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HEARING ON “THE FUTURE OF MONEY: DIGITAL CURRENCY”

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I. Introduction

Chairman Barr, Ranking Member Moore, and honorable members of the House Committee on Financial Services, thank you for the opportunity to share with you my views on the potential role of digital currencies in the U.S. economy and financial system.

In my remarks, I will focus on the implications of the evolution of new financial technologies, including but not limited to cryptocurrencies, for central banking. This testimony will accord particular attention to issues surrounding (i) the implementation and transmission of monetary policy and (ii) financial stability. I will also discuss the pros and cons of central bank digital currencies (CBDC).¹

II. Key Messages

While the advent of decentralized cryptocurrencies such as Bitcoin has dominated the headlines, a broader set of changes wrought by advances in technology are likely to eventually have a more profound and lasting impact on central banks. It is premature to speak of disruption of traditional concepts of central banking, but it is worth considering if the looming changes to money, financial markets, and payments systems will have significant repercussions for the operation of central banks and their ability to deliver on key objectives such as low inflation and financial stability.

- There are many potential advantages to switching from physical to digital versions of central bank money, in terms of easing some constraints on

¹ This testimony draws extensively from Eswar Prasad, “Central Banking in a Digital Age: Stock-taking and Preliminary Thoughts,” Brookings Institution Report, April 2018. <https://www.brookings.edu/events/digital-currencies-implications-for-central-banks/> Please see that report for a full set of references and sources.

traditional monetary policy and providing an official electronic payments system. The basic mechanics of monetary policy implementation will not be affected by a switch from physical currency to CBDCs. However, other technological changes that are likely to affect financial markets and institutions could have significant effects on monetary policy implementation and transmission.

- New financial technologies—including those underpinning nonofficial cryptocurrencies—herald broader access to the financial system, quicker and more easily verifiable settlement of transactions and payments, and lower transaction costs. Domestic and cross-border payment systems are on the threshold of major transformation, with significant gains in speed and lowering of transaction costs on the horizon. The efficiency gains in normal times from having decentralized payment and settlement systems needs to be balanced against their potential technological vulnerabilities and the repercussions of loss of confidence during periods of financial stress.
- Multiple payment systems could improve the stability of the overall payments mechanism in the economy and reduce the possibility of counterparty risk associated with the payment hubs themselves. However, multiple systems without official backing could be severely tested in times of crisis of confidence and serve as channels for risk transmission. Decentralized electronic payment systems are also exposed to technological vulnerabilities that could entail significant economic as well as financial damage. CBDCs could function as payment mechanisms that provide stability without necessarily limiting private fintech innovations.
- Financial institutions, especially banks, could face challenges to their business models, as new technologies facilitate the entry of institutions (or decentralized mechanisms) that can undertake financial intermediation and overcome information asymmetries. Banks will find it difficult to continue collecting economic rents on some activities that cross-subsidize other activities. The emergence of new institutions and mechanisms could improve financial intermediation but will pose significant challenges in terms of regulation and financial stability.
- New forms of money and new channels for moving funds within and between economies could also have implications for international capital flows and exchange rates. The proliferation of channels for cross-border capital flows will make it increasingly difficult for national authorities to control these flows. Emerging market economies will face particular challenges in managing the volatility of capital flows and exchange rates, and could be subject to greater monetary policy spillovers and contagion effects. These channels are also susceptible to exploitation for money laundering, illegal activities, and evasion of controls and reporting requirements related to cross-border capital flows.

III. Concepts and Definitions

At the outset, it is worth laying out some relevant definitions for the purposes of this testimony and to clarify certain terms that are sometimes used interchangeably in popular discussions.

- *Fiat currency*: Currency issued by a national central bank, typically in the form of currency banknotes and coins (which will henceforth be referred to as *cash*). Generally issued by a government entity, although can also be issued by private institutions under the authority of the government.
- *Legal tender*: Form of payment that a creditor is legally obliged to accept from a debtor in order to extinguish a debt. Fiat currencies are typically legal tender. Not only must they be accepted as settlement for debt between private parties, but the government—which has the authority to levy taxes—can require that such tax obligations only be settled using the legal tender. Fiat currencies are, in principle and at least to a limited extent, backed by this authority of the government.
- *Digital currency*: Broad term that encompasses any form of currency that is not tangible.
- *Central Bank Digital Currencies*: Fiat currencies issued by central banks in place of, or as a complement to, physical currency (banknotes and coins).
 - *E-money*: A simple version of an electronic currency, wherein the central bank in effect manages a centralized payment system linked to electronic “wallets”. The payment system could be managed using blockchain or other versions of distributed ledger technology to verify transactions, with the verification process managed by the central bank rather than through a decentralized mechanism.
 - *Official cryptocurrencies*: Cryptocurrencies issued by a government entity, although not considered the equivalent of fiat currency; could in principle count as legal tender if the government were to decree this. Logically, government cryptocurrencies would be centralized, with verification of transactions provided by the government itself or its appointed agents rather than through a decentralized verification mechanism. Open question if this provides anonymity to transacting parties.
- *Nonofficial Cryptocurrencies*: Digital currencies that are virtual, typically not backed by a government, and do not constitute legal tender. Key characteristic is the ostensible anonymity of transactions conducted principally using blockchain technology (this aspect is similar to cash, but cryptocurrencies are easier to scale than cash and do not require physical transfers of currency notes). Cryptocurrencies can either be decentralized (wherein, for instance, any economic agent with enough computing power can verify transactions in return for a reward) or centralized (with verification undertaken by or limited to those

approved by a central authority).² Another relevant characteristic is whether the record of transactions is public or private (restricted to those who have permissioned access).

