Session on Emerging Technologies

Discussion by Rod Garratt, UCSB

2019 Financial Stability Conference: Financial Stability: Risks, Resilience, and Policy

November 21, 2019

Overview

Blockchain Structure and Cryptocurrency Prices
Peter Zimmerman

- Object and environment given. What can we say about demand, pricing, volatility, etc.?

Tokenomics and Platform Finance
Ye Li, Lin William Cong, Neng Wang

Designing Central Bank Digital Currencies
Itai Agur, Anil Ari and Giovanni Dell'Ariccia

- Select the environment. What should the object look like to have desired properties?

Launching points

Zimmerman

- Builds on literature on Bitcoin pricing that has taken two approaches

I. Garratt and Wallace (2018), Fernández-Villaverde and Sanches (2019), Schilling and Uhlig (2019) specify full monetary equilibrium models in which Bitcoin price (coexists with fiat currency)
   - Many possible price paths consistent with REE

II. Bolt and van Oordt (2019), Athey et al. (2016), Ciaian, et al. (2016) Look at one particular (realized) price path and study theoretical/empirical implications of quantitiy equation

- Fee literature
  - Huberman et al (2018), Easley et al. (2018)

Launching points

Cong et al.

- Looks at token supply management problem (Utility token). Value of tokens comes from convenience yield, which depends on a production function (user base size, platform quality and utility parameter)

Builds directly on

- Cong, Li, and Wang (2018) – dynamic token valuation and inter-temporal linkages in user adoption
- Krishnamurthy and Vissing-Jorgensen (2012) – convenience yield of money
- Bolton, Chen, and Wang (2011) – dynamic corporate finance
- Li (2017) – banks' dynamic issuance of inside money

Complementary to

- Garratt and van Oordt (2018) – funding model with endogenous token supply

Launching points

Agur et al.

- Bech and Garratt (2017), Mancini-Griffoli et al. (2018), BIS (2018) – role/purpose of CBDCs
- Andolfatto (2018) and Chiu et al. (2019) – CBDC raises welfare by reducing banks deposit market power
- Keister and Sanches (2019) – CBDC can increase welfare by improving lending efficiency

But then, given emphasis on payment instrument variety and network effects

- Hotelling – not actually cited
- Katz and Shapiro (1985) – firms decisions to introduce mutually compatible products
- Bounie et al. (2017), Chakravorti (2010), Rochet and Tirole (2006) – analysis and measurement of network effects
- Krugman (1979) – product variety in international trade

