

# The Central Bank and Monetary Policy Tools

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## 1. The Central Bank Balance Sheet

### Can the Central Bank Set $i$ By Law?

- Last week, we saw the central bank will change the real interest rate ( $r$ ) as a response to changes in inflation ( $\pi$ ) or in the natural real interest rate ( $\bar{r}$ ).

$$r = \bar{r} + \lambda\pi$$

- And the Fisher equation says that the Fed must implement a change in the Fed Funds rate ( $i$ ) such that  $r$  will change, given that  $\pi$  is constant in the short-term:

$$i = r + \pi$$

### Can the Central Bank Set $i$ By Law?

- Can the central bank “set” **by law** the level of market short term interest rate ( $i$ )?
- **NO!**
- Does the central bank have some power to **force** the short-term interest rate ( $i$ ) to move to some target range/value?
- **YES!**
- To understand the logic behind this apparent contradiction we need to understand two issues:
  - The balance sheet of the central bank.
  - The main monetary policy tools available by law to the central bank.

### The Central Bank Balance Sheet

European Central Bank Balance Sheet: 31 December 2000

Assets	%	Liabilities	%
Foreign exchange reserves	46.9	Currency	44.4
Securities	10.1	Reserves of Commercial Banks	15.0
Loans	32.5	Other liabilities	19.6
Other assets	32.5	Equity	21.0
Total assets	100.0	Total liabilities	100.0

- Foreign exchange reserves: foreign currency + gold
- Securities: financial assets with a fixed return
- Currency: amount of money in circulation outside the banking system
- Reserves: amount of money held by commercial banks
- Loans: money lent to banks /// *Equity*: shareholders' stake in the bank

## 2. Changes in the Central Bank Balance Sheet

### Fed Buys US Treasury Bonds

The Federal Reserve Bank of New York purchases \$1 billion in U.S. Treasury bonds from a commercial bank (page 459)

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Assets	\$ Billions	Liabilities	\$ Billions
Securities	+1	Reserves	+1
Total assets	+1	Total liabilities	+1

Table 2: **Federal Reserve Balance Sheet**

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Assets	\$ Billions	Liabilities	\$ Billions
Reserves	+1		
Securities	-1		
Total assets	0	Total liabilities	0

Table 3: **Banking System's Balance Sheet**

- Liabilities change +1 billion
- Monetary Base changes +1 billion

## Fed Buys Bonds Denominated in Euros

The U.S. Treasury instructs the Federal Reserve to buy \$1 billion worth of bonds denominated in euros (page 459)

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Assets	\$ Billions	Liabilities	\$ Billions
Foreign Exchange Re-serves	+1	Reserves	+1
Total assets	+1	Total liabilities	+1

Table 4: **Federal Reserve Balance Sheet**

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Assets	\$ Billions	Liabilities	\$ Billions
Reserves	+1		
Foreign Exchange Re-serves	-1		
Total assets	0	Total liabilities	0

Table 5: **Banking System's Balance Sheet**

- Liabilities change +1 billion
- Monetary Base changes +1 billion

## Discount Loans to Commercial Banks

Commercial banks borrow 100 million dollars from the Fed, through the “discount window”, providing collateral.<sup>1</sup> (page 461)

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Assets	\$ Millions	Liabilities	\$ Millions
Discount loans	+100	Reserves	+100
Total assets	+100	Total liabilities	+100

Table 6: **Federal Reserve Balance Sheet**

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<sup>1</sup>Specific assets pledged by a borrower that a lender can seize in the event of nonpayment.

Assets	\$ Millions	Liabilities	\$ Millions
Reserves	+100	Discount loans	+100
Total assets	+100	Total liabilities	+100

Table 7: **Banking System's Balance Sheet**

- Liabilities change +100 millions
- Monetary Base changes +100 millions

### Jane Takes Cash Out of Her Bank Account

Jane withdraws \$100 from her checking account (page 462)

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Assets	\$ Millions	Liabilities	\$ Millions
Currency	+100		
Deposits	-100		
Total assets	0	Total liabilities	0

Table 8: **Jane's Balance Sheet**

- Jane changes money she had in Deposits into Currency
- What changes will appear in the Fed's balance sheet?
- What changes will appear in the Banking System's balance sheet?

