COMILLAS
UNIVERSIDAD PONTIFICIA
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3ºE2 - Spring 2026

Mercados Financieros

L2 – Monetary Policy

January 27th, 2026

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What are we going to do this week?

- **Talk about money**
  - Monetary policy before 2008
  - Monetary policy after 2008
- **Monetary policy in practice:**
  - Black swans
  - Interest rates evolution: 2001 – 2008
  - Lehman Brothers bankruptcy
  - Silicon Valley Bank Crisis
- **Time value of money**
  - Simple axioms
  - Future value and present value
  - Pricing zero coupon bonds
  - Net present value and Interest Rate of Return (IRR)

L2. Monetary policy and central banks

For next day:
I will ask you to write, at the beginning of the class:
What was the problem with Lehman Brothers?
15 minutes – The shorter the better.

And next week… since 2008 till now:
- Iceland breakdown
- Greek crisis

Evolution of the financial system

We are going to talk during this classes:

- 1921-1924 German hyperinflation
- 1944-1971 Bretton Woods. Gold standard (fixed exchange rates). Stability
- 1979-1998 European Monetary System. 1992 Soros and the pound.
- 2001 The Federal Reserve's Response to the Sept. 11 Attacks
- 2001-2008 Low interest rate period with the “recovery” from 2006.
- **Sept 2008 – Lehman Brothers Bankrupcy**
- 2009 Iceland Bankruptcy
- 2009 – 2013 Euro debt crisis (Greek crisis)
- 2020 – Covid Crisis

What is money?

Three principal uses:

- As payment method. Medium of Exchange. It has to be accepted by people (divisibility, difficulty of forgery, ease of handling and transportation among others...)
- Store of value
- Money as a unit of account.

Forms of money:

- Commodity money
- Metallic money
- Paper money
- Obligations
- Gold standard

How much money there is?

Interest rates

Inflation

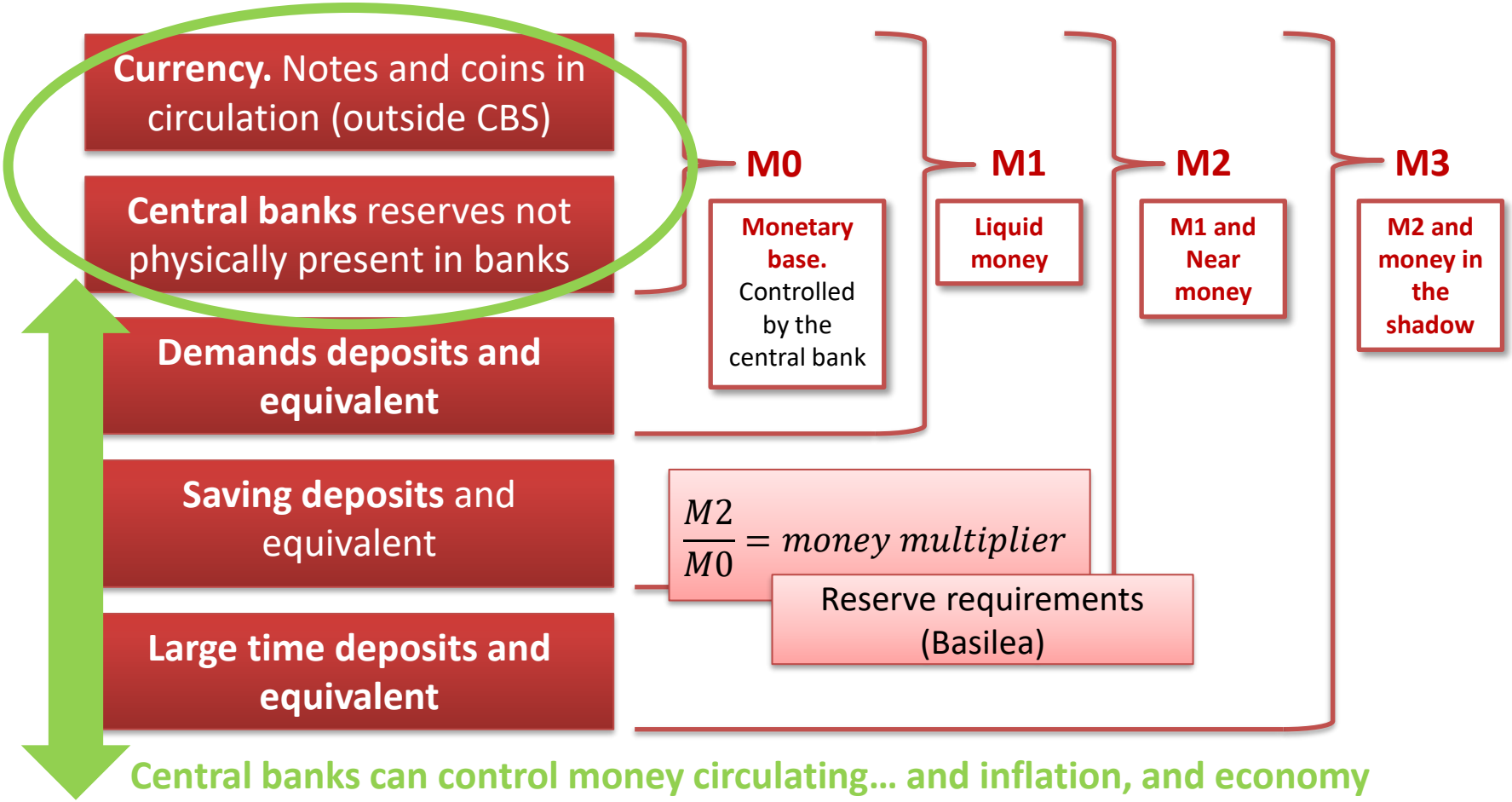
Economical activity

Financial markets

[All of the World's Money and Markets in One Visualization]

What is money?

