iscte BUSINESS SCHOOL

Macroeconomics

Week 6

Ricardo Gouveia-Mendes
ricardo.mendes@iscte-iul.pt

Undergraduate in Economics

1st Semester 2023-24

iscte BUSINESS SCHOOL

The Central Bank Balance Sheet & Monetary Policy Tools

The role of Central Banks

From last class...

- CB influence the real interest rate
- Usually in response to inflation (π) or to other factors (through $\overline{r}$)

$$r = \overline{r} + \lambda\pi, \quad \lambda > 0$$

- There are several reasons for *why* the CB acts this way

ECB defining its role

Our main aim at the ECB is to keep prices stable. We serve people living in the euro area by working to preserve the value of the euro. In this section you can learn about our policy strategy, the tools we use and the impact they have on your day-to-day life.

But we still need to discuss in more detail *how* they do it

The Balance Sheet of Central Banks

The Monetary Base

- As we saw before, the CB controls **liquidity** in the Economy
- It does so through fixing the interest rate and **issuing money**
- Issued money covers:
  - *Coins and bills* circulating in the economy
  - Held in *reserves* by each bank on an account at the CB
- This is the **Monetary Base** — the main liability of the CB

The Balance Sheet of Central Banks

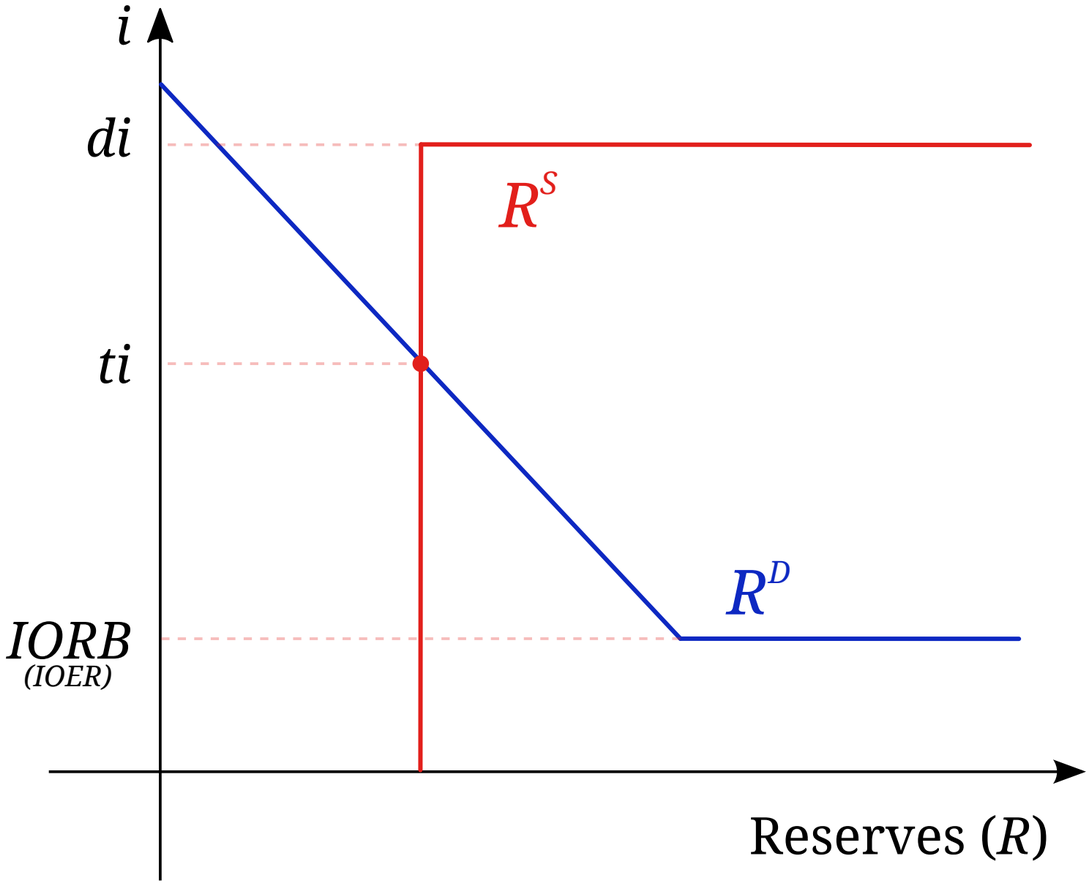
Reserves

- The **deposited reserves** of each commercial bank in the CB pay an interest (at the *IORB Interest Rate on Reserve Balances* —formerly IOER— or *Rate on the Deposit Facility*)

- Banks can also **borrow** from the CB itself (at what we call the *Discount Rate* or *Rate on the Marginal Lending Facility*)

