# Global Financial Systems
# Chapter 5
# The Central Bank

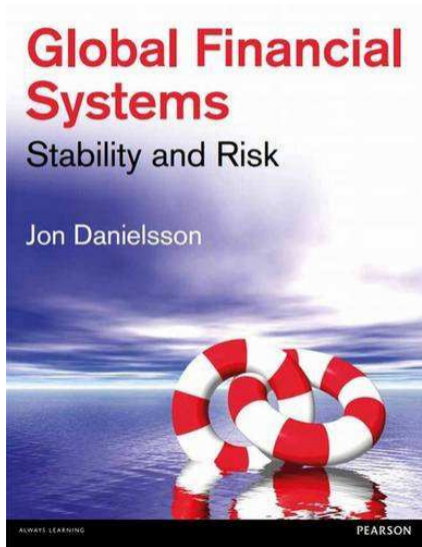Jon Danielsson London School of Economics
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To accompany
*Global Financial Systems: Stability and Risk*
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# Book and slides

**Global Financial Systems**

Stability and Risk

Jon Danielsson

PEARSON

- Updated versions of the slides can be downloaded from the book web page www.globalfinancialsystems.org

illusionofcontrol.org

# The central bank (CB)

- The most important institution in the financial system
- Has monopoly on *printing money* — liquidity, QE,...
- Functions
  1. Price stability
  2. Macroeconomic objectives (e.g. growth and employment)
  3. Financial stability (Chapter 13)
  4. Supervision (Chapter 13)
  5. *(Stimulating the economy)*
  6. *(Bailing out governments)*
  7. Increasingly environment (Chapter 21)
  8. And equality
  9. In this Chapter, we stop in 2019, as post-2019 is discussed in Chapter 21
- Over time, the relative importance of those changes frequently

# Background

- Often was a private bank
- Perhaps established to help in war financing
- And may retain some private ownership or connections (like in Switzerland)
- But generally is under the control of the government
- In some countries, private banks may issue money under a full reserve arrangement
  - Danske Bank in Northern Ireland, Scotland, HSBC in Hong Kong, etc.
- May have other names such as *monetary authority* or *reserve bank* or *federal reserve system* or *preople's bank* or *bank of*
- We use the term *central bank* to encompass all these

# Some central banks

- First: Swedish Riksbank 1668
- Second: Bank of England (BoE, Bank) 1694
- Last among major countries: Federal Reserve System (*Fed*) in the US, 1913
- ECB, 1998

# Money

- We have used many things for money
- Sea shells, cigarettes, pearls, etc.
- Over time, we converged to using metals, copper, but especially precious metals like silver and gold
- We now use fiat money
- Will we move to cryptocurrencies?
- Or digital currencies?

# Gold standard

- Gold is money
    - either we use gold to trade
    - or central bank issues paper money that is transferrable to gold with 100% certainty
    - brings stability (1873–1914)
    - but supply can not be adjusted to suit the economy (e.g. when it is growing or in crisis)
- The one who controls gold mining controls the world
    1. Did not work so well for Spain
    2. UK invasion of South Africa

# Fiat money

- Money created by governments
- No asset, like gold, guarantees money keeps their value
- We have to trust the government
- Printed by central banks
  - either physically on paper
  - or virtually by increasing the reserve accounts at the central bank
- First example in China in the $12^{th}$ century — led to high inflation
- Often ends up in too much money being printed, inflation and failure of the issuing bank

# Crypto- and digital currencies

- Crypto
  - Emulate gold standard
  - Fixed mining schedule
  - No central control
- Digital
  - Combine some elements of the cryptocurrencies
  - With central-bank fiat money
- (discussed in detail a bit later)

# Who creates money?

- Central banks create *base money* — see next slide
- Money in circulation is mostly created by commercial banks
- More broadly, money is created by the interaction of economic agents
- For example, if people lend and borrow from each other and use the IOUs to transact with
- They have created more money
- That is, for example a feature of the Japanese economy

# Creating base money

- Commercial banks have special accounts with CBs called *reserve accounts*
- They are required to have some amount in it (required reserves) and can more, optional
- CB buys a bond from a bank worth $X$
- And increases the amount in the reserve account that by $X$ — base money (M0) increases by $X$
- The CB does *not* transfer $X$ in
- It simply increases the number (amount on deposit)
- It then is a liability of the CB

