



On the Road to a U.S. Central Bank Digital Currency — Challenges and Opportunities

July 2021



On the Road to a U.S. Central Bank Digital Currency - Challenges and Opportunities

Preface

Legislators, policymakers, and central bankers seeking to establish a stable and successful United States (“U.S.”) Central Bank Digital Currency (“CBDC”) will need to consider various design options and their implications before developing or issuing CBDC in the U.S. This paper:

- (i) highlights significant implications of certain design and implementation choices that might be made with respect to a U.S. CBDC; and
- (ii) makes specific recommendations about CBDC, assuming the U.S. government may proceed with some form of CBDC implementation.

This paper also provides a brief summary of different approaches central banks around the world are taking to research or establish CBDCs in Appendix A, as well as a brief summary of CBDC-related research papers and events in the U.S. in Appendix B. This paper is a product of The Clearing House¹ (“TCH”) research, which focuses on challenges facing the U.S. financial sector, new developments relevant to the sector, and the role of banks in payments systems.

Executive Summary

Central banks around the world have begun researching, experimenting with, piloting, and even issuing digital equivalents of central-bank-issued paper currencies. Referred to as “central bank digital currencies,” or “CBDCs,” these currencies are a subset of digital currencies. Increasingly, it appears that the U.S. may be on a path to establishing a digital dollar, as the Federal Reserve has begun actively researching and experimenting with different digital currency designs, and Congress continues to look at U.S. CBDC as a means of addressing a wide range of policy objectives. However, whether the introduction of a U.S. CBDC is best suited to achieve these objectives, and whether a U.S. CBDC can be designed in a manner that would not negatively impact the health of the financial system or threaten financial stability, is far from clear.

A number of policy and legal considerations are integral to evaluating design options available for creating a CBDC. In some cases, these considerations are preconditions to issuing a CBDC — for example, questions about the legal authority to issue a CBDC. In other cases, these considerations are likely to influence the successful implementation or usability of a CBDC. Still other considerations reflect important effects on the financial system, particularly the banking and payments ecosystems likely to arise from specific CBDC design or implementation; as a result, policymakers must factor these considerations into CBDC-related policy decisions.

This paper identifies different CBDC designs, and the challenges and opportunities they present, as well as a number of important policy and legal considerations that must be addressed in order to provide a framework for discussion of the possible introduction of a CBDC in the U.S. This paper reflects a U.S. experience, and while many of the observations may resonate with those in other jurisdictions grappling with similar issues, it is not intended to present a view on CBDC generally. In particular, TCH makes the following recommendations and observations about the potential introduction of a U.S. CBDC:

- **Policymakers should articulate a clear purpose for a U.S. CBDC. Identifying the purpose is an essential first step, as it will inform other design choices that will need to be made to ensure that the CBDC’s stated purpose is being advanced. A clear purpose also enables policymakers to determine if there are other, less risky means available to meet the stated purpose and to more generally weigh the costs and benefits of a U.S. CBDC.**

- One frequently-articulated purpose for a U.S. CBDC — preservation of the U.S. dollar as a reserve currency — merits further study. There are numerous reasons the U.S. dollar is the world’s reserve currency of choice, including government and financial market stability, the primacy of the rule of law in the U.S., and other reasons that have nothing to do with whether the dollar is effectuated through a CBDC or otherwise. In particular, ongoing dialogue around CBDC would benefit from a better understanding of whether other nations’ central banks creating CBDCs actually poses a real and immediate threat to the status of the U.S. dollar as the world’s reserve currency and status as a preferred currency in both good and bad times. The ongoing discussion about CBDC as a means of preserving the U.S. dollar as a reserve currency would also benefit from the government conducting a wide-ranging study to determine whether there are ways in which the status of the U.S. dollar as the world’s reserve currency might be augmented without a U.S. CBDC.
- Another frequently-articulated purpose for a U.S. CBDC — financial inclusion (i.e., as a means of banking unbanked U.S. households and individuals) — often presupposes that CBDC will be account-based and made available directly to the public by the Federal Reserve. Regardless of whether the CBDC is account-based or token-based, U.S. CBDC may not be sufficiently additive in value to address the underlying challenges relating to banking the unbanked, particularly given the broad availability of low-cost and no-cost basic accounts at financial institutions across the U.S. Further, U.S. CBDC does not address a host of reasons households and individuals are unbanked in the U.S. in the first place (e.g., lack of trust in financial institutions and the government, a desire to be unknown to banking systems for privacy, and underlying access issues, such as a lack of reliable access to the internet, low levels of digital literacy, and lack of identification).
- **A U.S. CBDC is unlikely to be an equally effective tool for all of the purposes for which it has been advanced, or even to be effective for some stated purposes at all. The fitness of CBDC for specific purposes/use cases, and whether designing a CBDC for specific purposes will limit its effectiveness or utility for other purposes, as well as tradeoffs, should be thoroughly studied.**
- Congress should require the Treasury Department and the Federal Reserve to conduct a joint study of the specific purpose(s) for which they would consider issuing a U.S. CBDC. For each purpose, the study should

identify: (a) the likely impact of the introduction of CBDC on monetary and fiscal policy, financial stability, and the safety and soundness of the financial sector; the safety and efficiency of U.S. payments systems; and financial crime and sanctions evasion; (b) the likelihood that a U.S. CBDC would achieve the stated purpose; (c) whether there are other means of achieving the stated purpose at less cost or risk; and (d) tradeoffs that come with prioritizing a given purpose over other purposes.

- **Policymakers should continue to move cautiously with respect to evaluating and potentially introducing a U.S. CBDC.**

- **If the U.S. government ultimately proceeds with developing CBDC in some form, it is imperative that:**

- **There be a strong legal foundation underlying the CBDC that supports the purpose(s) for which it is being advanced.**
 - U.S. law is currently not sufficient to support a CBDC, except perhaps in the narrow use case of U.S. CBDC for interbank settlement of obligations. Any introduction of U.S. CBDC would require carefully crafted federal legislation that, among other things, describes the legal nature of CBDC, and the roles and responsibilities of relevant government entities and the private sector in the design, issuance, and on-going support of CBDC. If CBDC is designed to be interest bearing, the legislation would need to address whether the CBDC is a government security with terms determined by the Treasury Department or a tool for monetary policy subject to Federal Reserve control.
 - New laws (or revisions to existing laws) will be needed to address data protections with respect to both government and private sector collection, use, and the protection of data related to U.S. CBDC. In addition, new laws (or revisions to existing laws) will likely be needed to ensure that appropriate consumer protections and transaction risk allocation are in place, with a business model that enables potential losses to be absorbed.
- **Introduction of the CBDC does not threaten the health of the financial system by, for example, destabilizing existing domestic and foreign banking and payments ecosystems that are a large component of the financial system.**
 - If it is not right-sized, the introduction of a general purpose U.S. CBDC has significant potential to destabilize the financial services ecosystem and

drive out private sector investment, innovation, and competition.

- If a general purpose U.S. CBDC is introduced, it may be important in order to minimize destabilizing impacts for the design to replicate as closely as possible the role Federal Reserve notes play today, with the exception of geographic limitations imposed by the current non-digital qualities of Federal Reserve notes.
 - The use of paper currency for most Americans today is generally limited to small dollar, incidental transactions where the use of commercial bank money and other forms of electronic payments (e.g., e-money/stored value) might not otherwise be available or as convenient. Limiting the use of CBDC to these types of transactions could, for example, be partially effectuated through the imposition of transaction value limits, with safeguards against the evasion of those limits.
 - Establishing caps on the amount of CBDC holdings that individuals and businesses can maintain may be another way to minimize the destabilizing effect that a CBDC could have on the financial sector, as it could help preserve the deposit base of private financial institutions. Different holding caps for consumers and businesses would likely be required. Additionally, it may be beneficial for U.S. CBDC stored with financial institutions to be subject to fractional reserve requirements, allowing financial institutions to leverage CBDC holdings for lending purposes.
- Along with the use of CBDC ownership limits to minimize unintended consequences to the financial sector, a two-tier model leveraging regulated private sector entities may be the least disruptive way to implement a U.S. CBDC; though more study is needed and the exact details of the model,² including the degree to which the second tier may reflect the CBDC as a liability on individual companies' balance sheets, will be important.
 - A two-tier model may be best able to ensure that U.S. policy on anti-money laundering, terrorist financing, and sanctions is preserved. To minimize unintended consequences to U.S. policy in this area, the implementation may need to restrict or significantly limit the ability to conduct offline CBDC transactions or use self-hosted CBDC wallets where the end user is in control of their own private keys.
 - A two-tier model may offer opportunities to the

regulated private sector to innovate with CBDC product offerings and maintain a prominent role in payment activity.

- A two-tier model may also more smoothly enable “deposits” of general purpose CBDC where necessary or desired (i.e., enabling the general purpose CBDC to be readily convertible, or even in some instances automatically converted, into and out of commercial bank money at a bank, or private money at a non-bank provider). When a bank accepts cash today it typically credits it to a bank account. It does not typically hold that cash in a strong box for the customer.
- Unless CBDC is only intended to be created as a result of U.S. government payments to individuals and businesses, there will be a need for individuals and businesses to be able to “pay” to obtain U.S. CBDC. Today, this is typically done by converting commercial bank money to Federal Reserve notes at an ATM or teller.
- Similarly, unless CBDC is universally accepted and capable of supporting all payments, there is likely a need to be able to convert CBDC back to commercial bank or non-bank money. Even if CBDC can be used universally, consumers and

businesses should have the option to convert it to a different form of payment, especially if the other form of payment provides additional value (e.g., more customer protections, cheaper, etc.).

- Regulatory frameworks that could address concerns over the growth of private money being proffered by non-regulated institutions should be explored (e.g., the need to bring stablecoins into the regulatory perimeter as a clearly defined liability of a licensed issuer.)
- If a decision is made to introduce a wholesale token-based CBDC for purposes of interbank settlement, financial institutions will need the ability to convert CBDC into commercial bank money for use in general purpose transactions. Note that wholesale, non-token-based CBDC already exists in the form of Master Accounts at the Federal Reserve Banks³ and can be used to make payments across several central bank payment systems including the Fedwire Funds Service and FedACH, and, in 2023, the FedNow instant payment service. Policymakers should consider what the introduction of a wholesale CBDC system would achieve compared to potential enhancements to current Federal Reserve Bank payment systems (e.g., 24x7 operation of the Fedwire Funds Service) or those currently being developed (e.g., cross-border FedNow).

Table of Contents

- I. Central Bank Digital Currency — Overview7**
- II. Important Considerations for CBDC Evaluation, Experimentation, Design & Implementation10**
 - A. Establishing a Clear Purpose for a U.S. CBDC is a Vital First Step as Purpose Drives Design and Will Involve Important Policy Tradeoffs10**
 - B. Alternative Solutions13**
 - C. Observations & Recommendations16**
 - 1. A Strong Legal Foundation is Essential.....16**
 - 2. Do No Harm19**
 - 3. The Details Matter20**
- Conclusions22**
- Appendix A — Overview of Central Bank Digital Currency Projects Worldwide.....23**
- Appendix B — U.S. CBDC Scholarship & Focus.....27**

I. Central Bank Digital Currency - Overview

Central bank digital currency, or CBDC for short, has been defined in literature and scholarship in different ways,⁴ but for purposes of this paper is defined simply as: *a digital medium of exchange that is denominated in the national unit of account and that represents an obligation of the central bank or government that issues it.* By adopting this simple definition of CBDC, the paper avoids making any assumptions about the ultimate design of a U.S. CBDC,⁵ allowing the authors to explore various aspects of CBDC design. The terms “general purpose CBDC” and “wholesale CBDC,” when referenced in this paper, have the meanings most often used by central banks when discussing these forms of CBDC.⁶ “Wholesale CBDC” means CBDC issued to depository institutions for use solely to discharge interbank obligations, and “general purpose CBDC” means CBDC that may be used by any person or legal entity to make a payment.

The fact that CBDC represents an obligation of a central bank or government is what distinguishes it from the many forms of private digital currency that are available in the U.S. today.⁷ These forms of private digital currency include:

- both insured and uninsured obligations of a private entity including:
 - bank account balances (which represent an obligation of a bank to its account holder — also referred to as commercial bank money),
 - stored value or e-money accounts (which represent contractual obligations of other private, regulated entities, such as money services businesses, to their customers (e.g., accounts with PayPal)), or
 - a contractual obligation of an issuer of a digital currency to convert a customer’s digital currency holdings to some other form of “money” (this could be an implementation of a stablecoin⁸ where the terms of issuance require the issuer to provide the holder with a portion of the stablecoin reserves on demand⁹); or
- a digital “token” that derives its value solely because a segment of society views it as valuable (in other words, forms of money that are not liabilities of an issuer) (e.g., Bitcoin or Ethereum).

Private money has a long history in the U.S.¹⁰ and competes with money (or “public money”/“central bank money” as it is sometimes called) to some degree.¹¹ Where private money

represents the obligation of a private sector entity, regulated by the government (state or federal), to pay U.S. dollars to its customer, especially where the obligation is backed by federal deposit insurance, private money is for all practical purposes a substitute for public money.¹² But private money issued by unregulated entities (e.g., the stablecoin issued by Tether)¹³ and private token-based money that is not issued by anyone (e.g., Bitcoin, Ethereum)¹⁴ raise unique challenges for policymakers. At least with respect to private money issued by unregulated entities, U.S. CBDC is increasingly being viewed as an opportunity to better compete with these forms of digital currencies,¹⁵ thereby curtailing their usage in payments, and potentially advancing other public policies.

This hypothesis, that CBDC may aid central banks in achieving important public policies, has led central banks around the world to consider CBDC implementations (see Appendix A).¹⁶ While the details of the technology implementations vary significantly (e.g., distributed ledger versus single central ledgers, bar codes, tokens versus accounts, offline capabilities, etc.), the potential models being considered at a general level can be described as follows:

- **Wholesale CBDC only** — This model envisions CBDC as a technology advancement, but not necessarily a change to the traditional role of the central bank. The central bank would issue token-based CBDC to its normal account holders and, as is the case today with account-based central bank money, the CBDC could only be used to extinguish obligations between depository institutions (or in countries with open banking, the wider range of non-bank financial intermediaries that are authorized to maintain accounts with the central bank). The benefits of a wholesale model will generally depend on whether the technology used to create it can improve speed, security, resiliency, or other aspects of the payment rails currently operated by the central bank, or better advance delivery versus payment capabilities in the wholesale securities market than account-based solutions. It may also offer opportunities to speed up cross-border settlement of interbank obligations if wholesale CBDC is designed in cooperation with other central banks that are willing to “link” central bank payments systems and support foreign exchange settlement across the systems.¹⁷

- **Single-tier (sometimes referred to as “direct”) general purpose CBDC** — This model envisions CBDC issued by the central bank directly to the general public (both consumers and businesses). It can be offered by establishing accounts with the central bank for use by the general public that are similar to those the central bank currently maintains for depository institutions, or it can be offered through token issuance. Token-based CBDC can be designed to have many of the key attributes of government-issued paper currency – it is generally understood in a token system that the token is the thing of value, and whoever possess the token has the value.

Use of a token-based system also provides the possibility for peer-to-peer transactions, making it more akin to paper currency. By contrast, in an account-based CBDC system, the “value” is the right to instruct the central bank to decrease its indebtedness to the account holder and increase its indebtedness to a different account holder.¹⁸ As implied by this discussion, an account-based general purpose CBDC requires an implementation where the user’s identity (i.e., authority) to use the general purpose CBDC can be verified, whereas a token-based general purpose CBDC requires an implementation where the digital object (i.e., the token) can be verified.¹⁹ There is also the possibility of a mixed account-based and token-based single-tier model where general purpose CBDC tokens are stored in wallets that the central bank maintains for the general purpose customer.²⁰ Under this model, the wallet is similar to an account and can be established so that the wallet user’s identity must be verified before accessing the wallet’s content – the token or the keys needed to use the token.

Proponents of single-tier general purpose CBDC tend to believe it can advance financial inclusion efforts. However, the benefits of a single-tier general purpose CBDC, if there are any, most likely arise in the monetary policy sphere by providing a more direct avenue for central banks to implement policy, but its usefulness for even this purpose will depend on whether there is wide-scale acceptance of general purpose CBDC and whether the CBDC itself is designed to implement such policy (e.g., designed with an interest component). In general, and as detailed in this paper, single-tier general purpose CBDCs also have the highest likelihood of destabilizing the financial system (see *infra* Section C(2)).

- **Two-tier (sometimes referred to as “indirect”) general purpose CBDC** — This model envisions that the regulated private sector continues to play a role in supporting the general public’s use of government-issued money.

However, the private sector’s role in a two-tier model remains to be clearly defined. For example, it is possible that private sector distribution of a general purpose CBDC would be similar to the role depository institutions play today, where customers are able to convert their deposit balances or exchange an instrument (e.g., a check) for paper currency, with CBDC customers being able to convert their deposit balances to CBDC. There is also a potential role for the private sector in the “custody” of general purpose CBDC. While not necessarily described as custody, given the digital nature of general purpose CBDC, many two-tier designs envision that the private sector will help “store” the general purpose CBDC for its customers. In the U.S., this is often referred to as hosting digital dollar wallets. Implicit in the discussion of two-tier models is that the thing being “stored” remains a direct obligation of the central bank to the second tier customer, and not private money.

A benefit of this two-tier system is that it can continue to rely on the private sector for KYC/AML and sanction policy implementation, other customer facing support, and aspects of the security around general purpose CBDC. The positive realization of this benefit will at least in part turn on whether the general purpose CBDC design prohibits the use of the general purpose CBDC offline and in a manner that does not require any intermediation (e.g., holders of general purpose CBDC are not permitted to hold their own token/encryption keys or cannot transfer control of the general purpose CBDC without the involvement of a service provider, and without being tracked on a ledger).

Most general purpose CBDC model descriptions do not offer insight into how the private sector (or the government for that matter) is going to be able to recover the costs of these activities, including the significant on-going investment in cyber security that is required – and absorb any potential liability related to the provision of CBDC services, nor do they focus on the consequences that stem from a shift in the balance sheets of these intermediaries.

- **Combined or “hybrid” approach to general purpose CBDC** — This model allows both single-tier (meaning from the central bank, or “direct”) and two-tier (through a private sector actor or “indirect”) access to general purpose CBDC.

For almost a decade scholars and researchers have been expressing views on the need for and design of a U.S. CBDC (see Appendix B). More recently, the U.S. government has started to show an interest in a U.S. CBDC. This interest takes a variety of forms, from expressing curiosity in CBDC, or the fitness of CBDC-related technology for certain purposes, to

identifying use cases for certain types of CBDC. There are, however, significant questions as to whether a U.S. CBDC can be designed to serve one or more of the purposes for which it has been advanced without seriously jeopardizing U.S. monetary and financial stability, safety and soundness of the domestic and/or global banking sector, and the safety and efficiency of U.S. payments systems.

For this reason, this paper calls on policymakers to continue moving cautiously in potentially introducing a U.S. CBDC. Congress should require the Treasury and the Federal Reserve to conduct a joint study of the specific purpose(s) for which they would consider issuing a U.S. CBDC. For each purpose, the study should identify:

- The likely impact of the introduction of CBDC on monetary and fiscal policy, financial stability, and the safety and soundness of the banking sector; the safety and efficiency of U.S. payments systems; and financial crime and sanction evasion;
- The likelihood that a U.S. CBDC would achieve the stated purpose;
- Whether there are other means of achieving the stated purpose at less cost or risk;
- And tradeoffs that come with prioritizing a given purpose over other purposes.

Recognizing that the study this paper advocates for may result in continued calls for a U.S. CBDC, this paper also offers recommendations that must be explored in implementing CBDC to avoid causing unintended consequences.

II. Important Considerations for CBDC Evaluation, Experimentation, Design & Implementation

As detailed below, without a clear articulation of the purpose for introducing a U.S. CBDC, policymakers will not be able to determine whether the introduction of U.S. CBDC is likely to be successful in addressing the purpose for which it is intended, whether use of CBDC is necessary to achieve that purpose, or whether there are other options available that may be lower-cost or more suitable (such as real-time payments systems, enhancements to existing payment systems, and/or regulatory frameworks).

A. Establishing a Clear Purpose for a U.S. CBDC is a Vital First Step, as Purpose Drives Design and Will Involve Important Policy Tradeoffs

Perhaps the most important design consideration for a U.S. CBDC is its intended purpose, as CBDC design choices will need to be made understanding how such choices advance, or are in tension with, the purpose. The absence of a clear purpose results in discussions of design choice in the abstract, and gives rise to the impression that important policy implications can be easily managed by simply making other choices. As detailed in Section II(C), depending on the design of a CBDC, its introduction could threaten the viability of both domestic and foreign financial systems, eliminate consumer protections, exacerbate global environmental threats, and enable criminal activities, including money laundering and terrorist financing. Although there is almost always a way to avoid these outcomes by making different design choices, without a clear articulation of the purpose of a U.S. CBDC it is impossible to know whether these alternative design choices will advance or hinder the desired purpose. The clear articulation of the purpose to be served should be an absolute prerequisite to any U.S. CBDC proposal.

In that regard, there have been many potential reasons offered to support the introduction of CBDC.²¹ In the U.S., the reasons most often provided are: (a) financial inclusion, (b) the decline in the use of Federal Reserve currency (or, alternatively, control of the growth of unregulated, private sector cryptocurrencies), (c) reduction in cross-border payment frictions, (d) monetary policy enhancements, and (e) the preservation of the U.S. dollar as a reserve currency.²²

Each one of these potential purposes would require specific CBDC design choices. For example, if the purpose of

introducing CBDC is to control the growth of unregulated, private sector cryptocurrencies because of perceived concerns about their use, then the U.S. CBDC may need to mimic traits of a private sector cryptocurrency that make it attractive, and, where possible, improve upon what is offered. This likely means a U.S. CBDC that supports peer-to-peer payments with a high level of anonymity, maybe even supporting offline transactions where records of the transaction are not reflected on the ledger. As another example, a CBDC developed for the purpose of financial inclusion would likely need to be designed to leverage the banking industry to the greatest degree possible in order to provide the unbanked access to a wide range of channels and support systems, including physical bank branches, customer support services, and access to credit. CBDC designed to enhance monetary policy implementation would need to be designed to include interest, while a cross border payment solution may be better designed without an interest component. As still another example, a CBDC designed to maximize the status of the U.S. dollar as a reserve currency would need to permit foreign holding in all non-sanctioned countries and would need to have few or no limits on the amount of the holdings or the value of the permitted transactions.

As these examples demonstrate, what might be necessary or desired in the design of a CBDC to support one purpose may be in tension with what is needed to support a different purpose. Designing a U.S. CBDC to serve a specific purpose or purposes almost certainly means that it will be unable to serve other purposes as effectively, or at all. This observation – that it may not be possible to design a CBDC to serve all desired purposes – means that policymakers will need to prioritize the reasons for advancing a CBDC.

Closely related to the need to prioritize purposes for a CBDC, is the need to identify the policy tradeoffs that inevitably will need to be made to advance specific priorities. While not intended to be exhaustive, the following examples illustrate policy tradeoffs that will be faced if a U.S. CBDC is designed and implemented.

CBDC to Advance Financial Inclusion — CBDC has been viewed by many as a vehicle for financial inclusion. While discussions of some forms of CBDC, including, in particular,

account-based general purpose CBDC, can provide a framework for discussing financial inclusion in general, advocates for use of CBDC as a vehicle for financial inclusion often ignore the reasons households and individuals in the U.S. are unbanked or underbanked in the first place. For example, a segment of domestic unbanked consumers rely on cash and do not possess the tools (smartphones and devices capable of connecting to the internet, or internet access) that will likely be necessary to hold and use CBDC.²³ Moreover, CBDC, however it is designed, will struggle to address some of the most frequently cited reasons U.S. households are unbanked.²⁴ For example, there is no obvious reason consumers who do not trust banks, or who are concerned with the privacy implications of sharing information with anyone else, whether it be a commercial or governmental entity, would trust the Federal Reserve or be willing to accept privacy-related incongruities between cash and general purpose CBDC. If a CBDC were constructed principally as a tool for financial inclusion, then it would need to be usable offline (so as to avoid transaction records) and be constructed to have, at the very least, robust privacy protections in place – privacy protections that lessen the incongruities between cash and general purpose CBDC. Such a CBDC would also need to be accessible to individuals with little or no familiarity with technology and connected devices, be available to individuals with little or no access to broadband, address the challenges faced by the unbanked with respect to identification, and be structured to compliment efforts to introduce more traditional banking services, such as access to credit.

As suggested above, designing a CBDC that would appeal to the domestic unbanked and underbanked – such as a token-based CBDC that enables privacy via anonymity – would likely mean that the CBDC does not have features that would be optimal for tracking illicit activity or enforcing U.S. sanctions policy. In addition to forcing policymakers to consider the tradeoffs between potentially advancing financial inclusion and potentially introducing a tool for illicit activity, a CBDC designed for financial inclusion may not be suitable for other purposes, such as cross-border payments or to support use as a reserve currency, given the heightened need for AML and sanctions scrutiny in cross-border transactions and foreign holdings. Similarly, the need to resolve access challenges to maximize design for financial inclusion likely means that the Federal Reserve would need to offer services in retail locations. If done directly, or through partnering with other government entities such as the U.S. Postal Service, this could have wide-ranging and significant effects on the banking and payments sectors (*see infra* Section II(C)).