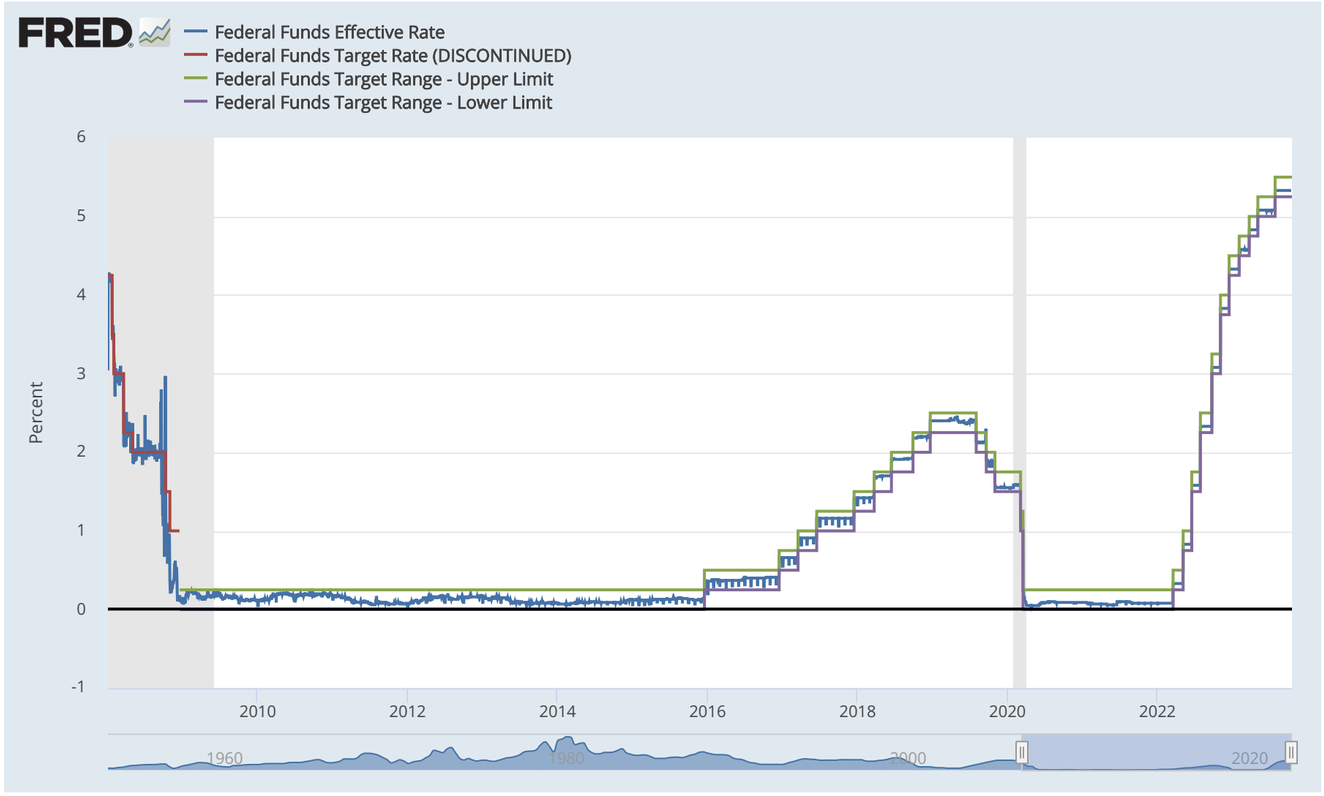
- But they can also lend and borrow from the reserves of each other

Defining interest rates



- In that case they will do it at an interest rate between the previous two
- By controlling R^S, the *IORB* and the *Discount Rate* the CB can determine the rate at which banks finance each other (the *Target Federal Funds Rate* or the *Rate on the Main Refinancing Operations*)

The Zero Lower Bound



- Nominal interest rates were close to zero for a while
- What can the CB do then?
  - Quantitative easing
  - Forward guidance
  - Targeted Assets Purchases

Exercises

Exercise 1. The central bank's balance sheet

Using Tables 6.1 and 6.2, which cover the balance sheet of the Fed for the years 2007 and 2009:

a. What is the monetary aggregate that is missing from the data?

b. Calculate the value of `Foreign reserves` and `Securities`.

c. Complete the balance sheets, according to the structure that was provided in the slides.

d. The data from 2007 reflects the Fed's balance sheet before the financial crisis blew up in 2008. At the end of 2008, the Fed started a type of policy known as "Quantitative Easing", and this new policy is already visible in the balance sheet of 2009. What are the main differences between the two years?

Exercise 1. The CB's balance sheet

A Central Bank's (summarized) Balance Sheet

Assets	**Liabilities + Equity**
Foreign Reserves	Currency
Securities	Reserves
Loans	Government account
Other assets	Other liabilities
	Equity
Total Assets	**Total Liabilities + Equity**

Exercise 1. The CB's balance sheet

Table 6.1 - Federal Reserve Board: Assets (billions)

Code	Item	2009	2007
tre	Treasuries*	776	797
mbs	Mortage-backed securities*	801	0
fad	Federal Agency debt*	258	0
oa	Other Assets	91	14
gol	Gold	12	11
fa	Foreign Assets	25	47
loa	Loans	276	25
ass	**Total Assets**	**2.239**	**894**

*All these items are Securities

Table 6.2 - Federal Reserve Board: Liabilities (billions)

Code	Item	2009	2007
cur	Currency	883	792
gov	Government Account	149	5
res	Reserves of commercial banks	1.073	11
ol	Other liabilities	81	49
lia	**Total Liabilities**	**2.187**	**857**

Exercise 1. The CB's balance sheet

a. What is the monetary aggregate that is missing from the data?

b. Calculate the value of "Foreign reserves" and "Securities".

The main aggregate missing in Table 6.2 is *Equity*.

```
fr_9 = fa_9 + gol_9
sec_9 = tre_9 + mbs_9 + fad_9
```

- Foreign reserves = 37
- Securities = 1835

Exercise 1. The CB's balance sheet

> **c.** Complete the balance sheets, according to the structure that was provided in the slides.

```
1  eqt_9 = ass_9 - lia
```

Assets	**$Billions**	**Liabilities**	**$Billions**
Foreign reserves	37	Currency	883
Securities	1.835	Reserves	1.073
Loans	276	Government account	149
Other assets	37	Other liabilities	81
		Equity	53
Total assets	**2.239**	**Liabilities + Equity**	**2.239**

Exercise 1. The CB's balance sheet

d. The data from 2007 reflects the Fed's balance sheet before the financial crisis blew up in 2008. At the end of 2008, the Fed started a type of policy known as "Quantitative Easing", and this new policy is already visible in the balance sheet of 2009. What are the main differences between the two years?

- In 2007, *Mortgage-backed securities* and *Federal agency debt* did not exist, reaching huge values two years later
- *Reserves* were minimal in 2007, but high in 2009
- *Unconventional monetary policy measures* to avoid the collapse of the banking system and a big recession

Exercise 2. Fed operations and the MB

Write down in the balance sheet of the central bank the following operations:

1. The Fed sells 200 million dollars of bonds denominated in Renminbi.

Changes to Fed's balance sheet

Assets	$M	Liabilities	$M
Foreign reserves	- 200	Reserves	- 200

Changes to the commercial banks' consolidated balance sheet

Assets	$M	Liabilities	$M
Reserves	- 200		
Securities	+ 200		

The **Monetary Base** will *decrease by 200 million dollars*.