### Jane's Impact on the Banking System

Recall that Jane changed money in her deposit account (Deposits) into money in her pockets (Currency)

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Assets	\$ Millions	Liabilities	\$ Millions
		Currency	+100
		Reserves	-100
Total assets	0	Total liabilities	0

Table 9: **Federal Reserve Balance Sheet**

Assets	\$ Millions	Liabilities	\$ Millions
Reserves	-100	Deposits	-100
Total assets	-100	Total liabilities	-100

Table 10: **Banking System's Balance Sheet**

- Liabilities change 0 dollars
- Monetary Base changes 0 dollars

### 3. The Monetary Base and the Money Supply

#### MB, M2, and the Money Multiplier

- We saw that whenever the central bank buys/sells assets or lends money to banks, the Monetary Base changes.
- The **Monetary Base (MB)** is the total amount of money printed by the central bank that is outside of the central bank (its liabilities).

$$MB = \text{Currency} + \text{Reserves}$$

- The **Money Supply (M2)** is the total quantity of money supplied to the economy by the banking sector (central bank + commercial banks) and is given by:

$$M2 = \text{Currency} + \text{Deposits}$$

- M2 is much greater than MB and the link between the two aggregates is the **Money Multiplier**.

#### The Money Multiplier

- The derivation of the money multiplier is not required in this course.<sup>2</sup>
- The money multiplier gives the following relationship:

$$M2 = \kappa \times MB$$

where  $\kappa$  is called the money multiplier and

$$\kappa = \frac{\beta + 1}{\beta + rr}$$

- $\beta = \text{Currency}/\text{Deposits}$
- $rr = \text{Reserves}/\text{Deposits}$

#### Monetary Base (MB) and M2

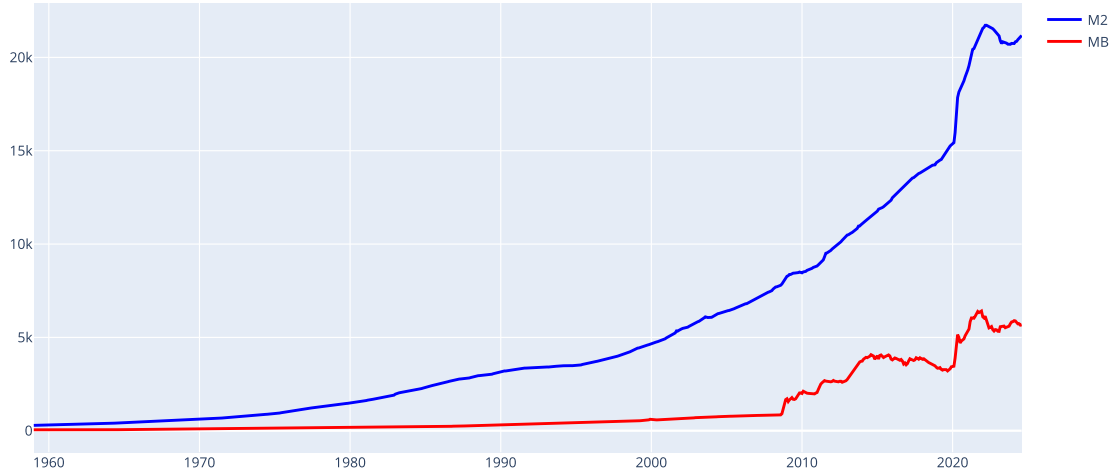
The total amount of money supplied by the banking system (M2) is much greater than the Monetary Base (MB)

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<sup>2</sup>See appendix A, if you are curious how the money multiplier is obtained. But, its derivation is not required for this course.

