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The Brave New World of Central Bank Digital Currencies

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Many hybrid models have been proposed with banks or other financial institutions acting as intermediaries and custodians, sitting between consumers and their central bank assets. Regardless of the technical and administrative structures, retail CBDCs would provide many of the same consumer-level benefits that cryptocurrency provides, including quick transactions and very low fees for transferring or exchanging money, with or without payment gateways and intermediaries. Just as in the world of cryptocurrencies, new developments in the world of CBDCs happen weekly if not daily. The Bank of International Settlements reports (Boar and Wehrli 2021) its third survey on CBDCs showed that although central bankers see promise in wholesale CBDCs, skepticism remains about the use of CBDCs at the retail (consumer) level:

In emerging market and developing economies, where central banks report relatively stronger motivations, financial inclusion and payments efficiency objectives drive general purpose CBDC work. A testament to these motives is the launch of a first “live” CBDC in the Bahamas. This front-runner is likely to be joined by others: central banks collectively representing a fifth of the world’s population are likely to issue a general purpose CBDC in the next three years. However, the majority of central banks remains unlikely to issue CBDC in the foreseeable future.

MORE THAN MONEY

When a technology enables a process or asset to move from the analog world to the digital, or a newer digital technology comes on the scene, we too often limit our thinking about future possibilities to the current way we conduct business.⁶ For example, when the web was introduced, it was viewed as a wonderful new way to send letters, access library holdings, view art, and discover recipes. Today’s web is built on the same technology but enables applications far

beyond what we thought possible when it started.

Central bankers should be cautious about consumer-level CBDCs. Although these digital dollars certainly might be used to make payments, transfer money between individuals, buy candy bars, and pay bar tabs, CBDCs could enable many new applications as they evolve. Some of these applications would be welcome by certain governments and soundly rejected by others. Once adopted, a government might find it challenging to abandon or transition away from a digital dollar or euro. It would be wise to ask, “What could be done with retail CBDCs that can’t be done with today’s dollars?”

ECONOMIC TRANSPARENCY

On public blockchains such as Bitcoin, all transactions can be viewed by anyone, and the sender and receiver of funds are identified by their public keys.⁷ This makes the auditing of blockchain transactions simple, but the identities of the parties are unknown unless a public key is linked, intentionally or unintentionally, to an individual. As such, most blockchains are considered pseudo-anonymous.

Similarly, CBDCs using blockchain technology could allow for a pseudo-anonymous ledger in which all the transactions occurring in an economy could be viewed nearly in real-time. The government, and perhaps the public, would know instantly which assets were being bought, sold, or held. And the central bank might know individual identities.⁸

Adjustments to the economy could happen in real time instead of waiting on spending reports and new policies. Lawmakers could include triggers in economic policy tied to thresholds that could be traced and tracked in the national ledger. If electric vehicles (EVs) are not selling at the rate needed to meet a national target, then incentives for EVs

could be increased automatically until sales improve. Economic policy adjustments could happen daily, hourly, or minute-by-minute.

GOVERNMENTAL TRANSPARENCY

Likewise, a blockchain-based CBDC could allow citizens to view government transactions. Citizens could see the flow of tax dollars to agencies, states, local governments, vendors, and employees. It could increase the transparency of government spending at all levels.

Students attending public universities could “follow the money” as it goes from their tuition payments to the custodial staff’s paychecks. Students and parents would better understand how tuition and tax dollars are allocated to educating students versus supporting vanity projects.⁹

Even if government officials favor such information transparency, they may not favor their citizens using another country’s digital currency. For example, the Bank of England had been researching and debating the merits of a digital sterling. But Jeremy Fleming, head of U.K. intelligence, raised concerns about how CBDCs can be used to collect information from British citizens traveling abroad.¹⁰

Ahead of the 2022 Olympic Games in Beijing, Fleming said:

China is taking every opportunity to project their digital currency, and their hope is that foreign visitors will use it in the same way as domestic visitors. ... If wrongly implemented, it gives a hostile state the ability to surveil transactions. ... It gives them the ability...to be able to exercise control over what is conducted on those digital currencies.

COMBATTING THE CANTILLON EFFECT

When central banks increase the money supply, the increase tends to initially

benefit the locations where money is injected into the economy, i.e., large banks and Wall Street institutions. This is known as the Cantillon effect, first described by 18th-century economist Richard Cantillon. Economist Friedrich Hayek compared it to putting honey in your tea: The honey pools in the bottom of the cup and it takes a while for the sweetness to disperse (Jovanovic 2019).