Exercise 2. Fed operations and the MB

2. The Fed buys 600 million of Mortgage-Backed Securities.

Changes to Fed's balance sheet

Assets	$M	Liabilities	$M
Securities	+ 600	Reserves	+ 600

Changes to the commercial banks' consolidated balance sheet

Assets	$M	Liabilities	$M
Reserves	+ 600		
Securities	- 600		

The **Monetary Base** will *increase by 600 million dollars*.

Exercise 2. Fed operations and the MB

3. The Fed buys 900 million of 10-Year Treasury bonds.

Changes to Fed's balance sheet

Assets	$M	Liabilities	$M
Securities	+ 900	Reserves	+ 900

Changes to the commercial banks' consolidated balance sheet

Assets	$M	Liabilities	$M
Reserves	+ 900		
Securities	- 900		

The **Monetary Base** will *increase by 900 million dollars*.

Exercise 2. Fed operations and the MB

4. The Fed lends 500 million to commercial banks.

Changes to Fed's balance sheet

Assets	**$M**	**Liabilities**	**$M**
Loans (Discount)	+ 500	Reserves	+ 500

Changes to the commercial banks' consolidated balance sheet

Assets	**$M**	**Liabilities**	**$M**
Reserves	+ 500	Loans (Discount)	+ 500

The **Monetary Base** will *increase by 500 million dollars*.

Exercise 2. Fed operations and the MB

> **5.** Due to an unexpected event, the private sector withdraws 200 million from bank accounts.

Changes to Fed's balance sheet

Assets	$M	Liabilities	$M
		Currency	+ 200
		Reserves	- 200

Changes to the commercial banks' consolidated balance sheet

Assets	$M	Liabilities	$M
Reserves	- 200	Deposits	- 200

The **Monetary Base** will *not change*.

Exercise 2. Fed operations and the MB

6. The Fed decided to raise the IOER to 0.25 percentage points.

- This will not immediately affect the Monetary Base, until the Fed buys/sells an asset
- Therefore the balance sheet will not change
- But we should expect future changes in the Monetary Base (increase in Reserves)

Exercise 2. Fed operations and the MB

7. The Fed buys 400 million dollars of bonds denominated in Euros.

Changes to Fed's balance sheet

Assets	$M	Liabilities	$M
Foreign reserves	+ 400	Reserves	+ 400

Changes to the commercial banks' consolidated balance sheet

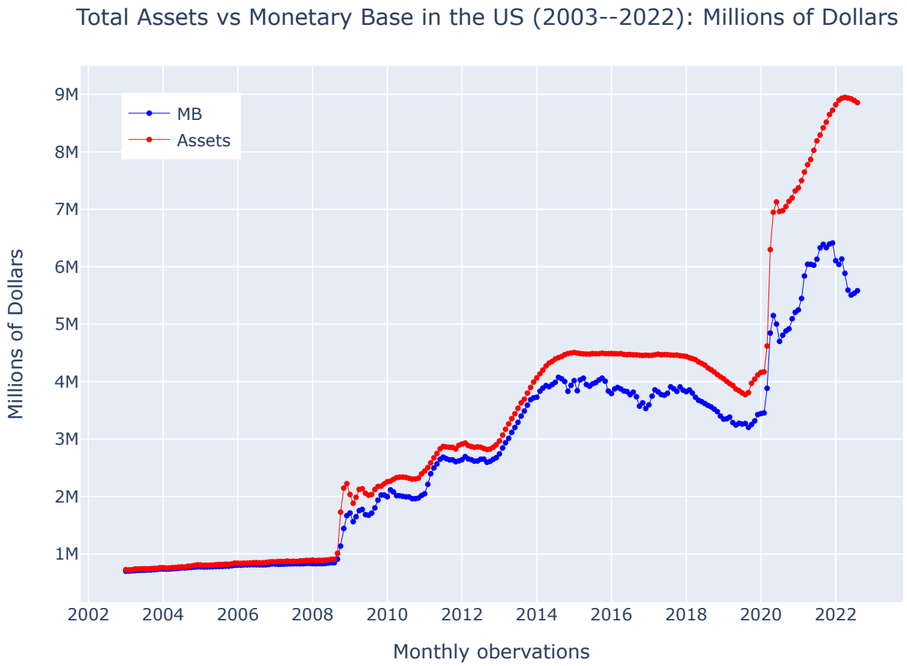
Assets	$M	Liabilities	$M
Reserves	+ 400		
Securities	- 400		

The **Monetary Base** will *increase by 400 million dollars*.

Exercise 3. MB vs Total Assets

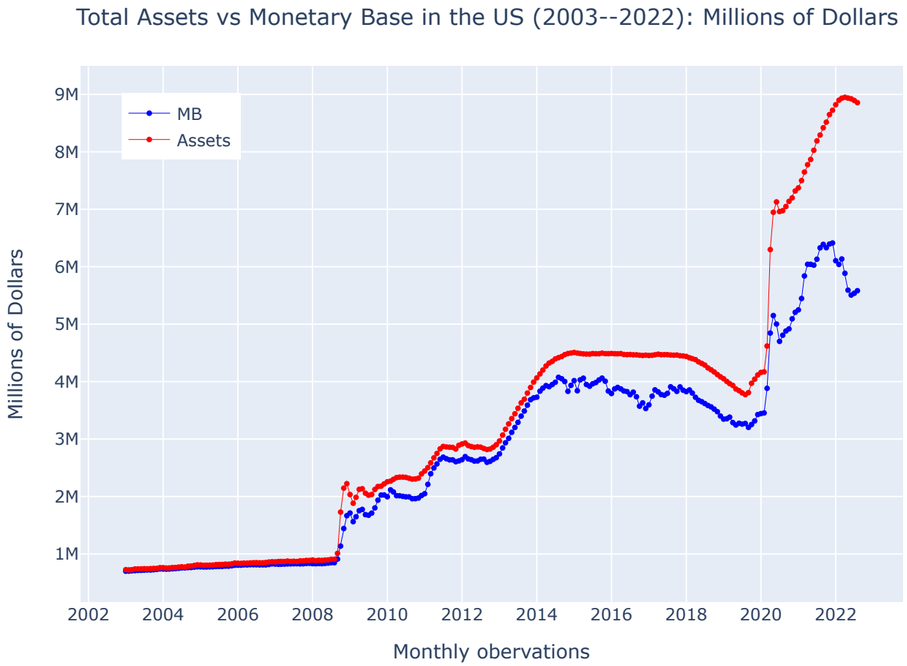
Using the file “Assets.csv”, we plot the evolution of two important monetary aggregates for the US economy – “Total Assets” and the “Monetary Base” (MB) – between 2003 and August 2022. By inspecting the plot (use the zoom facility), analyze the behavior of these two crucial macroeconomic aggregates in three different periods (before 2008, between 2008 and 2019, and after 2019), taking into consideration the gap between these two aggregates.

