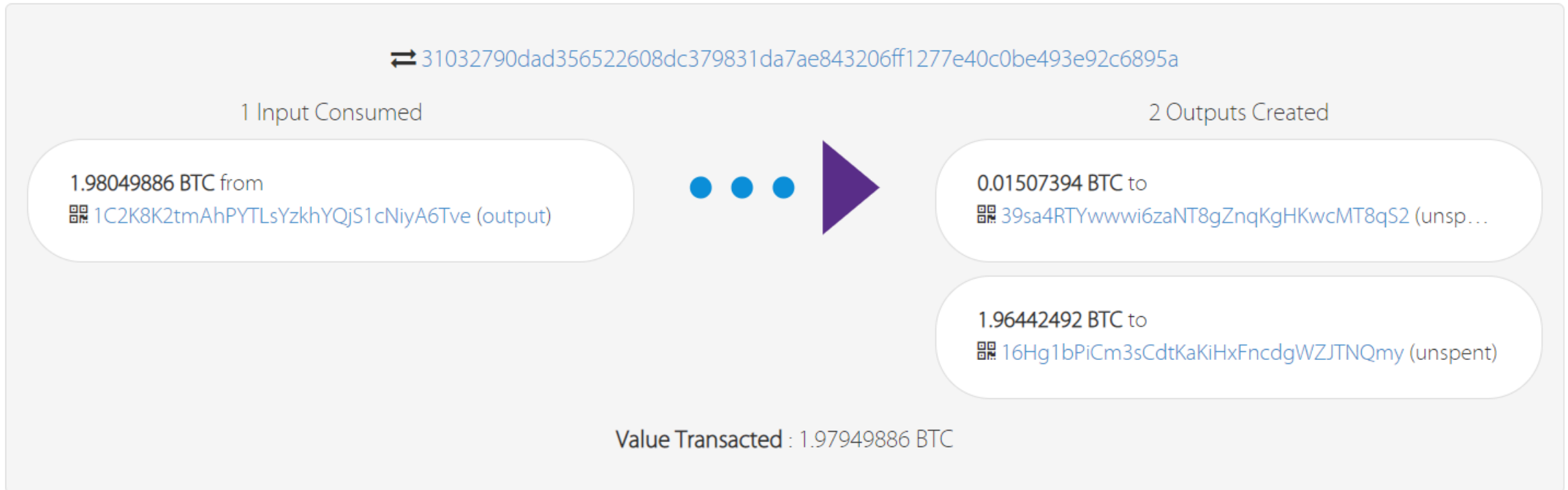- Conclusions

What's a blockchain

Blockchain is…

- A distributed ledger listing timestamped transactions organized in cryptographically linked blocks

- In the next few slides I quickly go through each part of the definition using Bitcoin as example

Timestamped transaction

- BTC 0.01507394 (approx. USD 150) is transferred from one wallet (1C2K8…) to another (39sa4…), with the rest being assigned to a newly created wallet (16Hg1…)
- The transaction is secured with public-key

⇄ 31032790dad356522608dc379831da7ae843206ff1277e40c0be493e92c6895a

1 Input Consumed

2 Outputs Created

1.98049886 BTC from
1C2K8K2tmAhPYTLsYzkhYQjS1cNiyA6Tve (output)

0.01507394 BTC to
39sa4RTYwwwi6zaNT8gZnqKgHKwcMT8qS2 (unsp…

1.96442492 BTC to
16Hg1bPiCm3sCdtKaKiHxFncdgWZJTNQmy (unspent)

Value Transacted : 1.97949886 BTC

Source: BlockCypher

Cryptographically linked blocks

- The transaction in the previous slide is one of 2,467 transactions that constitute block no. 595,134 of the Bitcoin blockchain