Retail CBDC would allow governments to send money directly to the wallets of those who need it. Need to help hurricane victims? Deposit money into the wallets of everyone in the affected area. Want to stimulate spending in a depressed economic area? Don't set up a new program or bureaucracy to help people. Instead, send money to people living in that area. Governments could bring money into existence with a laser focus on who gets that money, without intermediaries. Opinions may differ on the benefits versus the costs of government aid, but it is hard to deny the efficiency of just giving money to people who need it and will spend it.

China is the country that has the most experience with airdropping money. Various pilot projects have airdropped millions of digital yuan into the wallets of citizens in preparation for a nationwide rollout of the CBDC (Cheng 2022).

PROGRAMMABLE MONEY

Bitcoin was launched in 2009 and was the world's first working digital currency. Bitcoin is analogous to cash:

- It can be transferred between individuals.
- The transactions are not reversible by one party.
- Transactions don't require permission from a central authority.

Although digital, the blockchain ledger used for Bitcoin is not capable of logical operations commonly found in computer programs such as loops, if-then statements, etc. Our colleagues in

computer science would say that it is not Turing-complete. However, it didn't take much time to fix that oversight.

In September 2015, Vitalik Buterin and others launched Ethereum, a Turing-complete blockchain.¹¹ Ethereum allows the means of payment, known as Ether, to be combined with a smart contract system that can execute transactions automatically once a trigger is activated or a threshold has been met. Ethereum and other Turing-complete blockchains have spawned all sorts of new transactions and assets, from non-fungible tokens (NFTs) and smart contracts to decentralized autonomous organizations and decentralized dispute resolution platforms. What is possible for CBDCs using Turing-complete blockchain? Whatever can be imagined by a smart contract's programmer or a CBDC's central bank.

USE IT OR LOSE IT

The ability to distribute money as part of a smart contract could bring about even more efficiencies when cash is distributed in response to a financial crisis or catastrophic event.

For example, some of the stimulus distributed by the U.S. government during the beginning of the COVID-19 crisis was saved or invested rather than used to purchase goods.¹² An airdropped CBDC on a Turing-complete blockchain might be programmed with an expiration date. If the funds were not spent within a given time, they could be locked up and made unusable or destroyed (in cryptocurrency, this process is referred to as "burning"). With programmable money, investing in GameStop stock might have been a prohibited transaction, whereas rent or grocery payments could be transacted easily.

Such scenarios call into question the fungibility of future currencies and the abilities of a government to control microeconomics.

FUSING MONETARY AND SOCIAL POLICY

Western democracies may be uncomfortable with their governments having quick and easy access to a central database of every transaction in the economy. In theory, citizens in democratic countries would be able to exert control over how their governments access and use such data. But what happens when an authoritarian government uses programmable money?

In some areas of China, the behavior of individuals is monitored closely via smartphone applications, point-of-sale registers, and cameras enabled with facial recognition. All this data is poured into an algorithm that generates a social credit score for each citizen. That score is used to punish those whose behavior is not up to par via restrictions on purchases, travel, and even entrance into educational institutions.¹³

Consider two individuals—Mark and Scott—in a society where a social credit score is combined with a Turing-complete CBDC. GPS data from Mark's phone shows that he attends all the party-approved political rallies and is always home by 8 p.m. sharp. His activity tracker shows that he exercises regularly and gets eight hours of uninterrupted sleep (a sign of little or no alcohol consumption). Facial recognition cameras confirm that he crosses streets at the crosswalk, often helping frail older adults. His purchase history shows that he eats healthful foods. Mark has a high social credit score.

On the other hand, Scott is never at the right rallies, stays out until 3 a.m. in the wrong part of town, never exercises, and facial recognition cameras catch him jaywalking and littering. Scott's purchase history indicates that most of his money goes to beer and cigarettes. Scott would have a low social credit score.

What happens if we combine digital currency with a social credit score?

Perhaps the first six-pack of beer Scott buys is \$10, the second within a span of four days is \$15, and the seventh within four days is \$5,000. Perhaps we see a dynamic pricing system that is not based on market demand but on a particular buyer's demand and a government's judgment of the social value of that purchase. Programmable money can reward the righteous and punish the sinful in real-time.

