

## Module 1: Interest Rates

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## Module 1: Information

### Module 1 Overview Lecture



Hello and welcome, I hope you're doing well from wherever it is you're joining us. This is a course about central banks, monetary policy, and the macro economy. We will discuss how monetary policy is implemented and how choices made by the central bank are eventually transmitted to the macro economy. You will gain a deeper appreciation of the goals of monetary policy. We're going to start with the nuts and bolts of monetary policy implementations. You may have heard statements from the Central Bank such as, we are raising the interest rate by 25 basis points, or we are expanding our asset purchase program to put downwards pressure on long term interest rates. But what does it actually involve in practice? How does the central bank implement this policy? Which interest rates are affected and why?



## Module overview

- Financial markets
- Financial instruments
- Toolkit for understanding monetary policy

Monetary policy implementation is a complex topic that involves several different financial markets and financial instruments. This module provides the necessary background and explains exactly which interests rates are targeted by monetary policy. A word of warning, since monetary policy is only discussed in the next module, the videos in this module may feel a little disjointed and you may wonder how these videos relate to each other.



## Short-term funding markets

- Federal funds market
- Repo market
- Federal Reserve targets these overnight interest rates

Let me give you an overview how the videos in this module fit into the bigger picture. The first two videos introduce two short term funding markets, the market for federal funds and the repo market. These are important short term funding markets. We sometimes call them cash markets or money markets. This is where financial institutions come to borrow and lend. These are overnight money markets and are the main targets of monetary policy. You may already know that the Federal Reserve targets the interest rate in the federal funds markets, the federal funds rate, by announcing a target range for this interest rate. The repo market is an alternative to the federal funds market. Hence the Federal Reserve also targets the interest rate in the repo market to ensure that all overnight interest rates are consistent with monetary policy goals. The next video compares another overnight interest rate, the London Interbank Offered Rate, with the repo market interest rate as these interest rates are the benchmark for loans to firms.



## Government securities

- Central banks buy and sell these securities
- Treasury rates tell us about:
  - Risk-free rate
  - Inflation expectations
  - Expectations about growth

We then examine three key financial instruments that are central to the implementation and transmission of monetary policy. First, we look at government securities. Central banks buy and sell government securities to implement monetary policy, so understanding what they are and how they work is crucial. Since the US government securities have no default risk, we can also look at the components of the interest rates. For instance, how much of the interest rate reflects inflation. Since interest rates capture inflation and expectations about the future, we can compare the interest rates on shorter and longer maturity government securities to help us understand market expectations of future economic developments. We call this the term structure of interest rates. The term structure of interest rates is closely watched by central banks, investment banks, and financial analysts because it reflects the market expectations about the future developments of the economy.



## Other key concepts

- Money market mutual funds
  - Central banks interact with these funds
- Securitization (esp. MBS)
  - Central banks buy and sell these securities

We then consider money market mutual funds. Money funds are the largest overnight lenders of cash in the repo market. After the 2008 financial crisis, the Federal Reserve has started to conduct monetary policy with these funds as you will see later in this course. Finally, we consider securitization. Securitization has increased credit supply. Pools of securitized mortgages, also known as mortgage-backed securities or MBS are especially important. Since monetary policy affects the economy by reducing or increasing the supply of credit and the Federal Reserve can purchase certain MBS, securitization markets are an important factor in monetary policy considerations. In sum, all of the markets and instruments discussed in this first module are directly related to monetary policy and its implementation. Each video provides a small piece of the larger picture that will become clearer in the next module. Please try not to get frustrated if you have a hard time placing each video in the bigger picture. Keep in mind that these videos provide the background for understanding monetary policy and its implementation. You can always come back to these videos later when we discuss specific monetary policy tools that targets the markets or instruments or when we discuss financial crisis if you need to refresh your understanding of a particular concept.

## Lesson 1-1: Short-term Funding Markets

### Lesson 1-1.1: The Market for Federal Funds

## Learning Objectives

- Federal funds market
- Reserves at the Federal Reserve
- Federal funds: lend out excess reserves

Hello and welcome to this lecture on the federal funds market. I hope you're doing well from wherever it is you're joining us. In this class, we will discuss the background and workings of the federal funds market and why this market is a crucial overnight lending market for banks. First, we will examine why banks hold reserves at the Federal Reserve and distinguish between required reserves and excess reserves. Second, we will study the federal funds market, the market in which banks borrow and lend excess reserves from and to each other. To understand why banks borrow and lend in the federal funds market, we need to have a closer look at what reserves are and why banks hold reserves at the Federal Reserve.

## Banks

- Bank borrow short-term
- And lend long-term
- Reserves (cash) to meet liquidity demand

The business model of a bank is to take on-demand deposits and use these funds to make loans. Since deposits can be withdrawn at any time, the banks need to have a certain amount of cash that can be used to pay out depositors. The cash is held in an account at the Federal Reserve and is called reserves. How much reserves should a bank hold? This is a difficult question.

## Reserves

- Two types of reserves
- Required reserves
- 3% before March 2020
- 0% during Covid-19 pandemic

Banks are required by law to hold a certain amount of reserves at the Federal Reserve. This reserve requirement is set by the Federal Reserve at a level that the Federal Reserve deems necessary for banks to meet the cash needs. Before the COVID-19 pandemic, the reserve requirement were 3% of deposits. During the COVID-19 pandemic, this requirement was set to zero. But banks usually hold more reserves than what is required.

## Reserves

- Excess reserves
- Held to meet unexpected liquidity needs

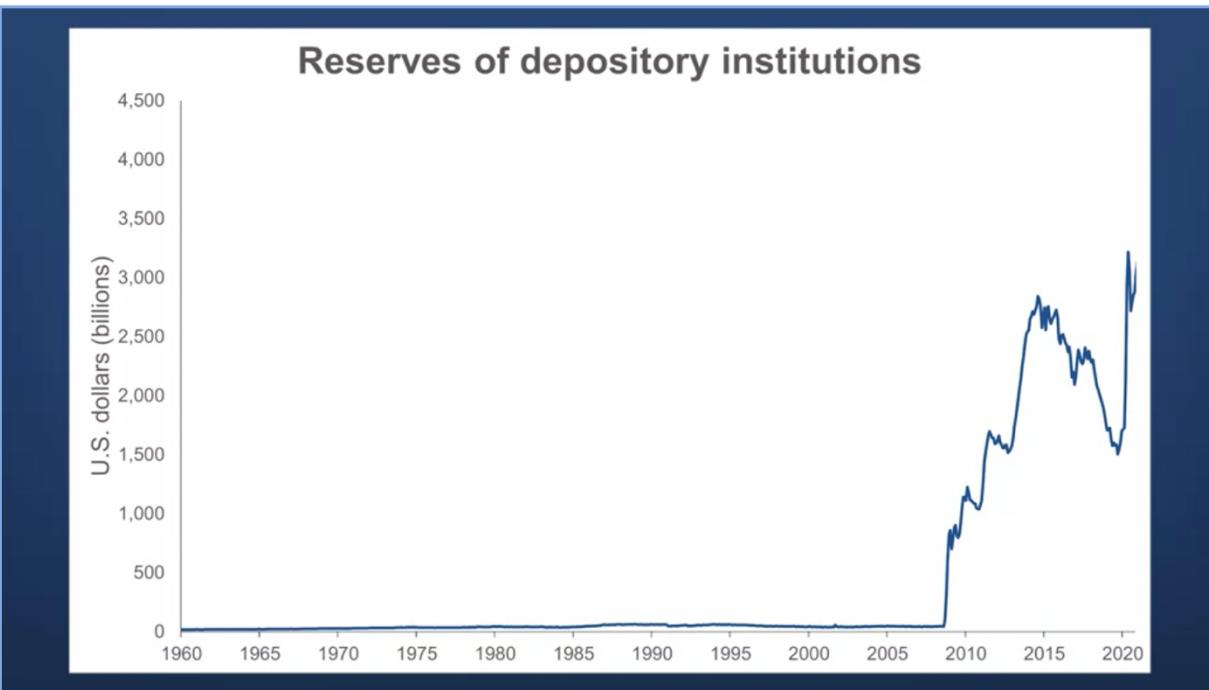
These reserves are called excess reserves. Banks hold excess reserves to meet unknown liquidity needs. For instance, during the onset of the COVID-19 crisis, US corporations drew down more than \$600 billion from their lines of credit. Banks could not plan for this unforeseeable event, but nevertheless, had to provide the \$600 billion on short notice. Hence, the need for access reserves.

## Reserves

- Key tradeoff
- Reserves vs loans
- Risk of needing to borrow overnight

How do banks choose their level of reserves? Banks can either hold cash in form of

reserves or invest in interest paying assets such as loans. But holding reserves pay no or very low interest. However, if a bank faces unforeseen shortfall in reserves, it has to borrow at the last minute in the federal funds market, which is costly. So banks face a trade-off between the liquidity needs and how much they could have earned if they had invested in interest paying assets. That is, the opportunity cost of holding excess reserves. Historically, reserves have been low.



As you can see, reserves barely increased between the 1960s and 2007. However, since the 2008 financial crisis, reserves have increased significantly. Reserves increased from about 40 billion in 2007 to almost three trillion in 2014 and further increased to 3.7 trillion in March 2021.

## Increase Post Financial Crisis

1. Low interest rates
2. Interest on reserves
3. Experience with large shocks

There are several reasons for this increase in reserves after the financial crisis. First, low interest rates have reduced the return on interests paying assets and therefore the opportunity cost of excess reserves. Second, the Federal Reserve started to pay interest on reserves, further reducing the cost of holding reserves. Third, banks had been exposed to a large cash demand during the financial crisis and decided to hold larger reserves.

## Unable to Cover Liquidity Needs

1. Federal funds market is a money market

Now, let's look at what happened when a bank does not have enough reserves to cover its liquidity needs. The bank can borrow reserves from another bank in the federal funds market. Recall that federal funds is just another term for reserves of a bank at the Federal Reserve. These loans in the federal funds market are usually overnight and do not require collateral. This means that this market requires a lot of confidence that banks will not fail. The federal funds market is also called a money market. That is it provides cash overnight. Why is it so important?

## Money Market

- Reallocation of liquidity
- Efficient use of funds

One important function of the federal funds market is to reallocate funds between banks. Suppose a bank has a lot of lending opportunities but little cash, so it cannot make the loans. Now suppose there is another bank with a lot of cash in form of reserve, but little lending opportunities. The federal funds market, the second bank, can lend the first bank federal funds. This allows the first bank to originate more loans.

## Money Market

- Interest rates across market are linked
- Federal funds rate determines cost of credit

The second important function is that interest rates for federal funds. The federal funds

rate influences all other interest rates. Recall that banks decide whether to originate loans or hold reserves based on the opportunity costs. If borrowing costs in the federal funds market is expensive, then the banks must receive a high interest rate on new loans. Otherwise, the bank can just hold reserves and lend them out in the federal funds market. In other words, the federal funds rate affects the funding costs of banks, which determine the cost of credit in the economy. We can generalize this specific example.

## Money Market

- Federal funds rate affects all assets
- Strong effect on shorter maturity assets

When the federal funds rate changes, then the tradeoff between reserves and all other asset changes. Other overnight cash markets will be affected immediately. Why borrow in a different market when the federal funds market has more attractive terms? The same logic holds for all other assets, not just loans. Consider an overnight loan and a one-month loan. You can roll over the overnight loan each business day of the month, replicating a monthly loan. The shorter the maturity is, the easier it is to replicate the loan with overnight loans. Therefore, interest rates on short maturity assets are closely linked to the federal funds rate.

## Federal Funds Rate

- Fed funds rate set by Federal Reserve
- Federal Reserve manages reserves

The federal funds rate is set by the Federal Reserve. To ensure that the federal funds rate does not diverge from the stated range, the Federal Reserve can increase reserves by buying assets from banks. Similarly, the Federal Reserve can decrease the reserves by selling assets to banks. We will discuss this in more detail when we talk about open market operations.

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## Summary

- Banks must hold required reserves
- Excess reserves meet unforeseen cash needs
- Fed funds market reallocates cash among banks
- Fed funds rate is a key benchmark

What have we learned in this lesson? First, banks hold excess reserves because they

are required to do so by law. Second, banks hold additional excess reserves to meet unforeseen liquidity needs. Third, the federal funds market reallocates cash across the banking system. Fourth, the interest rate for federal funds influences all other interest rates.

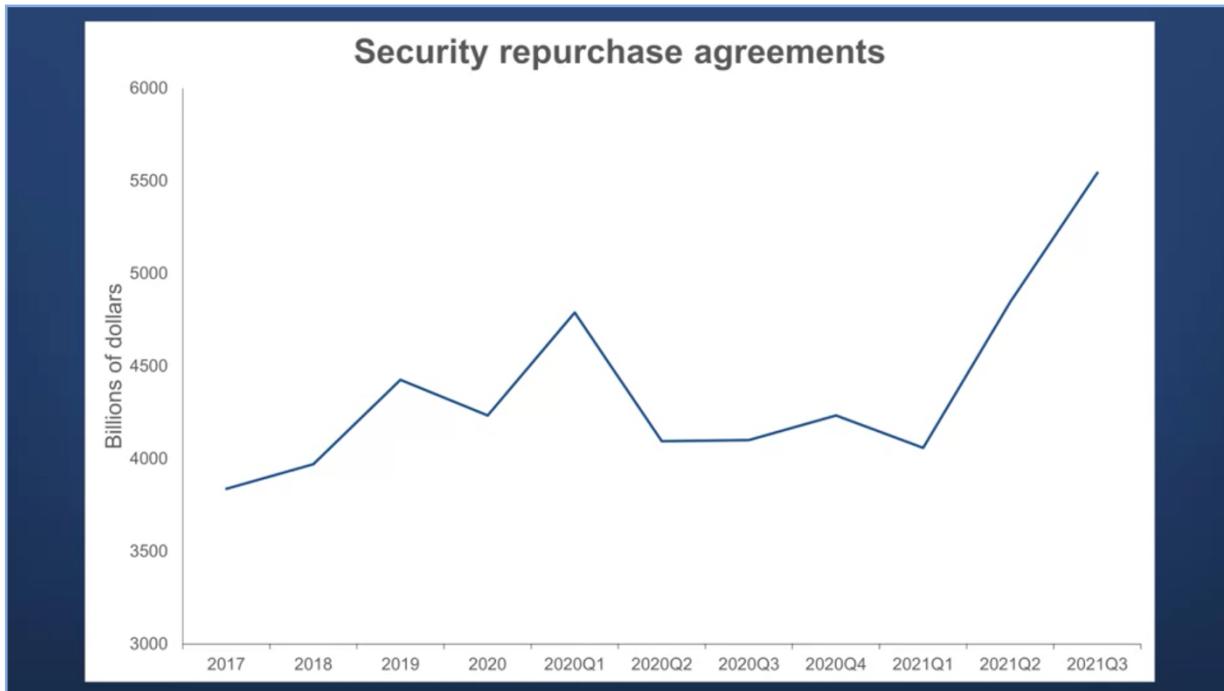
Lesson 1-1.2: The Repo Market

## Learning Objectives

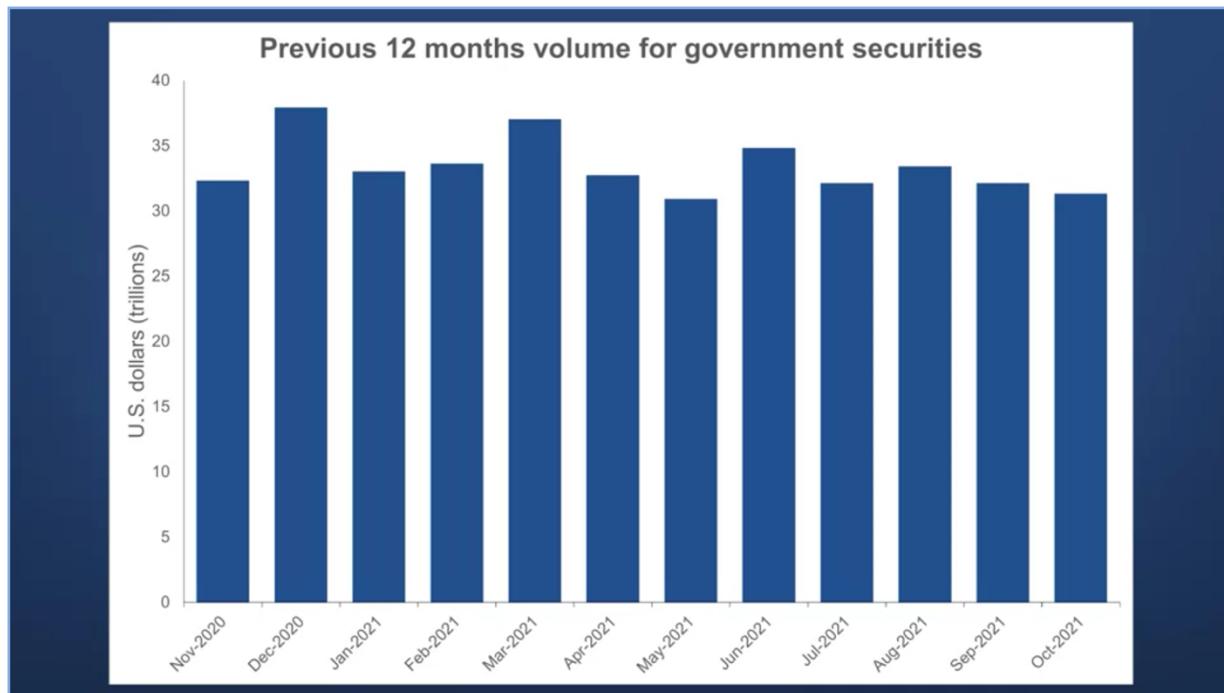
The repurchase agreement (repo) market

- Overnight lending market
- How do repos work?

Hello and welcome to this lecture on the repo market. I hope you're doing well from wherever it is you're joining us. In this class, we will discuss what a repurchase agreement or repo is and why the repo market is an important overnight lending market. Repos have become the most important type of overnight lending in the US economy. Data from the Federal Reserve's financial accounts of the United States show that the repo market started to gain traction in the early 1980s.

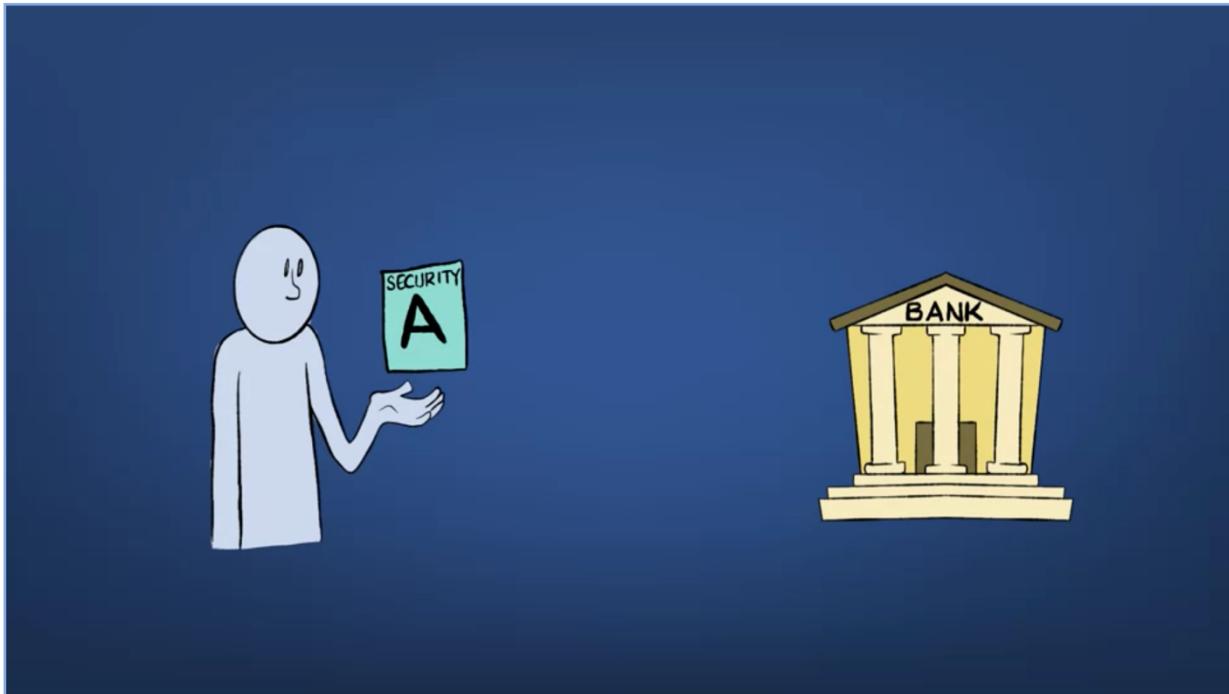


The course of the market accelerated through the early 2000s, peaking at about 4.8 trillion of repos outstanding right before the financial crisis. About four trillion of repos were outstanding in the fourth quarter of 2020.