- *Fintech*: Broad term that refers to various technological developments that are relevant to financial markets. While there are many developments under this rubric that are not directly related to digital currencies, they could facilitate the use of such currencies since many of the relevant technologies, especially decentralized distributed ledgers, are relevant to both contexts.

These broad definitions need to be complemented by a range of other combinations of these underlying concepts, as well as some practical and legal considerations. The blockchain or Distributed Ledger Technology (DLT) underpinning Bitcoin allows for decentralized public verification of transactions and ensures immutability of those records. This technology clearly has applications beyond Bitcoin. A similar technological setup could be used to set up a CBDC, although the nature of verification of transactions (by the central bank itself, by a set of authorized agents, or by miners who get rewarded for this process in some fashion) and whether the system allows for true anonymity would have to be decided by the central bank.

This points to an important difference between official and nonofficial digital currencies. A fiat currency in a decentralized distributed ledger would in effect be an IOU, which would have to be backed up by a payment system to transfer the underlying financial asset (the currency). By contrast, for a nonofficial cryptocurrency, the entry on the public ledger is itself the digital asset, which is not backed in any way. The status of official cryptocurrencies is ambiguous—in principle, such a cryptocurrency could be backed by the government; if this backing was credible, this would be similar to other official digital currencies with the potential for anonymity being the distinguishing characteristic relative to electronic money.

Of course, as noted above, a CBDC could also be set up more simply as an electronic token on the government's payment network. It is now (or will soon be) technologically feasible for a central bank to set up electronic deposit accounts for all of a country's residents, with blockchain technology making it easy for the central bank to manage a multitude of such accounts. Presumably, these accounts would not normally be interest bearing and would be used for payments rather than as a channel for financial intermediation by the central bank.

While a CBDC might serve as a complement to a physical currency, there could be legal considerations involved since, in some countries, the definition of legal tender might not cover the issuance of a CBDC. A statutory remedy would then be required to ensure the equivalence of digital and physical versions of the fiat currency. CBDCs could be limited to wholesale transactions between financial institutions or expanded to retail transactions, in the latter case essentially functioning as a central bank-managed retail payment system.

² In practice, the degree of centralization is not a binary choice.

Cryptocurrencies, which lack government or other backing, might appear to stand little chance of competing with fiat currencies. Moreover, with growing indications that cryptocurrencies such as Bitcoin do not truly guarantee anonymity, their roles as currencies rather than as just sophisticated payment systems have come under question. The natural market response has been the proliferation of cryptocurrencies that attempt to address one or more of these concerns. There are now close to 1600 cryptocurrencies that come in various flavors. Some of these are ostensibly backed in one form or another and are intended for a variety of purposes. For instance, the blockchain-based cryptocurrency Tether is in principle backed by and trades at par with the U.S. dollar (or, in its other incarnations, at par with other major currencies). Cryptocurrencies backed by a physical currency do not constitute new money creation and are in effect just a payments system. The value of some cryptocurrencies is backed by commodities or their prices are pegged to the prices of specific commodities.³

One of the initial attractions of nonofficial cryptocurrencies, and the reason for official concerns about them, was the anonymity they provided. Bitcoin and Ethereum, two popular cryptocurrencies, are in fact not anonymous since the amounts as well as source and destination addresses associated with each transaction are public information (this could allow the parties to any transaction to be traced). By contrast, Monero and ZCash are considered truly anonymous in the sense that none of this information associated with a particular transaction is publicly available. However, researchers have raised questions about the non-traceability of transactions even in these cases. These findings have implications for security risks associated with CBDCs and especially for official cryptocurrencies that might purport to provide anonymity in a digital environment.

The proliferation of cryptocurrencies and their relationship to fiat currencies, whether physical or digital, is likely to ultimately hinge on how effectively each currency delivers on its intended functions. In this sense, by parceling out the various functions, the advent of cryptocurrencies has already changed the nature of money. Fiat money bundles together multiple functions as it serves as a unit of account, medium of exchange, and store of value. Now, with the advent of various forms of digital currencies, these functions can conceptually be separated. Moreover, whatever the future of cryptocurrencies, the DLT and related technologies underlying their creation could have major impacts in the realms of finance and central banking.

Money

While the term money has no singular definition, it is popularly associated with currency banknotes and coins. Much of the above discussion about digital currencies is related to a narrow concept of money. Monetary aggregates that are more relevant for evaluating the

³ The U.K.'s Royal Mint has issued a cryptocurrency backed by its gold holdings. For other gold- or commodity-backed currencies, the verification mechanism for the backing seems to rely on audits by major auditing firms. Concerns have been raised about whether Tether is in fact fully backed by dollars as claimed by the issuers, who indicate that their reserve holdings are published daily and subject to frequent professional audits.

stance and outcomes of monetary policy are much broader and can be classified into two categories:

- Outside money: Fiat (unbacked) money issued by a central bank (or government entity) or backed by an asset that is not in zero net supply in the private sector (e.g., gold).
- Inside money: An asset representing or backed by any form of private credit; circulates as medium of exchange; in net zero supply in private sector.