# Monetary aggregates

**M0** Monetary base, this is the sum of currency in circulation and reserves

**M1** Narrow money, monetary base plus checkable accounts

**M2** M1 plus saving accounts

**M3** Broadest formal measure of money. M2 + large time deposits, institutional money market funds, short-term repurchase and other larger liquid assets

- M2 and M3 are a good indication of inflation and credit expansion.
- They increase in booms and fall in recessions
- Money is other things. We often can use debt promises — IOU — as money. Very common in Japan
- The central bank only fully controls M0

# 2005 US money supply
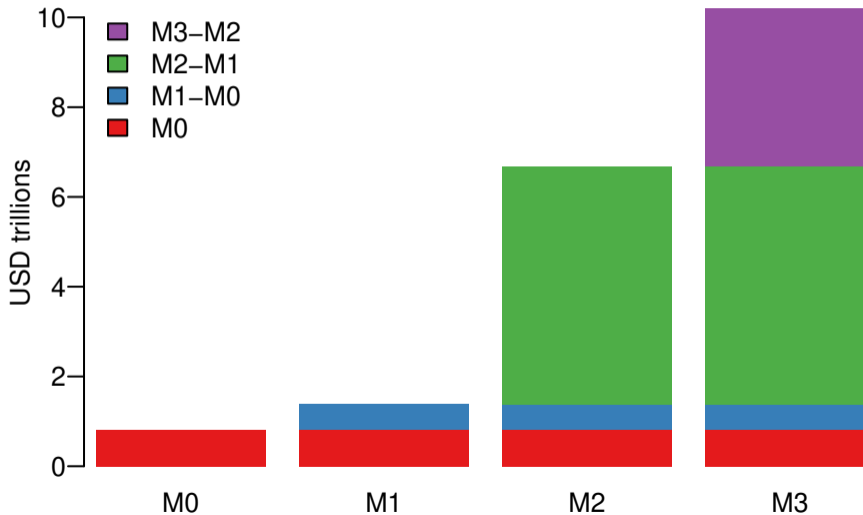
# Fractional reserve banking

### This is an oversimplified textbook version

1. Person $X$ deposits \$100 (M0) into bank $A$
2. Bank $A$ keeps 10% ($\delta$) which is the *reserve requirement*
3. Lends \$90 to Person $Y$ who deposits \$90 at bank $B$
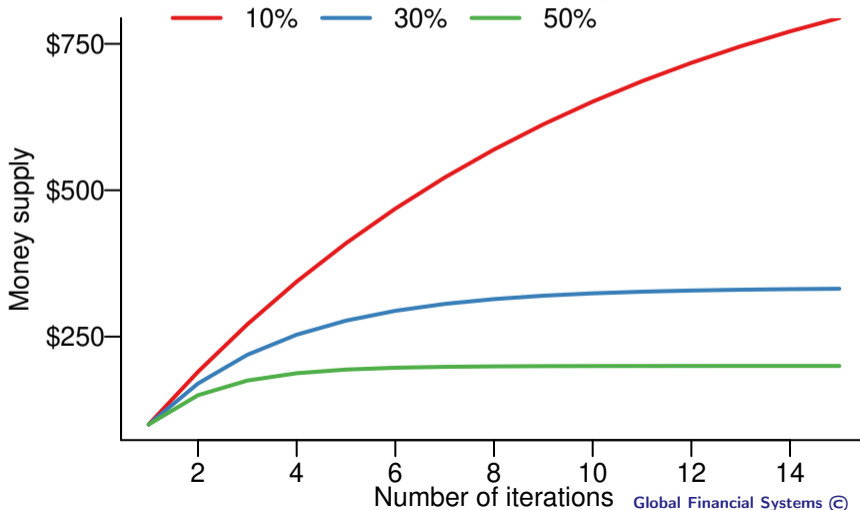4. Which keeps $\delta$ and lends out \$81 and so on

$$\text{In the limit, M1} = 100 + 90 + 81 + ... = \frac{100}{\delta} = 1000$$

$$\text{M1} = \gamma \times \text{M0}$$

5. Hence $\delta$ can be used to control credit

# Credit expansion of $100

### for various reserve requirements

# Fragilities of the fractional reserve banking system

- A Bank lends deposits out at *long maturities*
- But deposits are payable *on demand*
- If a sufficient number of depositors want money, the bank can't pay — *bank run*
- Bank runs are contagious

