

# **CENTRAL BANKS, CRYPTOCURRENCIES, DIGITAL CURRENCIES**

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# WHAT'S HAPPENING



- Bitcoins / stablecoins
- Cryptos & Digital Currencies
- Blockchain & Defi
- NFT's
- Smart Contracts

## WHAT CAN THE CB DO?



- Watch
- Regulate
  - forbid
  - adapt laws
  - organize
- Create its own technology
  - Central Bank Digital Currency
- Main problem: landscape changes very fast
  - technologies and market forces are not clearly understood

## TODAY

- review the main evolutions of the crypto-sphere
- call an expert about the ways to regulate cryptocurrencies
  - Mark Le Page from Ernst & Young
- discuss the challenges raised by central bank digital currencies

**BITCOIN**

## IS BITCOIN MONEY?

The traditional functions of money are:

- a medium of exchange
- a store of value
- a unit of account

How do they apply to Bitcoin?

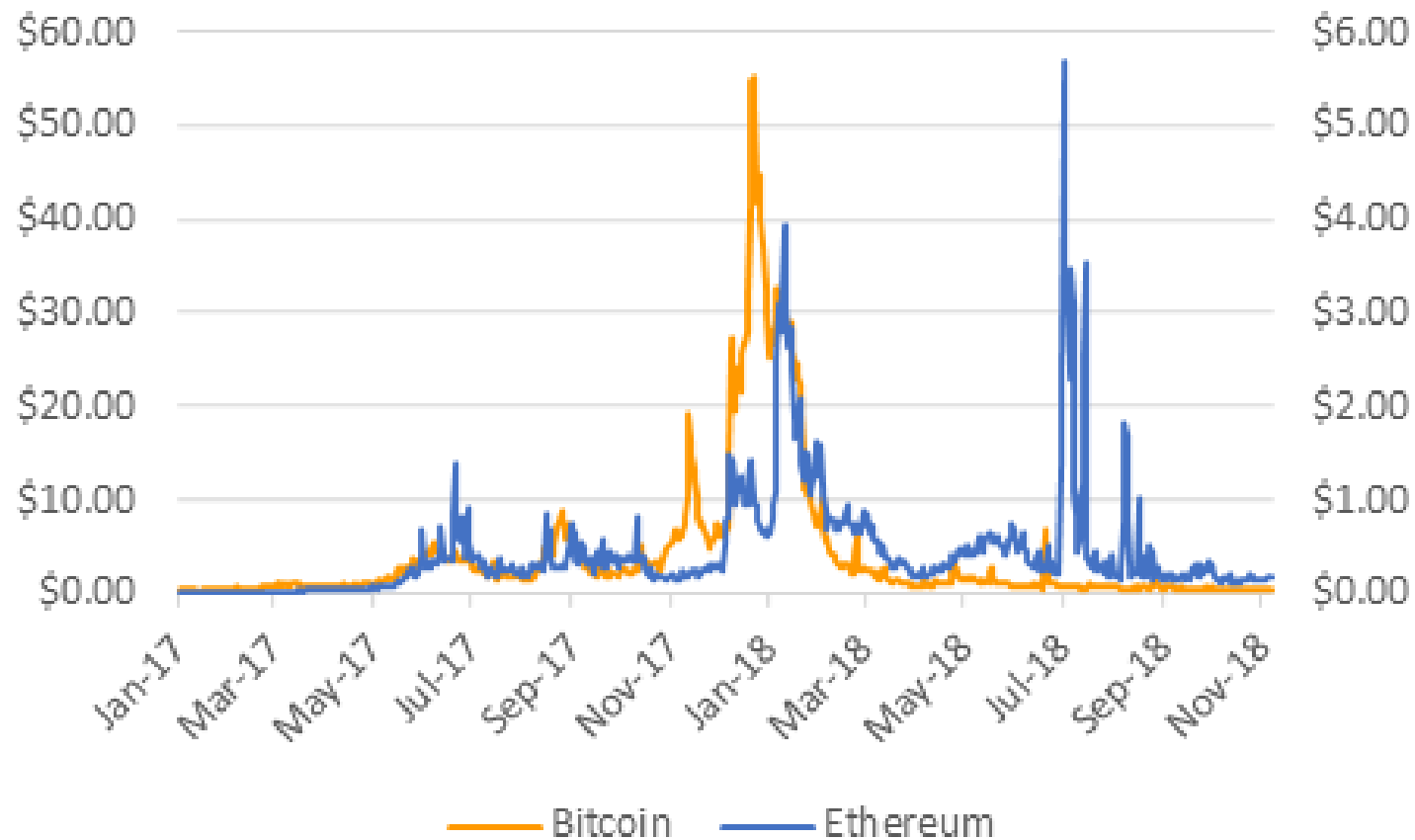
# IS BITCOIN A MEDIUM OF EXCHANGE?

