

Dear Federal Reserve Board,

The Digital Dollar Project is pleased to submit the attached response to the Federal Reserve Board's January 2022 Research and Analysis: "*Money and Payments: The US Dollar in the Age of Digital Transformation.*"

The Digital Dollar Project is a non-profit organization with a mission to encourage research and public discussion on the potential advantages and challenges of central bank digital currency (CBDC), convene private sector thought leaders and actors, and help inform national policy in consideration of the development of a U.S. digital dollar. See:

www.DigitalDollarProject.org

The Digital Dollar Project believes that only pilot projects of CBDC usage conducted under real-world conditions can generate the empirical data necessary to adequately inform the design and deployment of central bank digital currency. That is why the Project has launched a series of exploratory pilot programs with private sector participants to further inform the public, policymakers, and the Federal Reserve on the implications of various CBDC use cases. The Project looks forward to publishing the results of such pilot projects for public review and analysis and serving as a resource to inform this critical public policy discussion.

We welcome your consideration of our views and proposals in our submission and the Project's ongoing work.

Yours sincerely,

J. Christopher Giancarlo,

Executive Chairman

The Digital Dollar Project
Response to The Federal Reserve Board
Money and Payments: The US Dollar in the Age of Digital Transformation¹

Introduction

The Digital Dollar Project (DDP) is a non-profit organization with a mission to encourage research and public discussion on the potential advantages of a digital dollar, convene private sector thought leaders and actors, and help inform national policy.

CBDC Benefits, Risks, and Policy Considerations

1. [What additional potential benefits, policy considerations, or risks of a CBDC may exist that have not been raised in this paper?](#)

The DDP looks forward to the Federal Reserve Board's (FRB) planned deeper studies into financial inclusion and programmability as key benefits of a Digital Dollar. Although the FRB paper discusses various applications and use cases for CBDC, the paper doesn't discuss interoperability in detail, a feature that will be critical for widespread adoption and utility. By acting as a base layer for digital economic activity, CBDC could facilitate interoperability globally across digital asset networks. Designing a CBDC that enables intelligent interoperability to connect with current and future financial infrastructure systems domestically and abroad would advance the dollar's role in global transactions such as trade or remittances.

In the FRB discussion paper, there is also an absence of the potential benefits that CBDC could provide to wholesale settlements and capital market infrastructure. As tokenized economies emerge, a natively tokenized US central bank currency could complement the account-based Fedwire and FedNow systems and provide a modernized payment system. CBDC settlement for clearing and settlements could reduce counterparty risk and trapped liquidity, increase capital efficiencies, provide a more efficient, automated workflow, guarantee that cash and securities are delivered, and provide added transparency to regulators. While these benefits have been proven in other pilots globally, the DDP is pleased to explore further and quantify the benefits of CBDC settlement to support the US post-trade infrastructure

¹ Money and Payments: The US Dollar in the Age of Digital Transformation,
<https://www.federalreserve.gov/publications/files/money-and-payments-20220120.pdf>

during the Lithium Pilot Program with the DTCC². The data and outcome of this pilot will be made broadly available to the public and the Federal Reserve Board members in their consideration of a CBDC.

2. Could some or all of the potential benefits of a CBDC be better achieved in a different way

Although there are diverse payment solutions in the US, a Digital Dollar is the only medium that could provide a digital and cash-like bearer token issued by the central bank. It is possible that the benefits of CBDC can be idiosyncratically addressed by other solutions; however, they likely would be point solutions, whereas a tokenized CBDC offers the potential for an extensible system that could be built upon and enable a new ecosystem of services. Furthermore, a CBDC is the only instrument that could provide the transactional benefits of digital currency with the stability, trust, and risk weighting of central bank money. A CBDC is not antithetical to the development of other digital assets and rather provides consumers greater optionality across payment types and digital asset activities. The DDP envisions CBDC as an underlying asset network upon which industry participants could provide unique and customized services (e.g., digital wallets, banking capabilities, stablecoins, and automated payment information).