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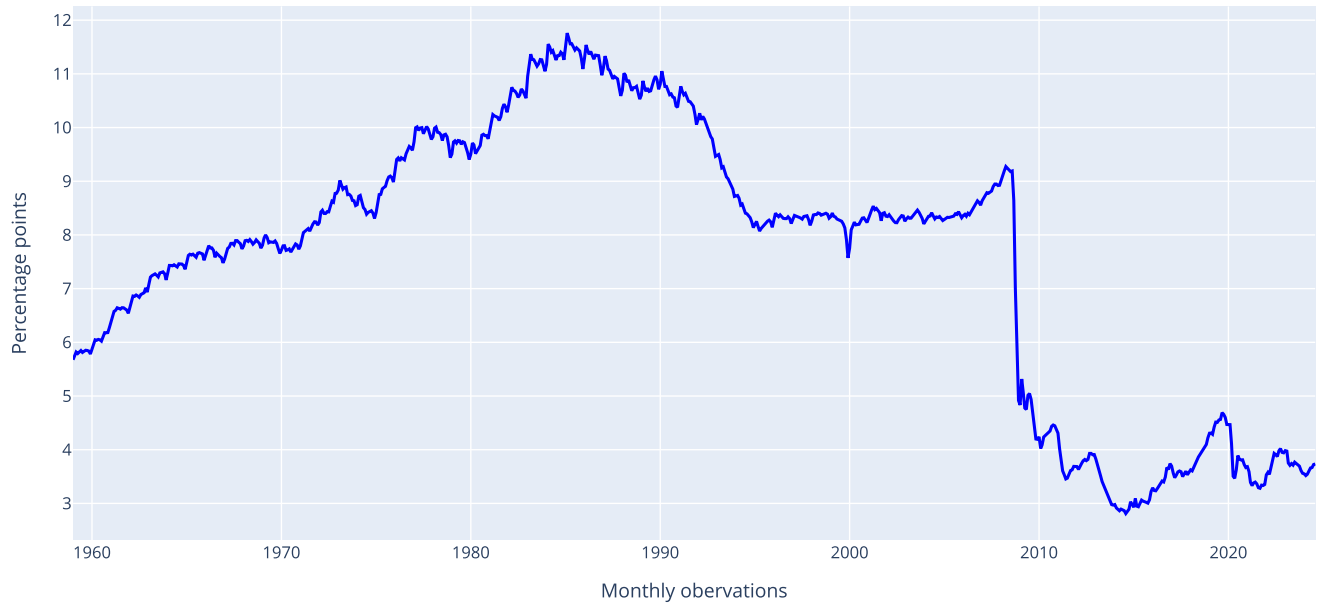
MB vs M2 in the USA (1959--2024): Billions of Dollars



## The Money Multiplier: Terribly Unstable

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The Money Multiplier for the USA (1959--2024)



- The money multiplier ( $\kappa$ ) is extremely unstable.

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- So, even if the central bank has a large control over the MB, it ends up with no control over the M2 because  $\kappa$  is terribly unstable.

## 4. Monetary Policy Tools

### Four Monetary Policy Tools

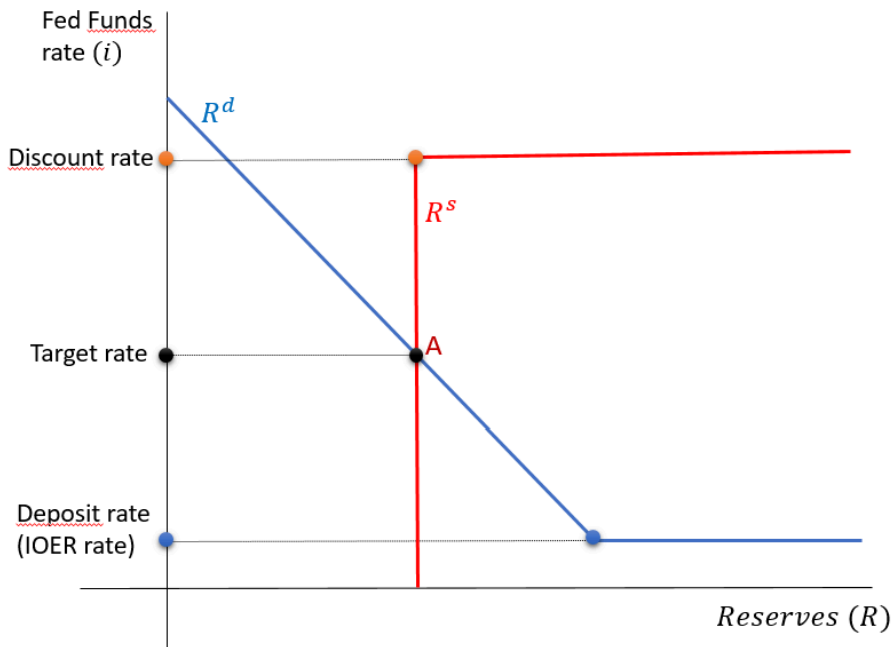
- Controlling M2 is extremely difficult for the Fed, because the money multiplier is extremely unstable, as we saw in the previous figure.
- The other option is trying to control (target), **not the quantity** of money, but **its price**: the short-term interest rate (Fed Funds Rate).
- The fed has 4 policy tools (instruments) to do that:
  - Target Federal Funds Rate Range
  - Interest Rate on Excess Reserves (IOER Rate)
  - Discount Rate
  - Reserve Requirement