It is now possible to buy some goods with Bitcoins (Tesla, Walmart, Some Coffee Shops)

But look at the transaction fees... And the transaction delays: >10 min



## Average Transaction Fees





# IS IT A UNIT OF ACCOUNT?



Not yet.

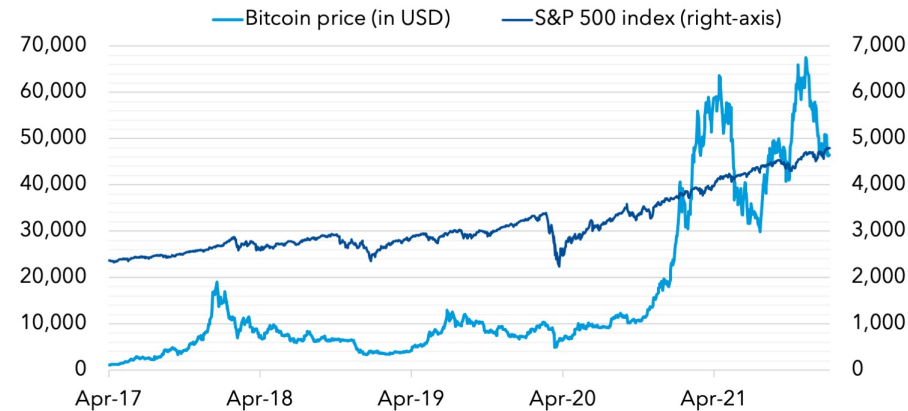


# IS BITCOIN A STORE OF VALUE?

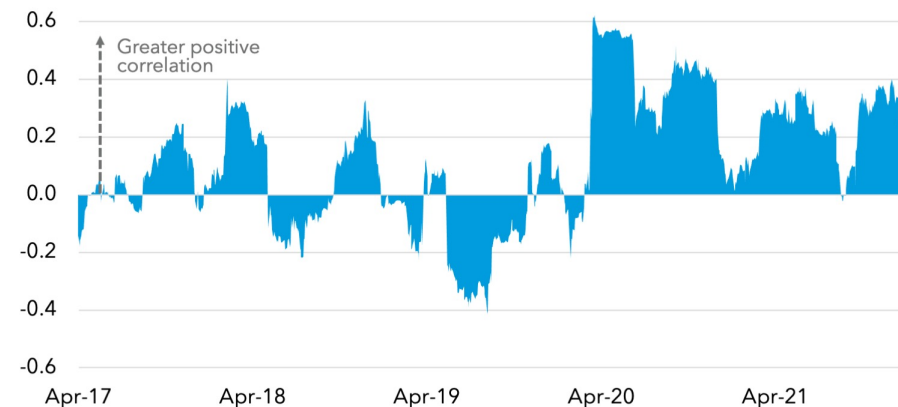
## Stronger correlation

Bitcoin and U.S. stocks have moved together more closely during the pandemic.

Bitcoin price and S&P 500 index



Correlation between Bitcoin returns and S&P 500 index



Source: CryptoCompare, Yahoo Finance, and authors' calculations.  
Note: Bottom panel shows rolling 60-day correlation coefficient.

- Is it safe?
  - Bitcoin price is 12 times more volatile than Eur/usd
  - Gold is 2 times more volatile than Eur/usd
- Maybe it is uncorrelated to other assets?
  - No it is not, it amplifies volatility of other assets.
- Maybe bitcoin has higher returns?
  - indeed it has had, but it might not be structural
- Overall, it doesn't look like a store of value or if it is, it's a risky one...