Decline in Use of Federal Reserve Notes (growth of unregulated stablecoins) — Concern over possible widespread use of certain unregulated private sector digital currencies, in particular, stablecoins, that are “issued” by unregulated entities is another driver for CBDC.²⁵ Facebook’s initial proposal for Libra caused many central bankers concern that they could ultimately cede control of the money supply to large tech giants,²⁶ and the growth of stablecoins like Tether that claim to be pegged to the a unit of currency like the dollar but may not be supported by sufficient liquid reserves raises concerns around financial stability.²⁷ The rise of unregulated cryptocurrencies like Bitcoin that have no issuer and are designed to circumvent government regulation have also raised concerns, but thus far those concerns have focused more on their use for illicit activities than as a substitute for “money.”²⁸

Among the attributes of stablecoins that make them appealing for payment transactions are their stable value, transaction anonymity, the ability to hold value that is beyond the reach of creditors, and the speed and global reach of transactions.²⁹ A CBDC designed to compete with unregulated stablecoins, therefore, would face several design challenges or tradeoffs. It would have to be international in scope and directly available to individuals around the world. But a U.S. CBDC, backed as it is by the Federal Reserve, could have significant destabilizing effects on foreign financial systems as populations in other parts of the world may prefer the relative safety and security of a U.S. central bank obligation. Foreign recipients of internationally transmitted U.S. CBDC would be the beneficiaries of 100% deposit protection from a foreign central bank – a benefit that they are unlikely to enjoy in their national banking system.³⁰ Second, the CBDC would need to have the same level of anonymity as stablecoins, as well as the ability to hold and transfer value that evades the reach of creditors and by-passes sanction programs. Those attributes could seriously undermine U.S. anti-money laundering policy goals related to the prevention of terrorist financing, the effectiveness of U.S. sanction programs, and the orderly administration of legal process in the U.S. and elsewhere.

Reduction in Cross-Border Payment Frictions — A CBDC designed to address cross-border payment frictions would face challenges similar to a CBDC designed to compete with stablecoins and unregulated private sector cryptocurrency in that it would have to be designed as international in scope and therefore could have a significant destabilizing effect on foreign financial systems. Being an obligation of the U.S. central bank, it could prove more attractive for foreigners to hold than their native currency, particularly

in times of stress. Further, most proposals to use CBDC to reduce frictions in cross-border payments assume that CBDC would be directly transferable and function essentially as a digital bearer instrument without depository financial institution intermediaries. The use of bearer instruments is, however, problematic from a financial crimes perspective.³¹ Physical bearer instruments are bounded by space – there is only so much money you can fit into a suitcase. Digital bearer instruments have no such limitation. Thus, to ensure appropriate scrutiny of transactions for AML and anti-terrorist financing and sanctions reasons, the CBDC would likely need to be designed for distribution through a two-tier system with regulated and supervised financial institutions or intermediaries engaged in performing AML and OFAC screening functions. But once you settle on a two-tier system, and on subjecting payments to AML and OFAC screening, you have reintroduced much of the friction that the use of a digital currency in cross-border payments could otherwise address. In addition, a two-tier system could also severely limit the CBDC's usefulness for financial inclusion purposes, given that the problem that financial inclusion is trying to solve is the lack of accounts at second-tier entities (i.e., banks).

CBDC to Enhance Monetary Policy — Because CBDC could be programmable or involve a direct on-going relationship with the central bank it could, in contrast to paper Federal Reserve notes, be designed to include certain features that would help support a more effective or targeted monetary policy.³² For example, CBDC that pays interest might also allow the Federal Reserve to reduce interest rates below zero (or the zero-lower bound) in the event of a deflationary spiral, and could increase Federal Reserve control over interest rates. Especially if programmable, CBDC could also be designed to accommodate rules such as defined expiration, or limited usability, which could permit more targeted monetary policy. Programmability, as a design feature, means the ability to predetermine the execution of certain operations if a set of conditions is met in the future.

The impact of CBDC on monetary policy is likely to present challenges alongside any benefits it poses – the policy tradeoff. Specifically, a CBDC designed for monetary policy implementation could lead to rapid and huge reductions in reserve balances (the deposits of commercial banks and other depository institutions at the Federal Reserve) when there is a flight to quality, driving up money-market interest rates and potentially destabilizing financial markets. To prepare for such swings in reserve balances, and to accommodate the potential demand for CBDC, the Federal Reserve would have to maintain a much larger balance sheet in normal times

than it does now, possibly more than one-third of GDP.³³ If investors in banks and other corporations shifted into CBDC in stress periods (which could occur very rapidly given the digital nature of CBDC) the Federal Reserve would need to replace the lost funding by lending potentially huge sums to banks and non-bank financial institutions, while purchasing correspondingly huge amounts of government and private securities. Also on the cost side, negative interest rates on cash may result in a public backlash.³⁴

As is the case with certain other policy tradeoffs, part of what the discussion above highlights is that CBDC will need to be right-sized – neither too big nor too small in distribution. If too small, CBDC will not meet any policy objectives. For example, you cannot meaningfully effectuate negative interest rates if CBDC distribution is too small. If CBDC is too big, however, then CBDC becomes a “category killer” in digital payments and deposits, with potential knock-on effects throughout the economy. Further, a CBDC designed for monetary policy purposes would need to be domestic in nature, thereby limiting its usefulness in addressing the rise of private cryptocurrencies, reducing frictions in cross-border payments, and preserving the role of the U.S. dollar as a reserve currency.

Preservation of U.S. Dollar as Reserve Currency — A CBDC designed to preserve the role of the U.S. dollar as the world's reserve currency faces many of the same challenges relating to the issuance of any CBDC that would be international in scope – including potential destabilization of the foreign financial systems, challenges around enforcement of anti-money laundering and anti-terrorist financing and sanction policies, and conflicts with the design of a CBDC to achieve financial inclusion and monetary policy goals. For example, a CBDC designed to address reserve currency goals could be designed for wholesale use only, to facilitate settlement of international interbank transactions, and thereby limit possible destabilizing effects. However, such a limitation could inhibit adoption as it would severely curtail the CBDC's overall usefulness for banks receiving the CBDC.

Technology decisions also come with tradeoffs — The technology options for implementing a U.S. CBDC also raise policy considerations and the potential to require tradeoffs. For example, certain distributed ledger technology (“DLT”) implementations, while arguably offering a higher level of resiliency and data integrity, raise serious environmental concerns. A DLT implementation is therefore more likely to require tradeoffs with U.S. environmental policy given the huge stores of computing power that are often needed to support the means by which the nodes on the ledger reach

agreement over the legitimacy of a transaction.³⁵ They also may not support the growing policy calls for instant payments.³⁶ Another example of a technology decision that has policy tradeoff implications is whether to use open source code to develop U.S. CBDC.³⁷ Proponents of building infrastructures using open source code note the benefits of leveraging the large community of developers that look to improve the code and identify and fix bugs ultimately leading to a more secure, resilient U.S. CBDC. It may also mitigate some of the impact on the private sector if providing the open source code to the private sector better enables it to develop unique products that support U.S. CBDC and more smoothly integrate it with financial sector systems. Reliance exclusively on open source for critical infrastructure, however, is not without risks to the stability and integrity of the U.S. dollar; it may provide critical information to hackers and other cyber criminals looking to destabilize the U.S. dollar especially in the near term before all of the code defects can be discovered and cured – for example, if U.S. CBDC is programmable, it may provide opportunities to introduce viruses that cause programming changes threatening the CBDC’s integrity (e.g., adding an expiration date).³⁸

B. Alternative Solutions

As suggested above, a U.S. CBDC is unlikely to be an equally effective tool for all of the purposes for which it has been advanced, or to be effective for some purposes at all. Moreover, for the numerous purposes for which CBDC has been advanced, it is unclear that CBDC is uniquely positioned as a solution, or that CBDC is the lowest-cost or most efficient solution. Each articulated reason for introducing a U.S. CBDC should be evaluated to determine if CBDC is likely to achieve the stated purpose(s) and, if there are available alternative solutions, to weigh the benefits and costs of those options.

CBDC to Advance Financial Inclusion — Proposals to design CBDC to foster financial inclusion (e.g., a means of banking the unbanked) often presuppose (though do not require) that CBDC will be account-based, and made available directly to the public by the Federal Reserve. Given the broad availability of low-cost and no-cost basic accounts at financial institutions across the U.S., CBDC may not in actuality be sufficiently additive in value to address the underlying challenges relating to banking the unbanked. Additionally, as discussed in the prior section, introducing CBDC does not address a host of reasons why households, individuals, and businesses in the U.S. are unbanked in the first place.

Moreover, the overall goal of addressing the unbanked challenge should be bringing those individuals and households who are unbanked *into the banking system*, where

they have the opportunity to grow their relationship with a financial institution and take advantage of the full array of services offered by the private financial sector, including access to credit, online bill payment, financial advice, and other services offered by the private financial sector. A CBDC does nothing to address these ancillary needs. Further, use of U.S. CBDC to address financial inclusion could also have unintended consequences that may not help, and may harm, the very community that the government would be trying to serve. This could result because CBDC technology and infrastructure is still nascent and it is difficult to anticipate and address all possible challenges and risks that will arise from its use. There are, however, several viable alternative options to advance financial inclusion in the U.S., including public-private partnerships that highlight low- and no-cost accounts offered by banks, such as the Bank On program, bank and fintech innovations that meet the needs of unbanked and underbanked individuals and households, upgrades to legacy systems that, if made by the government, could facilitate the rapid distribution of benefit payments through same-day ACH or existing instant payments systems, actions by the government to study and reduce barriers to individuals entering the banking system (including digital identification), and expanded broadband internet access in underserved areas.³⁹ Absent a study from the government demonstrating that issuing CBDC can better address financial inclusion, advancing a CBDC for financial inclusion likely introduces more costs and risks than alternative approaches to the issue.

Growth of Unregulated Stablecoins — Concerns over the growth of digital currencies are likely not about the use of private money in lieu of Federal Reserve notes or about a fundamental right to transact using central bank money. After all, for decades the U.S. has seen a sharp decline in the use of Federal Reserve notes and growth in the use of electronic payment methods that rely on private money without concern being expressed in Congress or by the Federal Reserve.⁴⁰ Today, if a business or consumer needs to make a payment it can use Federal Reserve notes (general purpose money), but because commerce is increasingly remote the business or consumer is more likely going to use a debit or credit card, electronic funds transfer (“EFT”) (including EFTs issued using traditional payment rails or alternative providers such as Square Cash, Venmo, or PayPal), or check. And while the central bank may be involved in facilitating that payment, central bank money is only used for the interbank component (what is referred to in this paper as “wholesale”). The party making the payment and receiving the payment is relying on private money. Historically, this has been commercial bank money, which, for all practical purposes, is as safe and secure

as Federal Reserve notes, especially FDIC insured commercial bank money which is backed by the U.S. Government.⁴¹ In recent years, regulated and supervised money services businesses (“MSB”), like PayPal, that are required to maintain adequate capital levels and hold reserves have also provided settlement based on the MSB’s promise to pay its account holder (i.e., commercial non-bank money).⁴²

If embraced as a payment instrument, stablecoins issued by unregulated entities will compete in this private money space.⁴³ To the extent there is a concern about the potential growth in the use of these private monies, for the reasons noted above, it is likely not because it will result in a decline in use of Federal Reserve notes. Rather, the concerns are more likely about the potential of these unregulated stablecoins to lead to a decline in the use of other forms of private money that are perceived as safer, especially insured commercial bank money, and their potential impact on monetary policy.⁴⁴

If this hypothetical is correct, introducing a U.S. CBDC that itself is likely to decrease the use of commercial bank money, and may do little to discourage use of unregulated stablecoins, may not be advisable. Instead, the government should consider regulating stablecoin issuance in order to protect the public, ensure a level playing field across the private sector, and retain control over monetary policy. In particular, policymakers should consider a regulatory framework that, among other things, could require issuers of stablecoins to be licensed and subject to supervision, and could require any stablecoin issued to be clearly tied to a single national currency, constitute an obligation of the issuer to the stablecoin holder, provide appropriate consumer protections, and be subject to clear rules around the issuer’s capital and collateral-holding requirements. This proposed approach, regulating new forms of private money, is consistent with the history of private money in the U.S.⁴⁵

Reduction in Cross-Border Payment Frictions — Substantial work on the part of the public sector and private sector is already underway to reduce friction in cross-border payments.⁴⁶ It should be noted, however, that such frictions are not the direct result of technological limitations in existing payments systems. In the U.S., most wire transfers clear and settle in minutes. While the operating hours of CHIPS and Fedwire are not presently 24x7, they could be expanded to accommodate such use. Further, new, domestic real-time payments systems have either come on-line (such as TCH’s RTP network) or will come on-line in coming years (such as the FedNow system that is under development and that represents a significant initiative for the Federal Reserve – an initiative that U.S. CBDC development might distract from). TCH’s RTP network operates 24x7 and payments

clear and settle in a matter of seconds, with good funds received into the recipient’s account. Technologically, these systems could be extended internationally and linked to other funds transfer or instant systems that are already operating in other areas of the world. Much of the friction is not technological, but regulatory, and stems from disparate regulatory and consumer protection frameworks that exist across jurisdictions (including AML and anti-terrorist financing regimes, data protection requirements, sanctions programs, and currency controls and taxes in the receiver’s jurisdiction) that have balkanized financial services and made it extremely difficult, if not impossible, to extend payments cross-border in a manner that results in the kind of frictionless activity that can be introduced domestically.⁴⁷ Friction may also result from the need for foreign currency exchanges that are often a part of the transaction. A CBDC will face these same sorts of regulatory barriers and foreign currency exchange barriers between jurisdictions and is not a solution for them. Rather than investing in the development of a CBDC that has the potential to crowd out private sector innovation, the government can and should play a role in reducing regulatory and jurisdictional frictions, harmonizing requirements, expanding the operating hours of real-time gross settlement systems, and promoting compatibility of payment message formats. Further, innovation in the private sector, such as the development of new digital business models by remittance transfer providers, and increased network connectivity, are contributing to increased remittance transfer speed and reductions in costs⁴⁸ that could be interrupted by the introduction of a CBDC.

Monetary Policy Enhancements — The introduction of a CBDC has been advanced as a means of providing the Federal Reserve with new monetary policy tools, such as a programmable interest rate, defined expiration or limited usability. Little actual material study has been conducted, however, to determine whether such tools would be effective, under what circumstances and whether they would be any more effective than existing monetary policy tools such as open market operations, the discount rate or reserve requirements. For example, the argument that a CBDC capable of paying interest might enhance the Federal Reserve’s monetary policy toolkit by enabling it to reduce interest rates below zero in the event of a deflationary spiral, ignores the fact that holders of CBDC would likely simply convert their holdings to Federal Reserve notes in such instances since Federal Reserve notes would not be subject to the same below zero interest rate feature. Thus, to be an effective tool in a deflationary spiral, implementation of an interest-enabled CBDC would need to be accompanied by the

elimination of Federal Reserve notes.

Preservation of U.S. Dollar as a Reserve Currency —

Concerns over adoption and use of a digital renminbi outside of China and erosion of the status of the U.S. dollar as a global reserve currency may be exaggerating the nascent or real threat to the U.S. dollar and its status. Given the numerous reasons why the U.S. dollar is the reserve currency of choice, including the stability of government and financial markets, and the primacy of the rule of law in the U.S., there is not likely to be a shift away from the dollar anytime soon. Developing a better understanding of whether the creation of CBDCs by other nations' central banks poses a real and immediate threat to the status of the U.S. dollar as the world's reserve currency and status as a preferred currency in good and bad times, such as times of flight, would benefit ongoing discussion about CBDC. The ongoing discussion about CBDC as a means of preserving the U.S. dollar as a reserve currency

would also benefit from the government conducting a wide-ranging study to determine whether there are ways in which the status of the U.S. dollar as the world's reserve currency might be augmented without a U.S. CBDC. Understanding the true risk to the U.S. dollar from CBDC introduced in other jurisdictions is especially important given the added risks of digitizing the U.S. dollar by introducing a U.S. CBDC (e.g., the digital nature of U.S. CBDC presents a unique opportunity for hackers or nation states seeking to destabilize U.S. currency by disrupting the ledger).⁴⁹

The chart below identifies specific purposes for which CBDC has been advanced, pros and cons of CBDC as it relates to these purposes, and alternative solutions for achieving the purpose (of which there are nearly always multiple other solutions available):

Purpose	CBDC	Alternative Solutions
Financial Inclusion/Distribution of Government Benefits	Pros: <ul style="list-style-type: none"> Government support Cons: <ul style="list-style-type: none"> Poorly suited for the U.S. unbanked population May crowd out or compete with other systems and innovations Potential to disrupt banking and payments ecosystems 	<ul style="list-style-type: none"> No- and low-cost bank accounts Bank On-certified accounts Prepaid cards Alternative financial products and services (e.g., fintech services) Instant bank-centric payment systems with immediate funds availability (e.g., RTP network and FedNow)
To Defend Against Unregulated Private Currencies	Pros: <ul style="list-style-type: none"> Provides government with additional tool in public-private currency competition Cons: <ul style="list-style-type: none"> May crowd out or compete with other systems and innovations Potential to disrupt banking and payments ecosystems 	<ul style="list-style-type: none"> Regulate private currencies to the extent not captured under current regulatory schemes. In particular, stablecoins should be brought within the regulatory perimeter
To Improve Cross-Border Payments	Pros: <ul style="list-style-type: none"> Could reduce the number of entities involved in a cross-border payment Could reduce the number of networks involved in a cross-border payment Cons: <ul style="list-style-type: none"> Not likely to be any more effective in improving cross-border payments than private sector efforts May increase AML/BSA risk and sanction evasion May crowd out or compete with other systems and innovations Potential to disrupt banking and payments ecosystems Potential to disrupt foreign banking markets 	<ul style="list-style-type: none"> Improvements in international bank-to-bank wire transfers through extended hours of operations, adoption of ISO 20022 standards, SWIFT GPI, and other market improvement initiatives Potential to extend reach of domestic instant payments systems to support cross border payments Improved transparency in remittance transfers Government efforts to remove frictions that only the government can address (e.g., disparate regulatory and consumer protection frameworks across jurisdictions)

To Facilitate Monetary Policy	Pros: <ul style="list-style-type: none"> • Unlocks new tools Cons: <ul style="list-style-type: none"> • Forces central bank to take a more active role in lending and to assume risks in times of crisis • Politicization of the central bank (requires mass adoption) 	<ul style="list-style-type: none"> • Traditional tools of the Federal Reserve, including interest on reserves, discount rate, buying and selling government securities
Preservation of U.S. dollar as a Reserve Currency	Pros: <ul style="list-style-type: none"> • U.S. would have a CBDC to defend against the introduction of CBDC by other governments Cons: <ul style="list-style-type: none"> • Potential to destabilize both domestic and foreign financial system 	<ul style="list-style-type: none"> • Ensure that the factors that have made U.S. dollar a reserve currency continue – stable government, rule of law, etc. are maintained • Conduct a wide-ranging study to determine whether there are ways in which the status of the U.S. dollar as the world's reserve currency might be augmented without a U.S. CBDC

C. Observations & Recommendations

Despite doubts as to whether there is any purpose that a U.S. CBDC is best suited to address, this section of the paper assumes that U.S. legislators and policymakers may proceed with testing and standing up some form of U.S. CBDC. While this may ultimately not come to pass, the following recommendations are made with this assumption in mind:

1. A Strong Legal Foundation is Essential

For a U.S. CBDC to succeed it must have a strong legal foundation. This almost certainly means that new federal legislation is needed to establish the legal nature of a CBDC and the roles and responsibilities of the U.S. Treasury, the Federal Reserve, and the private sector in the design and security of CBDC, the issuance and distribution of CBDC, and the on-going transaction and other support for CBDC. It also means that important legal issues around permissible or mandated use of CBDC, and legal protections and obligations that relate to CBDC, will need to be addressed.

More specifically, except for a wholesale U.S. CBDC, meaning a CBDC used solely to settle interbank obligations for depository institutions authorized to maintain accounts with a Federal Reserve Bank,⁵⁰ existing legal authority is likely insufficient. In the U.S. today, there are two forms of central bank money – Federal Reserve account balances and Federal Reserve notes. Federal Reserve notes are obligations of the U.S. redeemable “in lawful money” on demand at the Treasury and at any Federal Reserve Bank.⁵¹ Federal Reserve account balances, like any bank account balance, represent a debt of the Federal Reserve Bank holding the account to the account holder. While both reflect obligations of the Federal Reserve Banks, the legal structures authorizing these two types of central bank money are very different.

The legal framework that supports Federal Reserve notes

includes legal tender laws (discussed further below) and the Federal Reserve Act (“FRA”). Pursuant to Section 16 of the FRA, the Board of Governors has the discretion to issue Federal Reserve notes and the Federal Reserve Banks distribute the Reserve Bank notes to depository institutions. Importantly, the Federal Reserve does not create Federal Reserve notes. Rather, it is the Secretary of the Treasury who is responsible for the design and production of the notes and the security used to protect Federal Reserve notes from being counterfeited or fraudulently altered, as well as for minting legal tender coins.⁵² Thus, the FRA carefully divides responsibilities between the Federal Reserve and the Treasury with the Federal Reserve responsible for determining the need for new Federal Reserve notes and distributing such notes, and with the Treasury responsible for the design and production of the Federal Reserve notes with an eye towards ensuring the integrity of the notes.⁵³ These legal provisions assume paper.⁵⁴

The only other form of central bank money currently supported under U.S. law is found in the FRA’s framework for central bank accounts; there are no other provisions within the FRA that would authorize the Federal Reserve to create debt obligations.⁵⁵ A close examination of the FRA reveals that the Federal Reserve Banks are expressly authorized to provide accounts and services only to depository institutions and other specific types of entities like foreign banks, the U.S. government, and certain quasi-governmental entities.⁵⁶ The Federal Reserve Banks also have “such incidental powers as shall be necessary to carry on the business of banking within the limitations prescribed by this Act.”⁵⁷ Such incidental power, however, would not appear adequate to extend Federal Reserve Bank authority beyond the specific confines of the FRA, which limits the provision of accounts and services only to depository institutions and other specifically

enumerated entities. As observed by the Court of Claims when considering the breadth of the incidental powers clause in Section 4 of the FRA, a federal entity's incidental powers cannot be greater than the powers otherwise delegated to it by Congress.⁵⁸

Assuming that there is a compelling purpose for the issuance of a U.S. CBDC, and the current law does not provide sufficient certainty for the issuance of CBDC, or support of the potential intended purpose, the question arises as to whether the Federal Reserve or Congress should be taking the lead in assessing the need for a U.S. CBDC and analyzing the policy implications. Moreover, in the absence of a clearly applicable legal framework for CBDC, the legal design of CBDC is ripe for consideration with respect to all legal aspects of CBDC including roles and responsibilities, legal tender status, and the legal nature of CBDC more generally.

Roles and Responsibilities —

Allocation of Roles Within Government: Congress should carefully consider whether there is value in replicating the current shared responsibility model for Federal Reserve notes in connection with CBDC. Are there aspects of the Treasury's role in fiscal policy that would suggest that it is important to place some responsibility for the creation and security of CBDC with the Treasury? Does the answer vary depending on whether there continues to be significant demand for paper currency? If, as has been suggested by some, CBDC is designed so that holders of CBDC receive interest, is CBDC a type of government security and does the Treasury's interest in managing government debt come into play? Or should the provision of interest in a CBDC be viewed like interest on reserves – as a monetary policy tool of the Federal Reserve? As illustrated in the first part of this paper, the digital nature of CBDC means that there are several roles required to support CBDC that are not required in the context of Federal Reserve notes. While the necessary roles will vary depending on the proposed implementation, they may include such tasks as maintaining the security of issued CBDC (today the Federal Reserve stores only unissued Federal Reserve notes), creating and maintaining records of transactions, providing technical capabilities to enable the public (both domestically and internationally) to obtain, transfer, and store CBDC, and customer technical/operational support and dispute resolution. To the extent that the government is responsible for carrying out these roles, CBDC legislation should be clear as to where within the government the responsibility and accountability rests.⁵⁹

Allocation of Roles Between the Government and Private Sector: Any legislation also must consider the appropriate

balance of roles between the government and the private sector, including depository institutions, alternative financial service providers, and big tech. Today, the banking sector helps the Federal Reserve distribute Federal Reserve notes. The Federal Reserve has no role in transactions conducted by the general public using Federal Reserve notes. Should the government decide to move forward with a general purpose CBDC,⁶⁰ TCH recommends that distribution mirror the current distribution system in place for Federal Reserve notes as much as possible.⁶¹ When customer demand for Federal Reserve notes increases, depository institutions meet that demand by acquiring Federal Reserve notes from the Federal Reserve Banks and providing the notes to their customers.⁶² Similarly, when customer demand abates, depository institutions deposit surplus Federal Reserve notes into their Federal Reserve accounts. Using this framework, CBDC legislation could direct the Federal Reserve Banks to distribute general purpose CBDC through a similar tiered approach: the central bank would distribute CBDC based on requests from depository institutions that, in turn, have established relationships with businesses (including other banks and alternative financial service providers) and individuals. Properly designed, this two-tiered approach is likely to best enable the private sector, including both traditional banks and alternative financial services providers, to continue to provide the kinds of services and perform the functions that they do today. But to maintain the vibrant U.S. financial sector and to avoid destabilizing global financial sectors, U.S. general purpose CBDC legislation will need to consider the impact of general purpose CBDC on private sector balance sheets, including how general purpose CBDC is accounted for, the degree to which the private sector may charge for their support of general purpose CBDC, and the allocation of liability among the government, financial sector, and users for catastrophic events (e.g., erasure of the general purpose CBDC ledger).