By controlling the monetary base…



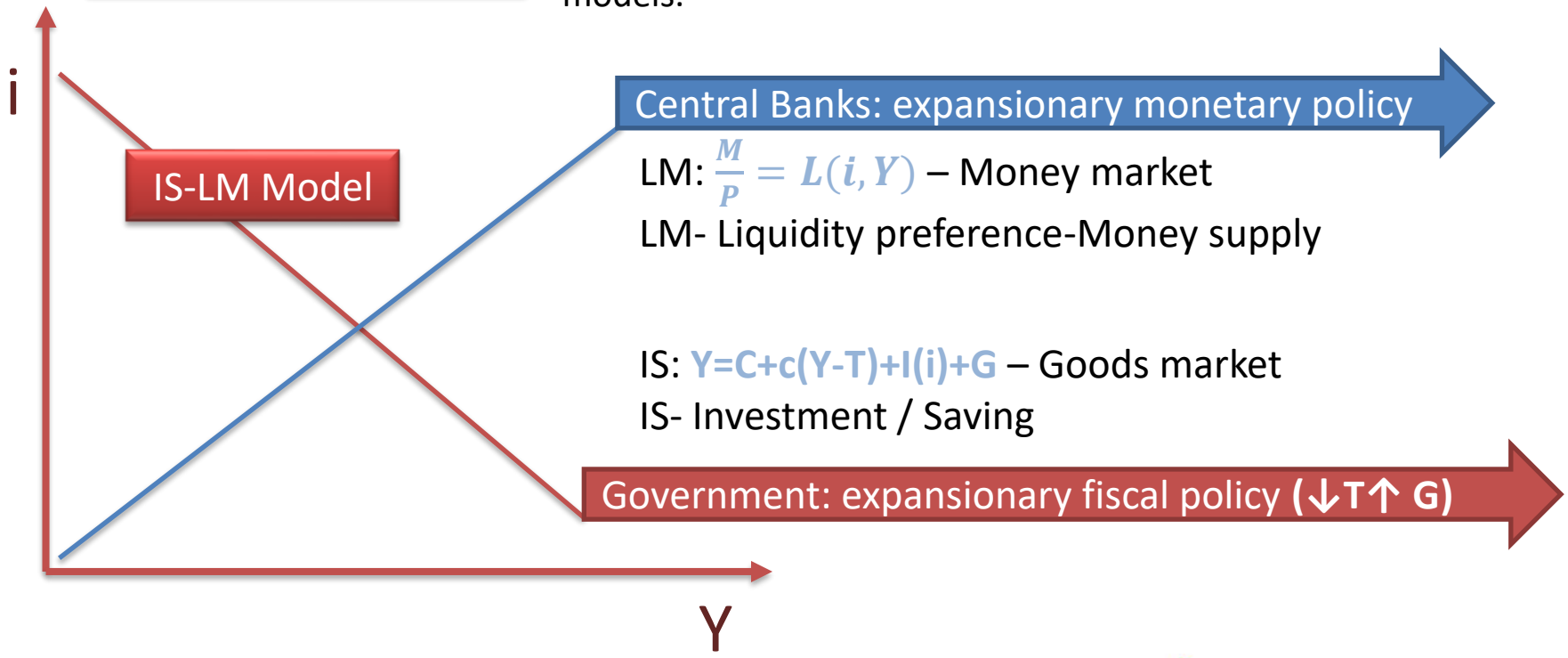
Central banks can control money circulating… and inflation, and economy growth… in theory.

How does it works?

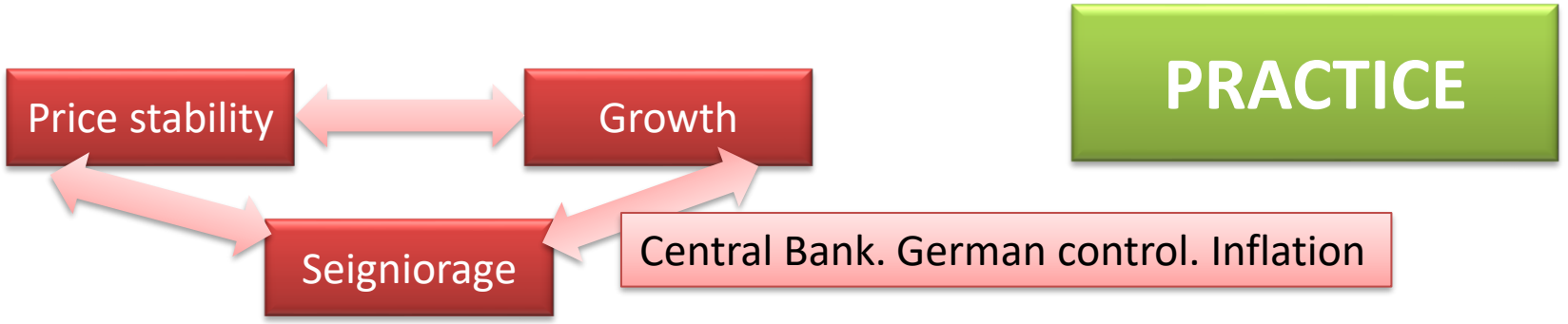
THEORY

$$\frac{M2}{M0} = money\ multiplier$$

Yesterday we talk about dynamic systems. Also we saw the contrast between theory and practice regarding equilibrium models.



How does it works?



1) The agreement reached at Bretton Woods at the end of the Second World War.
   - gave birth to the IMF and the World Bank
   - **established the gold-dollar parity**
   - fostered free trade and discarded protectionism

Longest period of stability

2) US economic imbalances at the end of the 60's meant the end of Bretton Woods:
   - **Floating exchange rates were introduced**
   - **The risk associated to floating rates and more global capital markets led to a higher degree of financial innovation: hedging products and derivatives**

3) 1979 the European Economic Community introduced the European Exchange Rate Mechanism:
   - The snake in the tunnel (link)

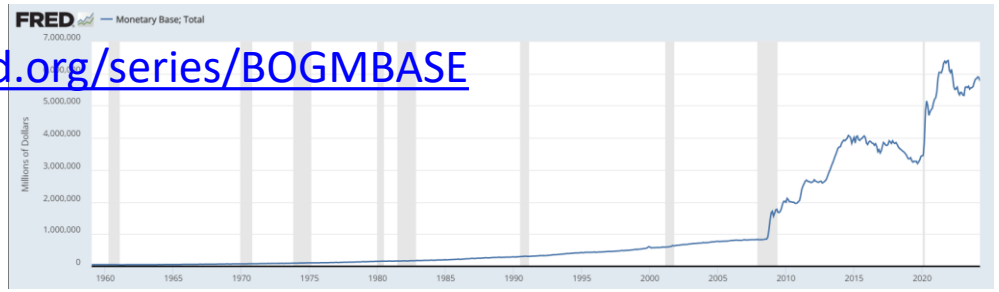
16 September 1992: Bank of England increased interest rates from 10 to 15%

Monetary policy

Entendiendo la política monetaria:

Interest rates: https://fred.stlouisfed.org/series/FEDFUNDS

Monetary base: https://fred.stlouisfed.org/series/BOGMBASE



Money supply (M2): https://fred.stlouisfed.org/series/WM2NS

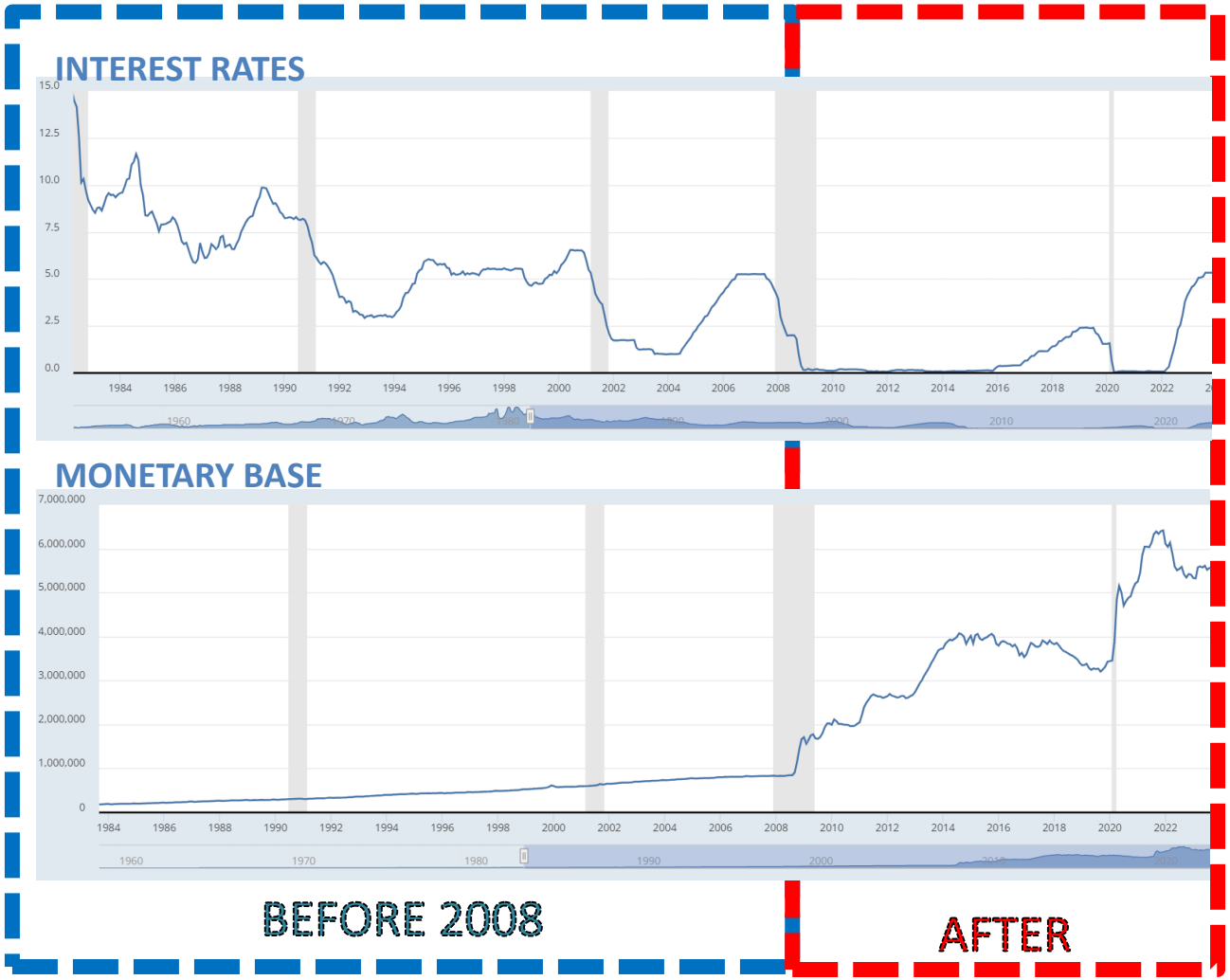
Monetary policy

People who do not know their history are doomed to repeat it.

Some historical events that are worth knowing:

- 1921-1924: German hyperinflation
- 1944-1971: Bretton Woods. Gold standard (fixed exchange rates). Stability
- 1972: End of the Vietnam War and start of the oil crisis
- 1979-1998: European Monetary System
- 1992: Soros and the British pound
- 2001: The September 11 attacks
- 2001-2008: Period of low interest rates
- **September 2008: Lehman Brothers bankruptcy**
- 2009: Bankruptcy of Iceland
- 2009-2013: Euro debt crisis (Greek crisis)
- 2020: Covid crisis

Monetary policy

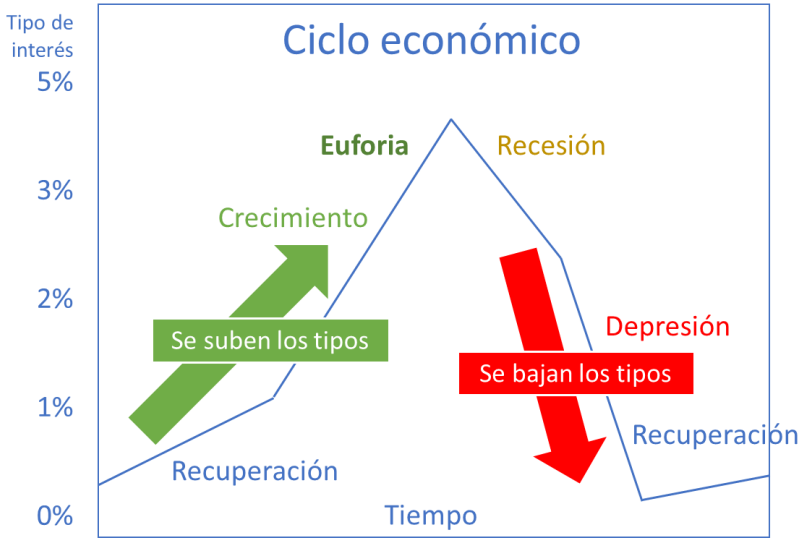


Monetary policy – Before 2008

- **Interest rate cuts in response to a crisis:** Central Banks would lower interest rates to stimulate the economy during recessions. Lowering rates made credit cheaper and more accessible, encouraging consumption and investment.

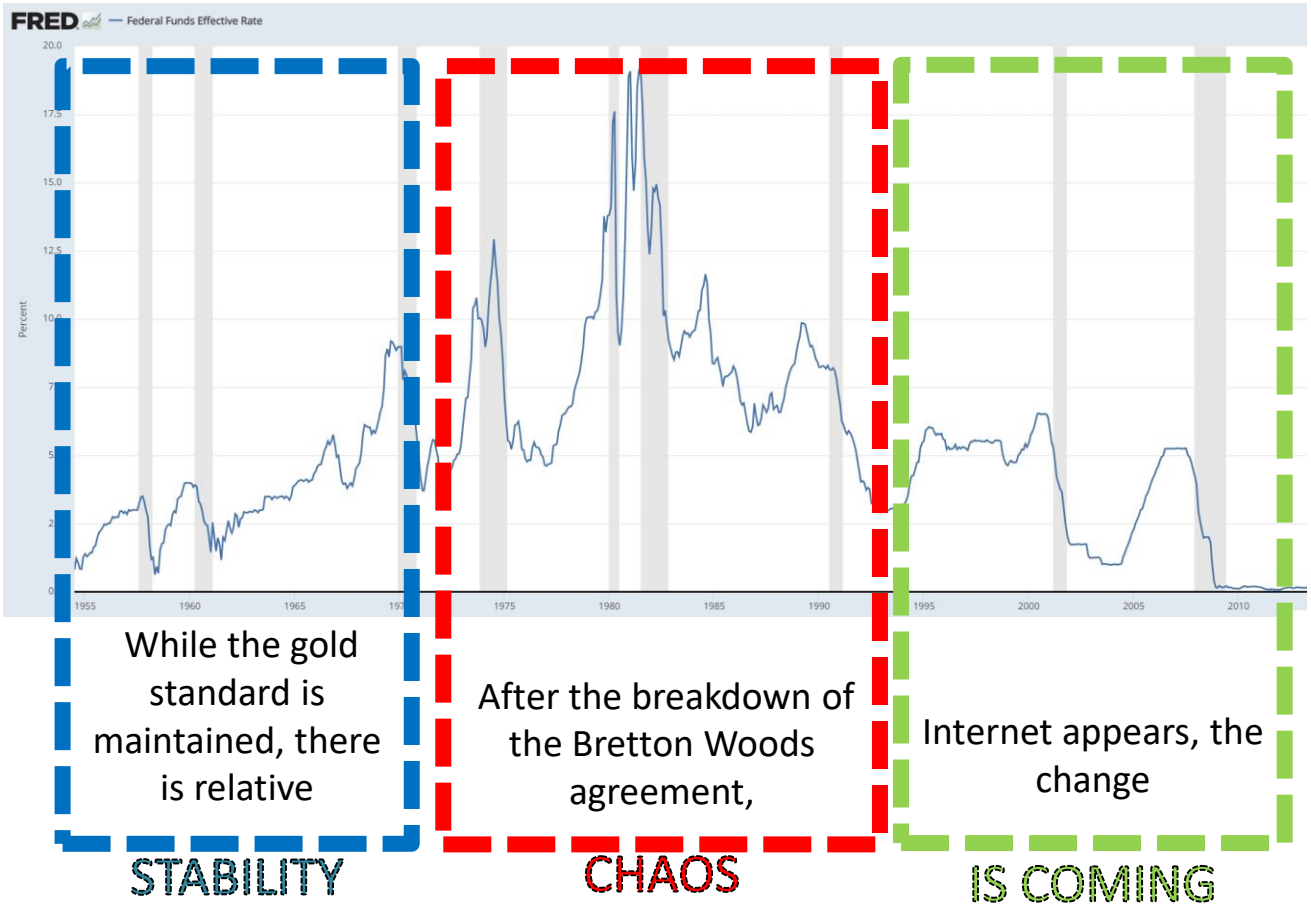
- **Interest rate hikes to control inflation:** In periods of strong economic growth and significant increases in inflation, Central Banks would raise interest rates. This increase made loans more expensive, reducing consumption and investment, which helped control inflation and prevent the economy from overheating.