### Monetary Policy Tools: Summary

	What Is It?	How Is It Controlled?	What Is Its Impact?
<b>Target Federal Funds Rate Range</b>	Range for the interest rate charged by financial intermediaries on overnight, uncollateralized loans to banks	Announced by the FOMC as the target range for the market federal funds rate	Influences interest rates throughout the economy
<b>Interest Rate on Excess Reserves (IOER Rate)</b>	Interest rate paid by the Federal Reserve on excess reserves held by banks	Announced by the FOMC as a rate to be paid on all excess reserves	Changes interest rates at which banks will lend and borrow
<b>Discount Rate</b>	Interest rate charged by the Federal Reserve on its loans to banks	Set by Reserve Banks, subject to approval by the Federal Reserve Board, at a premium over the interest rate on excess reserves (IOER rate)	Provides liquidity to banks in times of crisis; not used to alter day-to-day monetary policy
<b>Reserve Requirement</b>	Fraction of deposits that banks must keep either on deposit at the Federal Reserve or as cash in their vaults	Set by the Federal Reserve Board within a legally imposed range	Influences the demand for reserves; not used to alter monetary policy

### How Are the Tools Combined?

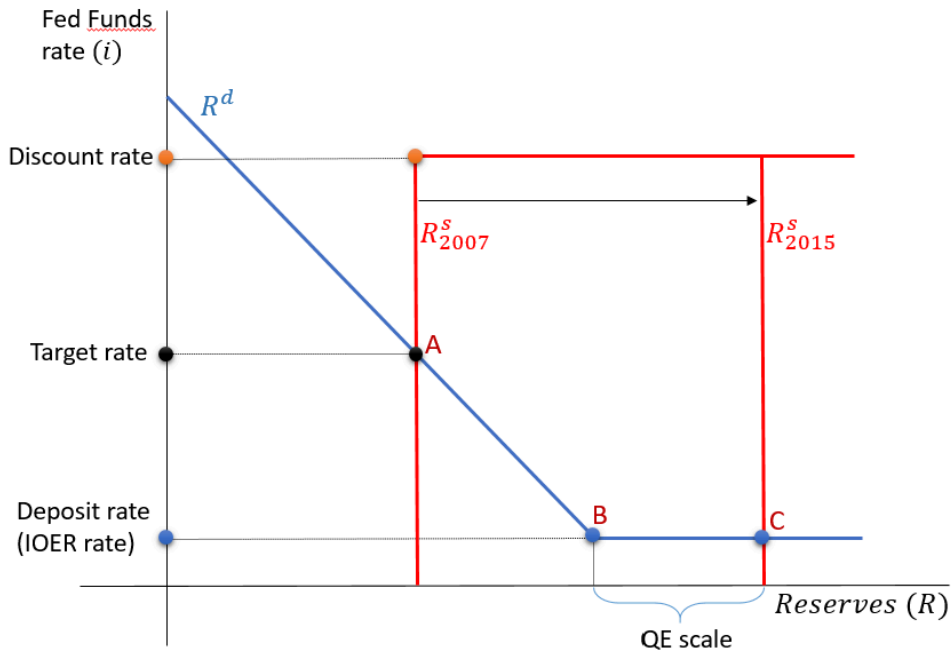
The Fed sets the quantity of reserves supplied ( $R^s$ )



- For a given level of the demand for reserves ( $R^d$ )
- The equilibrium between  $R^d$  and  $R^s$  will deliver the interest rate the Fed wants (Target rate)

### Extreme Situations: the Case of 2008-2015

The Fed implemented huge increases in  $R^s$ , a policy known as Quantitative Easing (QE).