# Monetary policy

# Monetary policy

- The main–day–to–day function of the central bank
- Used to meet (political) objectives like
    - level of aggregate output
    - employment
    - inflation
- By controlling
    - the supply of money
    - availability of money
    - cost of money or rate of interest

# Money supply and objectives

- Money is M (recall M0, M1, M2 and M3 )
- *Expansionary monetary policy* — M↑ Typical objective to combat unemployment or stimulate the economy, or prevent *deflation*
- "Printing" money is creating M0 (base money)
- *Contractionary monetary policy* — M↓ Combat *inflation* and overheating economy

# Interest rates

- The central banks control the shortest interest rates
- Why?
- There are many different names and mechanisms
- CBs do not directly control rates for longer maturities
  - Twist operations can be used on longer maturities
- Often they use *inflation targeting* and some form of the *Taylor rule* (next page)
- Inflation targeting is where the government tells the central bank what inflation should be, perhaps 2%
- And the central bank uses its tools to achieve that inflation

# Taylor rule

- By having a formal rule, a central bank may avoid inefficiencies induced by a discretionary policy

$$i_t = \pi_t + r_t^* + a_\pi(\pi_t - \pi_t^*) + a_y(y_t - \bar{y}_t)$$

- $i_t$ is the target short–term nominal interest rate
- $\pi_t$ the inflation rate (the GDP deflator)
- $\pi_t^*$ the desired rate of inflation
- $r_t^*$ is the equilibrium real interest rate
- $y_t$ an estimate of the logarithm of real GDP and $\bar{y}_t$ is the logarithm of potential output, obtained by a linear trend
- $y_t - \bar{y}_t$ is the *output gap*
- The parameters are restricted to be positive, $a_\pi, a_y > 0$, and Taylor proposed setting them at 0.5

# Central bank lending

- Effectively a *ceiling* for market (risk–free) rates
- In some countries also a *floor* by setting a slightly lower rate on reserves held by banks
- Also used to provide emergency liquidity in crises

# Open market operations

- Most common procedure — trading government bonds on the open market
- Buying M0↑ — increase the reserve account of seller's bank
- Increases the total volume of reserves in the system
- If there are aggregate excess reserves, market rates are competed down
- Hence expansionary open market operations do $r \downarrow$
- And vice versa
- Most common in developed economies

# Recall reserve requirements

- Reserve requirement — the minimum reserve a bank must hold at the CB
- Lowering reserve requirements reduces the demand for reserves
- Contrast with expansionary open market operations, which increase the supply of reserves
- But roughly the same effect — $r \downarrow$

$$M1 = \gamma \times M0 = \frac{1}{\delta}$$

Changing the reserve requirements, $\delta$, changes the money multiplier, $\gamma$, and hence the volume of M1 given an amount of M0

- Most common in emerging markets (e.g. China)

