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Design choices for central bank digital currency

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Many central banks are considering, and some are even piloting, central bank digital currency. This column provides an overview of important considerations for central bank digital currency design. While central banks already provide wholesale digital currency to financial institutions, a retail central bank digital currency would expand access to more users and provide opportunities for innovative central banking. The design must balance these benefits with the potential risks created by retail central bank digital currency deployment.

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Central banks around the world are exploring, and in some cases even piloting, central bank digital currencies (CBDCs). More than 80% of central bank respondents to a Bank for International Settlements survey in 2019 reported engagement in CBDC projects (Boar et al. 2020). One in ten central banks, representing approximately one-fifth of the world's population, expected to offer CBDCs within the next three years. The People's Bank of China has begun to pilot a digital yuan, while the US and the ECB are exploring CBDC development (Zhao 2020, Bharathan 2020, Mersch 2020). At the same time, a Facebook-initiated fiat-backed cryptocurrency called Libra has raised the prospect of an industry alternative (Light et al. 2020). Various forms of CBDC have in a sense existed for years, but as wholesale facilities available exclusively to financial institutions. What is striking and potentially transformative about many recent CBDC initiatives is their retail focus (Ricks 2018). They aim to democratise central banking by making accounts or liabilities directly available to individual consumers, households, and/or businesses.

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Requirements for a well-functioning retail CBDC

A well-functioning CBDC will require an extremely resilient, secure, and performant new infrastructure, with the ability to onboard, authenticate, and support users on a massive scale. It will necessitate an architecture simple enough to support modular design and rigorous security analysis, but flexible enough to accommodate current and future functional requirements and use cases. A CBDC will also in some way need to address an innate tension between privacy and transparency, protecting user data from abuse while selectively permitting data mining for end-user services, policymakers, and law enforcement investigations and interventions. Many of these requirements will necessitate the development of novel expertise for central bankers, as handling retail accounts requires a different skill set from management of a wholesale digital currency.

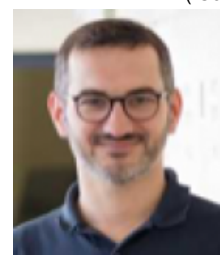
Potential benefits of a CBDC

Using a retail CBDC, central banks can potentially create a more efficient and more inclusive financial system. A CBDC can reduce friction in the existing payments system, lowering the cost and easing speed of transactions. It can also boost tax revenues by bringing more economic activity into the effective tax base. The tax base would be broadened by reducing tax evasion and the use of central bank money for illicit purposes. A retail CBDC can also serve as a



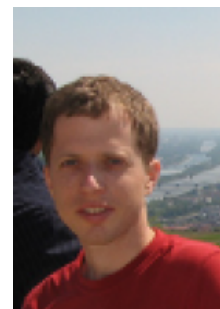
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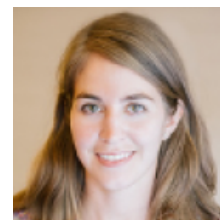
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gateway for unbanked and under-banked individuals to have access to electronic payments and, potentially, other banking services. It can facilitate a more flexible monetary policy than previously possible, theoretically allowing central banks to institute negative nominal interest rates and implement non-distortionary helicopter drops or withdrawals of central bank money. A CBDC can also act as a backstop to privately managed payment systems, avoiding the risk of a breakdown of the payments infrastructure in times of crisis.

Risks to consider

The expansion of central bank services to more users could result in disintermediation of the banking system. To avoid disruption, many CBDC plans involve a two-layer architecture; the CBDC itself serves as a basic functional layer, while existing non-governmental financial institutions manage a second layer that interfaces with users (Bank of England 2020). Nonetheless, by reducing transaction frictions and possibly even providing interest-bearing accounts, CBDCs could disintermediate significant swaths of the banking system with potentially destabilising systemic effects. CBDCs also raise privacy concerns. Given the limitations of current privacy-enhancing technologies, it seems likely that a true retail CBDC will expose new forms of sensitive information to CBDC operators (Agur et al. 2020). CBDC designers should consider legal and technical mitigations from the outset. Additionally, regulators may struggle to develop the tools and expertise to address the dramatic structural changes and financial innovations brought about by CBDCs (Fernández-Villaverde et al. 2020). They will also need to balance desire for government oversight with leaving room for innovation as there are risks to overemphasising either side. In summary, even with conservative design, CBDCs will represent a technical experiment with significant risk of information-security, privacy, and design failures, many of which may prove difficult to fix.