# IS MONEY MONEY?

Bitcoin is definitely not a traditional currency. Some economists prefer to call Bitcoin a crypto-asset.

Maybe the "traditional functions" of money might not be so useful categories. Think about whether *cash* satisfies the criteria

- a medium of exchange
  - but is cash a good medium of exchange (have you taken the taxi recently?)
- a store of value
  - right now, inflation is 5% in the Eurozone
- a unit of account
  - is that so important for smartphone assisted humans?

Imho, these definitions are perfectly adequate for economic anthropology: they explain best how we came out of the barter economy.

Nowadays, there is a continuum between assets and money (e.g. quasi-money, money-market funds, ...) and the narrow definition of money is less useful.

## WHY IS BITCOIN SO VALUED THEN?

- Its decentralized nature makes it independent from individual currencies
  - easy international transactions
- It is independent from states and banks
  - a dream for libertarians
  - a way to escape totalitarian states
- An ounce of technophilia
- The fact that other investors value it
  - that's pretty much the definition of a bubble
  - but bitcoin is actually used as underlying assets for other cryptos (which have faster and cheaper transaction costs)

# THE BLOCKCHAIN

- Blockchain is also called "distributed ledger"
- It keeps a record of all transactions between each "node"
  - this record is unfakable and unmutable
- Who keeps this record?
  - special participants called miners
- The system is based on cryptographic principles which allow to certify operations

# THE MINERS

How does it work?

- The distributed ledger
- Transactions are recorded in blocks, linked to each other
- The full blockchain is stored on all nodes (currently 324GB!)
- Any node can explore the blockchain to check that a transaction between A and B has taken place
- Transaction can be verified by looking up in the history
- Miners
- New blocks containing new transactions are added by miners
- Miners essentially maintain the blockchain
- They charge a fee to create new transactions
- And are incentivized by some probability of mining a new bitcoin (currently 6.25 per block)
- This process requires hard computational work. It is required to keep the currency supply limited.

## THE COST OF TRANSACTIONS

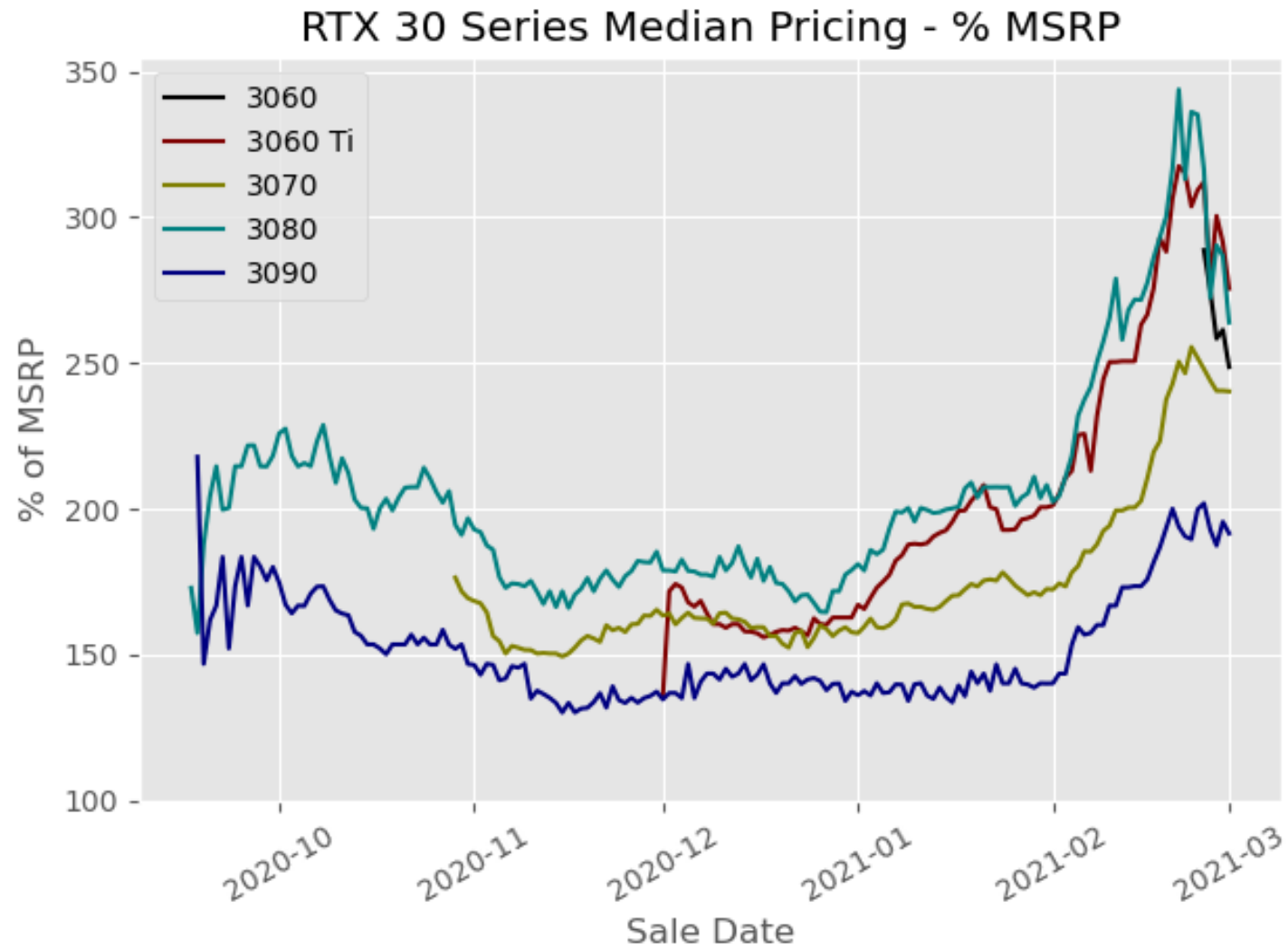
We have seen that performing a bitcoin transaction is expensive (between 1.78\$! and 62\$ !)