Exercise 3. MB vs Total Assets



- Before 2008:
  - *Peace and stability*
  - **Despite of:** recession in 2001, 9/11, wars in the Middle East, oil prices increase, inflationary pressures
  - Close and stable relationship between these two aggregates in the USA: no need for unconventional monetary policy measures

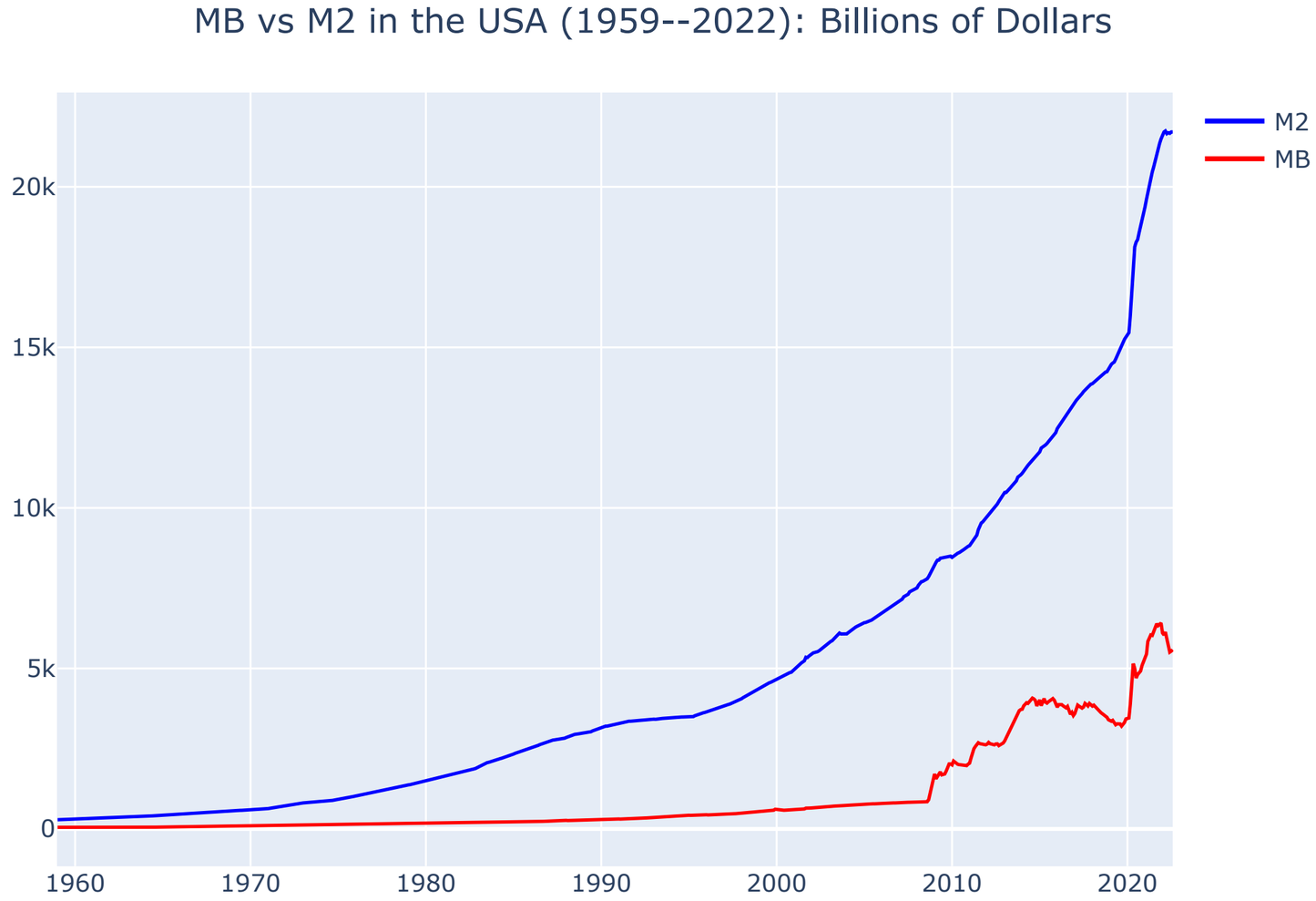
Exercise 3. MB vs Total Assets



- The Great Recession in 2008:
  - Bank failures and sovereign debt crisis in Europe, increased financial risk
  - Very high unemployment
  - Widening gap between these two monetary aggregates in the US
- The Pandemic: the gap between the two aggregates increased to historical proportions

Exercise 4. The Money Multiplier

Using the data file “Multiplier.csv”, we plot the Monetary Base (MB) and the Money Supply (M2) series for the USA economy between 1959 and 2022.



Exercise 4. The Money Multiplier

a. What is the money multiplier?

