



Central Bank Digital Currency, Design Choices, and Impacts on Currency Internationalization

By Stephanie Segal and Pearl Risberg

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THE ISSUE

Over the past decade, digital currencies and payment instruments—including cryptocurrencies, global stablecoins, and central bank digital currency (CBDC)—have emerged as important innovations with potentially large impacts on the international monetary and financial system. While there are a range of factors that will impact the pace and shape of digital transformation in the financial sector, this paper focuses primarily on CBDC, given recent attention on digital fiat currency and its potential to promote currency internationalization.

CBDC promises increased efficiency and lower costs, improved access to financial services, and greater transparency and accountability in payment systems and financial flows. It also raises new risks and greater technical and regulatory complexity. CBDC's future will depend, first and foremost, on national authorities' ambitions and assessments of benefits and risks. CBDC design elements can address individual country preferences, while international cooperation—for instance, on data frameworks, privacy protections, and technical interoperability—will be necessary to fully realize the benefits of CBDC, especially for cross-border payments. Multilateral agreement and CBDC standards will take time, but national authorities can act now to ensure an enabling domestic environment for CBDC and other digital currency developments.

DIGITAL CURRENCY EVOLUTION: CRYPTOCURRENCY, STABLECOIN, AND CBDC

The concept of digital currency dates back decades, but Bitcoin, launched in 2009, is recognized as the first privately issued, decentralized (ledger-based), and encrypted digital currency or *cryptocurrency*. Today, there are an estimated 7,000 **distinct cryptocurrencies**, with a combined market value in the hundreds of billions of dollars. Since their introduction, cryptocurrencies have been characterized by extreme price volatility, limiting their use as a store of value and unit of account, two key functions of money. As a result, cryptocurrency has primarily served as a speculative investment, with more limited use as a medium of exchange.

Stablecoins—private sector digital tokens backed by fiat (government-issued) currency held in physical reserves—were first introduced in 2014 and designed to address the extreme volatility of ledger-based cryptocurrency. However, like cryptocurrency, stablecoins are privately issued and neither regulated nor backstopped by a monetary authority, raising questions about how their adoption might impact monetary policy transmission, visibility into economic and financial activity, and financial stability. Policymakers, and monetary authorities, in particular, have greeted announcements of new global stablecoins with caution. In October 2020, the Financial Stability Board (FSB) **warned** that the emergence of global stablecoin (GSC) arrangements may “challenge the comprehensiveness and effectiveness of existing regulatory and supervisory oversight” and put forth recommendations

to address associated financial stability risks. Leaders from the world's 20 largest economies (G20) welcomed the FSB's work and **agreed** that “no so-called ‘global stablecoins’ should commence operation until all relevant legal, regulatory and oversight requirements are adequately addressed through appropriate design and by adhering to applicable standards.”¹

The emergence of stablecoins is widely seen as spurring work already underway in many central banks on a third category of digital currency: *central bank digital currency or CBDC*. Unlike private digital currencies, CBDC or “digital cash” is a liability of the central bank, and the holder of CBDC has a direct claim on the state. This feature of CBDC preserves the concept of money as a public good and makes CBDC a safe store of value, but it also has the potential to disintermediate banks and undermine financial sector stability if individuals and companies are able to hold accounts directly at the central bank.

CBDC, DIGITAL PAYMENTS, AND CURRENCY USAGE

For many of the world's central banks, discussion of CBDCs has shifted from “if” they will be developed to “when” they will be introduced and widely used. According to the Bank for International Settlements (BIS), over **80 percent of the world's central banks**, including the U.S. Federal Reserve, are now conducting research on CBDCs, with the majority of these already progressing to the experimental or pilot development phase. The case for CBDC is based in large part on the underlying technology's potential to improve payments efficiency and lower transaction costs, particularly for cross-border payments, as well as to bolster system integrity, spur financial innovation, and improve access to financial services. Some central banks are also motivated to pursue CBDCs in order to counter the declining use of physical cash and potential risks to payment system resilience and monetary policy transmission.