3. Could a CBDC affect financial inclusion? Would the net effect be positive or negative for inclusion?

Depending on design choices, CBDC could provide financial institutions and financial technology companies – in partnership with community outreach efforts -- with the underlying CBDC technology upon which to build inclusive payment and banking services. Regulated institutions can develop digital wallets that provide unique services and cater to distinct user bases. The DDP believes that lower operational, technology and regulatory costs related to offering digital wallet solutions for the custody of tokenized digital dollars may hold advantages over traditional bank accounts in terms of expanding access to underserved populations. For example, if designed with assured privacy and manageable onboarding, CBDC could provide a more accessible and less expensive option for traditionally underbanked communities who pay high fees to access the digital payment ecosystem. Financial inclusion benefits will also depend on design considerations such as maintaining a cash-like model that provides offline payment abilities, privacy, potentially tiered identity verification requirements, and distribution through the two-tier banking system, inclusive of regulated fintech companies. The BIS has recently posited that although not a panacea, central banks could use CBDC as a tool to promote financial inclusion in "promoting innovation in the two-tiered payment system, offering a robust and low-cost public sector technological basis and novel interfaces, facilitating enrolment and education on CBDC, and fostering

² Learn more about the Lithium Pilot Program with the DTCC, www.dtcc.com/news/2022/april/12/dtcc-building-industrys-first-prototype-to-supports-digital-us-currency

interoperability among multiple dimensions".³ Privacy will be critical to realizing the potential inclusion benefits of CBDC. Some portion of the unbanked prefer not to place their money in banks due to privacy concerns, and these people seem unlikely to transact heavily in a CBDC unless they are confident that privacy is assured.

Similarly, while it is vital to ensure robust KYC and other financial crime protections akin to what banks and other money services businesses have in place today, it will be critical to assure that these processes do not come at the cost of preventing people from accessing CBDC. Given how challenging it is to accurately verify identities, a better system for digital identity, or at least standards for such a system, could facilitate broad access to financial services when linked with CBDC distribution. In cases of disaster relief, such as distributing COVID relief funds, the US found challenges mainly in identifying the proper recipients, rather than a function of the speed in the payments systems.

4. How might a US CBDC affect the Federal Reserve's ability to effectively implement monetary policy in the pursuit of its maximum employment and price stability goals?

The Federal Reserve should view a US CBDC as a policy tool, not as a policy expression. Implementation of a digital dollar should be monetary policy neutral, without a view on issues of money supply. It is reasonable to expect that the Federal Reserve will be no less prudent in deploying and managing CBDC than it is in respect to the existing money supply.

5. How could a CBDC affect financial stability? Would the net effect be positive or negative for stability?

The impact of CBDC on financial stability will depend on how a CBDC is designed and deployed. The DDP recommends that the Federal Reserve continue its approach of engaging with the private sector to understand design requirements and build public confidence. If appropriately designed and distributed through banks and regulated intermediaries, with programmable money features, the negative effect of CBDC on financial stability could be negligible. A CBDC should not include features that would hinder the US Dollar as a store of value and safe-haven asset. There are appropriate concerns that a US CBDC might decrease money held in commercial banks. But without empirical data to gauge user habits, there is a lack of evidence to support any assumption of a change in commercial bank usage. There is also the potential that CBDC increases the flow of money into the banking sector, especially if previously un-or-under-banked communities shift US CBDC into bank accounts because of the ease of doing so. Only pilot projects of CBDC usage conducted under real-world conditions can generate the empirical data to know whether mobile devices and digital wallets provide attractive on-ramps for underbanked populations to move US CBDC to banking services offering interest on deposits and government insurance. Only real-world testing can answer whether the greater ease in converting

BIS, "Central bank digital currencies: a new tool in the financial inclusion toolkit?"
<https://www.bis.org/fsi/publ/insights41.htm>

commercial bank money into digital dollars would make people more or less likely to do so in a panic. More specifically, it is very possible that if consumers know they can readily convert commercial bank money (or FDIC insurance payouts) into a digital dollar, then there would be less reason to run on a bank.

