



# Central Bank Digital Currency and Cryptocurrencies

What's it all about?

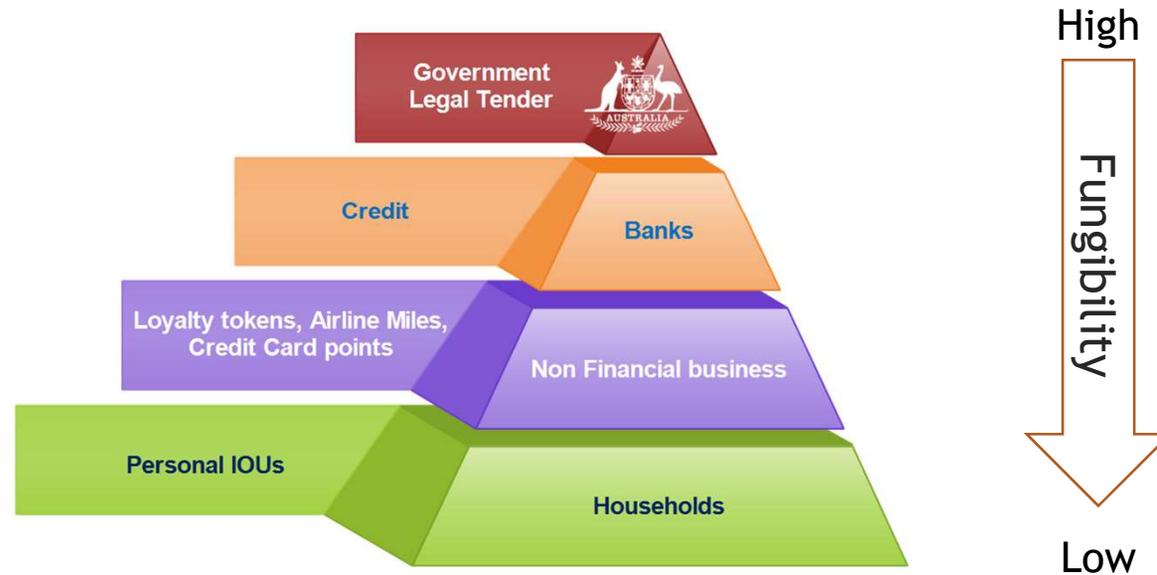


## Money – the basics

*“Everyone can create money;  
the problem is to get it accepted”*

- Hyman Minsky

# Hierarchy of Money



Definitions of money:

1. Unit of account
2. Store of value
3. Medium of exchange

# The payment process

**Cash** - a direct exchange between two parties



**EFT** involves multiple parties as well as digital technology



# Cryptocurrency

A cryptocurrency or crypto is a digital currency designed to work as a medium of exchange through a computer network that is not reliant on any central authority, such as a government or bank, to uphold or maintain it.

Individual coin ownership records are stored in a digital ledger, which is a computerized database using strong cryptography to secure transaction records, to control the creation of additional coins, and to verify the transfer of coin ownership.

# What Is Blockchain?

- aka Distributed Ledger Technology (DLT)

Based on a peer-to-peer (P2P) topology, blockchain is a distributed ledger technology (DLT) that allows data to be stored globally on thousands of servers - while letting anyone on the network see everyone else's entries in near real-time. That makes it difficult for one user to gain control of, or game, the network.

When data is added to the blockchain all copies in the network are updated which makes it almost impossible for anyone to interfere with the record.

# The Bitcoin Whitepaper

## Bitcoin: A Peer-to-Peer Electronic Cash System

Satoshi Nakamoto  
satoshin@gmx.com  
www.bitcoin.org

**Abstract.** A purely peer-to-peer version of electronic cash would allow online payments to be sent directly from one party to another without going through a financial institution. Digital signatures provide part of the solution, but the main benefits are lost if a trusted third party is still required to prevent double-spending.

We propose a solution to the double-spending problem using a peer-to-peer network. The network timestamps transactions by hashing them into an ongoing chain of hash-based proof-of-work, forming a record that cannot be changed without redoing the proof-of-work. The longest chain not only serves as proof of the sequence of events witnessed, but proof that it came from the largest pool of CPU power.

# Bitcoin - Digital Gold?

The proposed comparison with gold is to emphasise the built in scarcity (there can never be more than 21 million Bitcoin) and the cost of creating new Bitcoin.