- Every 10 minutes a new block is constituted and is "chained" to the previous block using nested hash functions
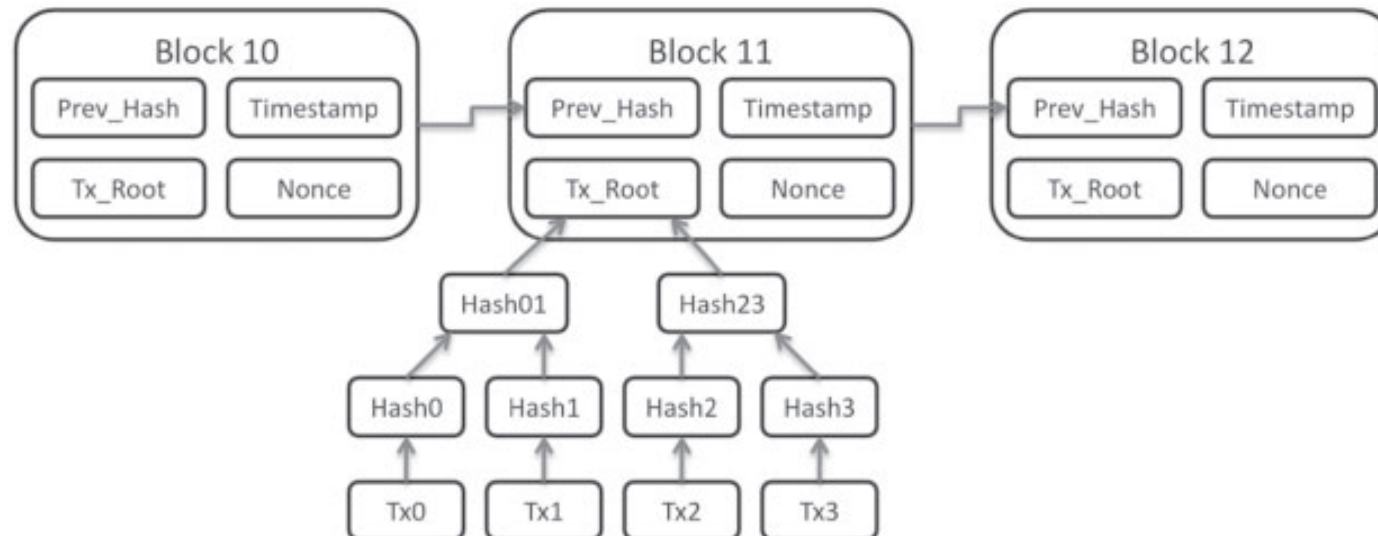
Source: Yermak (2017)