Alternatively, legislation could be enacted that would direct the Federal Reserve Banks to establish accounts directly with, or distribute token-based CBDC to, businesses and individuals to enable businesses and individuals to hold and use CBDC. Admittedly, the idea that central banks might offer accounts directly to businesses and individuals is not a new idea.⁶³ Because of the impact that direct general purpose accounts would have on the stability of the financial sector (both traditional banks and alternative financial services providers) and the unprecedented role that it would create for government in the lives of U.S. citizens and the public at large, TCH strongly opposes such an approach even were the government to outsource to the private sector some of

the roles needed to support CBDC. TCH's concerns with a single-tier approach extends to hybrid models as well. Even a two-tier model could negatively impact the stability of the financial sector if it is implemented without significant limits on the amount of U.S. CBDC that can be in circulation and/or in a manner that significantly limits the ability of financial institutions to leverage U.S. CBDC for lending purposes.

Legal Tender Status — Most discussions of CBDC assume that the CBDC would be treated as currency of the U.S. and would therefore have legal tender status. This too, however, is a legal design choice. Today, federal law provides that U.S. coins and currency (including Federal Reserve notes and circulating notes of Federal Reserve Banks and national banks) are legal tender for “all debts, public charges, taxes, and dues.”⁶⁴ As such, Federal Reserve notes must be accepted by creditors as valid for the payment of both public and private debts. U.S. law, however, does not require a person to accept legal tender for goods or services and does not prohibit the acceptance of other forms of “money” to extinguish a debt.⁶⁵ In fact, Federal Reserve account balances, which are not legal tender, are the preferred means of settling interbank payment obligations. TCH does not believe legal tender status is necessary for a successful CBDC and notes that if legal tender status is given to U.S. CBDC, there will be costs incurred by creditors as they will need to be able to accept and have a means to use the CBDC. This will likely mean engaging a third party, such as a wallet provider, or investing in technology that is designed to work with U.S. CBDC. While policymakers will understandably want to consider whether conferring such status is useful,⁶⁶ both private and public sector factors should be considered before deciding to grant CBDC legal tender status.

User Protections —

Protections related to data and privacy: The introduction of a U.S. CBDC means that fundamental questions about privacy and about how personal and transactional data is stored, shared, used, and protected from unauthorized access and use will need to be addressed.⁶⁷ Depending on aspects of CBDC design, and to some extent the degree of disintermediation of the private sector in the design of CBDC-related systems, state and federal data protection policies may be implicated. Policymakers will want to consider the impact of CBDC schemes on existing legal frameworks, and how legal and regulatory frameworks that protect consumers and businesses will apply to a U.S. CBDC system. These frameworks, which include rules designed to provide necessary information to users prior to providing sensitive information, and on an ongoing basis, engendering informed decision making about certain information,⁶⁸ specifying protections that should be in place for sensitive

information (such as nonpublic personal information or financial information),⁶⁹ limiting the extent to which sensitive financial information might be disclosed,⁷⁰ and specifying when parties must inform others about unauthorized access to information,⁷¹ largely assume a model where private sector institutions are involved and can play a key role in protecting the data and the data subject.

Because the design of a CBDC can affect the ability to offer data and privacy protections of the type that currently exist, data and privacy policy will need to drive design choices. For example, a public, peer-to-peer ledger may not afford opportunities to offer much in the way of data protection as a true public ledger has no central operator controlling the ledger. In contrast, a two-tier approach can be implemented with strong protections and has the potential to leverage traditional roles. Ultimately, there will be a need to establish a legal framework (or refine the existing legal framework) that governs the government's and private sector's collection and use of sensitive information related to CBDC, as well as legislation to address the permitted use of such information and any obligations to protect such information.⁷² TCH believes that the government's decision to introduce U.S. CBDC, including any decision to alter the traditional roles of the private sector and the government with respect to customer identification and transactional data, should not come at the cost of privacy protections.

Protections related to transactions: There are several important consumer protections that are available today, to varying degrees, with respect to electronic consumer payments, that may not be available with transactions using CBDC. These include protections related to theft of access devices, fraud loss, and error resolution.⁷³ While none of these protections exist with respect to transactions conducted using Federal Reserve notes, a general purpose CBDC, given its digital nature (both token and account based), would likely be used in a manner and for purposes that a consumer would normally assume come with these protections. For example, a general purpose CBDC would be able to be used to make payments to entities that are remote, and for goods and services that are not contemporaneously exchanged; payments that today are often made using credit or debit cards, or electronic fund transfers. Card-based payments come with important consumer protections. For example, when using a credit card, consumers are protected under the Truth in Lending Act (“TILA”) from loss due to fraud, including if the consumer pays for goods that it never receives or when received are damaged or are different than expected. Use of consumer debit cards and consumer electronic fund transfers benefit from mandatory error resolution procedures

and protections from unauthorized transactions under the Electronic Funds Transfer Act (“EFTA”). Both EFTA and TILA also protect consumers from losses resulting from the use of a stolen access device.

Absent legislative changes, protections under TILA will not be available for CBDC transactions. Whether EFTA protections apply will depend on whether a CBDC transaction is a “transfer of funds” involving the authorization of a “financial institution” to debit an “account,” as those terms are used in EFTA, and Regulation E, which implements EFTA. An account-based CBDC design will likely be covered under EFTA given the breadth of the definition of financial institution, even if the accounts are offered by the government, whereas peer-to-peer token-based CBDC transactions that do not involve the authorization of a financial institution to debit an account likely would not.⁷⁴ Less clear is whether transactions involving token-based CBDC held in wallets with financial institutions would carry EFTA protections. Regardless of whether certain consumer protections will apply to CBDC transactions under current laws, policymakers should consider whether those laws are sufficient or whether the protections are appropriate. In addition to considering the need for statutory protections for consumers, it may be necessary to consider more broadly whether new or revised rules governing payments in U.S. CBDC are necessary to, among other things, allocate risks in CBDC transactions (for example risks relating to errors (e.g., over payment, wrong payee, late payments), unauthorized transactions (e.g., hacker is able to initiate a payment using someone else’s CBDC), and loss (e.g., CBDC is stolen),⁷⁵ and address when a payment using CBDC is final.⁷⁶ Importantly, each of these legal assessments will need to be made with the specific CBDC technology and design in mind. For example, if a U.S. CBDC were designed to be fully traceable on a CBDC ledger and capable of being deactivated (expired), it may be possible to address fraud differently than under current consumer and commercial law schemes. Understanding the economics of CBDC will also be important as the government cannot reasonably expect the private sector to take on all of the fraud loss associated with CBDC if it does not have a sufficient revenue stream to offset those losses.

2. Do No Harm

General purpose CBDC widely available through the central bank in a single-tier model, or in a two-tier model in which the bank cannot leverage CBDC for lending purposes, could fundamentally alter the nature of the banking sector. The extent of the impact will depend in part on the nature of the CBDC (how it can be used) and the degree to which the central bank outsources back to the private sector some of the activities needed to support its CBDC. A CBDC structure

where the Federal Reserve Banks offer full service general purpose accounts or tokens is likely the most harmful implementation. It is expected that such an implementation would result in a flight to safety (to CBDC), and away from commercial bank deposits, during times of economic stress (a flight that might occur with great speed and severity given the digital nature of CBDC). Even in good times, a general purpose CBDC that can be easily used and widely accepted would likely lower the commercial bank deposit base especially if U.S. CBDC is designed with an interest component. Without consumer and commercial deposits, the role of banks in the economy would be little different from non-bank lenders. Banks would be required to fund their loans by borrowing either directly from the Federal Reserve Banks or from the wholesale debt markets. Even in a two-tier general purpose CBDC implementation there may be a loss of the deposit base. This may depend on how the CBDC is treated for purposes of the second tier’s balance sheet. Is the CBDC in a hosted wallet, for example, still an IOU of the Federal Reserve (with the host providing the safekeeping vault in effect)? Or could the CBDC in a hosted wallet be subject to a fractional reserve scheme?

A decrease in the deposit base also means that banks may not be in a position to serve as intermediaries in payment transactions. Were a U.S. CBDC system designed to be used through a direct interface between the Federal Reserve and CBDC holders (i.e., the Federal Reserve as the sole payments intermediary needed for CBDC transactions), or, without the need for any interface (peer-to-peer CBDC), the need for private sector payments in general would be challenged. Payments in the U.S. today are diverse and competitive.⁷⁷ A U.S. CBDC would not only compete directly with private cryptocurrency,⁷⁸ and with stablecoins that derive their value from the value of the U.S. dollar,⁷⁹ it would also compete with existing payment systems that utilize deposit accounts and stored value denominated in U.S. dollars, including payment systems operated by the private sector (e.g., the RTP network or PayPal), and payment systems operated by the Federal Reserve Banks (e.g., FedACH and the Fedwire Funds Service). While private sector payment systems have been able to compete with the government successfully to date, depending on the design of U.S. CBDC, this could be the first time that consumers and business will be able to make electronic payments without relying on private sector intermediaries or networks. Whether this vibrant, innovative payments marketplace continues to thrive may well turn on whether there is a level playing field between the government and the private sector. Even with a level playing field, if the introduction of a general purpose CBDC is not carefully calibrated, it could lead to the effective

nationalization of retail banking and alternative retail financial services.

Beyond the potential for immediate marketplace disintermediation that introduction of CBDC presents, there is a significant potential for CBDC introduction to have sizable unintended consequences. For example, if CBDC is designed as a true “cash” substitute, then it would likely mean designing CBDC as an electronic bearer instrument – the use of which does not require the central administration of accounts or wallets. A bearer-instrument model could be designed using tokens and could preserve the privacy protections that users of cash have today by using technology applications and devices (e.g., phones) that enable the exchange of tokens without creating a record on a ledger, meaning off-line payments could be conducted between private parties. Importantly, electronic bearer instruments, especially those that have the stability of Federal Reserve backing, have the potential to enable significant amounts of illicit finance. Another potential unintended consequence of a U.S. CBDC could be to expand the role of bigtech in U.S. consumers’ and businesses’ lives. Since general purpose CBDC is an IOU of the Federal Reserve, it is a risk free asset – its value does not depend on the credit worthiness of any private entity even the entity hosting the wallet that holds the CBDC. If this is true, then bigtech may be perfectly positioned to offer this service. Presumably, bigtech will be incentivized to offer CBDC wallets as a loss-leader because their business model is based on advertising and the data that can be seen and used, rather than traditional financial institutional drivers. It is questionable whether bigtech providers of CBDC wallets can be prevented from knowing the transactions that are conducted through those wallets. The role of bigtech in the CBDC second tier will need to be carefully considered.

Clearly, the introduction of a U.S. CBDC has the potential to destabilize both the domestic and foreign banking and financial services sectors, and to make illicit activity using the U.S. dollar easier. While it may not be possible to do no harm when introducing U.S. CBDC, TCH believes that avoiding these outcomes should be a high priority in any U.S. CBDC implementation even at the expense of the intended purpose.

Ultimately, if U.S. CBDC is to be introduced, designing it to minimize these risks must be a shared goal of the government and the private sector. While more in depth analysis is needed, it seems likely that a two-tier CBDC implementation that preserves the roles of the central bank, commercial banks, and regulated non-bank fintechs and MSBs will best protect against the severe disruptive and destabilizing effects that CBDC can cause. This likely requires an implementation that ensures that the commercial banking

sector has a sufficient deposit base in both good times and bad. Absent a fractional reserve system for CBDC, or possibly as a supplement to it, achieving this goal may require a combination of CBDC holding limits, interest rate tiers (the rate of return decreases as CBDC holding size increases), and active lending by the Federal Reserve.

3. The Details Matter

Thus far this paper has focused primarily on the issuance and initial distribution of U.S. CBDC with only passing consideration of the ultimate end user experience. However, the end user experience in many instances will determine whether a U.S. CBDC succeeds in its purpose and successfully competes with the vibrant U.S. payments ecosystem.⁸⁰ As already acknowledged elsewhere in this paper, if CBDC is not viewed as a medium of exchange by the vast majority of the population, and if CBDC does not provide capabilities that are significantly better than private sector alternatives, its attractiveness as a payments instrument will be called into question. Moreover, its status as a medium of exchange is not at all certain; even if U.S. CBDC is given legal tender status, there is no obligation to accept legal tender as payment for goods or services. Thus, any U.S. CBDC implementation is likely to experience network effect challenges – the usefulness of holding U.S. CBDC will depend on who else is currently on the network – and being first to the network is not desirable.

Most discussions of U.S. CBDC overlook these details and appear to assume that once the government designs its CBDC token or account scheme the rest of the infrastructure needed to conduct payments will naturally follow. Unfortunately, the saying “if you build it they will come” does not hold true in the world of payments. As any operator of a payment network or provider of a new payment product knows, it is not enough to build the network/product. To determine if the network/product will be embraced in the market place, it is necessary to understand the details of each potential use case, including how transaction information and the payment asset (in this case the U.S. CBDC) will flow from the payer to the payee (and if they do not flow together how the information is reconciled), how current business processes (both for the end users but also for each intermediary needed to facilitate the payment) will be impacted, and the degree to which financial investments will be required of parties in the payment flow to build the necessary infrastructure to enable CBDC transactions. Not only are initial implementation costs going to be a factor on U.S. CBDC success, but on-going costs necessary to support the use of U.S. CBDC need to be considered. These costs may well lead to fees for use of CBDC, either in the form of transaction fees or support fees (e.g.,

monthly fee for a wallet). Ultimately, if the cost to accept or use CBDC is higher than the cost to accept or use Federal Reserve notes or other payment options where technology investments have already been made (e.g., card networks), the appeal of CBDC will be limited.

The following non-exhaustive list is meant to illustrate the considerations that must be taken into account for end users, especially in remote transactions:

- Identification of who is able to accept U.S. CBDC (e.g., signage at the point of sale, redesigned website, etc.). What agreements are required before an end user can obtain and use CBDC (e.g., terms of use of wallet, terms of use of software application, etc.) and what rights and obligations do they create (e.g., use of data, cyber security risk allocation, etc.)?
- End user interface/application that communicates directly with the ledger in a single tier or with financial sector intermediaries in a two-tier U.S. CBDC implementation, domestically and if applicable abroad.
 - How is the payment transaction tied to the business transaction, how can the buyer access its wallet in an online transaction or at the POS, and how does the seller get confirmation of the payment? How long does this take? When is it safe to release the goods or provide the service?
 - Does the end user interface allow the payer to schedule payments using CBDC, respond to biller invoices, and validate ahead of payment the “address” of the payee? What information must the payer have in order to make a payment and how does the payer obtain the information?
- How do end users integrate these payments into their larger business processes – inventory systems, accounting systems, accounts receivable systems? For financial intermediaries, how are they able to implement KYC/AML/sanction programs in a manner that is compliant with regulatory expectations? How are the records related to these payments integrated into customer support and accounting systems?
- Can a payer make a payment to a payee that is not already established to accept U.S. CBDC? If U.S. CBDC is legal tender for all debts, how can creditors ensure that they are positioned to accept such payments?
- Is it possible to reverse/refund a payment? What information will the payer and payee have to connect the payment to a transaction in order to address payee/payer disputes or other customer service needs?

- What special hardware and software will be needed to support both holding and transferring U.S. CBDC? What is involved in maintaining these products and the risks of not keeping them up to date? What telecommunication, internet, or other connectivity requirements exist?
- Is U.S. CBDC available for use in transactions 24/7 – are each of the required elements for completing a transaction available 24/7? Are there volume limits, value limits, or other constraints based on the technology or the design?
- If a U.S. CBDC fails for some reason, will the payer and payee know? Is there sufficient clarity under the law/rules that apply to U.S. CBDC to address the allocation of loss resulting from errors (delay, duplication, wrong amount, and wrong payee) that may arise in U.S. CBDC transactions?
- Is there an ability to make batch payments in CBDC (not just one-by-one payments)?
- Will the CBDC have a proxy database to enable payments to mobile numbers/e-mail addresses?
- Will the CBDC support request-to-pay functionality or other bill payment services?
- Will CBDC wallets or accounts be subject to open-banking-related data sharing requirements (i.e., will there be an API through which CBDC account details can be shared with approved 3rd parties)?

While TCH does not expect federal legislation to address these important implementation issues, TCH believes that any U.S. CBDC legislation should require the development of detailed plans that address implementation needs of end users, financial intermediaries, and other third-party service providers prior to any significant expenditure by the government to implement U.S. CBDC. The detailed plan should be accompanied by recommendations as to how the costs associated with implementing and maintaining a U.S. CBDC can be recovered by both the government and the private sector.

Conclusions

U.S. payments systems are secure, stable, reliable, and resilient; and the U.S. dollar is the world's reserve currency of choice for myriad reasons, including the stability of the government and financial markets, and the primacy of the rule of law in the U.S. Ensuring that U.S. payment systems and the U.S. dollar continue to serve as engines of economic growth and sources of national stability necessarily requires modernization, enhancement, and adjustments. Whether it requires creation and issuance of a U.S. CBDC, however, is less certain. Clearly, much is at stake and much needs to be considered as legislators, policymakers and the Federal Reserve contemplate whether to introduce a U.S. CBDC and, if so, how it should be designed and function. Fundamental to those decisions is articulating a clear purpose for offering the CBDC, an understanding of policy trade-offs that come with pursuing that purpose, and fully evaluating if a CBDC or other alternatives are better suited to address the given purpose. As discussed above, CBDC is not a panacea – it is unlikely to be an equally effective tool for all of the purposes for which it has been advanced, or to be effective for some purposes at all. In addition, some potential designs for a U.S. CBDC have significant potential to threaten the health of the financial system by destabilizing existing domestic and foreign banking and payments ecosystems that are a large component of the financial system. The Clearing House therefore urges legislators, policymakers and the Federal Reserve to continue cautiously considering whether the U.S. should pursue the development of a CBDC, particularly given the potential harm that a CBDC could cause.

If the U.S. nonetheless decides to pursue a CBDC, then The Clearing House urges legislators, policymakers and the Federal Reserve to carefully consider the recommendations in this paper. The principle of “first, do no harm” should be paramount in a CBDC design. This will require careful consideration of how a CBDC may be structured to not only succeed in achieving the purpose identified, but also minimize destabilizing the financial system, and negatively impacting access to credit, consumer protections, data privacy, and anti-money laundering and terrorist financing goals. To this end, The Clearing House has suggested that a two-tier implementation that leverages the regulated private sector and places limits on general purpose U.S. CBDC holdings both domestically and abroad may be best even if it means that U.S. CBDC may not be suitable for certain purposes. Finally, The Clearing House identified the need to understand the details involved in implementing a U.S. CBDC from an end user and service provider perspective as essential given the extraordinary expenditure that will be required on the part of both the public and private sector.

The Clearing House recognizes that discussions and plans regarding a possible U.S. CBDC are only now beginning and looks forward to further dialogue with legislators, policymakers and the Federal Reserve in evaluating the wisdom of pursuing a CBDC and its potential design and operation.

Appendix A - Overview of Central Bank Digital Currency Projects Worldwide

This appendix provides a brief overview of CBDC projects around the world. It is not meant to be a comprehensive summary of these projects, but rather provides foundational information.

The Bahamas. In October of 2020, the Central Bank of the Bahamas became the first central bank to launch a CBDC.⁸¹ Called the Sand Dollar, the Bahamian CBDC is available to residents of the archipelago nation through a system of authorized financial institutions/authorized commercial banks (“Authorized Banks”) that perform initial customer and anti-money-laundering screens, and provide wallet and custodial services for Sand Dollar holders/users.⁸² Under the Bahamian system, the central bank issues the CBDC, monitors holdings, “sponsor[s] a centralized KYC/identity infrastructure,” and “maintain[s] the ledger of all individual holdings of the digital currency.”⁸³ Authorized Banks, payment service providers, and other parties, have access to a secure application that is provided by the Central Bank of the Bahamas which allows them to offer digital wallets to their customers.⁸⁴ These digital wallets must be linked to deposit accounts at domestic financial institutions for all business use and for high-value, personal transactions.⁸⁵ Non-high-dollar, non-commercial transactions may be conducted through use of a mobile wallet that is not connected to a deposit account.⁸⁶ Sand Dollars do not pay interest and cannot be held non-domestically (payees not domiciled in the Bahamas cannot accept Sand Dollars);⁸⁷ and limited offline transactions are permitted (“[b]uilt-in safeguards [] allow users to make a pre-set dollar value of payments when communications to the Sand Dollar Network [are] disrupted” and “[w]allets are updated against the network once communications are re-established.”)⁸⁸

Canada. The Bank of Canada is “building, as a contingency, the capability to issue a cash-like central bank digital currency (CBDC) to the public, should the need ever arise” and will consider launching a Canadian CBD “if certain scenarios materialize,” such as “if: the use of bank notes were to continue to decline to a point where Canadians no longer had the option of using them for a wide range of transactions; or one or more alternative digital currencies--likely issued by private sector entities--were to become widely used as an alternative to the Canadian dollar as a method of payment, store of value and unit of account.”⁸⁹ The Bank

of Canada notes that “[i]f either or both of these situations were to emerge, issuing a CBDC should be one of the policy responses considered as a means of continuing to fulfill the [Bank of Canada’s] mandate” to “conduct[] monetary policy to deliver low, stable and predictable inflation; promot[e] the stability and efficiency of the Canadian financial system, including payment systems; provid[e] bank notes that Canadians can use with confidence; and provid[e] fiscal-agent services to the Government of Canada.”⁹⁰ The Bank of Canada is still assessing the technical design of a Canadian CBDC and has identified the following attributes that will need to be supported by a Canadian CBDC: (1) that the CBDC be cash-like; (2) that it be relevant in an increasingly digital world, (3) that it be universally accessible, (4) that it pay no interest, (5) that it be reliable, safe, and resilient, (6) that it offer a degree of privacy (not anonymity), and (7) that it functions with existing payment systems in an interoperable fashion.⁹¹ In January of 2020, the Bank of Canada announced the creation of a working group with other central banks and the Bank for International Settlements (“BIS”) to share information and knowledge about CBDC implementation;⁹² and in November of 2020, Payments Canada, an organization that operates payment clearing and settlement systems in Canada, launched a series of papers and educational events to “provide a base of understanding for furthering the discussion around CBDC in Canada and its impacts on key players in the payments industry and end users, along with the potential economic and social implications.”⁹³ In the first paper in its series, Payments Canada identifies “numerous [CBDC] use cases[,] as [both] a general-purpose general purpose product or as a wholesale offering” including, on the wholesale side, “facilitat[ion] [of] cross-border interbank settlement as well as cross-border tokenized asset transfers and currency exchange,” and direct exchange of end users’ CBDC that would free up collateral held in payment systems to control risk, and on the general purpose side, potentially greater security than physical bank notes, reduced costs of physical cash handling, potential to drive competition among payments companies, particularly among new fintech entrants, in a way that generates greater access to payments, smoother and speedier disbursement capabilities, and greater flexibility with respect to government policy objectives, such as monetary policy.⁹⁴

China. The People's Bank of China, which is also a member of the BIS working group, is believed to be on the cusp of issuing its CBDC,⁹⁵ a digital yuan, and recently established a joint-venture with SWIFT (as well as China's Cross-border Interbank Payment System and the Payment & Clearing Association of China (both of which are overseen by the PBOC)) called Finance Gateway Information Services Co. to integrate information management systems, process data, and provide technological consultancy in connection with its to-be-obtained "licenses for local network management activities."⁹⁶ The PBOC's digital yuan has been under development since 2014⁹⁷ and was recently part of a large-scale test in which the government gave away the CBDC as part of a lottery in which lottery winners were able to download an application to receive digital yuan that could then be used at a network of over 3,000 merchants.⁹⁸ Under the digital yuan issuance framework established by the PBOC, commercial banks will distribute digital currency to customers, keeping reserves in the amount of the aggregate digital currency they have issued at the PBOC.⁹⁹ Users must download an approved digital wallet application and use of digital currency will be facilitated through the generation of QR codes that can be scanned at payment terminals.¹⁰⁰ It is believed that use of the digital yuan system will not carry any transaction fees, which will distinguish it from other electronic payment systems.¹⁰¹

Ecuador. In 2014, the Ecuadorian Central Bank announced that it would issue electronic currency that would be maintained in an account-based structure at the central bank and could be transferred between users through a mobile-phone-based application.¹⁰² The Ecuadorian National Assembly passed legislation enabling the issuance of Ecuadorian Central Bank electronic money, but, in 2017, passed legislation decommissioning the Ecuadorian Central Bank electronic money.

El Salvador. El Salvador recently became the first country to adopt Bitcoin as national legal tender.¹⁰³ El Salvador, which does not have its own currency, relies on U.S. dollars, and, now, private digital currencies, to facilitate transactions.

European Central Bank. The European Central Bank ("ECB") has published a report on the possibility of issuing a digital euro and has issued a request for public consultation to solicit input on system design and implementation.¹⁰⁴ The ECB's digital-euro-related request for consultation concluded with over 8,000 responses, a record for public feedback to ECB public consultations.¹⁰⁵ In June, the ECB published a paper on the international role of the euro with a section (a "special feature") about CBDC that details how the issuance of a CBDC could "impact the international role of currencies."¹⁰⁶ The paper suggests that CBDC supporting cross-border

payments might be more effective than other designs, but that international currency status is likely to be determined by other factors, such as stability and economic fundamentals.