**Is Bitcoin a currency? Does it have the following characteristics of money?**

- A medium of exchange with which to make payments for goods and services?
- A unit of account?
- A store of value for transferring purchasing power from today to some future time?

# Theory & Practice

Cryptography and the Hash function (one way only, you can mix the raisins in but never out)

the quick brown fox jumps over the lazy dog 

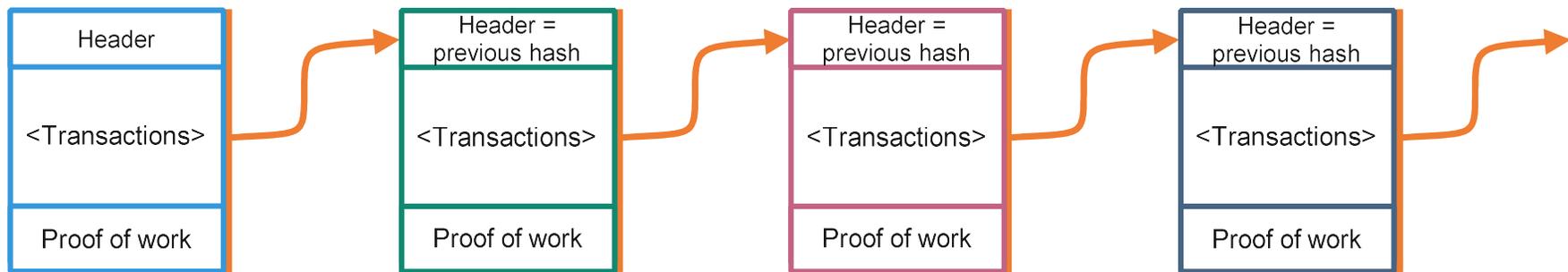
05c6e08f1d9fdafa03147fcb8f82f124c76d2f70e3d989dc8aadb5e7d7450bec

War & Peace (the complete text) 

46010d7b8af48416508df5484d160894a780baf001975f8316e31f99e70f2fb5

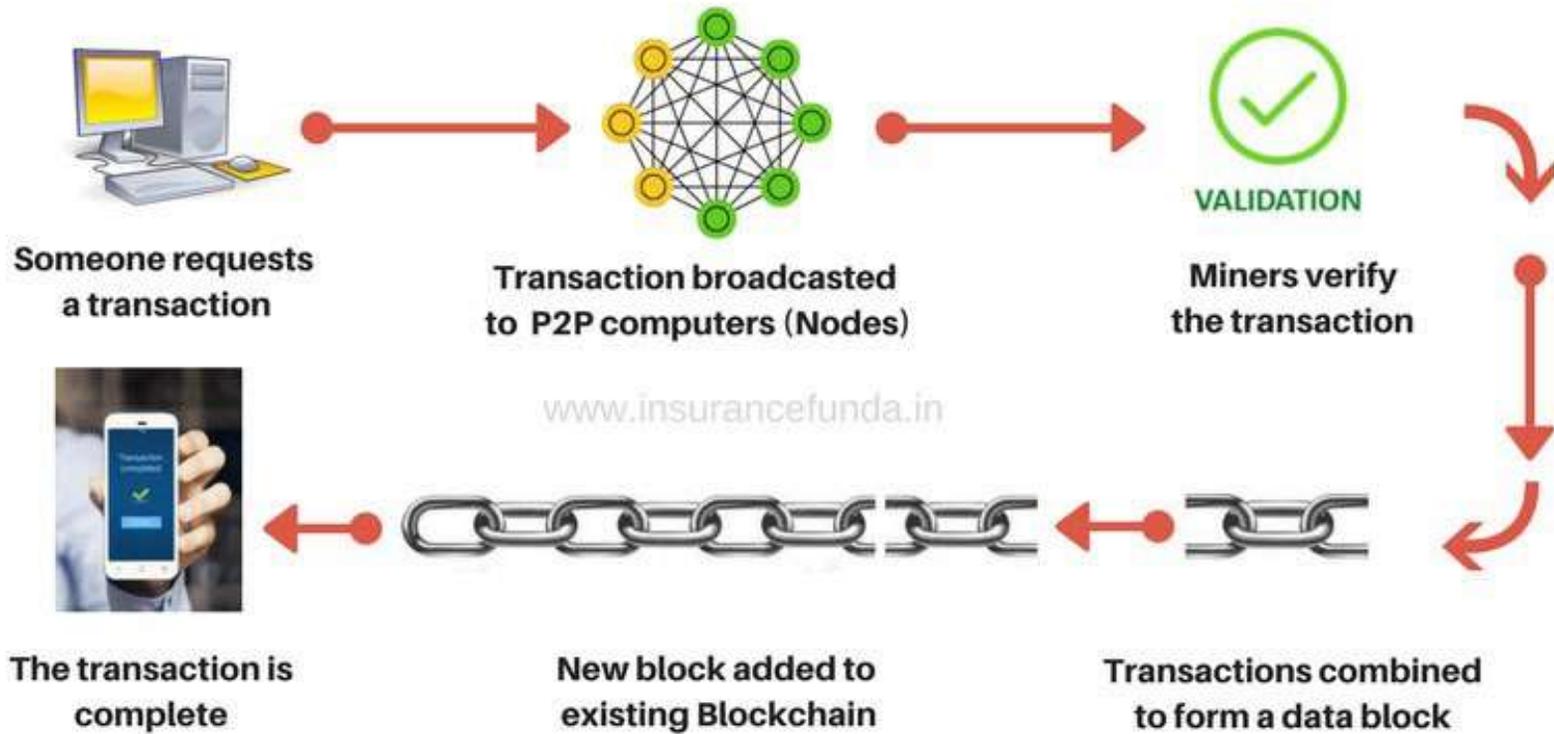
[Hash Generator](#)