6. [Could a CBDC adversely affect the financial sector? How might a CBDC affect the financial sector differently from stablecoins or other nonbank money?](#)

Concern has been raised that introducing a CBDC could lead to a disintermediation of the banking sector. However, the magnitude of potential impact is unclear and will depend on the design of a CBDC and how attractive it is to hold and use, compared to commercial bank money. The desire for consumers to hold and use CBDC tokens will depend on design considerations such as privacy, programmability, interoperability, and public confidence. To get these considerations right, the Federal Reserve should engage with the public to understand preferences and design trade-offs. Higher levels of disintermediation could have implications for the efficiency of credit provision in the economy – specifically, leading to more expensive credit and tighter lending criteria (already a challenge for the underserved communities). It is arguable that without safeguards or system assurances on convertibility, CBDCs could exacerbate financial instability during periods of economic stress as people would likely seek to substitute bank deposits with CBDCs. The same set of trade-offs that exist today between cash and account-based funds, such as immediate access, security, interest on account, and access to other financial services, will also apply to greater or lesser degrees in the future of CBDC and online banking. If consumers are confident in their ability to exchange CBDCs for FDIC insured commercial bank money, the banking relationship should mirror the current cash model.

7. [What tools could be considered to mitigate any adverse impact of CBDC on the financial sector? Would some of these tools diminish the potential benefits of a CBDC?](#)

The impact of CBDC on the financial sector will largely depend on the design and deployment of the network. Decisions such as issuing a non-interest bearing CBDC and not providing FDIC insurance over CBDC tokens should mitigate any adverse impacts of CBDC and maintain the existing cash usage model. To understand and mitigate any potential adverse impact(s), the Digital Dollar Project (DDP) encourages the Federal Reserve to work with private institutions and participants to understand how they would use a CBDC. Regulators can learn more about the implications of a CBDC issuance by performing gaming simulations, pilot programs, and research studies with broad stakeholder involvement. To this end, the DDP intends to facilitate exploratory pilot programs with industry participants to further inform the

Federal Reserve and the public on the implications of various CBDC use cases.⁴

8. [If cash usage declines, is it important to preserve the general public's access to a form of central bank money that can be used widely for payments?](#)

As economies and people become increasingly digitally connected, the government should consider offering an alternative to central bank issued physical cash that is natively digital and prepared for ongoing migration of economic activity to a digital environment. A CBDC that resembles cash could maintain the existing usage of money while capturing the consumer preference for electronic, non-account-based payments. A CBDC could co-exist as a viable, third format of US currency, alongside cash and reserve accounts. A well-designed, intermediated CBDC with programmable money features could enable low- or zero-cost transfers through new models of custody and transaction rails to be determined through experimentation.

9. [How might domestic and cross-border digital payments evolve in the absence of a US CBDC?](#)

In the past decade, there has been substantial advancement in digital payments. In some cases, private and public sector actors are developing scale payment platforms that can serve billions of users. These platforms are usually accounts-based and centralized, which raises privacy, resiliency, and security concerns. If countries like the U.S. do not actively explore payment system design, it is likely that foreign centralized, scale platforms will gain further market share. Robust discussion around privacy expectations and practices may also be neglected.