Early experiments with CBDC focused on possible applications of digital ledger technology (DLT) to digital currency to improve the efficiency and security of interbank and cross-border payments. Recently, the chairman of the U.S. Federal Reserve **indicated** that the main motivation for U.S. interest in CBDC, in fact, lies in its potential to improve payment systems.² While digital currency and digital payments are not synonymous, the two are closely related, and digital currency can only fulfill its function as a medium of exchange if its design is compatible with the underlying payments infrastructure.³

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In no country is experimentation with CBDC more developed, or the link between currency and payments more explicit, than in China. **The People's Bank of China (PBOC)** has been working on its “digital currency electronic payment” (DCEP) program since 2014, and in April 2020, it launched a DCEP pilot program in four Chinese cities: Shenzhen, Suzhou, Chengdu, and Beijing's satellite city Xiong'an. PBOC governor Yi Gang has said China's DCEP aims to “partially digitize” China's existing monetary base, boosting both efficiency and data collection. It has also **been reported** that China's DCEP program is motivated by concern that private digital payment platforms could displace traditional banks—posing a threat to financial stability and official sector oversight of economic and financial activity in China.

Despite domestic considerations that have driven China's CBDC efforts to date, **DCEP has also been linked** to efforts to expand renminbi (RMB) use outside China's borders, along with China's Cross-border Interbank Payments System (CIPS). Many factors influence the attractiveness of a sovereign currency outside its national borders, including the infrastructure and technology of cross-border payments. Other factors, such as capital account convertibility, deep and liquid financial markets, and established property protections and rule of law, also matter.

China is not alone in seeing CBDC as supporting currency internationalization. An October 2020 **report** from the European Central Bank (ECB) noted that a digital euro “could be issued to foster the international role of the euro,” and the Federal Reserve chairman has **said** that the United States is “committed to carefully and thoughtfully evaluating the potential costs and benefits of a central bank digital currency for the U.S. economy and payment systems, as well as for its international implications.”

CBDC DESIGN CONSIDERATIONS

It is clear that CBDC has captured the attention of policymakers around the world. However, they rightfully approach the issue with a high degree of caution, reflecting the challenges associated with a major technological

change to the so-called “plumbing” of the international financial and monetary system. A recent [working paper](#) on policy and technical considerations from the Brookings Institution acknowledged the experimental nature of CBDC, underscoring information security risks and the potential for fundamental design mistakes. Apart from prioritizing risk management and mitigation, CBDC design will depend on specific objectives and priorities and will entail certain trade-offs. In October 2020, a [joint report](#) from the BIS and seven central banks outlined foundational principles and core features of an effective CBDC, including resilience and security, convenience and low cost, a clear legal framework, and a role for the private sector.

However, different jurisdictions will have different priorities, and there remains a wide range in design features, which could have implications for interoperability and cross-border payments in particular. For example, U.S. officials have [articulated](#) their intent to evaluate CBDC on its ability to “improv(e) an already safe and active dynamic domestic payment system.” The ECB has [emphasized](#) the potential for a digital euro to enable the digital economy and support European sovereignty and stability. The ECB also raises the prospect of declining cash use, highlighting the need for low-cost, low-risk, and efficient cash-like CBDC design, a priority echoed by the [Bank of Japan](#), [Bank of Canada](#), and [Sveriges Riksbank](#). Japan also emphasizes the [stability and efficiency](#) of payment and settlement systems, along with universal access, instant payment capability, and interoperability, as requirements of CBDC.

Against this backdrop of multiple and sometimes competing priorities, an August 2020 [working paper](#) from the BIS identifies a short list of foundational design choices for CBDC:

- The most fundamental choice is that of CBDC **architecture**, which refers to the operational role and division of responsibilities between the central bank and private intermediaries;
- Next is CBDC **infrastructure**, which refers to the technical design and choice between a centralized database or decentralized DLT for recording transactions in CBDC; and
- Then there is the question of **access** to CBDC and whether its use is based on individual identity or anonymous, for instance, through digital tokens.