- **Economic cycle and monetary policy:** This cycle of lowering and raising interest rates was a common practice for managing the economic cycle. During a crisis, rates were lowered to stimulate the economy, and once the economy recovered and began to heat up, rates were raised to prevent excessive inflation, until a new crisis required lowering rates again.



Monetary policy – Before 2008

Evolution of the Federal Reserve's interest rate from 1954 to 2010



The chart can be viewed at the following link: https://fred.stlouisfed.org/series/FEDFUNDS

Monetary policy – Before 2008

Before 2008, the different crises could be analyzed by examining the evolution of interest rates. Each peak in the curve precedes a crisis.

1971 – Breakdown of Bretton Woods

1973 – 1st Oil crisis
1979 – 2nd Oil crisis

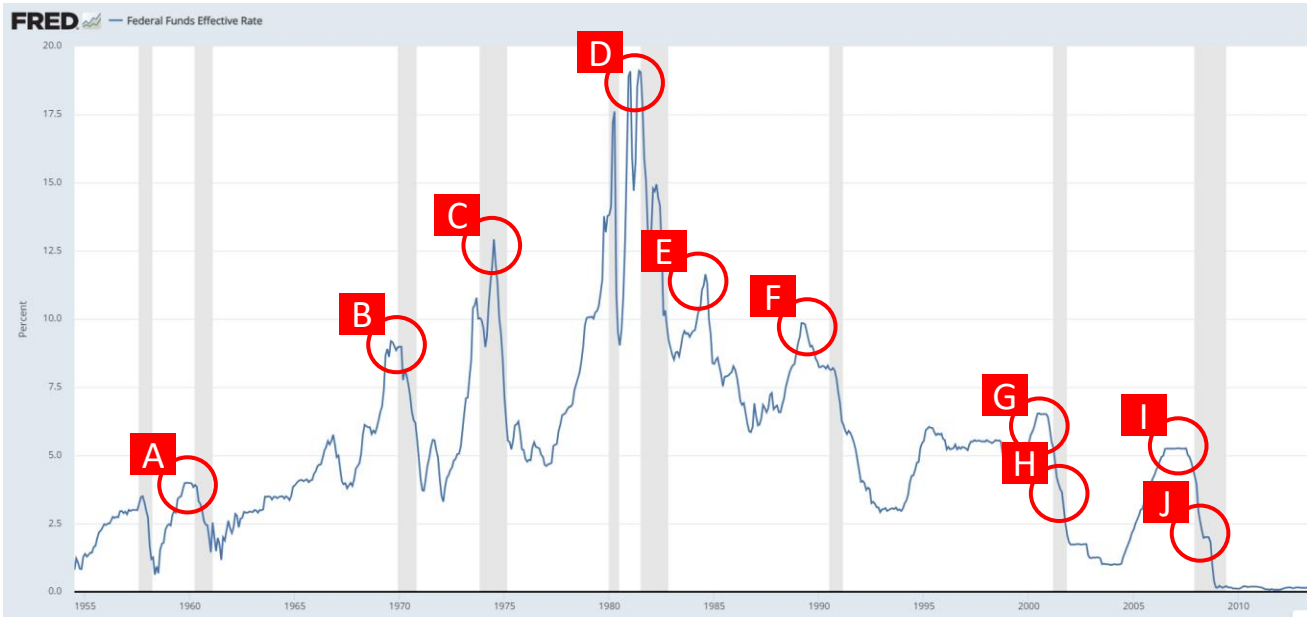
1989/92 – US recession and Iraq war

1999 .com crisis

2008 – Financial crisis

Monetary policy – Before 2008

Before 2008, the different crises could be analyzed by examining the evolution of interest rates. Each peak in the curve precedes a crisis.



A – Recession of 1960-1961
B – Recession of 1969-1970
C – 1973 oil crisis
D – Recession of 1980-1982
E – Latin American debt crisis

F – Savings and loans crisis
G – .Com crisis and H –11S attack
I –2008 financial crisis and J – LB bankruptcy
Searching on Google for each of these events will provide extensive information that elaborates on each point.

9/11 changed the world

The internet has transformed the world in less than 30 years.

Internet 1.0: Real-time news. We all watched 9/11 live.

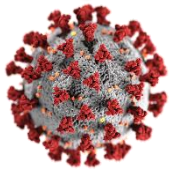
Internet 2.0: Social networks, the concept of prosumer.

Internet 3.0: Telecommuting, video calls, online training...

