# Survey of the Financial System

## Lecture Slides

Rory Mullen

Assistant Professor of Finance
Warwick Business School
University of Warwick

# Overview of Topics

# Survey of the Financial System
# Table of Contents

# Lecture 1: Introduction to Financial Markets
# Overview of Topics

---



Reading: Mishkin and Eakins (2018, Chapters 1, 2, and 7), Philippon and Reshef (2013)

# Survey of the Financial System: Table of Contents



Remarks:

- we aim for breadth here—other modules will dive deeper into narrower topics
- academic papers form an important (and examinable) part of the module material
- case studies, news articles, and problem sets will keep things interesting
- we aim for the *right* amount of mathematical detail, not the maximum amount

## Question 1

Which topic interests you most? (I'll ask again at end of term!)

A. Money market
B. Bond market
C. Equity market
D. Mortgage market
E. Foreign exchange market
F. Derivatives market
G. Financial Intermediation

# Lecture 1: Introduction to Financial Markets
# Overview of Topics



Reading: Mishkin and Eakins (2018, Chapters 1, 2, and 7), Philippon and Reshef (2013)

# Financial system function 1: information aggregation

**Question 2**

Will the share price of Apple Inc. open higher or lower on the date of our second lecture than on the date of our first lecture?

A. Higher

B. Lower

Remarks:

- individuals often have differing expectations about a firm's prospects
- market prices aggregate and summarize these competing expectations
- prices incorporate all current information and adjust quickly to news

# Financial system function 2: consumption timing

**Question 3**

Coffee is now \$1/cup, inflation is 5%, investments pay 10.5%, and you have \$100 for coffee next year. What's the real cost of not investing your \$100?

A. 5.5 cups of coffee

B. 10 cups of coffee

C. 15.5 cups of coffee

Remarks:

- the financial system allows you to smooth your consumption over your life cycle
- inflation erodes nominal value over life cycle, but financial assets offer protection

# Financial system function 2: consumption timing

**Question 3**

Coffee is now \$1/cup, inflation is 5%, investments pay 10.5%, and you have \$100 for coffee next year. What's the real cost of not investing your \$100?

A. 5.5 cups of coffee

B. **10 cups of coffee**

C. 15.5 cups of coffee

Remarks:

- the financial system allows you to smooth your consumption over your life cycle
- inflation erodes nominal value over life cycle, but financial assets offer protection

# Financial system function 2: consumption timing

**Solution 3**

Inflation is 5%, so a cup of coffee next year costs $\$1.00 \times 1.05 = \$1.05$.

# Financial system function 2: consumption timing

**Solution 3**

Inflation is 5%, so a cup of coffee next year costs $\$1.00 \times 1.05 = \$1.05$. If you invest \$100 at 10.5% for one year, you have \$110.5, which buys you

$$\$110.5/\$1.05 \approx 105.24$$

cups of coffee next year.

# Financial system function 2: consumption timing

**Solution 3**

Inflation is 5%, so a cup of coffee next year costs $\$1.00 \times 1.05 = \$1.05$. If you invest \$100 at 10.5% for one year, you have \$110.5, which buys you

$$\$110.5/\$1.05 \approx 105.24$$

cups of coffee next year. If you do not invest, your \$100 buys you

$$\$100/\$1.05 \approx 95.24$$

cups of coffee next year.

# Financial system function 2: consumption timing

**Solution 3**

Inflation is 5%, so a cup of coffee next year costs $\$1.00 \times 1.05 = \$1.05$. If you invest \$100 at 10.5% for one year, you have \$110.5, which buys you

$$\$110.5/\$1.05 \approx 105.24$$

cups of coffee next year. If you do not invest, your \$100 buys you

$$\$100/\$1.05 \approx 95.24$$

cups of coffee next year. The difference is about 10 cups of coffee in real terms.

# Financial system function 3: risk sharing

**Question 4**

Your firm is risky: investing \$100 pays \$200 with 50% probability, and \$0 with 50% probability. A friend's firm is the same. If payoffs are independent and you each invest \$50 in each firm, you lose \$100 with what probability?

A. 50%

B. 25%

C. 5%

Remarks:

- capital markets allow the risk to be shared and diversified
- investors can choose assets that match their appetite for risk

# Financial system function 3: risk sharing

**Question 4**

Your firm is risky: investing \$100 pays \$200 with 50% probability, and \$0 with 50% probability. A friend's firm is the same. If payoffs are independent and you each invest \$50 in each firm, you lose \$100 with what probability?

A. 50%

B. **25%**

C. 5%

Remarks:

- capital markets allow the risk to be shared and diversified
- investors can choose assets that match their appetite for risk

# Financial system function 3: risk sharing

**Solution 4**

Recall that for two independent events $X$ and $Y$,

$$\mathrm{Prob}(X \text{ and } Y) = \mathrm{Prob}(X)\mathrm{Prob}(Y)\,.$$

# Financial system function 3: risk sharing

**Solution 4**

Recall that for two independent events $X$ and $Y$,

$$\mathrm{Prob}(X \text{ and } Y) = \mathrm{Prob}(X)\mathrm{Prob}(Y)\,.$$

If $X$ is the event that your firm fails, and $Y$ is the event that your friend's firm fails, then the probability that both firms fail is

$$\mathrm{Prob}(X \text{ and } Y) = 0.5 \times 0.5 = 0.25\,.$$

# Financial system function 3: risk sharing

**Solution 4**

Recall that for two independent events $X$ and $Y$,

$$\mathrm{Prob}(X \text{ and } Y) = \mathrm{Prob}(X)\mathrm{Prob}(Y)\,.$$

If $X$ is the event that your firm fails, and $Y$ is the event that your friend's firm fails, then the probability that both firms fail is

$$\mathrm{Prob}(X \text{ and } Y) = 0.5 \times 0.5 = 0.25\,.$$

Diversification halves the risk of losing all of your initial \$100 investment.

# Financial system function 4: capital allocation

Lender-savers:

- households
- firms
- govt
- foreign

flow of funds

Borrower-spenders:

- firms
- govt
- households
- foreign

---

Remarks:

- you've saved $10,000 for retirement, and a farmer somewhere needs a tractor
- under your mattress, the $10,000 loses value each year from inflation
- without a tractor, fields lay fallow and the farmer forgoes profit
- you could lend to the farmer in exchange for a share of the profit!