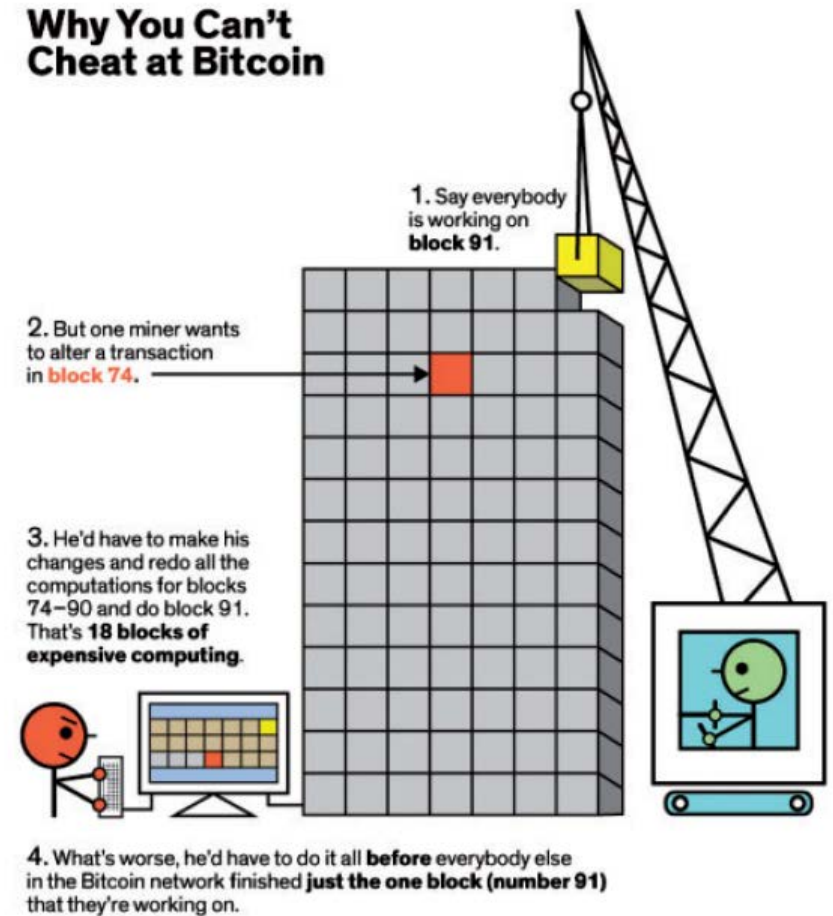# Immutability of the blockchain

- The fact that blocks are chained one to the next makes the blockchain resistant to tampering

- Someone trying to change an earlier block (e.g., to undo a payment) will have to change all the following blocks

Why You Can't Cheat at Bitcoin

1. Say everybody is working on **block 91**.

2. But one miner wants to alter a transaction in **block 74**.

3. He'd have to make his changes and redo all the computations for blocks 74–90 and do block 91. That's **18 blocks of expensive computing**.

4. What's worse, he'd have to do it all **before** everybody else in the Bitcoin network finished **just the one block (number 91)** that they're working on.

The ledger is distributed

- Most feature of Bitcoin predate Nakamoto (2008)
    - The general idea of a blockchain was proposed by Haber and Stornetta (1991)
    - The fact that money could be eliminated if we had a memory of all economic transactions was already discussed by Kocherlakota (1998)

- Possibly the most interesting feature of blockchain is the first adjective: "distributed"

The trust machine

- A blockchain is "distributed" in the sense that it works without a central record-keeper
  - Normally for financial transactions a bank would keep the records, e.g., how much you have on your bank account
  - In a blockchain the record-keeping is crowdsourced

- Nakamoto (2008) argued distributed consensus can be achieved through Proof of Work (PoW), as discussed later

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Implications of distributed consensus

- Distributed consensus has profound implications in terms of:
  - Privacy
  - Security
  - Ownership
  - Transparency
  - Censorship-resistance

Beyond Bitcoin

- Distributed consensus goes well beyond the initial application in Bitcoin and now "tokens'" are used in a growing zoo of applications, including:
  - Crypto-currencies
  - Distributed applications
  - Platform-tokens
  - Utility-tokens
  - Security-tokens
 - Asset-tokens
  - Crypto-collectibles
  - Crypto-fiat currencies

The governance of a blockchain

Proof-of-work

- With PoW users are sent a puzzle and the first "miner" who solves it gets a reward (currently 12.5 BTC)

- Some characteristics of the puzzle:
  - It is hard to solve (takes about 10 minutes)
  - Its solution is easy for everyone to verify