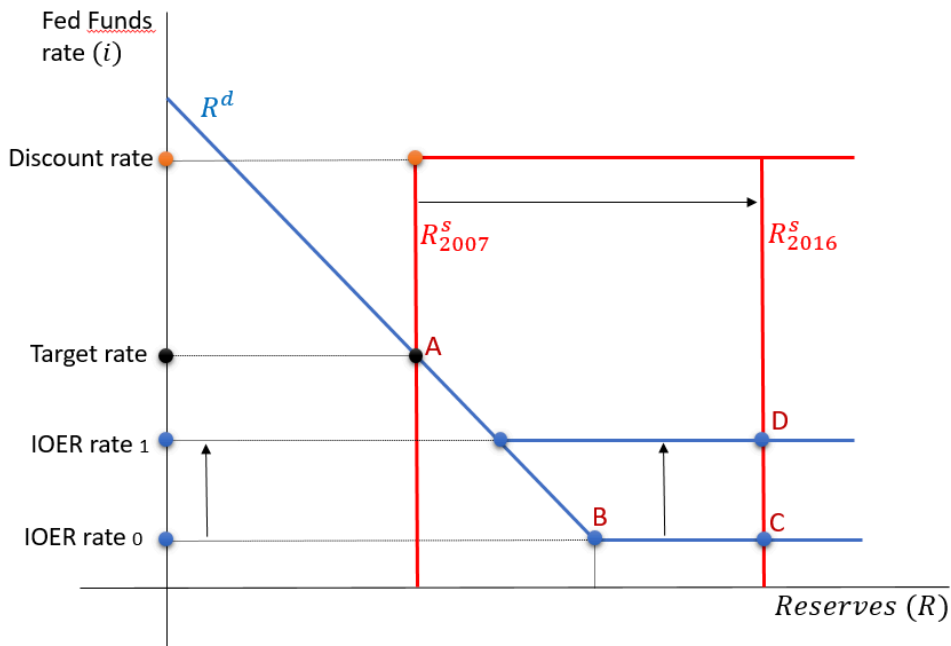
- The Fed's goal was to keep interest rates as low as possible



- For as long as desired
- The equilibrium moved from point A to C.

### An Increase in the IOER

In 2016 the Fed decided to increase the IOER.

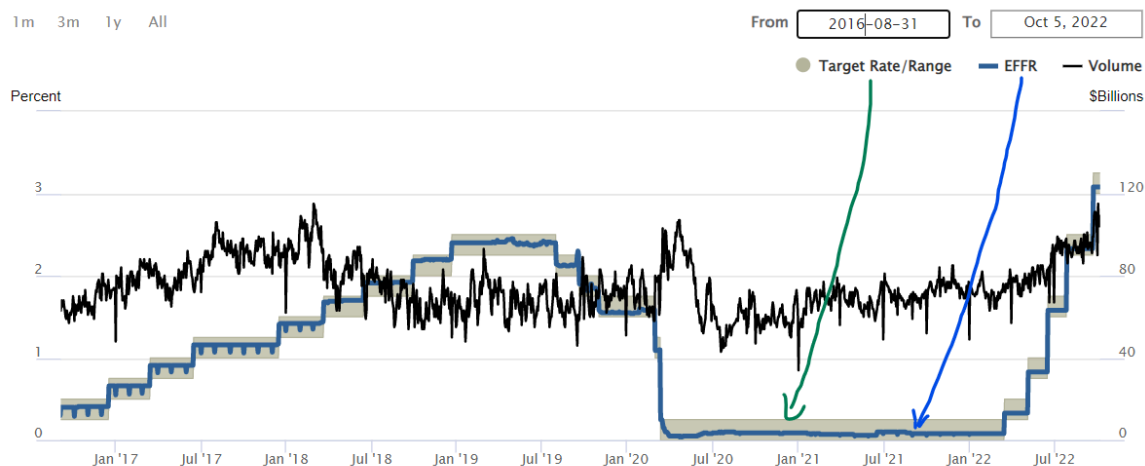


- The Fed's goal was to get an increase in interest rates
- The equilibrium moved from point C to D.

