

BARRY EICHENGREEN – WRITTEN EVIDENCE (CDC0036) – CENTRAL BANK DIGITAL CURRENCIES

Central bank digital currencies (CBDCs) are a solution in search of a problem. Virtually every central bank on the planet is actively exploring, or at least discussing, the design of a CBDC. A few, most notably the People's Bank of China, have piloted a digital currency (that is, issued one on a limited scale). But a lack of clear thinking underlies this headlong rush. In this submission I discuss rationales that have been offered by central bankers and other officials, assess their validity, and ask whether there are superior alternatives for addressing the same problems.

1. Increasing the efficiency of payments.

There is a logical progression from copper coin to banknotes to digital means when paying for goods and services. The progression is resource saving (fewer resources presumably need to be devoted to producing counterfeit-proof coins and notes). Transactions are completed faster. Personal contact is not required (something that is especially valuable in an age of pandemic).

Yet digital payments already exist. I pay my monthly cellphone bill electronically by setting up a Direct Debit at my bank. I pay for groceries at the corner store electronically with my Visa card. I can pay for a cup of coffee at Starbucks electronically by linking my credit card, PayPal account, Apple Pay account, or Google Pay account to my Starbucks card. I can send money to a friend using Venmo.

Arguments that a CBDC that would compete with and potentially supersede these private digital payments rails focus on convenience and cost. Funds transferred from PayPal to one's bank account, for example, incur a fee of 1 percent of the transfer amount, while using a PayPal to send funds to friends and family members who utilize a credit or debit card incurs a fee of 2.9 percent. While Venmo transfers between linked bank accounts, debit cards and Venmo accounts are free, a 3 percent fee is charged for sending money using a linked credit card. Although my bank doesn't explicitly charge when I ask it to transfer funds from my account to that of my cellphone carrier, comparable costs are hidden in the interest rate I receive on my balance.

A CBDC that was costless to use could relieve individuals of these 1 to 3 percent costs of digital transactions. The central bank, acting on behalf of the government, would provide basic electronic payments as a public service (it would treat them as a public utility). Society would still be paying for the service, but the cost would be borne by the central bank out of seigniorage profits that it would otherwise transfer to the Treasury. Social cost would be less only if one thinks that central banks can provide electronic payments services more efficiently than Visa or PayPal, something that is conceivable though by no means obvious.

This brings us to arguments concerning convenience and efficiency. I prefer American Express over other credit cards, but not all vendors accept it due to its relatively high transaction charges. Not everyone uses Venmo, so when paying an individual for a service I may have to resort to (horrors) cash. This fragmented

digital payments landscape creates costs and inconvenience for users. A central bank digital currency that was universally accepted would reduce these costs.

Another way of thinking about this is that the payments system is a natural monopoly owing to its network structure, so a single provider can deliver the relevant services more efficiently than myriad competing suppliers. Perhaps, but there are counterarguments. A diverse payments ecosystem is likely to be more robust than one that relies entirely on a CBDC. If Facebook can go offline for 10 hours because of a botched software update, one can imagine the same fate befalling a CBDC. If my PayPal account stops working, for whatever reason, I still have my credit cards.

In addition, a diverse private payments ecosystem is likely to be more innovative. Imagine that facial recognition replaces dual-factor authentication (which everyone agrees is annoying) as the dominant mode for securing digital wallets and accounts. Does one think that the central bank or a private provider will be first to implement this innovation? Imagine that payments data could be used to inform micro-lending decisions, bringing down the cost and increasing access to small-business loans. Does one think that the central bank or a private provider would be first to move in this direction? (M-Pesa already does this in Kenya.) Does one think that central banks will be prepared to move in this nontraditional direction, period?

Might a CBDC exist alongside, as opposed to superseding, these other means of digital payment? Individuals could use the CBDC for relatively small retail transactions but bank transfers, credit cards and so forth for larger transactions, for purchases where payment is spread out over time, and for purchases where related consumer-protection services are important. (I can invoke my credit card company's help when seeking reimbursement for defective merchandise. In the UK, the Direct Debit Guarantee protects bank customers from fraudulent bank-to-bank payments.) If they existed alongside one another, the CBDC and these other electronic payment rails could be interoperable.

(In this connection, it is relevant that the PBOC, when rolling out its CBDC on a limited basis, restricted its use to relatively small retail transactions. Doing so is consistent with that bank's statements that it will track only limited information about transactions completed using the CBDC and about individuals undertaking them – statements that are presumably required for take-up. In a U.S. or UK setting, where large-value transactions would have to be subject to know-your-customer rules to avoid problems of money laundering, tax evasion, sanction busting and so forth, anonymity for such transactions would not be possible. Again, the implication is that a CBDC would not substitute for bank transfers etc. in the case of larger transactions.)