These two concepts could become blurred as unbacked money that is privately issued (or created by a non-governmental entity) competes with government-issued fiat currency. This raises a number of analytical issues about the different roles played by various forms of money. It should also be noted that inside money, in the form of bank deposits, is arguably already mostly in electronic form.

The share of central bank money in overall monetary aggregates has declined in recent years in most economies. For instance, take Sweden, which has gained some attention as an economy that is fast moving towards becoming cashless. The ratio of currency (banknotes and coins) to the monetary aggregate M3, which includes currency as well as bank deposits of various maturities, fell from 7 percent in the early 2000s to 2 percent by 2016. A report from the Riksbank states that “the proportion of cash payments in the retail sector has fallen from close to 40 percent in 2010 to about 15 percent in 2016.”

The ratio of currency to M2—which typically includes currency as well as savings deposits, time deposits, and money market deposit accounts (although the precise definition varies from country to country)—ranges from close to 20 percent in Russia and Mexico, to about 10 percent in the India, Japan, Kenya, and the U.S., to under 5 percent in China, the U.K, and the Euro zone. In recent years, the ratio of currency to M2 has fallen in a number of advanced and emerging market countries, indicating the declining importance of outside money even within this narrow monetary aggregate. Since 2003, the ratio of currency to M2 has fallen by 5 percentage points in China, 7 percentage points in India, and 3 percentage points in the Euro zone.⁴

The implications of these crude calculations of the low and declining importance of currency are two-fold. First, the typical notion of money needs to be extended to consider broader concepts of money that are more relevant for economic activity and monetary policy. Second, when considering how technological developments could affect monetary policy, it is essential to examine the potential implications of these developments for financial institutions that play a critical role in creating inside money.

⁴ The ratio has held relatively steady in Japan, Switzerland, the U.K., and the U.S., all of which are, interestingly, reserve currency economies.

IV. Approaches Taken by Different Central Banks and Governments

The rapid rise of cryptocurrencies has elicited a range of responses from central banks and governments, from trying to co-opt the changes to their advantage to resisting certain developments for fear of stoking monetary and financial instability. For many central banks, the responses are driven by concerns about the rapidly declining usage of currency and the implications for both financial and macroeconomic stability if decentralized payment systems displace both cash and traditional payment systems managed by regulated financial institutions. For instance, Sweden's Riksbank is actively exploring the issuance of an e-krona, a digital complement to cash, with the objective of "promoting a safe and efficient payment system."

CBDC

A number of central banks are at various stages of looking into the feasibility and desirability of issuing CBDCs. The status of some key central banks is listed below.

- *In operation:* Tunisia issued the first CBDC, an e-Dinar designed as a virtual account, as early as 2010. It has now been superseded by a blockchain-based centralized digital currency (using the Monetas digital platform) that also functions as a payments system. In 2015, Ecuador introduced a centralized payment system backed by a digital currency but, since the system failed to attract a significant number of users or volume of payments, is deactivating the system in April 2018.
- *Preparation for implementation/groundwork in progress:* China has successfully tested a block-chain based digital notes transaction platform and is developing a digital currency known as the Digital Currency for Electronic Payment. A consortium of Japanese banks plans to introduce a digital currency (J Coin) in time for the 2020 Tokyo Olympics. This project has the approval of the Bank of Japan, which has indicated that it is not considering issuing a digital currency by itself. The Bank of Canada has a joint initiative with the national payment system operator to develop a DLT-based settlement asset for wholesale transactions (Project Jasper). The Monetary Authority of Singapore is developing a tokenized version of the Singapore dollar on an Ethereum-based blockchain (Project Ubin). Senegal intends to issue an electronic version of the eCFA that will co-exist with physical CFA. This will be issued by a regional bank and will not rely on blockchain technology.
- *Evaluating pros and cons, with no specific plans to issue digital currency:* None of the major advanced economy central banks have announced specific plans to issue CBDCs. Some officials of the Bank of Japan, Bank of Canada, Bank of England, European Central Bank, and the Federal Reserve have indicated they are evaluating the pros and cons of CBDCs, although none of them appear to be giving this serious consideration.

Cryptocurrencies

The approaches of governments and central banks to permitting and/or regulating nonofficial cryptocurrencies span a wide spectrum, with individual countries often changing their positions back and forth in response to consumer demand and concerns about financial stability implications.

- *Active regulation:* Canada and Japan have explicit laws concerning the trading and use of cryptocurrencies. The U.S. considers Bitcoin and other cryptocurrencies as financial assets that are subject to tax laws as well as regulations concerning anti money laundering and combating of financing of terrorism (AML/CFT).
- *Soft/hard bans on cryptocurrencies:* India's central bank, the Reserve Bank of India (RBI), has not authorized any institution it regulates to trade in or conduct business using cryptocurrencies. In April 2018, the RBI prohibited banks, financial institutions, and other regulated entities from dealing in virtual currencies. Korea's regulators have taken a dim view of cryptocurrencies, although they have not banned them outright. China banned domestic Bitcoin exchanges when it was trying to restrict speculative capital outflows in 2017, and has subsequently blocked access to cryptocurrency exchanges. China has also recently banned domestic initial coin offerings (ICOs) and prohibited individuals and institutions from participating in them.
- *Passive tolerance:* A majority of countries are in this category, not banning cryptocurrencies but discouraging their use by financial institutions and, in many cases, not clarifying the legal status of such currencies even as means of payment.
- *Governments/central banks issuing their own cryptocurrencies:* Venezuela's government issued the first official cryptocurrency, the petro, in February 2018. In April 2018, Venezuela declared the petro to be legal tender. The petro's value is in principle backed by Venezuela's oil reserves and the cryptocurrency's issuance was intended to bolster public finances and evade financial sanctions imposed against Venezuela by the U.S. and other countries. Russia has indicated that it will issue a CryptoRuble, mainly for the latter reason. Cambodia, Estonia, and the Republic of the Marshall Islands have announced plans to issue official cryptocurrencies.

