CHAPTER FOUR

Monetary Policy and Payments

SECTION ONE

Payment Systems and the Distributed Ledger Technology

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An essential function of the Federal Reserve is to manage the central payment system. The distributed ledger technology is a digital innovation with the potential to transform payments, clearing, and settlement processes. In my brief remarks, I will introduce the Federal Reserve's management of payment systems, emphasize how the distributed ledger technology could reduce operational and financial inefficiencies for payment systems, and highlight some potential challenges to the distributed ledger technology's broad implementation.

In "Strategies for Improving the U.S. Payment System," the Federal Reserve pronounces, "A U.S. payment system that is safe, efficient, and broadly accessible is vital to the U.S. economy, and the Federal Reserve plays an important role in promoting these qualities as a leader, catalyst for change, and provider of payment services to financial institutions and the U.S. Treasury."[1] This includes keeping

1. Federal Reserve System, "Strategies for Improving the U.S. Payments System," January 2015, 1. Available at https://fedpaymentsimprovement.org/wp-content/uploads/strategies-improving-us-payment-system.pdf.

sufficient currency in circulation, providing check collection services to depository institutions, operating electronic payment systems, and providing financial services to the US government. In aggregate, US payment, clearing, and settlement systems process approximately 600 million transactions per day, valued in excess of $12.6 trillion.[2]

The Federal Reserve's approach to improving US payment systems has been to encourage the private sector to innovate real-time payment solutions for both the Federal Reserve payment systems and private sector payment systems. As new payment technologies develop, the Federal Reserve has summarized its effectiveness criterion to be "a ubiquitous, safe, faster electronic solution(s) for making a broad variety of business and personal payments, supported by a flexible and cost-effective means for payment, clearing, and settlement groups to settle their positions rapidly and with finality."[3] That is the payment system criterion I focus on here. I then apply it specifically to the distributed ledger technology, which is being piloted and utilized in many applications worldwide to enhance and even replace existing transaction infrastructures.

Within this criterion are the following considerations:

Ubiquity: A system that is accessible and applicable to all relevant parties with multiple use cases, ideally with cross-border functionality.

Safety: Providing a trusted secure system of record with cryptographic integrity, no fraud, and direct legal enforcement.

Speed: Rapid clearing and settlement, moving toward real-time "immediate payments" systems. For example, stock trades currently

2. Federal Reserve Board, "Distributed Ledger Technology in Payments, Clearing, and Settlement," 2016. Available at https://www.federalreserve.gov/econresdata/feds/2016/files/2016095pap.pdf.

3. Federal Reserve Banks, "Federal Reserve System Faster Payments Task Force Charter Established 2015," FedPayments Improvement website, 2015. Available at https://fedpaymentsimprovement.org/wp-content/uploads/faster-tf-charter.pdf.

settle in T+3 days, moving to T+2 settlement in September. Why not T+0, same day settlement of stocks?[4]

Efficiency: Lower costs and increased convenience, achieved in part through scalability.

Payment finality: A process for handling and resolving disputed claims for prompt resolution.

I use "distributed ledger" as a collective term that encapsulates the continuously growing decentralized consensus databases secured by cryptography that authenticate ownership provenance by recording transactions. Blockchain, so named because it gathers and orders data into blocks of encrypted information and then chains them together, was originally developed in 2009 as the permissionless underlying ledger platform for the digital currency bitcoin. This technology is now being levered beyond the currency bitcoin to support a wide range of applications. Other distributed ledgers have emerged as well, the second largest being Etherium, which is associated with the cryptocurrency ether. There is also a collaborative public effort, Hyperledger, which is an open-source initiative hosted by the Linux Foundation.[5]

The distributed ledger, with its decentralized trust, is a striking alternative to classic double-entry bookkeeping maintained by a central authority. This difference is at the heart of its significant potential benefits, like enhanced speed and efficiency, but also its many challenges.

4. As of September 5, 2017, compliance with the amendment of Rule 15c6-1(a) of the Securities Exchange Act of 1934 will shorten the "regular way" settlement cycle for most stock transactions from three business days after the trade date (T+3) to two business days after the trade date (T+2). With the ledger technology, almost instantaneous (T+0) stock settlement could be possible.

5. The Bank of England is one of over 140 members of Hyperledger, which has no crypto assets built into it.

Let me focus first on the benefits of the distributed ledger technology for payment systems. It offers greater transparency of ownership and hence the ability to safely transfer more quickly, at lower cost, without the need for an intermediary.[6] In terms of ubiquity, it has the potential for broad application and accessibility if it is standardized. In terms of safety and security, it has non-falsifiable cryptographic integrity without a central authority or "trusted third party." In terms of speed, settlement can be nearly instantaneous. In terms of cost efficiency, it could eliminate intermediaries and infrastructure costs, allowing direct settlement. In terms of finality, it provides an immutable record that cannot be altered retrospectively.