France. Bank of France First Deputy Governor Denis Beau discussed progress toward central bank digital currency/currencies, possible regulatory changes, and legal frameworks at the 2020 Paris Blockchain Summit.¹⁰⁷ First Deputy Governor Beau noted that proposals for CBDC test applications will help the French central bank understand the risks and mechanisms of CBDCs, and further CBDC study will generally contribute to the Eurozone's digital cash conversation.¹⁰⁸ He mentioned that there would be eight CBDC experiments to facilitate the investigation into the potential for underlying technology to be adapted for CBDC issuance, and to address the participants in the ecosystem and what the future might look like.¹⁰⁹ One such experiment, an experiment to test wholesale CBDC cross-border settlement between banks, was conducted with the Swiss National Bank and BIS Innovation Hub, and involved use of a distributed ledger technology platform and both delivery versus payment and payment versus payment settlement mechanisms.¹¹⁰

Japan. In October, the Bank of Japan ("BoJ") published a document outlining "its approach to 'general purpose' CBDC – that is, CBDC intended for a wide range of end users, including individuals and firms."¹¹¹ The BoJ noted that it has no plans to issue CBDC but "considers it important to prepare thoroughly to respond to changes in circumstances in an appropriate manner" and to ensure "the stability and efficiency of the overall payment and settlement systems."¹¹² The BoJ's paper outlines three cases that would support issuance of a Japanese CBDC: (1) providing CBDC as a payment instrument alongside cash, where private digital money does not sufficiently substitute for the functions of cash and there is public demand for cash; (2) if CBDC issuance is necessary to enhance "the stability and efficiency of the overall payment and settlement systems"; and (3) if development of a CBDC "lead[s] to stable and efficient payment and settlement systems *suitable for a digital society*."¹¹³ In addition, the BoJ paper highlights core features that a Japanese CBDC must have (universal availability, strong security (including counterfeit deterrence technology), resilience, the capability of supporting instantaneous payment, and the capability of interoperating with other payment and settlement systems); and additional points of consideration (price and financial stability of a CBDC, the impact of a CBDC on private sector innovation, information privacy and handling, and the role of CBDCs for cross-border payments).¹¹⁴ As part of a multi-phase plan, the BoJ has begun – or will very soon begin – experimenting with CBDC design and systems, and has

begun identifying the various institutional arrangements and stakeholder coordination that would be necessary to issue a Japanese CBDC.¹¹⁵

The Marshall Islands. The Republic of the Marshall Islands was among a small group of nations to formally announce that it would take steps to issue a CBDC, signing into law the Declaration and Issuance of the Sovereign Currency Act in 2018 (the “SCA”).¹¹⁶ Under the SCA, the Ministry of Finance is responsible for issuing “Sovereign” or “SOV,” the Marshall Islands’ blockchain-based CBDC.¹¹⁷ A private firm has been engaged by the government of the Marshall Islands to provide technical support in the issuance of the SOV.¹¹⁸ And in September 2020, the body charged with overseeing the development and distribution of the SOV (The SOV Development Foundation), announced the formation of a board of economic and technical advisors that will provide guidance as the Ministry of Finance prepares to launch a public offering of subscription rights for the initial SOV issuance.¹¹⁹

Senegal. Senegal, in 2016, adopted a digital currency created for the West African Economic and Monetary Union by Banque Regionale De Marches and eCurrency Mint Limited.¹²⁰ Named the eCFA, the digital currency utilizes blockchain technology, and, according to its developers, “is a high security digital instrument that can be held in all mobile money and e-money wallets.”¹²¹

Singapore. In 2020, Singapore’s Monetary Authority completed its final phase of “Project Ubin,” a multi-phase project to evaluate and experiment with a CBDC.¹²² Project Ubin, which was completed with participation from Accenture and JPMorgan Chase & Co., as well as a number of participating partner organizations, developed a “domestic multi-currency payments network prototype, which addressed immediate business needs for cross-currency exchange and foreign currency transactions, and demonstrated clear value for the use of blockchain technology.”¹²³ The Project Ubin digital currency, leveraging JPM Coin architecture, utilized a blockchain ledger that interacted with a standard deposit account ledger that the issuer can use for standard deposit account operation.¹²⁴ In late 2020, Monetary Authority of Singapore Chief FinTech Officer Sopnendu Mohanty, in comments for a financial technology conference, observed that technical experimentation was complete, and that potential CBDC issuance is now a question of authorization by the central bank and, then, operationalization.¹²⁵

South Korea. The Bank of Korea has engaged in preliminary technical design and evaluation, has or will engage consulting partners to assist it with the development of a South Korean

CBDC, and is hoping to initiate a pilot trial of a South Korean CBDC system in 2021.¹²⁶

Sweden. In 2017, Sweden’s Riksbank announced that it would begin exploring “a technical solution for a Swedish krona in electronic form, an e-krona” in response to declining use of paper currency and coin, and rapid developments in electronic money and payments.¹²⁷ The Riksbank has summarized its research and conclusions in three reports, one issued in 2017, one in 2018, and one in 2021.¹²⁸ Following the 2018 report, the Riksbank engaged Accenture to begin an initial year-long e-krona pilot project to “broaden the [central] bank’s understanding of the technological possibilities of the e-krona.”¹²⁹ The initial pilot project assessed specific technological solutions, reviewed legal challenges to e-krona issuance, and identified next steps in the exploration of an e-krona.¹³⁰

Thailand. In the summer of 2020, it was reported that the Bank of Thailand had begun using a form of CBDC for transactions between the central bank and businesses;¹³¹ and in the fall of 2020, ConsenSys, a software engineering firm that provides full-stack Ethereum products, announced that it and other firms were assisting the Bank of Thailand in developing a blockchain-based, proof-of-concept prototype CBDC.¹³² This work appears to be associated with a 2018 to 2020 project of the Bank of Thailand (Project Inthanon) to explore and collaborate with private sector entities on a proof of concept for a wholesale CBDC.¹³³ In April of 2021, the Bank of Thailand released a paper titled “The Way Forward for General purpose Central Bank Digital Currency in Thailand,” that “lays out [the Bank of Thailand’s] approach in considering general purpose CBDC issuance and what lies ahead.”¹³⁴ And in May of 2021, Ms. Vachira Arrondee, Assistant Governor of the Financial Markets Operations Group of the Bank of Thailand, announced that the Bank of Thailand would begin soliciting feedback on the development of a general purpose CBDC for general use by the public.¹³⁵

Ukraine. The National Bank of Ukraine, which has been studying and experimenting with CBDC since 2017,¹³⁶ announced in January of 2021 that it, together with the Ministry of Digital Transformation of Ukraine, had selected Stellar Development Foundation to help it build a Ukrainian CBDC.¹³⁷ As part of a memorandum of understanding between Ukrainian governmental authorities and Stellar Development Foundation, a “virtual asset ecosystem and national digital currency of Ukraine” will be developed.¹³⁸

Uruguay. The Banco Central del Uruguay began testing a mobile-phone-based application that permitted the transfer of a test-form of CBDC in 2017.¹³⁹ The tests, which involved issuance, circulation, and transfer of an e-Peso, utilized a

central ledger to track ownership and transfer of 20 million e-Pesos.¹⁴⁰ In April of 2018 the pilot was concluded and all e-Pesos were canceled.¹⁴¹

Venezuela. Venezuela's central bank is reported to be working on a central-bank-run platform for transferring digital currency that would enable companies in Venezuela to make national and international payments.¹⁴²

Appendix B - U.S. CBDC Scholarship & Focus

Although Federal Reserve officials have only recently begun making public statements about the Federal Reserve's work to evaluate and consider a potential U.S. CBDC,¹⁴³ design sketches for a U.S. CBDC have been offered by scholars, economists, and technologists for almost a decade. These sketches, even when offered by Reserve Bank or Federal Reserve Board researchers, are in no way binding on the Federal Reserve. Nevertheless, a lot can be learned from these publications about the various decisions that will need to be made with respect to a U.S. CBDC. It is also important to note that design sketches are often inextricably intertwined with underlying policy positions, or assumptions about how ancillary aspects of a CBDC system will operate. For example, some design sketches assume the government should have a direct relationship with U.S. households for the provision of banking- or payments-related services, while other design sketches assume that transaction-level data will be recorded, maintained, and, at least for some time, searchable. The presentation of policy positions alongside design sketches in this appendix is not intended to convey support for any specific policy position or ancillary design feature or benefit.

In 2014, J.P. Koning, a financial writer for the American Institute of Economic Research, outlined a blockchain-based Federal Reserve CBDC on his blog "Moneynews."¹⁴⁴ Koning called his CBDC "Fedcoin."¹⁴⁵ As he described it, Fedcoin is a Federal-Reserve-established, ledger-based currency, where the Federal Reserve has special authority to create and destroy ledger entries; Fedcoin is set at a 1:1 ratio with the U.S. dollar, and the Fedcoin supply "is left free to vary endogenously, much like how the Fed currently let[s] the market determine the supply of Fed paper money."¹⁴⁶ Under Koning's system, the public "would have to bring paper dollars to the Federal Reserve Banks to be converted into an equivalent number of new Fedcoin ledger entries," at which point "the notes would [then be] officially removed from circulation and shredded"; and banks would "exchange reserves for Fedcoin at a rate of 1:1, [with] those reserves being deleted from Fed computers and the [corresponding Fedcoins] added to the Fedcoin ledger."¹⁴⁷ In Koning's system, the Federal Reserve has no control over the amount of CBDC that it issues. Rather, the Federal Reserve would create new CBDC in response to demands from the public or banks, and it would return paper currency in exchange for CBDC upon demand, making corresponding erasures from the Fedcoin ledger when it does so.

In 2015, Federal Reserve Bank of St. Louis senior economist David Andolfatto posted thoughts on a U.S. CBDC on his personal blogpost, and in his personal capacity.¹⁴⁸ Andolfatto, having reviewed, and, in part, responding to Koning's Fedcoin post, noted that a Federal Reserve CBDC, from the Federal Reserve's perspective, "can be viewed as just another denomination of currency, [as] its existence in no way inhibits the conduct of monetary policy."¹⁴⁹ Andolfatto observed that maintaining a CBDC could be less expensive than maintaining a paper money supply,¹⁵⁰ and, from the perspective of consumers and businesses, Andolfatto envisioned a CBDC that delivers "all of the benefits of [private digital currency] – low cost, P2P transactions to anyone in the world with the appropriate wallet software and access to the internet," as well as a system that will be free from user identification or user application processes, and that, as a push-payment-based system, would offer users greater security.¹⁵¹ Andolfatto went on to note that a CBDC system would necessarily leave, or produce, a digital trail, and that such a trail would "mak[e] it *easier* for law enforcement to track illicit trades" and would therefore support non-application of know-your-customer requirements to a U.S. CBDC system.¹⁵²

In 2016, researchers from the National Bureau of Economic Research ("NBER") published a paper detailing how "the blockchain technology behind digital currencies has the potential to improve central banks' payment and clearing operations, and possibly to serve as a platform from which central banks might launch their own digital currencies."¹⁵³ The NBER researchers concluded that monetary policy could become much easier for central banks to implement under certain CBDC systems, noting that certain CBDC systems could solve "many problems inherent in the current fractional reserve banking system." The NBER researchers argued that central bank adaptation of blockchain technology for use in payments processing and transaction clearing could result in significant efficiencies and cost savings independent from central bank issuance of digital currency.¹⁵⁴

In 2017, researchers from the Hoover Institute at Stanford University published a paper in which they "consider[ed] how a central bank digital currency [] could transform all aspects of the monetary system and facilitate the systematic and transparent conduct of monetary policy." The researchers found that CBDC can "serve[] as a stable unit of account, a practically costless medium of exchange, and a secure store of value."¹⁵⁵ The researchers speculated that "once a

central bank's digital currency is widely used as a form of electronic payment, the demand for holding paper currency and coins would quickly diminish, especially if deposits and withdrawals of cash are associated with substantial fees by the central bank and private financial institutions.¹⁵⁶ As for a CBDC system itself, the Stanford researchers suggested that an account-based system could be used for implementation, that the CBDC would be "legal tender for all payment transactions," that the central bank would process payments by debiting and crediting accounts, and that the privacy of all transactions would need to be strictly protected by the central bank.¹⁵⁷ In addition, the researchers argued that a CBDC "should provide a secure store of value for individuals or businesses who wish to hold [CBDC] at the central bank," whether or not "interest-bearing and/or indexed to fluctuations in the general price level."¹⁵⁸

Later that year, researchers from the Federal Reserve Bank of Richmond and the Federal Reserve Bank of St. Louis, together with a researcher from the Bank of Canada, released a paper debating the merits of a central bank issuing e-money.¹⁵⁹ In that paper, the researchers noted that "[a] central bank move into digital tokens will have important effects on financial stability and competition" and that many discussions of central-bank-issued e-money, or CBDC, are similar to discussions of consumer and business accounts at the central bank that go back to the 1980s.¹⁶⁰ The researchers looked at three schemes – (1) an account-based scheme where the general public has access to accounts at the central bank; (2) a de-centralized, token-based scheme; and (3) a centralized, token-based scheme – as well as at the involvement, or potential involvement, of intermediaries and delegates. The researchers concluded that, in general, CBDC could improve the conduct of monetary policy, but also found that "cash and digital tokens cannot be equivalent because cash and digital tokens have different tradeoffs of security and privacy." With respect to the debate as to whether central banks should hold accounts for consumers, the researchers concluded that "new technologies like DLT and mobile computing have not significantly changed the tradeoffs," but may have "changed tradeoffs in the provision of token-based systems by central banks" that would allow for increased competition in the market for payments services. Ultimately the paper calls for additional quantitative research before decisions about CBDC design and issuance are addressed.¹⁶¹

More recently, the Digital Dollar Foundation,¹⁶² a non-profit that, together with the consulting and global professional services company Accenture,¹⁶³ has formed the Digital Dollar Project,¹⁶⁴ published a white paper titled "The Digital Dollar Project[,] Exploring a US CBDC."¹⁶⁵ In the paper, the Digital

Dollar Project group ("DDP group") argues that a U.S. CBDC is necessary¹⁶⁶ and proposes a "champion model" for a U.S. CBDC that features: (1) tokenization; (2) harmonious operation of a U.S. CBDC alongside existing U.S. paper currency (Federal Reserve notes) and existing U.S.-currency-related systems; (3) distribution of U.S. CBDC through a two-tier system (similar to the current distribution of U.S. currency); (4) privacy that reflects "the jurisprudence around the Fourth Amendment"; (5) monetary policy neutrality; (6) nimble technology and design that are capable of reflecting policy and economic requirements of policymakers; (7) technological architecture that is sufficiently flexible so as to be able to accommodate future developments; and (8) no inhibition of private sector innovation.¹⁶⁷ More specifically, the group suggests that a U.S. CBDC be "a digital bearer instrument" that is "fully fungible with Federal Reserve notes (bank notes or cash) and reserves," "a liability of the Federal Reserve denominated in dollars," and "recorded on a new transactional infrastructure, potentially informed by distributed ledger technology."¹⁶⁸

In August 2020, on the same day that Governor Brainard made public the Board of Governors' 2019 DLT experiment, researchers at the Federal Reserve Board published a short paper on the "potential benefit that a central bank digital currency (CBDC) could provide in the context of existing payment mechanisms."¹⁶⁹ The researchers concluded that: (i) a U.S. CBDC that "used either bank accounts or smartphones as an entry point could reach 96.7% of households," and that if a U.S. CBDC "used bank accounts and ran over mobile networks without requiring the use of smartphones, it could reach 98% of [U.S.] households. Additionally, the researchers noted that a "CBDC would almost certainly need to comply with [anti-money laundering], [Bank Secrecy Act], and [know-your-customer] regulations, making it unlikely that a CBDC would provide anonymity to the same degree as cash" and that "as a digital payment system, a CBDC would [inherently] maintain an electronic history of transactions."¹⁷⁰ As for CBDC design, the researchers observed that a "CBDC could be designed to be a bearer instrument either through ownership of a digital object or ownership of a private key that allows for transfer of an object" and that a "CBDC could become functionally equivalent to cash or an endorsed check [if it is a bearer instrument and has offline transaction capabilities]."¹⁷¹ With respect to cost, the researchers reasoned that CBDC may be less costly than cash to businesses, but more costly than cash to consumers, and that "societal costs of a CBDC, inclusive of costs associated with banks, service providers, merchants, and consumers are simply unknown." Other design features explored in the paper include programmability,¹⁷² 24x7x365 availability,¹⁷³ offline capabilities, and use of intermediaries.¹⁷⁴

Ultimately, the paper noted that CBDC will necessarily have attributes similar to and different from other payment systems, and that design choices will come with tradeoffs.¹⁷⁵

In February of 2021, Federal Reserve Board researchers published a note that highlighted certain preconditions for the introduction of a CBDC and identified design issues that would need to be addressed. The researchers observed that:

- (i) “a foundational element for introducing a CBDC is understanding its purpose,” as a CBDC “designed to support ... economic stimulus payments, for example, would be quite different than a CBDC that is designed to be an alternative to cash”;
- (ii) broad stakeholder support is necessary and “will take time to achieve given the diverse interests involved and the number of complex decisions that will need to be made on system design and ecosystem development”;
- (iii) a sound legal framework is essential to development of a CBDC and to establishing public confidence that, as a payment instrument, CBDC is “robust and reliable, functions smoothly and securely, and comes with clear rules and protections for the payment recipient and for the consumer”; and clarity must be established with respect to legal authority, legal tender status, anti-money laundering laws and laws preventing criminal and illicit activities, and legal roles and responsibilities in general;
- (iv) the technology underlying a CBDC must be robust and, “[i]n some cases, business and operational requirements for a particular CBDC design may require the development of new technologies,” such as secure hardware that can enable offline CBDC transactions; and
- (v) the market must be ready for a CBDC to be introduced.¹⁷⁶

Calls from researchers and private groups for specific CBDC design come at the same time as the U.S. Government has started to show a keen interest in a U.S. CBDC. This interest takes a variety of forms, from expressing curiosity in CBDC, or the fitness of CBDC-related technology for certain purposes, to identifying use cases for certain types of CBDC. Recently, certain members of Congress addressed the topic of a U.S. CBDC by introducing legislation that would direct the Federal Reserve to study CBDC and issue a report in cooperation with other federal agencies,¹⁷⁷ while other members of Congress have introduced legislation that calls on the Federal Reserve to make digital dollars and digital dollar wallets available to the public to facilitate financial inclusion,¹⁷⁸ and other members of Congress have argued that U.S. CBDC is necessary in order for the U.S. to maintain its status among

advanced nations planning on issuing CBDC (China, in particular) or as a responsive measure to proliferating private digital currencies and risks these currencies present.¹⁷⁹

Although the current legislative session is not the first time that Congress has considered CBDC,¹⁸⁰ or consumer access to digital dollars/digital dollar wallets at the Federal Reserve,¹⁸¹ there is a sense of growing interest in the standing up of some form of U.S. CBDC, and specific design elements of CBDC are now being discussed and debated.¹⁸² Design elements, such as the use of an application programming interface by a U.S. CBDC system, as well as potential use cases and advantages of a U.S. CBDC, and the need for additional research and evaluations, were the subjects of recent hearings by both the Senate Committee on Banking, Housing, and Urban Affairs and the House Financial Services Committee.¹⁸³

Even Treasury Secretary Yellen, who has been skeptical of private digital currencies,¹⁸⁴ has recently expressed support for exploration of a U.S. CBDC, concluding that “faster, safer, and cheaper payments” may result from a U.S. CBDC.¹⁸⁵

For its part, the Federal Reserve is now discussing openly the possibility of a U.S. CBDC. The Federal Reserve Board appears to be taking a thoughtful and measured approach to evaluating the wide range of CBDC design choices, and the implications of these choices, making good on Federal Reserve Chair Powell’s comments in 2020 that for the Federal Reserve it is “more important to get it right than to be first” and that “getting it right means [] [] not only look[ing] at the potential benefits of a CBDC, but also [at] the potential risks ... recogniz[ing] the important trade-offs that have to be thought through carefully.”¹⁸⁶ Chair Powell noted, in recent testimony to Congress, that CBDC is a “very high priority project,” and that the Federal Reserve “need[s] to be careful with [its] design of the digital dollar [so] that [the Federal Reserve] does not create something that will undermine the healthy [functioning of] markets....”¹⁸⁷ Powell also recently asked, publicly, “Does the public want, or need, a new digital form of central bank money to complement what is already a highly efficient, reliable and innovative payments arena?”¹⁸⁸; and, in a public broadcast, presented the question of a U.S. CBDC this way: “In our very modern, advanced economy with a fast, efficient, full-blown payment system, would adding a digital currency, a form of digital currency, would it actually benefit the public that we serve? That’s the question that we’re asking.”¹⁸⁹

Still, the Federal Reserve’s drive towards a U.S. CBDC may be continuing. On May 20, 2021 Chair Powell announced that “the Federal Reserve will issue a discussion paper this summer outlining [its] current thinking on digital payments, with a

particular focus on the benefits and risks associated with CBDC in the U.S. context” and that, “[a]s part of this process, [the Board] will ask for public comment on issues related to payments, financial inclusion, data privacy, and information security.”¹⁹⁰ Although Chair Powell noted in his remarks that the design of a CBDC would raise important monetary policy, financial stability, consumer protection, legal, and privacy considerations, and will require careful thought and analysis, he made clear that the Federal Reserve is looking to see “whether and how a CBDC could improve on an already safe, effective, dynamic, and efficient U.S. domestic payments system.”¹⁹¹

Chair Powell’s remarks were immediately followed by a speech by Governor Brainard in which she observed that “[f]our developments – the growing role of private digital money, the migration to digital payments, plans for the use of foreign CBDCs in cross-border payments, and concerns about financial exclusion – are sharpening the [Fed’s] focus on CBDCs”¹⁹² and arguably expressed more of a bias towards a U.S. CBDC. Governor Brainard’s speech is the clearest statement from a Federal Reserve official to date as to why the Fed might feel compelled to issue a CBDC. (Ostensibly it would be to: (i) provide a counterbalance to risks introduced by the proliferation of (and possible someday predominance of) private monies; (ii) offer a safe central bank money in an age of digital payments; (iii) maintain competitive positioning

vis-à-vis other nations’ CBDCs, particularly those that obtain prominence in cross-border payments and as reserve currencies; and (iv) to engender greater financial inclusion.)¹⁹³ In June, Federal Reserve Vice Chair for Supervision Randal K. Quarles took a more measured view of U.S. CBDC development. Speaking at a conference of bankers in Utah, Quarles concluded that “the potential benefits of a Federal Reserve CBDC are unclear,” particularly in light of the quality of the U.S. dollar payment system, and that “developing a CBDC could ... pose considerable risks.”¹⁹⁴ Finally, in July, Chair Powell commented during testimony before the House Financial Services and Senate Banking Committees that the Federal Reserve would begin a “major public consultation” on CBDC when it releases CBDC-related research later this summer, and that the Federal Reserve is “legitimately undecided” on whether the benefits of a CBDC outweigh the costs.¹⁹⁵ It would thus appear that the official view of the Federal Reserve Board on a U.S. CBDC is yet to fully emerge. As the Federal Reserve Board’s view on CBDC continues to develop, a more immediate concern – stablecoins, including the use of stablecoins as a means of payment, and potential risks to end-users, the financial system, and national security – will be addressed by regulators as Treasury Secretary Yellen has convened the President’s Working Group on Financial Markets to “act quickly to ensure there is an appropriate U.S. regulatory framework in place [for stablecoins].”¹⁹⁶

¹ The Clearing House Association L.L.C. is a nonpartisan advocacy organization that represents the interests of its member banks and the broader banking industry by developing and promoting policies to support a safe, sound, and competitive banking system that serves customers, communities, and economic growth.

² There are different potential two-tier implementations, and the degree to which the two-tier model minimizes disruption may turn on whether the model envisions the second tier holding the CBDC on its balance sheet as a liability, or something else. For example, CBDC deposited with a bank could become a bank liability, just like a cash deposit. When such CBDC is withdrawn it could become a Federal Reserve liability, just like a cash withdrawal today. In comparison, a situation in which banks held CBDC in custody would be like banks holding customers' cash balances in safe deposit boxes and would keep such a CBDC off of banks' balance sheets, depriving them of a source of funds to contribute to economic growth. Alternatively, there could be a two-tier model that supports both a custody role and a deposit taking role for the second tier. In some such models limits on the amount of CBDC that a person may hold at any point in time are proposed. (See, e.g., Bank for International Settlements, Committee on Payments and Market Infrastructures, "Central bank digital currencies" (March 2018) (available at: <https://www.bis.org/cpmi/publ/d174.pdf>), p. 6 (observing that different forms of quantitative caps or limits on holding are often proposed as a means of limiting downside risks).)

³ See Federal Reserve Operating Circular 1 (available at: <https://www.frb services.org/resources/rules-regulations/operating-circulars.html>) (providing the Master Account framework).