In short, there is no unified approach to regulation (or tolerance) of cryptocurrencies. However, as indicated by the recent G-20 statement, many countries are concerned about the potential problems posed by cryptocurrencies, especially the avenues they may provide for evasion of taxes and AML/CFT regulations.⁵

⁵ The March 2018 communiqué of the G-20 finance ministers and central bank governors states that "Crypto-assets do...raise issues with respect to consumer and investor protection, market

V. Implications for Financial Institutions, Markets, and Stability

Recent technological developments have implications for the structure of financial markets as well as for banks and other financial institutions. These developments have the potential to increase the efficiency and stability of financial markets but could also create new risks and amplify them in certain circumstances. The structures of financial markets and institutions will also be affected, with even the viability of some traditional institutions coming into question.

Payment Systems

The potential efficiency gains and welfare improvements from DLTs and other technologies underlying both CBDCs and cryptocurrencies could be significant. As the technology matures, it will confer a variety of benefits such as lower transaction costs as well as quicker and more easily verifiable settlement of transactions. It will become easier and cheaper to conduct even micro transactions using electronic payment systems. Such technologies can also help in broadening access to the formal financial system. An earlier fintech development, mobile banking, is already revolutionizing the very concept of banking in developing economies and giving much of the population—including rural and poor households—access to the formal financial system.

Many of these efficiency gains are related to improvements in payment systems, which have the potential to transform a variety of financial transactions. Both domestic and cross-border payment systems face disruption, with significant gains in speed and lowering of transaction costs on the horizon. Traditional messaging and payment/settlement systems across institutions (e.g., Fedwire and Clearing House Interbank Payments System (CHIPS) in the U.S., SWIFT for international transactions) could be displaced by cheaper and more efficient alternatives based on either decentralized or centralized monitoring. Payment systems and intermediaries such as Visa and Mastercard, which operate both within and across national borders, could also have their business models disrupted if their innovation does not keep pace.

These changes have obvious positive welfare implications. The proliferation of payment systems could increase financial stability by creating multiple levels of redundancies, so that the technological (or other forms of) failure of one payment system would not be harmful to the system. However, there are important considerations that could worsen instability. As has become abundantly clear in multiple contexts, electronic systems have considerable technological vulnerabilities. These vulnerabilities, in addition to the lack of official backing, could expose these systems to crises of confidence. If this happens at a time when official payment systems have been sidelined as a result of competitive forces, there could be dire financial and macroeconomic consequences. Fragmentation and lack of oversight of payment systems could also lead to pooling of counterparty risk in the payment hubs, further increasing their fragility at times of financial stress.

integrity, tax evasion, money laundering and terrorist financing. Crypto-assets lack the key attributes of sovereign currencies. At some point they could have financial stability implications.”

Financial Institutions

As noted earlier, banks play a crucial role in the creation of money. Hence, changes to the financial system that affect the relative importance, or even the viability of, traditional banks have implications not just for financial markets but also for economic activity and monetary policy.

The traditional roles of banks—intermediating between savers and borrowers by offering deposits and loans—could be upended by more direct intermediation channels. But issues of maturity transformation and information asymmetries, traditionally the main issues that gave banks advantages over other financial institutions, could still affect whether commercial banks may be displaced or simply switch to different roles.

Commercial banks' traditional advantages can no longer be taken for granted. For instance, relationship banking and other sources of information give banks an advantage over other financial institutions in dealing with information asymmetries between borrowers and lenders. However, as has already been demonstrated by Alibaba and Alipay in China, the use of big data and tracking of multiple attributes and economic activities of agents (including their purchase and payment histories) could provide even more effective credit scoring that reduces information asymmetries. Similarly, peer to peer lending and other direct intermediation channels between savers and borrowers are being facilitated by new technologies.

These alternative channels of financial intermediation have passed the proof of concept stage, but whether they can be scaled to the extent that they challenge commercial banks remains to be seen. Maturity transformation is an inherently risky activity for a financial institution and there may be a limit to which informal institutions can take on this task. At any rate, banks can no longer count on collecting economic rents on many intermediation activities that they had hitherto conducted inefficiently and charged high fees on, exploiting their oligopolistic power. Competitive pressures from nonbank institutions are likely to lead to a rapid erosion of such rents, which could cause financial pressures for banks that had been using profits on certain activities to cross-subsidize other activities.

The rise of new types of nonbank and informal financial institutions could help increase the efficiency of financial intermediation, including by creating new products for savers and borrowers. But as these institutions intrude on the business areas of traditional banks, they would also take on some of the financial fragilities associated with those activities. Hence, the structures of financial supervisory and regulatory frameworks will need to adapt since the risks might shift to the under-regulated parts of the financial system.