Each block in the chain includes a unique signature of all previous blocks



<https://www.3blue1brown.com/lessons/bitcoin>

## HOW BITCOIN TRANSACTION WORKS



# Stablecoins

A stablecoin is a class of cryptocurrencies that attempt to offer price stability by being backed by a reserve asset.

Stablecoins have gained traction as they attempt to offer the best of both worlds - the instant processing and security or privacy of payments of cryptocurrencies, and the volatility-free stable valuations of fiat currencies.

# NFT - Non Fungible Token

Fungible tokens, such as currency are exchangeable for like tokens and divisible down to a specified minimum (1c or 1 satoshi - one hundred millionth of a Bitcoin).

Non fungible tokens are unique and in the digital world can comprise any content that can be uniquely digitised.

A digital artwork made by American artist Mike Winkelmann (Beeple) was the first-ever purely-digital piece fetching more than \$69.3 million at auction.

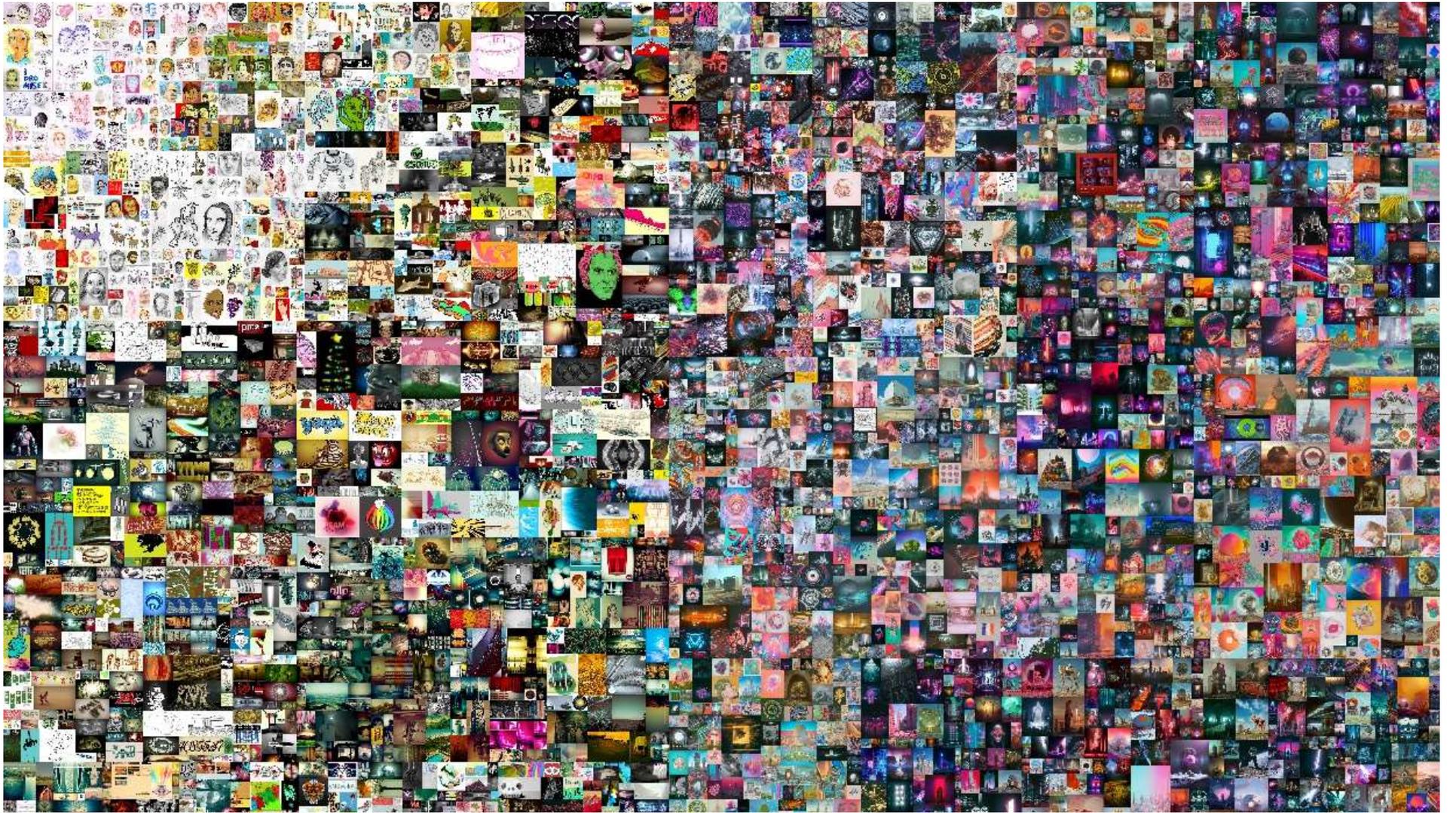
Titled *Everydays: the first 5000 days* it is uniquely referenced on some digital storage by the following hash:

[6314b55cc6ff34f67a18e1ccc977234b803f7a5497b94f1f994ac9d1b896a017](https://www.etherbase.io/etherscan/address/0x6314b55cc6ff34f67a18e1ccc977234b803f7a5497b94f1f994ac9d1b896a017)

References:

NFTs: <https://www.blockchain.com/nfts>

Beeple Explains The Absurdity Of NFTs: <https://www.youtube.com/watch?v=nTmF26NUZTA>



# Further information on cryptocurrencies

Search the blockchain for live transactions -

<https://www.blockchain.com/explorer>

Who owns most bitcoin?

<https://www.blockchain.com/btc/address/34xp4vRoCGJym3xR7yCVPFHoCNxv4Twseo>

A heatmap shows the current distribution of crypto currencies by value -

<https://coinmarketcap.com/crypto-heatmap/>

Transactions as they happen -

<https://www.digitalcoindata.com/bitcoin-transaction-map/>

# Bitcoin mining





# Single Bitcoin Transaction Footprint



Carbon Footprint - 1217 kgCO<sub>2</sub>

Equivalent to the carbon footprint of **2,697,096** VISA transactions or **202,819** hours of watching Youtube



Electrical Energy - 2182 kWh

Equivalent to the power consumption of an average U.S. household over 74.78 days



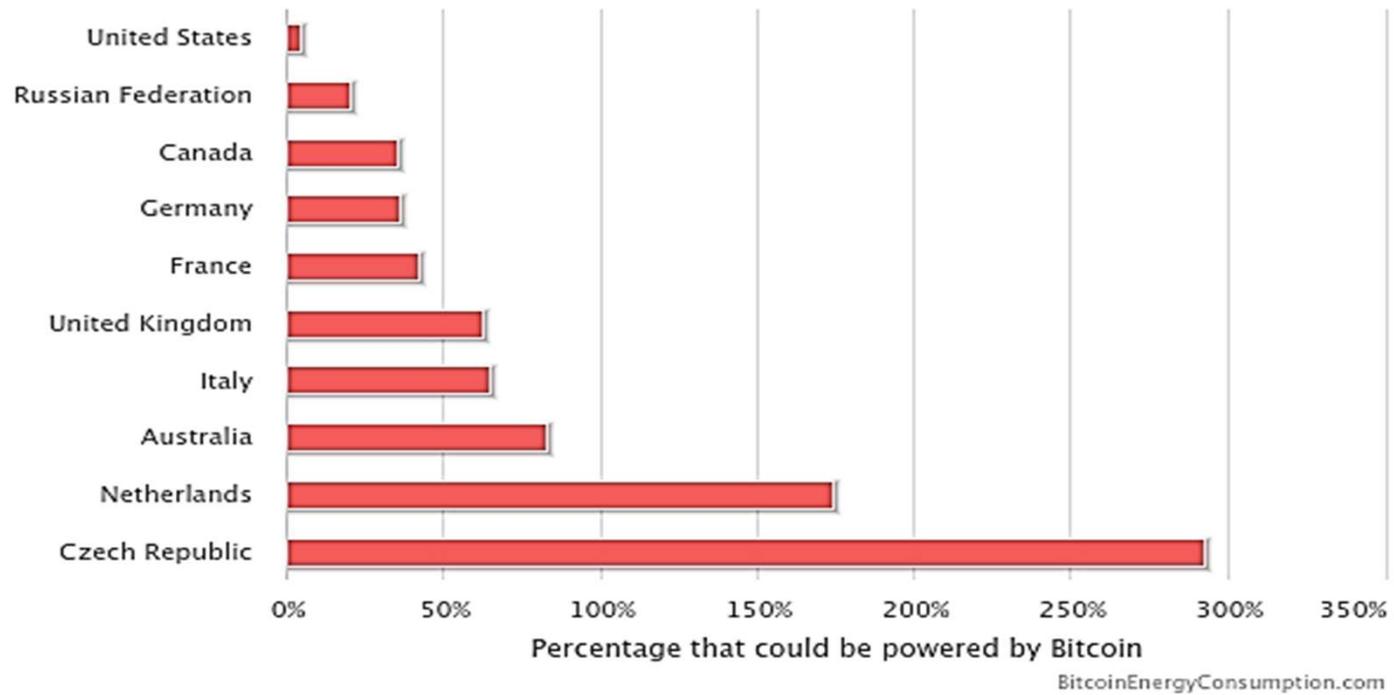
Electronic Waste

369.00 grams Equivalent to the weight of 2.25 iPhones 12 or 0.75 iPads

Energy Consumption: <https://digiconomist.net/bitcoin-energy-consumption>

# Energy use

## Bitcoin Energy Consumption Relative to Several Countries



<https://digiconomist.net/bitcoin-energy-consumption>

# Scams



In 2014 the Romanian Dr Ruja Ignatova started OneCoin with her brother Konstantin Ignatov.

In October 2017 Ruja Ignatova disappeared together with the estimated \$4.4 billion USD invested by believers.



In September 2021 Glenn Arcaro, Director and Promoter of BitConnect pleaded guilty in Global \$2 Billion Cryptocurrency Scheme.

# Central Bank Digital Currency (CBDC)

**IMF definition: CBDC is a digital representation of sovereign currency issued by a central bank or central monetary authority.**

# Payments and digital processing

Forty years ago payments were processed with cash and cheques. Then came the plastic card, imprinted on carbon paper and processed manually.