2001 – 9/11

2008 – Financial crisis

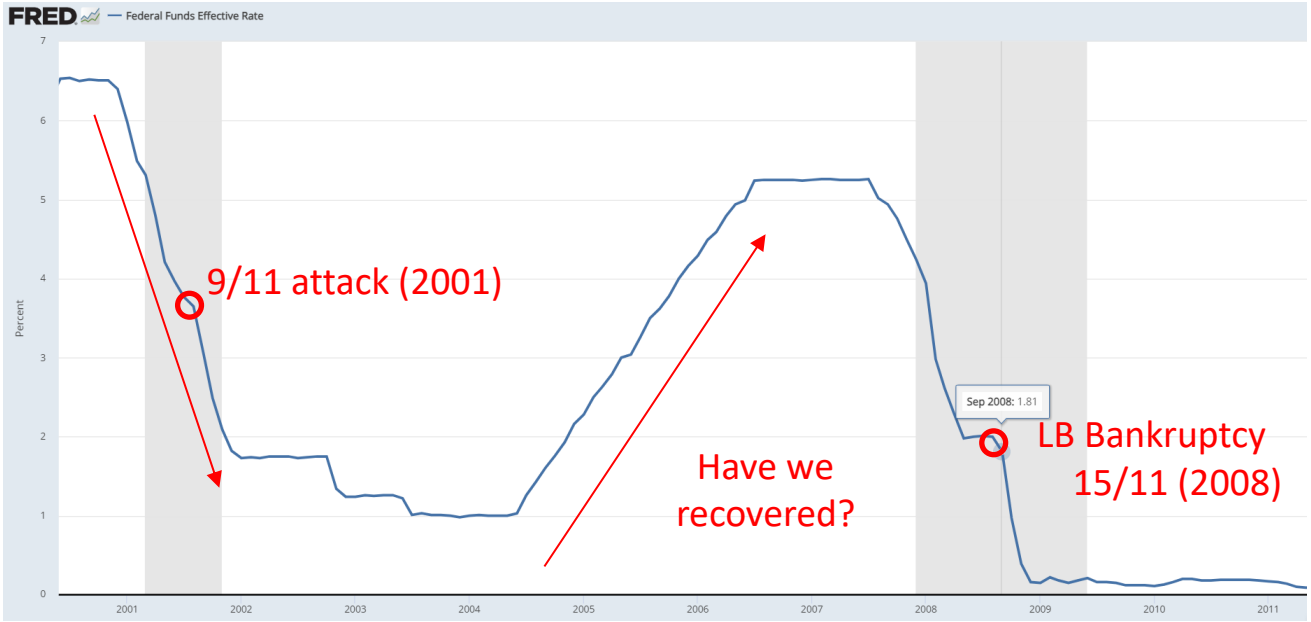
2020 – Covid 19



INTERNET — Media — Financial system — Governments

CHINA — Developing (the factory of the world) — Fully developed

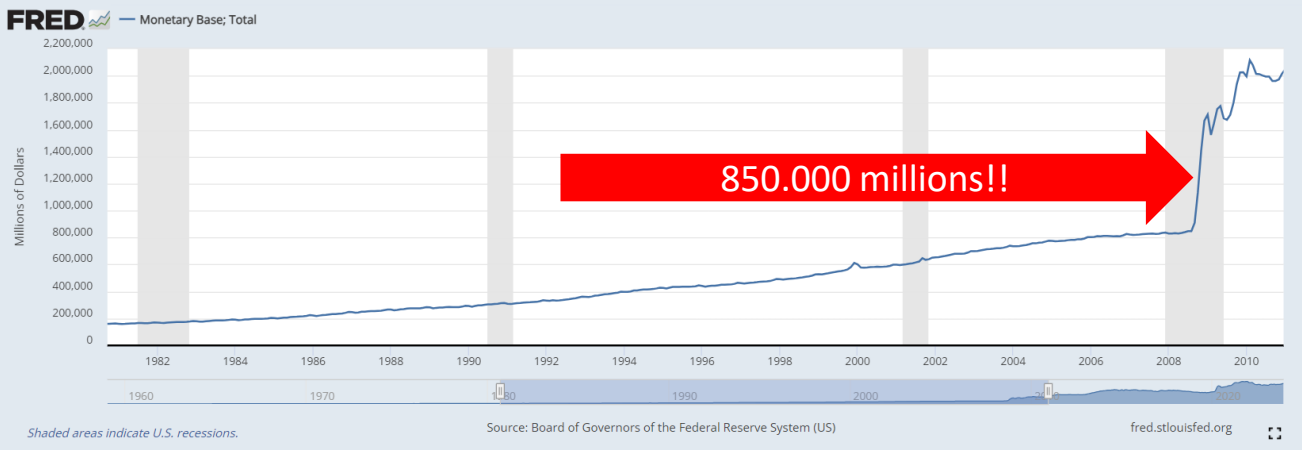
Lehman Brothers bankruptcy



- After the **dot-com** crisis and the **9/11 attacks**, interest rates were lowered.
- **Mortgages** and derivative products began to be granted as if there were no tomorrow.
- **The Fed raises interest rates**, thinking we have recovered.
- The **subprime crisis** is fully set in motion.
- **Everything culminates in the collapse:** Lehman Brothers bankruptcy.

Lehman Brothers bankruptcy

- **The interest rate cut** following the Lehman Brothers bankruptcy in 2008 **was insufficient** to restore confidence in the financial system; the interbank market froze due to widespread distrust among financial institutions.
- **Federal Reserve intervention:** The Federal Reserve had to intervene aggressively, injecting large sums of money using various tools such as asset purchases and providing direct liquidity to banks, to stabilize the financial system.
- **Change in monetary policy:** Since then, monetary policy has focused on continuous liquidity injection through programs like Quantitative Easing (QE) to maintain credit flow and support economic recovery.



LB bankruptcy – Liquidity injections

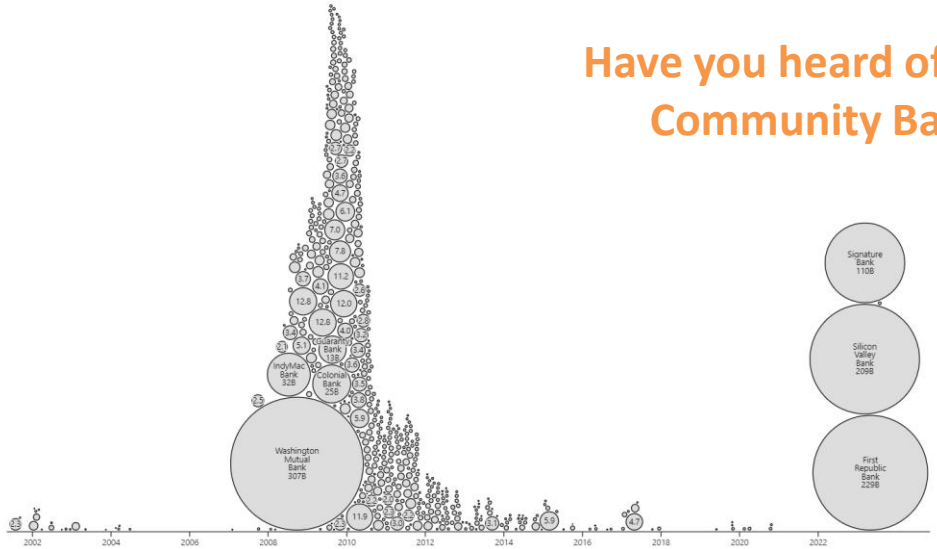
Since 2008, crises can be seen in the chart of the monetary base. Until 2008, it had remained stable, but what was exceptional with the Lehman Brothers bankruptcy began to become routine.

A – Lehman Brothers bankruptcy (September 2008)
B – Greek sovereign debt crisis
C – Spanish and Italian sovereign debt crisis
D – Coronavirus lockdown
E – Oil crisis during the lockdown

Silicon Valley Bank Crisis

Silicon Valley Bank

- High exposure to bonds with durations longer than 10 years.
- The Fed raises interest rates by more than 400 basis points in less than one year.
- After the pandemic, technology-sector clients withdraw deposits to cover layoffs and operating expenses.
- Significant losses occur due to the depreciation of long-term bonds held on the balance sheet.
- The Fed intervenes to prevent contagion and stabilize the financial system.



Have you heard of New York Community Bancorp?

https://observablehq.com/@mbostock/bank-failures

Past, Present and Future

Financial Crisis of 1929

- The 1929 crisis was a financial crisis. Since the U.S. government did not intervene, it turned into the Great Depression, which lasted for years.

Financial Crisis of 2008

- The 2008 crisis was also a financial crisis. However, the immediate intervention of the government prevented it from turning into an economic depression.
- Ben Bernanke, then Chairman of the Federal Reserve, had studied the 1929 crisis and implemented rapid measures, which earned him the Nobel Prize in Economics.

Financial crises after the collapse of SVB

- The banking crises following the collapse of SVB in March 2023 unfold in real time, and the Fed manages these crises in real time, often without the public being aware of it.

Time value of money

Finance is Based on Simple Axioms

1. Investors prefer more to less
   Example: $100 is better than $10.
2. Investors are risk averse
   Example:
   A) $1 million for sure
   B) 50/50 gamble $0/$2 million
3. Money paid in the future is worth less than the same amount today
   Example: $100 today is better than $100 next year
4. Financial markets are competitive; no arbitrage
   Example: There should not be a stock that people agree is under-priced

Future value (FV), present value (PV), and yield (r)

Examples:

- Single payment securities, e.g., zero coupon bonds
- Multiple payment securities, e.g., annuities and perpetuities

Time value of money

Future value: one period

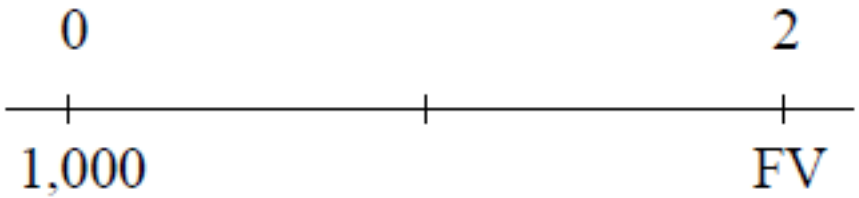
What is the value of $1.000 invested for one year at an annual rate of 5%?