Since repos are often overnight, the total volume created over a year is much larger. In

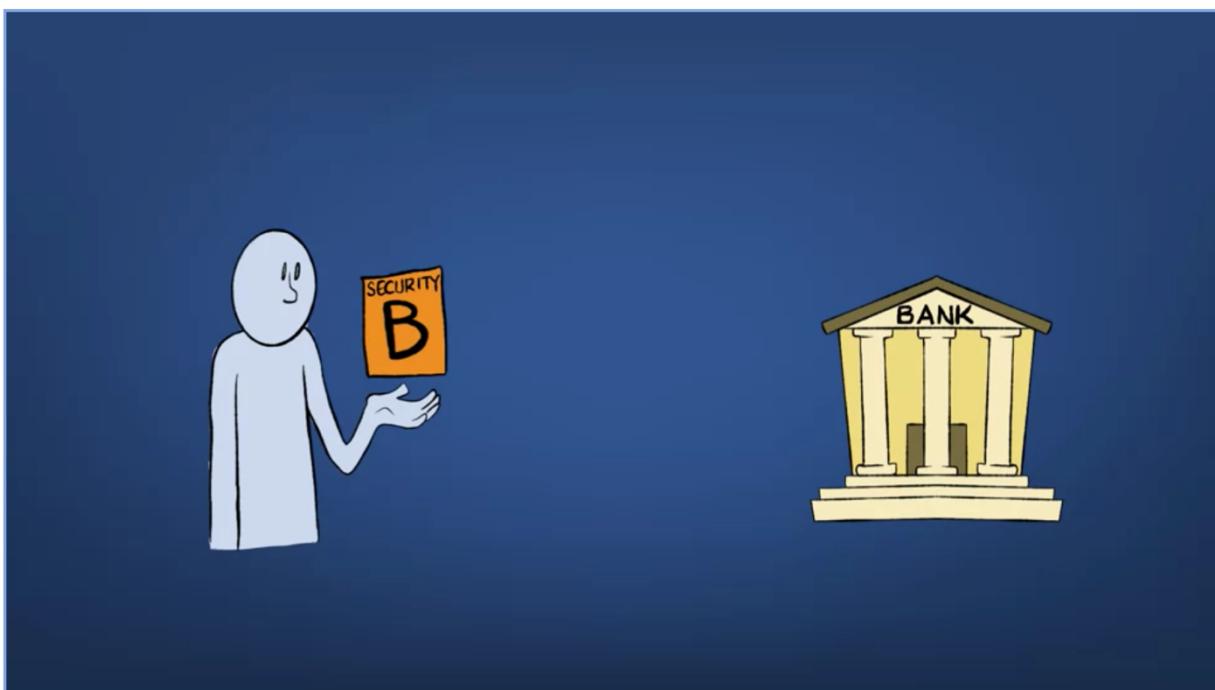
December 2020 alone, repo transactions worth almost 37 trillion dollars were conducted. How does a repurchase agreement work?



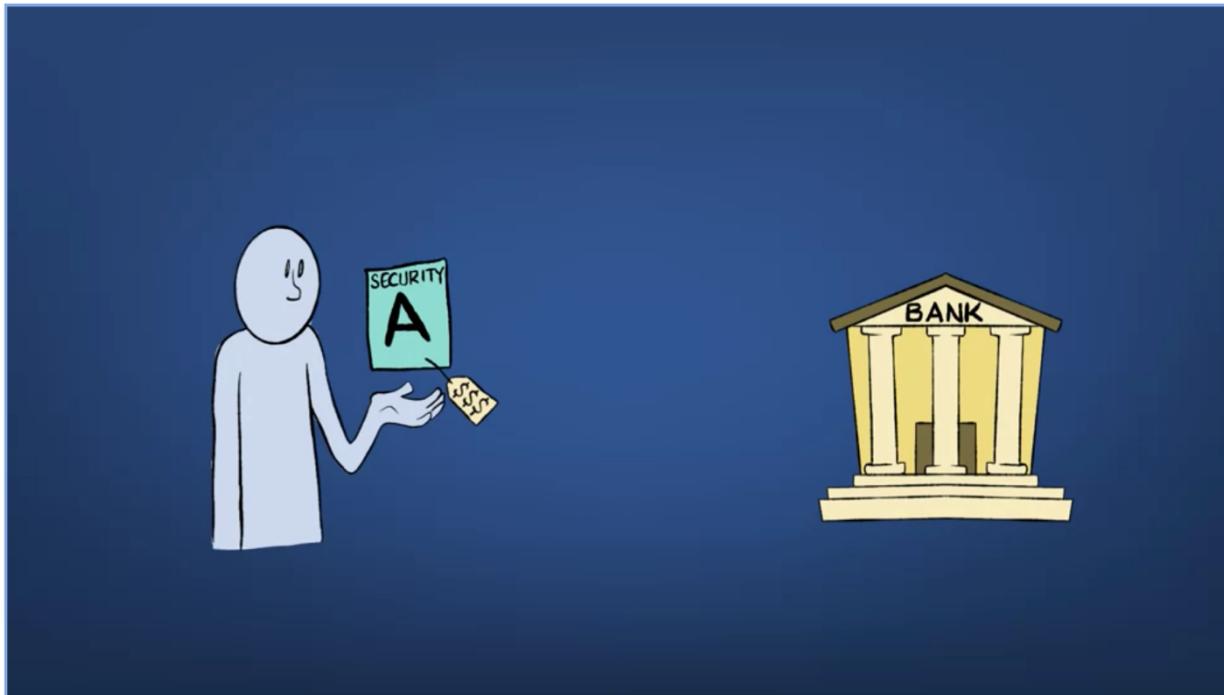
Suppose you have a treasury security and know that you'd get cash tomorrow, but you need cash today.



You can sell the treasury security today, pay your bill and purchase a new treasury security tomorrow.



However, buying and selling securities is costly. Alternatively, you can use the treasury security in a repo transaction.



In a repo transaction, you agree to sell the treasury security and buy it back tomorrow at a slightly higher price. This is called selling repo. By selling the repo, you're effectively borrowing and the other party the buyer is lending. The buyer becomes the owner of the security for the lengths of the transaction. In other words, a repo transaction is collateralized. The interest rate on this transaction can be calculated by the difference between the prices from initiation to repurchase.

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$$(\$200.02 - \$200) * 360 = \$7.20$$

Repurchase  
Price

Sale  
Price

Days

Annual  
Interest

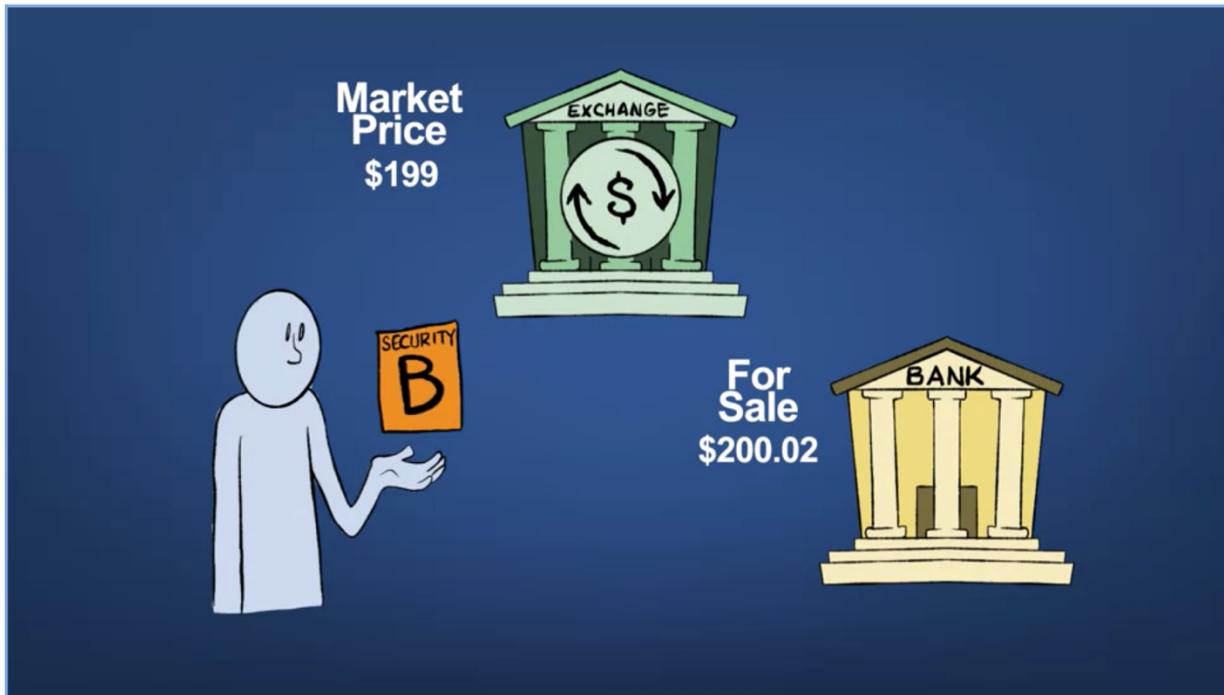
$$\$7.20 / \$200 = 3.6\%$$

Annual  
Interest

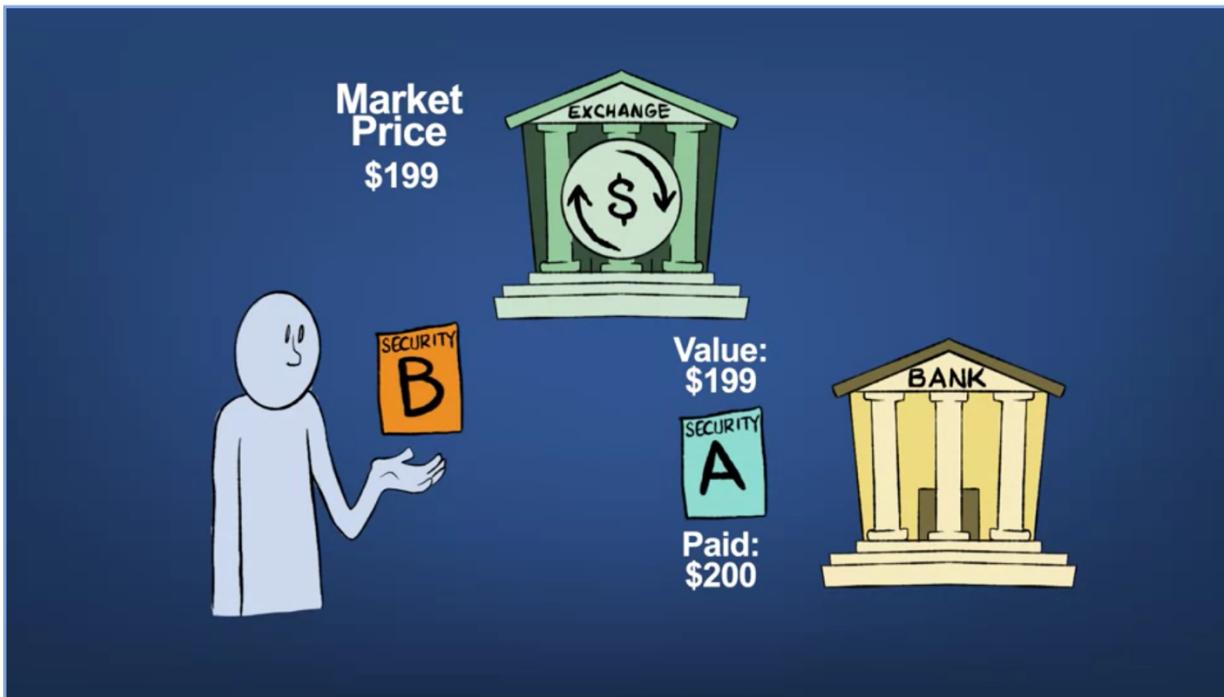
Sale  
Price

Annual  
Interest  
Rate

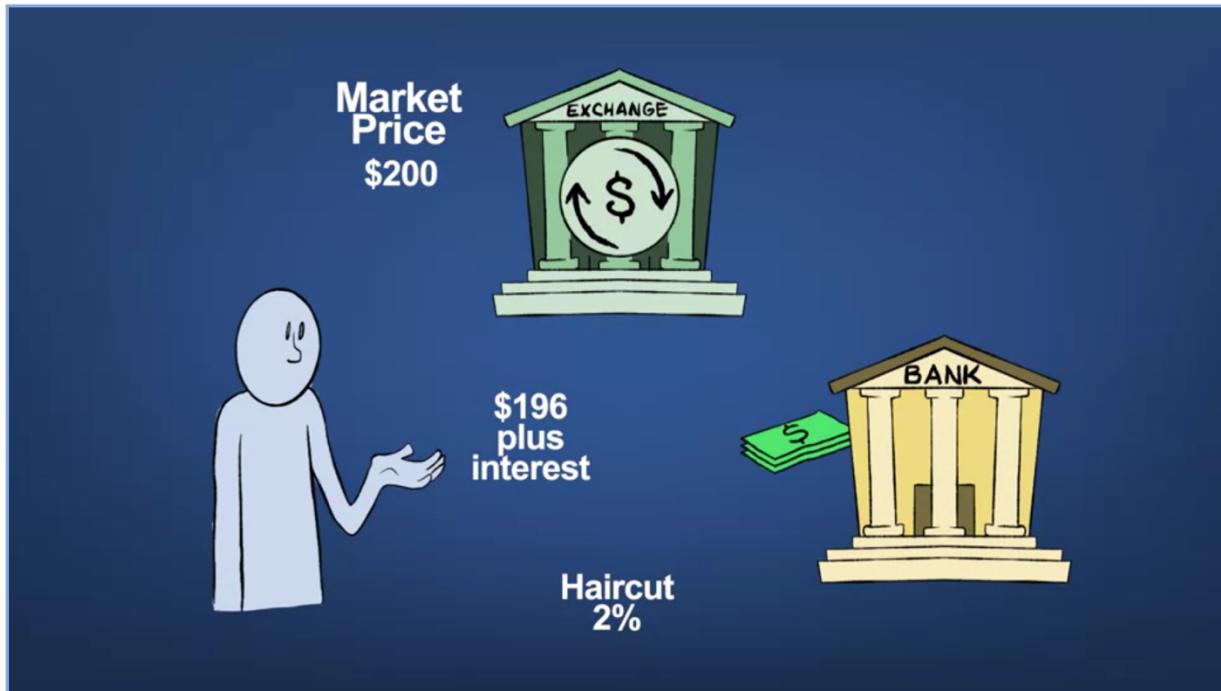
Here's an example. You sell a security with \$200 with the promise to repurchase the security for \$200.02 the next day. The annual interest paid can be calculated as follows. The repurchase price of \$200.02 minus the sales price of \$200 times 360 days, which is equal to \$7.20. The interest rate is the annual interest \$7.20 divided by the loan amount, the sales price of \$200, hence the interest rate is 3.6%. Since the lender, the buyer of the repo owns the security, she can sell the security if the seller, the borrower fails to repurchase the security. This means that the key risk in the repo market are changes in the price of the security.



Let's go back to our example. Now, the market price drops to \$199 the next day. You can either repurchase the securities at \$200.02 as promised or forgo with the securities and buy them on the market for \$199.



The buyers would have securities with \$199 but had lend \$200. To mitigate this risk, repo transactions usually have a haircut.



That is, the buyer will not pay the full amount on the security. In our example, let's say that the buyer imposes a haircut of 2%. The seller receives only \$196 for the securities that are worth \$200. Note that since the seller received only \$196, she only pays interest on \$196 and only has to repay \$196 plus interest. If in this case the price of the securities drops to \$199, the seller will still want to repurchase the securities.



The size of the haircut depends on three main factors. The first factor is the credit

quality of the underlying security. The lower the credit risk, the lower is the haircut. The second factor is the historic price volatility of the security. The less volatile the price is the lower is the haircut. The third factor are overall market conditions. The easier it is to sell the securities, the lower is the haircut. Indeed, most repos are significantly over collateralized, making them essentially risk-free for the repo buyers. While especially before the 2008 financial crisis many different securities have been used for repos, the most common securities in repo transactions are government bank securities, such as treasury securities.

## Repo Transaction

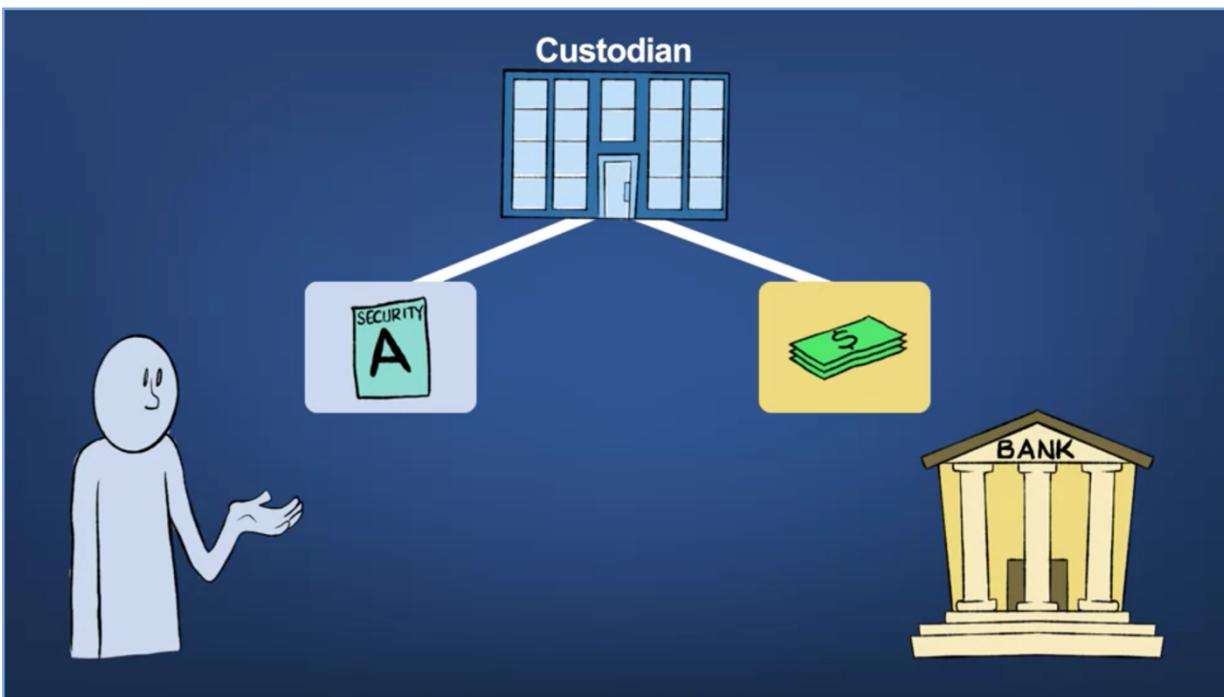
- Treasury securities bear little risk
- Haircuts for Treasury securities are low

Treasury securities have no credit risk. Treasury securities are not prone to price volatility and it is almost always easy and cheap to buy and sell treasury securities. Because government bank securities are considered risk-free, repo buyers are less picky about the specific type of government bank securities that is used in the repo transaction.

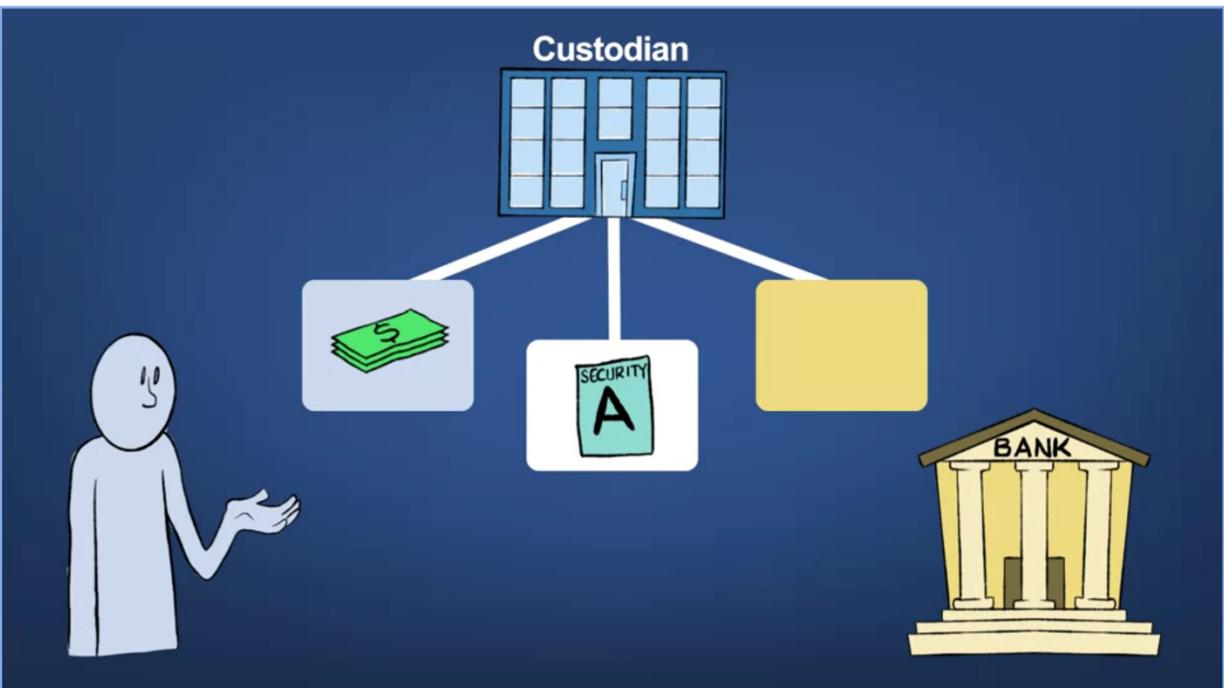
## Repo Transaction

- General collateral repo
- Any eligible government-backed security can be the collateral.
- Most common type of repo

Repo transactions that are agreed upon before the security is specified are called general collateral repos where the general collateral refers to all government bank securities that can be used in the transaction. General collateral repos have lower transaction costs because the interest rate is the same for all eligible collateral. The general collateral repo is the most common type of repo transaction. You may wonder how repo transactions are conducted if the buyer of the repo becomes the owner of the security. How does the seller deliver the security and how does she get it back?