Domestically, retail and wholesale stablecoin payment solutions are testing traditional account and message-based payment networks. Programmable money is a powerful tool that will continue to provide automation benefits from smart contracts, such as reoccurring and fractional payments across open economic systems. Stablecoin solutions are growing and evolving rapidly, though they would benefit from clear and coherent regulatory frameworks. In March 2022, the transaction volume of stablecoins backed by dollars was worth \$500 Billion.⁵ Although the leading stablecoins are denominated in dollars, the US should further solidify dollar-denominated digital networks. These payment networks are typically underpinned by the Dollar, which still requires the movement of dollars at the end of the transaction. A CBDC could make stablecoin transactions more efficient by connecting stablecoin networks to CBDC networks. In the absence of a US CBDC, foreign CBDCs and scale payments networks will increasingly provide

⁴ "Digital Dollar Project to Launch Pilot Programs to Explore Designs and Uses of a U.S. Central Bank Digital Currency" newsroom.accenture.com/news/digital-dollar-project-to-launch-pilot-programs-to-explore-designs-and-uses-of-a-us-central-bank-digital-currency.htm

⁵ In March 2022, the transaction volume of stablecoins backed by dollars was worth \$500 Billion, www.theblockcrypto.com/data/decentralized-finance/stablecoins/adjusted-on-chain-volume-of-stablecoins-monthly

modernized payment rails across wholesale and retail users.

10. How should decisions by other large economy nations to issue CBDCs influence the decision whether the United States should do so?

The decision of other large economy nations to issue CBDC will have a meaningful impact on global finance and America's economy. Preserving the dollar's central role in the global economy is an appropriate and correct objective of US policy. Foreign countries are developing CBDC capabilities to replace traditional payment rails and provide CBDC as a service to global financial participants. The global leaders of CBDC exploration will dictate the technology and standards in CBDC development. The Digital Dollar Project hopes that the US will take a leadership role and design a CBDC that upholds our democratic values of freedom, economic stability, and personal privacy.

In a CBDC future, the US should be engaged and lead discussions regarding governance, interoperability, security, privacy, and scalability standards, rather than reacting to foreign CBDC decisions. CBDC usage for wholesale transactions will be critically important to facilitate the continued role of the dollar as an international trade settlement currency. Recent work internationally has demonstrated the utility of a wholesale CBDC. The Banque de France demonstrated the ability to settle in a foreign currency outside of the issuing nation while still providing transaction data to the issuing central bank.⁶ The Bank of International Settlements Innovation Hub has been exploring the requirements to link wholesale infrastructure to CBDC networks. This work portrays an important ability for global nations to use central bank money. Overall, while technology is but one factor underpinning global currency use and adoption, it is an important one – the US must future-proof the role of the Dollar in an increasingly digital world.

In early 2021, the Hoover Institute convened a working group of distinguished experts in national security, finance, economics, central banking, technology policy, and computer science to study the global implications of the digital yuan, or e-CNY, China's central bank digital currency. During the period of study, over 250 million Chinese people have opted into the e-CNY. In March 2022, the working group issued its analysis⁷, which detailed the degree to which China has established first-mover advantage in, not only the deployment, but the technical underpinnings of CBDC. The study notes that e-CNY will be a digital substitute for paper money, grant more Chinese people access to the banking system, and provide Beijing with greater oversight and control of business and individual financial transactions. It warns that the e-CNY enhances Beijing's ability to exercise political control over Chinese society and provides a significant opportunity for China to cement its international leadership of payment technology innovation and adoption, set economic norms

⁶ "Banque de France, Bank for International Settlements and Swiss National Bank conclude successful cross-border wholesale CBDC experiment", www.banque-france.fr/en/communique-de-presse/banque-de-france-bank-international-settlements-and-swiss-national-bank-conclude-successful-cross

⁷ Digital Currencies: The US, China, And The World At A Crossroads, edited by Darrell Duffie & Elizabeth Economy, Hoover Institution, March 4, 2022, at: https://www.hoover.org/sites/default/files/research/docs/duffie-economy_digitalcurrencies_web_revised.pdf

and technical standards that align with its authoritarian governance system, and increase its ability to undercut the traditional dominance of the US dollar as a source of geo-economic and strategic influence. The Hoover study warns that the spread of the e-CNY might diminish the role of the dollar as the world's reserve currency and undermine the ability of the United States to deploy financial sanctions against rogue international actors.