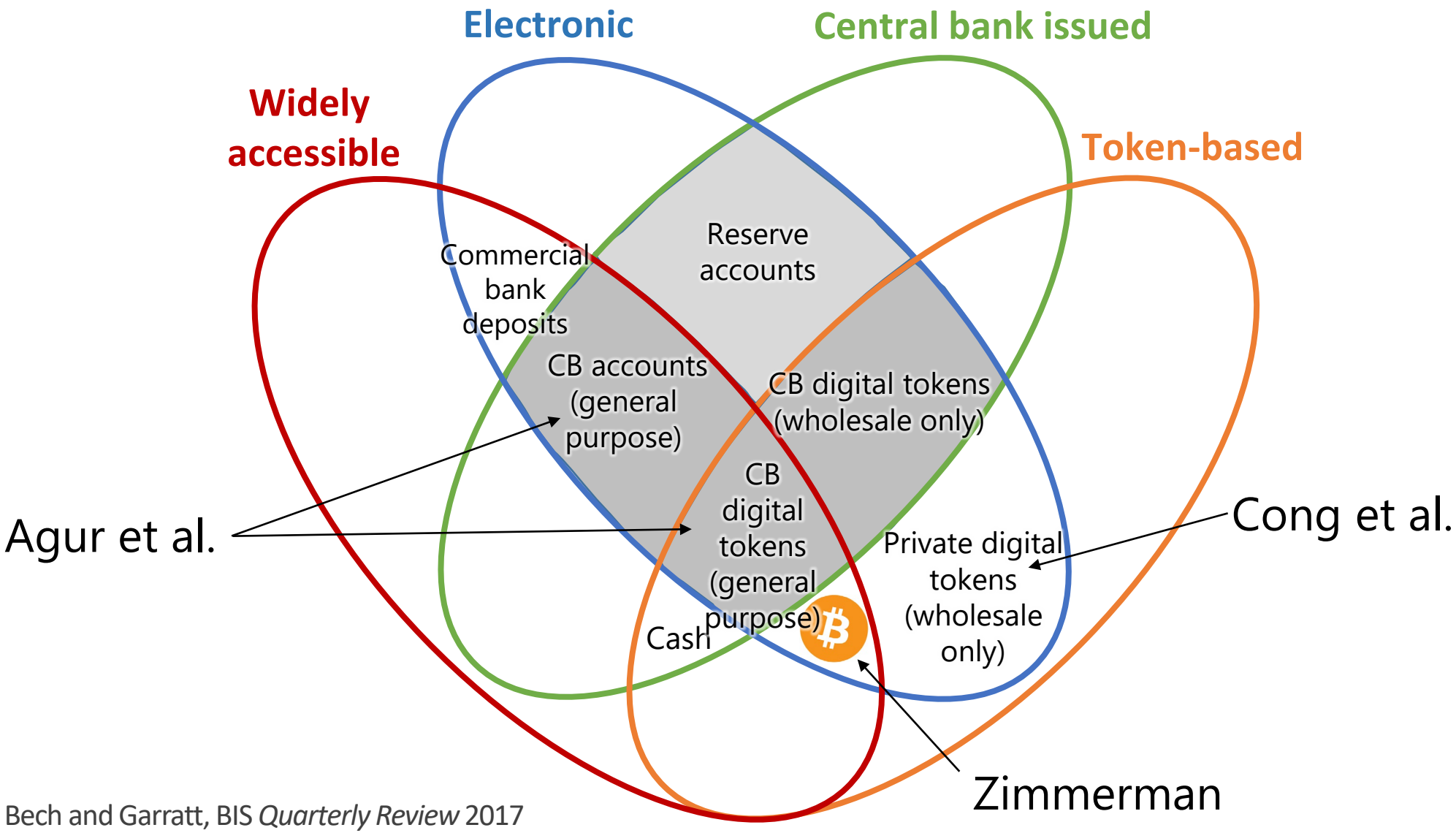
Bigger picture

- Friedrich Hayek: The Denationalization of Money, 1976
- Milton Friedman and Anna Schwartz: Has Government Any Role in Money? 1987

- James Tobin, Financial Innovation and Deregulation in Perspective, 1985

- Robert Mundell, A Theory of Optimum Currency Areas, 1961

THE MONEY FLOWER



Source: Bech and Garratt, BIS *Quarterly Review* 2017

Zimmerman

- Limited settlement space creates competition between households (traders) and speculators
- Crowding-out by speculative transactions undermines cryptocurrency's performance as a medium of exchange
  - Higher speculative demand can reduce prices, contrary to existing economic models. Eg Bolt and van Oordt
- Crowding-out raises the riskiness of investing in cryptocurrency, explaining high observed price volatility.

Players

Households

- Derive some utility benefit from using crypto, but crypto transactions do not always settle
- Tradeoff benefits to crypto against fees/delay

Speculators

- Trades on information about “strength of technology”, R, a parameter weight on household utility benefit of using crypto
- Also faces tradeoff for early consumption

Market Maker

- Observes noisy order flow (z=x+u). Sets fair prices

Results

- All agents play switching strategies relative to R*, which is decreasing in the block rate and network effects, and increasing in the number of speculators.
  - Capacity constrained asset used as a medium of exchange
- Crowding-out effect: an increase in informed speculative demand can reduce the price of crypto
  - speculative demand takes up blockchain space and reduce transactional demand
- Volatility is strictly increasing in the threshold R*
  - Biais et al. (2019) volatility through changes in beliefs, not adequate. Garratt and Wallace (2018) argue opposite

Additional interesting finding

Digital gold effect

- when cryptocurrency is more valuable, households become reluctant to spend it on fees; they prefer to hoard it and endure slower settlement times.
- can exacerbate the crowding-out effect.

