

Christopher J Waller: Innovation and the future of finance

Speech by Mr Christopher J Waller, Member of the Board of Governors of the Federal Reserve System, at the Cryptocurrency and the Future of Global Finance, Sarasota, Florida, 20 April 2023.

* * *

Thank you to the Global Interdependence Center for inviting me to speak today. While my remarks will touch on crypto-assets, they are focused more broadly on innovation and the future of finance.¹

Innovation has been defined as "the introduction of novelties; the alteration of what is established by the introduction of new elements or forms."² This definition does not take a position on whether innovation is a good thing or a bad thing. To our modern ears, innovation generally has a positive connotation--it is something desirable that we want to foster. But it is important to remember that there is also a long tradition of viewing innovation with suspicion. This gets to a fundamental point: Innovation is a double-edged sword, with costs and benefits, and different effects on different groups of people. This is a lesson that we as financial regulators should bear in mind. Former Fed Chair Paul Volcker was a well-known critic of financial innovation, noting that, while credit default swaps and collateralized debt obligations may have helped some people hedge investment risks, they also played a key role in the Global Financial Crisis. He famously praised the automated teller machine as a beneficial bank innovation, but was skeptical about most other financial innovation.³ As we think about crypto-assets, or other forms of innovation, we need to think carefully about which edge of the sword we are looking at: Will the innovation create new efficiencies, help mitigate risks, increase financial inclusion; or will it create new or exacerbate existing risks?

Recently, I gave remarks on crypto-assets,⁴ discussing how individuals can make their own choices about whether to invest in speculative assets, but I also said that banks and other intermediaries choosing to engage in crypto-asset-related activities must do so in a safe and sound manner. At the same time, the world is rapidly changing, and we need to be open to the potential benefits of innovation. In that light, I am focusing my remarks on two areas of innovation that may have the potential to deliver substantial benefits--tokenization and artificial intelligence, or AI.

Tokenization

Let's start with tokenization. As I discussed in my prior remarks on crypto-assets, I think of the crypto ecosystem as consisting of several parts, including the database management protocol used to record trades, commonly referred to as blockchain. A blockchain is ultimately a type of distributed database that can be used to record data, including asset ownership and transactions in the asset (i.e., changes in asset ownership).⁵ To date, blockchain has primarily served as the ledger of record for crypto-assets, but it may be suitable to play a similar role for traditional assets, such as securities and derivatives.

Before a blockchain can be used to facilitate transactions in traditional assets, the assets must first be "tokenized"--that is, represented on the blockchain such that the blockchain becomes the ledger of record for the asset. At that point, parties can engage in transactions with the tokenized asset by updating records on the blockchain.

Why would a financial institution undertake this process to tokenize an asset? What advantages does blockchain offer relative to traditional approaches to conducting transactions? I do not intend to provide exhaustive answers to those questions here, but I do want to highlight several areas.

First, blockchain can offer fast or even near-real time transfers on a 24/7/365 basis, which, among other things, allows parties precise control over settlement times and in some cases, can enhance efficiencies and reduce liquidity risks. I will note, of course, that these benefits are not unique to blockchains. The Federal Reserve's FedNow service, which is set to begin operations in July, does not rely on blockchain; and it will provide safe and efficient instant payment services in real time, around the clock, every day of the year.

Another potential advantage of tokenized assets is that they are "programmable" and have "smart contract" functionality. A smart contract is a computer program stored on a blockchain, which can be programmed to execute predefined actions once certain conditions are met. When assets are tokenized, smart contracts can be used to construct *and* execute transactions involving the asset. When the smart contract is activated, the transaction proceeds automatically as long as the specified conditions are met. This is the sense in which smart contracts are smart: they do not depend on the parties to the transaction to implement them; instead, they implement themselves, based on the terms specified by the parties.

Smart contracts may allow for what is called "atomic settlement." Rather than relying on each party to separately carry out its leg of the transaction, smart contracts can effectively combine the two, or more, legs of the transaction into a single unified "atomic" act that is executed by the smart contract. This may be an additional robust way to achieve delivery-versus-payment ("DVP") and payment-versus-payment ("PVP") functionality, such that one leg of a transaction settles if and only if the other leg settles as well. Atomic settlement is useful because it can mitigate settlement and counterparty credit risks: it ensures that the buyer will not pay if the seller does not deliver; and conversely, that the seller will not deliver if the buyer does not pay.