The Hoover study proposes a pathway toward revitalizing US financial leadership on the international stage in the digital age. It calls on the United States to respond to a spectrum of key policy concerns raised by the e-CNY and improve incentives for innovation and competition in its own payment systems. It advocates expediting development of technology and standards for a possible digital dollar affirmatively committed to democratic norms of privacy, accountability, transparency, and security in shaping the global rules surrounding central bank digital currencies. The Hoover study offers three broad recommendations for a US response to the emergence of non-USD CBDC: The United States should launch a well-resourced CBDC research and development effort drawing on the talent of US government, private sector, and university actors to ensure privacy, prevent illegal payments, and provide for a competitive and innovative payment landscape. The United States should establish a strategic plan for payment systems in the US digital economy that provides for the development of data privacy standards and the integration of CBDCs, fast-payment systems, and private payment arrangements, such as stablecoins. The United States should step up to lead the development of an international regulatory framework around digital currencies, including CBDCs, that prioritizes consumer protection, privacy, financial anti-crime compliance, financial stability, and the protection of monetary sovereignty.

11. Are there additional ways to manage potential risks associated with CBDC that were not raised in this paper?

The Federal Reserve should continue CBDC experimentation with the private sector on diverse use cases to understand potential risks associated with CBDC. Real-world testing and engagement is necessary to uncover CBDC implications on markets and users.

12. How could a CBDC provide privacy to consumers without providing complete anonymity and facilitating illicit financial activity?

The geo-political and economic challenge of China's e-CNY is significant and should not be ignored. Yet, it should also not be overstated or feared. The goal of a free society should not be to emulate a closed one. The US did not vanquish the Soviet Union by emulating the USSR's failed centrally controlled economy. Rather, the US out-performed and better served its citizenry through the efficiency and dynamism of its free market, incentive-based private sector economy and the endurance of its aspirational ideals of individual liberty. The challenge of the e-CNY calls for a similar return to free

society fundamentals. If the US is to assert a leading role in setting global standards for CBDC, just as it was a leader in setting the standards for the first wave of the Internet, then it must expand its exploration of CBDC itself. But it must do so in a way that is consistent with democratic values of individual liberty, freedom of speech, personal privacy, limited government, and the rule of law.

Some of those ideals are set out in the US Constitution including freedom of speech, assembly, and worship and the Fourth Amendment's right to personal privacy. From that amendment stems a body of jurisprudence defining the balance between an individual's right to privacy and the federal government's limited ability to abridge that privacy in pursuit of legitimate law enforcement, national defense, or other overriding objectives.

Although a right to financial and information privacy is not specifically established by the Fourth Amendment, for the last half-century, courts have generally protected privacy using a doctrine called "reasonable expectation of privacy." Even so, Fourth Amendment privacy protections have been eroded considerably since the attacks of September 11, 2001. In fact, no account-based financial transactions are truly private because, in every case, they require personal identity as a prerequisite step. The Fourth Amendment's jurisprudence needs to evolve further in this digital era to renew the balance between economic privacy with other societal priorities.

There is no "consumer transaction" limitation contained in the Fourth Amendment. Privacy protections, constitutional or otherwise, must clearly apply to data generated by all legal use, not just consumer use, of a US CBDC if it is to enjoy broad societal support. The Digital Dollar Project believes a well-functioning US CBDC should be private, secure, accessible, and transparent⁸

Without inviolable protections for such civil liberties as freedom of speech, assembly, free enterprise, and individual economic privacy, a US CBDC would be no more worthy of a democratic society than the currency of an authoritarian one. The American people – and free people everywhere - have everything to gain by encoding into a US CBDC stout protections for individual liberty and privacy. The US has everything to lose by neglecting it. The issue is essential to the future of real democracy.