⁴ Compare Bank for International Settlements, "Central bank digital currencies: foundational principles and core features" (2020), p. 3 (available at: <https://www.bis.org/publ/othp33.pdf>) (defining CBDC as "a digital payment instrument, denominated in the national unit of account, that is a direct liability of the central bank"); with Michael D. Bordo & Andrew T. Levin, "Central Bank Digital Currency and the Future of Monetary Policy," NBER Working Paper 23711 (August 2017) (available at: https://www.nber.org/system/files/working_papers/w23711/w23711.pdf), p. 1 (describing CBDC as "[j]ust like paper currency and coins, central bank digital currency (CBDC) would be fixed in nominal terms, universally accessible, and valid as legal tender for all public and private transactions").

⁵ See "Central bank digital currencies: foundational principles and core features" and "Central Bank Digital Currency and the Future of Monetary Policy," *supra* note 4 (going beyond looking at CBDC as simply another form of central bank money and including assumptions about the design of CBDC (such as the assumption that CBDC would be legal tender or the assumption that CBDC would be fungible with tangible bank notes)).

⁶ See, e.g., Bank for International Settlements, "CBDCs: an opportunity for the monetary system" (June 2021), p. 70 (available at: <https://www.bis.org/publ/arpdf/ar2021e3.pdf>) (noting that "[w]holesale CBDCs are for use by regulated financial institutions"); Bank for International Settlements, Swiss National Bank and Bank of France, "Project Jura" press release (available at: <https://www.bis.org/press/p210610a.htm>) (June 10, 2021) (detailing a wholesale CBDC experiment featuring bank-to-bank, cross-border settlement); and Financial Stability Board, "Targets for Addressing the Four Challenges of Cross-Border Payments" (May 31, 2021) (available at: <https://www.fsb.org/wp-content/uploads/P310521.pdf>), pp. 1 & 5-6 (construing the term "retail" broadly, so as to include business payments, business-to-business payments, person-to-business payments, business-to-person payments, person-to-person payments, and remittances). We use this definition despite the fact that U.S. law treats only transactions with consumers/households as retail transactions and treats all other transactions as wholesale transactions. (See, e.g., The Electronic Fund Transfer Act (15 U.S.C. § 1693 *et seq.* and Regulation E, which cover transactions involving consumers' accounts, and exclude transfers of funds for consumers within systems used primarily to transfer funds between financial institutions or businesses (offering the Fedwire Funds Service as an example); and The Truth in Lending Act (15 U.S.C. § 1601 *et seq.*) and Regulation Z, which cover credit extended for household purposes and generally exempting credit extended for a business purpose and credit extended not to natural persons.)

⁷ Private digital currencies, although they are sometimes considered similar to currency or money under the law, are neither currency, nor money, as those terms are defined under U.S. law. *See, e.g.*, 31 U.S.C. § 5103 (defining “United States coins and currency,” which includes “Federal reserve notes and circulating notes of Federal reserve banks and national banks” as “legal tender for all debts, public charges, taxes, and dues”); 31 C.F.R. § 1010.100(m) (defining the term “currency” for purposes of the BSA to mean “[t]he coin and paper money of the United States or of any other country that is designated as legal tender and that circulates and is customarily used and accepted as a medium of exchange in the country of issuance”); *and* U.C.C. § 1-201(24) (defining the term “money” as “a medium of exchange currently authorized or adapted by a domestic or foreign government”). Private digital currencies are, however, sometimes defined as something similar to money (e.g., “monetary value”) or are likened to fiat currencies under state law. For example, a growing number of states have defined digital currencies as “monetary value” for purposes of state regulation of money transmission and require digital currency issuers to obtain money transmitter licenses. (*See, e.g.*, The Alabama Money Transmission Act, at § 8-7A-2(8) (defining “monetary value” as “[a]medium of exchange, including virtual or fiat currencies, whether or not redeemable in money”); Title 7 of the Official Code of Georgia Annotated, at § 7-1-690(b) (1) (authorizing the “enact[ment] [of] rules and regulations that apply solely to persons engage in *money transmission or the sale of payments instruments involving virtual currency*”) & § 7-1-680(26) (defining “virtual currency” as a “digital representation of monetary value that does not have legal tender status as recognized by the United States government”); *and* Washington State’s Uniform Money Services Act, at §§ 19.230.010(18), 19.230.010(30) and 19.230.030 (defining “money transmission” to include transactions involving virtual currency, defining “virtual currency” as “a digital representation of value used as a medium of exchange, a unit of account, or a store of value, but does not have legal tender status as recognized by the United States government”; and requiring digital currency exchange operators to obtain a license to transmit digital currency (as money) for Washington residents) (italics added for emphasis).) Additionally, the Conference of State Bank Supervisors included state virtual currency regulation in its model law. (*See* Conference of State Bank Supervisors, “Model Regulatory Framework for Virtual Currencies” (March 30, 2017) (available at: <https://www.csbs.org/policy/model-regulatory-framework-virtual-currencies>.)

⁸ The term “stablecoin,” although widely adopted in digital currency literature and media, and used throughout this paper, may not be well-suited for these instruments as they may not in fact be stable or reliable (*see infra* notes 9 and 27). The continual usage of this term may give consumers the false impression that policymakers consider all of these instruments to be stable.

⁹ The fact that a token is backed by legal tender likely helps to control the volatility of the value of the token but may not provide the token holder with any rights to such legal tender. Whether the holder of such a token has a claim on the “reserves” backing the token or even on the token issuer is a matter of contract law. Recently, the Bank of England released a discussion paper in which it looks at new forms of digital money, stablecoins in particular, and the likely effects of private digital money proliferation and success on commercial bank money, central bank money, and monetary policy. (*See* Bank of England, “New forms of digital money” (June 7, 2021) (available at: <https://www.bankofengland.co.uk/paper/2021/new-forms-of-digital-money>.)

¹⁰ *See* Bruce Champ, “Private Money in our Past, Present, and Future,” Federal Reserve Bank of Cleveland (Jan. 1, 2007) (providing a historical overview of private money and money issued by specific community groups) (available at: <https://www.clevelandfed.org/newsroom-and-events/publications/economic-commentary/economic-commentary-archives/2007-economic-commentaries/ec-20070101-private-money-in-our-past-present-and-future.aspx>).

¹¹ *See* Max Raskin and David Yermack, “Digital Currencies, Decentralized Ledgers, and the Future of Central Banking,” NBER Working Paper No. 22238, pp. 5-6 (May 2016) (available at: https://www.nber.org/system/files/working_papers/w22238/w22238.pdf); Testimony of Alex J. Pollock, Distinguished Senior Fellow, R Street Institute, to the Subcommittee on Monetary Policy and Trade, Committee on Financial Services, United States House of Representatives, “Digital Money: More Competition? Even More Central Bank Monopoly?,” pp. 1-3 & 5 (July 18, 2018); Norbert J. Michel, “Improving Money Through Competition,” The Heritage Foundation Issue Brief, No. 4730, p. 2 (July 7, 2017) (available at: https://www.heritage.org/sites/default/files/2017-07/IB4730_0.pdf); *and* “Central bank digital currencies: foundational principles and core features,” *supra* note 4, at p. 2 (noting that “private digital money and alternative payment methods” are “[t]aking cash’s place”).

¹² *See* Speech by Federal Reserve Vice Chair for Supervision Randal K. Quarles, titled “Parachute Pants and Central Bank Money,” given at the 113th annual Utah Bankers Association conference (June 29, 2021) (available at: <https://www.federalreserve.gov/newsevents/speech/quarles20210628a.htm>).

¹³ See Tony McLaughlin, “Two paths to tomorrow’s money,” *Journal of Payments Strategy & Systems*, Vol. 15, No. 1 (Nov. 15, 2020), p. 24-32 (looking at unregulated tokenized digital currencies and identifying risks associated with these instruments); NBC New York, “NY Bans Tether, Bitfinex Over False Statements About Dollar Backing and Losses,” (Feb. 23, 2021) (available at: <https://www.nbcnewyork.com/news/business/ny-bans-tether-bitfinex-over-false-statements-about-dollar-backing-and-losses/2904206/>); Harry Robertson, “Janet Yellen says ‘misuse’ of cryptocurrencies like Bitcoin is a growing problem, as regulators increase scrutiny after surge in interest,” *Business Insider* (Feb. 11, 2021) (quoting Janet Yellen as saying that “misuse” of cryptocurrencies is a “growing problem”) (available at: <https://markets.businessinsider.com/currencies/news/janet-yellen-bitcoin-misuse-cryptocurrencies-growing-problem-tesla-2021-2-1030071724>); and Nathaniel Popper, Mike Isaac, and Jeanne Smialek, “Fed Chair Raises ‘Serious Concerns’ About Facebook’s Cryptocurrency Project,” *New York Times* (July 10, 2019) (quoting Federal Reserve Chairman Jerome Powell as saying that Facebook’s private digital currency proposal has a host of “serious concerns” around “money laundering, consumer protection and financial stability,” and that it “cannot go forward without there being broad satisfaction with the way the company has addressed money laundering” and other issues). See also Christine Lagarde, “The future of money — innovating while retaining trust,” as contained in *L’ENA hors les murs* magazine (Nov. 30, 2020) (available at: <https://www.ecb.europa.eu/press/inter/date/2020/html/ecb.in201130~ce64cb35a3.en.html>) (noting that stablecoins could “threaten financial stability and monetary sovereignty” if widely adopted).

¹⁴ The concerns raised by private cryptocurrencies like Bitcoin and Ethereum that derive their value solely because a segment of society views them as valuable, and not because there is an entity that stands behind their value, is not currently viewed as a significant threat to the U.S. dollar as a medium of exchange. Such cryptocurrencies are highly volatile and are not well-suited to payments. Whether this view will change over time is hard to predict, especially if several jurisdictions follow El Salvador and adopt Bitcoin as legal tender (see *infra* note 103), and private-sector networks enable Bitcoin payment capabilities (see, e.g., Taylor Lyles, “PayPal will let US users pay with Bitcoin, Ethereum, and Litecoin starting today,” *The Verge* (Mar. 30, 2021); and PayPal, “How to use Crypto at checkout?” (available at: <https://www.paypal.com/us/smarthelp/article/how-to-use-crypto-at-checkout-faq4477>)). But today the government’s primary concerns with respect to these cryptocurrencies are their use in illicit activities and not the threat the present to the U.S. dollar. (See *supra* note 13; see also Scott Reeves, “Treasury Secretary Nominee Janet Yellen Touts Crypto ‘Benefits,’ with Regulation,” *Newsweek* (Jan. 25, 2021) (available at: <https://www.newsweek.com/treasury-secretary-nominee-janet-yellen-touts-crypto-benefits-regulation-1564197>) (noting that Secretary Yellen has observed certain benefits of cryptocurrencies and digital assets).) Also unclear is whether certain digital currencies, such as Bitcoin, will continue to be a tool for the payment of ransom in connection with ransomware attacks. (See Greg Myre, “How Bitcoin Has Fueled Ransomware Attacks,” *NPR* (June 10, 2021) (available at: <https://www.npr.org/2021/06/10/1004874311/how-bitcoin-has-fueled-ransomware-attacks>)).

¹⁵ See Eswar Prasad, “Central Banking in a Digital Age: Stock-taking and Preliminary Thoughts,” *Brookings Institute Report*, p. 9 (April 2018) (available at: https://www.brookings.edu/wp-content/uploads/2018/03/es_20180416_digitalcurrencies_final.pdf), pp. 9-12 & 22-23 (observing competition between private digital currencies and government-issued currency); and Speech by Governor Lael Brainard, “Private Money and Central Bank Money as Payments Go Digital: an Update on CBDCs” to the Consensus by CoinDesk 2021 Conference (May 24, 2021) (available at: <https://www.federalreserve.gov/newsevents/speech/brainard20210524a.htm>) (noting that “the period in the nineteenth century when there was active competition among issuers of private paper banknotes in the United States is now notorious for inefficiency, fraud, and instability in the payments system” and speculating whether introduction of a U.S. CBDC might spur competition in light of the growing role of digital private money).

¹⁶ Central banks around the world have begun formally researching, experimenting with, piloting, and even issuing digital currencies (with Ecuador actually launching and then decommissioning its CBDC), or have formally released details about plans to do so. These include the central banks of the Bahamas, Canada, China, Ecuador, the European Central Bank, France, Japan, Marshall Islands, Senegal, Singapore, South Korea, Sweden, Thailand, Ukraine, the United States, Uruguay and Venezuela. The BIS recently noted, based on a survey that it sent to central banks, that “[t]he vast majority of central banks in the survey - 86% - are now exploring the benefits and drawbacks of CBDCs.” (See Codruta Boar and Andreas Wehrli, “Ready, steady, go? - Results of the third BIS survey on central bank digital currency,” *Bank for International Settlements* (January 2021), pp. 5-6 (available at: <https://www.bis.org/publ/bppdf/bispap114.pdf>) (noting that the 65 central banks respondents to the BIS’ third CBDC survey represent “close to 72% of the world’s population and 91% of global economic output” and that 86% report being actively engaged in some form of CBDC-related work).)

¹⁷ See Hyun Song Shin, “CBDCs and the Future of Central Banking,” Apple Odd Lots Podcast (available at: <https://podcasts.apple.com/us/podcast/odd-lots/id1056200096?i=1000526708083>) (June 2021). See also “Targets for Addressing the Four Challenges of Cross-Border Payments,” *supra* note 6, pp. 2, 5 & 11 (noting that “[w]holesale payments between financial institutions are by far the majority of the total cross-border payments market by volume” and that improvements in the speed of these transactions would address a principle challenge in cross-border payments).

¹⁸ In December 2020, Federal Reserve researchers published an article to give clarity to the terms “token” and “account” as they relate to digital currencies, including CBDCs. (See Lee, Malone, and Wong, “Tokens and accounts in the context of digital currencies,” FEDS Notes (available at: <https://www.federalreserve.gov/econres/notes/feds-notes/tokens-and-accounts-in-the-context-of-digital-currencies-122320.htm>).) In the article, the Federal Reserve researchers noted that “the term ‘token’ has been used to describe physical objects representing value, such as precious metals or official coinage that acted as symbolic representations and could be used to make payments,” and that use of the term “token” in money and banking dates back several centuries. (*Id.*) The researchers go on to note that “exchange of tokens between individuals eventually led to the use of ‘accounts’ to record asset ownership more easily and to facilitate more-complex trading and financial transactions.” (*Id.*)

¹⁹ In the context of CBDC specifically, Federal Reserve researchers have noted that:

A 2018 report by the Committee on Payments and Market Infrastructures and the Markets Committee, for example, described token-based systems as reliant on the ability of the users of the system to verify that the digital object (that is, a token) is genuine and not a counterfeit. The report contrasted this with the notion of account-based systems as being reliant on someone – usually the asset issuer or other third party – to verify a user’s ability to transfer an account balance by confirming the user’s identity. These definitions are agnostic to any technology.

Many central bank reports and speeches, as well as economics papers, have taken a similar approach by categorizing tokens as distinct from accounts, and by focusing on the object of verification (that is, verification of the token’s authenticity or the user’s identity) as a key determinant of CBDC classification. This view presents tokens and accounts as strict foils, as described in another recent report that described digital tokens as “digital representations of value that are not recorded in accounts.” Some reports, speeches, and papers offer a more nuanced view by acknowledging that value can be transferred from an account using information-based verification as well as identity-based verification. But, to a large extent, many CBDC reports, speeches, and papers focus on the known-identity concept as a key difference between tokens and accounts.

Taken as a whole, this central banking view of tokens and accounts is the byproduct of a desire to be both general (technology-agnostic) and categorical (tokens are distinct from accounts). The tokens concept is used, in some sense, as a short-hand for digital units of value that can be transferred anonymously, and offers a generic description for how that might happen (authenticating an “object”). As a practical matter, however, central banks often shy away from describing how, exactly, tokens are recorded using a digital recordkeeping system – except to avoid suggesting they are tracked in an account-like structure or using accounting entries. Accounts, from this CBDC perspective, are understood mainly as a shorthand for “traditional” bank accounts maintained by entities in centralized or hub-and-spoke systems.

(“Tokens and accounts in the context of digital currencies,” *supra* note 18.)

²⁰ See “Tokens and accounts in the context of digital currencies,” *supra* note 18 (noting that “making tokens and accounts an ‘either/or’ choice may not be useful” in discussions of CBDC and that “tokens can operate within the context of accounts in the cryptocurrency community”).

²¹ In an October 2020 BIS report, the BIS identified numerous reasons why central banks around the world are considering the introduction of CBDC, including: (i) to provide a means of payment, (ii) to facilitate and improve cross-border payments, (iii) to encourage financial inclusion, (iv) to facilitate the transfer of funds from the government to consumer and businesses in a crisis, (v) to enable monetary policy tools, (vi) to preserve the sovereignty of central bank money, and (vii) to keep pace with increasingly digitalized economies. (See Bank for International Settlements, “Central bank digital currencies: foundational principles and core features,” pp. 1, 5-6, 8-9 & 16-17 (Oct. 9, 2020) (available at: <https://www.bis.org/publ/othp33.htm>).) See also Appendix B.

²² See Appendix B.

²³ See The Clearing House, *et al.*, “Delivering Financial Products and Services to the Unbanked and Underbanked in the United States - Challenges and Opportunities” (May 2021), pp. 13-16 & 37 (available at: https://www.theclearinghouse.org/-/media/new/tch/documents/advocacy/tch_unbanked_report_may_2021.pdf). See also Emily A. Vogels, “Digital divide persists even as Americans with lower incomes make gains in tech adoption,” Pew Research Center (June 22, 2021) (available at: <https://www.pewresearch.org/fact-tank/2021/06/22/digital-divide-persists-even-as-americans-with-lower-incomes-make-gains-in-tech-adoption/>) (noting that “[r]oughly a quarter of adults with household incomes below \$30,000 a year (24%) say they don’t own a smartphone” and that “[a]bout four-in-ten adults with lower incomes do not have home broadband services (43%) or a desktop or laptop computer (41%)”); and Vanessa Sumo, “Bringing in the Unbanked,” Federal Reserve Bank of Richmond (Winter 2007) (noting that many individuals and households lack documentation, including forms of identification, necessary to open banks accounts).

²⁴ When the FDIC asks households why they do not have an account with a bank, responses are numerous and varied. Of the reasons households provide, the most frequently reported reason, perennially, and by a wide margin, is not having enough money to have an account or not having enough money to meet minimum balance requirements. After concerns about having sufficient funds to open an account, the next most frequently cited reasons as to why households remain unbanked are: trust (36.3 percent), privacy concerns from banking (36.0 percent), the costliness of bank fees (fees are too high) (34.2 percent), and the predictability of bank fees (31.3 percent). (See Federal Deposit Insurance Corporation, “How America Banks: Household Use of Banking and Financial Services [-] 2019 FDIC Survey,” p. 3 (available at: <https://www.fdic.gov/analysis/household-survey/2019report.pdf>). (See also The Board of Governors of the Federal Reserve System, “Report on the Economic Well-Being of U.S. Households in 2018-2019” (June 5, 2019) (available at: <https://www.federalreserve.gov/publications/2019-economic-well-being-of-us-households-in-2018-banking-and-credit.htm>); The Board of Governors of the Federal Reserve System, “Report on the Economic Well-Being of U.S. Households in 2019, Featuring Supplemental Data from April 2020” (May 2020) (available at: <https://www.federalreserve.gov/publications/files/2019-report-economic-well-being-us-households-202005.pdf>); and “Delivering Financial Products and Services to the Unbanked and Underbanked in the United States - Challenges and Opportunities” *supra* note 23, pp. 11-21 (noting many reasons why U.S. households and individuals are unbanked or use non-bank financial products and services).)

²⁵ See “Private Money and Central Bank Money as Payments Go Digital: an Update on CBDCs” *supra* note 15 (noting that the growing role of digital private money is sharpening the Fed’s focus on CBDC and that CBDC introduction “may increase [payment system] resilience relative to a payments system where private money is prominent”); Chiu, Sablik & Wong, “Should Central Banks Worry About Facebook’s Diem and Alibaba’s Alipay?” Federal Reserve Bank of Richmond Economic Brief, No. 21-17 (May 2021) (available at: https://www.richmondfed.org/publications/research/economic_brief/2021/eb_21-17) (concluding that private digital currency can result in suboptimal consequences, and reasoning that CBDC, as a policy tool, may temper these consequences); and both “Fed Chair Raises ‘Serious Concerns’ About Facebook’s Cryptocurrency Project” and “The future of money — innovating while retaining trust” *supra* note 13 (noting that stablecoins could “threaten financial stability and monetary sovereignty” if widely adopted). See also David Milliken and Tom Wilson, “BoE says ‘stablecoin’ payments need same rules as banks,” Reuters (June 7, 2021) (quoting Bank of England Governor Andrew Bailey as saying that “[t]he prospect of stablecoins as a means of payment ... have generated a host of issues,” and reporting that the Bank of England has adopted a view that stablecoin-based payments should be regulated in the same way as other forms of payment are today); and Gary B. Gordon & Jeffrey Y. Zhang, “Taming Wildcat Stablecoins” (July 17, 2021) (available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3888752) (presenting “proposals to address the systemic risks created by stablecoins, including regulating stablecoin issuers as banks and issuing a central bank digital currency”).

²⁶ The initial Libra effort has now given way to Diem. Many of the initial Libra-related concerns that were expressed by central banks are trying to be addressed in the reimagined Diem. (See Andrew Morse, “Facebook-backed crypto project Diem to launch US stablecoin,” CNET (May 12, 2021) (available at: <https://www.cnet.com/personal-finance/investing/facebook-backed-crypto-project-diem-to-launch-us-stablecoin/>) (noting that Facebook’s digital currency operations would re-brand as “Diem,” relocate to the U.S. from Switzerland, and focus on launching a stablecoin in 2021).) However, it is still too early to determine whether Diem, as implemented, will satisfy the concerns of central bankers (see *infra* notes 27 and 29).

²⁷ See Tether, “Digital money for a digital age” (2021) (available at: <https://tether.to/>) (describing Tether as a token-based digital currency that one obtains by converting cash into Tether token, and that is “100% backed by [Tether’s] reserves, which include traditional currency and cash equivalents and, from time to time, may include other assets and receivables from loans made by Tether to third parties...”); “Tether says its reserves are back by cash to the tune of...2.9%” Financial Times (2021) (available at: <https://www.ft.com/content/529eb4e6-796a-4e81-8064-5967bbe3b4d9>) (noting that Tether cash reserves are comprised of just under 3% of cash and cash equivalents); Marc Hochstein, “US Fed Official Calls Tether a ‘Challenge’ to Financial Stability,” Coindesk (June 25, 2021) (available at: <https://www.coindesk.com/us-fed-official-calls-tether-a-challenge-to-financial-stability>) (quoting Eric Rosengren (president of the Federal Reserve Bank of Boston) as characterizing Tether’s U.S. dollar stablecoin as a risk to the stability of the financial system, and as concerned about the stability of the assets in the underlying portfolio in times of economic stress, and reporting that CDs, Secured Loans, and Corporate Bonds/Funds/Previous Metals all make up large percentages of the portfolio underlying Tether’s U.S. dollar stablecoin); and *In the Matter of Investigation by LETITIA JAMES, Attorney General of the State of New York, of iFINEX INC., BFXNA INC., BFXWW INC., TETHER HOLDINGS LIMITED, TETHER OPERATIONS LIMITED, TETHER LIMITED, TERTHER INTERNATIONAL LIMITED*[,] Respondents, Settlement Agreement (Feb. 17, 2021) (available at: <https://ag.ny.gov/press-release/2021/attorney-general-james-ends-virtual-currency-trading-platform-bitfinex-illegal>) (banning Tether from conducting trading activities in New York and that Tether’s U.S. dollar stablecoin was unstable due to a variety of factors, including insufficient reserves backing the coins and parent company loss of access to banking services). See also Tobias Adrian, *et al.*, “Central Banks and Digital Currencies,” Federal Reserve Bank of New York Liberty Street Economics blog (June 23, 2021) (available at: <https://libertystreeteconomics.newyorkfed.org/2021/06/central-banks-and-digital-currencies/>) (noting that stablecoins, “which strive to stabilize the value of cryptocurrency by backing it with safe assets ... may not [themselves] be entirely devoid of credit and liquidity risk”).

²⁸ See *supra* notes 13, 14 & 25.

²⁹ See Gwyneth Iredale, “A Complete Guide On Facebook Diem,” 101 Blockchains (May 20, 2021) (available at: <https://101blockchains.com/facebook-diem/>) (touting these benefits); Sila, “Why You Should Embrace Stablecoin Payment” (April 29, 2021) (touting the benefits of stablecoin payments for transactions with international consumers, and “Sila’s banking [application programming interface], which allows business owners and developers an easy [software development kit] for creating a banking app, banking wallet, ACH transfer, and crypto transfer...”); and Coingeek, “Go Cashless: The Rise of Stablecoins as Payment” (2021) (available at: <https://coingeek.com/bitcoin101/go-cashless-the-rise-of-stablecoins-as-payment/>) (touting the stability, speed, convenience, and cost of stablecoin-based payment systems).

³⁰ “Two paths to tomorrow’s money,” *supra* note 13, p. 33.

³¹ *Id.* at p. 32.