Financial Market Regulation

The nature of regulation will change not just as new financial players emerge but also as the financial operations of existing players and the structures of financial markets are affected by the technological developments discussed in this note.

One of the key changes wrought by technology is that the cost of information acquisition and dispersion is falling. This should in principle engender greater financial stability since asymmetric and incomplete information are impediments to the smooth functioning of financial markets. However, a reduction in the cost of obtaining information, without commensurate improvements in reliable signal extraction mechanisms or the displacement of trusted signal interpreters, could actually lead to information overload. This in turn could lead to information cascades that worsen herding behavior and intensify contagion across financial markets. Bandwagon effects could intensify volatility in financial markets as more investors, including retail investors, can jump on more quickly and cheaply as they try to follow trends.

Informal financial institutions, which are outside the purview of regulators, could become increasingly important to the financial system. If the system does in fact efficiently disperse risk, then the outcome with a larger number of institutions due to the lower cost of entry might be a better one than present system. It has also been argued by some analysts that market discipline is often thwarted by government intervention or, worse, direct government involvement in the market. But will a decentralized system truly be subject to checks and balances in the absence of any oversight/regulation?

Decentralized payment processing and settlement systems could, in addition to increasing efficiency, level the playing field across small and large banks. The advantage of scale that large banks (and other large financial institutions) have would matter less as the costs of financial intermediation fall. However, regulators will need to be vigilant to avoid the risks of capture by large institutions. For instance, a set of large banks could set up a closed and centralized payment system that smaller banks do not have access to, making it harder for smaller banks that have access only to alternative decentralized systems to compete effectively.

Thus, while some aspects of financial regulation might become easier (because of better and quicker monitoring of digital transactions), the nature of financial regulation will have to keep pace with shifts in the structures of financial markets and institutions. For instance, while considerations such as too big to fail have been important in recent banking regulatory reforms, future regulation might also need to ensure that big banks do not use their size to cartelize the financial system by setting up restricted access payment and settlement systems outside the purview of the central bank or other regulatory authority.

Fintech and Regulatory Sandboxes

The challenge for regulators is to find a balance between regulation and providing space for financial innovation that does not pose systemic stability risks. By definition this is a difficult balancing act since the full scope of benefits as well as the full scale of risks associated with a particular innovation might not be clear in the early stages.

A number of central banks, recognizing the potential benefits of new technologies, have tried to allow some experimentation under controlled circumstances. Regulatory

sandboxes have proliferated as regulators try to take the measure of the new technologies and their potential without engendering systemic risks. The U.K. Financial Conduct Authority Regulatory notes that its sandbox “allows businesses to test innovative products, services, business models and delivery mechanisms in the real market, with real consumers.” The Monetary Authority of Singapore states that its regulatory sandbox enables financial institutions “...as well as FinTech players to experiment with innovative financial products or services in the production environment but within a well-defined space and duration. It shall also include appropriate safeguards to contain the consequences of failure and maintain the overall safety and soundness of the financial system.” The sandboxes allow regulators to observe the operation of new financial technologies as a precursor to designing suitable regulation as these activities scale up and move out of the sandboxes and into the broader financial system.

The list of countries that already have such financial regulatory sandboxes in operation includes a number of advanced and emerging market economies such as Australia, Canada, Denmark, Hong Kong, Malaysia, Thailand, Saudi Arabia, South Africa, Sweden, and the United Kingdom. The European Union recently set out proposals for an EU-wide regulatory sandbox.

The Federal Reserve has not initiated any proposals for such a sandbox or indicated any intention of doing so. Interestingly, in March 2018, Arizona enacted a new law establishing a fintech sandbox, making it the first U.S. state to do so.⁶ The program is to be managed by the Attorney General’s office, is due to open for applications in late 2018, and is slated to run through July 2028. Applicants will be able to serve up to 10,000 Arizonian customers, and will have two years for testing. The press release notes that, while the idea of a regulatory fintech sandbox is “being discussed at the federal level, Congress is moving at a glacial pace.”

Regulating Nonofficial Cryptocurrencies

Cryptocurrencies themselves pose an additional set of challenges. The range of financial activities that are facilitated by cryptocurrencies and the potential for gaps in regulatory oversight as different regulators sort through jurisdictional issues is illustrated by the U.S. experience so far. The following summary is based on a recent CFTC document:⁷

U.S. law does not provide for direct, comprehensive Federal oversight of underlying Bitcoin or virtual currency spot markets. As a result, U.S. regulation of virtual currencies has evolved into a multifaceted, multi-regulatory approach:

⁶ The official press release is available at: <https://www.azag.gov/press-release/arizona-becomes-first-state-us-offer-fintech-regulatory-sandbox>.

⁷ “CFTC Backgrounder on Oversight of and Approach to Virtual Currency Futures Markets” CFTC Public Affairs Office, January 2018. https://www.cftc.gov/sites/default/files/idc/groups/public/%40customerprotection/documents/file/backgrounder_virtualcurrency01.pdf

- State banking regulators oversee certain U.S. and foreign virtual currency spot exchanges largely through state money transfer laws.
- The Internal Revenue Service (IRS) treats virtual currencies as property subject to capital gains tax.
- The Treasury’s Financial Crimes Enforcement Network (FinCEN) monitors Bitcoin and other virtual currency transfers for anti-money laundering purposes.
- The Securities and Exchange Commission (SEC) has the authority to oversee initial coin offerings (ICOs) since they typically involve the offer and sale of securities.
- The CFTC has declared virtual currencies to be a “commodity” subject to oversight under its authority under the Commodity Exchange Act (CEA).