- Note that this is a market equilibrium:
  - users can choose their fee
  - their waiting time depends on the willingness of miners to record the transaction
- Somehow the price of transactions measures the value of the transaction motive



# THE COST OF TRANSACTIONS (2)

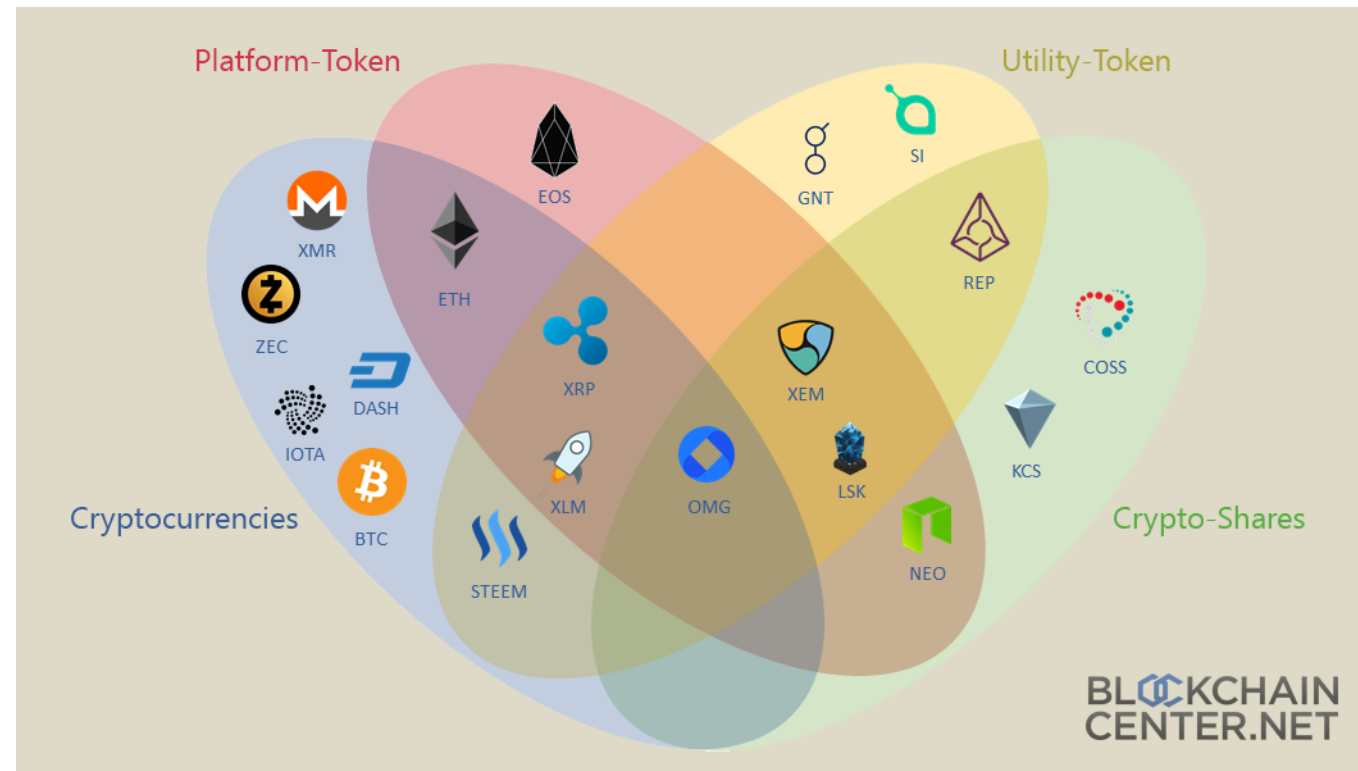
A whole industry has evolved to mine bitcoins