³² As David Andolfatto from the Federal Reserve Bank of St. Louis noted in his blog post, “[CBDC] gives the Fed an added [monetary policy] tool: the ability to conveniently pay interest on currency.” (See David Andolfatto, “Fedcoin: On the Desirability of a Government Cryptocurrency,” *MacroMania* (Feb. 3, 2015) (available at: <https://andolfatto.blogspot.com/2015/02/fedcoin-on-desirability-of-government.html>)). As researchers from Brookings put it, the implementation of monetary policy might be made more effective through CBDC issuance and dissemination in two ways: first, a central bank could institute a negative nominal interest rate and, in principle, encouraging such a rate should drive CBDC consumption; and second, large transfers of CBDC to eligible businesses, households, and individuals could occur quickly through a system in which official central bank accounts or electronic wallets are held by businesses, households, and individuals. (See Allen et. al, “Design choices for Central Bank Digital Currency,” *Brookings Global Economy & Development Working Paper 140*, pp. 62-64 (July 2020) (available at: https://www.brookings.edu/wp-content/uploads/2020/07/Design-Choices-for-CBDC_Final-for-web.pdf)). And as an economist from the Bank Policy Institute (“BPI”) has noted, “[a]dopting a CBDC would have two potential monetary policy benefits ... the potential for interest rates to no longer be constrained by the zero-lower bound ... [and] increase[d] [Federal Reserve] control of interest rates[,] especially when the FOMC eventually decides to tighten monetary policy by lifting interest rates above zero: If everyone had access to the CBDC, no one would lend at less than the CBDC interest rate.” (See Bill Nelson, “The Benefits and Costs of a Central Bank Digital Currency for Monetary Policy,” *Bank Policy Institute*, p. 1 (April 15, 2021) (available at: <https://bpi.com/wp-content/uploads/2021/04/The-Benefits-And-Costs-Of-A-Central-Bank-Digital-Currency-For-Monetary-Policy.pdf>)). Further, by incorporating an interest-related feature a CBDC system might permit interest rate-related decisions by the Federal Reserve to be rapidly effectuated. (See Federal Reserve, “Money, Interest Rates, and Monetary Policy,” FAQs (March 1, 2017) (available at: <https://www.federalreserve.gov/faqs/money-rates-policy.htm>) (providing information on how the Federal Reserve conducts monetary policy)).

³³ See “The Benefits and Costs of a Central Bank Digital Currency for Monetary Policy,” *supra* note 32, p. 7.

³⁴ “The Benefits and Costs of a Central Bank Digital Currency for Monetary Policy,” *supra* note 32, p. 1.

³⁵ The environmental impact of certain digital currencies’ validation protocols has drawn attention due to their outsized energy demands. (See University of Cambridge, *Cambridge Bitcoin Electricity Consumption Index* (available at: <https://cbeci.org/>); and *Total World Production & Consumption estimates* (available at: <https://cbeci.org/cbeci/comparisons>) (noting that the environmental impact of distributed ledger-based systems that implement a proof-of-work model can be significant)). (See also Peter Stella, “Who Will Afford to Use Bitcoin?” (International Monetary Fund paper abstract) (2021) (comparing cost and efficiency of Bitcoin blockchain and six centralized fiat money payments systems — TARGET2, FEDWIRE/CHIPS, NACHA ACH, Hong Kong CHAPS, UK CHAPS, and Payments Canada, and concluding that although technological innovations may improve the relative efficiency of proof-of-work in cryptocurrencies and digital currencies, there are likely to remain significant differences based on asymmetrical incorporation of knowledge and party identity that will make cryptocurrencies and digital currencies less efficient)). This has led at least one private digital currency issuer, Ethereum, to explore alternative approaches to the proof-of-work model, such as a proof-of stake model (a model that removes competition from the validator level by selecting validators at random once validators have reached a certain threshold (the stake)), to address energy usage concerns. (See Carl Beekhuizen, “A country’s work of power, no more!” *Ethereum Foundation Blog* (May 18, 2021) (available at: <https://blog.ethereum.org/2021/05/18/country-power-no-more/>); and Ethereum.org, “Proof-of-Stake” (Apr. 15, 2021) (available at: <https://ethereum.org/en/developers/docs/consensus-mechanisms/pos/>)).

³⁶ See, e.g., Aaron Klein and George Selgin, “We shouldn’t have to wait for FedNow to have faster payments,” Brookings (Mar. 3, 2020) (available at: <https://www.brookings.edu/opinions/we-shouldnt-have-to-wait-for-fednow-to-have-faster-payments/>) (highlighting the need for faster payments as a matter of public policy.) In terms of whether a CBDC will advance the policy of faster payments, implementation design will matter. A payment over the RTP network, an instant payment system in the US, is completed, with good funds available to the payee of the payment, in a matter of seconds, whereas a payment using Bitcoin could take anywhere from 10 minutes to an hour or more depending on the number of end points that are required to confirm the transaction. (See Steve Buchko, “How Long do Bitcoin Transactions Take?” Coin Central (Dec. 12, 2017) (available at: <https://coincentral.com/how-long-do-bitcoin-transfers-take/>) (noting that the average time to mine a block is 10 minutes and that the Bitcoin community has set a standard of 6 confirmation, meaning that a transfer takes approximately 60 minutes before it can be considered complete); “Average time it take to mine a Bitcoin from January 2017 to April 13, 2021,” Statista (Apr. 14, 2021) (estimating the average time to mine a Bitcoin at around 10 minutes; meaning that a transaction would be completed in around an hour); and Alexandria/Decentralized Dog, “How Long Does a Bitcoin Transaction Take?” (Sept. 30, 2020) (available at: <https://coinmarketcap.com/alexandria/article/how-long-does-a-bitcoin-transaction-take>) (noting that the average time for a Bitcoin-based payment is 10 minutes, but that transaction times can vary significantly).)

³⁷ See Federal Reserve Bank of Boston, “The Federal Reserve Bank of Boston announces collaboration with MIT to research digital currency,” FRB Boston Press Release (Aug. 13, 2020) (detailing a multi-year CBDC collaboration between the Reserve Bank and MIT and noting that “[t]he research results will be published jointly with MIT, and the code would be licensed as open-source software, so anyone can use or continue experimenting with it”) (available at: <https://www.bostonfed.org/news-and-events/press-releases/2020/the-federal-reserve-bank-of-boston-announces-collaboration-with-mit-to-research-digital-currency.aspx>); and MIT, “MIT DCI Collaborating With the Federal Reserve Bank of Boston to Build a Hypothetical Digital Currency” (available at: <https://dci.mit.edu/research/2020/8/13/mits-digital-currency-initiative-will-be-collaborating-with-the-federal-reserve-bank-of-boston-to-build-a-hypothetical-digital-currency>) (noting that MIT’s Digital Currency Institute has partnered with the Federal Reserve Bank of Boston to build a hypothetical digital currency and that the effort will include “open-source software for anyone to use for experimentation...”).

³⁸ See, e.g., Robert Lemos, “Open-Source Could Mean an Open Door for Hackers,” MIT Technology Review (June 7, 2010) (available at: <https://www.technologyreview.com/2010/06/07/262916/open-source-could-mean-an-open-door-for-hackers/>); Gilad David Maayan, “The Dangers of Open-Source Vulnerabilities, and What You Can Do About It,” Security Today (Aug. 19, 2019); and “The Modern Risks of Open-Source Code,” Software Development Times (Feb. 1, 2021) (available at: <https://sdtimes.com/security/the-modern-risks-of-open-source-code/>) (concluding that openly-sourced components or frameworks can pose risks stemming from their open nature, but that there are methods of reducing these risks and defending against attacks). *But see* Clarke, Dorwin & Nash, “Is Open Source Software More Secure?” (Homeland Security / Cyber Security) (available at: [https://courses.cs.washington.edu/courses/csep590/05au/whitepaper_turnin/oss\(10\).pdf](https://courses.cs.washington.edu/courses/csep590/05au/whitepaper_turnin/oss(10).pdf)) (concluding that open-source architecture may not pose additional, incremental security concerns).

³⁹ “Delivering Financial Products and Services to the Unbanked and Underbanked in the United States - Challenges and Opportunities,” *supra* note 23. See also PYMNTS.com, “Real Time Payments Help Underbanked Consumers Find Financial Relief” (July 7, 2021) (available at: <https://www.pymnts.com/news/faster-payments/2021/real-time-payments-help-underbanked-consumers-find-financial-relief/>) (noting that faster payments can help unbanked households better manage payments and bills, and avoid late fees).

⁴⁰ See Board of Governors of the Federal Reserve System, “2019 Federal Reserve Payments Study” (Oct. 29, 2020) (available at: <https://www.federalreserve.gov/paymentsystems/fr-payments-study.htm>); and “2016 Federal Reserve Payments Study” and “2013 Federal Reserve Payments Study[,] Recent and Long-Term Trends in the United States: 2000-2012” (available at: https://www.federalreserve.gov/paymentsystems/frps_previous.htm) (observing these trends).

⁴¹ See Gregory Baer, “Central Bank Digital Currencies: Costs, Benefits and Major Implications for the U.S. Economic System,” Bank Policy Institute Staff Working Paper, p. 15 (April 7, 2021) (available at: <https://bpi.com/central-bank-digital-currencies-costs-benefits-and-major-implications-for-the-u-s-economic-system/>) (noting that “[t]here is no record during the Global Financial Crisis of consumers abandoning FDIC-insured deposits - commercial bank digital money - for banknotes” and that it appears that “consumers now consider commercial-bank, digital money synonymous with cash in terms of its safety and reliability...”).

⁴² See, e.g., PayPal State Licenses (available at <https://www.paypal.com/us/webapps/mpp/licenses>) (listing each of the licenses held by PayPal to conduct its business).

⁴³ As previously discussed, cryptocurrencies like Bitcoin are not currently viewed as a threat to the U.S. dollar as a medium of exchange. (See *supra* notes 13 & 14.)

⁴⁴ See, e.g., Matthew Mallow and David Lowe, “Global Stablecoins: Monetary Policy Implementation Considerations from the U.S. Perspective,” Federal Reserve note (staff working paper (2021) (available at: <https://www.federalreserve.gov/econres/feds/files/2021020pap.pdf>) (concluding that widespread stablecoin adoption could have implications for U.S. monetary policy); and Bank of England, “New forms of digital money,” Bank of England Discussion Paper (June 7, 2021) (available at: <https://www.bankofengland.co.uk/paper/2021/new-forms-of-digital-money>) (noting that stablecoins, as a means of payment, must be trustworthy, credible, consistent, safe, stable, and engender the same confidence as commercial bank money; and that these and other factors likely require regulation of stablecoins similar to other payment instruments and systems). See also Bank of England, “Financial Stability Report, Financial Policy Committee Record and stress testing results - December 2019” (available at: <https://www.bankofengland.co.uk/financial-stability-report/2019/december-2019>) (noting that stablecoins used to make payments “pose additional risks for regulation,” and concluding that: (i) “[p]ayment chains that use stablecoins should be regulated to standards equivalent to those applied to traditional payment chains”; and (ii) “[w]here stablecoins are used in systemic payment chains as money-like instruments they should meet standards equivalent to those expected of commercial bank money in relation to the stability of value, robustness of legal claim and the ability to redeem at par in fiat”).

⁴⁵ Prepaid products (e.g., store gift cards and Visa- and Mastercard-branded prepaid cards that are usable like debit cards) offer an example of just this. Initial uncertainty about protections available to users of prepaid products was ultimately resolved by federal law and regulation that offered clearer, uniform protections and rules. (See Board of Governors of the Federal Reserve System, “A Summary of the Roundtable Discussion on Stored-Value Cards and Other Prepaid Products” (Jan. 2005) (available at: <https://www.federalreserve.gov/paymentsystems/storedvalue/default.htm>) (observing that in 2005 there was a significant degree of uncertainty about law and regulation applicable to stored-value and prepaid cards); accord Federal Reserve Bank of Philadelphia, “Federal Regulation of the Prepaid Card Industry: Costs, Benefits, and Changing Industry Dynamics” (available at: <https://www.philadelphiafed.org/-/media/frbp/assets/consumer-finance/conference-summaries/c2011-federal-regulation-of-prepaid-card-industry.pdf>); and see Lauren Saunders, “New CFPB Rule Provides Enforceable Protections for Prepaid Cards,” National Consumer Law Center (April 16, 2019) (noting the ultimate protections for users of such products).)

⁴⁶ See Bank for International Settlements, “Enhancing cross-border payments: building blocks of a global roadmap,” Stage 2 report to the G20 (July 2020) (available at: <https://www.bis.org/cpmi/publ/d193.pdf>) (constituting stage 2 of a 3-stage process to develop a roadmap for improving cross-border payments, and identifying areas where further public-private work could enhance cross-border payments); and Financial Stability Board, “Enhancing Cross-border Payments,” Stage 3 roadmap (Oct. 13, 2020) (presenting a roadmap to address challenges and frictions associated with cross-border payments, including, specifically, high costs, low speeds, limited access, and insufficient transparency). See also SWIFT, “What is SWIFT gpi?” (available at: <https://www.moneymover.com/about/faqs/what-swift-gpi/>) (noting that the SWIFT Global Payments Innovation (gpi) initiative is intended to increase cross-border payment speed, provide end-to-end tracking, improve the transparency of fees and charges, and maintain consistent data records).

⁴⁷ See Bank for International Settlements, “Enhancing Cross-border Payments,” Stage 1 report to the G20 (April 9, 2020) (available at: <https://www.fsb.org/wp-content/uploads/P090420-1.pdf>) (identifying challenges and frictions with cross-border payments, as well as actions being taken by public and private actors to address certain of these challenges/frictions (including projects by central banks to link payment systems)). Note: other market improvements are also underway, such as leveraging a secure interbank messaging network to deliver end-to-end transfer of funds in international payments.

⁴⁸ See Visa Economic Empowerment Institute, “The rise of digital remittances: How innovation is improving global money movement” (2021) (available at: <https://usa.visa.com/dam/VCOM/global/ms/documents/veei-the-rise-of-digital-remittances.pdf>), pp. 8-10 (finding that increasing digitization of infrastructures appears to be increasing the speed and reducing the costs of remittance transfer systems).

⁴⁹ Private digital currencies have already proven to be an attractive target for cyber criminals and would likely be a target of nation states seeking to destabilize key U.S. infrastructure in an attack. (See, e.g., Ishita Chigilli Palli, “Hacker Group Stole \$200 Million From Cryptocurrency Exchanges,” Bank Info Security (June 25, 2020) (noting that a specific cyber-criminal gang, the CryptoCore gang, targets cryptocurrency exchanges) (available at: <https://www.bankinfosecurity.com/hacker-group-stole-200-million-from-cryptocurrency-exchanges-a-14506>); Mike Orcutt, “Once hailed as unhackable, blockchains are now getting hacked,” MIT Technology Review (Feb. 19, 2019) (detailing various attacks on exchanges and other entities in the digital currency ecosystem, as well as the risk of exploitation of cryptographic flaws) (available at: <https://www.technologyreview.com/2019/02/19/239592/once-hailed-as-unhackable-blockchains-are-now-getting-hacked/>); “Russian Nationals Indicted for Conspiracy to Defraud Multiple Cryptocurrency Exchanges and Their Customers” (Sept. 16, 2020) (available at: <https://www.justice.gov/usao-ndca/pr/russian-nationals-indicted-conspiracy-defraud-multiple-cryptocurrency-exchanges-and>) (detailing an alleged conspiracy to defraud users of digital currency platforms); and Catalin Cimpanu, “US sues to recover cryptocurrency funds stolen by North Korean hackers,” ZDNet (Aug. 27, 2020) (describing U.S. government efforts to recover digital currency funds that were allegedly stolen by North Korean hackers).) (See also U.S. Securities and Exchange Commission, “Investor Alert: Bitcoin and Other Virtual Currency Investments” (May 7, 2014) (available at: https://www.sec.gov/oiea/investor-alerts-bulletins/investoralertsia_bitcoin.html) (noting the risk that crypto currency exchanges may stop operating or permanently shut down due to fraud, technical glitches, hackers or malware).)

⁵⁰ Importantly, section 14(e) of the FRA permits the Federal Reserve to open accounts for foreign banks and bankers which could enable the use of a wholesale CBDC for global wholesale transactions if limited to transactions between banks.

⁵¹ 12 U.S.C. § 411.

⁵² See 31 U.S.C. §§ 5103, 5112, and 5114; and 12 U.S.C. § 411 *et seq.* (§§ 413, 418, and 420, in particular). The Federal Reserve Board orders new banknotes from the Bureau of Engraving and Printing (“BEP”), a part of the Treasury. These orders are based upon estimates that each of the Federal Reserve Banks make about future currency needs, which they will satisfy with the banknotes currently in circulation or with new banknotes. The Federal Reserve pays the BEP the cost of printing new currency and arranges and pays the cost of transporting the currency from the BEP facilities to Reserve Bank cash offices. For coins, the Federal Reserve provides the Mint with projected coin demand in advance, buys coin at face value from the Mint, and stores and distributes coins. (See Testimony of Louise L. Roseman, Director, Division of Reserve Bank Operations and Payment Systems, “Distribution of coin and currency,” to the Subcommittee on Domestic and International Monetary Policy of the Committee on Banking and Financial Services, U.S. House of Representatives (March 28, 2000) (available at: <https://www.federalreserve.gov/boarddocs/testimony/2000/20000328.htm>) (detailing the role of the Federal Reserve in coin distribution).)

⁵³ See 12 U.S.C. §§ 411 – 421. Additionally, it is a federal crime for an agent or employee the Board of Governors to issue or put into circulation any Federal Reserve notes without complying with, or in violation of, the provisions of the Federal Reserve Act. (18 U.S.C. § 334.) Moreover, it is a federal crime for anyone to make, issue, circulate, or pay out “any note, check, memorandum, token, or other obligation for a less sum than \$1, intended to circulate as money or to be received or used in lieu of lawful money of the United States...”. (18 U.S.C. § 336.)

⁵⁴ See, e.g., 12 U.S.C. §§ 418 (noting that “In order to furnish suitable notes for circulation as Federal reserve notes, the Secretary of the Treasury shall cause plates and dies to be engraved in the best manner to guard against counterfeits and fraudulent alterations”); 420 (noting that “The plates and dies to be procured by the Secretary of the Treasury for the printing of such circulating notes shall remain under his control and direction”); 421 (noting that “The Secretary of the Treasury may examine the plates, dies, bed pieces, and other material used in the printing of Federal Reserve notes and issue regulations relating to such examinations”); and 12 U.S.C. § 5114 (providing the authority to print U.S. currency, as well as printing and plate requirements). See also 31 U.S.C. §§ 5112 (specifying diameters, weights, inscriptions, and other physical characteristics of coins); and 5113 (providing weight tolerance and testing requirements for coins).

⁵⁵ See Federal Reserve Act (12 U.S.C. § 226 *et seq.*) (available at: <https://www.federalreserve.gov/aboutthefed/fract.htm>).

⁵⁶ See, e.g., Federal Reserve Act §§ 13, 14(e), 15, 16 and 19.

⁵⁷ See Federal Reserve Act § 4. This provision of the FRA is practically the same as the section granting incidental powers to national banking associations (12 U.S.C. § 24, Seventh).

⁵⁸ See *Starr Int'l Co. v. United States*, 121 Fed. Cl. 428, 430-431 (2015). Section 4 of the FRA was also interpreted by the U.S. Court of Appeals for the Second Circuit as referring to activities convenient and useful in connection with the performance of an express power. See *Starr Int'l Co. v. Federal Reserve Bank of New York*, No. 12-5022-cv, p. 7 and footnote 4 (2d Cir. 2014) (available at: <https://www.govinfo.gov/content/pkg/USCOURTS-ca2-12-05022/pdf/USCOURTS-ca2-12-05022-0.pdf>).

⁵⁹ With respect to the assignment of responsibilities, it should be noted that the Treasury Department has significant experience interacting directly with the public, such as for the distribution of government benefit payments including Economic Impact Payments and tax refunds, and that the Treasury Department may be able to leverage these experiences in the context of CBDC.

⁶⁰ Wholesale CBDC by definition can only be used for interbank obligations and so, while it would be possible to distribute wholesale CBDC to depository institutions, there would need to be a way for depository institutions to convert the wholesale CBDC to retail CBDC or to commercial bank money for it to be used by the general public.

⁶¹ Today, Section 16 of the FRA, which provides that the Federal Reserve Banks distribute the Reserve Bank notes to depository institutions, provides the basic framework for Federal Reserve note distribution. Under this framework, the 28 Federal Reserve Bank cash offices provide cash services to approximately 8,400 banks, savings and loans, and credit unions in the United States. (The remaining depository institutions obtain currency and coin from correspondent banks rather than directly from the Federal Reserve.) (See “The Role of the Federal Reserve,” Board of Governors of the Federal Reserve System (available at: https://www.federalreserve.gov/paymentsystems/coin_about.htm)). Additional information on the Federal Reserve’s role in cash distribution is available from the Federal Reserve Bank of San Francisco’s Cash Product Office. (See “About the Federal Reserve’s Role in Cash Distribution” (available at: <https://www.frbsf.org/cash/federal-reserve-role-cash-distribution/cash-product-office/>)).

⁶² See “How Currency Gets into Circulation,” Federal Reserve Bank of New York (July 2013) (available at: <https://www.newyorkfed.org/aboutthefed/fedpoint/fed01.html>).

⁶³ As researchers from the Federal Reserve Banks of St. Louis and Richmond, and the Bank of Canada, note, “the idea of universal central bank accounts dates back to the ‘deposited currency’ scheme proposed [] [] [in] 1985.” (See “Kahn, Rivadeneyra, and Wong, “Should the central bank issue e-money?” at pp. 10-11 (first circulated in Oct. 2017) (presented at the Federal Reserve Bank of Atlanta in 2017) (available at: https://www.frbatlanta.org/-/media/documents/news/conferences/2018/1018-financial-stability-implications-of-new-technology/papers/rivadeneyra_should_the_central_bank_issue_emoney.pdf). Recent discussions of, and proposals for, consumer accounts at Federal Reserve banks, and distribution of U.S. CBDC through such accounts, appear to build from 2018 work from law professors from Vanderbilt Law School and the University Of California Hastings College Of Law who, together with a co-author, argued that all U.S. citizens and residents should be eligible to open bank accounts at the Federal Reserve called “FedAccounts.” (See, e.g., Morgan Ricks, John Crawford & Lev Menand, “Central Banking for All: A Public Option for Bank Accounts,” The Great Democracy Initiative (June 2018), p. 2 (available at: <https://greatdemocracyinitiative.org/wp-content/uploads/2018/06/FedAccountsGDI.pdf>); and Morgan Ricks, John Crawford & Lev Menand, “FedAccounts: Digital Dollars” Geo. Wash. L. Rev. (forthcoming) (April 2020) (available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3192162)). (See also “Biden-Sanders Unity Task Force Recommendations” (July 2020), p. 18 (calling for a system of accounts for households at the Federal Reserve); Nicholas Gruen, “Why Central Banks Should Offer Bank Accounts to Everyone,” Economics (Dec. 16, 2016) (available at: <https://economics.com/central-banks-for-everyone-nicholas-gruen/>) (making the case for disruption of retail accounts by wholesale providers (central banks, in this case)); and Nartin Sandbu, “Visa Glitch Shows It Is High Time for Digital Cash,” Financial Times (June 5, 2018) (available at: <https://www.businesslive.co.za/ft/opinion/columnists/2018-06-05-the-ft-column-visa-glitch-shows-it-is-high-time-for-digital-cash/>) (arguing for central banks to issue digital currency directly to consumers).)

⁶⁴ 31 U.S.C. § 5103.

⁶⁵ See Treasury, “Legal Tender Status” (2011) (available at: <https://www.treasury.gov/resource-center/faqs/currency/pages/legal-tender.aspx>) (noting that there is no requirement that legal tender currency or coin be accepted for payment).

⁶⁶ The importance of legal tender status as it relates to CBDC should be considered. As researchers from the National Bureau of Economic Researchers have reasoned:

[C]entral banks operate under regimes that have enacted legal tender laws whose function is to compel acceptance of their notes. Such laws do not require parties to contract in the currency of the central bank, but they deny legal recourse to a party who refuses to accept the legal tender of the country as payments for debts contracted in some other medium of exchange. This gives rise to Gresham's Law, namely that bad money drives out good. At the same exchange rate, a debtor is less likely, *ceteris paribus*, to pay in appreciated currency if he has the option to pay in depreciated currency.

Legal tender laws therefore confer a monopoly privilege on the government, allowing it to operate its printing press. Without such laws, central banks would simply be banks. If consumers were allowed to refuse acceptance of central bank currency for public and private debts, a regime of free banking would exist and the central bank would be forced to operate monetary policy in accord with the demands of its consumers and not according to political or policy goals untethered from the market....

(See "Digital Currencies, Decentralized Ledgers, and the Future of Central Banking," *supra* note 11, p. 7 (citations omitted).)

