Blockchain & Digital Finance

Implications for Financial Stability and Central Banks

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The views expressed here are my own and should not be attributed to the Federal Reserve Bank of St. Louis or the Federal Reserve System.
My talk today is divided into two parts.

Part 1: What do I mean by *Blockchain* and *Digital Finance*?
- Am concerned w/ innovations in accounting (database management).
- How does blockchain work?

Part 2: Monetary policy and stability implications.
- Currency competition; Maturity mismatch with cryptoassets; Cryptocurrencies as safe assets; Securities exchanges; Financial transparency and stability; Asset tokenization; Central bank digital currency.
What are we talking about?
Database Management

- What sort of data? Ownership records, payment records, credit histories, etc.

- Information is *currency* – incentive to counterfeit/steal.

- Databases located in virtual, communal ledgers. Centralized databases with delegated record-keepers.

- Perennial issues: discordant records, auditing costs, legal disputes, communication barriers, data security, trust, etc.

- Wanted: low-cost, secure, accurate database management systems to promote fair and efficient economic outcomes.
What is Blockchain?

- Basically, a consensus-based database management system (where data is stored and secured in a particular way.)
  - *Distributed* (open); Append-only (immutable) with time-stamped blocks of data connected sequentially via a *Merkle tree*; appended data subject to consensus.

- Deeply rooted in what I have labeled “primitive blockchains,” historically/presently used in small social groups.
  - Technological advances in data storage, communications, cryptography and game theory have permitted *scaling*.

- Major idea is to replace *delegated* record-keeping authorities with *permissionless* communal consensus-based protocols.
Demystifying Blockchain

- Consider a history textbook published in 2016 about events that happened in 2014 (Chapter 1) and 2015 (Chapter 2).

- History as time-stamped blocks of information (chapters) in an ever-expanding history textbook (blockchain).

- Merkle tree structure implies contents of “leaf” chapter logically connected to all earlier branches.
  - Cannot change something in Chapter 4 without: (1) changing all earlier chapters for consistency and (2) achieving consensus.
Database Management: Read/Write Parameters

- **Write Privilege**
  - Cash
  - Cryptocurrencies

- **Read Privilege**
  - Public Library
  - Bank Account

- **Open** (Public)
- **Closed** (Private)

- **Disintermediated** (Consensus)
- **Intermediated** (Delegated)
What is Digital Finance?

- I interpret *Digital Finance* more broadly to include database management systems that entail the use of trusted intermediaries (in which case, blockchain is pointless).
  - Basically just Fintech in general.

- These intermediaries may make use of cryptoassets (securities managed by blockchain databases).

- Key difference is that intermediated databases can be regulated *directly*.

- Blockchain databases can only be regulated *indirectly* b/c they are *Decentralized Autonomous Organizations* (DAOs).
Monetary Policy Implications
1. Currency competition

- For a given central bank, Bitcoin looks just like a foreign currency managed by a robot (DAO).

- CBs are accustomed to currency competition; well-managed CBs have little to fear; cryptocurrencies provide useful check.

- A potential problem for countries that rely heavily on seigniorage revenue. High inflation and currency controls increasingly difficult.

- Hypothetical Q: Would Venezuela’s current hyperinflation have been possible had Bitcoin been widely understood prior to crisis?
2. Flight-to-safety assets

- Gary Gorton claims that “safe assets” are “information-insensitive” assets.
  - In 2008 crisis, senior tranches of private-label MBS suddenly became speculative instruments, rendering them illiquid.
  - In crisis, investors flock to “simple” assets. Few people understand MBS. Everyone understands USD/UST.
  - This is true even if USD/UST is a “bubble” asset.

- Observation: Cryptoassets are typically governed by very simple, very transparent, non-politically-concentrated algorithms.
  - Natural “flight-to-safety” candidates (even if they are “bubbles”).
  - Implications for financial stability and policy?
3. Maturity transformation with cryptoassets

- Domestic agencies are known to issue debt obligations denominated in foreign currency. Problematic.

- Now replace foreign currency with Bitcoin. Even more problematic.
  - Likely to complicate (not eliminate) lender-of-last-resort interventions since domestic central bank rendered powerless (unless it accumulates Bitcoin reserves the way old-style CBs used to accumulate gold reserves).
  - Likely a greater role for government/treasury intervention.
  - Macropudential regulation must recognize cryptoassets as foreign currencies.
4. Security exchanges

- Unlike textbook models, real-world financial markets are decentralized (OTC) and most securities thinly-traded.

- Despite continued improvements, clearing and settlement can still take a long time (days).

- These frictions generate a huge demand for collateral (e.g., USTs) to guard against counterparty risk.

- Continued developments in digital finance (fintech) could imply significant collateral release.

- Potentially important implications for treasury and central bank.
5. Financial transparency and stability

- “Opacity” often cited as root cause of financial instability.
  - Lending standards, leverage, ratings, asset quality, etc.

- More transparency along several dimensions seems obviously desirable. Possible w/o blockchain.

- Blockchain not viable b/c: (1) delegated record-keeper more efficient; and (2) financial actors desire confidentiality.

- Note: theoretically, bank panics are possible even if banks have fully transparent balance sheets (Diamond and Dybvig, 1983).
6. Asset tokenization

- Goal is to render every conceivable asset liquid.
- This is standard “frictionless” Arrow-Debreu economics, from which all serious money/macro models depart.
  - Debreu (1959) even features “smart contracts.”
- Banks would completely vanish, since credit could be secured on any basis (e.g., by pledging/selling any amount of human/physical capital) – no need for banks to intermediate.

- Imagine selling a share of your house to buy a cup of coffee.
  - Not clear how this solves asymmetric information problems associated with asset ownership/control.
  - Record-keeping does not eliminate need for (or problem of) enforcement. Bitcoin cannot eliminate tyranny.
7. Central bank digital currency

- Utility banking an old idea (e.g., postal savings banks).

- Attraction of U.S. Postal Savings: (1) ubiquitous locations; (2) government-insured accounts.


- My paper *Assessing the Impact of CBDC on Private Banks* shows how interest-bearing CBDC:
  - Increases financial inclusion, reduces demand for cash, reduces monopoly bank profits.
  - Need not disintermediate banks (though depends on regulatory structure).
Conclusions

- Advances in data storage, communications, cryptography, and game theory leading to improved database management systems in financial markets (and elsewhere).

- This process is not new—we should not be surprised by change.

- Question is how to react when change inevitably occurs and how to be proactive.

- Central bankers and regulators have many historical examples and analogies to draw on for guidance.

Accenture built a network of more than 170 nodes to model the financial ecosystem of exchanges, market participants and broker/dealers supported by DTCC. The prototypes were designed to test the capture of matched equities trades from exchange DLT nodes, novation of those trades with DTCC acting as the central counterparty (CCP) to maintain trading anonymity on the ledger, creation of netted obligations and settlement of the trades.

“This project answered key questions and built serious confidence in blockchain’s ability to drive large scale transformation,” said David Treat, Managing Director, Global Blockchain Lead, Accenture.