Coexistence would seem to be the most plausible scenario, since consumers value these other services supplied by private providers of digital payments. But this means that the savings to consumers from a CBDC would actually be much less than the 1-3 percent figures cited above. When a merchant pays my credit-card company a 1 percent transaction fee (much of which is passed along to me in the sales price), I am not only making a payment but also obtaining a contingent credit

line and insurance against defective merchandise. These additional services would not come packaged with a CBDC.

2. Keeping control of the payments system.

A second suggested rationale for a CBDC is in order for the central bank to retain control of the payments system. Ensuring the stability and soundness of this essential public utility is a key aspect of the central bank's mandate, implicitly or explicitly. If digital payments migrate away from Fedwire to, say, Google Pay, the Fed will then have limited insight into the operation of the payments system and limited ability to ensure its integrity. A related danger is that payments will migrate to a single large private provider that will then possess market power over both payments and related services. Another related argument is that central banks' oversight of the payments system provides them with valuable real-time information on the state of the economy.

But if the concern is with the concentration of payments in a single or small set of private hands, then the obvious solution is to strengthen regulation of those private providers. This is the approach taken, for better or worse, by the Chinese authorities when cracking down late last year and early this year on Alipay and WeChat Pay. These providers were required to share more information on their operations with the authorities and to build firewalls between their payments data and other operations. More generally, if private nonbanks take on more payments responsibilities of a sort traditionally executed by banks, then they can be regulated like banks. Stablecoins are beginning to be used for payments, mainly in the cryptosphere but possibly, in the not-too-distant future, more widely. Governments are responding appropriately by asking whether they should be required to take out a bank charter or otherwise be regulated like banks. This is a more appropriate response to concerns about losing control of the payments system than issuing a CBDC.

As for the real-time-information-about-the-economy argument, there exist myriad other sources of real-time information about the economy: financial market data, cellphone location data, web traffic data, etc.

3. Broadening financial inclusion

A third frequently repeated argument for a CBDC is on grounds of financial inclusion. Two percent of UK households, or more than 1.2 million adults, are unbanked, according to Pockit, the digital bank account provider. Numbers for the U.S. are considerably higher. In the U.S., the Treasury noted last year the difficulty of getting COVID relief checks to households lacking bank accounts. The unbanked pay more (are able to purchase less consumer-friendly plans) from power, telecom and broadband companies. They find it more difficult to obtain credit. The unbanked in the UK are primarily the young (18-24 year olds, according to the government's Financial Inclusion Report), the unemployed and migrants unable to document UK residence.

A CBDC, it is said, would broaden financial inclusion, since everyone with a cellphone could download the central bank's digital wallet and app. (Everyone with a cellphone has been entitled to download the PBOC's digital wallet and app in those Chinese cities where the bank has trialed its CBDC.) Thus, everyone would have the equivalent of a bank account into which funds could be deposited by the government and from which utility companies and others could be paid.

A directly central-bank-facing CBDC, like that trialed by the PBOC, might make it easier for the unbanked to receive unscheduled transfers from the government. (There are of course other channels through which individuals can receive regularly scheduled payments. Thus, to receive Universal Credit in the UK, it is possible to make a claim through a trusted third party.) But many central banks reluctant to open retail accounts for individual customers or to provide them with individual wallets are contemplating wholesale CBDCs, where they would provide CBDCs to commercial banks, which would be customer facing. The commercial bank would operate their own CBDC wallets, apps and accounts. Whether they would be able and willing to do so for individuals other than their own existing account holders is unclear.

Moreover, the argument that giving the unbanked the CBDC equivalent of a bank account would allow them to obtain services and credit on the more favorable terms available to the banked is specious. Power, telecom and broadband companies provide more favorable terms to the banked because they can be expected to be paid more promptly and regularly (through inter alia Direct Debit). Possession of an account with a commercial bank is a signal of financial stability and reliability; it is not surprising that it is associated with superior access to credit. A CBDC that was available to everyone unconditionally would not signal anything.

4. Enhancing cross-border payments

Cross-border payments are expensive. International wire transfers generally incur fees of \$50 or more. International ACH (automated clearinghouse) transfers have lower costs but can take three or more days to clear. For a cash transfer from storefront to storefront, the preferred vehicle of the unbanked, Western Union charges 7 percent for \$100.

A central bank digital currency that was used globally could effect cross-border transactions more conveniently (no need to visit the Western Union store), more quickly, and at lower cost. A digital dollar that also circulated outside the United States, for example, or a Chinese CBDC that also circulated outside China would have this merit. If American importers as well as Chinese producers could open digital renminbi wallets, payment for orders could be seamlessly transferred from purchaser to supplier without mediation by correspondent banks or a clearinghouse.