# Lecture 1: Introduction to Financial Markets
## Overview of Topics

---



Reading: Mishkin and Eakins (2018, Chapters 1, 2, and 7), Philippon and Reshef (2013)

# What's the difference between real and financial assets?

| | Real Assets | Financial Assets |
|---|---|---|
| Intuition: | Main Street | Wall Street |
| Definition: | Assets that contribute to firms' productive capacity | Legal claims on the real assets and cash flows of firms |
| Examples: | Tangible: buildings, equipment<br>Intangible: patents, brands | Primitive: stocks, bonds<br>Derivative: options, futures |

Remarks:

- an asset is anything of value; here we study *financial* rather than real assets
- financial assets represent investors' legal claims on firms' real assets and cash flows

# Some examples of financial assets traded in financial markets

Debt: fixed liability of a firm, paying regular interest

- recourse to assets of borrower if interest not paid
- examples: government, corporate, and municipal bonds, mortgages

Equity: residual claim on firm profits and assets

- ownership share of firm profits, paid as dividends (or retained)
- examples: common & preferred stocks (differ in voting rights, seniority)

Derivatives: assets with payouts that depends on other assets

- flexibly constructed financial assets used to manage risk
- examples: forwards, futures, options, swaps

Other products: delegated portfolio management

- financial assets that are managed by profession investors
- examples: mutual and index funds, hedge funds, pension funds

# What type of asset is this?

## Question 5

A friend makes you an offer: you pay \$1 today, and tomorrow your friend pays you \$2 if Apple's stock price closes higher than today. What type of asset is this?

A. Debt, the payoff is a fixed liability for your friend
B. Equity, the payoff depends on Apple's stock price
C. Derivative, Apple stock is the underlying asset
D. Real, your friend is a tangible asset

# What type of asset is this?

**Question 5**

A friend makes you an offer: you pay \$1 today, and tomorrow your friend pays you \$2 if Apple's stock price closes higher than today. What type of asset is this?

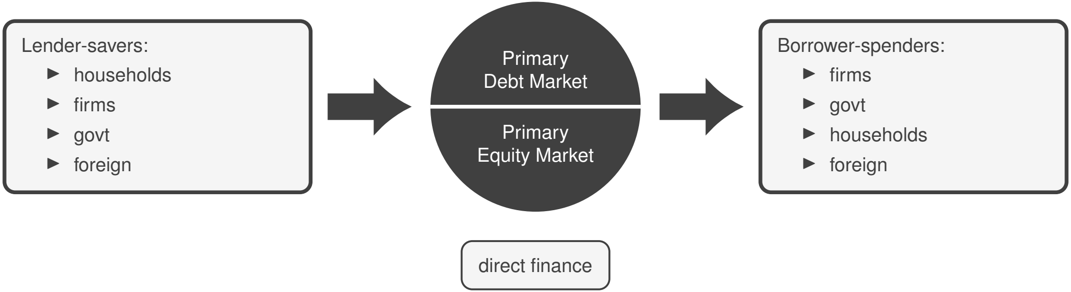
A. Debt, the payoff is a fixed liability for your friend

B. Equity, the payoff depends on Apple's stock price

C. **Derivative, Apple stock is the underlying asset**

D. Real, your friend is a tangible asset

# Primary debt and equity markets directly link savers with borrowers




Remarks:

- savers pay funds through primary markets to buy borrowers' new stocks and bonds
- primary because assets newly issued, direct because no intermediary involved

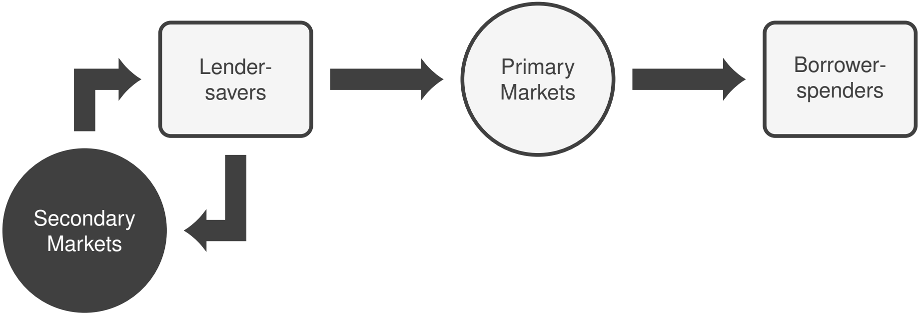
# Primary vs. Secondary Markets

| | Primary Markets | Secondary Markets |
|---|---|---|
| Definition: | Markets for newly-issued securities that firms create (with help from investment banks) and sell to investors | Markets for previously-issued securities that investors trade over the counter (OTC) or in exchanges |
| Examples: | Treasury bill auctions, initial public offerings (IPOs) of stock | Exchanges like NYSE, AMEX, LSE, TSE, CME, CBOT, etc. |

Remarks:

- typically institutional investors (not households) trade in primary markets
- typically, media coverage of “markets” refers to the secondary markets
- note that secondary markets do *not* transfer funds from borrowers to savers

# Secondary markets let lender-savers trade existing assets




Remarks:

- once issued, securities can be traded among saver-lenders in secondary markets
- secondary markets are *not* direct finance, because they make no link to borrowers

# Money vs. capital: different markets for different durations

| | Financial Markets | |
|---|---|---|
| | Money Markets | Capital Markets |
| Definition: | Shorter-term financing ($<$ 1 yr)<br>Often liquid, lower risk | Longer-term financing ($>$ 1 yr)<br>Often higher risk |
| Examples: | Treasury bills<br>Certificates of deopsit<br>Commercial paper | Treasury bonds<br>Corporate bonds<br>Stocks |

Remarks:

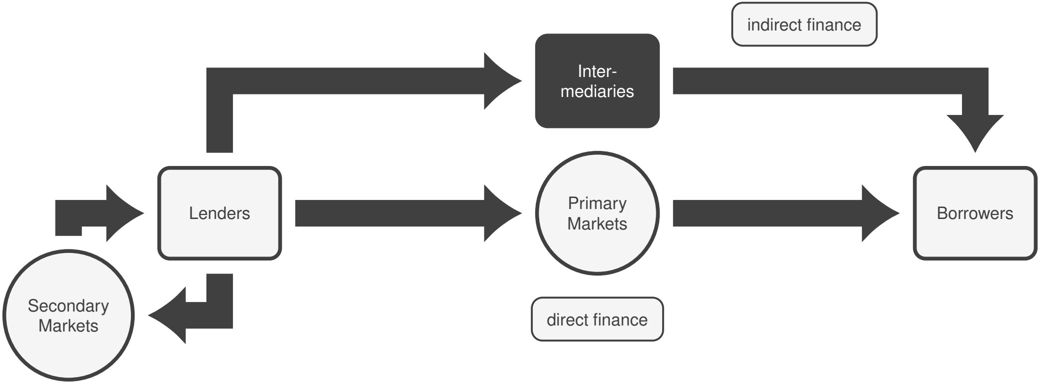
- financial market here refers to short- and long-term financing markets
- more loosely, it can mean capital, money, commodity, derivative, or fx markets, etc.

# Lecture 1: Introduction to Financial Markets
# Overview of Topics



Reading: Mishkin and Eakins (2018, Chapters 1, 2, and 7), Philippon and Reshef (2013)

# Intermediaries offer another channel for the flow of funds




Remarks:

- intermediaries include banks, mutual funds, insurers, and many other institutions

# Intermediation mitigates two problems with financial markets

**Definition 1**

| | |
|---|---|
| Transaction costs: | Time and money spent carrying out financial transactions |
| Asymmetric information: | Differences in buyer and seller information sets |

Remarks:

- in this section we learn how these two problems can negatively affect markets
- we also learn how financial intermediaries can help mitigate the problems

# Two types of information asymmetry can make markets fail

**Definition 2**

| | |
|---|---|
| Adverse selection: | High-risk borrowers are most likely to seek funds and you can't distinguish high from low risk. |
| Moral hazard: | Borrowers have incentives to misuse funds after you've lent them if you can't monitor effectively. |

Remarks:

- adverse selection happens *before* a transaction has occurred
- moral hazard happens *after* a transaction has occurred
- both result from differences in information between buyers and sellers

# What's your problem: adverse selection or moral hazard?

**Question 6**

Two friends are selling their cars: one car is high in value, one car is low in value. You're no mechanic, so you don't know which car is which. If you offer to pay a price equal to the value of an average car, which friend will sell?

A. friend with the high-value car

B. friend with the low-value car

Remarks:

- information is asymmetric, your friends know more about the cars than you do
- in the end, you may decide not to transact at all $\Rightarrow$ market failure
- intermediaries are specialized in *screening*, which mitigates adverse selection

# What’s your problem: adverse selection or moral hazard?

**Question 6**

Two friends are selling their cars: one car is high in value, one car is low in value. You’re no mechanic, so you don’t know which car is which. If you offer to pay a price equal to the value of an average car, which friend will sell?

A. friend with the high-value car

B. **friend with the low-value car**

Remarks:

- information is asymmetric, your friends know more about the cars than you do
- in the end, you may decide not to transact at all $\Rightarrow$ market failure
- intermediaries are specialized in *screening*, which mitigates adverse selection

# Financial intermediaries: the good and bad and the ugly

Intermediaries' solutions to market problems:

- scale economies: standardize financial products $\Rightarrow$ transaction-cost degression
- screening: check creditworthiness using deep knowledge and experience
- monitoring: keep close relationship with borrower (i.e. relationship lending)

Two other positives and a negative:

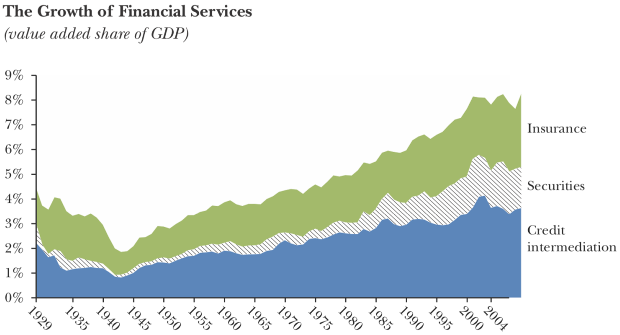
- asset transformation ($+$): turn safe assets into risky ones (e.g. deposits into loans)
- scope economies ($+$): re-use borrower information (e.g. loans and bond issuance)
- conflict of interest ($-$): e.g. trading desk uses confidential creditworthiness info

# Lecture 1: Introduction to Financial Markets
# Overview of Topics



Reading: Mishkin and Eakins (2018, Chapters 1, 2, and 7), Philippon and Reshef (2013)

# Big picture: the growth of U.S. financial services

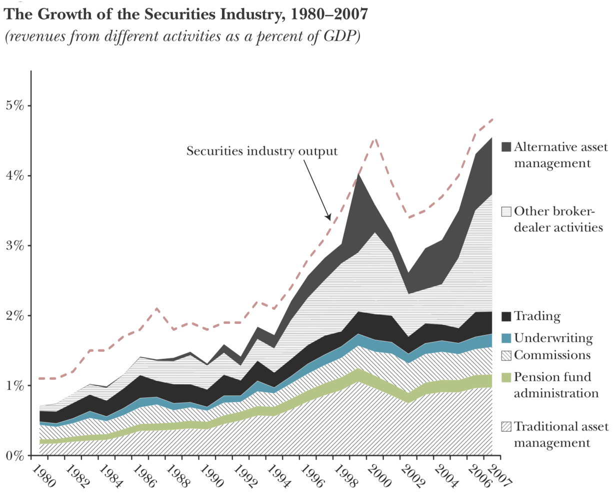



Source: Greenwood and Scharfstein (2013)

Remarks:

- steady growth since WWII
- credit intermediation is important
- dramatic rise of securities industry
- Note: growth is *relative* to GDP!
- What could be driving the growth?