Interpretations

- Not a bubble: *My paper shows that a high degree of speculative activity and price volatility is consistent with low payments usage in a REE.*

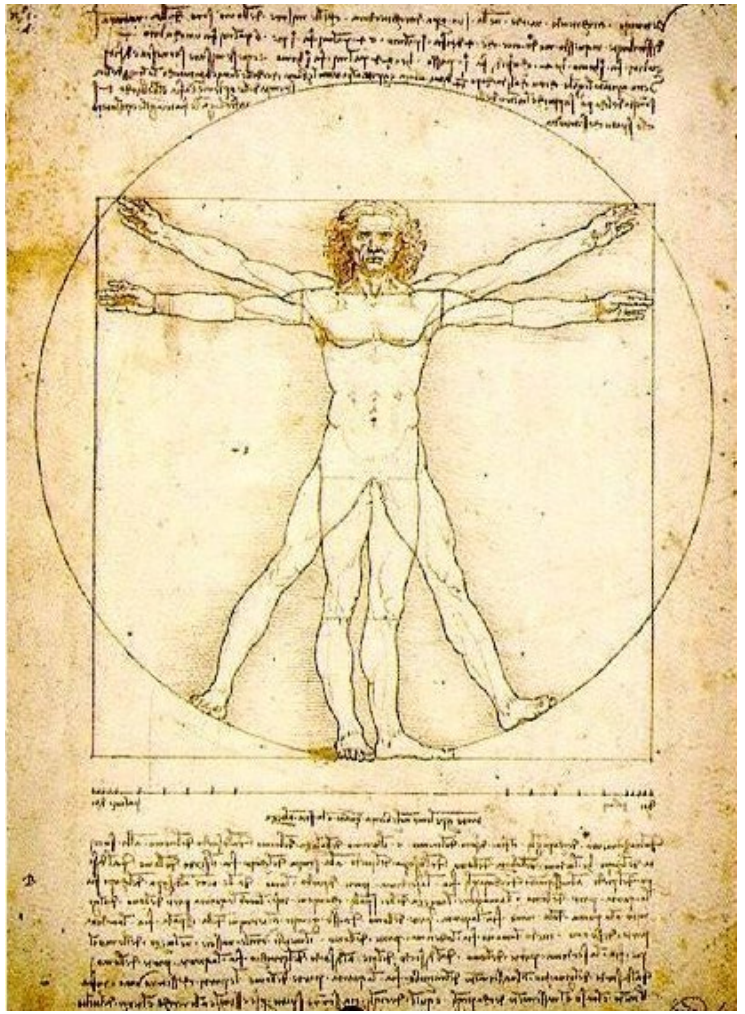
- *The crowding-out effect may explain why we have so far seen much more speculative trading of cryptocurrencies than monetary usage.*

- *My results suggest that price volatility may fall and payments usage increase if, in the future, a greater volume of speculation could be carried out outside the blockchain.*
  - cash-settled derivatives markets or the introduction of the Lightning Network could have profound consequences

Comments (Things I misunderstood)

- Why are mining fees paid at submission to mempool?
- What happens to fees paid to miners?
- How is v(y) *not* the intrinsic value of crypto?
- Costly information acquisition for speculators might be more realistic (literal interpretation of R)
- Testable implication: model predicts that price volatility should rise on days where there is a drop in hash rate
- Social welfare analysis: fee system is socially costly. Society may be better off if blockchain space were simply allocated randomly.