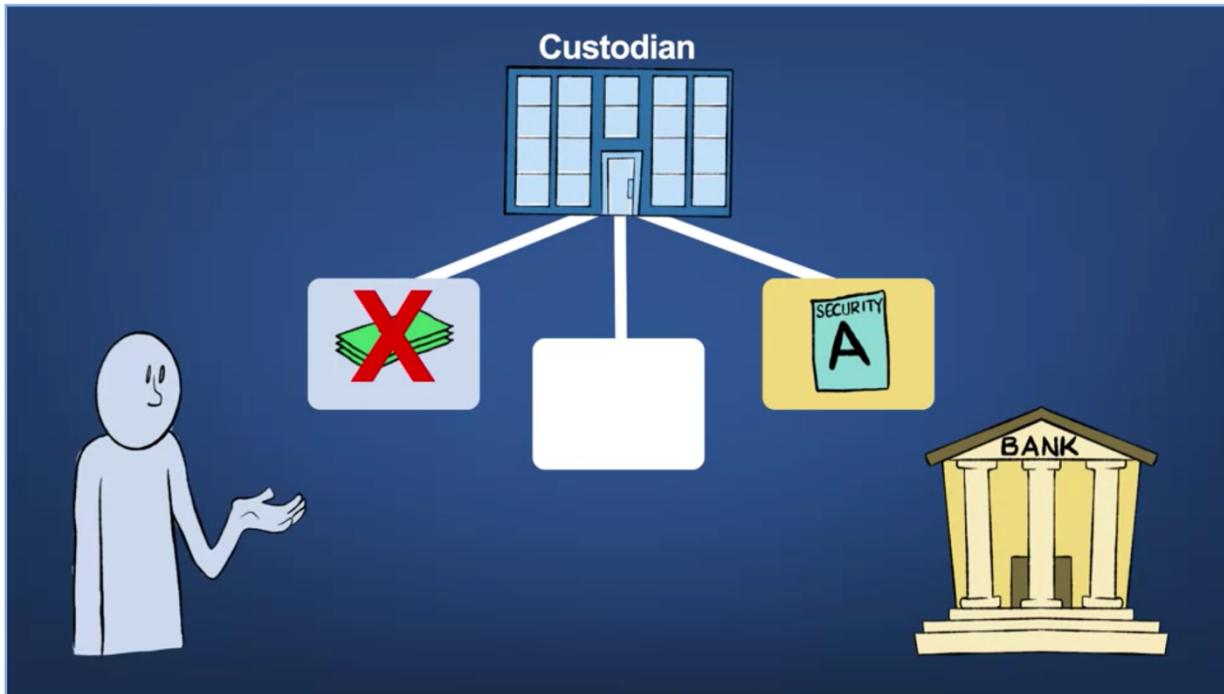


For overnight borrowing, this sounds very time-consuming. For this reason, most repo transaction involve a third party, a custodian. These transactions are referred to as tri-party repo. The buyers and sellers of repos have cash and securities accounts with the custodian.



In the transaction, the custodian moves the cash between accounts and puts the seller

security in a separate account. When the seller repays the buyer, the custodian moves the cash to the buyer's account and returns the security to the seller's account.

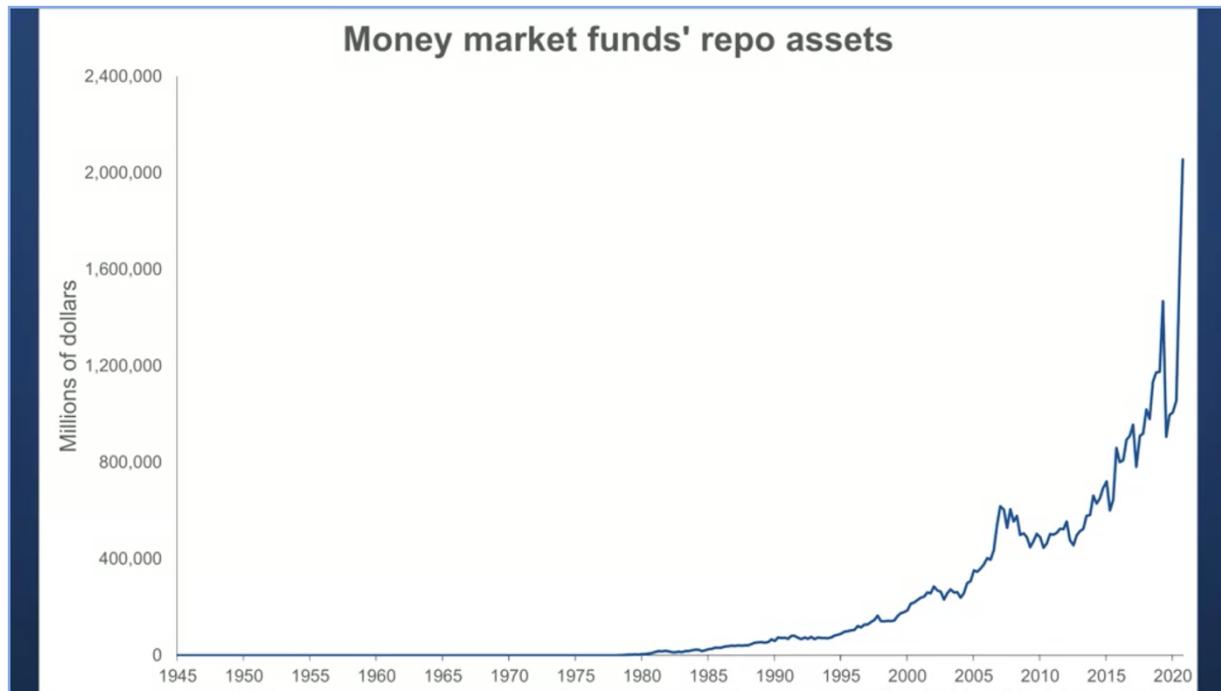


If the seller fails to repay, the security is transferred to the buyer's account. There is no need to physically deliver securities.

## Repo Market

- Repo is widely used, not just banks
- Money market mutual funds lend cash in the repo market

Why is the repo market so popular? The repo market is the largest cash market in which all type of financial institutions can participate. This is the main difference to another important overnight funding market; the federal funds market that can only be accessed by banks with reserves at the Federal Reserve. One of the largest purchasers of repos, that is lender of cash, are money market mutual funds.



Instead of buying and holding assets, over one trillion repos outstanding were bought by money market mutual funds at the end of 2019.

## 2008 Financial Crisis

- Collapse of Lehman tied to repo market
- Moving assets “off” balance sheet market
- Regulatory fix

The repo market came under scrutiny with the 2008 financial crisis because of Lehman's process use of the so-called 105 repo. In repo 105 refers to the fact that the assets were worth at least 105% of what Lehman was getting for them, meaning there was a

significant haircut on the value of the securities. Under accounting rules, a security in a repurchase transaction with a haircut is counted as a sale. With transactions at quarter end, Lehman process reduced the amount that it had borrowed temporarily moving assets off balance sheet and receiving cash for it. Regulatory reforms have since addressed this issue.

## Summary

- Repo market is key for short-term borrowing
- Utilized by banks and non-banks
- Collateral and haircuts reduce risk

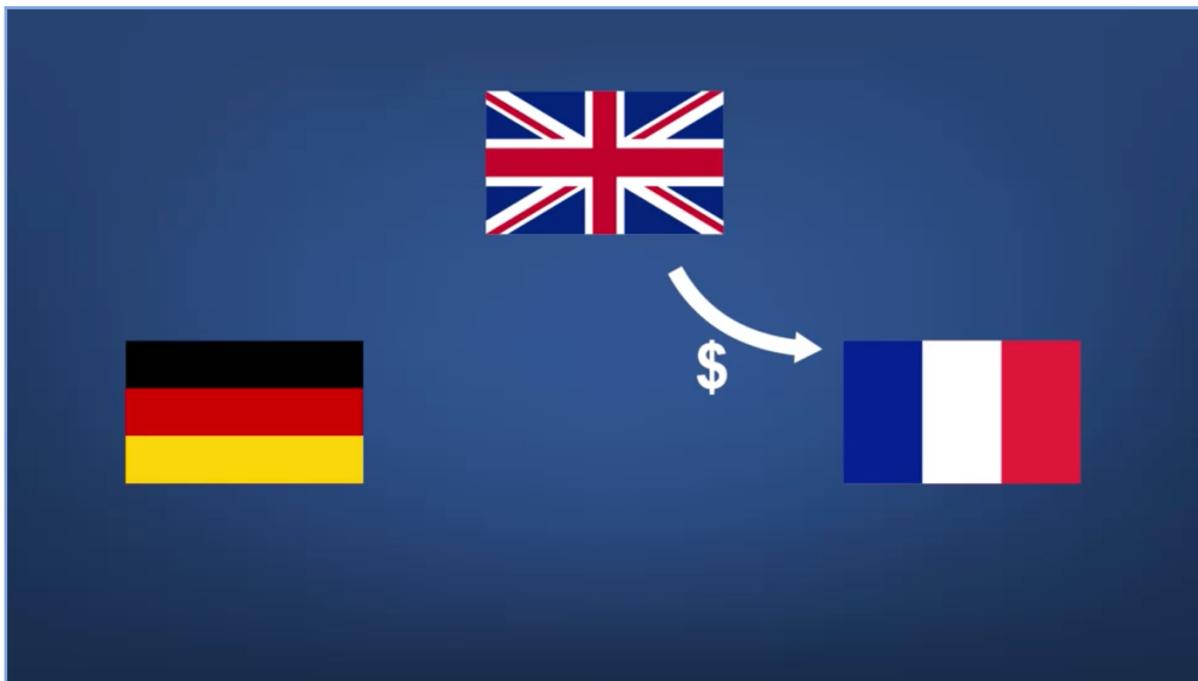
What have we learned in this lesson? First, the repo market is an important money market for all financial institutions and not just banks. Second, repos are a form of secured lending even so it is technically a sale but with the promise to repurchase. Third, haircuts reduce the risk of losses for the repo buyer.

Lesson 1-1.3: Short-term Interest Rates

## Learning Objectives

- Short-term interest rates
- London Interbank Offered Rate (LIBOR)
- Secured Overnight Financing Rate (SOFR)

In this class, we will discuss two crucial short-term interest rates that affect consumers and firms. We start with the London Interbank Market and the London Interbank Offered Rate LIBOR. We then look at an alternative interest rate, the Secured Overnight Financing Rate, SOFR and discuss via regulators favors which from LIBOR to SOFR as reference interest rates full loans to the real economy.



The London inter-bank money market is a market in which banks can borrow and lend amongst each other. In this markets, bank can borrow and lend in different currencies. Most loans are made in US dollars. Since the interbank market of US dollar loans is in Europe, they are also called Eurodollar loans and measure how much it costs to borrow US dollars abroad.

## LIBOR

- Uncollateralized
- Has counterparty risk
- Loan maturities up to 1 year

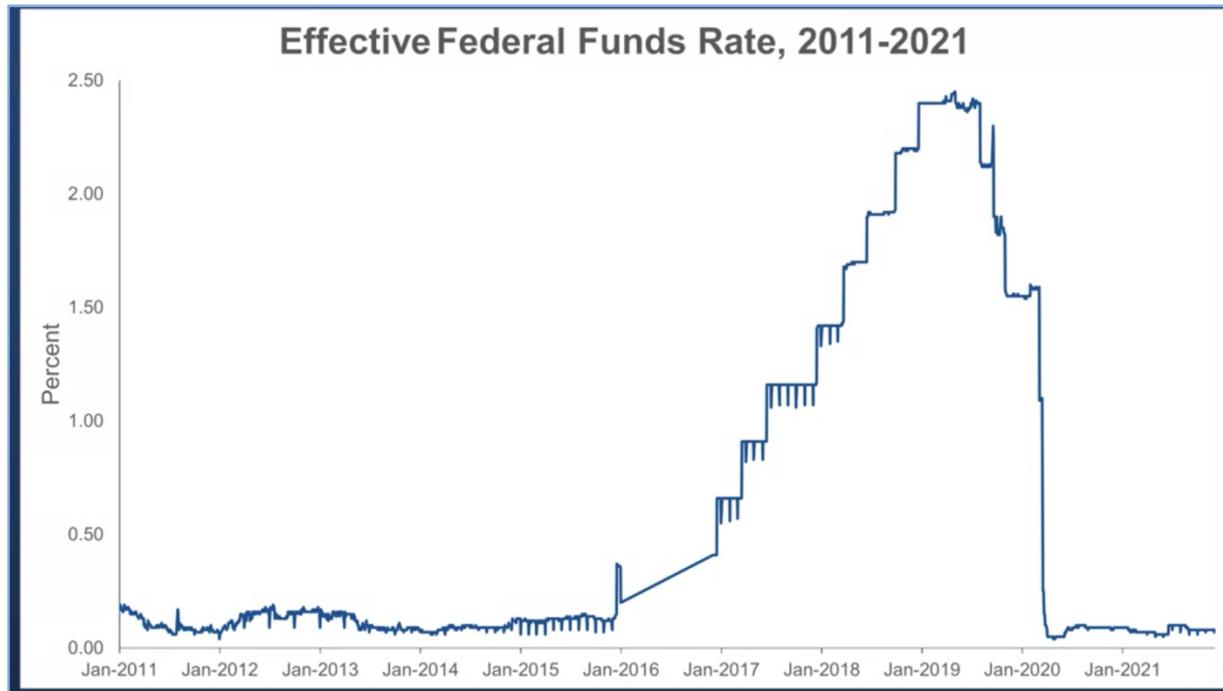
Loans in this market are unsecured. That is, no collateral is required. Because no

collateral is required for this inter-bank loans and they are subject to credit risk. That is the risk that a bank cannot repay the loan. Seven different loan maturities exist in this market. Overnight, one week, one month, two months, three months, six months, and 12 months.

## LIBOR

- Annualized interest rate
- Not transaction based
- Derived from survey of banks

The interest rates in the London inter-bank market. The London Interbank Offered Rate, or LIBOR is reported as an annualized average interest rate for loans in this market. Different from most other markets all transaction in this market are bilateral and each bank may charge a different interest rate. As a result, the average interest rate is calculated not from actual transactions, but from surveys. The ICE benchmark administrations pulls a panel of large high-volume banks which participate in the London wholesale money market and then calculates and publishes the mean interest rate for each maturity.



Let's have a look at the overnight LIBOR over the last 10 years. What does this pattern remind you of? The effective federal funds rate, which measures how much US banks pay for unsecured US dollar loans from other banks in the US. As you can see, over the last 10 years, the LIBOR, the price of unsecured US dollar loans among banks abroad, and the federal funds rate, the price of unsecured US dollar loans amongst US banks move together very closely. We discussed the details of the federal funds market in a separate lecture. To better understand this core movement, suppose the two interest rates differ significantly.

# LIBOR

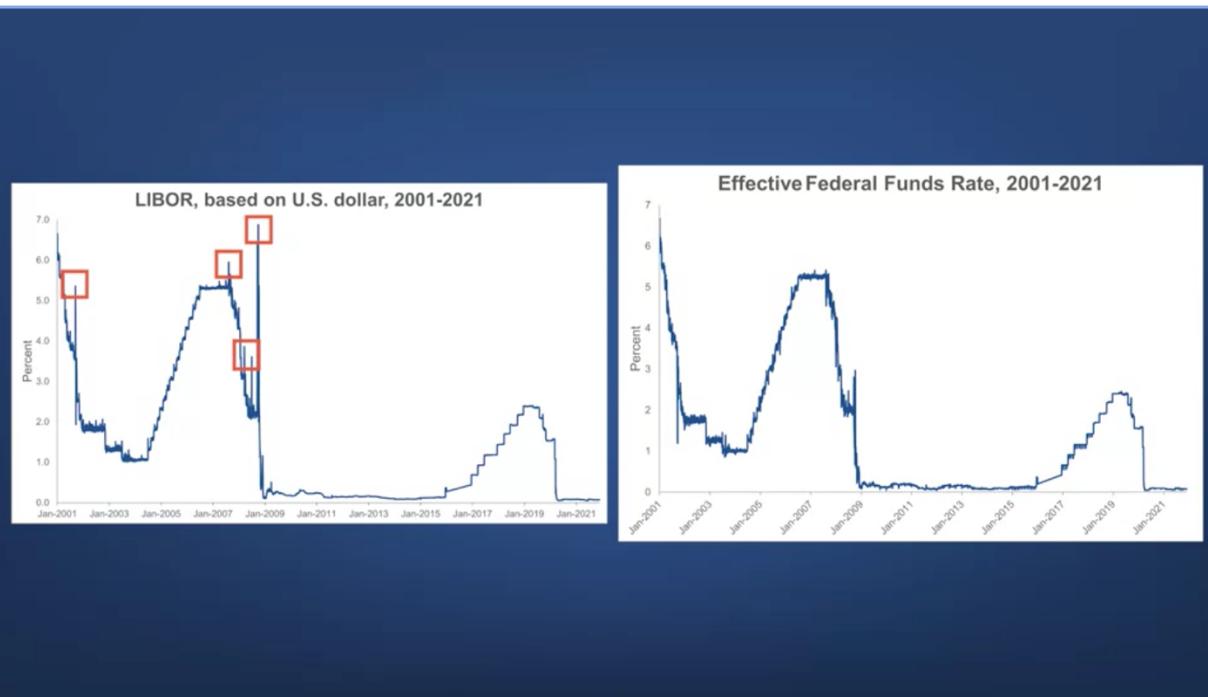
- Arbitrage between short-term funding markets
- Both the interest rates are nearly equal

In this case, banks could make money by borrowing US dollar in the market in which the interest rate is lower and lend out that money in the market with the higher interest rate. This basic arbitrage ensures that the LIBOR and the federal funds rate are roughly equal. They can, however, differ slightly due to transaction costs. Since the LIBOR measures the cost of US dollar funding for banks, it has become the reference rate for many other loans. If you look at interest rates on loans to corporations, you will often see that the interest rate is not fixed, but floating and tied to the LIBOR. That is, the LIBOR is the reference rate. A specific example might help.

“The committed lines of credit....  
maturing at various times  
between May 2020 and May 2024,  
carry interest rates generally  
ranging between LIBOR  
plus 10 basis points and LIBOR  
plus 75 basis points.”

***-2019 regulatory filing of Walmart***

The 2019 regulatory filing of Walmart states that the committed lines of credit maturing at various times between May 2020 and May 2024 carry interest rates generally ranging between LIBOR plus 10 basis points and LIBOR plus 75 basis points. In total, the LIBOR underpins over \$250 trillion in loans worldwide.



Now, let's look at the last 20 years. As you can see during the 2008 financial crisis, the

LIBOR spiked several times and did not always follow the federal funds rate. One reason is that lending in the London inter-bank market is unsecured and the health of several banks were in doubt driving up interest rates. In addition, after the financial crisis, reports alleged manipulations of the interest rate surveys, regulators find banks more than \$9 billion for manipulating the LIBOR.