Tax rates also could be adjusted based on a social credit score. Even if Scott started with more assets than Mark, his marginal tax rate might increase if his score stays low, eroding his finances. In contrast, Mark's tax rate might be significantly lower, allowing him to move up the housing ladder, etc. This social meritocracy would elevate Mark and reduce Scott's status, based on their individual behaviors.

WEAPONIZATION OF MONEY

Authoritarian governments could adopt CBDCs as a means of control over citizen behavior and extension of the surveillance state. It is probably not a coincidence that, in addition to China, many other authoritarian governments are researching or piloting CBDCs, including Venezuela, Turkey, Iran, Saudi Arabia, Singapore, and Russia.

It might seem far-fetched that a government could use a digital tool like CBDCs against its people. Still, after the Arab Spring, dictators such as Recep Tayyip Erdoğan of Turkey and Rodrigo Duterte of the Philippines weaponized social media to control citizens and hunt down dissidents. The only downside for dictators is that the transparency of the system might make it difficult for strongmen to hide their own corruption and side-dealing.

ONCE YOU GO CBDC, YOU WON'T GO BACK

Many voices are calling for a slowdown or a ban on CBDCs. NACHA, the organization responsible for the

development, administration, and governance of the ACH Network, recently urged the Federal Reserve to work instead on existing proposals for improving the interbank exchange network.¹⁴ In the U.S. Congress, bills have been introduced to ban a retail CBDC or require anonymity to be baked into any U.S.-issued retail CBDC.¹⁵

Although the digital-dollar scenarios presented here might seem far-fetched, they are all technically possible. Like many digital transformations, moving to a CBDC might be a one-way trip. Once implemented, future governments might decide to apply this technology in ways we may never have considered. 🟡

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ENDNOTES

1. Not issued by a central server or authority.
2. In the interest of readability and article length, I have made several abstractions and not addressed critiques that cryptocurrencies are not useful as currency.
3. Public blockchains such as Bitcoin are characterized by 10 properties: they are permissionless, borderless, transparent, neutral, verifiable, censorship resistant, immutable, decentralized, open-sourced, and anti-fragile. No CBDC proposed by a central bank meets all these criteria.
4. For the latest country-by-country updates on CBDC developments, visit <https://www.atlanticcouncil.org/cbdctracker/>.
5. Considering that more than \$200 billion of blockchain assets are inaccessible because individuals have lost access to their wallets, a custodial system for CBDC wallets would be needed, at least for the majority of funds held by an individual.
6. Skeuomorphism is the term used by user interface designers when the design of new technology mimics existing designs or functions. For example, a trash-can icon on a computer desktop mimics that of a physical trash can in an office with similar functionality.
7. There are several websites that will allow one to view the entire transaction history

of Bitcoin and other blockchains, for example <https://btccscan.org>.

8. To be entirely anonymous takes some work; wallets must be maintained by the individual, etc. Most exchanges for cryptocurrencies, e.g., Coinbase, are know-your-customer (KYC) compliant, act as a custodian for customer wallets, report to the Internal Revenue Service, and will reveal a user's identity when compelled to by law enforcement. Most models for a CBDC include KYC compliance at a central bank level or at an intermediary.
9. Access a CBDC project map at <https://cbdctracker.org>.
10. R. Khalaf and H. Warrell. "UK Spy Chief Raises Fears over China's Digital Renminbi," *Financial Times* (December 11, 2021), <https://www.ft.com/content/128d7139-15d6-4f4d-a247-fc9228a53ebd>.
11. The Ethereum network was described by V. Buterin in a white paper the year before: <https://ethereum.org/en/whitepaper/>.
12. S. Cowley, "Little of the Paycheck Protection Program's \$800 Billion Protected Paychecks," *New York Times* (February 1, 2022), <https://www.nytimes.com/2022/02/01/business/paycheck-protection-program-costs.html>.
13. N. Kobie, "The Complicated Truth About China's Social Credit System," *Wired* (July 6, 2019), <https://www.wired.co.uk/article/china-social-credit-system-explained>.
14. L. Marek, "Go Slow on a CBDC, Nacha Says," *Payments Dive* (September 2, 2022), <https://www.paymentsdive.com/news/Nacha-cbdc-digital-dollar-federal-reserve-payments/631144/>.
15. "U.S. Legislators Publish Multiple CBDC Bills with Privacy Emphasis," *Ledger Insights* (April 1, 2022), <https://doi.org/https://www.ledgerinsights.com/u-s-legislators-publish-multiple-cbdc-bills-with-privacy-emphasis/>.

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