The document notes that the CFTC has “taken action against unregistered Bitcoin futures exchanges (BitFinex), enforced the laws prohibiting wash trading and prearranged trades on a derivatives platform, issued proposed guidance on what is a derivative market and what is a spot market in the virtual currency context, issued warnings about valuations and volatility in spot virtual currency markets, and addressed a virtual currency Ponzi scheme.”

The complexity of regulations when secondary markets are involved is illustrated by the case of Bitcoin derivatives. As the price of Bitcoin surged towards \$20,000 near the end of 2017, derivatives exchanges sensed an opportunity to exploit the interest in products for speculating on Bitcoin prices. In December 2017, the Chicago Mercantile Exchange Inc. (CME) and the CBOE Futures Exchange (CFE) self-certified new contracts for bitcoin futures products, and the Cantor Exchange (Cantor) self-certified a new contract for bitcoin binary options.⁸

The CFTC claims jurisdiction when a virtual currency is used in a derivatives contract (or if there is fraud or manipulation involving a virtual currency traded in interstate commerce). However, the CFTC noted that, so long as the self-certification by the derivatives exchanges adhered to certain guidelines, it had no authority to even hold public hearings or seek public input before the new products were launched. In responding to concerns about the new products adding to the Bitcoin hype (and price volatility), CFTC Chairman Giancorlo acknowledged that “Bitcoin... is a commodity unlike any the Commission has dealt with in the past.” The CFTC added that “In working with the Commission, CME, CFE and Cantor have set an appropriate standard for oversight over these bitcoin contracts given the CFTC’s limited statutory ability to oversee the cash market for bitcoin.”

⁸ See <https://www.cftc.gov/PressRoom/PressReleases/pr7654-17>. The CFE and CME Bitcoin futures began trading in December 2017, the Cantor exchange product has not yet been launched.

As Bitcoin and other cryptocurrencies, along with the technologies underpinning them, start playing a bigger role in financial markets, issues of regulatory jurisdiction and the potential for regulatory gaps/arbitrage take on greater significance. This discussion raises some important concerns in the context of the fragmented, overlapping, and inconsistent regulatory framework for U.S. financial markets that may have played a role in the global financial crisis and remains largely unchanged to this day.

Nonofficial cryptocurrencies may also require greater coordination and harmonization of regulatory efforts across national regulators. While some cryptocurrency exchanges are nominally domiciled in specific countries, the nature of these virtual currencies makes it difficult to subject them to national rules and regulations, especially in terms of investor protection. U.S. Securities and Exchange Commission Chairman Jay Clayton summarized this in a cautionary statement to the public: “Please...recognize that these markets span national borders and that significant trading may occur on systems and platforms outside the United States. Your invested funds may quickly travel overseas without your knowledge. As a result, risks can be amplified, including the risk that market regulators, such as the SEC, may not be able to effectively pursue bad actors or recover funds.”

VI. Monetary Policy Implications

Central banks are likely to face technical and operational challenges to their core monetary policy mandates or, at a minimum, will need to adapt to the evolving financial technologies.⁹

Monetary Policy Implementation

One obvious question is whether CBDCs will have an effect on monetary policy or other aspects of macroeconomic policies. CBDCs disseminated through electronic wallets would make it easier to implement monetary policy more effectively in two ways. First, the nominal zero lower bound, which became a binding constraint for traditional monetary policy in advanced economies during the worst of the global financial crisis, would no longer apply. The central bank could institute a negative nominal interest rate simply by reducing balances on these electronic wallets at a pre-announced rate. In an economy with physical cash, this should in principle not be possible since consumers (and firms) have the alternative of holding physical currency banknotes, a zero nominal interest rate instrument. In principle, negative nominal interest rates should encourage consumption by making it expensive for households to maintain cash positions.

Monetary policy could also be implemented through “helicopter drops” of money, once seen as just a theoretical possibility of increasing cash holdings in an economy in a non-

⁹ See BIS, 2018, “Central Bank Digital Currencies.” Committee on Payments and Market Infrastructures, and Lael Brainard, 2018, “Cryptocurrencies, Digital Currencies, and Distributed Ledger Technologies: What Are We Learning?” Federal Reserve Board of Governors.

distortionary fashion by making lumpsum transfers to all households. This would be easy to implement if all citizens in an economy had official electronic wallets and the government could transfer central bank money into (or out of) those wallets. Channels for injecting outside money into an economy quickly and efficiently become important in circumstances of weak economic activity or looming crises, when banks might slow down or even terminate the creation of outside money.

Thus, a central bank could substantially reduce deflationary risks by resorting to such measures in order to escape the liquidity trap that results when it runs out of room to use traditional monetary policy tools in a physical cash-based economy.

There is an important asymmetry in this context that could become even more consequential if outside money were to have only a small role in the overall money supply. In that case, if banks were expanding outside money rapidly at a time of strong economic activity with rising inflationary risks, the central bank's ability to shrink electronic wallets holding CBDC might not do much to control the overall money supply. Although most advanced economy central banks now use price-based monetary policy measures (policy interest rates) rather than quantity-based monetary policy measures, this might be another reason for central banks to issue CBDCs rather than letting central bank money wither away if households were to use less and less cash.