- Once the solution is found, it is included in the latest block and miners start to work on the next block of transactions
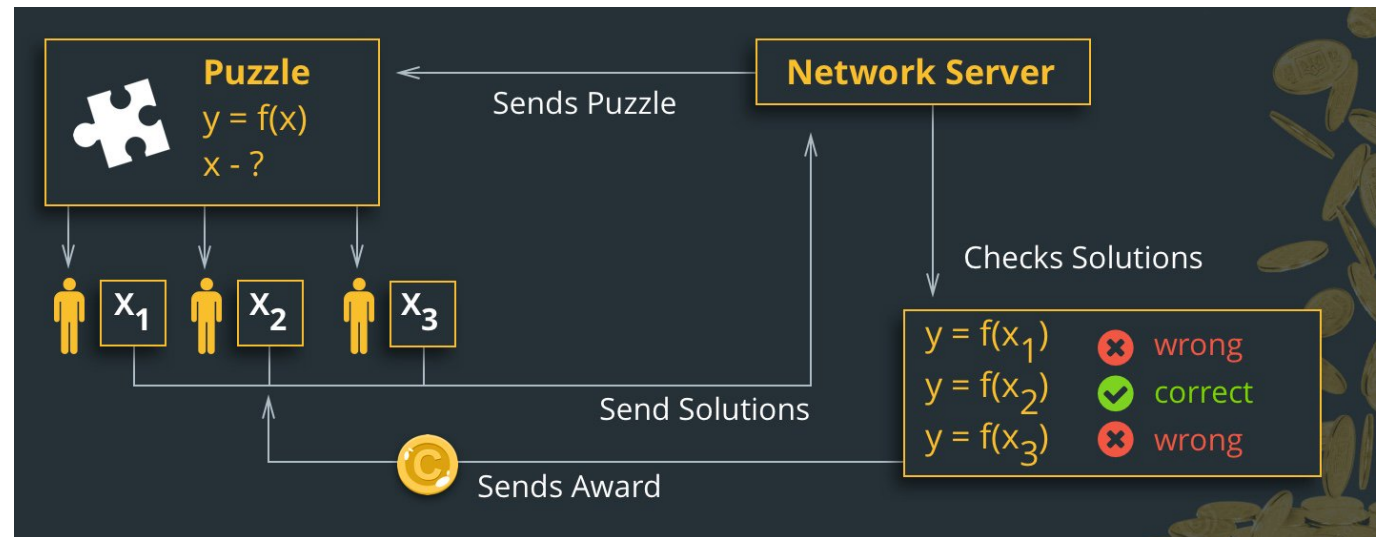
What's so special about PoW?

- By agreeing that the solution to the puzzle has been found the economic agents validate the latest block on (e.g., what transactions took place, between which parties, for what amount etc.) without the intervention of any regulatory authority or centralized record-keeper
- But does PoW really work? Economics can help here…

The economics of PoW

▪ Recent literature in economics and finance studies PoW from a game-theoretic perspective

▪ Biais et al. (2019) study PoW as a stochastic game and show that mining the longest chain, as proposed by Nakamoto (2008) is an equilibrium but… multiple equilibria with forks exist

▪ A fork occurs when at some point two concurrent versions of a blockchain exist, and miners split over which block is the "true" one
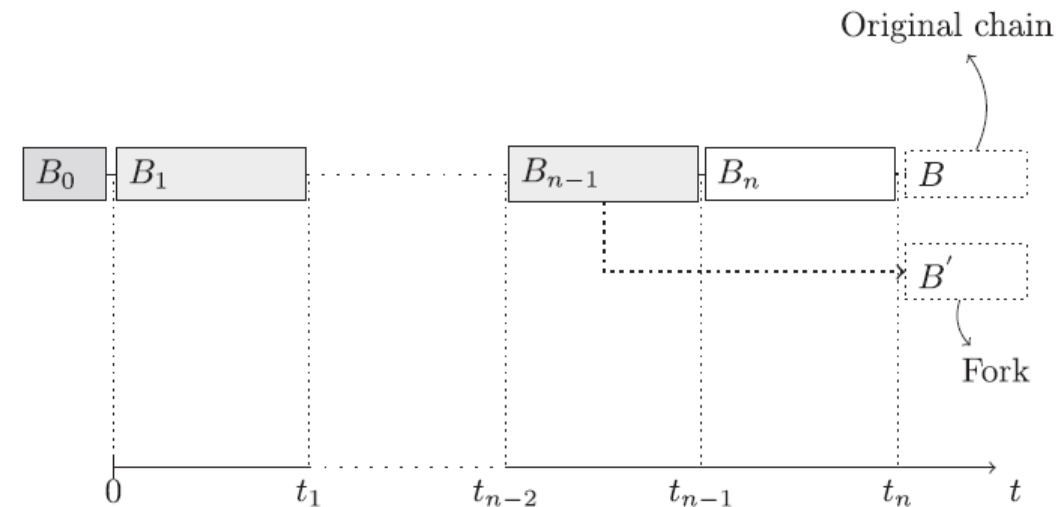
Why forks?