# Chinese reserve requirements
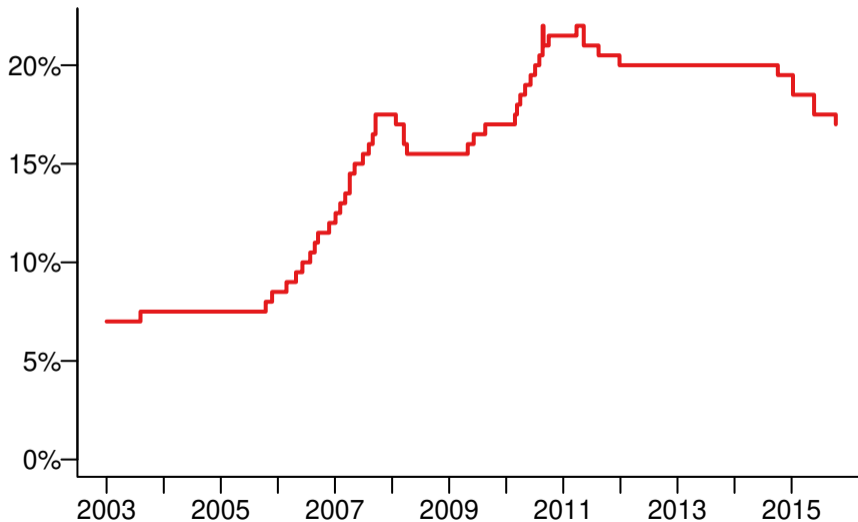
# Zero lower bound

- Typically, the central banks can exercise control by changing short-term interest rates
  - increase them if the economy is heating up and inflation is high
  - lower them if economy is slowing down and inflation is low
- What if inflation is low, the economy is slowing down, and interest rates are close to zero?
- It is not possible to make interest rates very negative. They can be slightly below zero
- That is the *zero lower bound*
- In that case, we may do quantitative easing

# Transmission mechanism
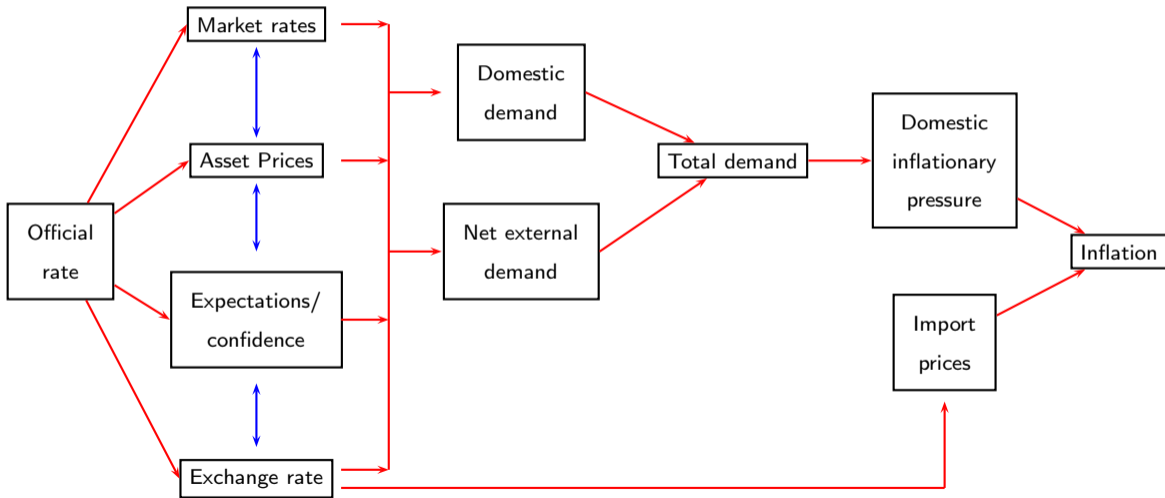
# Quantitative easing — QE

# Quantitative easing — QE

- Used when danger of deflation and interest rates are close to 0
- Traditional monetary policy tools don't work
    - Interest can't be below 0, and banks hoard balances at the central bank
- Involves buying securities — typically government bonds but can be anything — from the public
- The difference between QE and open market operations is *scale*, *scope* and *motivation*
- More efficient might be *helicopter drops of money* (next slide)

# Helicopter drops of money

- The central bank directly increases the money supply

  *"Let us suppose now that one day a helicopter flies over this community and drops an additional \$1000 in bills from the sky, ... Let us suppose further that everyone is convinced that this is a unique event which will never be repeated,"*

  *Milton Friedman 1969*

- Friedman suggested that a monetary authority can escape a liquidity trap by bypassing financial intermediaries to give money directly to consumers or businesses

- This is referred to as a money gift or as helicopter money

# Biden's helicopter drops

- $1.9 trillion Covid relief bill
- Direct $1,400 payments to each American sent immediately to their bank accounts
- "Monetized" by QE

# Bailing Out Governments

# Bailing out governments

- It's not one of the four core functions listed above
- But always has been a core function
- Even a founding function
    - BoE was founded to help with war funding
- Usually viewed as dirty or unseemly
- However, under the right conditions, it is appropriate
- We see the danger a few slides down
- Japan and ECB are especially enthusiastic

# Mechanisms

- Print money and buy government bonds
- *Unexpected* inflation
  - Why can't it be expected?
  - Cagan double exponential model below
- Seigniorage