The money multiplier κ is a relationship between the money supply (M2) and the monetary base (MB):

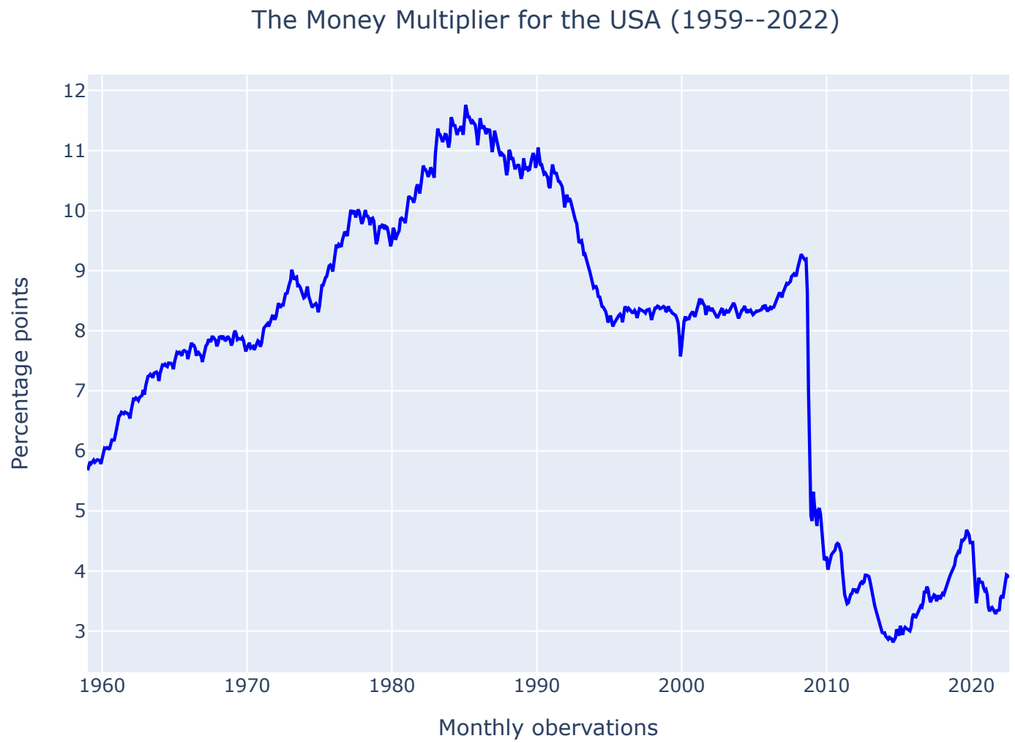
$$\kappa = \frac{M2}{MB}$$

b. Looking at the first plot above, what can we conclude about the relationship between M2 and the MB over the period under consideration?

- Does not seem to exist a stable relationship between those two monetary aggregates in the period
- Clarification: analyze the evolution of κ

Exercise 4. The Money Multiplier

c. In the second figure below, we plot the money multiplier. Does this multiplier display a stable behavior?



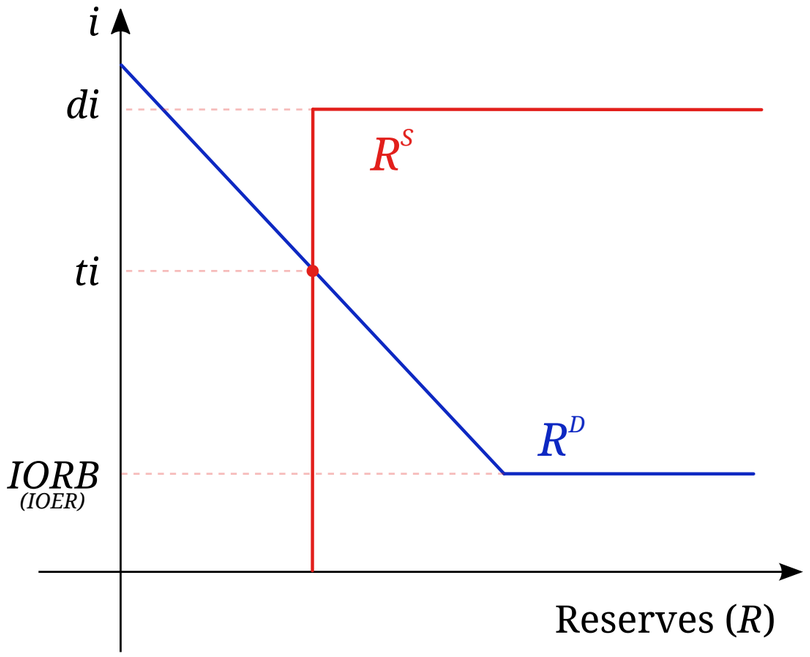
- Clear *upward trend between 1960 and 1985*
- After 1985, becomes terribly unstable

Exercise 4. The Money Multiplier

d. What is the main implication for managing monetary policy that arises from large instability in the money multiplier?

- If the money multiplier is very unstable it becomes **useless** to define monetary policy
- The Fed can control the MB rigorously, but if κ turns out to be tremendously unstable, then the Fed will have very little power to influence the level of M2 (*actual liquidity around*)
- Therefore, instead of trying to control ("target") M2, the Fed tries to control ("target") *the nominal interest rate*