- Forks can be distinguished in:
  - Soft vs. hard
  - Intended vs. unintended
  - Orphaned blocks vs parallel chains

- One example of an intended, hard fork that resulted in parallel chains is Ethereum after TheDAO (a sort of blockchain-based VC fund) got hacked
  - Most miners agreed to revert the blockchain to the status before the hack
  - Some miners disagreed and continued to mine the original chain
  - Result, now there are two incompatible versions of Ethereum (Ethereum and Ethereum Classic)

- Bitcoin forks include: Bitcoin XT, Bitcoin Classic, Bitcoin Unlimited, Bitcoin Cash, Bitcoin Gold, Bitcoin SV…

Forks and competition

- Forks are bad for a blockchain, but could have an overall positive effect by creating competition between blockchains

- Abadi and Brunnermeier (2019) argue that forks are one of the key elements that make blockchain *desirable*
- Forking allows competition between different versions of a blockchain, reducing switching costs

Ownership vs possession

- Abadi and Brunnermeier (2019) also point out that:
    - Distributed ledgers can be superior in recording ownership transfers (e.g., recording that you buy a house)
    - But not in enforcing possession (e.g., making sure no one lives there)
- A combination of distributed ledger and centralized enforcement can be optimal (UK Royal Mint Gold is an interesting example)

The last mile problem and the IoT

- More generally, blockchain can make a piece of information transparent and immutable but it cannot make it more trustworthy (a.k.a. the last-mile problem, see e.g., this short article)
- Blockchain is a great example of Garbage In – Garbage Out, which is only made worse by immutability

- The Internet of Things (IoT) could be a great complement to blockchain, which could accelerate the penetration of both technologies (see this report)

Governance of blockchain

- Several papers study other interesting aspects of mining:
  - Stability of blockchain equilibrium (Iyidogan, 2018)
  - Market structure and use of resources (Ma et al., 2018)
  - The growth of mining pools (Cong et al., 2019)
- More efficient alternatives to PoW are also being studied (Saleh, 2019)

Economic implications of blockchain

Blockchain-driven innovation

- Catalini and Gans (2016) argue that blockchain has some key features of a general-purpose technology (like the steam engine, electricity and the internet):
    - Spurs innovation across different sectors
    - Positive externalities can lead to underinvestment

- Often general-purpose technologies have effects that are initially:
    - Underestimated in their extent
    - Overestimated in their speed

Intensive vs. extensive margin

- Catalini and Gans (2016) show that blockchain can have substantial impact affecting:
  - The intensive margin → allowing you to do the same things more efficiently
  - The extensive margin → allowing you to introduce new products and services on the market

- Ripple, FileCoin and IBM food trust are interesting examples

Blockchain and corporate governance

- Yermak (2017) highlights that the transparency and ease of verification of blockchain could have significant effects on corporate governance
  - Improving shareholder voting
  - Increasing ownership transparency
  - Improving liquidity
  - Preventing backdating of executive stock options
- However, increased transparency could backfire, by preventing some activist investor strategies

- The ASX DLT testing provides and interesting example

Competition and market structure

- Blockchain can have a significant effect on an industry, but the effect is not necessarily positive:
    - Cong and He (2019) show that blockchain reduces barriers to entry, but it also facilitates collusion among incumbents
    - Aoyagi and Adachi (2018) show that blockchain can cause market segmentation between blockchain and cash markets, which could reduce consumer welfare

Tokens and ICOs

ICOs

- An initial coin offering is the offering of native tokens (or coins) from a blockchain (e.g., Filecoin's $250million ICO)
- Hard to obtain reliable statistics about initial coin offerings (ICOs)
- It is generally accepted that:
  - in the past few years blockchain startups raised more money through ICOs than through VC
  - Many ICOs are scams
  - Those that are not scams often fail to deliver
  - ICOs would benefit from better regulation

Red flags for fraud

- Frauds in ICOs are so common, the SEC has a webpage about it: https://www.investor.gov/howeycoins
- Red flags for fraud include the following
  - Claims of high, guaranteed returns
  - Celebrity endorsements
  - Claims of "SEC-compliance"
  - Investing with a credit card
  - Pre-ICO pump special