## FROM THE BITCOIN TO A BANKING SYSTEM

- Since transactions can't easily be done by individuals users use custodial Wallets
- A custodial Wallet is a notional account provided by an intermediary
  - it represents ownership of some bitcoins
- When transactions are made between several wallet users
  - no actual bitcoin payment is made
  - only the notional values by the intermediary are changed
- When transactions involve several firms, only net flows need to be executed
- Wait, that sounds a lot like a bank!

## OTHER CRYPTOCURRENCIES



**DEFI**

# GENERALISATION OF THE BLOCKCHAIN

- A system that can record and authenticate transactions can be used to perform many other things than currency
  - instead of currency, interest bearing instrument
- Currency, debt instruments are fungible tokens (no difference between one bitcoin and another)
- But blockchains are increasingly being used to exchange non fungible tokens.
  - An NFT is a property title on a unique asset.
  - diamond, digital key, immaterial goods (Sorare, )
- Then this title can be resold and it is possible to find out who owns it.
- Note that the conversion of the title into an actual object/service is still the responsibility of the issuer.
  - it works best in the virtual world

# SMART CONTRACTS

- Relying on computational power to implement the blockchain allows for more advanced operations.
- Some platforms permit the execution of programs on the blockchain.
  - these are called smart contracts
- Most famous smart contract platform is Ethereum
- It makes it possible to perform operations (not only property checks)
- There is an incentive scheme to compensate for the needed computations with Ethereum currency (Ether)



## SMART CONTRACTS (2)

- For example, an issuer A can create a token with the guarantee he will pay  $x\%$  to the owner of the token every month
  - this is a debt contract!
  - with a natural secondary market (debt can be resold)
- Program can be more complicated: it can pay an amount that is linked to inflation or exchange rate
  - it becomes a derivative product!

## SMART CONTRACTS (2)

Warren Buffett: derivatives are "financial weapons of mass destruction."

Derivatives have created a very complex interdependent market which collapsed in 2008.

Imagine the same with automatic execution algorithms on Ethereum...

## SMART CONTRACTS (3)

There is a difference though:

- for traditional assets, guarantees are given by contracts (and law)
- for a smart contract, it is by algorithm design
  - in that sense, it permits the creation of crypto-assets that are safe, by design
  - ... as long as everything remains on the blockchain (collateral, margin calls, etc...)

# STABLE COINS

- **Stable coins** are special crypto assets whose price vs the dollar remain fairly stable.
- They are especially useful to convert returns in crypto currencies to real currencies
- How do you control the value of a currency? Two possibilities:
  - intervene on the market by selling / buying the currency
  - change the amount of currency ...
  - or its intrinsic value (debase, reevaluate)
    - (fix the conversion rate of the stablecoin with another crypto asset)
- All are famous practices of central banks!
  - FX Markets: use foreign exchange reserves to stabilize market
  - control inflation by issuing more money
  - debasement with old metal currencies / banknotes redenomination

## REMARK

- The weak point is always the link to the real economy:
- conversion to dollars
- data suppliers
- real goods supply
- These points of contact are still governed by real world contracts and trust
- The more contracts happen on the blockchain, the more trustable the system is...
- ...as long as you trust the blockchain!