### Fed's Perfect Control of the Fed Funds Rate

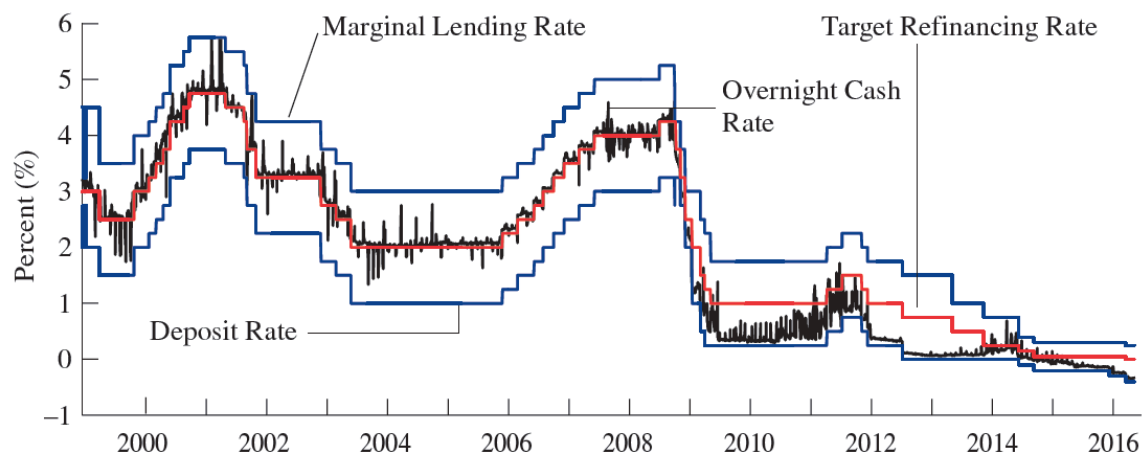
The Fed navigates with the tools close to perfection.

## FEDERAL FUNDS CHART



## Monetary Policy in the ECB

The ECB has a similar monetary policy structure. The names change a little bit, but the essence is the same.



## Unconventional Policy Tools (Not covered in this course)

### Fed's Unconventional Tools

When the Fed Funds Rate comes down to zero, and the economy still needs some support from monetary policy, the Fed has two options:

- Force short-term interest rates (Fed Funds Rate) to go below zero, as many European central banks did from 2010 to 2021.
- Keep rates at zero and use some “unconventional policy tools”.

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The unconventional monetary policy tools are basically three:

- Quantitative easing
- Forward guidance
- Targeted asset purchases (TAP)

### **Quantitative Easing (QE)**

QE consists basically of one decision by the central bank: buying vast quantities of bonds and expanding its balance sheet by a magnitude of 3 or 4 in a few years.

Why is it different from “conventional” monetary policy?

Because the bonds bought under QE are:

- Long term maturity bonds (in opposition to short term maturity)
- They have considerable risk attached to them (in opposition to risk free)
- They belong to classes of bonds that were not eligible to be used by conventional policy.