The geography of ICOs

- Huang et al (2019) show that ICOs originate more frequently from countries with:
    - Developed financial markets
    - Advanced digital technologies
    - Investment-based crowdfunding platforms
    - Friendly regulation
- Venture capital availability and taxation do not seem to affect ICOs geography

- Note that these findings do NOT support the idea that ICOs are a solution to startup financing in developing countries, as it is often claimed

Who invests in ICOs

- Fish et al. (2019) use survey data to study the motives of ICO investors
- A substantial part of the variance is explained by non-financial motives which can be:
    - Ideological
    - Technological enthusiasm
- This is not dissimilar from findings on crowdfunding motives

Which ICOs are successful

- Adhami et al. (2018) and Amsden and Schweizer (2019) and Deng et al. (2018) study the determinants of ICO success on different samples and time periods
- The studies overall agree that successful ICOs are those with better:
  - quality of disclosure,
  - governance mechanisms
  - teams

- Benedetti and Kostovetsky (2018) study post-ICO returns and find positive returns in the 30 days after the ICO
  - Their sample is concentrated in a period that is unlikely to be representative, so more study is needed here

ICOs and platform building

- Li and Mann (2018) argue that tokens act as a fundamental coordination mechanism overcoming cross-side and same-side network effects
- When network effects are present different equilibria exist:
  - Good equilibrium: buyers and sellers actively engage in trading
  - Bad equilibrium: both buyers and sellers abstain from trading

- Tokens act as a commitment device for buyers to signal their existence, attracting sellers and hence strengthening the good equilibrium
- The model also explains why many ICOs have an increasing price schedule to attract early adopters

Token exchanges

- Some 5,000 tokens are currently traded on hundreds token exchanges
- Token exchanges vary substantially in terms of their
  - Functioning
  - Admission criteria
  - User selection
- This results in market segmentations (Benedetti, 2019), which leads to significant cross-listing

Regulation

Regulation of blockchain

- The regulatory landscape of blockchain is extremely fragmented (see report by the Law Library of Congress, 2018)
  - In some jurisdictions (e.g., the US), some tokens tend to be considered as securities, and hence be regulated as such
  - In other jurisdictions (e.g., Japan), a specific status (Virtual Currency) is created for tokens
  - In other jurisdictions (e.g., China) exchanging fiat money for crypto-currencies is prohibited

Regulation of token exchanges

- One of the main issues with token exchanges is that they are at the same time exchanged AND custodians of the tokens, leading to conflicts of interest

- Absent strong regulation some token exchanges have failed spectacularly
  - MtGox in 2014 was a big one in Japan, leading to stricter regulation
  - Recent cases like Coincheck illustrate not all issues have been solved, leading to even stricter regulation

Lack of regulation

- When regulation is weak, tokens become a great place for
  - Market manipulation
  - Financing of illegal activities

Market manipulation

- Shin and Wang (2019) show that token exchanges are fraught with market manipulation
- Groups of speculators coordinate on Telegram to set up pump&dump schemes
- These groups often include "fees" paid to the organizers to front-run other investors
- These schemes generate positive returns:
  - Over very short time windows (<1 minute)
  - for front-runners but not for the other speculators
- This type of market manipulation would be illegal for financial securities, but it is legal for utility tokens
- Note that these are transactions occurring on a token exchange, i.e., nothing is recorded in the blockchain until an investor exits the pool

Financing illegal activities

- The excellent privacy, censorship-resistance and relatively low transaction cost of Bitcoin are particularly prized by criminals
- But how big is that a part of Bitcoin today? Pretty big probably

- Foley et al. (2019) show that a substantial amount of on-chain Bitcoin transactions could be related to illegal activities
- Illegal activities account for as much as:
  - ¼ of all bitcoin users
  - ½ of bitcoin transacted (about $76 billion)