There is not a right or wrong choice for each design element, rather a preference based on objectives and priorities. On the question of architecture, a “two-tier”

or “wholesale” model in which CBDC is issued by central banks through commercial banks to end users could prevent some of the more disruptive impacts of CBDC on the financial sector but may limit efficiency gains and broad access to CBDC relative to a retail model. On the other hand, a “general purpose” or “retail” CBDC could lower barriers to financial inclusion but would also compete with traditional deposit-taking institutions, limit the financial intermediation role currently played by banks, and concentrate credit allocation decisions with the state. Differences between countries in the architecture of CBDC are likely to impact the competitive landscape for financial services as well as currencies.⁴

The infrastructure of CBDC will have to support choices regarding who has access to CBDC and under what conditions. The underlying technology and design, in turn, will influence the payment and settlement platforms on which a CBDC can operate and whether these platforms are interoperable with one another and with legacy systems. In particular, the record-keeping structure (token- or account-based) will determine who records and stores transaction data. While a decentralized digital token would allow for greater anonymity and arguably be more resilient to infrastructure outages and cyberattacks, a centralized ledger could promote greater transparency and facilitate compliance with anti-money laundering and countering the financing of terrorism (AML-CFT) and know-your-customer (KYC) frameworks.⁵

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DATA FRAMEWORK AND PRIVACY POLICY

Digital currency and digital payments transform economic activity into data, resulting in a digital record that did not exist in the analog world. As a result, designing rules and regulations around the access, use, and transfer of data is among the most pressing challenges and opportunities of CBDC. Just as today’s private payment providers and financial institutions have data on individual vendors and consumers, the advent of a CBDC, depending on its design, could make such data available to national governments,

leading to concerns over the privacy and surveillance of citizens by governments as well as private companies. In addition, there is a **likely trade-off** between privacy and efficiency, and interest in fostering innovation (which often entails the monetization of data) will place additional demands on the treatment of data in CBDC design.

According to the BIS's Committee on Payments and Market Infrastructures (CPMI) **July 2020 report**, it is also critical to identify and address friction between financial regulatory requirements and restrictions on cross-border data flows and data storage. Societal and government preferences will dictate the balance of these sometimes-competing objectives and are likely to impact cross-border use, the role of the private sector, and collaboration on CBDC.

Issues around data privacy and consumer protections are further complicated in the cross-border context, as they require agreement on common protocols for data exchange and adherence to privacy policies across multiple jurisdictions. A 2018 **joint report** from the Bank of Canada, Bank of England, and Monetary Authority of Singapore noted that fragmentation of data standards introduces cost and complexity to systems, with ensuing operational and compliance risks. Data standardization is necessary for “straight-through processing,” whereby a payment message can move through every stage without having to undergo duplicate reviews, thus realizing the potential of CBDC for seamless cross-border payments. Standardization around high-quality data standards also has the potential to improve compliance—for instance, with AML-CFT—but raises questions of what data is collected, how it is stored, and who has access.

GLOBAL COOPERATION AND THE PATH FORWARD

The path forward will require a balanced approach. Central banks will need to weigh the trade-offs inherent in CBDC design choices and find solutions that take domestic interests into account while forging new international standards. As U.S. Federal Reserve governor Lael Brainard recently stated, specific design elements of CBDC **will depend on** the “domestic legal framework and financial and economic context” of each country, yet the system's overall security and interoperability will require international collaboration and joint research efforts. Such research and reporting have already begun to reveal initial preferences for certain design features—for instance, an early preference for a two-tier CBDC model—which in turn may provide foundations for common standards that could

eventually promote globally interoperable CBDCs. While the issues around CBDC are complex and likely to require compromise, these challenges should not prevent concerted efforts to educate policymakers and the public, including on the policy objectives that drive design choices, in order to make progress toward developing CBDC.

For some country authorities, among the most compelling reasons to move ahead urgently with CBDC development may be the possibility that failing to do so could undermine the home currency's position or result in the diminution of reserve currency status. To the extent there is a “first-mover advantage” in arriving at a viable CBDC, those countries that have a CBDC in advanced development could also be setting the standard for cross-border CBDC use. Some industry participants have **even pointed out** that first-mover advantage could translate into a strong network effect, which historically has been a **determinant** of reserve currency status. While central bankers are aware of first-mover considerations, the chair of the Federal Reserve **recently stated**, “[i]t's more important for the United States to get it right than to be the first.”