# A closer look at the U.S. securities industry

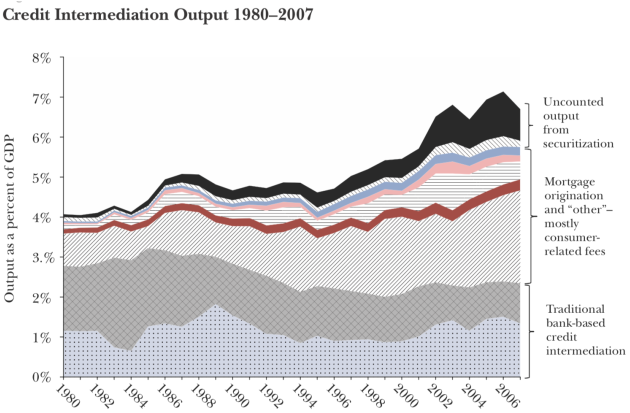



Source: Greenwood and Scharfstein (2013)

Remarks:

- striking rise of U.S. securities industry since 1980s
- clearly traditional asset management has grown
- what are “other broker-dealer activities”?
- what about “alternative asset management”?
- what happened around 2000!?

# A closer look at U.S. credit intermediation




Source: Greenwood and Scharfstein (2013)

Remarks:

- steady growth in credit intermediation since 1980s
- growth has come entirely from fees and securitization!
- for details, read through Greenwood and Scharfstein (2013)

# Lecture 1: Introduction to Financial Markets
# Overview of Topics



Reading: Mishkin and Eakins (2018, Chapters 1, 2, and 7), Philippon and Reshef (2013)

# Paper of the Week: Philippon and Reshef (2013)

> *Studies of long-run evolution of the finance industry have largely focused on the United States. These studies reveal three key facts: 1) the share of aggregate income spent on financial intermediation is time varying; 2) the unit cost of financial intermediation is relatively flat; and 3) the pattern of changes in human capital and wages in finance relative to the whole economy exhibits a U-shape over the twentieth century. In this paper, we ask whether these facts hold for a set of other economies with similar levels of development.*
>
> — **Thomas Philippon and Ariell Reshef**

# Lecture 1: Introduction to Financial Markets

Revision Checklist

- ☐ Module Introduction
- ☐ Financial System Functions
- ☐ Financial Markets
- ☐ Financial Intermediation
- ☐ The Growth of Finance
- ☐ Paper of the Week

Reading: Mishkin and Eakins (2018, Chapters 1, 2, and 7), Philippon and Reshef (2013)

# Survey of the Financial System
# Table of Contents

# Lecture 2: Interest Rates and Term Structure
# Overview of Topics

2.1. Yield to Maturity
2.2. Term Structure
2.3. Forecasting
2.4. Paper of the Week

Reading: Mishkin and Eakins (2018, Chapters 3 and 5), and Misawa (2020, June), Campbell (1995)

# Is there a discount rate that rationalizes an asset price, taking the asset's cash flows as given?

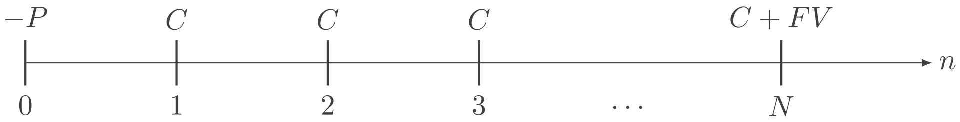
**Definition 3**

| | |
|---|---|
| Yield to maturity: | The interest rate that makes the present value of cash flows from a financial asset equal the asset's current price. |

Remarks:

- to compute an asset price, we typically need to know the appropriate discount rate
- if we know the asset price, we can find an implied discount rate—i.e. yield to maturity
- interpret yield to maturity as representing an asset's internal rate of return

# Yield-to-maturity example: coupon bond (1/3)




Notation and remarks:

- $P$ purchase price in period $0$
- $C$ fixed coupon payment in period $n$
- $FV$ fixed face value in the period of maturity
- $N$ period of maturity
- coupon bonds pay periodic fixed coupon payments, plus a face value at maturity
- the coupon rate expresses the coupon as a fraction of the bond's face value

# Yield-to-maturity example: coupon bond (2/3)

**Question 7**

A bond with \$1,000 face value paying an annual \$100 coupon matures in 2 years. The bond is selling for \$1,100 today. What is the bond's yield to maturity?

A. 5.00%

B. 4.65%

C. 6.45%

Remarks:

- note that here you're given price and face value, and asked for yield to maturity
- recall that for $x^2 + ax + b = 0$ we have $x_{1,2} = -\frac{a}{2} \pm \sqrt{\left(\frac{a}{2}\right)^2 - b}$, ignore negative roots

# Yield-to-maturity example: coupon bond (2/3)

**Question 7**

A bond with \$1,000 face value paying an annual \$100 coupon matures in 2 years. The bond is selling for \$1,100 today. What is the bond's yield to maturity?

A. 5.00%

B. **4.65%**

C. 6.45%

Remarks:

- note that here you're given price and face value, and asked for yield to maturity
- recall that for $x^2 + ax + b = 0$ we have $x_{1,2} = -\frac{a}{2} \pm \sqrt{\left(\frac{a}{2}\right)^2 - b}$, ignore negative roots

# Yield-to-maturity example: coupon bond (2/3)

**Solution 7**

We need to find the interest rate that makes the present value of the bond's cash flows equal to the bond's price.

# Yield-to-maturity example: coupon bond (2/3)

**Solution 7**

We need to find the interest rate that makes the present value of the bond's cash flows equal to the bond's price.

Solve for $i$ in the equation

$$1100 = \frac{100}{1+i} + \frac{1100}{(1+i)^2}\,.$$

# Yield-to-maturity example: coupon bond (2/3)

**Solution 7**

We need to find the interest rate that makes the present value of the bond's cash flows equal to the bond's price.

Solve for $i$ in the equation

$$1100 = \frac{100}{1+i} + \frac{1100}{(1+i)^2}\,.$$

Recognizing that this equation is quadratic, rewrite as

$$(1+i)^2 - \frac{1}{11}(1+i) - 1 = 0 \quad \Rightarrow \quad 1+i = \frac{1}{22} \pm \sqrt{1/22^2+1}\,.$$

# Yield-to-maturity example: coupon bond (2/3)

**Solution 7**

We need to find the interest rate that makes the present value of the bond's cash flows equal to the bond's price.