With the proper Fourth Amendment jurisprudence and thoughtful design choices relating to anonymity and individual privacy, a US CBDC could well enjoy superior privacy protections than many competing instruments—whether provided by commercial interests or other sovereigns. A US CBDC may have certain advantages over non-sovereign stablecoins if it is properly and affirmatively bound by constitutional Fourth Amendment protections, to which private stablecoins would not be subject. Coding traditional democratic ideals of economic liberty and privacy into a US CBDC will greatly enhance its global appeal. Hundreds of millions of people here and abroad may well be reluctant to surrender their

⁸ http://digitaldollarproject.org/wp-content/uploads/2021/05/Digital-Dollar-Project-Whitepaper_vF_7_13_20.pdf

economic security and autonomy to authoritarian state surveillance simply for the convenience of digital payments. As it has often in its history, the US has the opportunity to lead in a way consistent with its finest ideals.

Protecting constitutional privacy rights while ensuring effective law enforcement can be achieved by taking advantage of the design flexibility of digitally based CBDC, where technology constraints are less restrictive of policy objectives than traditional analog systems. A US CBDC could be constructed to provide privacy to citizens by maintaining a two-tiered banking system where banks, fintechs, and other service providers conduct identity verifications, just as they do in today's model. Identity verifications can be tiered and specific to the type of activity that customers are conducting. Identity management can leverage zero-knowledge-proofs and verifiable credentials to maintain data privacy. Criminal activity enforcement should follow today's existing legal model where financial institutions have oversight over their customers, and the government can only access customer user information through a subpoena.

13. How could a CBDC be designed to foster operational and cyber resiliency? What operational or cyber risks might be unavoidable?

One of the key attributes sought by many central banks is developing a new, independent payment rail that can be used by consumers and businesses alike in times of a national crisis. The design of a CBDC should be flexible and modular to foster operational and cyber resilience as the network continues to scale. Notwithstanding these features, it remains an open question what type of payment rail or system should underpin a CBDC, and the Fed is largely silent on this topic in its discussion paper. The DDP strongly encourages the Fed to focus exploratory work on appropriate CBDC rails as ultimate selection will have a profound impact on system governance, interoperability, security, resiliency, and privacy. More specifically, CBDC rail options range from a centralized government database to open public blockchains to middle-ground permissioned blockchains with curated nodes and validators. While testing is necessary to better understand technical, operational, and governance implications of underlying CBDC rails, DDP suggests that the Fed should avoid pursuing a highly centralized database system. Such an approach could raise critical security and resiliency concerns. A highly centralized database would also raise privacy concerns given the "honey-pot" of information contained in a centralized place. Finally, a centralized database would likely have interoperability disadvantages relative to more open ledger designs.

A likely preferable design approach would focus on a DLT-based or inspired CBDC network that prevents a single point of attack. If designed as a distributed network, such a network would definitionally be a more resilient and redundant data construct. Additionally, a blockchain-based CBDC could utilize a multi-signature wallet to stop single-channel attacks. Funds could be verified and transacted locally within a wallet. If a CBDC enabled offline payments during low or no network connection, the system would be resilient to operational failures or disruptions such as natural disasters, electrical outages, and other issues.

To this end, systems designed with distributed architectural components and validations can continue to operate when other parts of the network are offline or unavailable. In an extreme case, if the entire system goes offline, then the ability to conduct transactions offline allows digital currency to exhibit a degree of resiliency regardless of its online/offline status. Offline transactions will no doubt have limits as security of these transactions are directly proportional to the storage capacity in secure end-devices such as chip cards or secure storage options.

Unavoidable cyber risks include cryptographic algorithm insecurity over the lifetime of any digital currency used. Digital currencies are typically comprised of cryptographic keys that are intended to be resistant to attacks. There is a direct correlation between the strength of algorithm used, the size of the cryptographic key material, the compute time to generate the encrypted or signed data, the time value of the data, and the compute time to cryptographically 'break' or compute the above with access to the key. Evaluation of cryptography durability is an area of focus and exploration for central banks. Much like how security features on old physical bills are easier to replicate, the design must consider a modular infrastructure that prepares for advancements in attack capabilities. Certain security features may have tradeoffs that reduce functionality or may not be enforceable, e.g., recall old digital currencies and re-issue new ones. Further exploration and experimentation into the design requirements of diverse use cases will help shed light on the potential risks and design trade-offs.