The other side of the cryptocoin, if you'll forgive the pun, involves the ledger's potential challenges. In addition to the risks already inherent in payment activities, these challenges include operational, technological, legal, regulatory, and other hurdles. In terms of ubiquity, there is currently a lack of standardization and interoperability, both across applications as well as across jurisdictions. In terms of safety and security, there are issues of privacy and transparency. Currently, there is a full spectrum of networks, from open and public and permissionless, to consortium, to fully private and permissioned. There are key questions of who has permission to update the code and to legally enforce transactions. There are FINRA rule requirements, including compulsory anti–money laundering compliance (FINRA Rule 3310) and know-your-customer (FINRA Rule 2090) processes.[7] There has been a history of hacks

6. The ledger could also provide an additional monetary policy instrument in the form of a central-bank-issued digital currency, like that being considered by Norway's Norges Bank.

7. Silk Road, a website founded in 2011 that allowed the transaction of narcotics and other illicit goods, used bitcoin to mask the identities of merchants and customers. Some 600,000 bitcoins changed hands on the site, worth over $1.5 billion at current exchange rates. The Justice Department successfully prosecuted founder Ross Ulbricht.

in some of the ledgers.[8] In terms of speed, as transaction volume has approached a distributed ledger network's capacity limit, transaction processing speed has slowed.[9] In terms of cost efficiency, one growing challenge to scalability is that transaction fees have risen. The fee necessary to foster transaction processing has risen in response to a growing transaction backlog. In terms of finality, unresolved ambiguities include how to satisfy the regulatory requirements and how to handle disputed claims, with a possible solution being to have regulated authorities as observer nodes.

While not included in the Federal Reserve's criterion, other overarching questions emerge. These include who will pay for progress and whether central banks should form their own consortium.

In summary, while the distributed ledger is not yet ready for wide-scale adoption, it may become a transformative technology that provides ubiquitous, safe, faster electronic solution(s) for making a broad variety of business and personal payments, supported by flexible and cost-effective means for paying, clearing, and settling positions rapidly and with finality. While there are significant implementation challenges ahead, there are also huge benefits to their resolution.

Although I have focused today specifically on payment systems, the distributed ledger technology can be used to transfer any asset that can be presented in digital form. There is an important

8. In 2014, the Tokyo-based exchange Mt. Gox collapsed after a yearlong series of attacks resulted in the theft of $460 million in bitcoins, about one-fourth of which were later recovered. In 2016, a hacker used the Decentralized Autonomous Organization code to withdraw $60 million of ether. A hack on the Hong Kong–based digital currency exchange Bitfinex resulted in the theft of $65 million in bitcoin. In 2017, Bitcoin was attacked by WannaCry ransomware, which locked down over 200,000 computers in at least 150 countries, demanding a ransom payment of $300 each in bitcoin.

9. For the past two years, there has been contentious debate between segregated witnesses (SegWit) and Bitcoin Unlimited about whether to conduct a hard fork or use lightning networks and side chains to raise the block limit (currently 1MB for the Bitcoin network, as compared to 8MB for the Litecoin network). On August 1, 2017, the Bitcoin Cash hard fork increased block size to 8MB.

parallel between what is emerging at the Federal Reserve for payment systems, and what is emerging, for example, with regulators for securities markets. As my own research explores, this gives the distributed ledger technology the potential to disrupt not only payments and money transfers, but also the execution, clearing, and settlement of securities transactions.

In "The Blockchain and Its Implications for Corporate and Securities Law and Practice," David J. Berger, a litigation partner at Wilson Sonsini Goodrich & Rosati, Joseph A. Grundfest, my colleague at Stanford Law School, and I explore the requirements for the distributed ledger technology's adoption by US securities markets; the emergent role of this technology in those markets; the implications for corporate and securities trading, law, and practice; and how the SEC should prepare for and respond to these technological developments.

SECTION TWO

Cryptocurrencies

Some Lessons from Monetary Economics

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In 1976, F. A. Hayek published a short pamphlet, "The Denationalization of Money." Worried that the high inflation of the 1970s in Western countries would not be tackled by central banks because of political constraints, Hayek argued that money issuing should be opened to market forces and that the government monopoly on the provision of means of exchange should be abolished. He envisioned a system of private monies where the forces of competition would