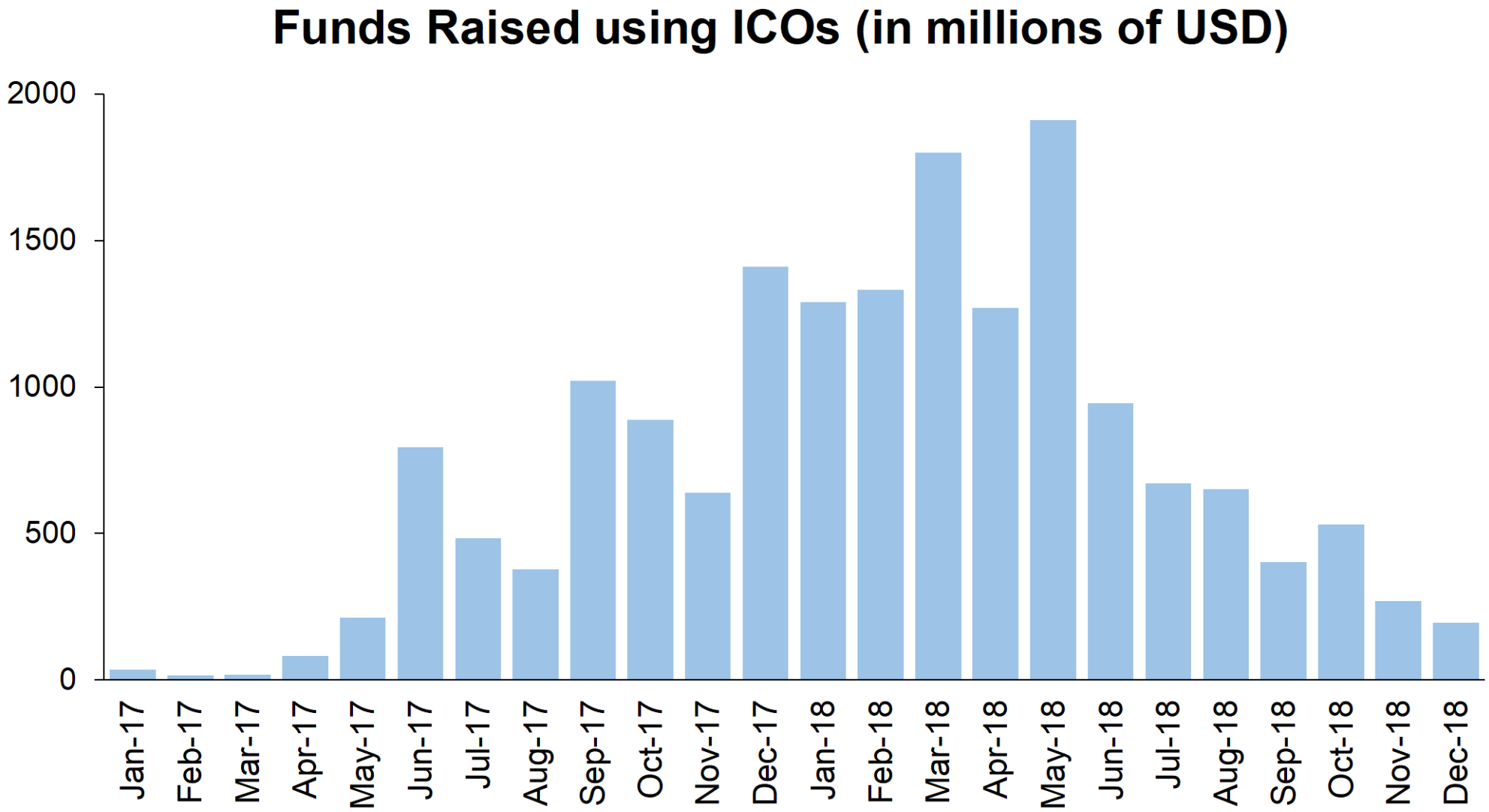
Frankenstein