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A number of central banks have published research and views on various considerations, along with **requests for public input**, at times **in collaboration** with other central banks. In addition, numerous international organizations are working to understand the implications of design choices, with an eye to defining international standards for cross-border payment interoperability and standardized communication channels among central banks. The FSB, in coordination with the BIS's **CPMI**, has taken a leadership role in coordinating next steps, including with other multilateral institutions and intergovernmental bodies such as the International Monetary Fund (IMF), World Bank, and the Financial Action Task Force (FATF). The FSB, currently chaired by the vice chair of the U.S. Federal Reserve and whose **membership** includes monetary and fiscal authorities from 24 countries, has published a

“roadmap” to **enhance cross-border payments**, including on new payment infrastructures and arrangements such as CBDC and GSC. This roadmap was endorsed by G20 leaders in November, and the FSB will continue to report on an annual basis to the G20 on implementation of the road map, a process that can serve to promote public buy-in and political accountability.

While these broad international efforts provide a platform for collaborative approaches to improving cross-border payments, smaller country groupings may also expedite progress, at least on high-level standards. In October, finance ministers and central bank governors from the Group of Seven (G7) industrialized democracies issued a **statement** on digital payments linking confidence in the stability of domestic payment systems and the international monetary system to “longstanding public sector commitments to transparency, the rule of law, and sound economic governance.” Critically, action on the part of national authorities will be required to align regulatory, supervisory, and oversight frameworks and provide the regulatory clarity required by private sector participants. This is especially true in the areas of data frameworks, customer due diligence, and digital unique identifiers.

Consensus on standards will be challenging, given the range of policy objectives across jurisdictions. Without alignment, however, the efficiency gains of digital currency and digital payments may be lost on cross-border flows. According to the FSB’s roadmap, by July 2021, the CPMI, IMF, and World Bank will “take stock of multilateral platforms for cross-border payments and analyze pros and cons, demand, design features, risks and challenges to establishing such platforms,” a useful step toward building international consensus. At the same time, individual central banks with interest in CBDC cannot wait until all policy questions are answered to make progress. In the U.S. context, national legislation on data privacy and **digital identity**—the implications of which extend well beyond the scope of CBDC—may well be complementary to efforts at developing a digital dollar.

CONCLUSION

There is a solid use case for CBDC that justifies the intense interest across multiple jurisdictions. At the same time, establishing the architecture, infrastructure, and rules for access to CBDC will entail design choices that are not without trade-offs. Tough choices, however, should not stymie progress, especially given the rapid pace of innovation and the fact that developments in one jurisdiction can have impacts beyond national borders, including for currency internationalization. Near-term priorities for national authorities should include data frameworks as well as digital identity, given their centrality to CBDC design and digital currencies and payments more generally. Policymakers should make these issues central to consultations with stakeholders and in outreach with the public. ■

Stephanie Segal is a senior fellow with the Economics Program at the Center for Strategic and International Studies (CSIS) in Washington, D.C. Pearl Risberg is a research associate with the Economics Program at CSIS.

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ENDNOTES

- 1 In a 2019 **statement**, the Libra Association committed to “building a system that replicates or exceeds current standards for consumer protection, financial stability, and global cooperation to prevent money laundering and illicit finance while preserving national sovereignty over monetary policy.”
- 2 Release of FedNow, a real-time gross settlement system (RTGS) under development to support instant payments, is targeted for 2023/2024. At launch, FedNow will support only domestic payments between U.S. depository institutions. The Federal Reserve has **announced** its commitment to use the ISO-20022 standard to achieve interoperability with other payment systems; however, the compatibility of FedNow with any future CBDC is unclear.
- 3 Similarly, the FSB has highlighted that a GSC could become systemically important in and across one or many jurisdictions, including as a means of making payments.
- 4 According to the **BIS**, the majority of central banks researching CBDC remain uncommitted on the foundational architecture but show a preference for a two-tier model where the CBDC is a form of central bank money and commercial banks and payment service providers manage all end-user services. Under this scenario, central banks could manage a wholesale database but do not gain access to personal or transaction data.
- 5 Currently, commercial banks, as regulated entities, are responsible for implementing anti-money laundering (AML), combatting the finance of terrorism (CFT), and know your customer (KYC) frameworks.