# CENTRAL BANK DIGITAL CURRENCY



## WHY DO THE CENTRAL BANK WANT TO CREATE THEIR OWN DIGITAL CURRENCY?

- Most Central Banks (80%) are investigating the feasibility of emitting their own Digital Currency (CBDC)
  - sometimes based on a distributed ledger (blockchain)
  - but mostly without (central certification authority)
- Main reasons:
  - it would replace crypto-currencies and reduce their systemic risk
  - it would reduce the number of fraudulent operations and increase tax revenues
  - it would ease the implementation of monetary policies more efficient
- Major unknown:
  - it is not clear what form it would take: token, account, who would have access
  - the impact of CBDC's on the economy/financial market is still unknown

## SEVERAL KINDS OF CBDC

CB plans evolve around many different scenarios.

In all cases, the digital currency would have legal tender.

		Retail CBDCs	Wholesale CBDCs (Large companies and payment service providers)
Token-based CBDCs (Peer-to-peer payments)		Money cards ('e-money'), digital wallets	—
Account-based CBDCs	Means of payment	All-purpose CBDCs (Direct CBDC)	All-purpose CBDCs
	Store of value	Store-of-value CBDCs ('safe assets')	Indirect CBDCs (narrow banks), Synthetic CBDCs

## SEVERAL KINDS OF CBDC: TOKEN BASED

Digital euro: "accessible to everyone"

- Token CBDC is a new equivalent of cash.
  - it can be used for exchange
  - stored anywhere (for instance a wallet, a website, ...)
  - it respects privacy better (of owners, not transactions)
- Account CBDC basically replaces deposits
  - individuals/entities have an account at the central bank
  - payments consists in transferring money from one account to another

## PRIVACY AND TAX REVENUES

- Transactions can be verified using "Zero-knowledge proof" algorithms.
- It is theoretically possible to build the system in a way such that individuals can share their personal data only when needed.
  - to other individuals
  - to the central bank
  - to fiscal authorities
  - to the judiciary authorities
- In particular it is possible to make illegal income and transactions, taxable

## WOULD CBDC REPLACE CRYPTO-CURRENCIES?

By design a CBDC would outperform all cryptocurrencies on all functions of money:

- transaction costs: would be essentially free and instant
  - essentially, the costs of transacting would be subsidized as a kind of public service
- accounting unit: because it would have legal tender
- store of value: as long as the central bank has a good reputation
  - note that the situation might be different in emerging countries

## WOULD CBDC REPLACE CRYPTO-CURRENCIES?

One could still see some advantages in using cryptos instead

- one could use inflation-immune or interest bearing cash
- perform international transactions more easily
- better anonymity

Some of these advantages could be obtained with a blockchain on top of the CBDC



## IMPLEMENTATION OF MONETARY POLICIES

As we have already noted, using a digital currency would make it easier for the central bank to conduct monetary policy:

- it could perform implement helicopter drops easily in a non distortionary way
- just increase the amount on all bank accounts at the Central Bank
- if CBDC is bearing an interest it could change it as a way to directly influence consumption/savings incentives

## WHAT BECOMES OF THE FINANCIAL SECTOR?

- If you can have a bank account at the CB, or a wallet with digital currency, why would you open a current account and make deposits?
  - current accounts charge high fees, transfers are sometimes slow, etc.
- There is little doubt bank accounts as we know them would disappear...
- retail banking activities would be split into several services

## WHAT BECOMES OF THE FINANCIAL SECTOR?

- ... and with it the current model of commercial banks which take short term deposits to invest in longer term projects
- Then these projects would have to be
  - financed by the CB or
  - financed through equity and investment bank
- Without current accounts, commercial banks wouldn't be able to create money and the fractional reserves system would be obsolete
  - money creation would become again a monopoly of the central bank

## WHAT BECOMES OF THE FINANCIAL SECTOR?

- So far, the experiments made by the CB and BIS, have pledged to "do no-harm" (to the financial sector)
- But once everybody uses the digital asset, nobody wants the cash and deposits anymore

