Digital Currencies Are Coming

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What Is Digital Currency?

Today we take digital music and digital video for granted. As more things going digital so is currency. Yes, we are talking about money, the bills and coins we use in our lives. They are going digital as well.

In the not so distant future, sovereign countries may elect to issue their legal tender in digital forms, represented by computer codes instead of physical objects. Such digital money are known as CBDC (Central Bank Digital Currencies). CBDC are legal tender and backed by the full faith and credit of the issuing government, just like paper money in that country.

The Bahamas has made the first move. According to the `sanddollar.bs` website, on 10/20/2020 the Central Bank of The Bahamas formally rolled out its CBDC, the *Bahamian Sand Dollar*. Other countries, in various stages of issuing their CBDC, include China (DCEP), Sweden (e-krona), EU (digital euro), Marshall Islands (SOV), and more.

The United States, on the other hand, has decided to wait for conditions to ripen as indicated by a February 24, 2021 report from the Federal Reserve System entitled "*Preconditions for a general-purpose central bank digital currency*."

Let's take a closer look at the CBDC from a consumer's point of view.

Evolution of Money

Digital currency is the most recent step forward in a long history of transformations for money dating back to as early as 1100 B.C. when sea shells and miniature bronze replicas of weapons were used in ancient China as tokens for the exchange of goods.

Paper money began to appear around 700-1000 A.D. in China where paper was invented earlier (105 A.D.). Being much easier to carry and use than coins and precious metals (silver and gold), paper money became widely adopted as banknotes. Modern banknotes issued by central banks as legal tender are still the main form of money in all countries.

Later came electronic ways to pay and transfer money with credit/debit cards and services such as Paypal, Alipay, Apple Pay, Google Pay etc. These are even more convenient. But these are services that require bank accounts with deposits/credits and may involve transaction fees. They are not really forms of money but merely efficient ways to manage money.

What comes next for money is digital currency. Turning bills and coins into computer codes or character strings that can be sent, received, and processed through digital communication by computing devices.

Understanding CBDC

For a digital currency (DC) to become an alternative to cash, it ought to satisfy a set of conditions including the following.

- It must be issued by a national central bank (CB) giving it legal tender status. Also it should be freely exchangeable with physical cash at the same value.
- It must be easily verifiable as genuine and impossible to alter, copy or counterfeit.
- CBDC are held in a safe and secure app known as a digital purse or wallet to run on smartphones, smart cards, and other computing devices.

- A CBDC transaction involves the transfer of DC from the payer's wallet to the payee's wallet. Ideally this can happen online or offline. Transactions happen quickly and securely, double-spending (using the same DC more than once) is impossible.
- Wallets form part of the CBDC's management and operation system which keeps track of all user accounts, balances, and transactions at all times. The system can also be used to set monetary policies and add "smarts" to wallets and transactions.
- Security aspects of a CBDC system calls for 24/7 service availability, high processing speed and capacity, data integrity, and information confidentiality.

Making It Work

Many of the preceding conditions can be met by using certain crypto techniques also used by cryptocurrencies such as Bitcoin or Ethereum. Anyone can easily create and release such a cryptocurrency. In fact there are more than 4,000 cryptocurrencies in existence as of January 2021. Cryptocurrencies such as Bitcoin not only have no intrinsic value but also fail to meet many important conditions listed for CBDC. Furthermore, as investments they are "highly speculative" as according to United States secretary of the treasury Janet Yellen. Warren Buffett was more critical and referred to Bitcoin as "rat poison." This is why the likes of Bitcoin are illegal in most countries.

PlusToken was the a recent (late 2020) cryptocurrency related crime—a Ponzi scheme that grew to over 3000 layers. Chinese authoritie have seized cryptocurrencies worth nearly $4 billion which will be forfeited to the national treasury.

In my previous *Computational Thinking* (CT) post "*Bitcoin Is No Coin*" you can find a more detailed analysis.