FV = PV(1+*r*) = 1000(1+5%) = 1000(1,05) = $1.050

Principal plus (simple) interest

Future value: multiple periods

What is the value of $1000 invested for two years at an annual rate of 5%?



FV = PV(1+*r*)(1+*r*) = 1000(1.05)^2 = 1102.50

FV= 1000 + 2(5%)1000 + 5%(5%)1000

Principal plus simple interest plus compound interest

More generally: FV = PV(1+*r*)^t

Time value of money

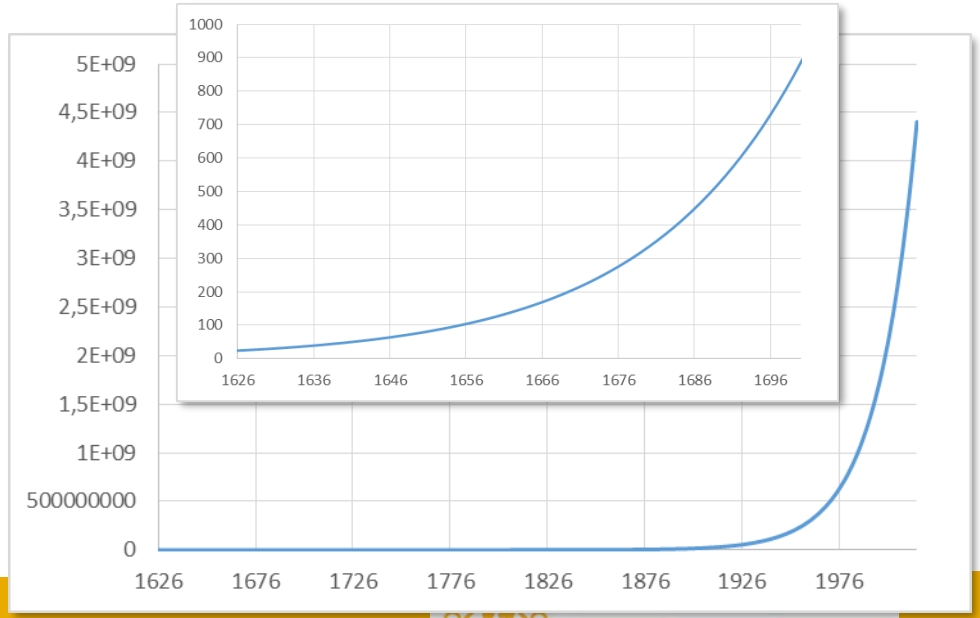
The power of compound interest

The Dutch West India Company dispatched the first permanent settlers to Manhattan Island in 1624. In 1626, the fledgling town's governor, Peter Minuit, bought Manhattan from the Canarsie tribe for $24 worth of beads and trinkets. Locals sometimes cite this transaction as one of the last real estate bargains in New York.

How big of a bargain was it at a 5% interest rate?

Assume 5% interest rate, the future value of $24 is 24(1.05)^390 = $4.4 billion (4,405,932,902)
A lot of money, but a good deal for the Dutch.

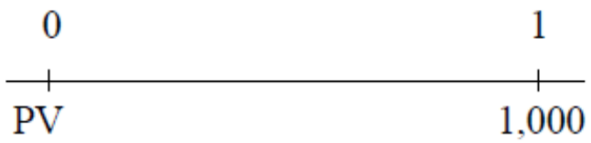
How much of this is simple interest? 24(0.05)(390)=$468 (The power of compounding!!)



Time value of money

Present value: one period

To receive $1000 in one year, how much should I invest today at a rate of 5%?

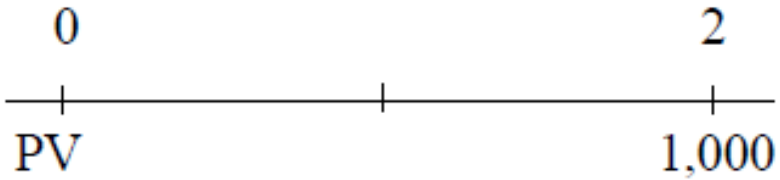


PV = FV/(1+r) = 1000/(1+5%) = 1000/1.05 = $952.38

This formula should look very familiar!

Present value: multiple periods

To receive $1000 in two years, how much should I invest today at a rate of 5%?



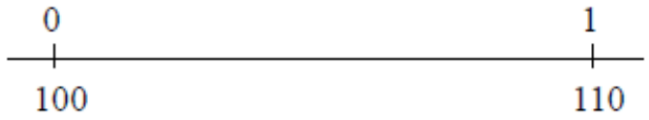
PV = [FV/(1+r)]/(1+r) = 1000/1.052 = 907.03

In general: $PV = FV/(1+r)^t$

Time value of money

Discount Rate/Yield: one period

If you invest $100 and receive $110 in 1 year, what rate are you earning



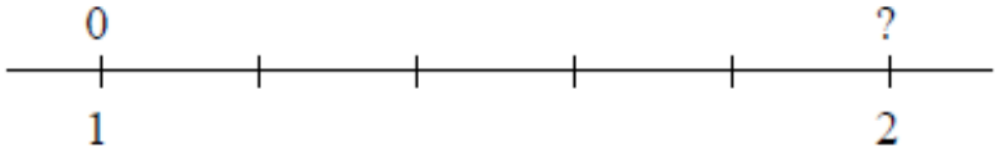
$r = (FV/PV)-1 = (110/100)-1 = 0.1 = 10\%$

Discount Rate/Yield: multiple periods

If an investment offers to double your money in 5 years, what rate are you earning?

$$r = (FV/PV)^{1/t}-1 = (2/1)^{1/5}-1 = 14.87\%$$

At a rate of 5% how long will it take to double your money?



$t = \log(FV/PV)/\log(1+r)$

$t = \log(2/1)/\log(1.05) = 14.21$ years

Given 3 you can always find the 4th

$FV = PV(1+r)^t$

$PV = FV/(1+r)^t$

$r = (FV/PV)^{1/t}-1$

$t = \log(FV/PV)/\log(1+r)$

Time value of money

Zero Coupon Bonds

What is a zero coupon bond?

A bond that pays no interest/coupon, only the face value at maturity.

Where do zero coupon bonds come from?

- Issued in primary markets (Treasury bills) –we will talk about this next week–
- Stripping of coupon bonds

We are interested now in determining the price of a ZCB. We will be thinking about a 10 year ZCB with face value = par value = future value FV = $100 and a discounting rate of 5%.

$$\text{Price} = PV = F/(1+r)^t$$

$PV=100/(1.05)^{10}=61.39$

What if?

t=10 P= 61.39
t=5 P= 78.35
t=1 P= 95.24

We see that the value of a zero increases to its face value as remaining maturity goes to 0: This gradual price increase is called the pull to par.

Assume now that the interest rate was 4% instead.