⁶⁷ As Federal Reserve researchers have observed, "it will be essential to consider how privacy is respected and how personal data is protected in a CBDC arrangement"; and foundational questions of "what type of information is kept on the system, who owns the information, who has access to it, and how it can be used" will need to be answered. (See Cheng, Lawson, and Wong, "Preconditions for a general-purpose central bank digital currency," FEDS Notes (Feb. 24, 2021) (available at: <https://www.federalreserve.gov/econres/notes/feds-notes/preconditions-for-a-general-purpose-central-bank-digital-currency-20210224.htm>).) Robust privacy protections may also offer a U.S. CBDC an advantage over other nation's CBDCs. For example, China's CBDC is believed to be structured in such a way that the government, through China's central monetary authority, has complete control over and line of sight into the ledger. While the precise privacy-related designs of a U.S. CBDC are yet unknown, it would very likely not permit the same sort of access to personal transaction information as the Chinese model is believed to. (See Mercy A. Kuo, "China's Digital Currency: Implications for the US," *The Diplomat* (March 31, 2021) (available at: <https://thediplomat.com/2021/03/chinas-digital-currency-implications-for-the-us/>) (providing details on the Chinese model); Jeanna Smialek, "Still Getting Your Head Around Digital Currency? So Are Central Bankers," *The New York Times* (Apr. 26, 2021) (noting that China pursued a digital currency in part to address private-sector digital payments); Caitlin Reilly, "Digital dollar backers say privacy, trust give US edge over China," *Roll Call* (June 15, 2021) (available at: <https://www.rollcall.com/2021/06/15/digital-dollar-backers-see-privacy-trust-as-us-edge-over-china/>) (providing the viewpoint of some U.S. policymakers that privacy protections available in a U.S. CBDC would offer such a CBDC a comparative advantage over other nations' CBDCs); *and* Comments of Neha Narula, Director of the MIT Digital Currency Initiative (available at: <https://dci.mit.edu/nehana-narula>) (noting the importance of designing a U.S. CBDC that preserves users privacy).)

⁶⁸ For example, under the Gramm-Leach-Bliley Act ("GLBA"), reuse and redisclosure obligations travel with the data and need to be adopted by parties that receive the data. (See Gramm-Leach-Bliley Act ("GLBA"), Title V, Subtitle A (15 U.S.C. § 6802).) (See *also* 12 C.F.R. § 1016.11 (implementing this provision).)

⁶⁹ See GLBA, Title V, Subtitle A (15 U.S.C. §§ 6801-6809) (which applies to "financial institutions" and requires consumers' personal information to be protected in certain ways, including with respect to information security and with respect to how information is shared); *and* Federal Trade Commission, "Standards for Safeguarding Customer Information" (codified at 16 C.F.R. Part 314). See *also* 81 Fed. Reg. 61,632 (Sept. 7, 2016) (requesting public comments on the standards for safeguarding customer information, including comment on whether a response plan should be a required element of an information security program).

⁷⁰ For example, the GLBA's privacy provisions require privacy notices to be provided to consumers and place limitations on the sharing of nonpublic personal information (15 U.S.C. §§ 6802, 6803 & 6809); *and* the 1978 Right to Financial Privacy Act mandates that federal government authorities follow specific procedures in order to obtain information from a financial institution about a customer's financial records (12 U.S.C. §§ 3401-3422).

⁷¹ State data breach notification laws, for example, typically mandate notices be provided for certain types of breaches that resulted in consumers' personal information having been accessed. See National Conference of State Legislatures, "Security Breach Notification Laws" (May 15, 2021) (available at: <https://www.ncsl.org/research/telecommunications-and-information-technology/security-breach-notification-laws.aspx>) (noting that all fifty states and various other jurisdictions "have enacted legislation requiring private or governmental entities to notify individuals of security breaches of information involving personally identifiable information").

⁷² See Thomas P. Vartanian, "No. 1 rule for central bank digital currencies: Do no harm," American Banker, BankThink (April 21, 2021) (available at: <https://www.americanbanker.com/opinion/no-1-rule-for-central-bank-digital-currencies-do-no-harm>) (noting that CBDC-related concentration of information in the hands of the government could potentially allow the government to surveil financial transactions, and monitor the behavior of citizens).

⁷³ For example, the EFTA/Regulation E and the TILA/Regulation Z provide frameworks for resolving disputes relating to unauthorized transfers and unauthorized credit card charges, and limitations on consumers' liability for unauthorized transfers and fraud. (See, e.g., 15 U.S.C. § 1693g(a)/12 C.F.R. § 1026.6 (limiting consumer liability for unauthorized funds transfers); and 15 U.S.C. § 1643(a)/12 C.F.R. § 1026.12(b)(1) (limiting cardholder liability for unauthorized charges to \$50).) To the extent that a U.S. CBDC system does not incorporate similar protections, consumer should be informed of the disparities as many have come to expect protections with electronic payments.

⁷⁴ The term "financial institution" is defined as "a State or National bank, a State or Federal savings and loan association, a mutual savings bank, a State or Federal credit union, or any other person who, directly or indirectly, holds an account belonging to a consumer" (15 U.S.C. § 1693a(9)) (italics added for emphasis). See also 12 C.F.R. § 1005.3 applying provisions of Reg. E (implementing EFTA) to "any electronic fund transfer that authorizes a financial institutions to debit or credit a consumer's account" and defining the term "electronic fund transfer" to mean "any transfer of funds that is initiated through an electronic terminal, telephone, computer or magnetic tape for the purpose of ordering, instructing, or authorizing a financial institution to debit or credit a consumer's account."

⁷⁵ In general, policy decisions as to how to allocate responsibility for theft of CBDC resulting from breaches in the security of CBDC design, or the design of the wallets and other products supporting CBDC, will need to be considered. If banks are expected to provide custody services for CBDC, it may not be reasonable to apply traditional notions of risk of loss in bailments especially if financial institutions do not have sufficient control over the design of the technology or ability to generate significant revenues through CBDC activities to absorb what could be catastrophic loss.

⁷⁶ Since a government adopted CBDC will be "money" under U.S. payments laws, the need for new or revised rules may depend on unique features of the CBDC implementation including whether there is a new payment network that must be used to transfer U.S. CBDC that makes current law inadequate. See U.C.C. §§ 1-201(b)(24) (defining "money" to include "a medium of exchange currently authorized or adopted by a domestic or foreign government"); U.C.C. 4A-103(a)(1) (defining "payment order," for example, as "an instruction of a sender to a receiving bank ... to cause another bank to pay[] a fixed or determinable amount of money to a beneficiary..." (italics added for emphasis). Ultimately, if it is determined that new or revised rules are required, careful consideration will need to be given as to how such rules can be adopted in the U.S. in a manner that ensures their applicability to all relevant parties, including foreign entities. As a general matter under U.S. law, absent a statute or regulation, rules are only binding on parties that have agreed by contract to those rules. There is, however, Article 4A of the U.C.C. governing wire transfers which allows "funds transfer system rules" to apply to parties not in privity if certain conditions are met. See Comment 4 to U.C.C. § 4A-507 (noting the application of the rule to parties not in privity to a payment order). This statute, which is state law in all fifty states, does not apply to consumer payments governed by EFTA (see U.C.C. § 4A-108); and also only applies to the extent that the payment in question involves instructions to "banks" to pay or cause another bank to pay a payee (see U.C.C. § 4A-103(a)(1) (defining the scope of the term "payment order"). For this reason, depending on the breadth of the proposed U.S. CBDC implementation, if payment transaction rules are necessary it will likely require legislation or regulation. (See, e.g., Board of Governors of the Federal Reserve System, "Proposed Amendments to Regulation J (Collection of Checks and Other Items by Federal Reserve Banks and Funds Transfers Through Fedwire) to Govern Transfers over the FedNow Service" (May 7, 2021) (recommending new rules to "provide a clear, predictable, and comprehensive set of foundational rules for the [FedNow] service").)

⁷⁷ See, e.g., Anan, Barrett, Mahajan & Nadeau, “U.S. Digital Payments: Achieving the next phase of consumer engagement,” McKinsey & Company (Nov. 25, 2020) (available at: <https://www.mckinsey.com/industries/financial-services/our-insights/banking-matters/us-digital-payments-achieving-the-next-phase-of-consumer-engagement>) (noting that consumers use numerous forms of payment and technological developments are driving rapid changes in the U.S. payments landscape).

⁷⁸ Bitcoin is perhaps the most widely recognized private cryptocurrency, but it is certainly not the only one (for example, Ether, Litecoin, and Cardano are all private cryptocurrencies). (See Ethereum, “Welcome to Ethereum” (available at: <https://ethereum.org/en/>) (describing the Ether cryptocurrency); Litecoin, “The Cryptocurrency for Payments[,] Based on Blockchain Technology” (available at: <https://litecoin.org/>) (describing Litecoin); and Cardano Foundation, “About us” (available at: <https://cardanofoundation.org/en/about-us/>) (describing the Cardano Foundation’s role in overseeing and supervising the advancement of the Cardano cryptocurrency).) And in some instances, private digital currency, representing commercial bank money similar to a dollar balance held by a bank, is already serving as a mechanism for transfers between parties. (See, e.g., J.P. Morgan, “J.P. Morgan Creates Digital Coin for Payments” (Feb. 1, 2021) (explaining the operation of JPM Coin, which is a proprietary, “permissioned, shared ledger system that serves as a payment rail and deposit account ledger” and enables clients of the bank “to transfer U.S. Dollars held on deposit with J.P. Morgan”) (available at: <https://www.jpmorgan.com/solutions/cib/news/digital-coin-payments>).)

⁷⁹ Unlike direct holding of central bank money, holders of privately-issued digital currencies that derive their value from central bank money would not have a claim on the central bank. Instead, a holder of a stablecoin pegged to the U.S. dollar would have only those rights based on the agreement made between the stablecoin issuer and the holder.

⁸⁰ See, e.g., Aleksy Grym, “Lessons learned from the world’s first CBDC,” Bank of Finland Economics Review (Aug. 2020) (available at: https://helda.helsinki.fi/bof/bitstream/handle/123456789/17590/BoFER_8_2020.pdf), pp. 14-17 (likening a Finnish payment-card-based e-money program (Avant) to CBDC and observing that anonymity and the opportunity to avoid bank accounts were not sufficient to result in widespread adoption of Avant, which failed to successfully compete with alternative forms of payment).

⁸¹ See Central Bank of the Bahamas, “PROJECT SANDDOLLAR: A Bahamian Payments System Modernization Initiative” press release (Dec. 24, 2019) (available at: <https://www.centralbankbahamas.com/publications/main-publications/project-sanddollar-a-bahamian-payments-system-modernization-initiative>). See also Vipin Bharathan, “Central Bank Digital Currency: The First Nationwide CBDC In The World Has Been Launched By The Bahamas” Forbes (Oct. 21, 2020) (available at: <https://www.forbes.com/sites/vipinbharathan/2020/10/21/central-bank-digital-currency-the-first-nationwide-cbdc-in-the-world-has-been-launched-by-the-bahamas/?sh=78078dcb506e>).

⁸² See Central Bank of the Bahamas, “PROJECT SAND DOLLAR: A Bahamas Payments System Modernization Initiative” paper, pp. 21-26 (Dec. 24, 2019) (available at: <https://www.centralbankbahamas.com/viewPDF/documents/2019-12-25-02-18-11-Project-Sanddollar.pdf>).

⁸³ *Id.* at p. 12.

⁸⁴ *Id.* at p. 13.

⁸⁵ *Id.* at p. 12.

⁸⁶ *Id.*

⁸⁷ *Id.* at pp. 10 & 12.

⁸⁸ *Id.* at p. 10.

⁸⁹ Bank of Canada, “Contingency Planning for a Central Bank Digital Currency” (Feb. 25, 2020) (available at: <https://www.bankofcanada.ca/2020/02/contingency-planning-central-bank-digital-currency/>).

⁹⁰ *Id.*

⁹¹ *Id.*

⁹² See Bank of Canada, “Central bank group to assess potential cases for central bank digital currencies,” press release (Jan. 21, 2020) (available at: <https://www.bankofcanada.ca/2020/01/central-bank-working-group-cbdc/>).

⁹³ See Payments Canada, “Payments Canada launches Central Bank Digital Currency series,” press release (Nov. 20, 2020) (available at: <https://www.payments.ca/about-us/news/payments-canada-launches-central-bank-digital-currency-series> (access Feb. 6, 2021)). See also S. Mohammad R. Davoodalhosseini, “Central Bank Digital Currency and Monetary Policy,” Bank of Canada Staff Working Paper 2018-36 (July 2018) (available at: <https://www.bankofcanada.ca/wp-content/uploads/2018/07/swp2018-36.pdf>) (envisioning a CBDC system in which each individual has an account with the central bank and a debit card system that is owned and operated by the central bank provides access to CBDC funds).

⁹⁴ Payments Canada, “Central Bank Digital Currency (CBDC): The Fundamentals,” pp. 10-11 (Nov. 2020).

⁹⁵ See Dion Rabouin, “China looks to take its digital currency global,” Axios (Feb. 5, 2021) (available at: <https://www.axios.com/china-central-bank-digital-currency-global-3268579f-bc4b-4a0e-82d8-004a1cd633e2.html>).

⁹⁶ Reuters Staff, “UPDATE 1-SWIFT sets up JV with China’s central bank” (Feb. 4, 2021) (available at: <https://www.reuters.com/article/china-swift-pboc/update-1-swift-sets-up-jv-with-chinas-central-bank-idUSL1N2KA0MS>).

⁹⁷ See Alun John, “Explainer: How does China’s digital yuan work?” Reuters (Oct. 19, 2020) (noting that the PBOC has been working on the digital yuan project since 2014) (available at: <https://www.reuters.com/article/us-china-currency-digital-explainer/explainer-how-does-chinas-digital-yuan-work-idUSKBN27411T>).

⁹⁸ See Arjun Kharpal, “China hands out \$1.5 million of its digital currency in one of the country’s biggest public tests,” CNBC (Oct. 12, 2020) (noting that digital yuan was distributed to lottery winners through a digital renminbi app and that winners could then spend their digital yuan at over 3,000 merchants enabled to accept the CBDC); and Jonathan Cheng, “China Envisions Its Digital-Currency Future, With Lotteries and Year’s Worth of Laundry,” The Wall Street Journal (Dec. 27, 2020) (available at: <https://www.wsj.com/articles/china-envision-its-digital-currency-future-with-lotteries-and-a-years-worth-of-laundry-11609066819>) (noting that the most recent pilot was significantly larger than earlier pilots as the PBOC builds scale ahead of its CBDC launch).

⁹⁹ See “Explainer: How does China’s digital yuan work?” *supra* note 97.

¹⁰⁰ *Id.* See also “China’s CBDC ‘Dress Rehearsal’ Sets Stage for Other Central Banks,” PYMNTS.com (Jan. 4, 2021) (available at: <https://www.pymnts.com/news/payment-methods/2021/chinas-cbdc-dress-rehearsal-sets-stage-for-other-central-banks/>) (noting that the digital yuan system utilizes QR codes and a bank-based distribution system).

¹⁰¹ See “China’s CBDC ‘Dress Rehearsal’ Sets Stage for Other Central Banks,” *supra* note 100.

¹⁰² See Everett Rosenfeld, “Ecuador becomes the first country to roll out its own digital cash,” CNBC (Feb. 9, 2015) (noting the launch of the Ecuadorian digital money system); Lawrence H. White, “The World’s First Central Bank Electronic Money Has Come - And Gone: Ecuador, 2014-2018,” CATO Institute (April 2, 2018) (available at: <https://www.cato.org/blog/worlds-first-central-bank-electronic-money-has-come-gone-ecuador-2014-2018>) (detailing the rise and fall of the Ecuadorian digital dollar); and Auer, Cornelli, and Frost, “Rise of the central bank digital currencies: drivers, approaches and technologies” BIS Working Paper No. 880, p. 7 (Aug. 2020) (available at: <https://www.bis.org/publ/work880.pdf>) (noting that Ecuador had completed a pilot utilizing its electronic currency).

¹⁰³ See Renteria, Wilson, and Strohecker, “In a world first, El Salvador makes bitcoin legal tender,” Reuters (June 9, 2021) (available at: <https://www.reuters.com/world/americas/el-salvador-approves-first-law-bitcoin-legal-tender-2021-06-09/>); and Gian Volpicelli, “El Salvador’s Race to Be the Bitcoin Capital of the World,” Wired UK (June 30, 2021).

¹⁰⁴ See European Central Bank, “ECB intensifies its work on a digital euro,” ECB Press Release (Oct. 2, 2020) (available at: <https://www.ecb.europa.eu/press/pr/date/2020/html/ecb.pr201002~f90bfc94a8.en.html>); and European Central Bank, “Report on a digital euro” (Oct. 2020) (available at: https://www.ecb.europa.eu/pub/pdf/other/Report_on_a_digital_euro~4d7268b458.en.pdf).

¹⁰⁵ See European Central Bank, “ECB digital euro consultation ends with record level of public feedback,” ECB Press Release (Jan. 13, 2021) (available at: <https://www.ecb.europa.eu/press/pr/date/2021/html/ecb.pr210113~ec9929f446.en.html>).

¹⁰⁶ European Central Bank, “The international role of the euro” (June 2021) (available at: <https://www.ecb.europa.eu/pub/ire/html/ecb.ire202106~a058f84c61.en.html>), at Section B, “Central bank digital currency and global currencies,” by Massimo Ferrari and Arnaud Mehl.

- ¹⁰⁷ Speech by First Deputy Governor of the Bank of France Denis Beau, titled “Innovations in the financial sector and central banks’ contributions,” given at the Paris Blockchain Week Summit 2020 (Dec. 10, 2020) (available at: <https://www.bis.org/review/r201211b.htm>).
- ¹⁰⁸ *Id.* See also Bank of France, “Call for applications - central bank digital currency experimentations” (available at: <https://www.banque-france.fr/en/financial-stability/market-infrastructure-and-payment-systems/call-applications-central-bank-digital-currency-experimentations>) (calling for CBDC-related experimentation).
- ¹⁰⁹ See “Innovations in the financial sector and central banks’ contributions,” *supra* note 108.
- ¹¹⁰ See “Project Jura” press release, *supra* note 6.
- ¹¹¹ Bank of Japan, “The Release of ‘The Bank of Japan’s Approach to Central Bank Digital Currency,’” press release (Oct. 9, 2020) (available at: https://www.boj.or.jp/en/announcements/release_2020/rel201009e.htm/).
- ¹¹² *Id.*
- ¹¹³ Bank of Japan, “The Bank of Japan’s Approach to Central Bank Digital Currency,” p. 1 (Oct. 9, 2020) (available at: https://www.boj.or.jp/en/announcements/release_2020/data/rel201009e1.pdf) (italics added for emphasis).
- ¹¹⁴ *Id.* at pp. 2-3.
- ¹¹⁵ *Id.* at p. 4. See also Kevin Reynolds, “BOJ’s Kuroda Says Central Bank Will Start CBDC Experiments in Spring: Report,” Coindesk (Oct. 12, 2020) (available at: <https://www.coindesk.com/bojs-kuroda-says-central-bank-will-start-cbdc-experiments-in-spring-report>) (noting that BoJ Governor Haruhiko Kuroda has said that the BoJ will begin its CBDC experiments in the Spring of 2021).
- ¹¹⁶ Nitijela of the Republic of the Marshall Islands, 39th Constitutional Regulation Session, 2018, “Declaration and Issuance of the Sovereign Currency Act 2018” (available at: <https://sov.foundation/law.pdf>).
- ¹¹⁷ *Id.* at §§ 102 & 103(a).
- ¹¹⁸ See SFB Technologies, “Marshall Islands to Power World’s First National Digital Currency with Algorand and SFB Technologies” (Mar. 2, 2020) (available at: <https://www.algorand.com/resources/news/marshall-islands-to-power-worlds-first-national-digital>) (announcing the partnership and use of Algorand technology for the SOV).
- ¹¹⁹ “Council of Economic Advisors to Ring in Marshall Islands’ Final Phase to Launch First Auction of Sovereign Subscription Rights (SSRs) to its National Digital Currency,” Global Newswire (Sept. 9, 2020) (available at: <https://www.globenewswire.com/news-release/2020/09/09/2090848/0/en/Council-of-Economic-Advisors-to-Ring-in-Marshall-Islands-Final-Phase-to-Launch-First-Auction-of-Sovereign-Subscription-Rights-SSRs-to-its-National-Digital-Currency.html>).
- ¹²⁰ “Senegal creates digital currency history,” African Business (May 22, 2017) (available at: <https://african.business/2017/05/economy/senegal-creates-digital-currency-history/>).
- ¹²¹ “eCurrency Mint Limited and Banque Regionale De Marches Launch New Digital Currency in Senegal,” Business Wire Press Release (Nov. 4, 2016) (available at: <https://www.businesswire.com/news/home/20161103006949/en/eCurrency-Mint-Limited-and-Banque-R%C3%A9gionale-De-March%C3%A9s-Launch-New-Digital-Currency-in-Senegal>).
- ¹²² Monetary Authority of Singapore, “Project Ubin Phase 5,” MAS Report (6th Report) (available at: <https://www.mas.gov.sg/-/media/MAS/ProjectUbin/Project-Ubin-Phase-5-Enabling-Broad-Ecosystem-Opportunities.pdf?la=en&hash=91091CAD39265C03FF7A4253E70FBEE6D1177714>). See also “Monetary Authority of Singapore completes multi-currency blockchain payments test using JP Morgan tech,” Ledger Insights (July 2020) (available at: <https://www.ledgerinsights.com/monetary-authority-of-singapore-multi-currency-blockchain-payments-experiment-jp-morgan-tech/>).
- ¹²³ “Project Ubin Phase 5,” *supra* note 122, pp. 2, 11-13.
- ¹²⁴ *Id.* at pp. 13-14.
- ¹²⁵ See “Singapore MAS exec says all that’s missing for a CBDC is a central bank decision,” Ledger Insights (Sept. 2021) (available at: <https://www.ledgerinsights.com/mas-says-cbdc-just-needs-central-bank-decision/>).

¹²⁶ Daniel Palmer, “South Korea’s Central Bank Starts Technical Phase for Digital Currency Ahead of 2021 Pilot,” Coindesk (Aug. 31, 2020) (available at: <https://www.coindesk.com/south-korea-central-bank-partner-develop-digital-currency-cbdc-won>).

¹²⁷ Sveriges Riksbank, “E-krona” (available at: <https://www.riksbank.se/en-gb/payments--cash/e-krona/>).

¹²⁸ Sveriges Riksbank, “The Riksbank’s e-krona project,” Report 1 (Sept. 2017) (available at: https://www.riksbank.se/globalassets/media/rapporter/e-krona/2017/rapport_ekrona_uppdaterad_170920_eng.pdf); and Sveriges Riksbank, “The Riksbank’s e-krona project,” Report 2 (Oct. 2018) (available at: <https://www.riksbank.se/globalassets/media/rapporter/e-krona/2018/the-riksbanks-e-krona-project-report-2.pdf>).

¹²⁹ Sveriges Riksbank, “Riksbank develops an e-krona in a test environment” (Dec. 13, 2019) (available at: <https://www.riksbank.se/en-gb/press-and-published/notices-and-press-releases/notices/2019/riksbank-develops-an-e-krona-in-a-test-environment/>).

¹³⁰ See Sveriges Riksbank, “E-krona pilot phase 1” (June 2021) (available at: <https://www.riksbank.se/en-gb/payments--cash/e-krona/e-krona-reports/e-krona-pilot-phase-1-report-3/>). Additional information on the E-krona project is available at: <https://www.riksbank.se/en-gb/payments--cash/e-krona/>.

¹³¹ See Paddy Baker, “Thailand Already Using Central Bank’s Digital Currency,” Coindesk (July 17, 2020) (available at: <https://www.coindesk.com/thailand-central-banks-digital-currency>).

¹³² See ConsenSys, “ConsenSys Selected as Technology Partner by the Bank of Thailand for CBDC Project,” Press Release (Oct. 28, 2020) (available at: [https://consensys.net/blog/press-release/consensys-selected-as-technology-partner-by-the-bank-of-thailand-for-cbdc-project/#:~:text=ConsenSys%20will%20develop%20technology%20for%20a%20retail%20central%20bank%20digital%20currency%20PoC.&text=ConsenSys%20has%20joined%20the%20Bank,and%20Digital%20Ventures%20\(DV\)](https://consensys.net/blog/press-release/consensys-selected-as-technology-partner-by-the-bank-of-thailand-for-cbdc-project/#:~:text=ConsenSys%20will%20develop%20technology%20for%20a%20retail%20central%20bank%20digital%20currency%20PoC.&text=ConsenSys%20has%20joined%20the%20Bank,and%20Digital%20Ventures%20(DV))).

¹³³ Bank of Thailand Press Release No. 21/2021, “The Way Forward for Retail Central Bank Digital Currency (CBDC) in Thailand” (available at: <https://www.bot.or.th/English/PressandSpeeches/Press/2021/Pages/n2164.aspx>), pp. 4-5.

¹³⁴ *Id.* at p. 3.

¹³⁵ *Id.*

¹³⁶ See “Rise of the central bank digital currencies: drivers, approaches and technologies,” *supra* note 102, p. 7 (noting that Ukraine had completed a successful CBDC pilot). See also National Bank of Ukraine, “Central Bank Digital Currencies: New Opportunities for Payments” (available at: <https://bank.gov.ua/en/events/6zdlCQh1KNK1g8bG>).

¹³⁷ See Ian Allison, “Ukraine Government Picks Stellar Development Foundation to Help Build National Digital Currency,” Coindesk (Jan. 4, 2021) (available at: <https://www.nasdaq.com/articles/ukraine-government-picks-stellar-development-foundation-to-help-build-national-digital>).

¹³⁸ *Id.* (quoting a Ukrainian government press release detailing the arrangement).

¹³⁹ See “Rise of the central bank digital currencies: drivers, approaches and technologies,” *supra* note 102, p. 7 (noting that Uruguay had completed a successful CBDC pilot). See also Nikhilesh De, “Uruguay is the latest country to see its central bank start experimenting with its own digital currency, according to statements,” Coindesk (Sept. 22, 2017) (available at: <https://www.coindesk.com/central-bank-of-uruguays-president-announces-digital-currency-pilot-program>).