# Pros and cons

- Only recommended in exceptional circumstances
- When done routinely, it locks in inflationary expectations — very costly to eventually fight
- If the economy is in deep recession (way below output potential)
- And inflation negligible
- Justified for two reasons
    1. relieves pressure on the government
    2. reverses contracting money supply

# Case of one CB — one nation state

- Most of the time, the CB belongs to a single nation-state
- In that case, using the CB to bail out the state is effectively a *tax*
- And like any other tax, it has distributional effects
  - Disproportionately falling on pensioners and savers (who often can't do much about it)
  - And benefiting borrowers
- Most of the cost falls on domestic residents

# Europe's central bank

- Belongs to 19 governments
- By using the ECB to bail out (private or public entities) it is a tax on all residents of the eurozone for the benefit of some countries only
- Turns the EU into a *transfer union*
- This limits the legitimacy of the ECB to fulfil its core functions
- Two possibilities
    - Because the ECB belongs to no one, it is easy to abuse it
    - And therefore, it is subject to excessive amounts of rules and restrictions — limiting its flexibility

# How ECB sells QE

1. The European Central Bank buys bonds from banks
2. This increases the price of these bonds and creates money in the banking system
3. As a consequence, a wide range of interest rates fall, and loans become cheaper
4. Businesses and people are able to borrow more and spend less to repay their debts
5. As a result, consumption and investment receive a boost
6. Higher consumption and more investment support economic growth and job creation
7. As prices rise, the ECB achieves an inflation rate below, but close to, 2% over the medium-term

# 2008 crisis

**Chapter 17**

- The worst global crisis since the Great Depression
- Biggest impact in Europe and the US
- Developing and/or Asian countries (Chapter 6) had memories of recent crises and hence were in a better place
- Caused by rapidly increasing liquidity risk that was hidden until too late
- We don't discuss the causes here (see Chapter 17)
- And focus on how central banks reacted

# Central bank response

- Did not want to repeat mistakes from the Great Depression
- "I looked at the portrait of my predecessor in our main meeting room from the Great Depression and opted to do the opposite"
- We discuss bailouts in Chapter 14
- Bail out banks
- Massive liquidity injection
    1. quantitative easing
    2. low interest rates
- Note how slow the ECB is to react
- And how little BoJ reacts