## Secured Overnight Financing Rate (SOFR)

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DATE	RATE (%)	1ST PERCENTILE (%)	25TH PERCENTILE (%)	75TH PERCENTILE (%)	99TH PERCENTILE (%)	VOLUME (\$BILLIONS)
10/28	0.05	-0.03	0.02	0.05	0.15	871
10/27	0.05	-0.03	0.02	0.05	0.15	865
10/26	0.05	-0.03	0.02	0.05	0.15	877
10/25	0.04	-0.03	0.02	0.05	0.15	858
10/22	0.05	-0.03	0.02	0.05	0.15	863
10/21	0.03	-0.05	0.00	0.05	0.15	879
10/20	0.03	-0.04	0.00	0.05	0.15	857
10/19	0.03	-0.03	0.01	0.05	0.15	875
10/18	0.05	-0.02	0.01	0.05	0.15	879
10/15	0.05	-0.01	0.02	0.05	0.15	889
10/14	0.05	-0.03	0.03	0.05	0.15	873
10/13	0.05	-0.01	0.03	0.05	0.15	907
10/12	0.05	-0.01	0.03	0.05	0.15	925
10/08	0.05	0.00	0.04	0.05	0.15	887
10/07	0.05	0.00	0.04	0.05	0.15	911
10/06	0.05	0.00	0.04	0.05	0.15	902
10/05	0.05	0.00	0.04	0.05	0.15	916
10/04	0.05	0.00	0.04	0.05	0.15	925
10/01	0.05	0.00	0.04	0.05	0.15	928
09/30	0.05	-0.01	0.03	0.05	0.15	939
09/29	0.05	-0.02	0.03	0.05	0.15	872
09/28	0.05	0.00	0.04	0.05	0.15	883
09/27	0.05	0.00	0.04	0.05	0.15	927
09/24	0.05	0.00	0.04	0.05	0.15	896
09/23	0.05	0.00	0.03	0.05	0.15	878

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To prevent further manipulation, regulators also mandated that starting in 2022, the Secured Overnight Financing Rate, SOFR, as published by the Federal Reserve Bank of New York, replaces LIBOR as reference rate for loans. The SOFR rate is the interest rate on overnight repurchase agreement with treasury collateral. The repurchase agreement market is a key funding market for banks, which we discussed in detail in a separate lecture. What are the differences? The SOFR is based on a transaction that is free of credit risk because it is collateralized.

Underlying Market	SOFR (Treasury secured)	LIBOR (Interbank loans)
Collateral	US Treasury	None
Market Size (daily)	\$1 tr	<\$500 bn
Maturity	Overnight	7 different rates

In contrast, the LIBOR incorporates some credit risk as it is an interest rate on unsecured loans. The SOFR is based on a market worth about 1 trillion of daily transactions, while the LIBOR is based on less than half of this volume. However, the SOFR is only an overnight lending rate while the LIBOR is calculated for seven different maturities. This has made it difficult to adjust loan contracts that had different maturity as reference rate. In response, the Federal Reserve Bank of New York has developed SOFR indices for longer maturities and publishes them daily.

## Summary

- LIBOR and SOFR are interest rates
- Short-term borrowing rates for banks
- Unsecured (LIBOR) vs. secured (SOFR)
- Transition to SOFR as reference rate

What have we learned in this lecture? First, LIBOR and SOFR, are interest rates that represent funding costs for banks for unsecured and collateralized loans, respectively. Second, LIBOR is subject to credit risk and was manipulated in the past. Third, regulators mandated that SOFR, which is a risk-free interest rate, replaces LIBOR as reference rate.

## Lesson 1-2: Government Securities and Long-term Interest Rates

### [Lesson 1-2.1: Nominal and Real Interest Rates](#)

## Learning Objectives

- Nominal vs real interest rates
- Fisher Effect
- Treasury Inflation Protected Securities TIPS

Hello and welcome to this lecture on nominal and real interest rates. I hope you're doing well from wherever it is you're joining us. In this class, we will discuss the difference between nominal and real interest rates. We will examine the Fisher Effect that links the two interest rates and last we will have a look at Treasury Inflation Protected Securities or TIPS, one of the few securities paying a specific real interest rate. Let's start with the difference between a nominal return and a real return on an investment.

\$100      10%  
Annual  
Interest  
↑  
Nominal  
Interest  
Rate

A diagram on a blue background showing a flow from initial capital to interest rate. On the left, '\$100' is displayed in large white font. To its right, '10%' is followed by 'Annual Interest' in smaller white font. A curved arrow points upwards from the word 'Interest' towards the text 'Nominal Interest Rate' on the right.

Suppose you have \$100 in a saving account that pays 10% interest annually. This 10% interest rate that the bank gives you is the nominal interest rate.

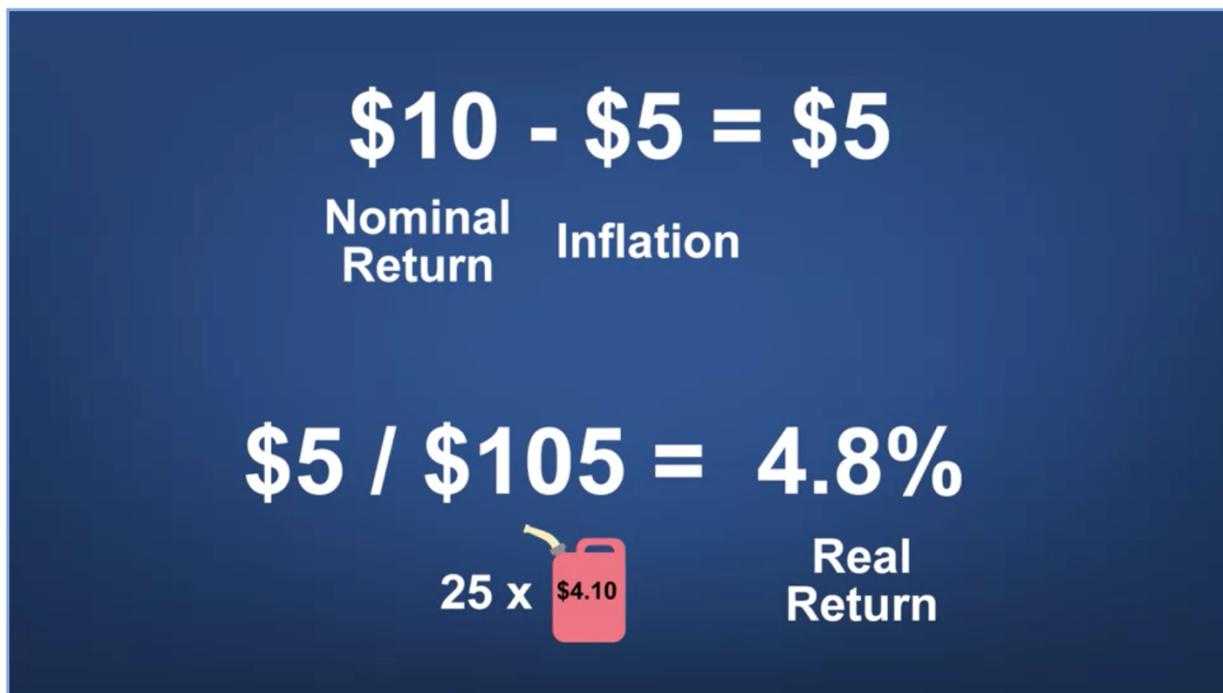
\$110      10%  
Annual  
Interest  
↑  
Nominal  
Interest  
Rate

A diagram on a blue background showing a flow from initial capital to interest rate and final value. On the left, '\$110' is displayed in large white font. To its right, '10%' is followed by 'Annual Interest' in smaller white font. A curved arrow points upwards from the word 'Interest' towards the text 'Nominal Interest Rate' on the right.

After one year your nominal return is \$10 and to have \$110 in your account. But how much is this worth in terms of goods you can purchase next year?



Consider the following example, this year you can buy gas for your car at \$4 a gallon. That is your 100 dollars are worth 25 gallons of gas today. Now assume inflation, the pace at which prices increased throughout the economy is 5%. This means that next year the price of gas is \$4.10 a gallon, and 25 gallons of gas will cost you \$105. This means that after buying 25 gallons you have \$5 left to spend on gas at a price of \$4.10.



The real return, therefore is the nominal return of \$10 minus inflation of \$5 is equal to

\$5. However, this is \$5 next year, which we have to divide by the cost of goods tomorrow. In our example this is the cost of 25 gallons at \$4.10 a gallon or \$105. The real return then is about 4.8%.

**Nominal Return: \$10**  
**Inflation: \$5**  
**Real Return: 4.8%**

This sample example shows that nominal and real interest rates are linked by inflation.

$$(1 + i) = (1 + r)(1 + \pi)$$

i = Nominal interest rate

r = Real interest rate

$\pi$  = inflation

Generalizing our example, we have the cross nominal return 1 plus nominal interest rate

i has to be equal to the cross real return 1 plus the real interest rates r times 1 plus the rate of inflation  $\pi$ .

$$r = i - \pi$$

i = Nominal interest rate

r = Real interest rate

$\pi$  = inflation

**I**

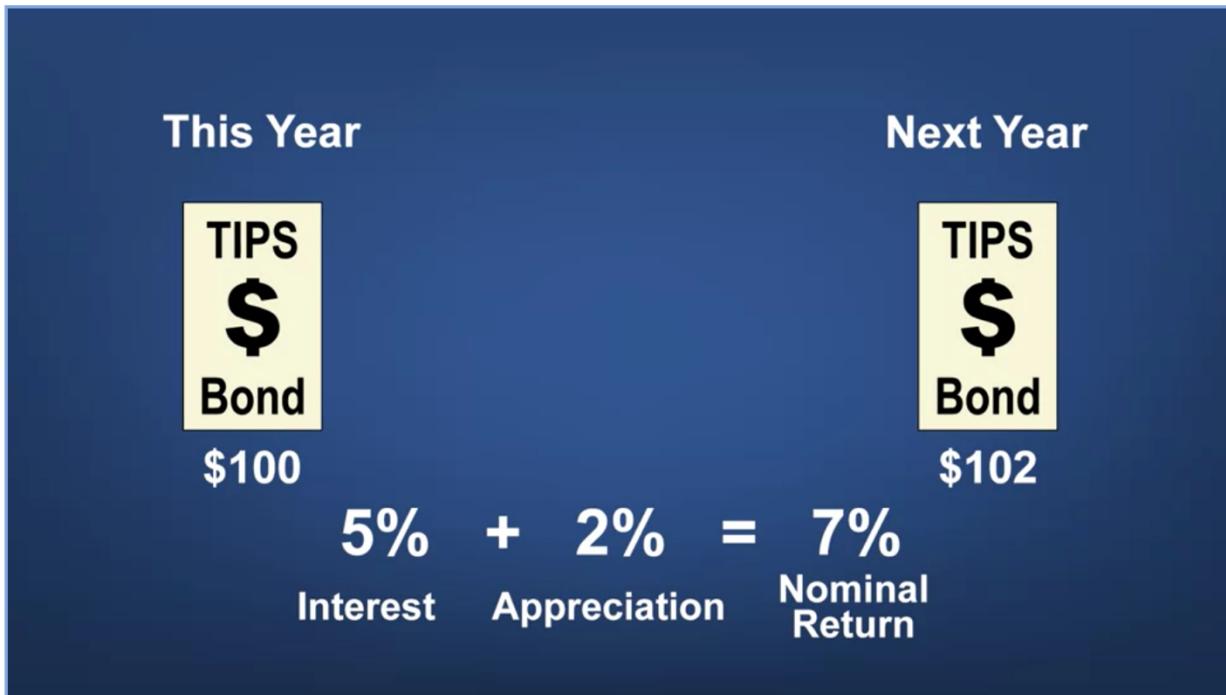
We can approximate this formula with the real interest r is roughly equal to nominal interest rate i minus inflation  $\pi$ . This relationship is called the Fisher Effect named after the American economist Irving Fisher, who first stated this formula.

## Treasury Inflation Protected Securities (TIPS)

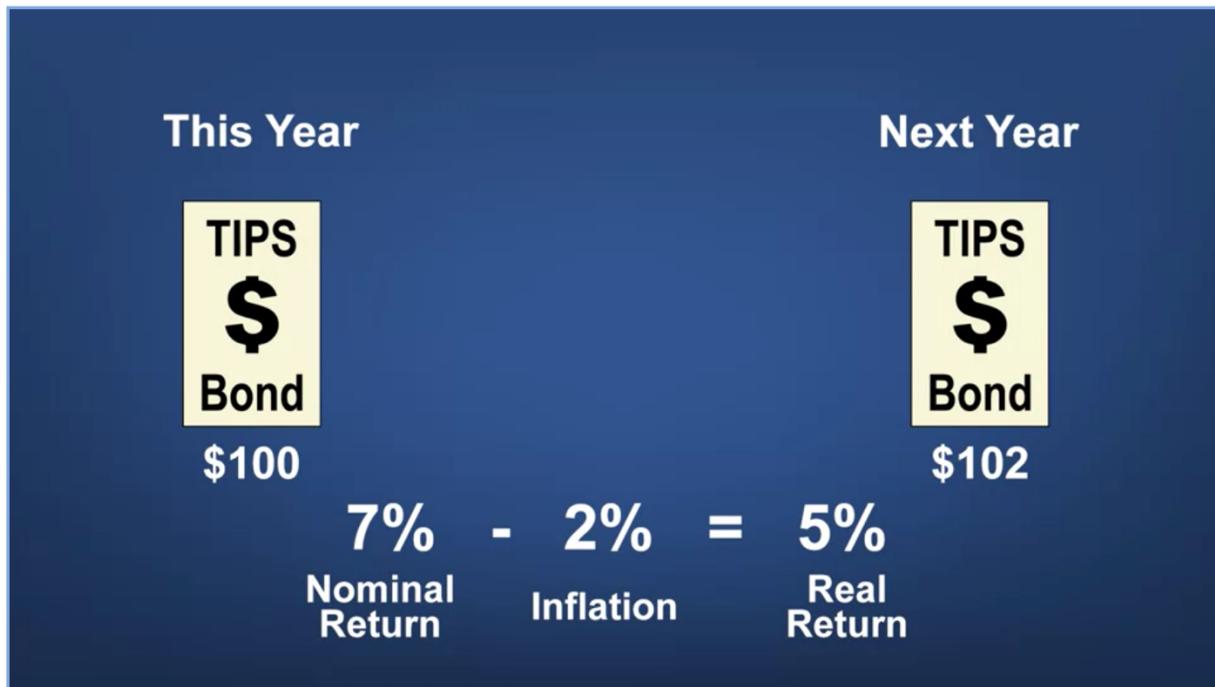
- Principal increases at rate of inflation

One specific investment takes inflation explicitly into account. Treasury Inflation

Protected Securities or TIPS, the principal value of TIPS rises at the same rate as inflation measured by the consumer price index or CPI. In other words, the interest rate paid on tips bonds is a real interest rate.



Let's look at a specific example, suppose you buy a TIPS bond that pays 5% interest for \$100 the principle, inflation is 2%. The next year the principal on the TIPS bond will be \$102, so that the total nominal return is 5% interest plus 2% principal appreciation or 7%.

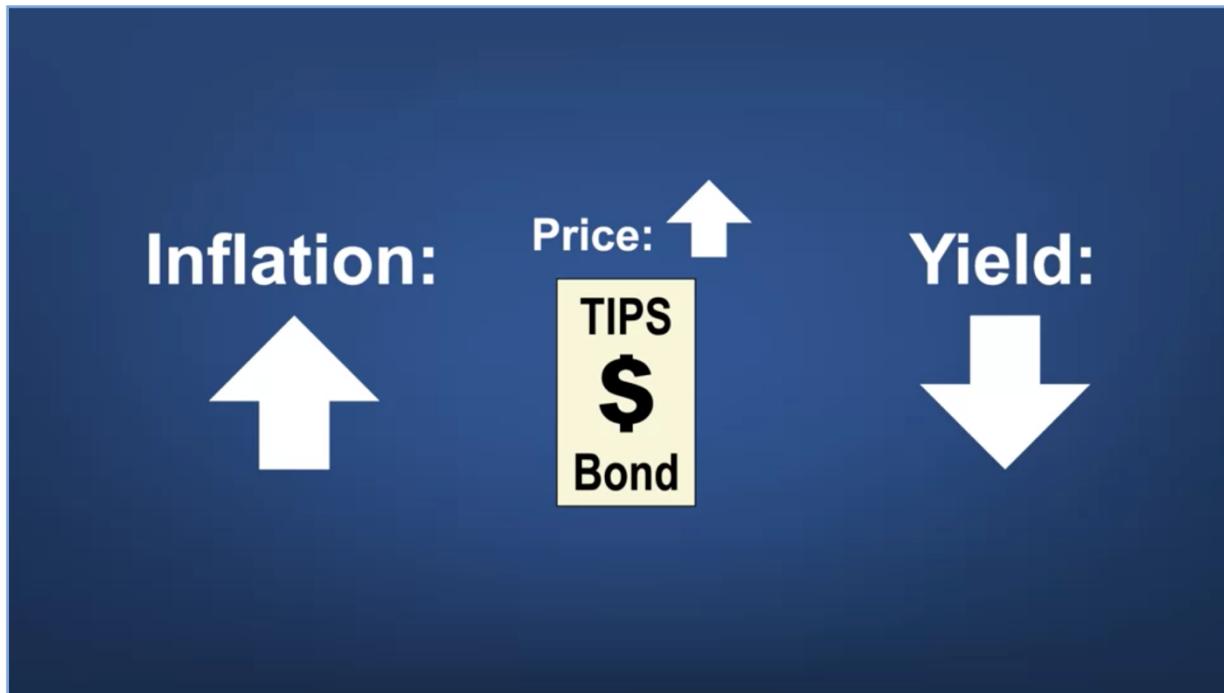


We call this the Fisher formula. The nominal return is the real return plus inflation, the 2% principal appreciation offsets the 2% inflation and the rate of return is 5%.

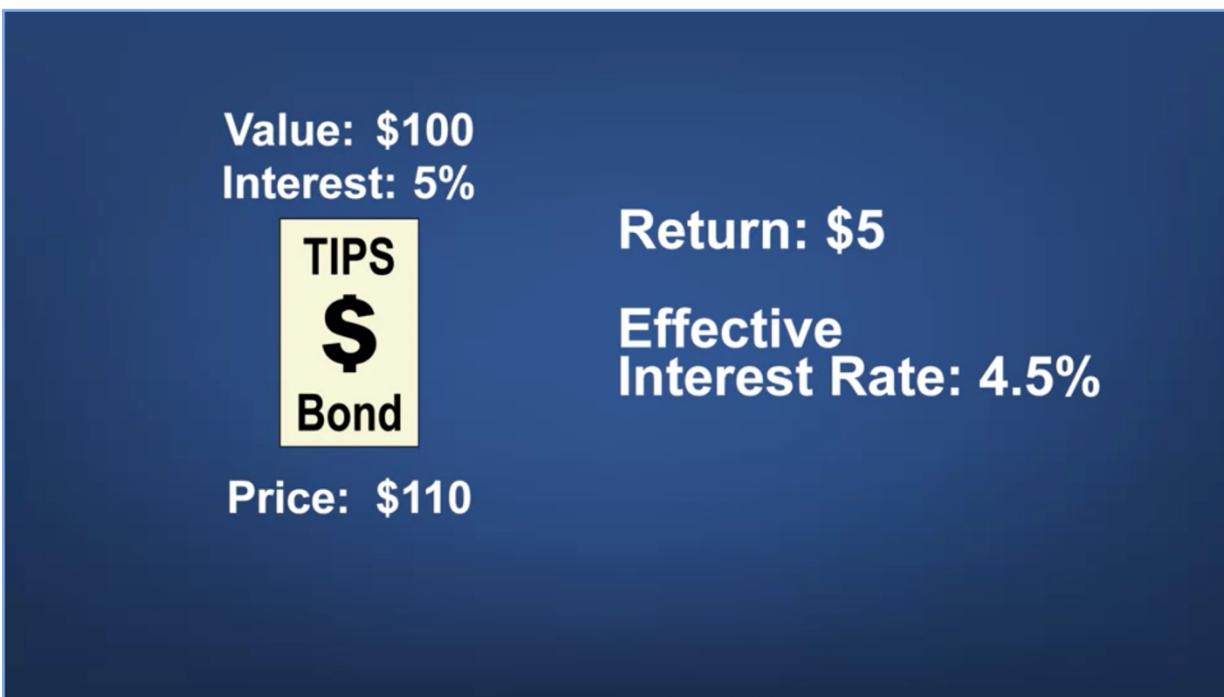
## Treasury Inflation Protected Securities (TIPS)

- Current inflation unknown
- TIPS include inflation expectations

Why do many financial and macro economists pay close attention to the price of TIPS. When we calculate the real return on investment that we can make today, we do not know what inflation will be. So we use our best guess the expected rate of inflation. The price of tips bonds incorporates the market expectation of inflation.



Let's see how this works. If expected inflation is high, the inflation protection is worth a lot and the price of TIPS bonds goes up. This also means that the effective interest rate paid or the yield of the TIPS bond goes down.



To see why that is, consider buying a bond with the principal value of \$100 that pays

5% interest. But the price of the bond is \$110. So your return is the \$5 interest, the 5% of the principal for \$110 invested. The effective interest rates or yields then is 4.5%. Conversely, if inflation is expected to be low, then the price of TIPS bonds fall and the yield on tips bonds goes up. Let's have a look at the yield on the five year TIPS bond over time, and compare it to the yield on the Nominal Interest Paying 5-Year Treasury Note.



The larger the difference in yields between the nominal interest note and the TIPS, the larger is the price difference between the two.



The larger the price difference is, the more investors are willing to pay for inflation protection, meaning that they expect high inflation. As you can see, investors yields on TIPS were high compared to the nominal Treasury notes in 2009. Therefore, investors expected low inflation, investors expected higher inflation in early 2013, as well as during the last stages of the COVID-19 pandemic.