Solve for $i$ in the equation

$$1100 = \frac{100}{1+i} + \frac{1100}{(1+i)^2}\,.$$

Recognizing that this equation is quadratic, rewrite as

$$(1+i)^2 - \frac{1}{11}(1+i) - 1 = 0 \quad \Rightarrow \quad 1+i = \frac{1}{22} \pm \sqrt{1/22^2 + 1}\,.$$

The equation has one positive solution for $i$, namely $i \approx 4.65\%$.

# Yield-to-maturity example: coupon bond (3/3)

$$P = \frac{C}{(1+i)^1} + \frac{C}{(1+i)^2} + \frac{C}{(1+i)^3} + \cdots + \frac{C+FV}{(1+i)^N}$$

Remarks:

- the price of a coupon bond with maturity $N$ satisfies the above equation
- think of bond prices as *responding to* changes in prevailing interest rates
- given four of the variables $\{C, FV, P, i, N\}$, you can always find the fifth
- but price nonlinear in yield to maturity $i$, so often no closed-form expression for $i$

# Real yields reflect the true cost of borrowing

$$\boxed{i \approx i_r + \pi^e}$$

Notation and remarks:

- $i$ nominal yield to maturity
- $i_r$ real yield to maturity
- $\pi^e$ expected rate of inflation
- real interest adjusts for rises in the cost of living that come from price inflation
- the Fisher equation above is named after American economist Irving Fisher

# Lecture 2: Interest Rates and Term Structure
# Overview of Topics



Reading: Mishkin and Eakins (2018, Chapters 3 and 5), and Misawa (2020, June), Campbell (1995)

# What does term structure mean?

**Definition 4**

| | |
|---|---|
| Term structure: | The relationships among the various yields to maturity on bonds in the same risk class but with different maturities. |

Remarks:

- bonds in the same risk class with different maturities have different yields
- term premium: yield spread on bonds with same risk but different maturities
- three term structure theories: expectations, market segmentation, liquidity premium
- you can see the recent term structure for several countries in the FT

# What does risk structure mean?

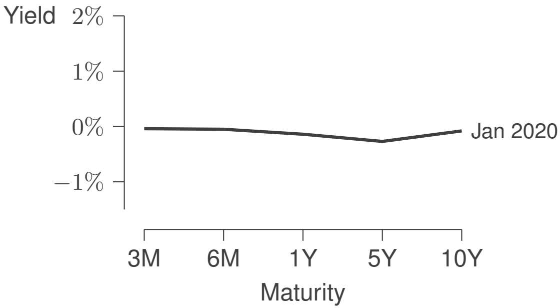
**Definition 5**

| | |
|---|---|
| Risk structure: | The relationships among the various interest rates on bonds of the same maturity but with different default, liquidity, and/or income tax risks. |

Remarks:

- bonds with same maturity in different risk classes have different yields
- risk premium: yield spread on bonds with different risk but same maturity
- corporate bonds are generally riskier than govt bonds, offer higher yields
- risk structure and risk premia will be covered in detail in another module
- we will cover risk structure in our lecture on bond markets in a few weeks

# Visualizing term structure stylized facts



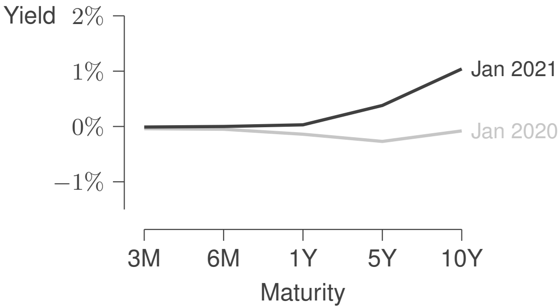

Term Structure Stylized Facts:

1. yields move together across maturities
2. yield curve almost always slopes up
3. high short yield $\Rightarrow$ negative slope likely

Remarks:

- good theories term structure should explain these yield curve stylized facts
- remember that there are plenty of exceptions to these “facts”—hence “stylized”
- this section introduces concepts aimed at explaining the term structure stylized facts

# Visualizing term structure stylized facts



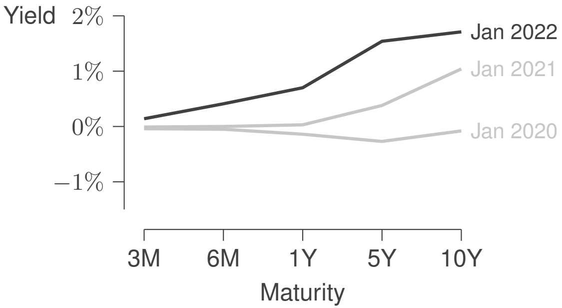

Term Structure Stylized Facts:

1. yields move together across maturities
2. yield curve almost always slopes up
3. high short yield $\Rightarrow$ negative slope likely

Remarks:

- good theories term structure should explain these yield curve stylized facts
- remember that there are plenty of exceptions to these “facts”—hence “stylized”
- this section introduces concepts aimed at explaining the term structure stylized facts

# Visualizing term structure stylized facts



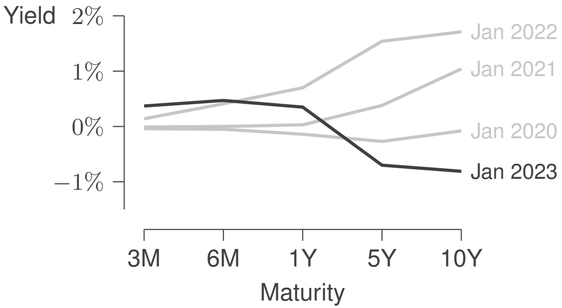

Term Structure Stylized Facts:

1. yields move together across maturities
2. yield curve almost always slopes up
3. high short yield $\Rightarrow$ negative slope likely

Remarks:

- good theories term structure should explain these yield curve stylized facts
- remember that there are plenty of exceptions to these “facts”—hence “stylized”
- this section introduces concepts aimed at explaining the term structure stylized facts