And then came the Internet and digital processing. Today, millions of people use those same plastic cards online, "swiping" their cards without any face-to-face interaction.

**Four participants in a typical digital transaction:**

1. The consumer.
2. The retailer
3. Consumer's bank.
4. Retailer's bank

There are two monetary flows: the flow of bank deposits and the flow of central bank deposits.

# Conventional forms of digital money

## 1. Retail bank transaction deposits

**Deposits in transaction accounts**, making up the lion's share of the narrow monetary aggregate.

## 2. Retail bank term deposits.

**Deposits in time accounts**, returning interest and forming part of the broad monetary aggregate.

## 3. Banking reserves (high-powered money).

Banking institutions' **central bank deposits**.

## 4. Treasury bonds and other **securities on issue**.

Broad state fiat money (sovereign debt), returning interest, tradeable, interchangeable with banking reserves.

## **Notes on Treasury bonds**

Foreign debt taken on by a government is always a very bad idea and practice, from a modern money perspective. Note the term "broad" used for describing sovereign debt as a form of state fiat money.

Banking reserves are, by contrast, "narrow" state fiat money. The two are basically interchangeable -- it's just a matter of moving the financial asset between a debt account and a reserves account at the central bank. It is done with a simple computer keystroke. Their interchange takes place routinely whenever the CB conducts monetary policy.

# The basic digital transaction mechanism

When a digital retail transaction occurs, several things happen:

1. The consumer acquires goods and/or services
2. The consumer's bank account is reduced by the sale price
3. The retailer's bank account is increased by the sale price
4. The consumer's bank experiences a commensurate reduction in their reserve account at the CB
5. The retailer's bank experiences a commensurate increase in their reserve account at the CB

We have a **dual monetary system**, in which banking reserves tag along with bank deposit money in every transaction involving banks.