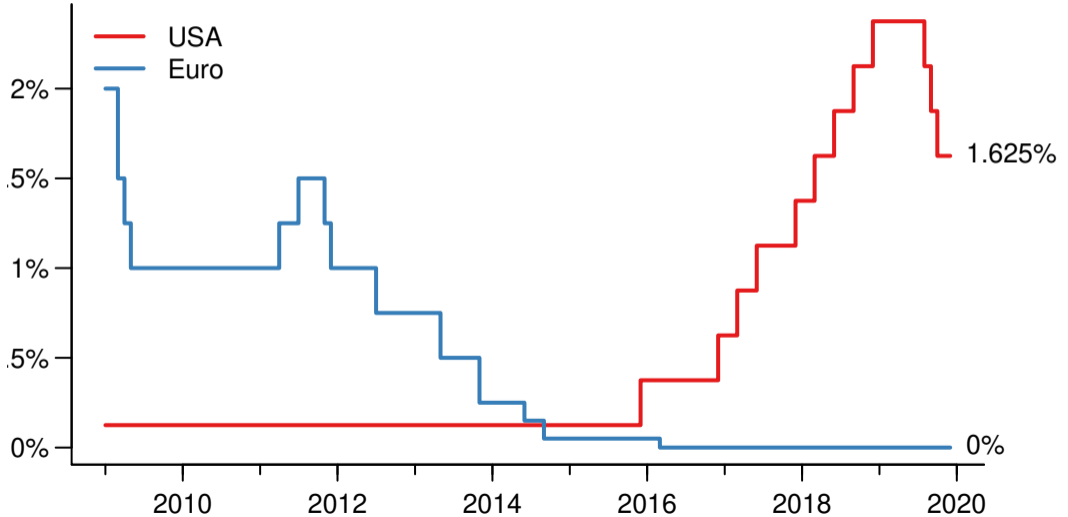# Central-bank interest
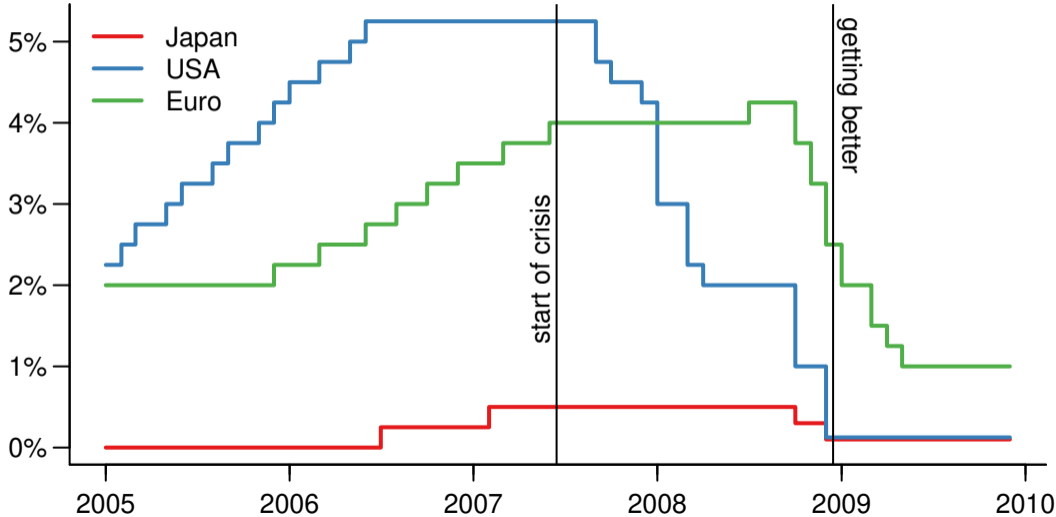
# Central-bank assets
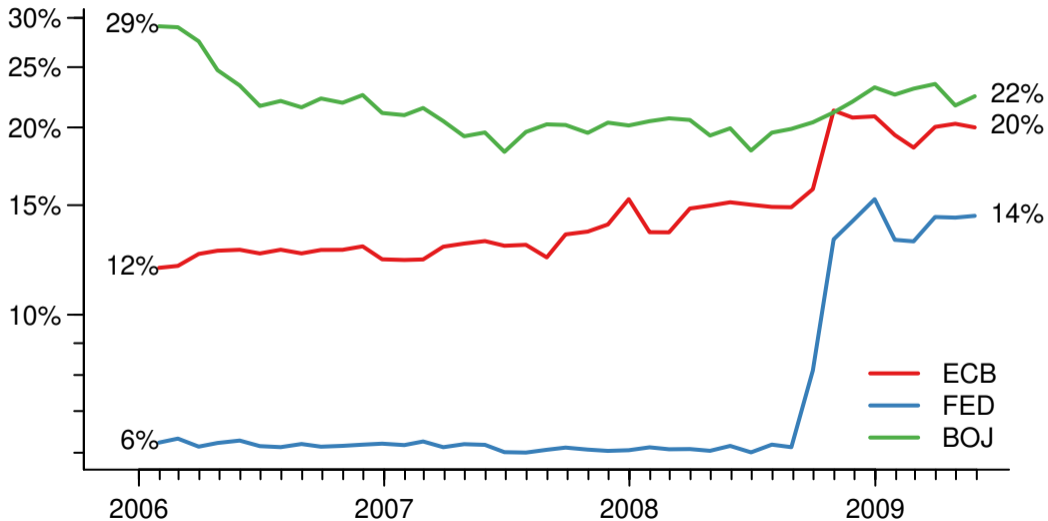
# Effectiveness

- Did prevent 2008 from becoming another Great Depression
- However, fostered the idea of the central banks being responsible for growth
- Affected inequality — see later section
- Created moral hazard — discussed latter

# Assets — QE

- BOJ did not react to 2000, and ECB reacted less than Fed
- The Fed reacted quicker and more forcefully than ECB to Covid-19
- The US got out of 2008 much better than Europe
- But, a question for later is what is the appropriate reaction to Covid 19

Central Bank
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Money
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ooooo