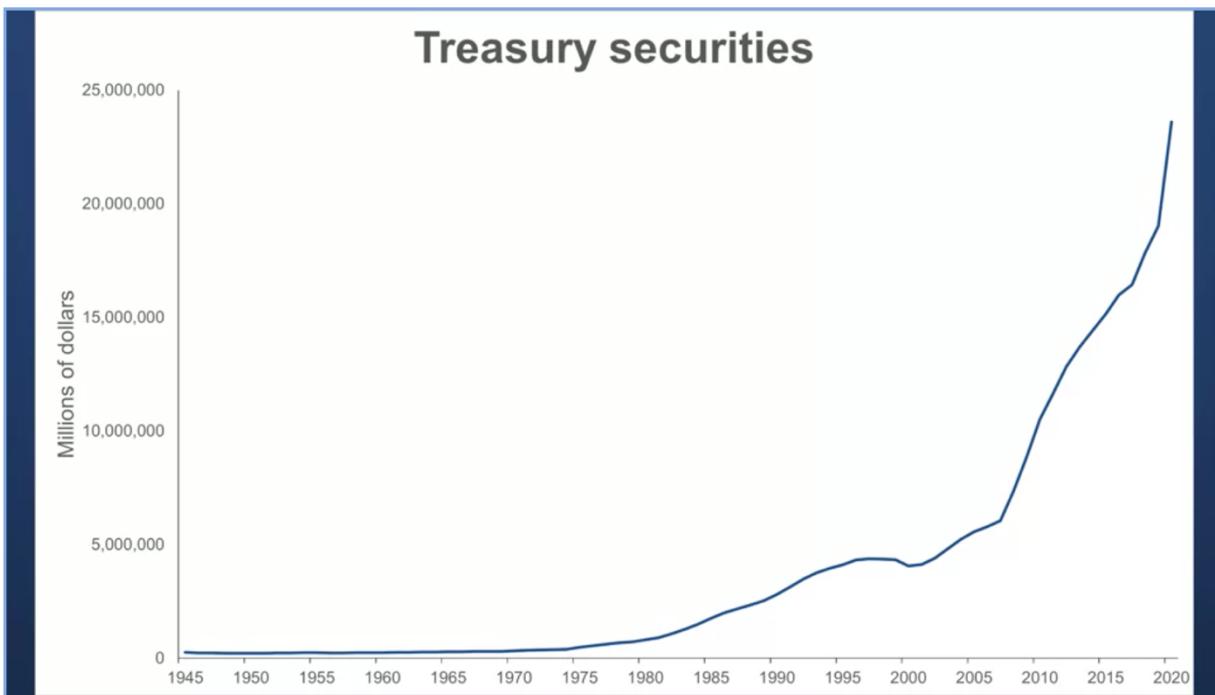
## Summary

- Nominal interest rates ignore inflation
- Nominal interest = real interest + inflation
- TIPS embed inflation expectations

What have we learned in this lesson? First, nominal interest rates do not account for

changes in the price of goods. Second, the nominal interest rate is equal to the real interest rate plus inflation. Third, TIPS bonds helped to measure inflation expectations.

Lesson 1-2.2: Treasury Securities and Their Importance



Hello and welcome to this lecture on risk-free or safe assets. In this class, we will discuss the most prominent type of risk-free assets, US Treasury securities. We will examine the distinct features of US treasuries and the role they play in financial markets worldwide. With outstanding securities worth over \$24 trillion as of summer 2021, the Treasury security market is the largest debt market in the world. Almost every type of US financial institution owns US Treasury securities. For instance, banks, mutual funds, money market funds, insurance companies, pension funds, and of course the Federal Reserve. But about one third of treasuries are owned by international investors. Before examining the market for US treasuries more closely, let's start by looking at the different categories of US treasuries.

## U.S. Treasuries

- Treasury Bills
- Maturity up to 1 year

There are three different categories according to the lengths of maturity. First, we have treasury or T-Bills, which account for about 20% of US Treasury securities. T-bills have the shortest range of maturities, the shortest being four weeks and the longest, 52 weeks. T-bills are sold continuously at Treasury auctions.

## U.S. Treasuries

- Treasury notes
- Maturity  $\geq 2$  years &  $\leq 10$  years

Second, there are treasury notes, which account for most of US treasury securities

outstanding. Notes are the securities in the middle range of maturities and are issued with maturity terms between two and 10 years. Most notes are sold at monthly treasury auctions, ensuring a continuous supply of notes.

## U.S. Treasuries

- Treasury bonds
- Maturity >10 years

Third, we have treasury bonds. Treasury bonds are essentially identical to treasury notes, except that they mature in 20 or 30 years. Treasury bonds are also referred to as the long bond.

## U.S. Treasuries

- All three categories repay par value

All three categories repay the principal at par value at maturity.

## U.S. Treasuries

- No credit risk
- Guaranteed payment of interest and principal
- Treasury interest rate = risk-free interest rate

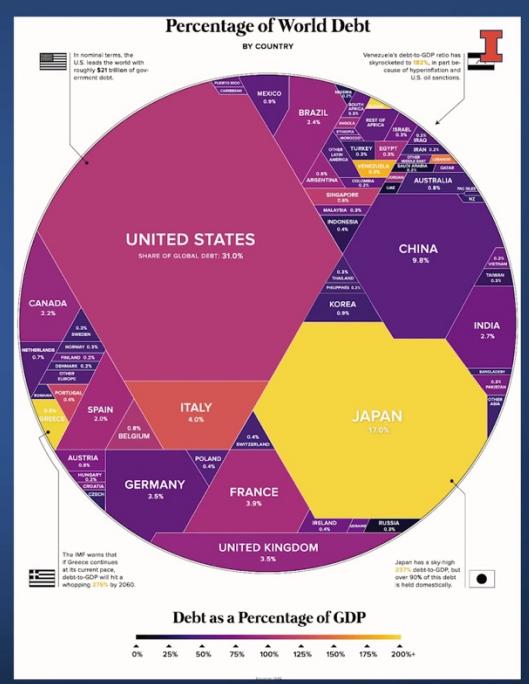
Why are US treasuries so popular with investors? One reason is that US treasuries are considered to be risk-free because they are unconditionally backed by the full faith and credit of the US government. Investors are guaranteed the payment of both the interest and the principal as long as they hold the treasuries to maturity. In other words, US treasuries bear no credit risk and the interest on US Treasury securities is therefore a

good measure of the risk-free interest rate. You may wonder why US treasuries are preferred to government debt from other developed countries with no default risk, for instance, Germany, China, or Japan.

US Treasury market is  
bigger than any other market

US Treasuries are one form  
of holding US Dollars  
(the most transacted  
currency in the world)

US Treasury is a convenient way for central banks to maintain US Dollar reserves

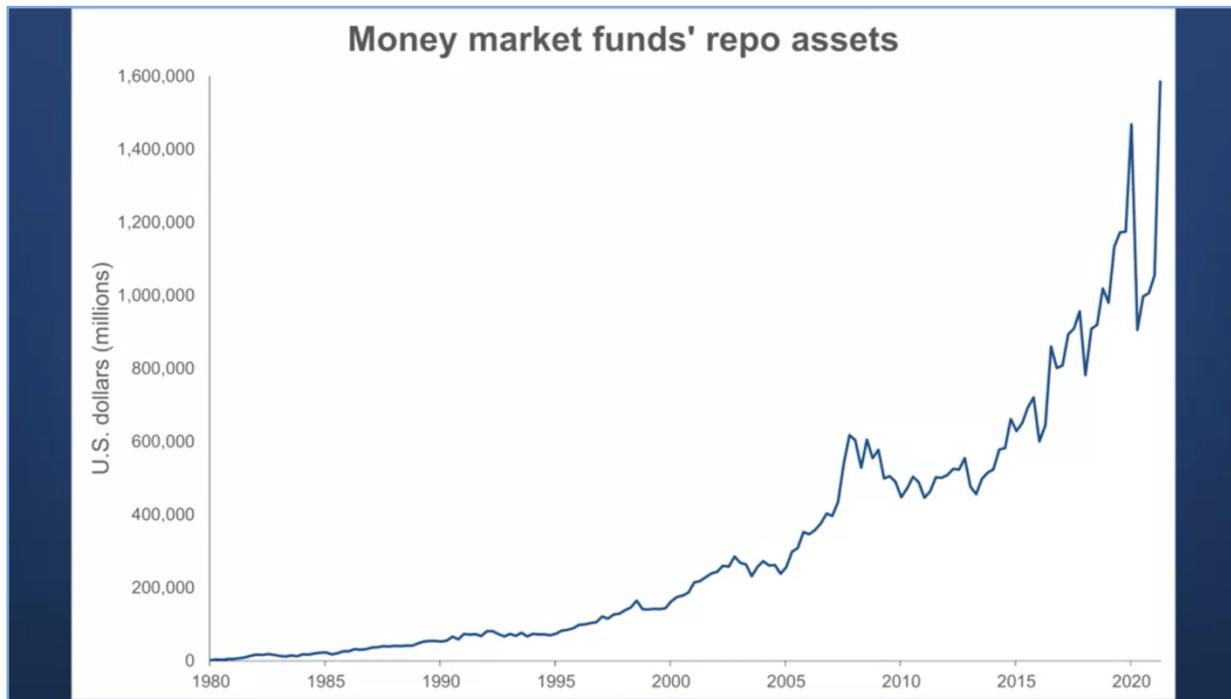


First, the US Treasury market is much bigger than any other market. Second, most financial transactions worldwide are conducted in US dollars and US treasuries is one form to hold US dollars. Third, US treasuries is the most common way for central banks around the world to keep US dollar reserves. The US treasuries are also popular because of the depth of the US Treasury market.

## U.S. Treasuries

1. Little trading cost
2. Highly liquid market
3. Cash-like asset

Since a broad varieties of investors are interested in buying treasuries, it is always easy to sell them at little cost. When securities in a market can be traded with little cost, the market is commonly referred to as being liquid and the US Treasury market is the most liquid security market in the world. For this reason, US Treasury securities are also referred to as cash-like assets. It is hard to overestimate the importance of US treasuries for the global financial system because US treasuries are risk-free and liquid, they are used as collateral in the four trillion dollar repurchase agreement or repo market, a crucial short-term funding market for financial institutions. If you're interested in the details of the repo market, please watch the corresponding video.



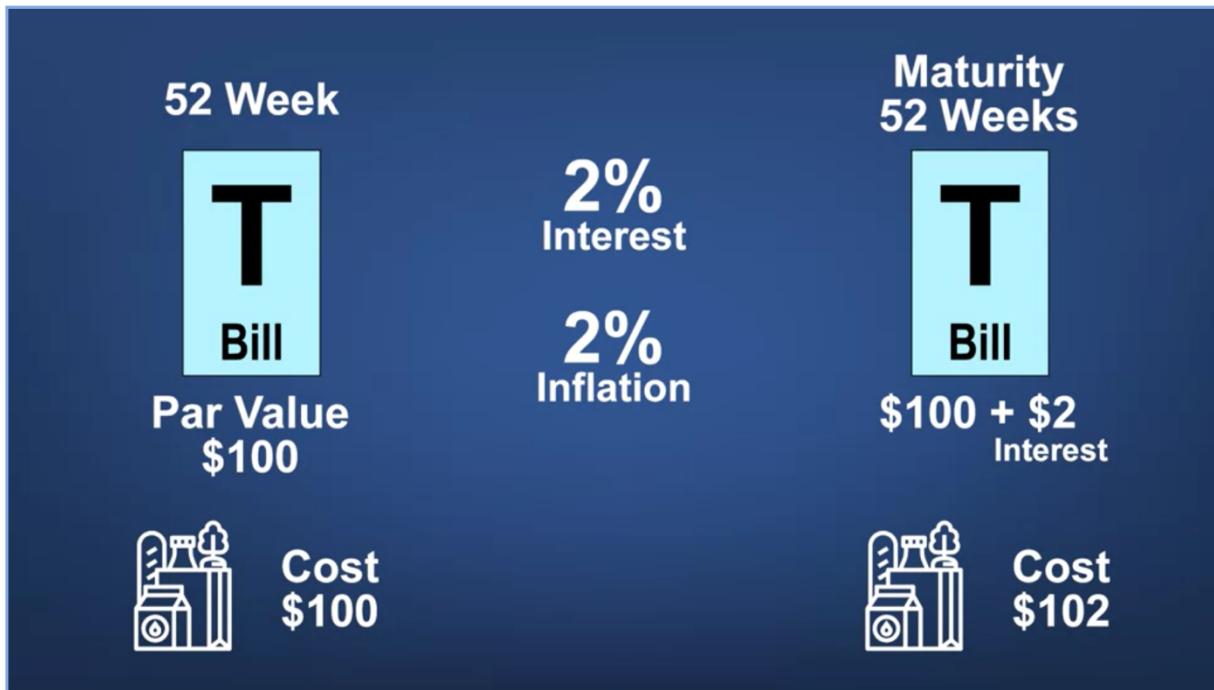
Similarly, by the end of 2020, corporations and household deposited over two trillion dollars in money market mutual funds that only invest in US Treasury securities. However, investing in longer maturity US Treasury securities is not entirely without risk.

## Risks for Treasury Investors

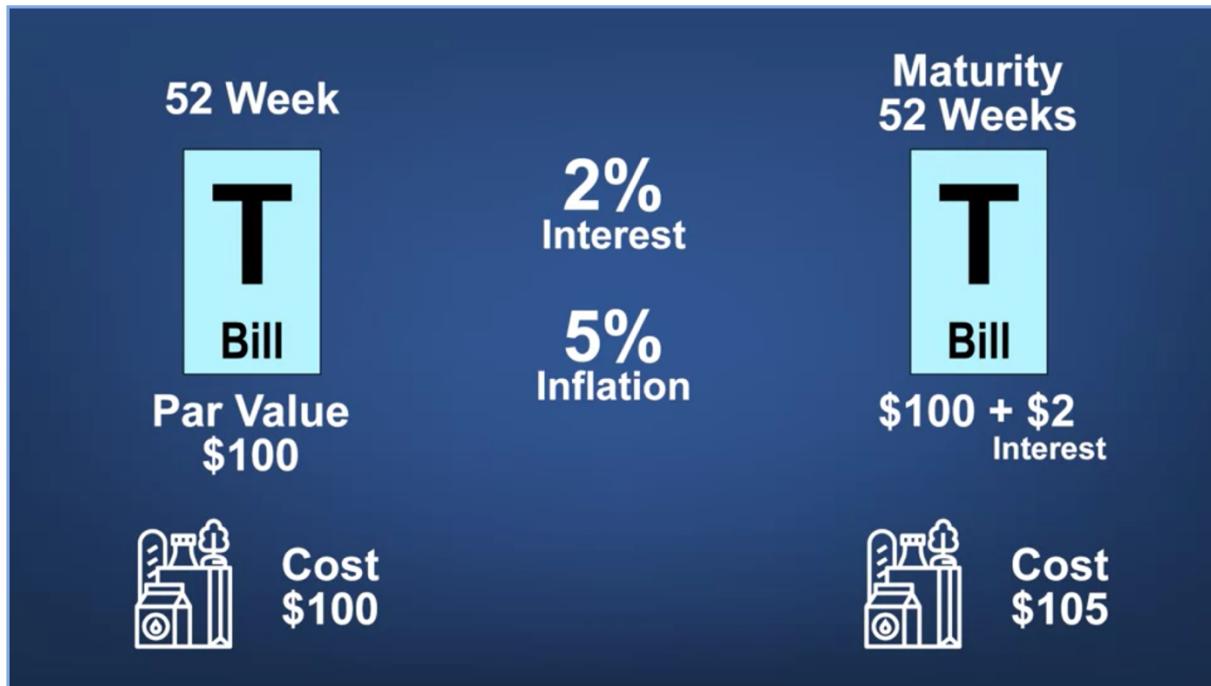
- Inflation
- Other long-run risks (e.g., interest rate changes)

The two main risk factors for treasury investors are first inflation and second, other risk factors that are important in the long run, such as changes in the interest rate. How

does inflation affect the price of US treasuries? Recall that US treasuries are repaid at par, typically \$100 at maturity.



Suppose you bought a 52 week T-bill with a par value of \$100 that pays 2% interest and you expect 2% inflation. At maturity, you get the par value, \$100, plus \$2 interest. At the same time, goods that had cost \$100 when you bought the T-bill now cost \$102 due to inflation. With interest, you can still buy exactly the same goods that you could have bought when you bought the T-bill.



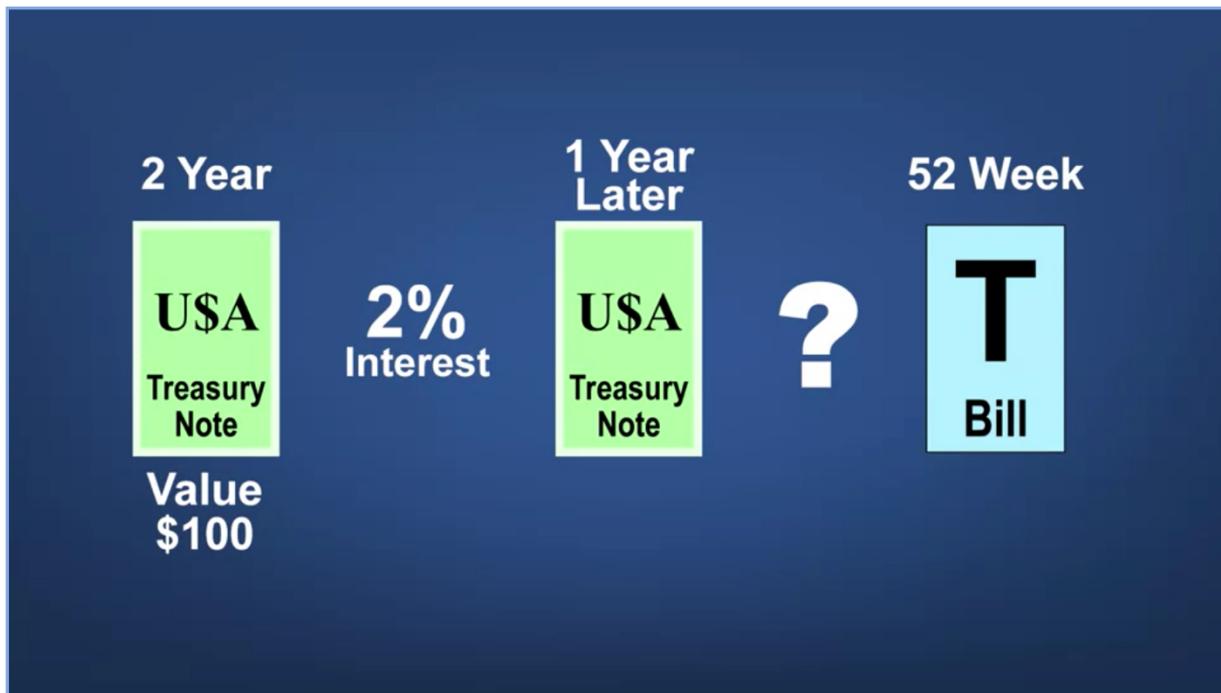
Now assume that this year inflation is higher, say 5%. At maturity, you still get the par value, \$100, plus \$2 interest. But now the goods cost \$105, meaning you cannot afford the same goods as before.

**Nominal Return:**  
**2%**

**Real Return:**  
 **$2\% - 5\% = -3\%$**   
Nominal      Inflation  
Return

That is, your nominal return was 2%, but your real return, which is the nominal return

less inflation, is minus 3%. This also means that the price of treasuries will decline when inflation is higher than expected because from today's perspective, they're worth less.



Changes in the interest rate can have a similar effect. Suppose you bought a two-year treasury note at \$100 that pays 2% interest. After one year, you want to sell this note, which now has only one year left to maturity. How much money you can get for this note depends on the interest rate on the closest substitute, a newly issued 52-week T-bill. If the interest rate on the newly issued 52-week T-bill is higher, the 3%, then this is a more attractive investment than your note that pays only 2%. Since the new T-Bill costs \$100, the price of your note will be less than \$100.

## Term Premium

- Captures all long-run risks (e.g., conflicts)
- Interest rate changes

Of course, there are other risks, such as international conflicts, that make longer run securities riskier. These risks are referred to as the term premium.



To summarize, long-run nominal interest rates on Treasury securities have three components. First, the real interest rate, that is, the interest rate after taking inflation into account. Second, the expected rate of inflation and third, the term premium, capturing

other long-run risks. Because there's no credit risk in this market, financial market analysts use movements in the treasury market to learn about expected inflation.

## Summary

- U.S. Treasury market
- Treasury rate = risk-free rate
- Long-term treasury rate embeds:
  1. Real interest rate
  2. Inflation expectation
  3. Term premium

What have we learned in this lesson? First, the US Treasury market is the largest and most liquid debt market in the world. Second, US treasuries have no credit risks and the interest rate is a good proxy for the risk-free rate. Third, long run nominal interest rates on US Treasury securities can be decomposed into the real interest rate, expected inflation, and the term premium.