Note, however, that fees for international payments are much lower, as a share of the funds transferred, for larger-value transactions. And other entities are already experimenting with digital technologies with the potential to reduce costs and accelerate transactions. Global banks such as Santander are using Ripple's

open-source, semi-permissioned system to transfer funds between branches in different countries. SWIFT (the Society for Worldwide Interbank Financial Communication), through which virtually all international interbank transfers are effected, is experimenting with distributed ledger technology. It has launched "Swift gpi," a set of high-speed electronic rails to increase the speed and predictability of high-value payments, and "SWIFT Go" for small payments. These systems allow participating banks (currently limited in number) to pre-validate information about the beneficiary and to correct costly and time-consuming mistakes, using an Application Programming Interface, or API, that allows the sending bank to automatically tap into information on the account of the receiving bank.

Similarly, countries with instant payment systems that do not use distributed-ledger technology but allow retail customers to transfer funds instantly between participating banks are exploring linking these up across countries. Singapore and Thailand linked their PayNow and PrmoptPay real-time retail payments systems in April 2021, allowing customers to transfer funds simply by entering the recipient's phone number. Credit-card companies such as Visa and Mastercard, which operate in multiple countries, are developing the capability to settle transactions using stablecoins. In mid-2021 Mastercard announced a partnership with Circle, the principal issuer of USD Coin, which will enable it to accept USD Coin from card issuers and then either pay it out or the exchange it for fiat currency when settling with the merchant. All this suggests that a variety of private entities are starting to do in the cross-border sphere the same things to which potential CBDC issuers aspire.

Then there is the question of whether central banks will permit nonresidents to maintain digital wallets. In the PBOC's pilot projects to date, such permission has been promised only to foreigners traveling temporarily in China. Even if permission was granted, one wonders whether foreigners resident in other countries would feel safe using the Chinese CBDC, given privacy concerns. In mid-2021, the PBOC described "anonymous" wallets tagged only with a phone number (presumably a Chinese number), with balances limited to 10,000 yuan (US\$1,560), but also wallets permitting larger balances and payments but requiring "valid ID" and bank account information. How comprehensively such transactions will be tracked by the authorities – how much information they will demand or simply harvest – is unclear. The PBOC states that it will follow the principle of "anonymity for small value and traceable for high value." It insists that its CBDC "collects less transaction information than traditional electronic payment" and that the information so collected will not be shared with other central bank or government departments. We shall see.

Alternatively, cross-border payments would be facilitated if different national CBDCs were interoperable. A growing number of central banks are investigating this possibility. For example, the Bank of Thailand and Hong Kong Monetary Authority are exploring building their own separate CBDC platforms ("Inthanon" and "LionRock" respectively) but allowing them to "talk to" one another. ((In a second project, the central banks of Hong Kong, Thailand, China and the United Arab Emirates, each with separate CBDC instructures, are exploring the possibility of

making them interoperable.) Thus a Hong Kong importer of silk would be pay the Thai exporter in HK\$, assuming that nonresidents are permitted to download a Hong Kong wallet. But that Thai exporter presumably has no appetite or use for HK\$. An alternative would be for the Hong Kong importer to ask his bank for a HK\$ depository receipt, at which point a corresponding amount of HK\$ in the payer's account would be extinguished. That depository receipt would then be transferred into a dedicated international "corridor" where it would be exchanged for a Thai-denominated depository receipt at the best rate offered by dealers licensed to operate in the corridor. Finally the Thai payee's account would be credited with the corresponding number of digital baht, extinguishing the depository receipt. The transaction would be completed in real time at a fraction of the current cost of cross-border payments.

Notice the formidable preconditions for making this work. The two central banks would have to agree on an architecture for their corridor. They will have to jointly govern its operation. They will have to license and regulate dealers holding inventories of currencies and depository receipts to ensure that the exchange rate inside the corridor doesn't diverge significantly from that outside. They will have to agree on who provides emergency liquidity, against what collateral, in the event of a serious order imbalance.

In a world of 200 currencies, moreover, arrangements of this type would require scores of bilateral agreements. And corridors of more than two countries would require rules and governance arrangements considerably more elaborate than those of the World Trade Organization or the IMF.

Finally, it is worth asking again: by how much would such arrangements reduce costs and increase speed relative to, say, SWIFT Go or blockchain-free linked instant payments systems a la Singapore and Thailand? With linked CBDC platforms, it would still be necessary to pre-validate or ex-post verify the identity of the customer account at the recipient bank. It would still be necessary to engage the services of an authorized dealer to complete the foreign exchange (depository receipt for depository receipt) transaction. One can imagine using automated market-making (AMM) and automated liquidity management (ALM) technology for the foreign exchange transaction, but these have yet to be stress tested. (Automated liquidity management systems are programmed to provide rewards – additional digital tokens – for agents that lend the token in question when demand rises. But as in old-fashioned systems of liquidity provision, one can imagine circumstances when there is no rate of return – no number of additional tokens – that compensate providers adequately for supplying such liquidity. Perhaps the central bank as liquidity provider of last resort can be programmed into such a system. Who knows?) And it is not obvious why, if and when AMM and ALM technology is proven, it can't be adopted equally by SWIFT and other non-distributed-ledger-based payments services.