Exercise 5. Successful Fed

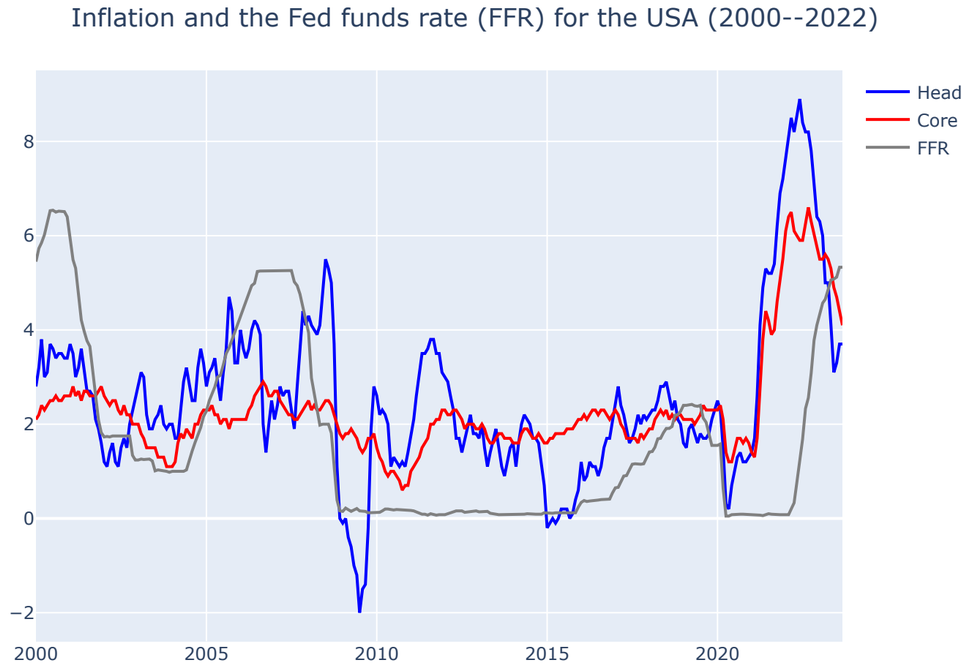


> Using the figure above, explain why the Fed so successfully guarantees that short-term interest rates stay where the bank wants them to be.

- The Fed legally sets the window for the Fed funds rate
- Furthermore, the Fed controls the overall amount of Reserves of the system (R^s)
- Then, the equilibrium i will **always** occur inside that interval

Exercise 6. The Fed's dilemma

The US has been experiencing the highest inflation rate for the last forty years. The following figure presents the evolution of the two main measures of inflation (Headline inflation and Core inflation) and the Fed funds rate since 2000. "Core" inflation (which excludes energy and food prices from "Headline" inflation) is one of the preferred Fed measures of inflation.



Exercise 6. The Fed's dilemma

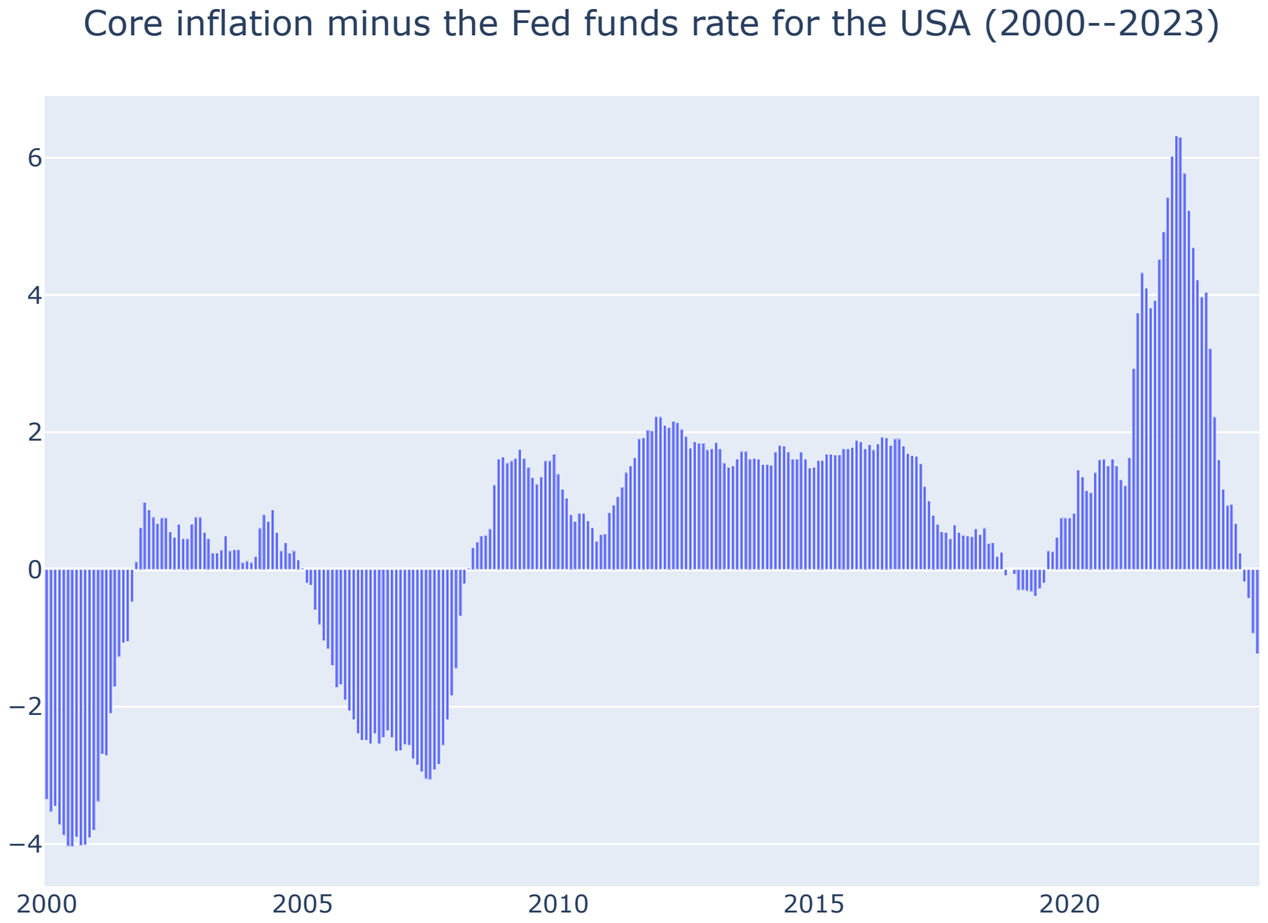
> *"We have got to get inflation behind us. I wish there were a painless way to do that. There isn't."* —Jerome Powel, Chair of the Fed, 21 September 2022
>
> What does Powel mean by saying, *"I wish there were a painless way to do that"?*

- The Fed will have to *fight inflation aggressively*
- It *increased nominal interest rates* significantly
- Will induce losses in GDP and employment (recession)
- But losing control of inflation is worse

Exercise 7. A $1M question: how far will the Fed go?