There is, however, a flip-side to the ease with which a central bank can increase or decrease the supply of outside money. The ability to impose a haircut on CBDC holdings, or to increase them rapidly in case the government were to apply pressure on a central bank to monetize its budget deficit, could lead to substitution away from the CBDC. The reduction in nominal balances and the erosion in the real purchasing power of nominal balances through monetary injections would have similar effects—decreasing confidence in the currency as a safe asset that can hold its value, at least in nominal terms.

Monetary Policy Transmission

A number of banks and consortiums of banks are exploring the use of DLT for bilateral settlement of clearing balances without going through a trusted intermediary such as the central bank. DLTs, as discussed earlier, make it easier to track and verify transactions. If all participants in a closed pool can monitor such activities and if there is a permanent indelible transaction record that is tamper-proof, they may be able to use group monitoring as an alternative for a trusted central counterparty.

Will such developments dilute the ability of the central bank to affect interest rates in the economy through its control of very short-term policy interest rates (such as the discount rate and the Fed funds rate in the U.S.)? This gets to the crux of the question about whether central banks can maintain their influence over aggregate demand and inflation even if they are sidelined from some of their traditional roles—issuing (outside) money and providing payment and settlement services for major financial institutions.

If banks and other major financial institutions do create such settlement mechanisms among themselves (both bilaterally and across members in the group), and are also able to more effectively manage their liquidity positions and overnight balances, then settlement and liquidity management through the central bank might play a less important role. Of course, the ability to observe such transactions (or even to observe that such transactions are taking place between certain participants in the system) conveys important information that banks might not want to reveal to their competitors. Thus, competitive forces might limit the use of DLTs as an alternative for a trusted third party such as a central bank to provide settlement services while maintaining the confidentiality of those transactions. In short, significant technological as well as conceptual hurdles will need to be overcome before commercial banks sideline the central bank.

If these challenges are overcome, one possibility is that the central bank eventually becomes a liquidity provider of last resort in times of crises but, otherwise, commercial banks route their settlement and liquidity management operations through direct channels among themselves.

A related issue is whether nonbank and informal financial institutions are less sensitive to policy interest rate changes than traditional commercial banks. If these institutions do not rely on wholesale funding and have other ways of intermediating between savers and borrowers, then the central bank might face significant challenges to the effectiveness of monetary policy transmission. This might also prove to be only a long-term challenge for advanced economies if and when the relative importance of traditional commercial banks declines, although in developing economies informal financial institutions already play a significant role. Despite the proliferation of nonbank financial institutions and more direct intermediation channels, it is far from obvious that these can be scaled up such that they displace (rather than erode the prominence of) commercial banks.

Capital Controls and Exchange Rates

Financial globalization has increased as a result of greater pressures for capital to flow across national borders, in search of either or both yield and safety, and the spread of financial institutions with a global footprint. This has led to rising de facto financial openness of all economies, including emerging market economies such as China and India that maintain de jure capital controls. In the case of China, for instance, its large banks now have a global presence and provide channels for moving money into and out of the country more easily than when the operations of these banks were mostly domestic. In addition, rising trade volumes have created opportunities for evading capital controls through trade misinvoicing.

New channels for transmitting payments across borders more quickly and cheaply are likely to make it more difficult to regulate and control capital flows. Such changes are hardly imminent since cross-border payment systems are still in their infancy. But China's recent experience provides a cautionary tale. When the government was trying to control capital outflows in order to manage pressure on the currency, Bitcoin demand emanating from China surged. It is not possible to establish a clear connection between

these developments, but there was enough circumstantial evidence that the government banned Bitcoin trading mainly to tamp down on capital flight through this channel.

Other Considerations

Paper currency is vulnerable to counterfeiting, a challenge that governments have faced since the very introduction of paper currency by the Tang Dynasty in China in the 7th century. CBDCs could in principle reduce this risk, although the risk of electronic counterfeiting on an even more massive scale through hacking is a major concern for governments that intend to take this route.

A potential advantage of a CBDC is that it would discourage illicit activity and rein in the shadow economy by reducing the anonymity of transactions now provided by the use of currency banknotes, a point made forcefully by Rogoff (2016), especially in the context of high-denomination banknotes. This would also affect tax revenues, both by bringing more activities out of the shadows and into the tax net and also by enhancing the government's ability to collect tax revenues more efficiently.

An argument in favor of preserving physical cash is that the level of access to the formal financial system is limited among poorer households. Hence, cash is crucial for financial intermediation and, in developing economies, even as a more secure form of savings. This argument is being undercut rapidly by technologies such as mobile banking and the falling cost of digital transactions. Moreover, the introduction of CBDCs does not necessarily entail the immediate elimination of physical cash. The two could co-exist during a transition period or even indefinitely.