MP
oooooo
oooooo

QE
oooo

Bailing
oooo

ECB
ooo

2008
ooooo

**2009-2019**
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Digital currencies
oooooo

Stable coins
ooo

CBDC
oooooooo

# Central-bank interest

# Central-bank assets
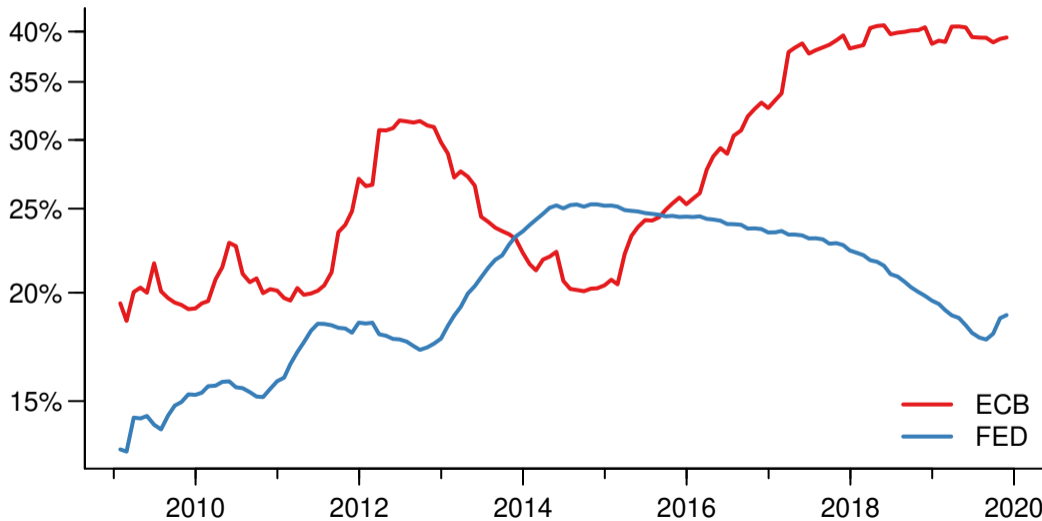
# Post 2008

- The immediate reaction to the crisis in 2008 was
  - sharp reduction of central bank interest rates to almost 0
  - massive QE
  - direct liquidity assistance (discussed in a later chapter)
- Since then, interest rates have remained very low
- Some countries, especially the EU, continue to do QE
- Is this a permanent structural break?
- What are the dangers?

# Debate about QE and low interest rates since 2008

| | | |
|---|---|---|
| have to, else depression | ⟷ | depression when it ends |
| save the banking system from collapse | ⟷ | encourages reckless behavior moral hazard |
| without it economic activity would collapse | ⟷ | excessive debt was the cause of the crisis |
| creates jobs for the poor | ⟷ | benefits the super wealthy |
| there is deflation | ⟷ | inflation will happen |
| structural reforms too hard | ⟷ | prevents structural reforms |
| bad for savers | ⟷ | lifeline for borrowers |

# Consequences

- Equality
- Reforms
- Inflation
- Market disruption

# Digital currencies

# All that is not old school fiat or cryptocurrencies

- Cryptocurrencies are based on money is a token on blockchain where the blockchain is public, and mining underpins trust
- If we do away with either or both public and mining
- But keep tokens (next side)
- We are left with digital currencies
  - Corporate: like Facebook's Libra (then Diem, now cancelled) or JPM's coin
  - Public, like central bank digital currencies (CBDC)
- There are other mining substitutes (like proof of stake (PoS) )

# Tokens



| Hash(last block) | Nonce | | Owner |

- Information/record is a *token*, representing some asset
- Can be on a blockchain, but increasingly in other databases
- Could be anything, but here it is fiat money, so the 20 tokens = $20
- When we change the owner of the token, we change the ownership of the $20
- Done by adding a new block that indicates a change in ownership

# Accounts

- Image a credit card transaction
  1. money goes from your account to the bank
  2. to payment system account
  3. to merchants' bank account
  4. to merchant's account
- Transactions/transfers typically involve money taken out of and put into multiple accounts
- We need verification at each stage
- And there is plenty of scope for mistakes

# Replacing accounts with tokens

- If money is tokens
- All we have to do is to swap tokens
- Perhaps add transfer of ownership a block to the blockchain
- Much more robust, quick, fewer errors, and cheap
- This seems to be the promise of *J.P. Morgan Coin*
- Clients of the bank can transfer money by swapping tokens
- JPM still maintains full control. It is hard to see any benefit from blockchain compared to other DB technologies

# ~~Libra~~ Diem — RIP

- Facebook ~~is~~ was the lead partner in a consortium that runs a money transfer setup relation to blockchain tangental

- Money is a basket of currencies. E.g. 50% USD, 30% JPY, 20% INR

- People transfer fiat money into a financial institution that gives them in return tokens on the blockchain

- These tokens can then be used for purchases, money transfers, and the like

- Do we trust Facebook?

