Christopher J Waller: Technological advancements in payments

Speech by Mr Christopher J Waller, Member of the Board of Governors of the Federal Reserve System, at the Wyoming Blockchain Symposium 2025, Teton Village, Wyoming, 20 August 2025.

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Thank you for inviting me to speak today on payments innovation.[1] It is an exciting time to work in payments. While I have always been interested in the topic, I would have never imagined decades ago that payments would generate this amount of enthusiasm, where now some of the coolest jobs in tech are working in this area.

The payment system is experiencing what I have called a "technology-driven revolution," where the latest advances in computing power, data processing, and distributed networks have fueled growth in innovative new payment services.[2] This includes 24/7 instant payments, user-friendly digital wallets and mobile payment apps, and stablecoins and other digital assets. Alongside these new services sits enabling technology, such as artificial intelligence (AI), that has the potential to improve the precision and efficiency of the underlying payment products even further.

While there has been a lot of excitement, and admittedly sometimes hype, around the possibilities of these new technologies, there have also been some who have been fearful or skeptical of innovation in this space. But we only have to look to history to see that the evolution of the payment system has long been a story of technological advancement.

In any payment transaction, three things happen. First, an object is bought and paid for with another object. Second, there is a technology for conducting this transaction. Finally, there is a technology for recording the history of the transaction and ownership of the objects. For example, I can go to the grocery store and buy an apple and use a digital dollar in my checking account to pay for it. I tap my debit card on a card reader to conduct the transaction. Finally, the machine prints out a receipt, which is the record of the transaction. The same process applies to the crypto world. I buy a meme coin and use a stablecoin as the means of payment. The transaction takes place using a smart contract. Finally, the transaction is recorded on a distributed ledger.[3] There is nothing scary about this just because it occurs in the decentralized finance or defi world-this is simply new technology to transfer objects and record transactions. There is nothing to be afraid of when thinking about using smart contracts, tokenization, or distributed ledgers in everyday transactions.

The technologies available today might be new, but leveraging innovative technology to build new payment services is not a new story. What I'd like to emphasize today is that the private and public sectors can both embrace innovation within their respective roles.

First, I will recap how I generally approach these issues. I am a strong believer in the benefits of the free market. I hold the view that it is generally the private sector that can most reliably and efficiently allocate resources and take risks to explore the value of new technologies. I also see firsthand the important role the Federal Reserve plays in

fostering a payment and settlement system that is both safe and efficient. Such a system promotes a vibrant economy, since it allows for participation from a broad range of individuals and businesses without requiring them to invest heavily in bilateral arrangements.[4]

I would argue that broadly, there have been two models of payments innovation, which can be useful in characterizing the longer-term arc of payments evolution, as well as some recent developments. The first is private sector-driven innovation. As I have noted, this should be the default model. The second approach is where public sector entities like the Fed build platforms that enable the private sector to offer services to their customers. This should be done only rarely, and in instances where there is a specific market need. Both models are important in the payments ecosystem, and I'll walk through some historical and recent examples.

Let's take the first model of private sector-led innovation and use payment cards as an example. Early cards were metal plates or cardboard, then they incorporated magnetic strips, then chips, and now I tap my phone to pay. In the early days of consumer credit used for transactional purposes, privately operated card companies seized on the availability of new technology to support automated card authorizations and processing, continually upgrading over time, to build what are now global networks of interconnected banks that support the preferred payment method for consumers and many small businesses in the United States.[5] Here, the private sector demonstrated its ability to effectively build a payment service that met the needs of consumers, all based on proprietary technology. Even still, card networks interact with the broader payments, clearing, and settlement ecosystem, benefitting from Fed-operated payment infrastructures for settlement of interbank obligations.[6]

Stablecoins are the latest example of private sector-led innovation in payments.[7] The original use of stablecoins was to facilitate crypto trading. Crypto-asset prices can be volatile and as with any financial market, there is a need for traders to move out of relatively risky positions into safer ones with a stable asset price. As the stablecoin market matured, firms found that the properties of stablecoins using distributed ledger technology- including 24/7 availability, fast transferability, and their freely circulating nature -could be attractive for other use cases as well. That includes providing a means to access and hold U.S. dollars, particularly in countries with high inflation or without easy or affordable access to dollar cash or banking services. In fact, I believe that stablecoins have the potential to maintain and extend the role of the dollar internationally. Stablecoins also have the potential to improve retail and cross-border payments.

I spoke about the maturing stablecoin market in February of this year, and, at the time, I noted the need for a regulatory regime for stablecoins in the U.S to provide regulatory clarity and reduce regulatory fragmentation for market participants.[8] Last month, the GENIUS Act became the first major crypto-asset legislation to become law. This was an important step for the payment stablecoin market and could help stablecoins reach their full potential. Stablecoins, like card payments, are a private sector-driven innovation. And, like card payments, we see connections to the traditional payments, clearing, and settlement ecosystem. For example, many stablecoin arrangements use legacy payment services to fund and redeem stablecoin balances.