### **Forward Guidance**

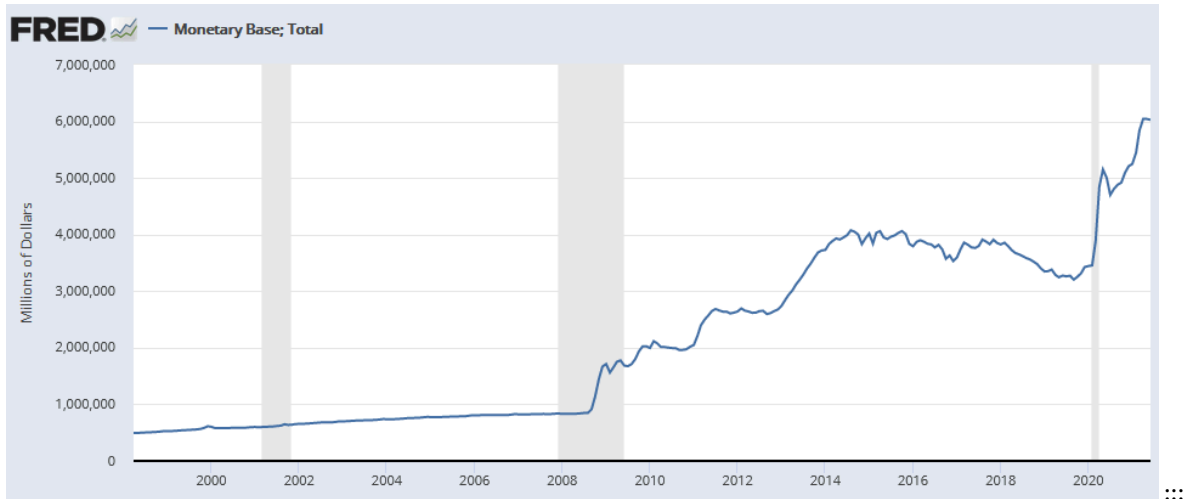
- Forward guidance is usually used by central banks when they **communicate with private agents**. If the central bank thinks that is convenient to signal a particular point to the private sector, they will do that.
- But if short term interest rates are at zero (call this as the Zero Lower Bound), this guidance becomes vital.
- At the ZLB there is a danger of deflation, and it is crucial if the private sector gets a clear commitment from the central bank that “we will do whatever it takes” to avoid the trap of a long deflationary period.
- The central bank has to clarify that it will not increase interest rates if inflation surpasses the 2% target value by a significant amount: it will allow inflation to “overshoot” the 2% main goal for a significant time.

### **Targeted Asset Purchases**

- In contrast to QE, which increases the size of the central banks balance sheet by all sorts of bonds, targeted asset purchases (TAP) shift the composition of the balance sheet toward selected assets in order to boost their relative price, reducing their yields, and stimulate economic activity.
- A recent example of this type of tool has become known as the “Operation Twist”. The Fed bought longer-term Treasuries and Mortgage-Backed Securities. It simultaneously sold some of the short-term assets it already held to ease the economy by bringing down long-term interest rates.

### **How Far Unconventional Can I Go?**

In 2008: MB=0.8 trillion dollars; in 2021: MB = 6 trillion US dollars



## Appendix A: Derivation of the Money Multiplier (Not required studying)

### Money Multiplier: Derivation

- Money Supply ( $M2$ ) and Monetary Base ( $MB$ ) are defined as:

$$M2 = Cur + Dep$$

$$MB = Cur + R$$

where  $Cur$  is “Currency”,  $Dep$  is “Deposits”,  $R$  is “Reserves”. From (1) and (2):

$$\frac{M2}{MB} = \frac{Cur + Dep}{Cur + R}$$

- Dividing the right hand side of eq. (3) by  $Dep$ :

$$\frac{M2}{MB} = \frac{Cur/Dep + Dep/Dep}{Cur/Dep + R/Dep}$$

### Money Multiplier: Derivation (continuation)

- In eq.(4) we have  $Cur/Dep$ , a ratio that is stable in the short-run:  $Cur/Dep = \beta$
- Moreover, the reserves requirement rate set by the central bank is given by:

$$R/Dep = rr$$

- Therefore, eq. (4) can be simplified to:

$$\frac{M2}{MB} = \frac{\beta + 1}{\beta + rr}$$

- Then:

$$M2 = \frac{\beta + 1}{\underbrace{\beta + rr}_{=\kappa}} \times MB$$

- $\kappa$  is the money multiplier.

## 5. Readings

### Readings

For this topic, we recommend reading some parts of **Chapters 17 & 18** of the following textbook:

Stephen G. Cecchetti and Kermit L. Schoenholtz (2017). *Money, Banking, and Financial Markets*, Fifth Edition, McGraw-Hill.

Chapter 17: “The Central Banks Balance Sheet” (pages 453-457). The subsection “The Importance of Disclosure” not required reading.

“Changing the Size and Composition of the Balance Sheet” (pages 457-463).

“The Monetary Base and the Money Supply” (468-473). It deals with the money multiplier in some detail. ***This part should be skipped.*** You have just to know what the money multiplier is supposed to do; nothing else.

### Readings (continuation)

Chapter 18: “The Federal Reserves Conventional Policy Toolbox” (485-494). All pages are very important. Concentrate on Table 18.1 and on figures 18.2 a 18.4, as we do in the slides above.

“Unconventional Policy Tools” (pages 506-513). ***This part should be skipped; not covered in this course***

## Bibliography