- Know your customer (KYC) and anti-money laundering (AML)

- Deposit insurance, consumer protection

- Undermining the operation of domestic payment systems

# Stable coins

- A type of cryptocurrency that promises that its price in fiat money, typically USD, remains constant — stable

- The advantage to crypto investors is that they can trade crypto using a stablecoin as a temporary store of value — much cheaper and efficient than using fiat

- There are also seen as underpinning the envisioned decentralised financial system (DeFi and Web3) — Crypto banks

- They are, therefore, a competitor to CBDSs and the incumbent banking system

# Types

- The staple coin can be based on having full or partial USD reserves, 1 USD for each coin, like Tether

- Then you have to trust the company behind the coin to keep adequate reserves, and if they are full reserves, how can The firm make money?

- Or the staple coin can be algorithmic, like TerraUSD, using a trading algorithm to maintain parity. That can be tricky, and TerraUSD fell by 60% in 2022

# Issues

- We have to trust the firm running the staple coin, and some are very reliable
- Because stable coins touch on a much larger part of the financial system than traditional cryptocurrencies, like Bitcoin and Ethereum, the financial regulators have taken a particular interest in stablecoins

Central Bank    Money    MP    QE    Bailing    ECB    2008    2009-2019    Digital currencies    Stable coins    **CBDC**
ooo             oooooo   ooooo oooo  oooo       ooo    ooooo   oooooo       oooooo               ooo            oooooooo
                ooooo    oooooo

# Central-bank digital currencies

- The central bank introduces a digital currency in parallel with the current set-up
- Main motivation is competition from private payment systems
- Especially foreign systems
- Bad memories of PayPal
- Most (not all) governments are reluctant to introduce CBDCs
- But feel they have no choice
- Initially on a blockchain but now usually a token with a digital fingerprint — hash — on a more traditional database

# Central bank digital currencies — Obvious implementation

- Central bank creates a blockchain with tokens on its own fiat money
- CB controls blockchain (no mining, trust from CB)
- People can then swap their old-school fiat money for tokens and use those for regular transactions
- Transactions then involve swapping tokens on the central bank blockchain
- Some countries find it a fantastic idea, others hate it
- Very disruptive, we are essentially replacing big parts of the financial system infrastructure

# Issues for governments from the obvious implementation

- All financial transactions are visible to the central bank — really good tool for monitoring and controlling people

- Gives private sector financial institutions a much-diminished role — more power to government

- Fine-tuning the money supply is easy because the central bank can simply increase/decrease the number of tokens

- Swapping over the technology on such a massive scale carries with it significant risks and enormous costs

- How to ensure privacy in countries that care about privacy
- If all the money is on a central bank blockchain
  - people engage directly with the central banks
  - who then oversees savings and presumably lending
  - it will have to be customer-facing
  - What is the role of the private sector in such an economy?

# Monitoring of citizens

- Because money will be a token on a central bank-controlled blockchain
- The central bank can monitor every transaction
- They know that you got paid with block *ac32b3aa* and used that to buy lunch, while then the shop owner used that block to pay for bread
- All transactions can be fully traced
- Of considerable attraction to some governments

# The hybrid implementation A

- The implementation above is unlikely to happen
- Instead, we may get a hybrid model
- Perhaps private banks face clients and use tokenized central bank money
- Clients access central bank tokens/coins by proxy
- Not compatible with existing infrastructure
- So it will take a long time to implement

# Hybrid B

- Intermediated model
- Existing infrastructure
- Central bank blockchain is just a more efficient payment system

# Adoption

- Most countries are considering CBDCs, and some have already launched them
- They don't seem very popular, and use so far has been limited
- That doesn't seem to be a compelling case for them in countries that already have a well-functioning payment infrastructure