In fact, private sector institutions are testing use cases to better understand the benefits and risks of this technology. Firms have executed foreign-exchange trades using blockchain technology with smart contracts in an attempt to improve efficiencies. Separately, financial institutions have used blockchain to facilitate intraday repo transactions. Parties to these transactions may have more flexibility as to when the transactions settle, which in turn has the potential to create additional capital and liquidity efficiency. And blockchain's atomic settlement functionality may serve as another way to achieve an important risk mitigant: using repurchase agreements as an example, the repo "seller" can have confidence that it will receive the specified loan amount in exchange for the collateral it conveys; while the repo "buyer" knows it will receive the specified collateral.

These efforts are still in early stages, but I expect that as functionality expands with more currencies, eligible securities, and new products, there will be more participation and growth.

That isn't to say that there aren't risks associated with tokenization and the use of smart contracts: smart contracts can have bugs and potential cyber vulnerabilities; and instantaneous settlement raises its own set of risks. But there is considerable promise, and I look forward to seeing what private sector participants come up with to potentially enhance the way traditional transactions are conducted.

Artificial Intelligence

The second area I will discuss is artificial intelligence. Can you go anywhere without hearing about AI? AI, as I am sure you know, is currently seeing a surge in interest thanks to so-called generative language models. These types of models can provide complex responses to user requests in conversational prose that comes very close to passing the famous "Turing Test" for artificial intelligence. You could ask it to write you a 10-page story that involves foxes, and a fairly polished short story will be ready for you in a matter of seconds. It can also develop presentations, summarize documents, do elementary coding, and perform a host of other functions, all at superhuman speeds.

By now, it has been well-documented that these generative language models remain fallible, and that the technology still has a way to go. Its responses are often inaccurate, although even in those cases, it often *sounds* like it knows what it is talking about. As with other sources of information, it is important for anyone using these tools to review the output with an appropriately critical eye and not take it at face value.

But the advances keep coming, and we can only speculate as to what these models will be capable of in the coming years. So, what does all this mean for banking? Banks are already testing or using AI in a variety of areas. Banks have started to use AI models to generate personalized product suggestions for their customers, and AI can even generate and send a customized marketing email to that customer based on the model's product recommendations. Banks are also looking to AI for a range of customer service applications such as chatbots that can help reset passwords, locate a branch or ATM, and check account balances without the need for human intervention. AI has also proven useful for fraud monitoring: it can, for example, help banks spot potentially fraudulent credit card transactions, including by identifying new spending patterns that are indicative of fraud.

Banks have also begun to explore the potential for using AI to refine their credit underwriting process and analysis, with the potential to speed up underwriting decisions and lower loan pricing.

Like many innovations, AI involves novel risks, or at least new variations on old risks. AI models are only as good as the data they are trained on. This can raise challenges when AI depends on high volumes and different varieties of data, which can complicate efforts to detect problems or biases in datasets. Another key consideration is the "black box" problem, because with some AI models it can be difficult to explain how they arrive

at outputs given a set of inputs (this is often called a lack of explainability). In some cases, even the AI developers themselves may not know precisely how the AI approach works.

As I noted, we are already seeing banks use AI in a number of ways, and we have regular discussions with them about understanding and managing the associated risks.⁶ Whether and how they might make use of generative language models remains to be seen. The technology may bring new efficiencies to banks' software development processes; or have applications in customer service; or it may be useful in some way we haven't foreseen yet. As with tokenized assets, I am curious to see how banks may make further use of AI. I also want to make sure they do that responsibly.

Conclusion

Tokenization and AI are just a few of the innovations that may ultimately come to play a prominent role in banking and, for that matter, more broadly in the economy. I could just as easily today have talked about Web3 or quantum computing. All of these innovations will have their champions, who make claims about how their innovation will change the world; and I think it's important to view such claims critically. But it's equally important to challenge the doubters, who insist that these innovations are much ado about nothing, or that they will end in disaster. The world will change, and we should encourage innovations that show promise for benefitting society, including the financial services sector.

¹ The views expressed here are my own and are not necessarily those of my colleagues on the Federal Reserve Board.

² "Innovation," Oxford English Dictionary, accessed April 18, 2023, <https://www.oed.com/view/Entry/96311?redirectedFrom=innovation#eid>.

³ Paul Volcker, "Paul Volcker: Think More Boldly," *The Wall Street Journal*, December 14, 2009, <https://www.wsj.com/articles/SB10001424052748704825504574586330960597134>.

⁴ Christopher J. Waller, "[Thoughts on the Crypto Ecosystem](#)" (speech at the Global Interdependence Center Conference: Digital Money, Decentralized Finance, and the Puzzle of Crypto, La Jolla, CA, February 10, 2023).

⁵ The remainder of this speech refers to tokenized assets that are represented on a blockchain. But assets can also be tokenized on other forms of distributed ledger technology.

⁶ Request for Information and Comment on Financial Institutions' Use of Artificial Intelligence, Including Machine Learning, 86 Fed. Reg. 16837 (March 31, 2021).