
**Innovation on the Fringe and at the
Core of Financial Services**

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The views expressed today are my own and not necessarily those of the
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Introduction

I am delighted to be included in the third annual Fintech Conference, and grateful to our host, the Federal Reserve Bank of Philadelphia, and conference partners—the Wharton School of the University of Pennsylvania, the Bank Policy Institute, the Brookings Institution, and the University of Cambridge. We think of fintech as a new thing, but I'd like to begin my talk by considering a historical example of financial technology and innovation from the time of the Fed's founding. Countless innovations have been made in finance throughout history. And policymakers, including central bankers, have long grappled with how to foster financial innovation while at the same time ensuring the smooth operation of the financial system, as well as the stability of the broader macroeconomy. Before I go on, let me remind you that my comments reflect my own views and not necessarily the views of the Federal Reserve System or the Federal Open Market Committee (FOMC).

In the early 1900s, many contemporaries saw the American payment system as slow and costly. This may ring a bell for those of you who have studied our payment system today. The debate in the early 1900s was different, of course, focusing on the processing of checks. Advocates for reform liked to cite an example involving an actual check that was written out of a bank in Sag Harbor,

Long Island, New York, and deposited in a bank in Hoboken, New Jersey, only 100 miles away. To receive the payment, the bank in Hoboken sent the check to its correspondent bank in New York City. But its correspondent did not deal directly with the bank in Sag Harbor, so it sent the check along to another bank it partnered with. This continued, and in defiance of all sensibility, the check traveled to eight more banks—in Boston, Tonawanda, Albany, Port Jefferson, Far Rockaway, back to New York City, Riverhead, and Brooklyn—before finally reaching its destination in Sag Harbor. The point of that 1,500-mile journey was to avoid fees imposed on check processing by working through existing banking relationships, but this caused a considerable delay. This is the problem of “circuitous check routing,” as it was known.¹

I am sure that fintech innovators could have thought of many ways to improve on that system, which sounds inefficient and a little absurd. And as a monetary policymaker, I can think of several things that might have concerned me.

Ultimately, monetary policy is intended to create financial conditions that promote the ability of businesses and households to make good use of the economy’s productive resources. Long gaps in the ability to access payments could impair liquidity, for both households and businesses, as well as for the banks themselves. Circuitous check routing seemed like a sign of inefficiency in financial technology that could get in the way of the macroeconomy functioning at

¹ Spahr (1926, pp. 105–106).

full potential. Finally, a payment system with so many points of failure raised questions about how resilient it would be in times of stress.

Now, scholars have debated whether examples like that 1,500-mile journey were cherry-picked by advocates for payment system reform. That may well have been the case. Nevertheless, scholars have also viewed the creation of the Fed as having substantially sped up check clearing and reduced the costs associated with it. One of the Fed's early key accomplishments was the creation of a national check-clearing system. The national scope of this system largely eliminated the need to route checks around the country, at least for banks that were members of the Federal Reserve System, as they could simply use the nearest Federal Reserve branch. In addition, the Fed used a telegraph network to increase the speed of check clearing, particularly on the back-end. Once the check was in the Fed's possession, it would credit the appropriate account and telegraph out that information. Lastly, the Fed insisted on clearing of checks at par—something many banks had resisted as their business models depended on fees from check processing. Overall, in a short time, from 1912 to 1918, check clearing sped up from an average of 5.3 days to 2.4 days, and was largely at par. This was a major change.²

Clearly, the Fed has had a long-standing interest in improving the speed and resilience of the U.S. payments infrastructure. That interest continues, and the Fed is currently embarking on a major new initiative to deliver real-time

² Quinn and Roberds (2008), James and Weiman (2010), Chang et al. (2008), and Gilbert (2000).

payments. I will discuss this initiative, known as FedNowSM, a little bit later. Notably, the Fed has not sought to displace existing payments infrastructure. At the time of its founding, for example, the Fed's check-processing system continued to operate alongside private-sector systems run by correspondent banks and clearinghouses. Today, the Federal Reserve continues to serve a prominent role in the payment system as a provider alongside private operators of financial services. Moreover, the Chicago Fed has had a long-standing role in leading Federal Reserve System initiatives in payment services. Staff in Chicago manage the System's Customer Relations and Support Office and oversee FedLine[®]—the network through which U.S. financial institutions connect to the Fed for services such as wire transfers, automated clearinghouse (ACH) transactions, and cash processing. Chicago Fed staff also manage relationships with these banks and oversee the System's Industry Relations function, which facilitates industry engagement and collaboration on payments.