# Visualizing term structure stylized facts



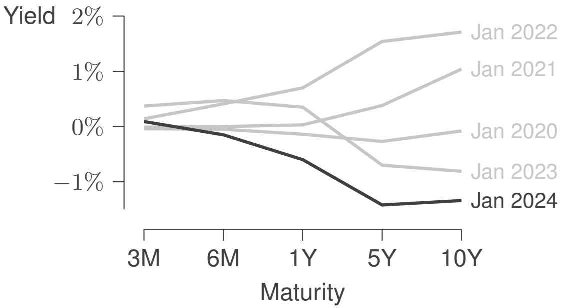

Term Structure Stylized Facts:

1. yields move together across maturities
2. yield curve almost always slopes up
3. high short yield $\Rightarrow$ negative slope likely

Remarks:

- good theories term structure should explain these yield curve stylized facts
- remember that there are plenty of exceptions to these “facts”—hence “stylized”
- this section introduces concepts aimed at explaining the term structure stylized facts

# Visualizing term structure stylized facts




Term Structure Stylized Facts:

1. yields move together across maturities
2. yield curve almost always slopes up
3. high short yield $\Rightarrow$ negative slope likely

Remarks:

- good theories term structure should explain these yield curve stylized facts
- remember that there are plenty of exceptions to these “facts”—hence “stylized”
- this section introduces concepts aimed at explaining the term structure stylized facts

# What were the term structure stylized facts, again?

**Question 8**

Which of the following was *not* a term structure stylized fact?

A. yields move together across maturities

B. high short-term yield $\Rightarrow$ negative slope more likely

C. short-term yields move opposite to long-term yields

D. yield curve almost always slopes up

# What were the term structure stylized facts, again?

## Question 8

Which of the following was *not* a term structure stylized fact?

A. yields move together across maturities
B. high short-term yield $\Rightarrow$ negative slope more likely
C. **short-term yields move opposite to long-term yields**
D. yield curve almost always slopes up

# What theories explain the term structure?

1. Expectations Theory
2. Market Segmentation Theory
3. Liquidity Preference Theory

---

Remarks:

- which of these theories best explains the term structure stylized facts?
- the first two theories offer partial explanations for the stylized facts
- the third theory combines the first two and captures all three stylized facts

# Theory 1: The Expectations Theory (1/2)

**Definition 6**

| | |
|---|---|
| Expectations Theory: | Theory that the interest rate on a long-term bond equals the average of expected future interest rates on short-term bonds. |

Remarks:

- requires assumption that bonds of different maturities are perfectly substitutable
- helps explain two of three stylized facts, but ultimately unsatisfactory
- cannot explain fact 2: the yield curve almost always slopes upward (more on this. . . )

# Theory 1: The Expectations Theory (2/2)

$$(1+i_{nt})^n = (1+i_t)(1+i^e_{t+1})\cdots(1+i^e_{t+n-1}) \;\Rightarrow\; i_{nt} \approx \frac{i_t + i^e_{t+1} + \cdots + i^e_{t+n-1}}{n}$$

Notation and remarks:

- $i_t$ time $t$ interest rate on one-period bond
- $i_{nt}$ time $t$ interest rate on an $n$-period bond
- $i^e_{t+n}$ time $t$ expected interest rate on one-period bond at time $t+n$
  - long rates are (approximate) averages of expected short rates
  - approximation uses $ii' \approx 0 \; \forall \; i, i' \approx 0$ (i.e. the product of small numbers is small)
  - short rates are persistent, so low today often means low tomorrow (fact 1)
  - short rates revert to mean: deviations from mean disappear in long run (fact 3)

# Theory 2: Market Segmentation Theory

**Definition 7**

| | |
|---|---|
| Market Segment. Theory: | Theory that markets for bonds of different maturity are segmented, and that investors have a preference for bonds with certain maturities. |

Remarks:

- segments can arise from differences in interest-rate risk across maturities
- investors prefer low-risk short bonds, so these have higher prices and lower yields
- expectation hypothesis won't work here because perfect substitutability fails
- segmentation can explain fact 2 but not facts 1 and 3, so ultimately unsatisfactory

# Theory 3: Liquidity Premium Theory (1/2)

**Definition 8**

| | |
|---|---|
| Liquidity Premium Theory: | Theory that the interest rate on a long-term bond equals the average of expected interest rates on short-term bonds *plus* a liquidity premium that responds to supply and demand for that bond. |

Remarks:

- bonds of different maturities are substitutes, but not perfect substitutes
- investors prefer short-term bonds, require a risk premium to hold long-term bonds
- liquidity premium (or term premium) is larger for longer maturities
- liquidity preference can explain all three facts, ultimately most satisfying theory

# Theory 3: Liquidity Premium Theory (2/2)

$$i_{nt} \approx \frac{i_t + i^e_{t+1} + \cdots + i^e_{t+n-1}}{n} + l_{nt}, \quad \text{where } l_{nt} \text{ increases in } n$$

Notation and remarks:

$l_{nt}$ liquidity premium at time $t$, an increasing function of maturity $n$

- liquidity premium is a positive and increasing function of the maturity $n$
- thus, liquidity premium theory implies tendency for upward-sloping yield curve

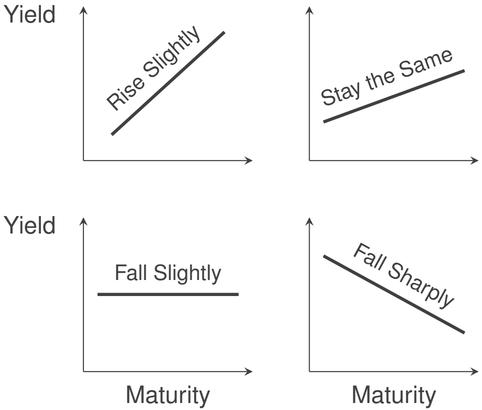
# Lecture 2: Interest Rates and Term Structure
# Overview of Topics



Reading: Mishkin and Eakins (2018, Chapters 3 and 5), and Misawa (2020, June), Campbell (1995)

# Yield curves and market expectations

Future short-term interest rates expected to:




Remarks:

- yield curve slope shows market expectations at different horizons
- implied expectations (forward rates) can be backed out of yield curve
- note: slight upward slope due to the liquidity premium rising in $n$
- more than slight upward slope $\Rightarrow$ market expectations on short rates