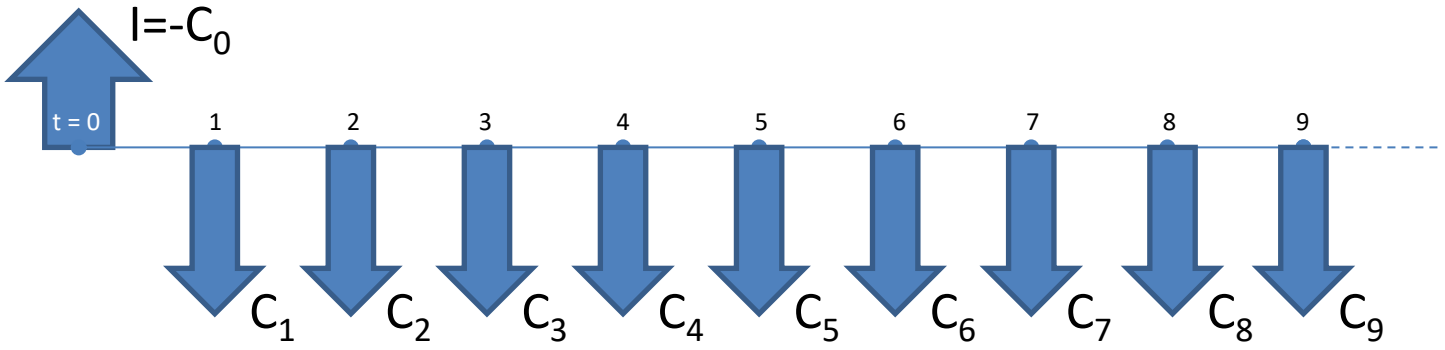
r=4% PV = 100/(1.04)^10 = 67.56

Lower rates higher prices. Why?

Time value of money

Cash flow series

Cash flow



Present Value (PV)

$$NPV = C_0 + \frac{C_1}{1+r} + \frac{C_2}{(1+r)^2} + \ldots + \frac{C_9}{(1+r)^9}$$

Future value (FV) of the same cash flow stream

$$FV_9 = C_0(1+r)^9 + C_1(1+r)^8 + \ldots + C_9$$

Time value of money

Cash flow series

What is the PV of a $1,000 par, 2-year, 5% coupon bond (annual payments) at a 6% interest rate?

0	1	2
PV	50	1,000+50

PV=50/1.06+1050/1.06^2=47.17+934.50=981.67
This is a discount bond (price<par)! Why?

What is the present value at 5%?

You should be able to answer this question without any computation!

PV=50/1.05+1050/1.05^2=47.62+952.38=1000.00 (discount rate = coupon rate -> a par bond!)

Time value of money

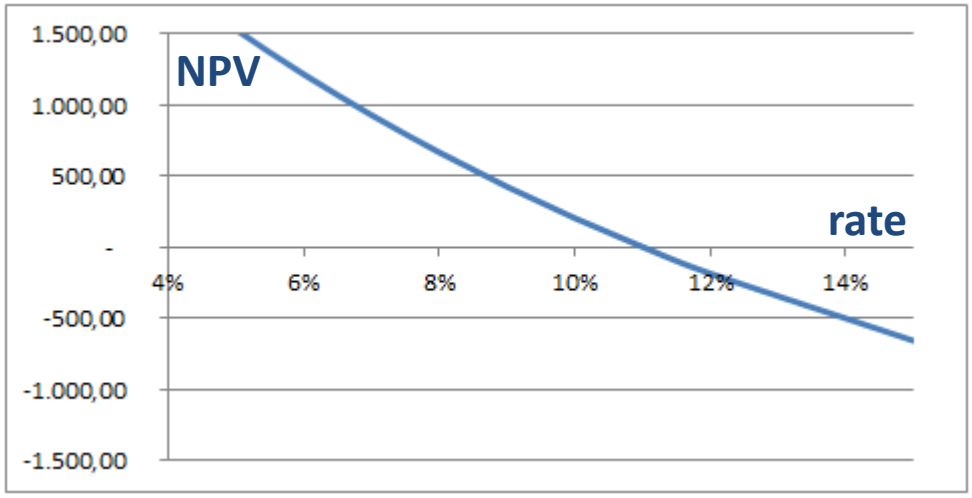
Cash flow series

Calculate NPV at **8%** and **12%** of following amounts **by using excel**:

	0	1	2	3	4	5	6	7	8	9	10
C	-1.200	-1.200	-1.200	-1.200	1.200	1.200	1.200	1.200	1.200	1.200	1.200

NPV (8%) = 667,06 **NPV (12%)** = -184,13

Repeat the same exercise with **5%** and with **10%**...



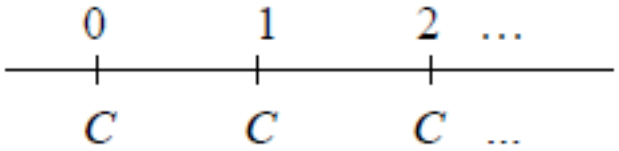
NPV (11,01%) = 0

Internal Rate of Return (IRR)
11,01%

Time value of money

Perpetuity

Definition: Pays a fixed cash flow, C, every period, forever (starting at time 1)



Pricing: PV = C/r

Proof easy (see handout), but not required!

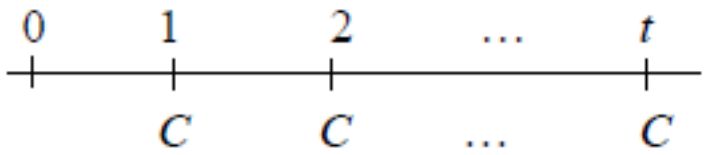
- Suppose that maintenance of your grave costs $100 every year, forever
- The interest rate is 5% per year
- How much money should you leave your trustee?

The answer is PV = C/r = 100/0.05 = 2,000

Time value of money

Annuities

Definition: Pays a fixed cash flow, C, for t periods (starting at time 1)



$$PV = \frac{C}{(1+r)} + \frac{C}{(1+r)^2} \ldots + \frac{C}{(1+r)^t}$$

$$= C\frac{\left[1 - \frac{1}{(1+r)^t}\right]}{r} = C\left[\frac{1}{r} - \frac{1}{r(1+r)^t}\right]$$

What car can you afford?

- You have no large amount of cash
- You can afford $632 per month
- You can borrow at an interest rate of 1% per month
- You want to have paid the loan in full in 48 months

$$PV = C\left[\frac{1}{r} - \frac{1}{r(1+r)^t}\right]$$

$$= 632\left[\frac{1}{0.01} - \frac{1}{0.01(1+0.01)^{48}}\right] = 24{,}000$$

Time value of money

Interest Rates and Prices

For bonds?