14. Should a CBDC be legal tender?

As a complement to cash, which holds legal tender status, a CBDC should be treated the same as its physical counterpart. Of note, however, legal tender status in the US means something different from most countries. Neither the statute (31 US Code § 5103) nor any federal law compels an individual or entity to accept currency or coins as payment for goods and services. Therefore, legal tender status would not guarantee CBDC acceptance.

CBDC Design

15. Should a CBDC pay interest? If so, why and how? If not, why not?

Like physical cash, which does not pay interest, a CBDC should not pay interest. Notably, most countries exploring CBDCs around the world do not propose to pay interest.

While an interest-bearing CBDC could serve as a monetary policy tool, it would compete against existing depository institutions with negative implications for the financial sector, including potential bank disintermediation, increased cost of credit, and possible disruption of money market funds and other short-term assets. Further, elevated redemptions to a US CBDC during times of financial stress could exacerbate a troubled economy. Importantly, a remunerated CBDC would make it attractive to hoard money, whereas today, it is impractical to store significant amounts of cash.

An interest-bearing CBDC also raises the possibility of negative interest-bearing CBDC tokens, incentivizing dollar spending but lowering public confidence in dollars. Critically, implementing an interest rate on CBDC could have other far-reaching ramifications, including the heightened risk of the Federal Reserve being viewed as an agent of the government rather than the independent institution it is intended to serve today.

16. Should the amount of CBDC held by a single end user be subject to quantity limits?

If a US CBDC does not bear interest, consumers will likely be incentivized to continue to hold their money in an interest bearing commercial bank account as opposed to accumulating significant CBDC holdings. This of course, is dependent on economic considerations such as how much interest is being paid and current inflation rates. CBDC could be perceived as a safer alternative to other government liabilities (e.g., Treasuries subject to interest rate and liquidity risk). DDP believes that the key questions are whether the impacts on the structure of the banking system or the implementation of monetary policy under extreme scenarios would be significant enough to warrant imposing and enforcing limits. Limits would ideally be avoided in the long-term but perhaps considered during earlier, testing phases.

17. What types of firms should serve as intermediaries for CBDC? What should be the role and regulatory structure for these intermediaries?

A fully mature CBDC ecosystem will require healthy involvement from diverse intermediaries. CBDC is a government responsibility, but one that most thoughtfully and carefully integrates with private sector technologies and intermediaries. CBDC infrastructure will require similar industry involvement as existing cash, commercial bank, and reserve-account payment infrastructures that require significant involvement from the private sector to control onboarding, security, governance, management, and reporting. Commercial banks, technology companies, fintechs, retail users, clearing and settlement institutions will all be key partners and will require regulatory frameworks that ensure healthy network usage.

With respect to distribution of CBDC, it is important that the Fed leverage the commercial capabilities of the private sector in order to maximize access and financial inclusion benefits. For this reason, as previously noted, a digital dollar should be offered to consumers through banks and regulated fintech firms. Fintech, in particular, holds promise in broadening distribution of digital wallets in order to reach un-and-under-banked individuals.

With respect to CBDC payment rails, the private sector should be involved in helping to develop and operationalize the system. For example, if a blockchain-based system is developed, then private sector entities, including non-profits or newly-formed utilities, could be tasked with helping to validate and maintain the distributed ledger. Careful governance requirements would need to be crafted regarding the specific roles and access to information of participants. By using

innovative cryptographic technologies across operators and participants in a CBDC network may be able to enhance privacy and limit any one actor's access to sensitive payments data.