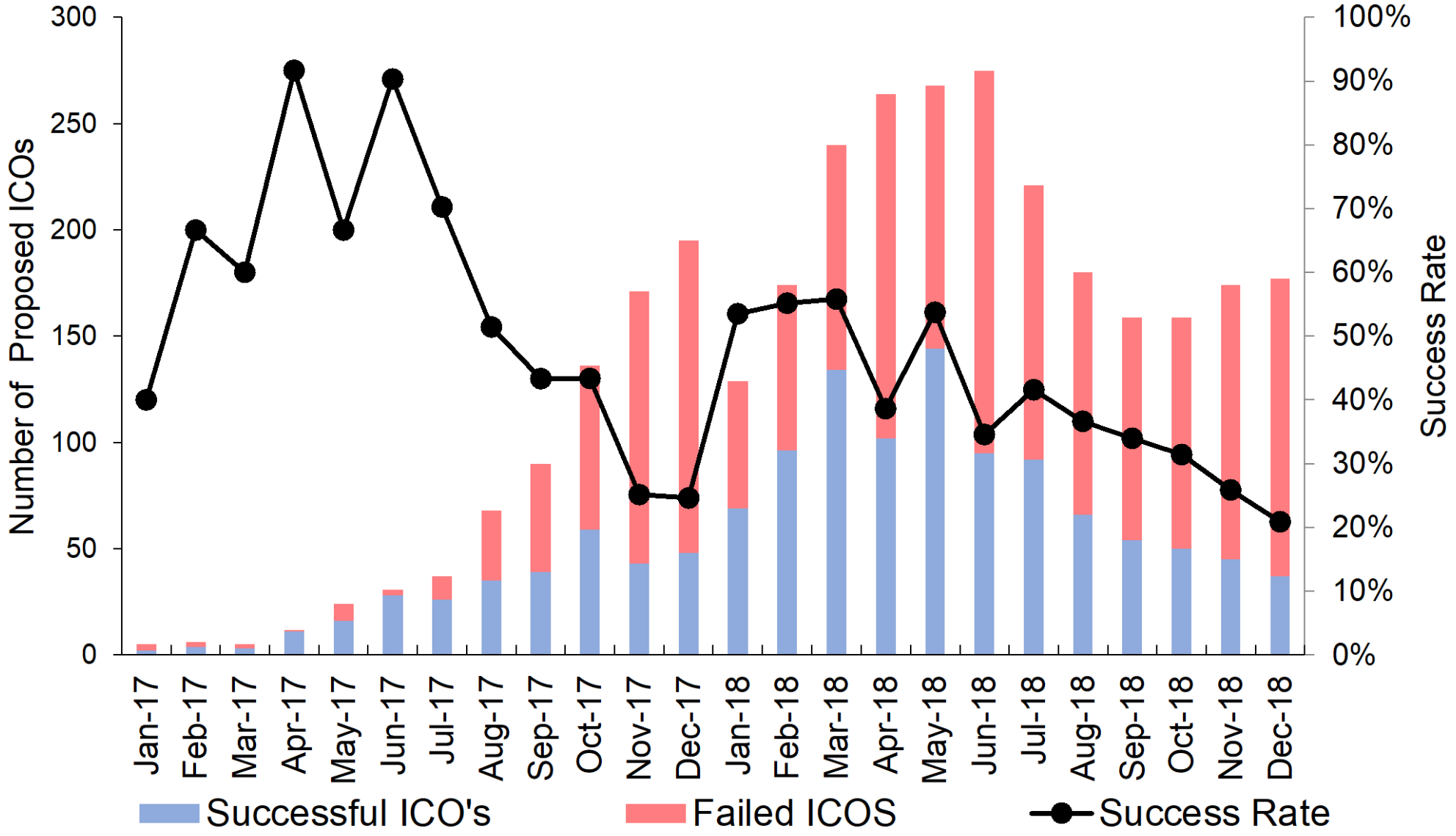
Vitruvian Man

Cong et al.