> *"The Fed raised borrowing costs by three-quarters of a percentage point, their third-straight jumbo increase, taking their official interest rate to a range of 3 to 3.25 percent. But they also penciled in additional increases for the rest of this year and next, projecting that rates would reach 4.4 percent by the end of the year and climb to 4.6 percent by the end of 2023."* —New York Times, 21 September 2022
>
> How far will the Fed go? This is a one-million-dollar question! The following figure presents the difference between "Core" inflation and the Fed funds rate since 2020.

Exercise 7. A $1M question: how far will the Fed go?



Exercise 7. A $1M question: how far will the Fed go?

> Do you want to have a go? Will the Fed raise rates to 4.6% next year? Will it stop there?

The best answer we have seen so far is this:

"We're not going to get back to 2 percent inflation with persistent supply chain disruptions and a war in Europe disrupting commodity markets. No amount of rate hikes is going to overcome either of those, so the hope is that while they're raising rates, that issues on the supply side begin to abate as well."

— Greg McBride, CFA, Bankrate Chief Financial Analyst

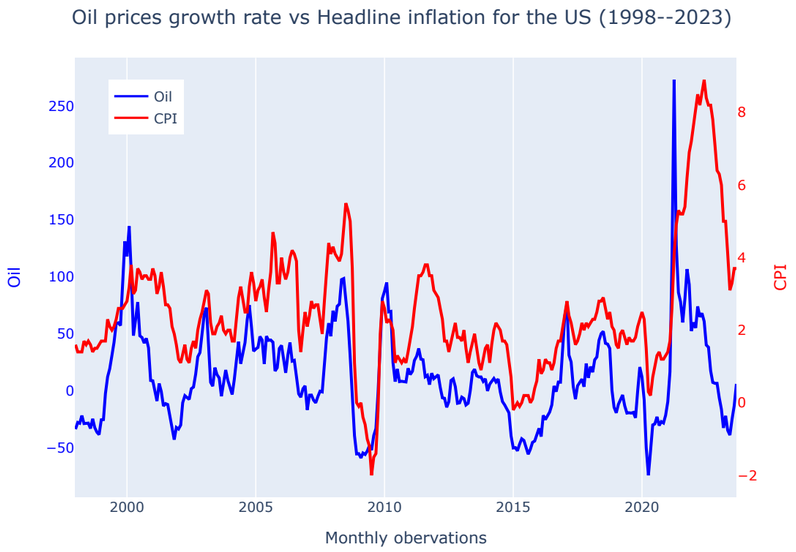
Exercise 8. Oil prices & Fed mistakes

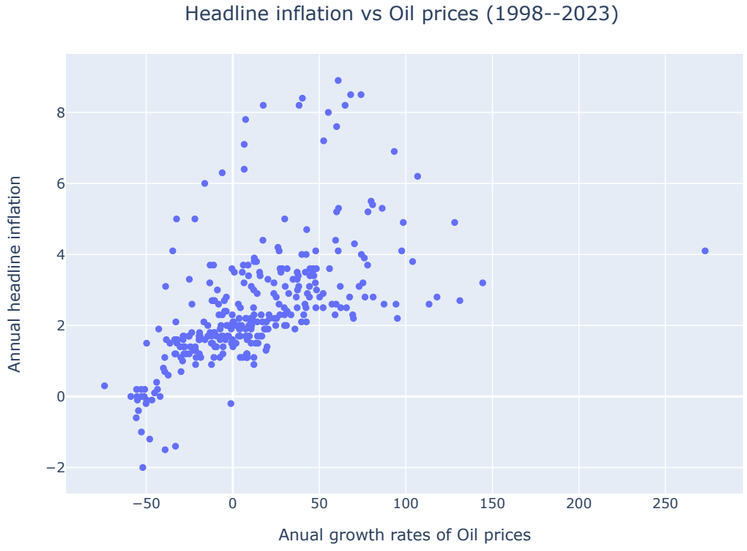
> *"In the long history of Federal Reserve mistakes, one general error stands out. They tend to wait too long and then do too much, and, in so doing, actually accentuate rather than tame the business cycle. They appear to be well on their way to repeating this error today."* — David Kelly, JPMorgan Funds chief global strategist, 10 October 2022

a. Is monetary policy a science?

- Monetary theory *is an art*, not a science
- There is too much uncertainty and too many structural breaks from one period to another
- So, do not be so picky about those sitting on the Federal Reserve Board (Fed)