18. Should a CBDC have "offline" capabilities? If so, how might that be achieved?

One of the key desirable features enabled by digital currencies is offline payments. Similar to the features of cash and banknotes, the offline capabilities of CBDCs are a crucial enabler and necessary for addressing remote users, stability in emergency scenarios, or potential network outages. Offline capabilities of CBDC have a unique set of challenges, namely the reconciliation of transactions that have been performed offline with the 'normal' state of the CBDC ledger when the wallet goes back online. Security controls at the endpoint prevent a user from double spending, and risk mitigation via transaction limits and volumes will prevent runaway conditions, if these controls are ever circumvented. The security controls are typically secure elements that have been deployed over many decades and have been battle-tested to provide security and resilience to cyber-attacks. Offline capabilities of CBDC are a risk management decision, and although there may be hesitation to enable this capability, there are various controls and mitigations that can enable offline features. Importantly, offline transaction capabilities preserve the existing cash ecology, which is inherently offline and peer-to-peer. The Digital Dollar Project intends to further explore technical architectures and requirements of offline transactions through future pilot programs.

19. Should a CBDC be designed to maximize ease of use and acceptance at the point of sale? If so, how?

Yes, the DDP believes a CBDC should be competitive and easy to use alongside existing forms of payment across various use cases. In order to further understand the preferences of users for CBDC adoption, the DDP recommends that the Federal Reserve continues to engage the private sector.

20. How could a CBDC be designed to achieve transferability across multiple payment platforms? Would new technology or technical standards be needed?

To support wide ranging use cases, a CBDC will need to enable transferability across traditional and DLT-based networks. CBDC development should consider emerging token standards, such as SWIFT's intended use of ISO-20022⁹ as viable future token networks that will aim to connect with future CBDC networks. In a CBDC system with diverse intermediaries, its design will need to support payments across networks and share transactional data. Earlier this year, Michael J. Hsu, the Acting Comptroller of the Currency spoke about the need for architecture standards and

⁹ <https://www.swift.com/standards/iso-20022/iso-20022-programme/timeline>

interoperability across stablecoin networks¹⁰. Hsu mentions that "without interoperability amongst USD-based stablecoins [and CBDC], the risk of digital ecosystems being fragmented and exclusive (with walled gardens) is heightened". CBDC architects should consider that digital asset networks will be commonplace in the future, and CBDC should be designed to support and enable those networks.

21. How might future technological innovations affect design and policy choices related to CBDC?

The inevitable evolution and advancement of technology should encourage architects to design an adaptable CBDC that can scale modularly over time. The foundation of a US CBDC network should set a framework that can evolve as technology changes as well. Quantum computing will challenge CBDC features such as hashing lengths as it matures. Careful design and testing will reveal evolving risks before they can occur. Healthy regulation and standards will also ensure that network intermediaries adhere to best practices and protect the network from bad actors.

22. Are there additional design principles that should be considered? Are there trade-offs around any of the identified design principles, especially in trying to achieve the potential benefits of a CBDC?

Considering the potential adoption of a CBDC, architects should consider the technical and functional requirements across diverse use cases. Throughput and transaction speed will be important scalability requirements as adoption increases. A tokenized architecture, that doesn't rely on account and messaging systems, has proven to be a superior CBDC design choice in many overseas CBDC experiments to address scalability requirements.

About The Digital Dollar Project (DDP)

A non-profit organization, The Digital Dollar Project was created to encourage research and public discussion on the potential advantages and challenges of a U.S. CBDC — or a "digital dollar." DDP will identify options for a CBDC solution to help enhance monetary policy effectiveness and financial stability; provide needed scalability, security and individual privacy in retail, wholesale and international payments; and integrate with existing financial infrastructures, including U.S. Federal Reserve-related projects. Read the DDP [Privacy Principles](#) and "[Digital Dollar Paper: Exploring a Digital Dollar](#)". Visit <http://digitaldollarproject.org>.

¹⁰ Acting Comptroller of the Currency, Michael J. Hsu, Remarks Before the Institute of International Economic Law at Georgetown University Law Center "Thoughts on the Architecture of Stablecoins", April 8, 2022 <https://www.occ.gov/news-issuances/speeches/2022/pub-speech-2022-37.pdf>