[Lesson 1-2.3: Term Structure of Interest Rates](#)

## Learning Objectives

- Term structure of interest rates
- Predicting recessions

Hello and welcome to this lecture on the term structure of interest rates. In this class, we will discuss what the term structure of interest rates is. We will examine why the term structure of interest rates provides important information about the macroeconomy. Specifically, we will look at how the term structure behaves before recessions.

## Term Structure

- Compares interest rates across maturities

The term structure of interest rates refers to the comparison of interest rates or securities by the same issuer of different maturity at a given day. For the term structure,

we do not use coupon interest rates, the interest rates paid to bond owners, but the yields which takes the prices of bonds into account.

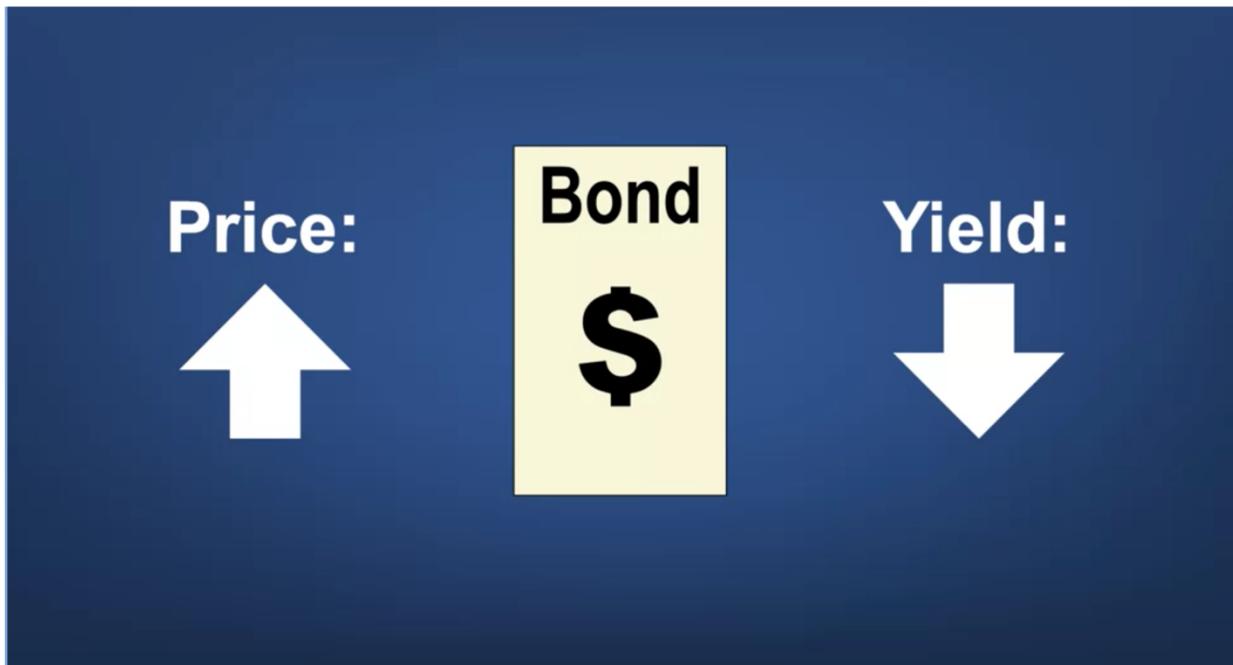


For example, a bond with a par value of \$100 pays 5% interest on its principle. If you buy the bond for \$99, you still receive five-dollar interest payment. So your current yield is 5 divided by 99 or 5.051%.

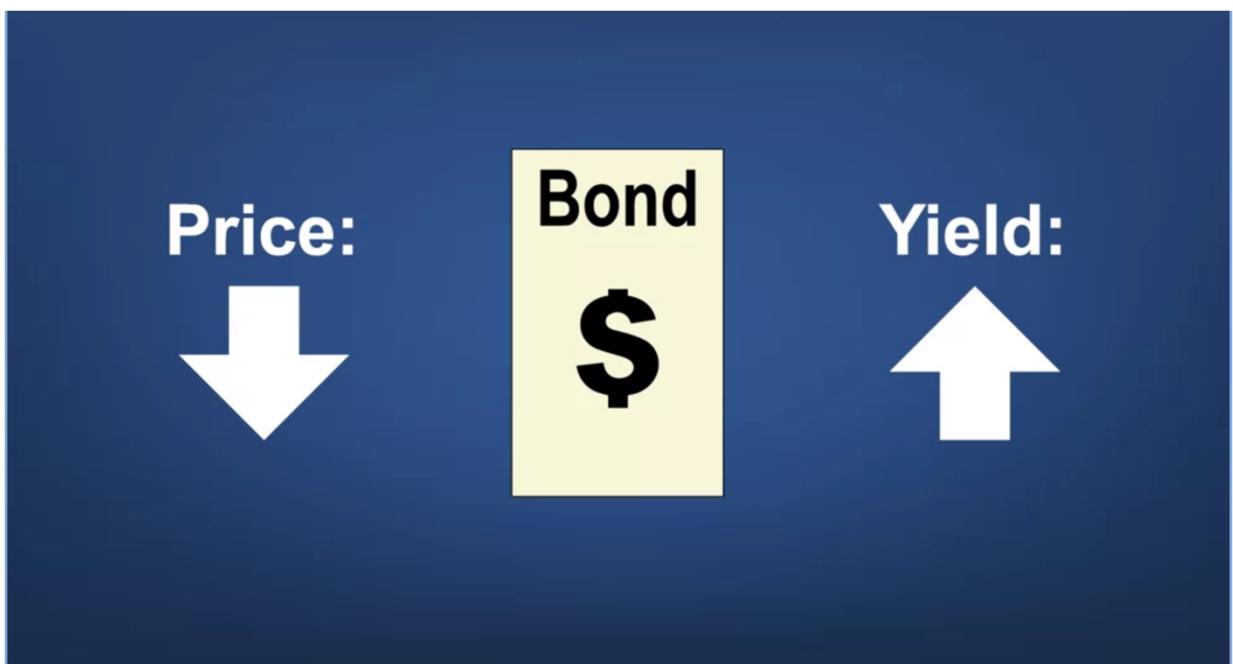


Conversely, if you buy the same 5% interest paying bond for \$101, then your yield will

be 5 divided by 101 or 4.95%. The more general insight here is that bond yields and bond prices move in opposite directions.



When bond prices increase, yields fall.



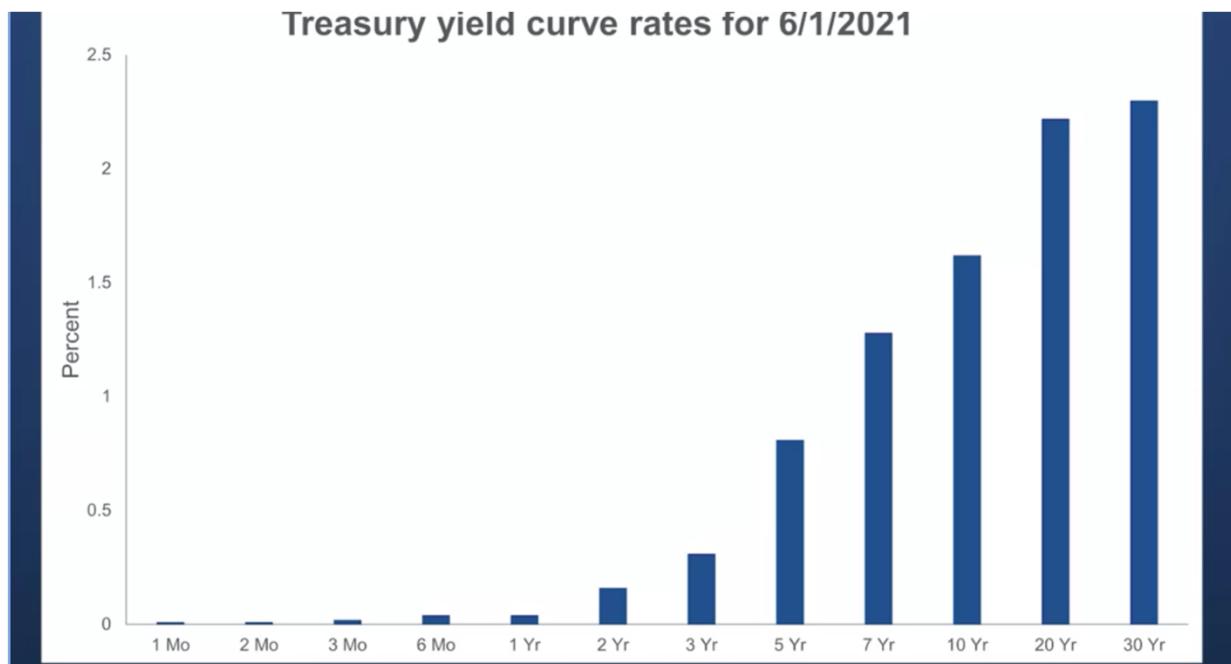
When bond prices decrease, yields increase. We can observe daily changes in yields and, therefore, the term structure of interest rates, which is also commonly referred to

as the yield curve. The most important yield curve is based on US Treasury securities. There are three reasons why US Treasury securities provide good measures of yields.

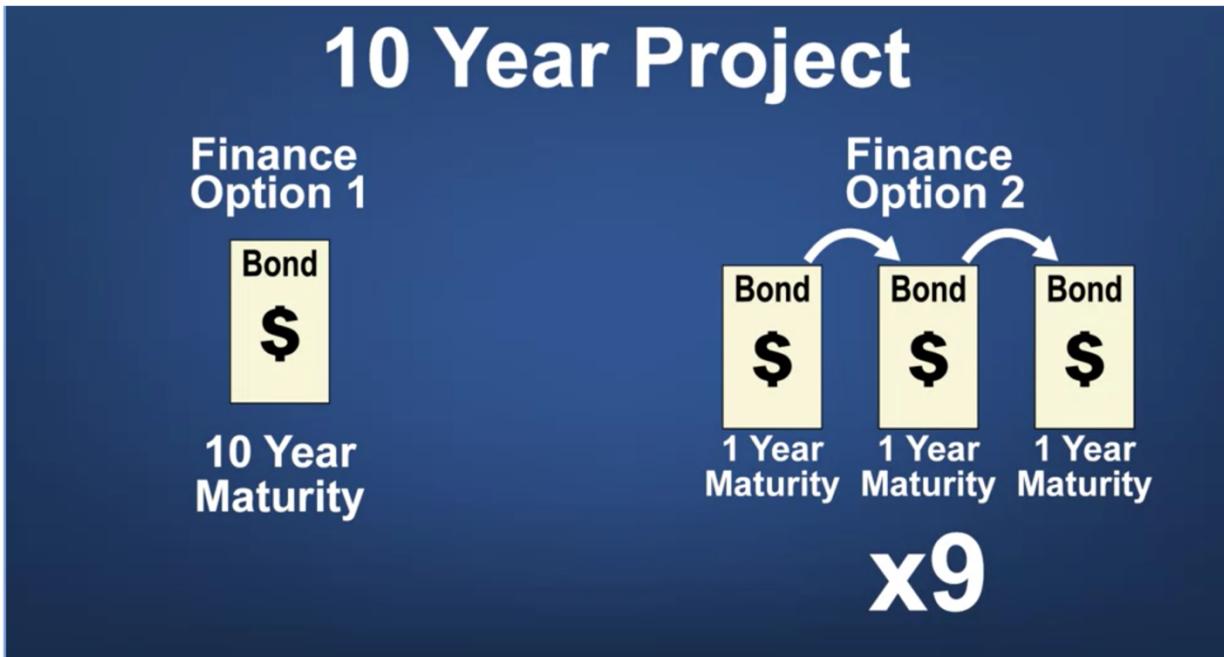
## Treasury Term Structure

- No credit risks
- Many different maturities
- Little trading cost

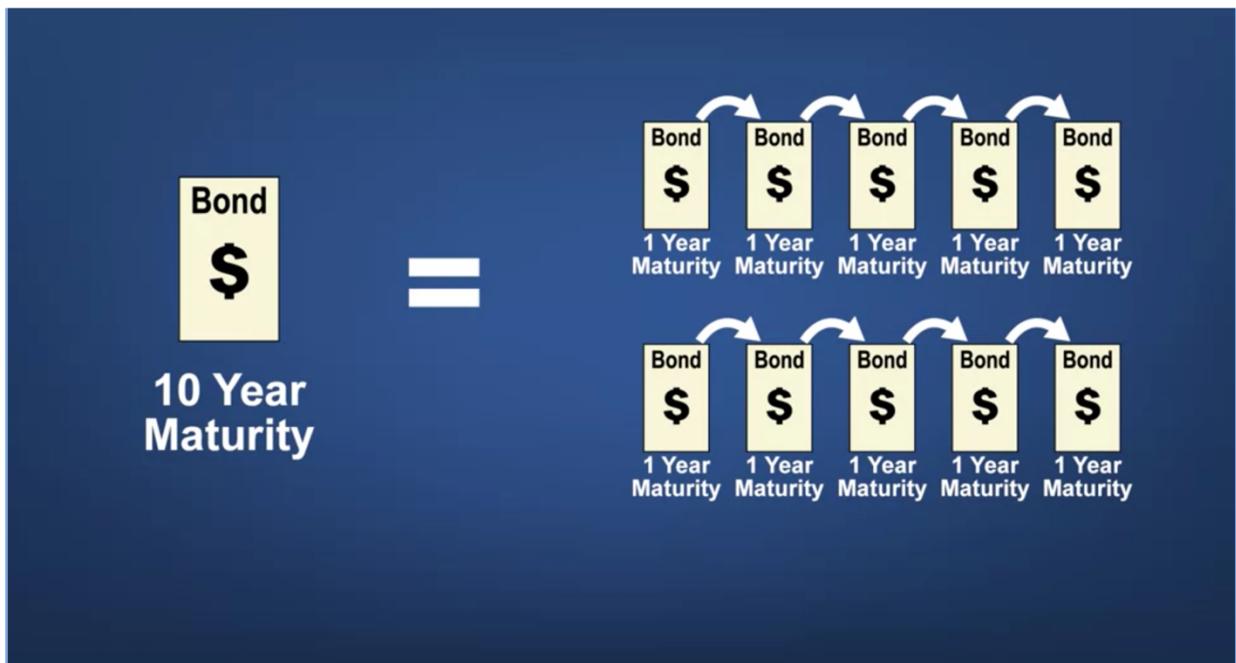
First, they have no credit risk that could change over time. Second, they're issued at many different maturities. Third, they have little trading costs that would otherwise distort security prices and, therefore, yields. We cover more details on US Treasury securities in a different lecture.



Now let's have a look at an actual yield curve derived from US Treasury securities. This yield curve is from June 1st, 2021. As you can see, the yields on short maturity bonds is almost zero. Even a US note with a one-year maturity yields only 0.04% annually. However, a note with a maturity of 10 years yields 1.62% annually. How do you explain this difference between the yields on shorter and longer maturities? Consider two alternatives to finance a project that will take 10 years before you can repay the principal.

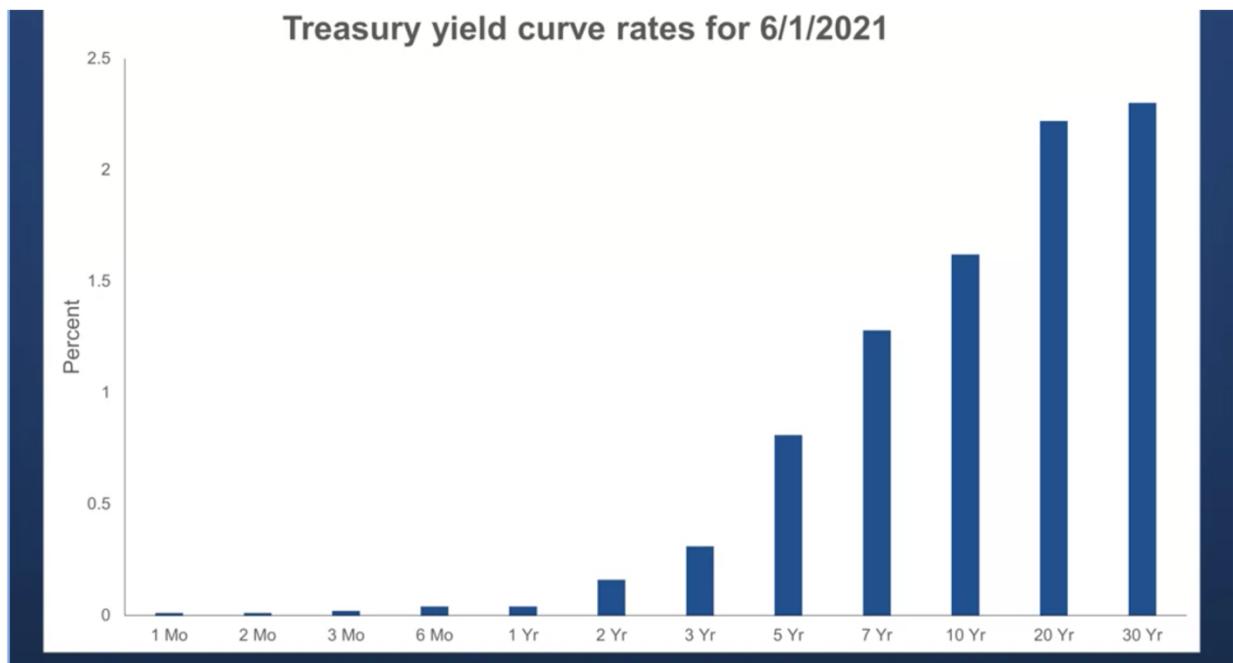


The first alternative is to issue a bond with a 10-year maturity. The second alternative is to issue a bond with a one-year maturity, and roll over the debt after one year with a new bond with a one-year maturity. Of course, in this case, you need to roll over your debt nine times.

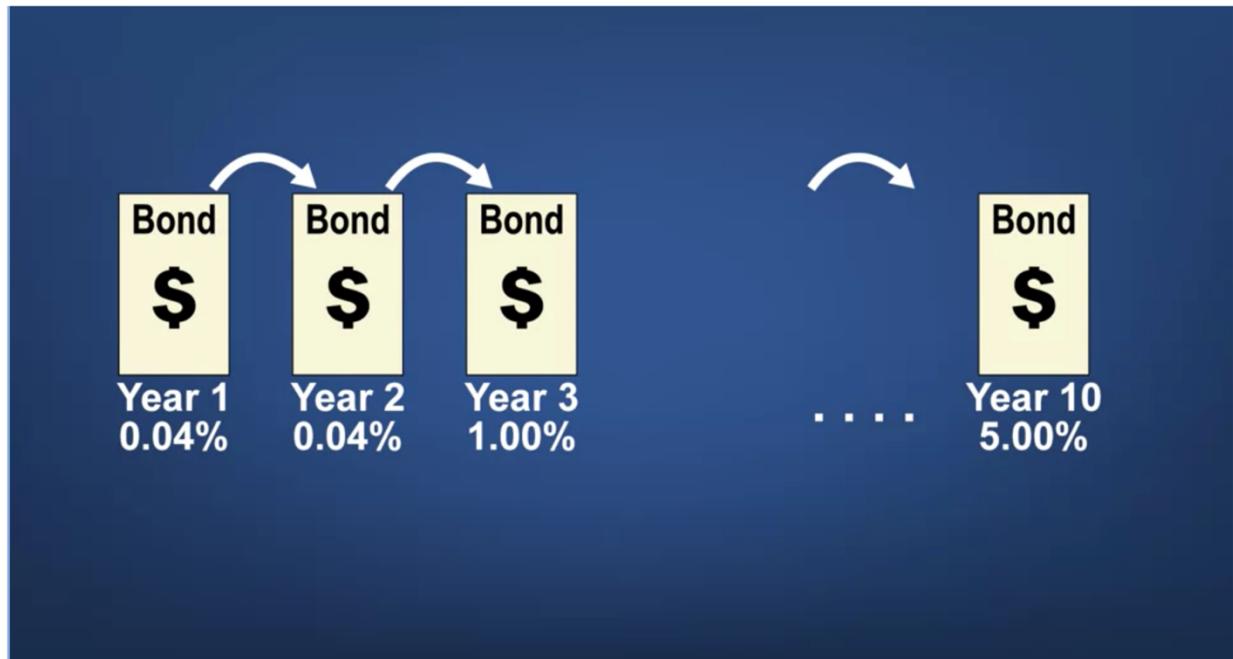


Now suppose you would be able to roll over the debt with one-year bonds always yielding exactly the same as the first time. In this case, issuing 10 times one-year bonds would cost you in sum the same as issuing one 10-year bond, and hence the yields

would be the same. If they were not the same, you would be better off issuing whichever alternative is cheaper.