# Forwards rates: expected short rates at different horizons (1/2)

From the expectation hypothesis,

$$(1+i_{2t})^2 = (1+i_t)(1+i^e_{t+1})$$
$$\Rightarrow \qquad i^e_{t+1} = \frac{(1+i_{2t})^2}{(1+i_t)^1} - 1,$$

and notice that

$$(1+i_{3t})^3 = (1+i_t)(1+i^e_{t+1})(1+i^e_{t+2})$$
$$\Rightarrow \qquad i^e_{t+2} = \frac{(1+i_{3t})^3}{(1+i_{2t})^2} - 1, \text{ using } i^e_{t+1} \text{ from above.}$$

---

Notation and remarks:

$i^e_{t+1}$ one-year interest rate expected in one year

$i^e_{t+2}$ one-year interest rate expected in two year

- these are the unadjusted one-period and two-period forward rates

# Forwards rates: expected short rates at different horizons (1/2)

By iterating in this way, we obtain

Unadjusted $n$-period forward rate: $$i^e_{t+n} = \frac{(1+i_{n+1t})^{n+1}}{(1+i_{nt})^n} - 1.$$

And adjusting for the liquidity premium yields

Adjusted $n$-period forward rate: $$\tilde{i}^e_{t+n} = \frac{(1+i_{n+1t}-l_{n+1t})^{n+1}}{(1+i_{nt}-l_{nt})^n} - 1.$$

# Lecture 2: Interest Rates and Term Structure
# Overview of Topics



Reading: Mishkin and Eakins (2018, Chapters 3 and 5), and Misawa (2020, June), Campbell (1995)

# Paper of the Week: Campbell (1995)

> *“The academic literature on the term structure is enormous, and it continues to expand whether or not the subject is in fashion. Fortunately, the literature has improved in quality in the 25 years since Ed Kane’s (1970) half-serious jibe: “It is generally agreed that, ceteris paribus, the fertility of a field is roughly proportional to the quantity of manure that has been dumped upon it in the recent past. By this standard, the term structure of interest rates has become [...] an extraordinarily fertile field indeed.” I first summarize recent research on the term structure of interest rates and then relate it to recent swings in the bond market and the government’s choice of debt maturity.”*
>
> — **John Y. Campbell**

# Lecture 2: Interest Rates and Term Structure

Revision Checklist

- ☐ Yield to Maturity
- ☐ Term Structure
- ☐ Forecasting
- ☐ Paper of the Week

Reading: Mishkin and Eakins (2018, Chapters 3 and 5), and Misawa (2020, June), Campbell (1995)

# Survey of the Financial System
# Table of Contents

# Lecture 3: Central Banks and Money Markets
# Overview of Topics

---

3.1. Central Bank Goals and Structures

3.2. Central Bank Operations

3.3. Reserves and T-Accounts

3.4. Reserves Supply and Demand

3.5. Money Markets

3.6. Paper of the Week

Reading: Mishkin and Eakins (2018, Chapters 9, 10, and 11), Bernanke (2013)

# What are central banks?

**Definition 9**

| | |
|---|---|
| Central bank: | Government authority in charge of monetary policy, with the power to manage the money supply and manipulate interest rates. |

Remarks:

- the primary goal of most central banks: keep the general price level from rising
- other goals: lower unemployment, stabilize output, protect financial system
- history: Sveriges Riksbank (1668), Bank of England (1694), Federal Reserve (1913)
- large central banks by total assets: U.S. Fed, ECB, BoJ, PBC, RBI

# A closer look at central bank goals

Primary goals:

- price stability and low unemployment
- hierarchical mandate (EBC) vs. dual mandate (Fed)

Secondary goals:

- real and financial stability
- interest rate stability
- foreign exchange rate stability

---

Remarks:

- note well: hard trade-offs in short run, but fewer trade-offs in the long run
- short-run: higher interest rate $\Rightarrow$ lower inflation, higher unemployment
- long-run: price stability is consistent with the other goals in the long-run

# Central Bank Independence at a Glance

Positive aspects of independence: avoid political influence

- political pressure will tend to add an inflationary bias to monetary policy
- politicians aiming for re-election will push for expansionary monetary policy
- policymakers may have expertise in monetary matters that politicians lack

Negative aspects of independence: governance by unelected elites

- elite group controlling the economy without accountability to electorate?
- leaves other government branches with little control over the economy
- mistakes: 1930s depression, 1970s inflation, 2000s fin crises, 2020s inflation

### Question 9

Do you agree with the following statement: “Central bankers in my home country should have more independence and less oversight than members of other branches of government.”

A. Yes

B. No

Remarks:

- central bank independence is sometimes attacked by politicians in other branches…
- …but central bankers also accused of unethical behavior, e.g. personal investments

# Lecture 3: Central Banks and Money Markets
## Overview of Topics



Reading: Mishkin and Eakins (2018, Chapters 9, 10, and 11), Bernanke (2013)

# Banking reserves: a simple definition

**Definition 10**

| | |
|---|---|
| Banking reserves: | Liquid funds that commercial banks deposit with a central bank or hold themselves in physical currency (vault cash). |

Remarks:

- reserves let banks quickly respond to customers who withdrawal deposits on demand
- banks must hold in reserve a minimum fraction (required reserve ratio) of deposits
- banks often hold excess reserves above the required minimum as insurance
- central banks may pay interest on (excess) reserves that commercial banks deposit

# Discount rate: a simple definition

**Definition 11**

| | |
|---|---|
| Discount rate: | The interest rate at which commercial banks borrow reserves on short term from a central bank. |

Remarks:

- central banks stand ready to supply any quantity of reserves at this interest rate
- for this reason, central banks serve as lenders of last resort for troubled banks
- actually three rates in U.S.: primary (5.00%), secondary (5.50%), seasonal (4.80%)
- primary rate is for healthy banks, secondary for sick ones, seasonal for specialists