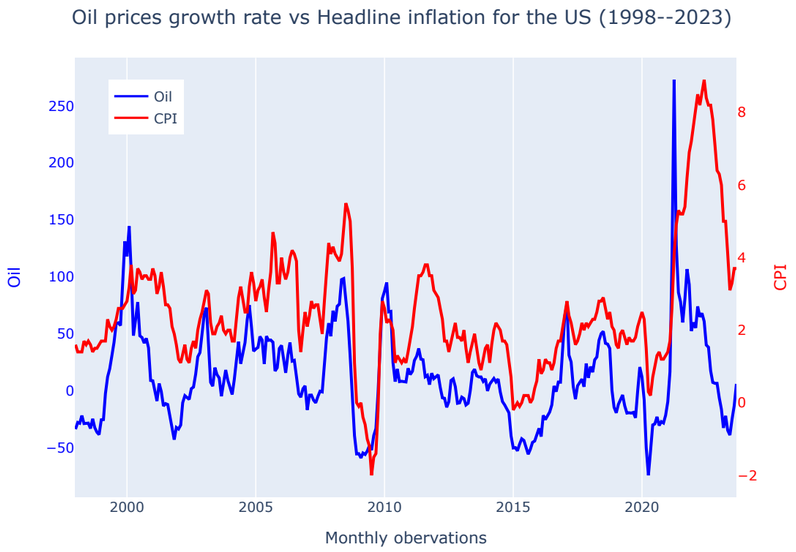
Exercise 8. Oil prices & Fed mistakes

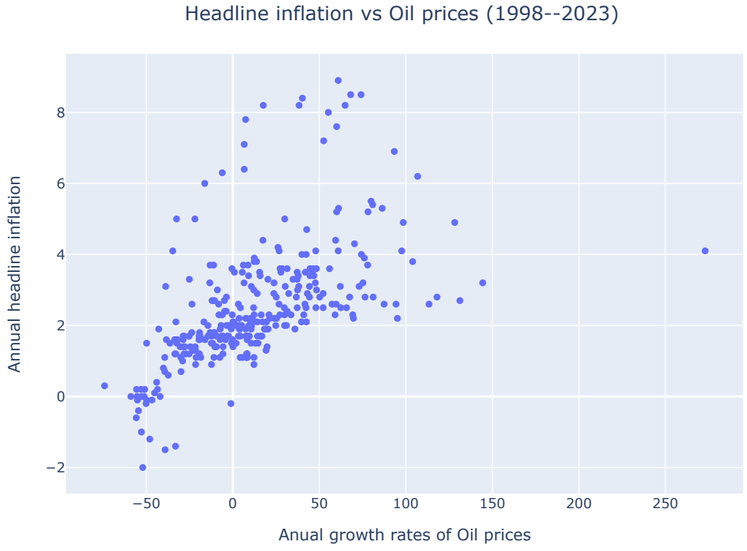




b. In the two figures above we plot the annual growth rates of crude oil prices (Oil) and the rate of Headline inflation (CPI), since 1998. The first plot is a time series of the two growth rates, while the second one is a cross-plot of them. Do you see any link between the growth rate of oil prices and the inflation rate for the US economy for that period?

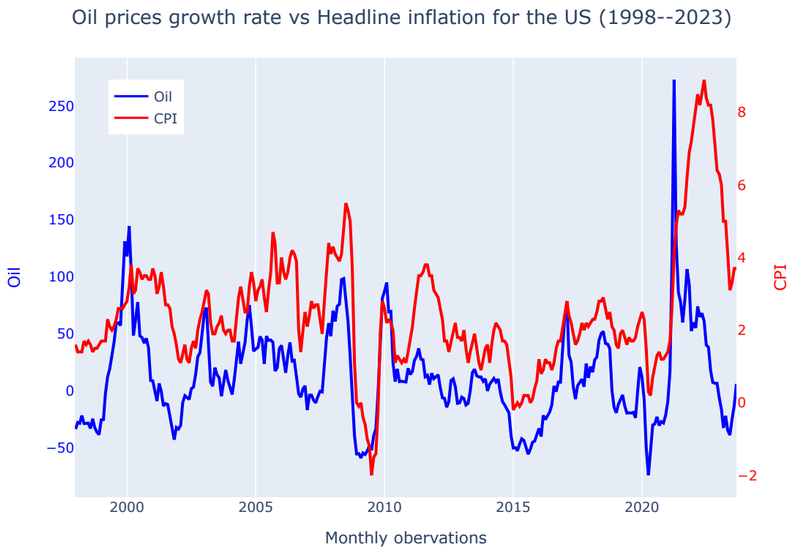
Exercise 8. Oil prices & Fed mistakes

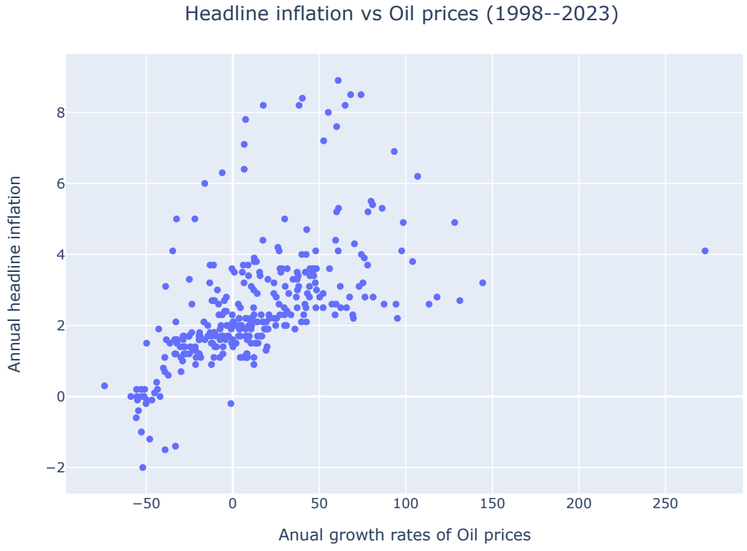




- The rate of inflation display a *remarkably close association* with the growth rate of oil prices
- An increase in *oil prices seems to lead to higher inflation*
- What about the other way around? Seems not very sounding

Exercise 8. Oil prices & Fed mistakes





c. What is the implication of oil price increases for monetary policy management?

- The Fed needs to keep it at sight when fixing interest rates
- Interest rates will need to be kept high while oil prices are high

Exercise 9. COVID-19 and MP

In Table 9.1, we present the data on August 11, 2021, of the balance sheet of the Federal Reserve Board. This data was compiled from FRB on August 13. This table reflects the drastic intervention of the Fed in the financial markets to fight the negative impacts of the COVID19 pandemic.

Exercise 9. COVID-19 and MP

Table 9.1 - The Federal Reserve Board's Balance Sheet on August 11, 2021

Assets	**$Millions**	**Liabilities**	**$Millions**
Foreign reserves	38.611	Currency	2139815
Securities	8.028.859	Reserves	4.369.073
Loans	82.500	Reverse Repo Agreem.	1.267.998
Portfolio	63.707	Government account	389.747
Other assets	43.480	Other liabilities	50.790
		Equity	39.734
Total assets	**8.257.157**	**Liabilities + Equity**	**8.257.157**

Exercise 9. COVID-19 and MP

> What are the primary aggregates that are, in essence, new in this balance regarding the standard balance sheet of the Fed?

- New items:
  - *Portfolio* (Assets): help provided to several companies (temporary holding stocks)
  - *Reverse Repo Agreements* (Liabilities): selling Securities subject to an agreement to repurchase (temporarily reduces the supply of reserves)

Detailed explanation about Repos and Reverse Repos here.