Important areas of CBDC design

As they contemplate issuing CBDCs, central banks should give special consideration to certain elements of policy and technical design.

Ledger infrastructure

A range of architectural options for the digital ledger could underpin a CBDC. Central banks will wish to retain tight control over currency issuance and transaction processing, including the ability to alter or reverse transactions. The two-layer approach embraced by many CBDC efforts continues existing customer-service models and is the easiest to integrate with existing laws, such as anti-money-laundering and countering the funding of terrorism regulations (AML/CFT). Other designs will have a harder time supporting important legal use cases, such as secured credit and consumer protection against fraud. Notably, however, a two-layer system would not remedy the privacy concerns associated with representation of individuals' accounts (or banknotes) in the CBDC and may introduce complications around the authority and legitimacy of applications used by consumers to interact with the system, as compared with an approach in which the CBDC is managed entirely by the central bank.

Wallets and funds/key custody

Users will need a secure way to hold their funds and send provably legitimate transactions. For cryptocurrency users, management of the secret keys needed for authentication has been unduly burdensome, resulting in heavy reliance on financial intermediaries. Unless central banks innovate a user-friendly secret-key-management system, CBDC users are likely to pursue the same route, potentially impeding the very financial inclusion that is a major goal of CBDC creation. Workable approaches to custody of funds and/or secret keys will be of pivotal importance in a CBDC.

Privacy

A CBDC can potentially reveal significantly more information about individuals' transactions to central banks than existing systems do. Should a CBDC maintain the account balances of individuals on the ledger, which would seem to be a prerequisite for a retail CBDC, privacy will become an issue of major importance. This observation strongly motivates consideration of technical and legal confidentiality protections for ledger contents.

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Notwithstanding the potential benefits, there are many unanswered questions about how the new financial technologies could affect the structure of financial institutions and markets. Questions also abound about whether retail CBDC will in any significant way affect monetary policy implementation and transmission. These uncertainties suggest a cautious approach to embracing the concept of CBDC.

The issuance of CBDC will not mask underlying weaknesses in central bank credibility or other issues such as fiscal dominance that affect the value of cash. In a shift to digital forms of retail central bank money, the transitional risks could be higher in the absence of stable macroeconomic and structural policies, including sound regulatory frameworks that are agile enough to be able to recognise and deal with financial risks created by new types of financial intermediaries.

Opportunities for innovation

We believe there are rich opportunities for innovation in a CBDC. Some derive from the unprecedented transparency a CBDC would afford regulators, including a panoramic yet fine-grained view of global spending in an economy. These opportunities would also include new monetary policy levers, such as the ability of central banks to institute negative nominal interest rates, create currency with time limits or other spending conditions (e.g. required spending on durable goods) in order to create highly targeted monetary interventions in a national economy (Agur et al. 2020, Bossone 2020). Innovation would be best captured by CBDC support for smart contracts, programmes that can extend a CBDC's functionality.

In summary, the benefits and risks of CBDC are complex, encompassing financial, legal, and technical considerations and the interplay among them. With many central banks currently considering or piloting CBDCs, each country will have to take into account its specific circumstances and initial conditions before deciding whether the potential benefits of introducing a CBDC outweigh the possible costs (Allen et al. 2020). Any CBDC will require a secure, user-friendly way to hold and transfer funds. A two-layer infrastructure with central bank management of the digital ledger and existing financial institutions providing customer service is a likely choice; it would maintain existing models and avoid disintermediation of the financial system. Regardless of the infrastructure choice, central banks should consider technical and legal confidentiality protections for ledger contents. Once deployed, a retail CBDC will provide rich opportunities for innovative central banking.

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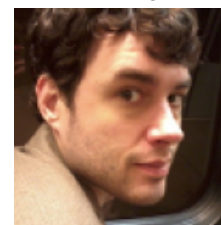
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