A CBDC may use cryptography techniques for implementation but it has nothing to do with the likes of Bitcoin in purpose and function. Specifically the techniques to implement a CBDC include public-key encryption, decryption, digital signature, hashing (document digital finger printing), and fast and secure ledgers of all transactions.

To achieve the required transaction speeds, a distributed public blockchain is not advisable. A private ledger kept and shared by a few key participants, banks and authorized agents, should be used instead.

As mentioned before, multiple countries are in the process of developing CBDC using approaches suitable in their own situations. Let us look at one example.

An Example–The Chinese DCEP

China is the only major economy that has already piloted its own CBDC in several cities. The digital RMB has been officially named DCEP (Digital Currency Electronic Payment). A closer look at DCEP can shed more light on many aspects of CBDC.

(1) A Brief History

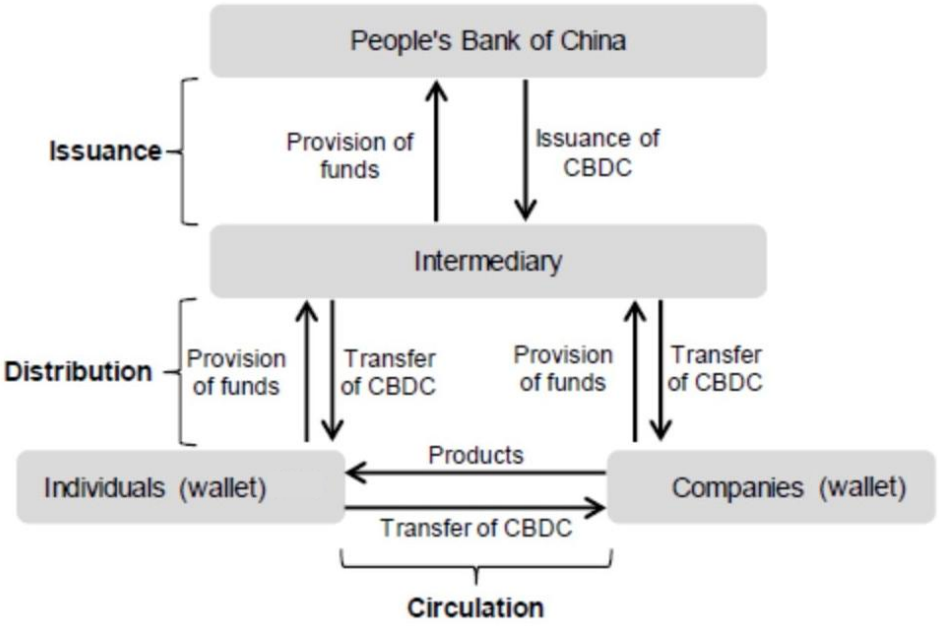
In 2014 China's central bank, The People's Bank of China (PBoC), established a research group to study the feasibility of a Chinese CBDC. With progress in multiple fronts the PBoC has basically completed the overall design, technical standards, applications development, and operations testing/debugging in 2019. Immediately, pilot testing of DCEP started in four cities (Shenzhen 深圳, Suzhou 蘇州, Xiong'an 雄安, Chengdu 成都). In 2020, seven more cities were added to expand the piloting.

2021 has seen cross-border testing of DCEP with Hong Kong and internationally with Thailand and the United Arab Emirates.