However, in the June 1st, 2021 yield curve, shorter-term notes have lower yields. This means that market participants expect that the interest rates will rise at some point in time over the next 10 years. Otherwise, they would sell one-year notes, decreasing their price and increasing their yields, and instead buying 10-year notes, increasing their price and decreasing their yields.



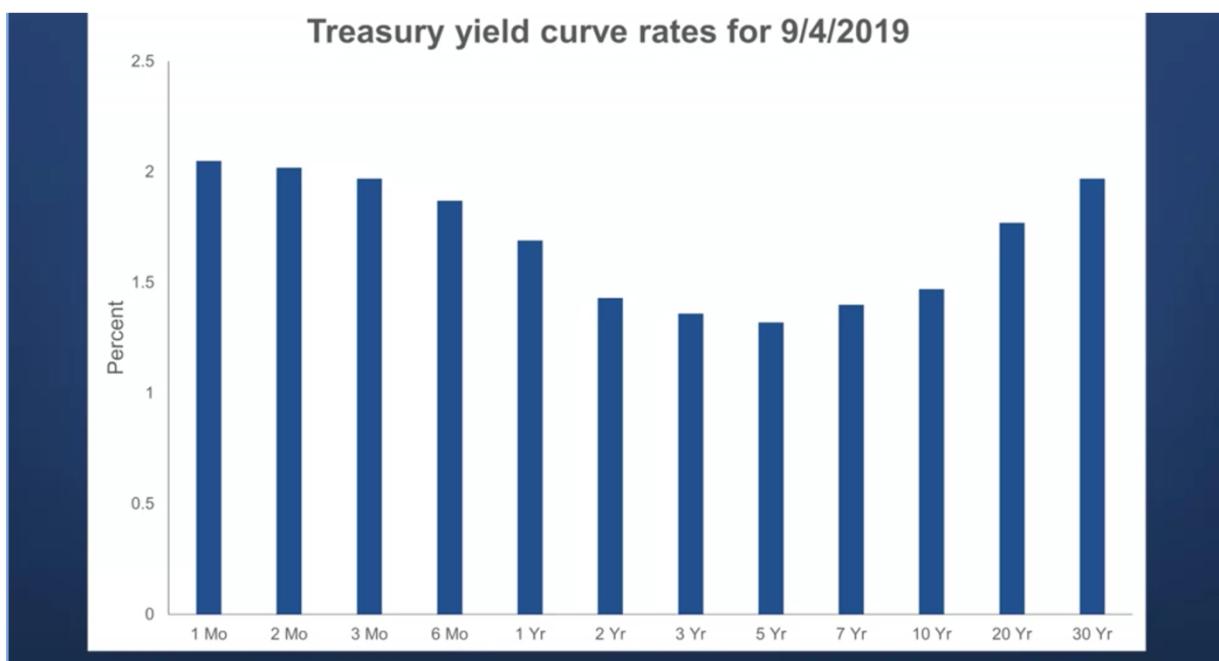
In our example, at some point, when you want to roll over the one-year bond, you will have to offer a higher yield compared to the 1st June one-year bond you issued. What drives the expectation of higher interest rates?

## **I** What Drives Interest Rates Higher?

- Monetary policy
- Inflation
- Fiscal policies

First, market participants could expect that the Federal Reserve is going to increase short-term interest rates. This is generally expected during economic expansions, and the yield curve is typically sloping upward. Second, market participants expect high inflation. Since interest rates on US Treasuries are nominal, yields on longer maturity

Treasury securities have to increase to offset the increase in inflation to continue to attract investors. Third, fiscal policies that will increase government debt will increase the supply of US Treasuries. In this case, yields on longer maturity treasury securities have to increase for investors to buy the additional supply of US Treasury securities. Now, let's have a look at the yield curve on September 4th, 2019.



You will notice that the yield curve is now downward sloping or inverted at the front end of the curve. This means that market participants must expect lower interest rates in the future. When do market participants expect lower interest rates? Before recession. Let's look at a commonly used measure of the yield curve. The difference between the yields on a 10-year treasury note, and a two-year treasury note over the last 40 years.



You can see that almost all of the time, this difference is positive, meaning that the yields on the 10-year note is higher than on the two-year treasury note. For most of the time, market participants expect interest rates to go up. This is consistent with an economic expansion. The gray bars in the figure indicate recessions. Since in recessions demand is low, interest rates tend to fall during recessions. Now focus on what happens to the yield curve right before the gray bars. It inverts each time before the recessions of the 1980s, the recession in the early 1990s, before the dotcom burst in 2000, before the 2008 financial crisis, and before the COVID-19 pandemic. In some, the treasury yield curve is a strong predictor of subsequent performance of the economy, and is therefore closely watched by market participants and policymakers.



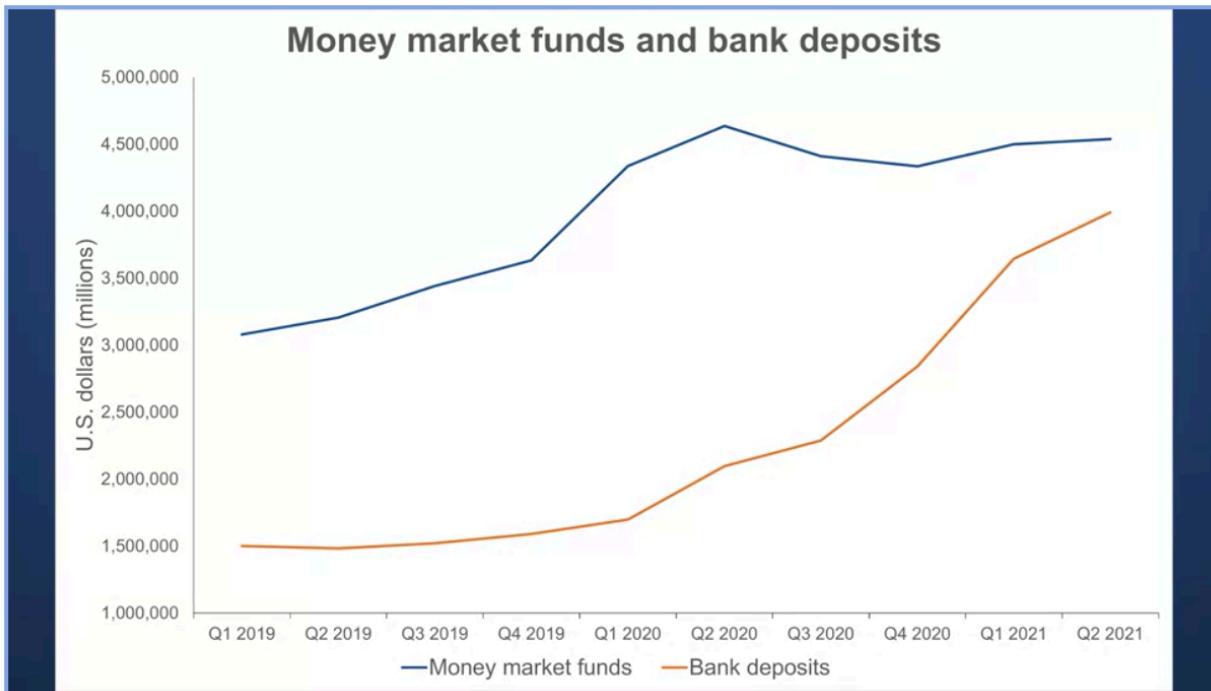
## Summary

- Yield curve compares rates across maturities
- Yield curve embeds interest rate expectations
- Inversion predicts economic recession

What have we learned in this lecture? First, the term structure of interest rates or yield curve, compares yields across different maturities. Second, the yield curve is a closely watched economic indicator. An upward sloping yield curve indicates that market participants are expecting interest rates to rise in the future, which happens during economic expansions. An inverted downward sloping yield curve suggesting a future decline in interest rates typically signals the end of an economic expansion.

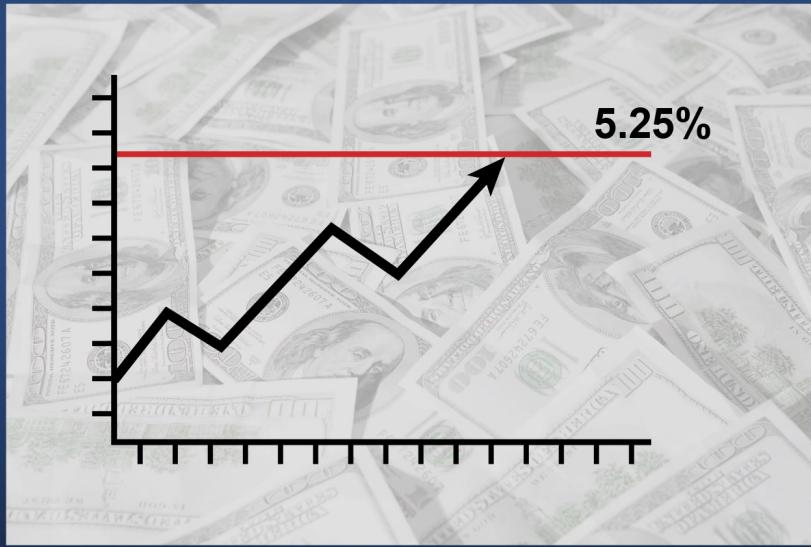
## Lesson 1-3: Cash-Management and Interest Rate Risk

### Lesson 1-3.1. Money Market Mutual Funds

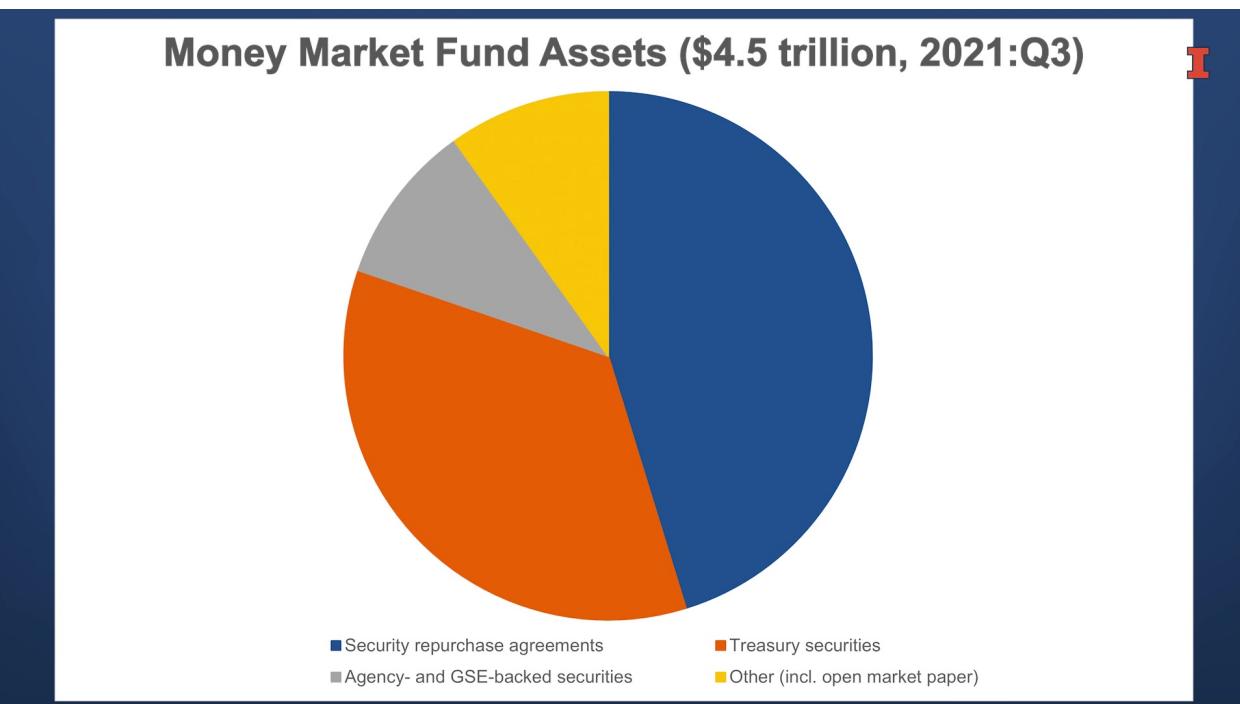


Hello and welcome to this lecture on money market mutual funds. In this class, we will discuss what money market mutual funds are. We will examine why money market mutual funds are popular with investors, and why money market mutual funds are such an important component of the shadow banking system. Money market mutual funds, or money market funds, are one of the most popular investments. In the first quarter of 2021, money market funds managed over \$4.4 trillion. In comparison, total deposits of firms and households at banks were only about four trillion dollars in the first quarter of 2021. In the graph, you can also clearly see the effect of the COVID-19 pandemic, in which spending sharply declined and savings sharply increased. What are money market funds and why are they so popular?

## Bank deposit rate ceilings (before 1986)



Money market funds in the United States were originally created because of bank regulation, regulation queue that limited the interest rate that could be paid on deposits. The maximum interest rate was kept at five-and-a-quarter percent. That may sound like a lot today, but recall that in the 1970s and 1980s, inflation was much higher. In the early 1980s, inflation was above 8%, meaning that cash in deposit accounts lost value at a significant pace. Moreover, short-term interest rates, such as the federal funds rate, were also above 8%. Money funds not being subject to regulation could pay high interest rates.

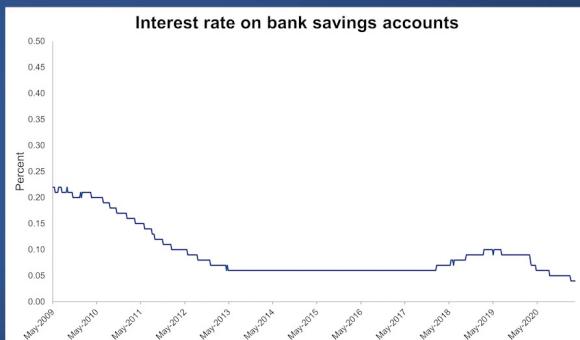
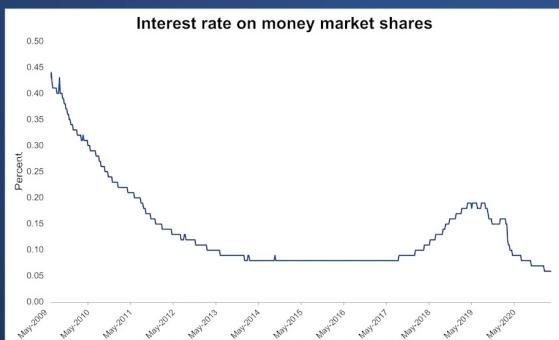


Money funds invest in short-term debt securities with minimal credit risks. For instance, US Treasury bills or highly rated commercial paper. As you can see, the lion share of money market funds investments is in US Treasury securities. The second largest investments are repurchase agreements that use US treasuries as collateral. We discuss these in detail in a different lecture. Money market funds that solely invest in US treasuries are called treasury funds. Those also invest in other government securities and government funds. These are arguably the safest investments, but they also have the lowest return. In contrast, prime funds are money market funds that also invest in debt securities, such as open-market paper or certificates of deposits issued by corporations and banks. They are little riskier, but they also have a slightly higher return. However, all money market funds are expected to maintain the value of investment by keeping the net asset value of a frontier at one dollar.

## Net asset value of \$1 per share



That is, an investor who buys a money market fund share at one dollar expects to sell the share for one dollar and receive interest payments in between. Money market fund shares are redeemable on-demand. These features make money market fund investments very similar to bank deposits.



There are, however, two crucial differences between money market funds and deposits. First, the interest paid is different. Money markets pay a higher interest rate. Consider a

corporation managing cash to the payroll date. For corporations with large payrolls, small differences in the interest rates can mean a lot of money.

## **M**oney Fund Yield vs Bank Savings Account

- Bank deposits are insured
- Money market funds shares are not insured
- Potential of losses in money funds

The second difference is deposit insurance. If a bank fails, deposit insurance guarantees that depositors get all their money back. Money market funds are supposed to have a stable value of assets, but no deposit insurance. Especially for prime funds, there is a small risk of losses. Let's now have a look at why money market funds are the cornerstone of the shadow banking system.



The main reason is that money market funds lend out cash on the short-term funding markets. Before the financial crisis, money market funds provided significant funding to a corporation by purchasing commercial paper to issuers of structured financial vehicles that finance, for instance, mortgages and order lawns by buying asset-backed commercial paper, to banks, by buying certificates of deposits, but also to hedge funds through repurchase agreements.

## Money fund investments

- Money funds lend cash to all types of financial institutions

In some, money market funds provide short-term funding to many financial institutions and corporations. This short-term funding is hard to replace on short notice. But this is precisely what happened during the 2008 financial crisis.

Reserve  
Primary  
Fund

LEHMAN  
BROTHERS

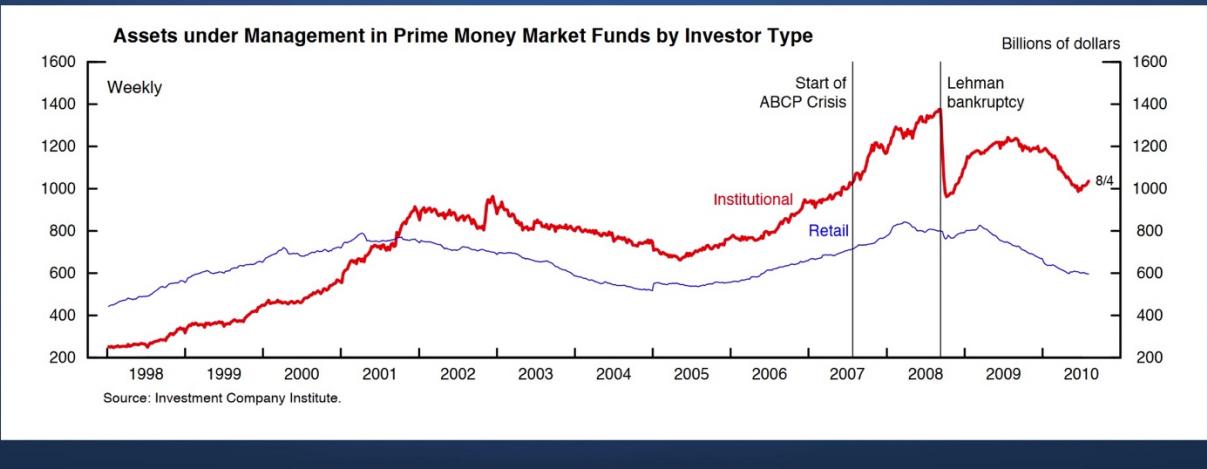


The reserve primary fund had invested in commercial paper of Lehman Brothers, which failed during the financial crisis. Experienced losses, the net asset value fell to 97 cents even so, the fund were supposed to maintain a net asset value of one dollar.



As a result, investors withdrew their money from the fund and the fund had to pay one dollar per share. Eventually, the fund could not meet or redemption at one dollar per share and went into bankruptcy. This event is referred to as breaking the buck. Recall that there is no deposit insurance for money market mutual funds. So when a fund breaks the buck, investors are losing parts of the investment.

## Runs on Money Funds during the 2008 crisis



Investors became concerned about the health of other prime money market mutual funds, and withdrew about \$400 billion, or about 30% of total assets from these funds. This sharp reduction in cash in the money funds significantly reduced the credit supply in the short-term funding markets. Firms and financial institutions that usually borrowed from money market mutual funds scrambled for cash, sold assets, or in the case of banks and structured financial vehicles, reduced their own supply of credit to businesses and households. The 2008 financial crisis showcases how essential money market mutual funds are for the financial system.

## Money Market Mutual Funds

- Money funds allocate cash
- Withdrawals reduces short-term credit supply
- Spillovers to wider economy

By lending short-term to many different counterparties, money market mutual funds help to efficiently allocate cash throughout the economy. The flip side was that once money market mutual funds experienced large redemptions, many borrowers that depended on short-term loans from money market mutual funds could not fall over their debt and face bankruptcy themselves. After the financial crisis, financial market regulators implemented reforms to avoid large redemptions from money market mutual funds in the future.