Inverse relationship between price and interest rate. You give me the interest rate and I give you the price or vice versa

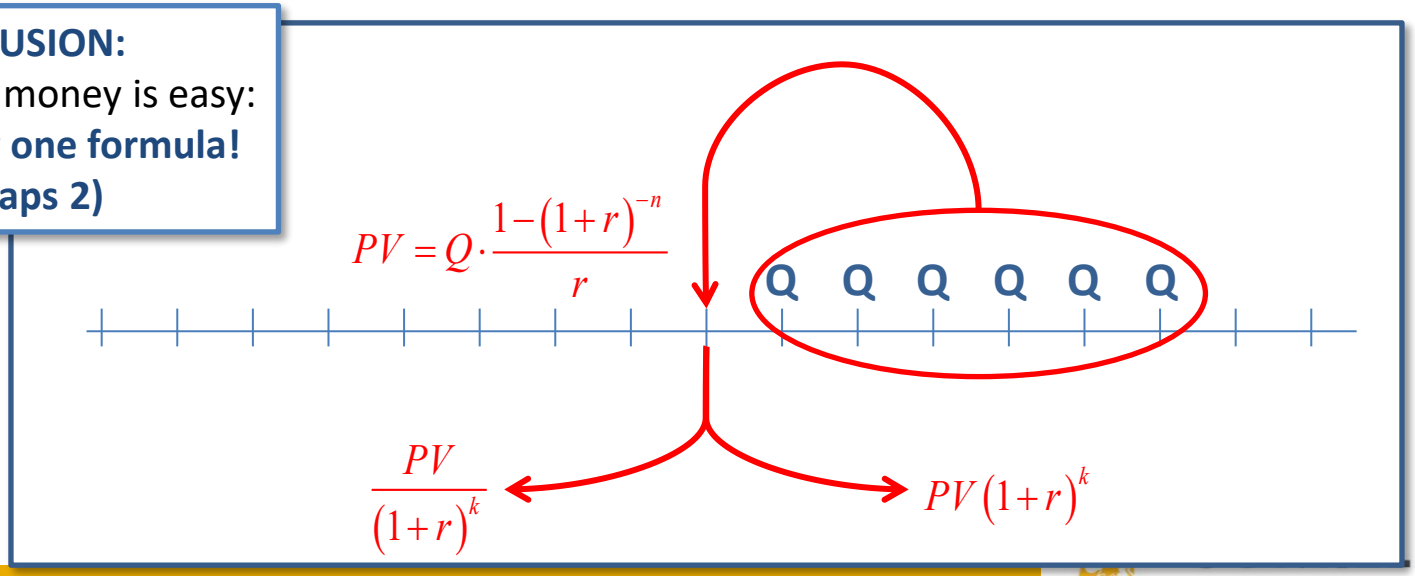
For perpetuities?

Inversely proportional. Double interest => half the price. This is unique to perpetuities

For stocks?

inverse relation between price and discount rate (holding expected cash flows fixed!)

CONCLUSION:
Time value of money is easy:
There is only one formula!
(perhaps 2)



Annex:

Instruments of the Eurosystem

Instruments of the Eurosystem

In order to achieve its primary objective, i.e. price stability, the Eurosystem manages the Eurozone monetary policy through a series of instruments and procedures which make up its operational framework. Decisions regarding monetary policy are made by the Governing Council of the European Central Bank (ECB) and are implemented by the national central banks of the countries comprising the Eurozone. Monetary policy is implemented under uniform criteria that are valid for all by using three instruments which are accessible to the financial institutions in the Eurozone under exactly the same conditions:

1. **Open market operations.** These make it possible to steer interest rates, manage market liquidity and guide monetary policy. They are divided into four categories:
   - **Main refinancing operations.** These are regular liquidity-providing reverse transactions with a frequency and maturity of one week, executed by the national central banks on the basis of standard tenders. They are the main source of financing for the credit system within the Eurosystem framework.
   - **Longer-term refinancing operations.** These are liquidity-providing reverse transactions with a monthly frequency and maturity of three months. They are executed by the national central banks by means of standard tenders. Their purpose is to provide counterparties with additional longer-term financing.
   - **Fine-tuning operations.** These are executed on an ad hoc basis to manage the liquidity situation in the market and temper the effects that unexpected fluctuations in market liquidity have on interest rates. The national central banks normally carry out these operations through rapid tenders or bilateral procedures.
   - **Structural operations.** These operations are carried out whenever the ECB wishes to adjust the structural position of the Eurosystem vis-à-vis the financial sector, on a regular or non-regular basis. They are carried by the issuance of debt certificates, reverse or outright transaction.

Instruments of the Eurosystem

2. **Standing facilities.** The purpose of standing facilities is to provide and absorb overnight liquidity and control overnight market interest rates. They are managed by national central banks in a decentralised manner. The institutions that operate with the Eurosystem may, on their own initiative, use two types of standing facilities:
   - **The marginal lending facility.** It enables institutions to obtain overnight liquidity from the national central banks against collateral. Apart from the requirement to present adequate collateral, there are usually no credit limits or other restrictions placed on institutions to access this facility. The marginal credit facility interest rate normally provides the ceiling for the overnight market interest rate.
   - **The deposit facility.** Institutions may place overnight deposits with the national central banks. There are normally no limits or other restrictions placed on institutions' access to this facility. The deposit facility's interest rate normally provides the floor for the overnight market interest rate.

3. **Maintenance of minimum reserves.** This system is applicable to credit institutions in the Eurozone. The purpose of minimum reserves is to stabilise money market interest rates and create (or enlarge) the structural liquidity deficit. Their main characteristics are as follows:
   - They are determined according to some of their balance sheet items.
   - They are determined based on the average level of daily reserves over a maintenance period of one month.
   - The interest rates applied to reserves are those of the Eurosystem's main financing operations.

Banking Union process in the UE

The Banking Union process is a response to the banking and financial fragmentation within the EU, which is not compatible with a monetary union

In response to the financial crisis that emerged in 2008, the European Commission pursued a number of initiatives to create a safer and sounder financial sector for the single market. These initiatives, which include stronger prudential requirements for banks, improved depositor protection and rules for managing failing banks, form a single rulebook for all financial actors in the 28 Member States of the European Union. The single rule book is the foundation on which the Banking Union sits.

Such fragmentation has become evident looking at the following:

- Interbank lending in the Eurozone, which had increased since the Euro was launched, began to decrease since 2007.
- ECB's monetary policy measures were not adequately reflected in the real economy, specially in certain countries. Since 2010, interest rates on lending to families and businesses dropped in some countries but rose in the periphery (Greece, Portugal, Ireland, Italy and Spain).
- The connection between sovereign risk and banking risk has demonstrated its procyclical nature, causing situations where damage to the financial system has far exceeded a country's fiscal capacity, e.g. Ireland.

Banking Union process in the UE

As the financial crisis evolved and turned into the Eurozone debt crisis, it became clear that, for those countries which shared the euro and were even more interdependent, a deeper integration of the banking system was needed. That's why, on the basis of the European Commission roadmap for the creation of the Banking Union, the EU institutions agreed to establish a **Single Supervisory Mechanism** and a **Single Resolution Mechanism** for banks. Banking Union applies to countries in the euro-area. Non-euro-area countries can also join. As a further step to a fully-fledged Banking Union, in November 2015, the Commission put forward a proposal for a European Deposit Insurance Scheme (EDIS), which would provide a stronger and more uniform degree of insurance cover for all retail depositors in the banking union.

1) The **Single Supervisory Mechanism (SSM)**, based in Frankfurt.
   - From November 2014 onwards, the ECB is the supervisor of around 130 sizeable banks (those with assets exceeding Euro 30 billion), replacing the national central banks.
   - Non-significant banks (some 6,000) will continue to be supervised by the national central banks
   - Before the SSM became effective in 2014, the 130 banks placed under the direct supervision of the ECB had their balance sheets subjected to a comprehensive assessment.
2) The **Single Resolution Mechanism (SRM)**
   - A common architecture for restructuring troubled and non-viable banks which will fully come into force on 1 January 2016.
   - All participating banks must draw up a comprehensive recovery plan, which must be examined and approved by the supervisor.
   - The SRM aims to stop the perverse link between banking and sovereign risks and limit the impact of bank bail-outs on the tax payer, forcing bank creditors to take on a significant part of the losses.
3) The **Single Rulebook**. One single regulation as regards capital requirements and bank insolvency procedures to be implemented throughout all member states.

Thanks