Conclusions

8 things I learned about blockchain

1. Its novelty is more about game theory than cryptography
2. Forks are inherent in PoW, but they're not always bad
3. It makes Garbage-In immutable, but IoT could help
4. It can affect intensive and extensive margins
5. It can change market competition and lead to collusion and market segmentation
6. ICOs are a hot mess
7. Unregulated token exchanges are prone to market manipulation
8. Bitcoin is great if you are a crook

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The blockchain of tomorrow

- Blockchain is likely to change dramatically in the next few years:
  - Alternatives to PoW, which scale better, are being tested
  - The blockchain fad that has seen its heydays in late 2017 has cooled down
  - Large players (IBM, Facebook etc.) are stepping in the blockchain ecosystem
  - Regulation is underway in many countries
  - IoT and blockchain will help the integration of supply-chains

Roundtable

Utility vs Security tokens

- As mentioned, in some countries (notably the US) some tokens are classified as securities (see Howey test)
- Security tokens are subject to stricter (and more costly) regulation and are often only reserved for accredited investors
- Because of the importance of fraud and market manipulation, the benefits of this extra layer of regulation can outweigh the costs
- Polymath is an example of an Ethereum-based platform that helps in the creation of security tokens

Equity tokens

- A subset of security tokens is equity tokens, which mimic equity
- This is as close as blockchain can get to equity crowdfunding
- Cases of equity or equity like token issues are:
  - Overstock, which triggered an SEC investigation
  - Causam exchange

- Atlant.io is a platform selling equity in real estate

Wisdom of the crowd and blockchain

- Some blockchain applications are trying to monetize the wisdom of the crowd
    - An interesting example is Augur
- More generally the wisdom of the crowd can be an important element linking blockchain and reality, widening the space of contractibility
    - See, for instance, distributed oracles and Chainlink

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Royal Mint Gold

- Royal Mint Gold is a project of the UK Royal Mint to set up a blockchain-based trading platform in which:
  - A distributed ledger is used to transfer ownership of gold
  - Possession is ensured by the reputation and auditing by the UK Royal Mint

- The project, launched in 2016, is currently in stall, possibly because of regulatory issues (see later)

Ripple

- [Ripple](#) is a blockchain based service that allows for cheaper cross-border payments than traditional systems
- Cross-border payments are notoriously complicated and require reconciliation across different centralized ledgers
- By reducing the cost of verification, Ripple can offer a cheaper solution

Filecoin

- [Filecoin](#), a distributed data-storage platform based on blockchain technology
- The company has its own native coin (Filecoin), which is exchanged for data storage
- The company raised $250 million at the ICO

IBM food trust

- **IBM food trust** is a network of participants along the food supply chain, in which all information from growers to shelf is recorded in a blockchain
    - Intensive margin: the cost and time of retrieving information about food provenance declines dramatically
    - Extensive margin: a supermarket can show in real time to its customers where their food comes from, how and when and in which conditions it was transported, etc.

ASX DLT testing

- ASX (the Australian Stock Exchange) was one of the first stock exchanges to be interested in blockchain technology
- It plans to replace CHESS, its cash equity market platform, with a distributed ledger by Q1 2021

- Chiu and Koeppl (2019) estimated that if implemented in the US corporate bond market, blockchain could yield 1-4 bps of gains

Blockchain, competition and collusion

- Cong and He (2019) show that blockchain can have a dramatic effect on competition
- They identify two key features of decentralized consensus:
  - reduces the cost of validation
  - increases information distribution
- The two have opposite effects on competition:
  - Reduction in the cost of validation results in lower barriers to entry and promotes competition
  - Information distribution makes collusion more stable, hence reducing competition
- The adoption of blockchain by powerful incumbents seems to be particularly problematic (think Facebook's Libra)

Blockchain and market structure

- Aoyagi and Adachi (2018) show that in presence of asymmetric information the reduction in the cost of verification could cause a segmentation of the market
  - High-quality goods trade on the blockchain market (B-market)
  - Low-quality goods trade on the cash market (C-market)

- This segmentation has complex welfare effects and after a certain level of sophistication, the blockchain could actually result in a loss of consumer welfare (the price increases faster than the quality on the B-market)