¹⁴⁰ Christian Barontini and Henry Holden, “Proceeding with caution -- a survey on central bank digital currency,” BIS Paper No. 101, pp. 4-5 (Jan. 2019) (available at: <https://www.bis.org/publ/bppdf/bispap101.pdf>).

¹⁴¹ *Id.*

¹⁴² See Pymnts, “Venezuela Readies Central Bank Crypto Payments” (Sept. 30, 2019) (available at: <https://www.pymnts.com/cryptocurrency/2019/venezuela-readies-central-bank-crypto-payments/>) (noting that the Venezuelan central bank’s finance minister has stated publicly that the central bank has “new instruments” that it will soon make available for cryptocurrency-based “banking transactions as well as national and international payments through the central bank’s accounts”).

¹⁴³ In 2013, then-Federal-Reserve-Chair Bernanke wrote to Congress to describe the “long-term promise” of digital currency, addressing private-sector developments. (See Delphine Strauss and Stephen Foley, “Bitcoin hits \$785 with a little help from Bernanke,” *Financial Times* (Nov. 18, 2013) (quoting a letter written by Federal Reserve Chair Ben Bernanke).). Only recently, however, has the idea that the Federal Reserve would itself issue a digital currency become a topic of discussion by Federal Reserve officials. (See “Private Money and Central Bank Money as Payments Go Digital: an Update on CBDCs,” *supra* note 15; “The Federal Reserve Bank of Boston announces collaboration with MIT to research digital currency,” *supra* note 37 (detailing a multi-year collaboration between the Reserve Bank and MIT to “perform technical research related to a central bank digital currency”) (available at: <https://www.bostonfed.org/news-and-events/press-releases/2020/the-federal-reserve-bank-of-boston-announces-collaboration-with-mit-to-research-digital-currency.aspx>); Buttecali, Proom and Wong, “Observations from the FooWire Project: Experimenting with DLT for Payments Use,” FEDS Notes (available at: <https://www.federalreserve.gov/econres/notes/feds-notes/observations-from-the-foowire-project-experimenting-with-dlt-for-payments-use-20200813.htm>); and Craig Torres, “Powell Says Fed Has Made No Final Call on Digital Currency,” *Bloomberg* (Oct. 19, 2020) (available at: <https://www.bloomberg.com/news/articles/2020-10-19/powell-says-fed-has-made-no-final-decision-on-digital-currency>) (quoting Federal Reserve Chair Jerome Powell as saying the Fed “hasn’t made a decision to issue a digital currency” and that there is a “need for further work and [] public consultation with stakeholders before doing so.”); and compare “Private Money and Central Bank Money as Payments Go Digital: an Update on CBDCs,” *supra* note 15, with “Parachute Pants and Central Bank Money,” *supra* note 12 (offering different viewpoints on the Federal Reserve and CBDC).

¹⁴⁴ See J.P. Koning, “Fedcoin,” *Moneynews* blog post (Oct. 19, 2014) (available at: <https://jpkoning.blogspot.com/2014/10/fedcoin.html>) (outlining how Fedcoin would work and the case for Fedcoin). See also Adrian Hope-Bailie, “Re-imagining payment network architectures” (Oct. 13, 2014) (available at: <https://medium.com/@ahopebailie/re-imagining-payment-network-architectures-2669f7b139f3>); and Sina Motamedi, “Will Bitcoins Ever Become Money? A Path to Decentralized Central Banking” (July 21, 2014) (available at: <https://tannutuva.org/2014/will-bitcoins-ever-become-money-a-path-to-decentralized-central-banking/>) (describing possible adoption of digital currency-related technology by the Federal Reserve).

¹⁴⁵ “Fedcoin,” *supra* note 144.

¹⁴⁶ *Id.*

¹⁴⁷ *Id.*

¹⁴⁸ See “Fedcoin: On the Desirability of a Government Cryptocurrency,” *supra* note 32. Andolfatto also gave a speech in Germany in 2015 in which he outlined some of the fundamentals of a U.S. CBDC (available here: <https://www.youtube.com/watch?v=WrTsVg7V31Y>).

¹⁴⁹ “Fedcoin: On the Desirability of a Government Cryptocurrency,” *supra* note 32.

¹⁵⁰ *Id.*

¹⁵¹ *Id.*

¹⁵² *Id.* (italics contained in the original materials).

¹⁵³ “Digital Currencies, Decentralized Ledgers, and the Future of Central Banking,” *supra* note 11.

¹⁵⁴ See “Digital Currencies, Decentralized Ledgers, and the Future of Central Banking,” *supra* note 11, at pp. 10-15.

¹⁵⁵ “Central Bank Digital Currency and the Future of Monetary Policy,” *supra* note 4, p. 1.

¹⁵⁶ *Id.* at p. 1.

¹⁵⁷ *Id.* at pp. 1-2.

¹⁵⁸ *Id.* at pp. 2-3.

¹⁵⁹ See Kahn, Rivadeneyra, and Wong, “Should the central bank issue e-money?” (first circulated in Oct. 2017) (presented at the Federal Reserve Bank of Atlanta in 2017) (available at: https://www.frbatlanta.org/-/media/documents/news/conferences/2018/1018-financial-stability-implications-of-new-technology/papers/rivadeneyra_should_the_central_bank_issue_emonney.pdf).

¹⁶⁰ *Id.* at pp. 3-4.

¹⁶¹ *Id.* at pp. 11-15 & 18. In 2018, research fellows at the Federal Reserve Bank of St. Louis published a paper looking at “the case for central bank electronic money.” (See Aleksander Berensten and Fabian Schar, “The Case for Central Bank Electronic Money and the Non-case for Central Bank Cryptocurrencies,” Federal Reserve Bank of St. Louis Review, Second Quarter, 2018, pp.97-106 (available at: <https://files.stlouisfed.org/files/htdocs/publications/review/2018/04/16/the-case-for-central-bank-electronic-money-and-the-non-case-for-central-bank-cryptocurrencies.pdf>).)

¹⁶² See Alexander Osipovich, “Former Regulator Known as ‘Crypto Dad’ to Launch Digital-Dollar Think Tank,” The Wall Street Journal (Jan. 16, 2020); and Ben Jessel, “Former CFTC Chairman And Accenture Launch Think-Tank To Digitize The U.S. Dollar,” Forbes (Jan. 17, 2020) (detailing the formation of the Digital Dollar Foundation).

¹⁶³ Accenture views digital currencies as having the potential to disrupt traditional financial players and to force central banks to “play a major role in shaping [the digital currency] landscape.” (See Accenture, “The (R)Evolution of Money[,] Blockchain Empowered Digital Currencies” (2020) (available at: <https://www.accenture.com/cn-en/insight-blockchain-evolution-money>).)

¹⁶⁴ Information about the Digital Dollar Project is available at: <https://www.digitaldollarproject.org/>.

¹⁶⁵ See Digital Dollar Foundation & Accenture, “The Digital Dollar Project[,] Exploring a U.S. CBDC” (May 2020) (available at: <https://www.digitaldollarproject.org/exploring-a-us-cbdc>).

¹⁶⁶ The reasons provided include (i) enhancement of the technological infrastructure underlying the economy, (ii) continued Federal Reserve pursuit of policy objectives, (iii) preservation of the utility of the U.S. dollar, and (iv) facilitation of retail, wholesale, and international payments, and preservation of the status of the U.S. dollar as a unit of account and the world’s reserve currency. (See *id.* at pp. 11-12 & 28-32.)

¹⁶⁷ *Id.* at pp. 6, 8-12 & 20-23.

¹⁶⁸ *Id.* at pp. 7, 17, 26 & 35.

¹⁶⁹ See Paul Wong and Jess Leigh Maniff, “Comparing Means of Payment: What Role for A Central Bank Digital Currency?” FEDS Notes (Aug. 13, 2020) (available at: <https://www.federalreserve.gov/econres/notes/feds-notes/comparing-means-of-payment-what-role-for-a-central-bank-digital-currency-20200813.htm>).

¹⁷⁰ *Id.*

¹⁷¹ *Id.*

¹⁷² Programmability, as a design feature, means the ability to predetermine the execution of certain operations if a set of conditions is met in the future. For example, interest payments at regular intervals might be encoded into a particular design.

¹⁷³ “24x7x365 availability” means that a system is in continuous operation and is therefore accessible or useable at any time, and on any day, through the year.

¹⁷⁴ The term “intermediaries” refers to entities other than a central bank or governmental operator of a CBDC system. Intermediaries can play various roles, including financial or operational roles. Intermediaries may establish accounts, process and settle transactions, make ledger entries, or perform some other task.

¹⁷⁵ “Comparing Means of Payment: What Role for A Central Bank Digital Currency?” *supra* note 169.

¹⁷⁶ “Preconditions for a general-purpose central bank digital currency,” *supra* note 67.

¹⁷⁷ See, e.g., The Central Bank Digital Currency Study Act of 2021, H.R. 2211, 117th Cong., 1st Sess. (2021), at § 3(1) (directs the Federal Reserve to “continue to conduct research on, design, and develop, a CBDC that takes into account its impact on consumers, businesses, the United States financial system, and the United States economy, including the potential impact of a CBDC on monetary policy...”). The Digital Currency Act more specifically then instructs the Federal Reserve to conduct a study, in consultation with the Office of the Comptroller of the Currency, Federal Deposit Insurance Corporation, United States Department of the Treasury, Securities Exchange Commission, and Commodities Futures Trading Commission, on the impact of the introduction of a U.S. CBDC. *Id.* at § 4. The study is meant to cover ten areas: (1) consumers and small businesses, including with respect to financial inclusion, accessibility, safety, privacy, convenience, speed, and price considerations; (2) the conduct of monetary policy and interaction with existing monetary policy tools; (3) the effectiveness of United States economic sanctions programs and the status of the United States dollar as a reserve currency; (4) the United States financial system and banking sector, including liquidity, lending, and financial stability mechanisms; (5) the United States payments and cross-border payments ecosystems, including the FedNow Service; (6) compliance with existing AML/BSSA, illicit financing, and related laws and regulations, and electronic recordkeeping requirements; (7) data privacy and security issues related to CBDC, including transaction record anonymity and digital identity authentication; (8) the international technical infrastructure and implementation of such a system, including with respect to interoperability, cybersecurity, resilience, offline transaction capability, and programmability; (9) the likely participants in a CBDC system, their functions, the benefits and risks of having third parties perform value-added functions, and such as fraud insurance and blocking suspicious transactions; and (10) the operational functioning of a CBDC system, including— (A) how transactions would be initiated, validated, and processed; (B) how users would interact with the system; and (C) the role of the private sector and public-private partnerships.

¹⁷⁸ See, e.g., The Banking for All Act, S. 3571, 116th Cong., 2nd Sess. (2020) (the 117th Cong., 1st Sess. (2021) version of the Act was not available as of the publication of this paper). The Banking for All Act, sponsored by the Chair of the Senate Banking Committee, U.S. Senator Sherrod Brown of Ohio, calls for the Federal Reserve System to establish and maintain a form of digital wallet, referred to as “digital dollar wallets,” “pass-through digital dollar wallets,” or “digital dollar account wallets”/“FedAccounts,” that would be made available to U.S. citizens, legal U.S. residents, and U.S.-domiciled businesses. In addition, the bill requires private institutions to offer specific products to the public by calling for any bank that is a “member bank” (defined as “any national bank, State bank, or bank or trust company which has become a member of one of the reserve banks...”) to “open and maintain pass-through digital dollar wallets for all persons ... who elect to deposit funds into [such] wallets.” And the bill provides required terms / conditions (e.g., no account fees, no minimum balances, and interest payments in certain instances) that must be made available to users of the digital wallets. The Banking for All Act is part of a trio of bills that were introduced in the 116th Congress that call for financial services to be provided directly by the government. (The Banking for All Act, S. 3571, 116th Cong., 2nd Sess. (2020), the Financial Protections and Assistance for America’s Consumers, States, Businesses and Vulnerable Populations Act (H.R. 6321, 116th Cong., 2nd Sess. (2020)), and the Automatic Boost for Communities Act (H.R. 6553, 116th Cong., 2nd Sess. (2020)).)

¹⁷⁹ See, e.g., U.S. Senate Committee on Banking, Housing, and Urban Affairs, Subcommittee Hearing, “US-China: Winning the Economic Competition” (July 22, 2020) (available at: <https://www.banking.senate.gov/hearings/us-china-winning-the-economic-competition>); and U.S. Senate Committee on Banking, Housing, and Urban Affairs, Subcommittee Hearing, “US-China: Winning the Economic Competition, Part II” (Dec. 16, 2020) (available at: <https://www.banking.senate.gov/hearings/us-china-winning-the-economic-competition-part-ii>) (arguing that a U.S. CBDC is necessary in order to maintain competitive positioning between the U.S. and China); and Jason Brett, “As China Pilots New Digital Renminbi, Congress To Hear Proposed ‘Digital Dollar’ Response,” *Forbes* (July 21, 2020) (noting the discussion of U.S. CBDC as part of the hearings). See also U.S. Senate Committee on Banking, Housing, and Urban Affairs, Subcommittee Hearing, “Building A Stronger Financial System: Opportunities of a Central Bank Digital Currency” (June 9, 2021) (available at: <https://www.banking.senate.gov/hearings/building-a-stronger-financial-system-opportunities-of-a-central-bank-digital-currency>) (during which Senators Kennedy and Brown commented on U.S.-China competition concerning CBDC and currency, and the need for the U.S. to “lead the way”; and during which witnesses Mr. Lev Menand and Honorable J. Christopher Giancarlo observed that Chinese CBDC pose a serious risk to the U.S. dollar and to U.S. currency-related standard setting. Also during the hearing, Chair Warren and witness Mr. Lev Menand observed that private digital currencies represent significant risks to U.S. consumers and businesses, including ransomware attacks which demand payment in private cryptocurrencies).

¹⁸⁰ In 2018, the concept of a U.S. CBDC began receiving attention in Congress. In hearings before the House Financial Services Subcommittee on Monetary Policy and Trade, professors and researchers from the University of California Santa Barbara, Cornell University, The Heritage Foundation, and the R Street Institute, provided an overview of CBDC. The 2018 hearings, which discussed the possibility of CBDC, the impact of CBDC on the implementation of monetary policy, and numerous implications that might arise from the introduction of a CBDC, did not address, in great detail, specific design elements of a U.S. CBDC and the implications that arise from specific design choices U.S. policymakers might elect, which is something that has become part of CBDC conversations more recently. (See U.S. House of Representatives, Committee on Financial Services Hearing, “The Future of Money: Digital Currency” (July 18, 2018) (available at: <https://www.govinfo.gov/content/pkg/CHRG-115hhrg31510/pdf/CHRG-115hhrg31510.pdf>); Eswar S. Prasad, “U.S. House of Representatives: Committee on Financial Services Subcommittee on Monetary Policy and Trade Hearing on ‘The Future of Money: Digital Currency,’” prepared testimony (July 18, 2018); and Eswar Prasad, “Central Banking in a Digital Age: Stock-taking and Preliminary Thoughts,” Brookings Institute Report (April 2018) (available at: https://www.brookings.edu/wp-content/uploads/2018/03/es_20180416_digitalcurrencies_final.pdf).)

¹⁸¹ See *supra* note 178. Additionally, in June, the House Financial Services Committee’s Task Force on Financial Technology held a hearing entitled, “Inclusive Banking During a Pandemic: Using FedAccounts and Digital Tools to Improve Delivery of Stimulus Payments,” and the Senate Committee on Banking, Housing, and Urban Affairs held a hearing titled “The Digitization of Money and Payments,” during which J. Christopher Giancarlo, the former Chairman of the U.S. Commodity Futures Trading Commission, and a founder and principal in the Digital Dollar Project, presented the DDP group’s arguments for - and vision of - a U.S. CBDC. The majority staff memo for the Senate Committee on Banking, Housing, and Urban Affairs hearing addressed possible benefits of a U.S. CBDC, noting that a U.S. CBDC presents a number of “potential advantages” over existing payment systems, including “decentralization,” “disintermediation,” incremental privacy gains, “facilitate[ion] [of] faster payments” in the U.S., reduction of payments expense, and increased financial inclusion. The memo goes on to note that the U.S. “regulatory framework for the oversight and governance of digital currencies” is fragmented, and that some nations’ central banks have “explicit authority for general retail payments oversight” and “systemically important payments,” but the Federal Reserve does not; and observes that “a Fed-backed digital dollar would ostensibly allow those who cannot afford a traditional bank account to participate in the financial system,” particularly as digital currency-based transactions can be facilitated without requiring access to bank accounts/an account-based system. (See House Financial Services Committee Task Force on Financial Technology, “Inclusive Banking During a Pandemic: Using FedAccounts and Digital Tools to Improve Delivery of Stimulus Payments,” (June 11, 2020) (available at: <https://financialservices.house.gov/calendar/eventsingle.aspx?EventID=406617>); U.S. Senate Committee on Banking, Housing, and Urban Affairs, Full Committee Hearing, “The Digitization of Money and Payments” (June 30, 2020) (available at: <https://www.banking.senate.gov/hearings/the-digitization-of-money-and-payments>); Hon. J. Christopher Giancarlo, “Testimony [before the] United States House of Representatives Committee on Financial Services Task Force on Financial Technology[,] ‘Inclusive Banking During a Pandemic: Using FedAccounts and Digital Tools to Improve Delivery of Stimulus Payments,’” (June 11, 2020) (available at: https://financialservices.house.gov/uploadedfiles/hhrg-116-ba00-wstate-giancarloj-20200611.pdf?fbclid=IwAR16l8vyFASxasVxVPnQ8VG71kYKPYo_tp5ZgJFmtEzDXscwmR51jq8bKml); Hon. J. Christopher Giancarlo, “Testimony [before the] U.S. SENATE COMMITTEE ON BANKING, HOUSING, AND URBAN AFFAIRS[,] ‘The Digitization of Money and Payments,’” (June 30, 2020) (available at: <https://www.banking.senate.gov/imo/media/doc/Giancarlo%20Testimony%206-30-20.pdf>); and Memo from Majority Staff to Banking LAs, “The Digitization of Money and Payments” (June 26, 2020), p. 4 (on file with The Clearing House staff) respectively.) See also Congressional Research Service, “Financial Innovation: Central Bank Digital Currencies” (March 20, 2020) (available at: <https://crsreports.congress.gov/product/pdf/IF/IF11471>) (providing background on CBDC initiatives and design considerations).)

¹⁸² While discussion of a U.S. CBDC in Congress is not new, recent hearings have begun focusing on specific design elements of a U.S. CBDC and the processes by which the U.S. might establish a CBDC. (*Compare, e.g.,* U.S. House of Representatives, Committee on Financial Services Hearing, “The Future of Money: Digital Currency” (July 18, 2018) (available at: <https://www.govinfo.gov/content/pkg/CHRG-115hhrg31510/pdf/CHRG-115hhrg31510.pdf>) with U.S. Senate Committee on Banking, Housing, and Urban Affairs, Full Committee Hearing, “The Digitization of Money and Payments” (June 30, 2020) (available at: <https://www.banking.senate.gov/hearings/the-digitization-of-money-and-payments>).) (*See also* C-Span, “Virtual Currencies” (July 18, 2018) (coverage of the House Financial Services Subcommittee on Monetary Policy and Trade’s hearings on the benefits and risks of digital currencies) (available at: <https://www.c-span.org/video/?448611-1/house-panel-examines-digital-currency>).) In addition, sections 4(b)(2)-(4) of the Digital Currency Act require the Federal Reserve to, within one year after the date of enactment of the Act, submit a study report to the House Financial Services and Senate Banking Committees that summarizes the results of the study and makes recommendations about how a U.S. CBDC system might be designed (e.g., a model(s) for implementation). The submission must also provide a timeline for U.S. CBDC development (detailing important milestones) and a “description of any legal authorities, if any, the [Fed] would require to implement the CBDC model.”

¹⁸³ *See* “Building A Stronger Financial System: Opportunities of a Central Bank Digital Currency,” *supra* note 179; and House Committee on Financial Services, Task Force on Financial Technology hearing, “Digitizing the Dollar: Investigating the Technological Infrastructure, Privacy, and Financial Inclusion Implications of Central Bank Digital Currencies” (June 15, 2021) (available at: <https://financialservices.house.gov/calendar/eventsingle.aspx?EventID=407953#LiveStream>).

¹⁸⁴ Timothy B. Lee, “Janet Yellen Will Consider Limiting the Use of Cryptocurrency,” WIRED (Jan. 22, 2021) (available at: <https://www.wired.com/story/janet-yellen-consider-limiting-cryptocurrency/>) (noting that Secretary Yellen has suggested the government should “examine ways in which [it] can curtail the [] use [of certain digital currencies] and make sure that [money laundering] doesn’t occur through those channels”). *See also* Harry Robertson, “Janet Yellen says ‘misuse’ of cryptocurrencies like bitcoin is a growing problem, as regulators increase scrutiny after surge in interest,” Business Insider (Feb. 11, 2021) (quoting Janet Yellen as saying that “misuse” of cryptocurrencies is a “growing problem”) (available at: <https://markets.businessinsider.com/currencies/news/janet-yellen-bitcoin-misuse-cryptocurrencies-growing-problem-tesla-2021-2-1030071724>); and “Fed Chair Raises ‘Serious Concerns’ About Facebook’s Cryptocurrency Project,” *supra* note 13 (quoting Federal Reserve Chairman Jerome Powell as saying that Facebook’s private digital currency proposal has a host of “serious concerns” around “money laundering, consumer protection and financial stability,” and that it “cannot go forward without there being broad satisfaction with the way the company has addressed money laundering” and other issues).

¹⁸⁵ *See* Scott Reeves, “Treasury Secretary Nominee Janet Yellen Touts Crypto ‘Benefits,’ with Regulation,” Newsweek (Jan. 25, 2021) (available at: <https://www.newsweek.com/treasury-secretary-nominee-janet-yellen-touts-crypto-benefits-regulation-1564197>) (noting that Secretary Yellen subsequently touted the benefits of cryptocurrencies and digital assets, while continuing to stress certain threats they present). *See also* PYMNTS, “Digital Dollar Exploration Gets Backing From Treasury Secretary Yellen” (Feb. 22, 2021) (available at: <https://www.pymnts.com/digital-payments/2021/digital-dollar-exploration-gets-backing-from-treasury-secretary-yellen/>) (noting Treasury Secretary Yellen expressed support for exploration of a U.S. CBDC and recently concluded that “faster, safer, and cheaper payments” may result from a U.S. CBDC).

¹⁸⁶ “Fed’s Powell: More important for U.S. to get digital currency right than be first,” Reuters (Oct. 19, 2020) (quoting Federal Reserve Chair Jerome Powell) (available at: <https://www.reuters.com/article/us-usa-fed-powell-digitalcurrency/feds-powell-more-important-for-u-s-to-get-digital-currency-right-than-be-first-idUSKBN2741OI>).

¹⁸⁷ Testimony of Chair Powell on Monetary Policy to House Financial Service Committee on Monetary Policy (Feb. 24, 2021) (<https://www.federalreserve.gov/newsevents/testimony/powell20210223a.htm> (does not contain this reference)) (comments were in response to questions from Rep. McHenry, available here: <https://financialservices.house.gov/calendar/eventsingle.aspx?EventID=407168>).

¹⁸⁸ Jeanna Smialek, “Jerome Powell says the Fed won’t issue a digital currency without congressional approval,” The New York Times (Mar. 22, 2021) (available at: <https://www.nytimes.com/2021/03/22/business/jerome-powell-says-the-fed-wont-issue-a-digital-currency-without-congressional-approval.html>) (quoting Chair Powell).

¹⁸⁹ Interview of Federal Reserve Chair Jerome Powell by Scott Pelley, 60 Minutes (April 11, 2021) (available at: <https://www.cbsnews.com/news/jerome-powell-full-2021-60-minutes-interview-transcript/>).

¹⁹⁰ Speech by Chair Powell on “Developments in the U.S. Payments System” (May 20, 2021) (transcript available at: <https://www.federalreserve.gov/mediacenter/files/payment-innovation-message-transcript-20210520.pdf>). See also Federal Reserve Press Release, “Federal Reserve Chair Jerome H. Powell outlines the Federal Reserve’s response to technological advances driving rapid change in the global payments landscape” (May 20, 2021) (available at: <https://www.federalreserve.gov/newsevents/pressreleases/other20210520b.htm>).

¹⁹¹ *Id.*

¹⁹² See “Private Money and Central Bank Money as Payments Go Digital: an Update on CBDCs” *supra* note 15 (detailing benefits of a U.S. CBDC that are “sharpening the focus” of the central bank’s exploration of CBDC).

¹⁹³ *Id.* at pp. 1-3.

¹⁹⁴ “Parachute Pants and Central Bank Money,” *supra* note 12.

¹⁹⁵ See Testimony of Chair Jerome H. Powell, “Semiannual Monetary Policy Report to the Congress” (July 14 & 15, 2021) (available at: <https://www.federalreserve.gov/newsevents/testimony/powell20210714a.htm>) (comments contained in the recording of questions and answers).

¹⁹⁶ U.S. Department of the Treasury, “Readout of the Meeting of the President’s Working Group on Financial Markets to Discuss Stablecoins” (July 19, 2021) (available at: <https://home.treasury.gov/news/press-releases/jy0281>).