- Kin
  - Digital ecosystem of consumer apps and services
- Coins enter circulation via an incentive model
- Kin Rewards Engine rewards developers that create compelling user experiences with Kin
- Incentivizes the adoption of new use cases, while encouraging the exchange of value between users



Source:https://icorating.com/statistics/market



Source:https://icorating.com/statistics/market

Howeycoin

Benefit of an ICO as a funding model

- Catalini and Gans (2018): Better revelation of product quality
- Chod and Lyandres (2018): Investors are more diversified
- Li and Mann (2018): Avoid coordination problem
- Cong et al. (2018): Internalize user-base externality
- Bakos and Halaburda (2018): Tokens better than user subsidy
- Malinova and Park (2018): Reduce moral hazard in production
- Garratt and Van Oordt (2018): Eliminate moral hazard associated with cost reduction

Players

Users

- trade off cost of tokens against utility flow

Competitive Contributors

- provide content or functionality

Entrepreneurs

- Make two choices in a dynamic setting:
  i. Per period investment L_t
  ii. Change in token supply dD_t through dividends and buyback

Entrepreneurs recognize

- Positive network externality among users
- Platforms have to incentivize and compensate participants to innovate and grow the system
- Optimal solution requires dynamic decisions on financing and investment

Results

- Characterize prices, investment, adoption
- Token Overhang
  - Should expect price to fall to marginal cost – in this case would mean token price equal zero (Coase)
  - Here token demand grows stochastically over time
  - Cannot expect price to fall to zero; Costly buyback means want to control (excess) supply

Comments

- Is underinvestment in form of Token Overhang avoidable? How does it relate to other financing/operational models?
- No initial investment
- No time value of money (external cost to raising funds, but no opportunity cost to funds on platform)
- No saving (avoid costly buyback?)
- Implications of tokens trading off platform

Source: https://www.coinbase.com/price/kin

Agur et al.

- Optimal design of a central bank digital currency (CBDC)
- Network effects (disutility of using payment instrument that is not commonly used - nonlinear)
- Interest rates on deposits and CBDC

Players

- Central Bank
  - Decides whether and in what form to introduce a CBDC (anonymous or secure)
- Households
  - Sort into cash, CBDC and bank deposits according to preferences over anonymity and security
  - Hotelling linear city
- Bank
  - Collect deposits from households and extend loans to firms (competitive)
- Firm
  - Is endowed with positive net present value projects (pay off in consumption good) but require bank financing (can’t borrow directly from households)
  - Liquidation value if can’t get loan