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## Summary

- Money funds are the largest cash lenders
- Similar to bank deposits, but uninsured
- Runs at money funds can disrupt broader economy

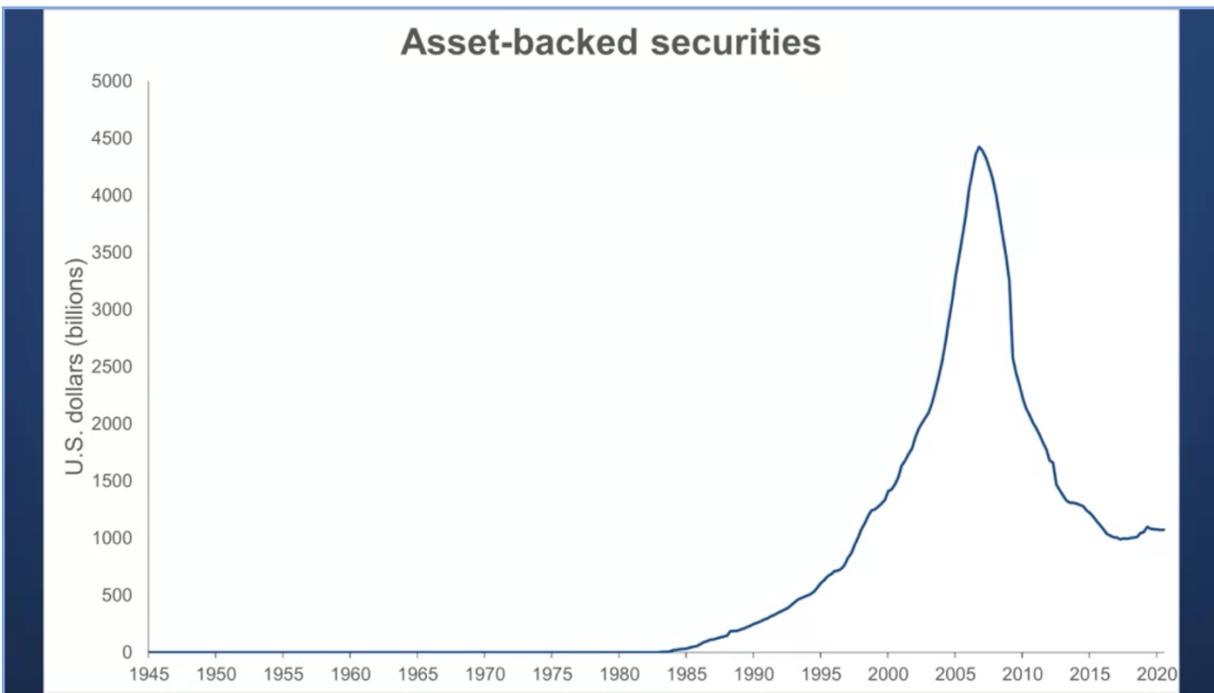
What have we learned in this lecture? First, money market mutual funds are the largest short-term or cash lenders in the US financial system. Second, money market mutual funds are a substitute for bank deposits, but are not insured like bank deposits. Third, losses in money market mutual funds can affect large parts of the financial system through a reduction in short-term credit.

Lesson 1-3.2. Securitization

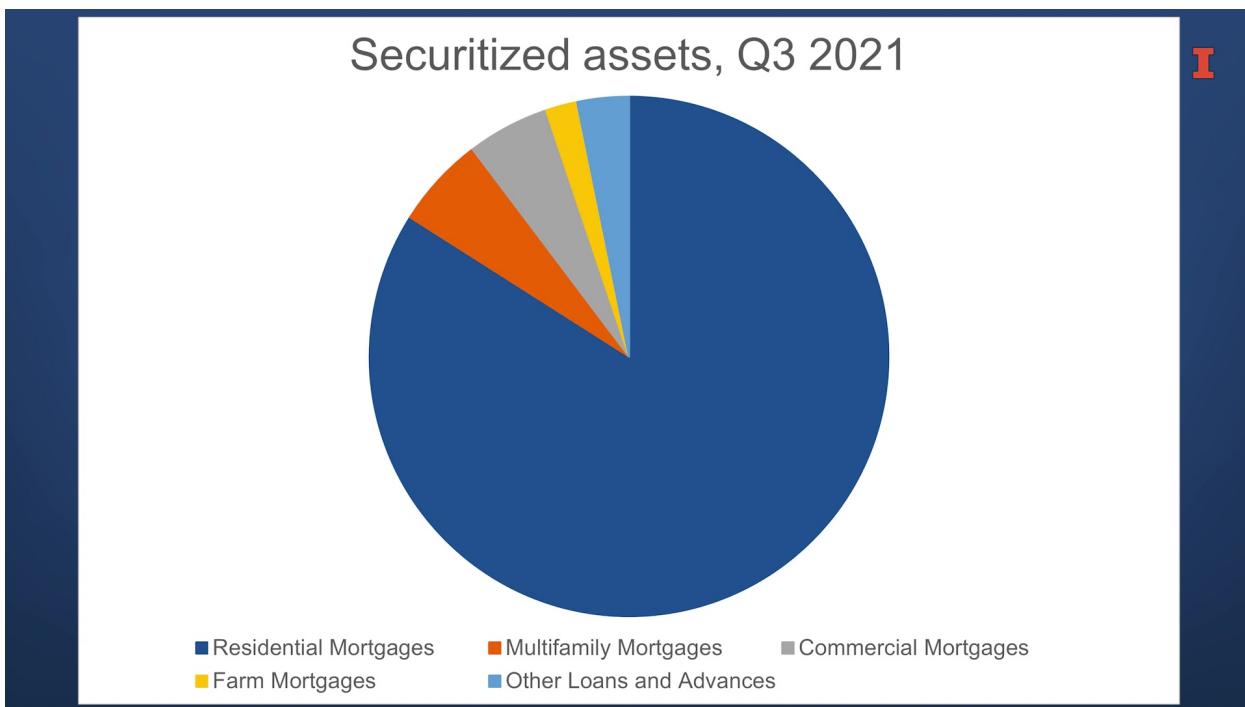
## Learning Objectives

- Securitization
- Large market
- Depends on short-term funding

Hello and welcome to this lecture on securitization and how securitization depends on short-term funding markets. In this class, we will discuss what securitization is. We will examine the importance of securitization for the US economy. Last, we will discuss the dependence of securitization on short-term funding markets. A considerable share of loans to households and businesses in the United States are bundled and securitized.

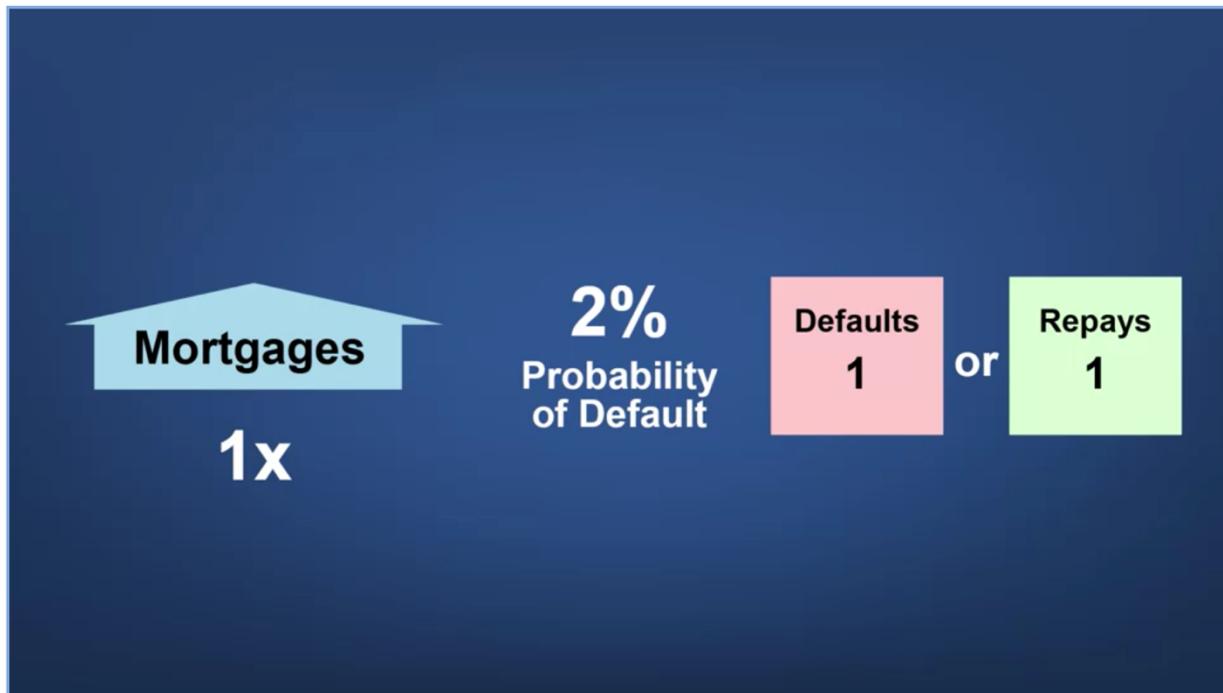


In 2021, the total amount of bonds that were related to securitization was about \$12 trillion. Most of these bonds, more than \$10 trillion, were issued by government-sponsored enterprises and guaranteed by the US government. That is, these bonds are considered to be as safe as US Treasury securities. The rest, about \$1.2 trillion, came from securitizations of private issuers such as banks and finance companies.

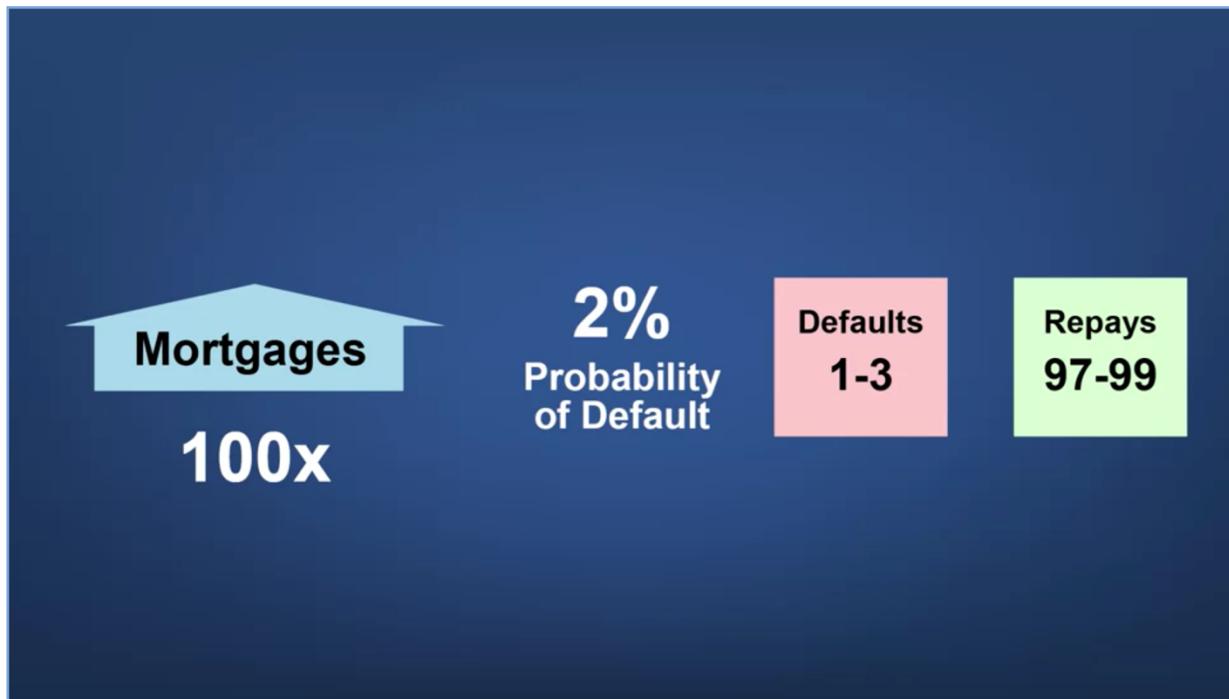


The vast majority of loans that are securitized are mortgages, not only residential

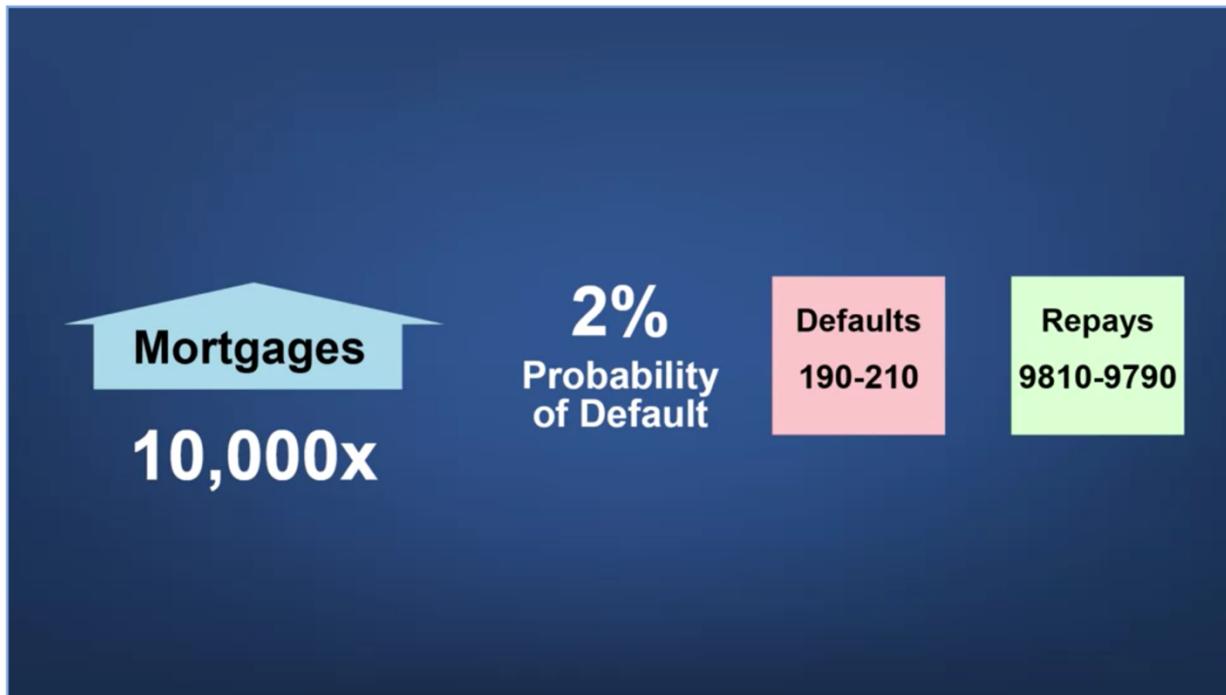
mortgages, like your single-family home, but also mortgages for multifamily homes, that is, apartment buildings and commercial mortgages for office buildings and shopping malls. A significant share of other loans, loans backed by accounts receivable and small business loans are also securitized. Let's have a look at how securitization works. Consider one mortgage to one customer.



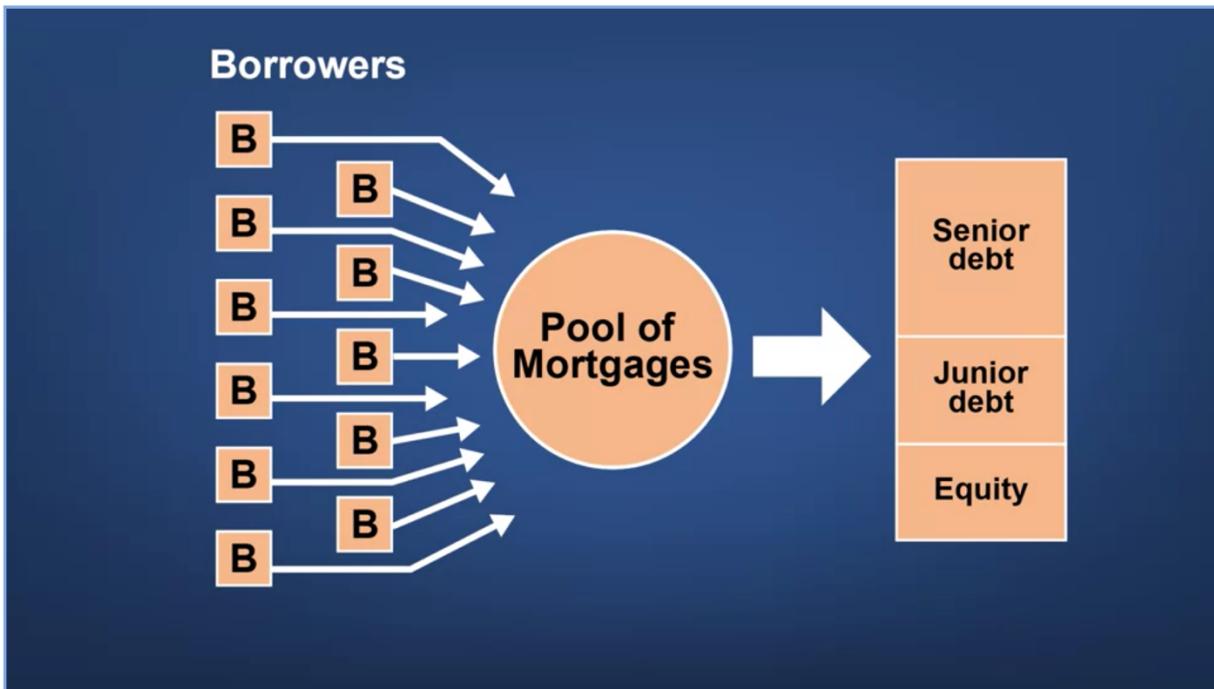
Based on the credit score, you expect the customer to default with a probability of 2%. But with only one loan, you face one of two outcomes. Either the customer repays or defaults. That is, the losses on these loans are highly uncertain. It is all or nothing. Now consider a pool of 100 of these mortgages with customers who have all an expected probability of default of 2%.



They all live in different parts of the country, and therefore, they are unlikely to default at the same time. You expect two out of 100 to not repay. But with 100 loans, you may find that one does not repay, or in some other case, three do not repay. The outcome of this pool of 100 mortgages is considerably less uncertain than the one loan example. Now consider a pool of loans with 10,000 of these mortgages with an expected probability of default of 2%.



You expect 200 to default, and this time, the expectation is likely to be fairly accurate. There may be 190 or 210 defaults, but 1.9% or 2.1% is quite close to your expectation. This is an illustration of the law of large numbers. The larger the mortgage pool, the more accurate you can estimate the expected losses, and therefore, cash flow. Being able to precisely forecast cash flow from pools of loans is the main principle that makes securitization work.



In a securitization, the issuer sells bonds backed by a loan pool. Because the issuer has a good estimate on the cash flow, she can issue a significant amount of senior debt, that is, the least risky debt. This debt has a first claim on the cash flow generated by the loan pool, so there's little risk. The issuer can then issue junior debt, relatively risky debt. The junior or subordinated debt has a claim on the cash flow that is left over after paying the senior debt. The riskiest portion in a securitization is the equity portion. The equity portion owner gets the cash flow after all bondholders have been paid. Why is securitization profitable?

<b>Assets</b>	<b>Liabilities</b>
Mortgages    \$100	Senior debt    \$80
	Junior debt    \$15
	Equity            \$5

Let's look at a concrete example. Suppose you have a pool of mortgages worth \$100 that pay 5% interest. You issue \$80 senior debt, \$15 junior debt, and retain five-dollar equity. Recall that for one loan, it is quite uncertain what the outcome is so the interest rate will be higher than on the senior debt that are virtually guaranteed payment.

$$\begin{array}{ll} \textbf{Senior debt } \$80 @ 3.5\% & = \$2.80 \\ \textbf{Junior debt } \$15 @ 4\% & = \$0.60 \\ \textbf{Total interest income:} & = \$5.00 \end{array}$$

Let's say 3.5% interest on the senior debt. The junior debt is riskier than the senior debt,

but still quite safe. Let's say the interest rate is 4%. In total, you pay \$2.80 interest to the senior bondholders and \$0.60 to the junior bondholders.


$$\begin{array}{ll} \text{Total interest income:} & = \$5.00 \\ \text{Total interest expense:} & = \$3.40 \\ \text{Return on equity} & \frac{\$5 - \$3.40}{\$5} = 32\% \end{array}$$

Your total interest income is five dollars. The total return on equity in this example is the interest income of \$5 less the \$3.40 of interest expenses, leave you with \$1.60 income on a five-dollar investment. That is a return of equity of 32%. Of course, if many borrowers do not pay, and the cash flow falls to \$3.50, then the equity holder gets only \$0.10 on their five-dollar investment or 2%.

## Securitization Pool

- Precise statistical model needed
- Securitization increases credit supply

This example illustrates why it is so important to get a precise estimate of cash flow in securitization pools. It also shows another advantage of securitization. The issuer doesn't need to have all the cash for all the loans but can borrow it from the market. This additional funding allows the issuer to make more loans. Over the last 30 years, the possibility to raise funding for loans on the securitization market has considerably increased the supply of credit to firms and households in the United States. Even before securitization, many issuers finance loans short-term before they can pull and securitize them. That is, the issue, for instance, commercial paper to money market mutual funds while they build the loan pools.

## Pre-Securitization

- Short-term funding before selling bonds
- E.g. asset-backed commercial paper
- 2008 financial crisis: no short-term funding
- Collapse of credit supply

When the loan pools get securitized, the issuer repays the commercial paper with the funds raised from bond investors. This is one reason by disruption in the short-term funding markets can affect the wider economy. When no short-term funding is available, the securitization chain breaks down and firms and households have less access to credit. This is what happened, for instance, at the onset of the 2008 financial crisis.

## Summary

- Securitization is a key funding model for loans to businesses and households
- Securitization relies on statistical models
- Securitization increases credit supply

What have we learned in this lecture? First, securitization is a large market in the United

States. Second, securitization is based on statistical models relying on a large number of loans. Third, securitization raises money from investors, increasing the total supply of credit.