One key lesson I take from payments innovation at the time of the Fed's founding is that the pace of change can be unpredictable. Rarely does a single invention result in sweeping reform. Instead, major productivity improvements in economic history have been driven by the accumulation of incremental changes, with their adoption shaped by compatibility with existing practices.³ The telegraph, for example, certainly existed before the Fed. However, its use in payments was limited by the high fixed cost of operating a nationwide telegraph network, as well as the inability of private banks to impose consistent operating standards. The

³ Rosenberg (1982).

Fed played an important role in shaping the adoption of payments technology—in this case the telegraph—in part by creating an appropriate institutional setting for it to be adopted.

The payment system has evolved considerably since the age of the telegraph, alongside improvements in communications and computing. Today, payments are an active area of innovation—one part of the broad umbrella known as fintech. I would like to turn my attention now to a few recent developments in fintech. I will focus in particular on cryptocurrencies and then come back to the subject of payments and discuss the FedNow initiative.

Cryptocurrencies

Cryptocurrencies have blossomed over the past decade. Since the introduction of Bitcoin in 2008, investors have purchased thousands of such currencies. Today, the market capitalization of all digital currencies is estimated to be over \$200 billion.⁴ It is clear there is an appetite for cryptocurrency. For some, cryptocurrencies represent a potential break from established banking and payments infrastructure. Other users value anonymity and, therefore, the ability to conceal their identities in cryptocurrency transactions. Merchants may be attracted by opportunities to avoid costs incurred with existing payment options—

⁴ Details on the estimate from CoinMarketCap are available online, <https://coinmarketcap.com/charts/#total-market-capitalization>. CoinMarketCap tracks cryptocurrencies and the markets in which they trade.

such as interchange fees in debit and credit card transactions. Many others are simply speculating on the values of these cryptocurrencies.

The policy implications of cryptocurrencies are fascinating and evolving. As an asset in the global financial system, cryptocurrencies seem to be still a fairly small development. As a means of payment, the potential use of cryptocurrencies could have important implications for the financial system and for monetary policy, if a significant share of payments activity shifted into cryptocurrencies. In such a scenario, the business models of commercial banks could come under significant pressure. In addition, it is an open question whether significant use of private digital currencies could alter the ability of the Federal Reserve to implement monetary policy through its existing toolkit.

Thus far, however, cryptocurrencies have largely been used as vehicles for speculation rather than as a means of payment. For these digital currencies to have more wide-reaching effects on the macroeconomy, they would likely have to overcome some barriers to adoption. One such barrier is the instability of their values. For example, the price of Bitcoin was roughly \$3,500 at the beginning of 2019, over \$13,000 in June, and as of last week, back down to around \$9,000. In addition, transaction speeds have been slow—a Bitcoin transaction could take anywhere from minutes to over an hour. The line at Starbucks would move even more slowly if we had to wait for that. Some scholars doubt that a privately issued currency can ever serve as a reliable means of exchange given these factors, together with the inherent default risk associated with the absence of any government or institutional backing. These barriers illustrate a theme I touched

on a few minutes ago—that innovation often occurs through incremental changes that are shaped by the compatibility of new ideas with existing ones. Blockchain and digital currencies constitute a major single invention, but one with some barriers to adoption that subsequent innovators have been attempting to address in a myriad of ways. Some of these attempts probably don't have much future: Among the thousands of cryptocurrencies, the Bananacoin, for example, doesn't seem ripe for a breakthrough.⁵ But others that are geared toward addressing some of the key barriers to wider adoption that I just mentioned may have more promise.