# Central Bank Digital Currency

The basic mechanism of CBDC is that the central bank (CB) would provide a national depository facility for **non banks**, in addition to **banks**. Sometimes termed **retail** and **wholesale** CBDC.

There is no obvious reason why banks, post offices and perhaps other large organisations cannot operate as agents of the national depository, which could be a division of the central bank.

It is highly probable that CBDC would serve as **legal tender**.

The balances also could be stored on hardware (e.g. a stand-alone device issued by the CB), rather than in a bank account.

# Central Bank Digital Currency

## The less radical proposal:

The two types of deposit (i.e. for **banks** and **non-banks**) would operate in a cooperative manner. The latter would be interchangeable with the former and with hard currency. Bank depositors would have the option of demanding to have their withdrawals paid in either hard currency or CBDC. Being state-based, both forms of fiat money would have a lower systemic risk than bank deposits.

Banks and the federal government would both retain their ability to create money. The model could work both with and without the existence of hard currency (coins and banknotes).

This CBDC model is one basis for all central bank studies of CBDC to date (there are variations)

## Pros and Cons of this model

This is a similar arrangement to current practice, except for the feature of DC for non-banks. It would not impact on inequality (it can be argued that the existence of bank reserves increases inequality). In terms of risks, it has been argued that DC for non-banks would accelerate the reduced use of cash, and there would be a temptation to **remove cash altogether**, taking away individual freedoms and giving banks more power and control. But this does not need to happen if there is adequate bank regulation.

If that doesn't work, banks could be nationalized or (see next) the more radical proposal adopted.

# Central Bank Digital Currency

## The more radical proposal:

- There would be a **single national depository** facility open to everyone, including each state government Treasury and all financial institutions. It could be a branch of the CB.
- Bank reserves would no longer be needed. This depository would **neither borrow nor lend**; its primary function would be to **store money and effect payments** in an efficient manner.
- Commercial banks would transform into institutions that operate as true intermediaries and would no longer be able to create credit money. Financial institutions could borrow from the CB.
- This model would be able to accommodate the use of hard currency.

This CBDS model was devised and studied by William Hummel

## Risks in this model

One possible risk is that associated with the "dead hand of bureaucracy", which is always a risk with anything operated by the state (and also by monopoly private corporations). However since payments are an essential feature of any economy, **there is a strong incentive to keep it working adequately** in the national interest.

# Implementation of CBDC

It is possible for a CBDC to make use of distributed ledger technology, although this does not need to be the case. Thus more traditional data bases can be used, and the latter option appears to be the case for the planned Chinese CBDC.

The Peoples' Bank of China (PBOC) has started real-world trials of CBDC and is leading the world in the field. The trials have been taking place in a number of cities including Shenzhen, Chengdu and Suzhou.

# Benefits of introducing CBDC in China

(according to the PBOC)

1. Replaces hard currency (cash) which is decreasing.
2. Using and storing CBDC is less costly than is cash.
3. CBDC can effect financial payments more efficiently.
4. DC increases the competition of payments companies.
5. Commercial banks could integrate similar functionality.

Ref: <https://www.cnbc.com/2021/03/05/chinas-digital-yuan-what-is-it-and-how-does-it-work.html>

## Could CBDC be introduced for the wrong reasons?

Owing, in part, to China's digital yuan pilot, the cryptocurrency advocates have mostly turned against CBDC as an “Orwellian spy surveillance nightmare”.

These people and others on the political right see CBDC as a mechanism for phasing out the use of hard currency (cash), claiming that this is its real objective and that it would give both the state and the banks too much control over the lives of ordinary citizens.

However there is no reason why CBDC and cash cannot coexist and work cooperatively.

The barriers to CBDC at this point are political, not technological.

## Treasury Issued Digital Currency

Rep. Stephen Lynch very recently introduced to the US House of Representatives a bill - for an ECASH\* Act, proposing a form of digital currency that would operate without the Fed (CB). The proposal seeks to pilot a digital dollar issued by federal Treasury. In this proposal, it is envisaged that the electronic currency would not use blockchain.

In essence, it seeks to re-create the virtues of cash - privacy and all - in digital form. The balances would be stored on hardware (e.g. a stand-alone device), rather than in a bank account.

\*ECASH = Electronic Currency and Secure Hardware Act