The alternative to linking separate national blockchains would be for multiple central banks to share a single blockchain. The Monetary Authority of Singapore and Banque de France have run experiments using Ethereum's permissioned enterprise blockchain. In the summer of 2021, the BIS announced that the MAS, Reserve Bank of Australia, Bank Negara Malaysia and South African Reserve Bank

would engage in cross-border settlement trials using “a variety of different blockchain technologies and governance structures.” “A variety of different governance structures” leaves important questions up in the air. Indeed, the type of governance structure that would be needed for a single unified blockchain running the currencies of 200 different countries boggles the mind.

5. Reforming the international monetary system

It is sometimes asserted that issuance of CBDCs by countries other than the United States could hasten movement away from our current dollar-dominated international monetary system. Those who see China as a geopolitical rival to the United States see the PBOC’s digital yuan as an effort on the part of the Chinese government to supplant the dollar. Others more positively see growing use as international reserves of CBDCs issued by countries other than the United States as potentially correcting the unstable imbalance between our dollar-dominated international monetary system and an increasingly multipolar global economy.

But if there are formidable obstacles to using CBDCs in cross-border transactions, as argued in the immediately preceding section, then there are formidable obstacles to their supplanting the dollar as the dominant international and reserve currency. Recent academic research has emphasized the complementarities between the currency composition of private financial transactions and the currency composition of central bank reserves and interventions. If CBDCs are not going to radically alter the currency composition of private financial transactions, as argued in Section 4, then they are not going to radically alter the currency composition of international reserves.

As we have seen, central banks will be reluctant to allow nonresidents to maintain CBDC wallets. Nonresidents will be reluctant to conduct transactions in CBDCs of central banks with which they are not entirely familiar and whose promises of confidentiality they do not entirely trust. If CBDCs were truly interoperable, then every currency would be as convenient as a vehicle for cross-border transactions as any other, and the currency composition of cross-border payments would presumably come to more closely resemble the national composition of international trade and investment. Central banks hold the same currencies as reserves in which their banks and nonbank firms borrow. This is so central banks can lend those same currencies to those banks and firms in extremis – so that they can act as a lender- and liquidity-provider of last resort to domestic firms and markets, in other words. Thus, in a world of interoperable CBDCs, the currency composition of global foreign exchange reserves would similarly come to more closely resemble the national composition of private financial flows. But there are serious very obstacles to interoperability.

Alternatively, there is the “Synthetic Hegemonic Currency” mooted by Mark Carney at the Federal Reserve’s Jackson Hole conference in 2019. Evidently, this is the idea that an unspecified entity, perhaps the International Monetary Fund, would issue a digital unit backed by a basket of national CBDCs, perhaps with the same weights as the IMF’s Special Drawing Rights. This would be an attractive alternative to the dollar as a form of international reserves, the argument goes.

And if central banks held the SHC as reserves, the argument continues, global banks would find it attractive to issue securities denominated in SHCs, and importers and exporters would invoice and settle their transactions in SHCs.

The best that can be said of these arguments is that they are incomplete. Central banks hold reserves in dollars because private financial transactions are conducted in dollars, and central banks want to be able to provide dollars when the need arises. Moreover, central banks can be confident that the Federal Reserve will provide dollar swap lines and ensure their adequate access to dollars in response to extreme events, as in September 2008 and March 2020. Do we really think that governments, and the U.S. Congress specifically, will empower the IMF to inject large numbers of new SHCs into the global financial system over a weekend in response to a crisis?

Finally, there is the fact that Carney's SHC, like the SDR, is no one's natural habitat. UK companies have liabilities denominated in sterling. Having their receivables denominated in a currency basket would result in a currency mismatch or require them to book costly hedging transactions. If doing business in an SDR-like unit was attractive to market participants, investment banks would have long since issued SDR-denominated securities, which – a few isolated exceptions notwithstanding – they have not. There is no demand.

It is revealing that Facebook's initial design for its stablecoin, Libra, was as a basket-based unit. There was a lack of enthusiasm among potential users, and pushback from regulators, so Libra, now renamed Diem, was redesigned as a dollar-linked stablecoin, to be followed, in principle, by the issuance of other national-currency-linked units.

6. Conclusion

All of which is to say that the case for central bank digital currencies remains to be made.

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