Stablecoins

This brings me to a second development, the emergence of stablecoins—that is, cryptocurrencies that peg their value to target the price of a real-world asset. These currencies are designed to address the price stability shortcomings that have inhibited the wider adoption of digital currencies for use cases that require a stable medium of exchange, such as payments.

Still, no stablecoin offers the network breadth that would be necessary to function as a medium of exchange. This, in part, has been why Facebook's announcement of plans to create the cryptocurrency Libra has gathered widespread attention. With a network of almost two and a half billion active monthly users and growing, Facebook would potentially provide Libra with a

⁵ Bananacoin is a utility token designed to crowdfund expansion of a banana operation in Laos.

huge user base.⁶ But legislators, regulators, and central bankers have been quick to highlight the risks, along with the need for more details about how Libra will function. It is critical to assess Libra's potential impact on users and the financial system, as well as how it can be effectively regulated on a global scale. Facebook's past missteps on user privacy and security raise serious questions around user protection. Central banks have called for more clarity over how the underlying Libra Reserve will function and what the makeup of currencies backing the value of Libra will be. In his July 2019 testimony to the House Financial Services Committee, Fed Chair Powell highlighted our concerns about Libra, particularly around consumer privacy and protection, the risks of money laundering, and the need to assess its impact on broader financial stability.⁷ With this increase in unfavorable regulatory and congressional attention, the Libra Association—the group founded to fund Libra and provide oversight over it—has seen an exodus of original founding partners, including PayPal, Visa, and Mastercard.

Central bank digital currencies

Thus far, digital currency innovation has largely been the product of private-sector efforts. A central bank digital currency could conceivably address some of the barriers to widespread use that I noted earlier. A central bank's nationwide

⁶ As of September 2019, Facebook statistics show the social media service has 1.63 billion daily active users and 2.45 billion monthly active users. Details are available online, <https://newsroom.fb.com/company-info/>.

⁷ Some of Fed Chair Jerome Powell's testimony before the House Financial Services Committee on July 10, 2019, is quoted in Schroeder and Hunnicutt (2019). The webcast of his full testimony is available online, <https://financialservices.house.gov/calendar/eventsingle.aspx?EventID=403999#Wbcast03222017>.

reach could spur widespread adoption, and government backing could ensure the currency would be default free.

A small number of central banks around the world have experimented with issuing digital currencies, particularly for the purpose of cross-border payments. Despite these experiments, few central banks have immediate plans for broad implementation.⁸ Likewise, the Federal Reserve is not actively considering issuing a digital currency, but continues to monitor other central banks and engage with them to remain current on issues and plans.

Some scholars have suggested that a central bank digital currency could provide additional tools for central bankers' toolkit. In particular, new tools could be useful in situations where conventional monetary policy has been exhausted and short-term interest rates have reached the effective lower bound. For example, a central bank could conceivably impose a negative interest rate on the digital currency or carry out a metaphorical helicopter drop of new money supply to all existing holders. Such tools raise some immediate questions, such as how a central bank would manage outflows from the digital currency in the presence of negative rates. These questions are in addition to the profound operational and technical challenges that any central bank would need to address in launching a digital currency, as well as other concerns such as how existing financial institutions would be affected by such a currency.⁹

⁸ Barontini and Holden (2019).

⁹ Prasad (2018) and Bordo and Levin (2019).

Blockchain technology

Outside of digital currencies, blockchain technology has other potential uses. For example, blockchain is gaining traction as a means of tracking inventory or provenance. For example, blockchain has enabled suppliers and retailers to track products like milk and meat from origin to consumers—in other words, “from farm to fork.” In addition, global banks and groups of private firms are testing the technology and its capacity to allow for group monitoring and public tracking of contractual agreements, also known as “smart contracts.” Thus far, however, the use of blockchain to trade financial information and assets has been largely limited to pilot experiments where participation is strictly limited, such as Chase’s network in which a small number of corporate clients can transfer funds between each other using the JPM Coin. Large, decentralized, or “permissionless” public blockchains face implementation and regulatory barriers, as well as challenges in scaling up. They also require a high bar for data privacy and protection.