Would the proliferation of digital currencies affect the seigniorage revenues that accrue to central banks when they issue cash? These revenues are the difference between the worth of the cash issued (in terms of goods and services it can procure) and the cost of producing and distributing it. The cost of printing paper currency and its lack of durability reduce direct seigniorage revenues. Hence, a CBDC could, all else unchanged, increase seigniorage revenues. However, the demand for central bank issued currency, either in physical or digital form, could be lower if it is displaced as a medium of exchange. Hence, the net effect on seigniorage revenues depends on how technological developments affect the demand for central bank money. In any event, seigniorage revenues tend to be modest for most central banks although, for ones such as the Federal Reserve and ECB that issue a major reserve currency, the revenues are hardly trivial.

Ensuring compliance with AML/CFT regulations has been a major challenge for government authorities. The elimination of physical cash could assist in these efforts, although the likely shifting of illicit fund transfers to decentralized payment systems and intermediated through anonymous, decentralized cryptocurrencies could vitiate this progress. This is one reason why central banks might seriously consider issuing CBDCs so they can retain control of or at least oversight over payment systems that could as easily be used for illicit as for licit purposes.

VII. Implications for the Dollar's Role in Global Finance

The advent of CBDCs and cryptocurrencies could have implications over the long run for certain elements of the international monetary system, but these are not likely to be revolutionary. Some changes could occur even earlier, although their effects on global finance will mostly be limited to the structure of financial markets themselves.

One of the major benefits of improved electronic payment and settlement systems that would go with the proliferation of digital currencies is the increase in speed and security of transactions, along with a reduction in their costs. This would mark a substantial improvement for settlement of trade-related transactions as well as remittances. Even cross-border settlement of other types of financial transactions could benefit from these developments. DLTs offer the potential for reliable tracking of different stages of trade and financial transactions, reducing one of the frictions associated with such transactions. Such changes might simply increase the efficiency and lower the cost of transactions routed through banks and other traditional financial institutions rather than displacing such institutions.

International payment messaging systems such as SWIFT are vulnerable to being replaced by alternatives that have the benefits of security and verifiability, but at a lower cost. SWIFT has the major initial advantage of a standardized communication protocol but it is difficult to imagine that that advantage is sufficient as a business model. Indeed, many countries such as China and Russia are setting up their own payment systems so as to reduce their reliance on foreign payment systems and also as a gateway to the international payment system. In other words, such countries could conceivably link their payment systems, routing bilateral international transactions through their own payment systems rather than relying on SWIFT and the payment systems that use it for messaging.

A longer-term and perhaps less likely outcome is the advent of cryptocurrencies, or at least decentralized payment systems, that function as mediums of exchange in international transactions. This would in effect create new channels for cross-border capital flows that are more difficult for a government to control through either macroprudential regulations or explicit capital controls.

Financial and Real Spillovers

Both banks and nonbank financial institutions could expand the geographical scope of their operations across national borders using the new technologies. This entails new challenges for supervision and regulation. One complication is the lack of clarity about the domicile of informal financial institutions and the geographical locus of the supervisory authority of national regulators. The second is the potential accentuation of cross-border financial stability risks as more institutions operate across national borders. Some of these challenges could be overcome by the greater transparency of transactions if they are conducted using a public DLT or if the regulator has access to the relevant private ledgers. New channels for capital flows could also transmit financial market volatility more rapidly across countries.

The Dollar's Role as a Reserve Currency

The demand for Bitcoin as a store of value rather than as a medium of exchange has stoked discussion about whether such cryptocurrencies could challenge that role of traditional reserve currencies. It is more likely that, as the underlying technologies become more stable and as more efficient verification mechanisms are developed, such decentralized nonofficial cryptocurrencies will start playing a bigger role as mediums of exchange. Even that proposition is a tenuous one given the high levels of price volatility experienced by such currencies recently. Nevertheless, this shift could occur over time as the utilitarian functions of cryptocurrencies and the underlying payment verification and transfer systems take precedence over the speculative interest in them.

The decline in transaction costs and easier settlement of transactions across currency pairs could have a more direct and immediate impact—a decline in the role of vehicle currencies such as the U.S. dollar that are used to intermediate transactions across pairs of other currencies. The dominance of the dollar as a vehicle currency, followed by the euro, is related to the depth and liquidity of most currency pairs with the dollar (and the euro), which reduces the associated transaction costs. This dominance is unlikely to persist and could even result in an erosion of the dollar's role as a unit of account. For instance, the denomination of all oil contracts in dollars could easily give away to denomination and settlement of contracts for oil and other commodities in other currencies, perhaps even emerging market currencies such as the renminbi.

Notwithstanding any such changes, the role of reserve currencies as stores of value are not likely to be affected. Safe financial assets—assets that are perceived as maintaining most of their principal value even in terms of extreme national or global financial stress—have many attributes that cannot be matched by nonofficial cryptocurrencies.

The key technical attributes include liquidity and depth of the relevant financial instruments denominated in these currencies, such as U.S. Treasuries. More importantly, both domestic and foreign investors tend to place their trust in such currencies during times of financial crisis since they are backed by a powerful institutional framework. The elements of such a framework include an institutionalized system of checks and balances, the rule of law, and a trusted central bank. These elements provide a security blanket to investors that the value of those investments will be largely protected and that investors, both domestic and foreign, will be treated fairly.

While reserve currencies might not be challenged as stores of value, digital versions of extant reserve currencies and improved cross-border transaction channels could intensify competition among reserve currencies themselves. In short, the finance-related technological developments that are on the horizon portend important changes to domestic and international financial markets but a revolution in the international monetary system is not quite on the cards for the foreseeable future.

END