In addition to stablecoins, the use of AI in payments is an area where we are seeing significant private sector-led innovation. Here, AI is not serving as payments infrastructure but as an enabling technology that could bring considerable benefits to both private and public sector-operated payment services.

It may surprise some to learn that, within the financial sector, the payments industry has long been at the forefront of AI adoption. This is true for several major waves of AI technology. Since the early 1990s, payment firms have used machine learning for things like detecting fraud and money laundering, or predicting payment flows and trends.[9]

More recently, as large language models and generative AI have matured, payments innovators have used the technology to further enhance fraud detection and compliance systems and to make the cumbersome process of reconciling payments files more accurate and efficient. Agentic AI systems, which operate autonomously by planning and executing multistep processes, appear to be the next wave of AI advancement. While agentic AI is still in its early days, payments innovators in the private sector are once again channeling the promise of this technology and rapidly building out various use cases.

Now, let's touch briefly on the second model of public sector innovation of payments infrastructures to support the private sector. Almost since its founding, the Federal Reserve has provided core clearing and settlement infrastructure to maintain the safety and efficiency of the payment system. The Fed has consistently upgraded the infrastructure over time using the latest available technology. For example, in the early 20th century, interbank transfers were effected through telegraph wires-an early version of Fedwire-then through emerging forms of electronic payment messages. Now fast-forward to this century where we have interbank payment systems that process transactions in real time.[10] Banks, payment services providers, and even fintechs have used the infrastructure provided by the Fed to build payment services that their customers demand.

All of this is to demonstrate that the evolution of the payment system has long been a story of technological advancement. Much of this evolution has been led by private sector innovators. Key components have been supported by the Federal Reserve, either providing core infrastructure as a payment system operator or in convening the industry around specific solutions like payment standards.[11] These complementary roles have led to a U.S. payment system that operates safely and efficiently and serves as a backbone for commerce in the U.S. and globally. That is why it is important for the Federal Reserve to continue to embrace technological advancements to modernize its services and continue to support private sector innovation.

The Fed is also conducting technical research on the latest wave of innovations, including tokenization, smart contracts, and AI in payments. As a payment system operator, it is important to understand trends in payments technology so that we can continue to support private sector firms that leverage our infrastructures, as well as understand whether emerging technologies could provide opportunities to improve our existing platforms and services. Finally, we engage with innovators like you to better understand new technologies and their potential to improve payments. In fact, it is my

belief that the Federal Reserve could benefit from further engagement with innovators in industry, particularly as there is increased convergence between the traditional financial sector and the digital asset ecosystem. We are working on ways to further that engagement, so stay tuned.

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[1] Thank you to Alex Sproveri and Kirstin Wells of the Federal Reserve Board for their assistance in preparing this text. The views expressed here are my own and not necessarily those of my colleagues on the Federal Reserve Board.

[2] See Christopher J. Waller, "Reflections on Stablecoins and Payments Innovations," speech delivered via webcast at the 2021 Financial Stability Conference, cohosted by the Federal Reserve Bank of Cleveland and the Office of Financial Research, Cleveland, OH, November 17, 2021.

[3] See Christopher J Waller, "Centralized and Decentralized Finance: Substitutes or Complements?" speech delivered at the Vienna Macroeconomics Workshop, Institute of Advanced Studies, Vienna, Austria, October 18, 2024. Crypto-asset generally refers to any digital object traded using cryptographic techniques.

[4] See Christopher J. Waller, "What Roles Should the Private Sector and the Federal Reserve Play in Payments?" speech delivered at The Clearing House Annual Conference 2024, New York, NY, November 12, 2024.

[5] Data from the 2024 Diary of Consumer Payment Choice survey show that more than three-quarters of U.S. consumers prefer credit or debit cards for in-person payments. See Berhan Bayeh, Isaiah Nardone, Shaun O'Brien, and Hailey Phelps, *2025 Findings from the Diary of Consumer Payment Choice (PDF)* (Federal Reserve Financial Services, 2025).

[6] See Susan Herbst-Murphy, "Clearing and Settlement of Interbank Card Transactions (PDF)," Payment Cards Center Discussion Paper (Federal Reserve Bank of Philadelphia, October 2013).

[7] See Christopher J. Waller, "Reflections on a Maturing Stablecoin Market," speech delivered at A Very Stable Conference, San Francisco, CA, February 12, 2025. For the purposes of this speech, I will define stablecoins as a type of digital asset designed to maintain a stable value relative to a sovereign currency and backed at least one-to-one with safe and liquid assets.

[8] See Christopher J. Waller, "Reflections on a Maturing."

[9] For example, Visa began using neural networks for fraud detection as early as 1993. See Rajat Taneja, "30 years of AI and counting," *Visa Perspectives*, September 14, 2023, https://corporate.visa.com/en/sites/visa-perspectives/innovation/thirty-years-of-ai-and-counting.html.

[10] See Christopher J. Waller, "What Roles Should the Private."

[11] See Christopher J. Waller, "Payments Innovation, Technical Standards, and the Federal Reserve's Roles" speech delivered at the Federal Reserve Bank of Minneapolis, Minneapolis, MN, May 17, 2024.