Other technologies on the fintech spectrum

Of course, cryptocurrencies are not the only fintech development shaping payments, banking, regulation, and the financial ecosystem.

Artificial intelligence (AI), with its capabilities for pattern recognition and prediction, is being used for a host of processes and tasks in finance and banking. Banks and technology firms deploy AI for monitoring fraud, identifying breach points, and automating customer support tools. Additionally, AI has the potential to automate regulatory and compliance activities while incorporating

more data for both regulators and regulated institutions. At the Chicago Fed, we are exploring AI projects to support core work in economic research, bank supervision, and internal business processes—similar to the ways banks and their technology vendors are exploring the use of AI to gain efficiencies and new insights.

While artificial intelligence and machine learning can introduce efficiencies, this is an area where caution and a clear understanding of the risks are critical. Given that tasks such as underwriting and credit scoring rely on broader sets of data and algorithms to support lending decisions, financial institutions will need to frequently examine the impact of this approach. Responsible AI fundamentals are necessary to ensure that unintended bias that could have an adverse effect on borrowers and access to credit is addressed.

Real-time payments and FedNow

I would like to shift gears now and turn to current plans for innovation in the U.S. payment system. Here I see the Federal Reserve as a leader in promoting innovation both to speed up payments and to ensure resilience of the U.S. payment system.

Even with all of the advances in computing and communications technologies over the past few decades, the U.S. payment system still relies heavily on decades-old infrastructure. Indeed, real-time payments are generally unavailable in the U.S. As a result, a bill payment made by a consumer online can still take multiple days to post and settle. Contract workers who are not part of a regular

payroll could face delays in collecting their wages. Real-time payments offer the potential for people to gain access to money they earned immediately. For liquidity-constrained households, access to real-time payments could mean avoiding late fees, as well as potentially faster access to ad hoc payments like insurance payouts. For small businesses, immediate access to funds from a sale would provide the ability to invest in inventory more quickly, avoiding costly short-term financing. For contract workers, having immediate access and certainty of funds provides predictability and reduces risk.

The demand for faster payments and the possibility of increasing efficiency with such payments have inspired innovation by private actors. However, these innovations still rely on legacy infrastructure that involves delays—whether those delays are visible to end-users or not. For example, popular person-to-person payment services, such as Venmo and Zelle, actually mask back-end processes. As a result, even as funds may be available immediately, interbank settlement can take days. Many cryptocurrency trades also often rely on existing settlement infrastructure. Moreover, current innovations have had only limited reach. Checks often remain a desirable method of choice because they carry some enduring advantages for businesses and households that want to track their spending or include identifying information along with a payment, such as a purchase order number.

In August, the Federal Reserve announced plans to develop the FedNow service—a new, round-the-clock real-time payment and settlement service. FedNow will be accessible to all financial institutions and will leverage the

Federal Reserve System's connections with over 10,000 financial institutions across the U.S. This is a reach no single private-sector provider would be able to achieve on its own.

The goal of FedNow is to ensure efficiency and resiliency and broaden reach while operating in healthy competition with private-sector providers of real-time payments. The Fed's participation in real-time payments will ensure redundancy and reduce the risk of a single point of failure, and will also allow us to continue to serve the important role of providing liquidity and operational continuity in times of stress in real-time payments.

The move to faster payments has been a global goal. Other central banks and jurisdictions are in varying stages of development and market adoption of faster payment services. The U.S. has avoided mandates, primarily because of the size of our economy, our banking infrastructure, and our market-driven system for financial services. Instead, the U.S. has largely relied upon market-driven innovation and joint public-private collaboration to deliver advancements in payment services.