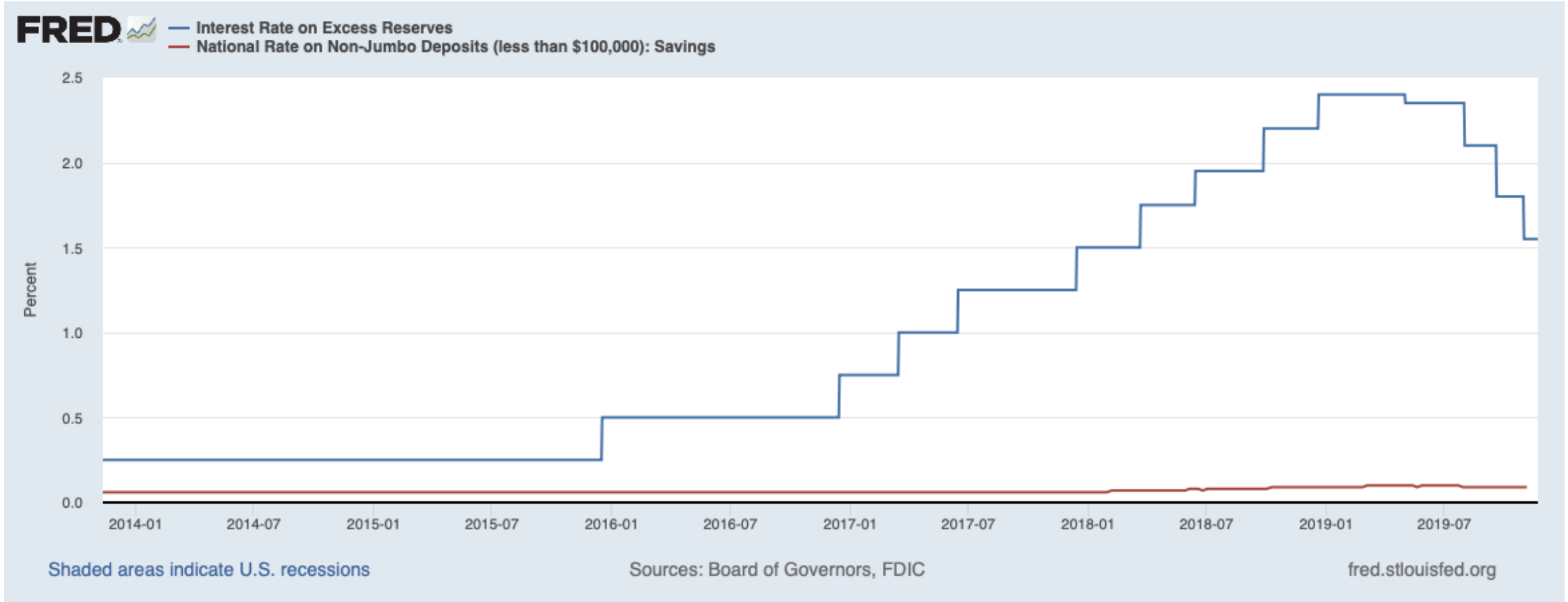
Results

- CBDC raises aggregate welfare, but not Pareto improving
  - Cash-inclined household loses out from the introduction of a CBDC
  - Still prefers cash and CBDC causes some contraction in bank intermediation and therefore consumption

- Welfare improvements easier with interest-bearing CBDC

Comments

- Justification for interest on CBDC in the presence of network effects
- Why do all monies trade at par?
- Why can consumers only hold one form of money?
- CBDC is extension of ONRRP policy. Can we say anything about the relationship between interest on CBDC and other central bank rates?
- Deposit market is not competitive. Assuming it is therefore misses potential benefit of CBDC.


FRED
Interest Rate on Excess Reserves
National Rate on Non-Jumbo Deposits (less than $100,000): Savings
Percent
2.5
2.0
1.5
1.0
0.5
0.0
2014-01
2014-07
2015-01
2015-07
2016-01
2016-07
2017-01
2017-07
2018-01
2018-07
2019-01
2019-07
Shaded areas indicate U.S. recessions
Sources: Board of Governors, FDIC
fred.stlouisfed.org

Privacy

"In our framework, the social value of the CBDC comes from the fact that it can bring some of the anonymity of cash into the digital realm."

Two papers on privacy and CBDC

BANK OF CANADA
BANQUE DU CANADA

Staff Working Paper/Document de travail du personnel 2019-24

Privacy as a Public Good: A Case for Electronic Cash

by Rodney J. Garratt and Maarten R. C. van Oordt

The Privacy Function of Central Bank Digital Currencies*

Rodney Garratt† Michael Junho Lee‡

July 2019

Abstract

By providing an anonymous means of digital payment, privacy-preserving electronic money enables consumers to make digital transactions without revealing their identities to vendors. In this way, consumers can access digital vendors whilst preventing vendors from collecting and accumulating data. We show that vendors respond by offering transfers to consumers in return for access to their transaction histories. In the absence of privacy preserving-electronic money, consumers have no way to capture the surplus generated from their collective data. However, privacy preserving electronic money creates an environment in which agents can choose whether or not to monetize their data, in effect intermediating privacy by offering an anonymous base method of digital payment.

*The views expressed in this paper are those of the authors and do not necessarily reflect the position of the Federal Reserve Bank of New York or the Federal Reserve System.
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Thank You!