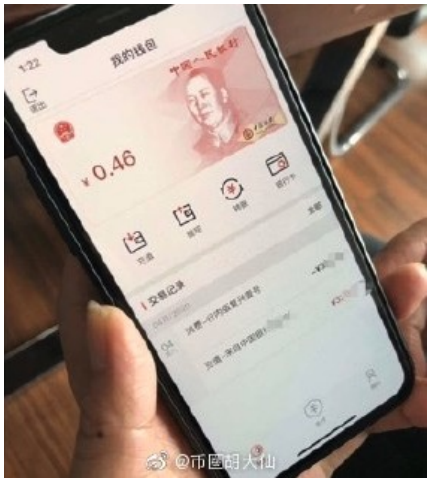
(2) Management And Operation

The primary purpose of DCEP is to serve as a preferred alternative to the physical RMB. The PBoC uses a two-tier system to issue and distribute

DCEP. The intermediaries consist of designated banks and financial institutions. An intermediary deposits RMB with PBoC to obtain equal amounts of DCEP which it can then distribute to end users—individuals, businesses, and merchants.



In order to use DCEP, you need to register and obtain a *DECP wallet*, the official secure app to receive, spend and otherwise manage your DCEP.



The previous picture shows a DCEP wallet app on a mobile phone. Other forms of DCEP wallet include card with display and finger print sensor, keychain, smart watch, etc.

As you can see, PBoC is the control center of DCEP. For management and operation, the central bank has established two databases (DCEP banks database and DCEP issuance database) and three processing centers (DCEP authentication center, DCEP transactions recording center, and DCEP data analysis center). All these aim to achieve safe, secure, accurate, and speedy operations of DCEP.

After the pilot phases, the DCEP should be available to everyone who has a wallet and widely accepted. By law, any merchant who accepts a credit/debit card or another form of e-payment must accept DCEP in China. Because a wallet contains digital money and is not directly connected to a bank account it means DCEP functions much like cash.

(3) Degrees of Anonymity

DCEP has been designed to easily track questionable, illegal, or criminal activities such as tax evasion, bribery and money laundering, while preserving the privacy and transaction anonymity of typical users. This is done by having four levels of wallets with different limits on the balance and per transaction amounts.

An anonymous wallet, good for common folks, can be established with

one's cellphone number alone. The cellphone owner's account information is by law private and cannot be disclosed by the cell service provider to others. This means even the PBoC cannot obtain that info without a court order. An owner needs to supply more personal information to elevate her/his wallet to the next level.

CBDC Advantages and Disadvantages

Having seen the basics and a concrete example of CBDC, now we can discuss its pros and cons.

Advantages

1. Easier and more convenient to carry and to use
2. Say good-bye to loose change or making change
3. People without bank accounts can still use money electronically
4. No-cost fund transfer and transactions
5. Low cost to issue, track, control, and destroy
6. Safer and more secure against counterfeit, loss/steal
7. Better for fighting corruption, bribery, money laundering, and other financial crimes
8. Making cross-border transaction easier and less expensive
9. Enabling new and innovative financial products and services based on digital currency
10. Ability to better implement national monetary policies and to add features for transactions

Disadvantages

1. Lacking the feel of satisfaction from holding and counting physical money

2. Adding to the digital divide—people who do not use computing devices can find it harder to accept/use a digital currency
3. Losing your phone with a CBDC wallet becomes much more serious
4. Funds in a wallet don't usually earn interest
5. Central bank can potentially directly compete with commercial banks, financial institutions and e-payment services
6. Concerns on anonymity and/or privacy for users
7. The electronic control system can become a critical point of failure or a target for hackers
8. A bug or operator error can cause serious consequences

Finally

We have briefly introduced CBDC, described its characteristics, provided some details of the Chinese DCEP as a concrete example, and listed its pros and cons. We have also largely avoided details too technical or complicated. A CBDC supported by a country's central bank must not be confused with cryptocurrencies regarded as rat poison. In fact, in May 2021 Chinese regulators have barred all institutions and organizations from any cryptocurrency related business, service, or transaction.

While some countries such as the US are taking a conservative wait-and-see approach, others are aggressively moving into the digital currency era with innovation and vision.

The fact is, as everything is going digital so is currency. And this could be the next great evolution in the history of money. Of course an understanding of CBDC adds to our computational thinking. And hopefully, one day soon we will be lucky enough to enjoy the next form of money.