The decision to build FedNow has been several years in the making, and is the culmination of extensive industry engagement, market assessment, and dialogue with a diverse range of stakeholders. In 2015, the Federal Reserve released a paper titled "Strategies for improving the U.S. payment system." This paper outlined the Fed's broad commitment to modernizing the U.S. payment system. It also described the industry's desire to achieve positive outcomes involving faster

payment speed, system security, improvement of international payments, industry collaboration, and payment system efficiency.¹⁰ The Federal Reserve then led an effort to bring stakeholders in the payment system together to establish a vision for a faster payment system in the United States. The Faster Payments Task Force included a wide range of payment system stakeholders including providers, banks, consumer groups, corporations, and others.¹¹ The Task Force finalized their work in 2017. It issued ten recommended actions intended to deliver a safe, ubiquitous, faster payment ecosystem facilitated through industry-driven governance and collaboration. Two of these recommendations focused on the Fed's role in faster payments. The first called for the Federal Reserve to expand settlement windows to 24-7; and the second called on the Fed to assess other operational roles it may need to take to support the ubiquity of faster payments, competition in delivering them, and equitable access to them.¹²

As a result of these recommendations, the Federal Reserve conducted extensive outreach and sought public feedback on the potential to expand the Fed's role as an operator of real-time payments. A *Federal Register* notice requesting comments on the potential introduction of a faster payment settlement service generated over 400 responses representing 800 entities. Over 90 percent of those responses indicated support for the Fed offering a settlement service for

¹⁰ Federal Reserve System (2015).

¹¹ Details on the Faster Payments Task Force are available online, <https://fasterpaymentstaskforce.org/>.

¹² The goals and recommendations of the Faster Payments Task Force are available online, <https://fasterpaymentstaskforce.org/goals-and-recommendations/>.

faster payments. Responses highlighted the importance of safety and security in faster payments, noting the Fed's record of resiliency, especially during periods of stress. Another theme from the comments was that the Fed would ensure nationwide, equitable access to banks of all sizes by operating a real-time service for faster payments alongside a private-sector system. And finally, comments noted that a Federal Reserve real-time retail payment service would increase competition, decrease market concentration, and provide a neutral platform for innovation. The announcement of the FedNow service followed a close review of these supportive comments. In addition, the Fed gave careful consideration to the broad public benefit of faster payments; the Fed's ability to fully recover costs; and whether the private sector on its own could achieve faster payments with adequate scope, equity, and effectiveness.

Resiliency of the payment system

Real-time payments aren't about speed alone. The payment system must also be resilient in the face of financial stress. Central banks are a classic source of such resiliency. For example, as a lender of last resort, the Fed has the unique capacity to expand total liquidity in the financial system. This is crucial in times of stress when the overall demand for liquidity increases. The history of payments is filled with examples of private-sector innovation, but also with examples of the fragility of privately run payment systems. For example, scholars have found that one source of fragility during the Great Depression was the privately run correspondent banking system, that is, the system used mostly by non-Fed-member banks to clear payments. The failure of a correspondent bank during the

Great Depression resulted in a cascade of additional failures among its partner banks, known as respondents.¹³ Another example comes from the aftermath of the September 11th terrorist attacks. Communications interruptions in lower Manhattan led to disruption in payment flows.¹⁴ Sometimes fragility is more idiosyncratic. One well-known example is a computer failure in 1985 at a large New York bank, which has a central role in clearing transactions among financial institutions. The computer failure resulted in the inability of Bank of New York Mellon to receive any payments, leading to knock-on disruptions in the securities markets in which it had a large role.¹⁵ In the face of potential disruptions such as these to private real-time payment systems, the FedNow platform will provide an important source of redundancy and resiliency. By ensuring the system is secure and resilient, FedNow will engender confidence in the use of real-time payments.

Conclusion

In conclusion, financial technology has come a long way since checks journeyed hundreds of miles around the country. Central banks have had an important role in promoting this innovation, and indeed the Fed continues to innovate alongside private-sector actors. These are exciting times, and I look forward to seeing what the future will bring.

¹³ Richardson (2007).

¹⁴ Ferguson (2002).

¹⁵ Ennis and Price (2015).

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