# Conventional Monetary Policy Tools (x4)

1. Open Market Operations:
   - buy and sell U.S. treasury securities to manipulate level of reserves
   - can be dynamic (adjust reserves) or defensive (maintain reserves)
2. Discount Rate:
   - set interest rate $i_d$ that commercial banks pay to borrow from central banks
   - primary (healthy banks), secondary (troubled banks), seasonal (small banks)
3. Interest on Reserves:
   - set interest rate $i_{er}$ that central banks pay to commercial bank for reserves
   - if $i_{er}$ negative, banks hold fewer excess reserves and lend more to economy
4. Required Reserve Ratio:
   - require banks to maintain specific ratio of reserves relative to deposits
   - infrequently used tool (in the west) because of impact on bank liquidity

# Lecture 3: Central Banks and Money Markets
# Overview of Topics

---



Reading: Mishkin and Eakins (2018, Chapters 9, 10, and 11), Bernanke (2013)

# How do open market operations affect banking reserves?

| Banking System | | | |
|---|---|---|---|
| Reserves | $R$ | Discount Loans | $L_d$ |
| Loans | $L$ | Deposits | $D$ |
| Securities | $S$ | | |

| Central Bank | | | |
|---|---|---|---|
| Discount Loans | $L_d$ | Reserves | $R$ |
| Securities | $S$ | Currency | $C$ |

Remarks:

- the t-accounts are stylized versions of bank and central bank balance sheets
- the t-accounts will show us the impact of open market purchase $X$ on reserves

# How do open market operations affect banking reserves?

**Banking System**

| Assets | | Liabilities | |
|---|---|---|---|
| Reserves | $R$ | Discount Loans | $L_d$ |
| Loans | $L$ | Deposits | $D$ |
| Securities | $S$ | | |
| | $-X$ | | |

**Central Bank**

| Assets | | Liabilities | |
|---|---|---|---|
| Discount Loans | $L_d$ | Reserves | $R$ |
| Securities | $S$ | Currency | $C$ |
| | $+X$ | | |

Remarks:

- the t-accounts are stylized versions of bank and central bank balance sheets
- the t-accounts will show us the impact of open market purchase $X$ on reserves
- example: the central bank buys govt securities from primary dealer banks…

# How do open market operations affect banking reserves?

**Banking System**

| | | | |
|---|---|---|---|
| Reserves | $R$ | Discount Loans | $L_d$ |
| | $+X$ | | |
| Loans | $L$ | Deposits | $D$ |
| Securities | $S$ | | |
| | $-X$ | | |

**Central Bank**

| | | | |
|---|---|---|---|
| Discount Loans | $L_d$ | Reserves | $R$ |
| | | | $+X$ |
| Securities | $S$ | Currency | $C$ |
| | $+X$ | | |

Remarks:

- the t-accounts are stylized versions of bank and central bank balance sheets
- the t-accounts will show us the impact of open market purchase $X$ on reserves
- example: the central bank buys govt securities from primary dealer banks. . .
- . . . the central bank pays primary dealers by creating new reserves

# How does discount lending affect banking reserves?

| Banking System | | | |
|---|---|---|---|
| Reserves | $R$ | Discount Loans | $L_d$ |
| Loans | $L$ | Deposits | $D$ |
| Securities | $S$ | | |

| Central Bank | | | |
|---|---|---|---|
| Discount Loans | $L_d$ | Reserves | $R$ |
| Securities | $S$ | Currency | $C$ |

Remarks:

- begin with the same stylized bank and central bank balance sheets as before
- now let's see how discount lending $X$ impacts the quantity of reserves in circulation

# How does discount lending affect banking reserves?

| Banking System | | | | Central Bank | | | |
|---|---|---|---|---|---|---|---|
| Reserves | $R$ | Discount Loans | $L_d$ $+X$ | Discount Loans | $L_d$ $+X$ | Reserves | $R$ |
| Loans | $L$ | Deposits | $D$ | Securities | $S$ | Currency | $C$ |
| Securities | $S$ | | | | | | |

Remarks:

- begin with the same stylized bank and central bank balance sheets as before
- now let's see how discount lending $X$ impacts the quantity of reserves in circulation
- example: a commercial bank borrows $X$ reserves from the central bank

# How does discount lending affect banking reserves?

| Banking System | | | | Central Bank | | | |
|---|---|---|---|---|---|---|---|
| Reserves | $R$ | Discount Loans | $L_d$ | Discount Loans | $L_d$ | Reserves | $R$ |
| | $+X$ | | $+X$ | | $+X$ | | $+X$ |
| Loans | $L$ | Deposits | $D$ | Securities | $S$ | Currency | $C$ |
| Securities | $S$ | | | | | | |

Remarks:

- begin with the same stylized bank and central bank balance sheets as before
- now let's see how discount lending $X$ impacts the quantity of reserves in circulation
- example: a commercial bank borrows $X$ reserves from the central bank
- the central bank creates the $X$ reserves and credits the commercial bank

# Lecture 3: Central Banks and Money Markets
## Overview of Topics



Reading: Mishkin and Eakins (2018, Chapters 9, 10, and 11), Bernanke (2013)

# Interbank lending: an alternative to CB's discount window

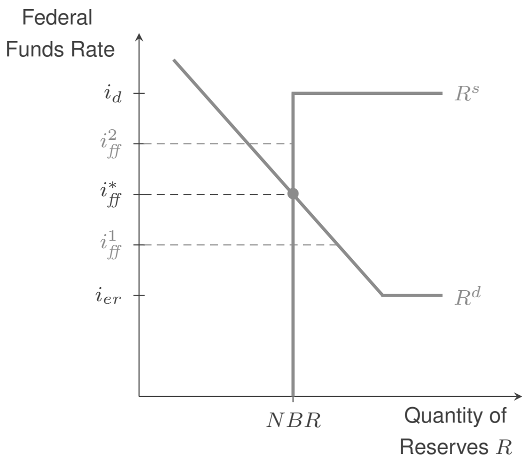
**Definition 12**

| | |
|---|---|
| Interbank lending markets: | Markets in which banks lend reserves to one another on short-term basis to meet liquidity needs. |

Remarks:

- interbank markets serve as alternatives to borrowing reserves from central banks
- geographically segmented interbank markets have different reference interest rates
- importantly, interest rates in these markets are targeted directly by central banks
- examples: federal funds rate in the U.S. and London interbank offered rate in the U.K.

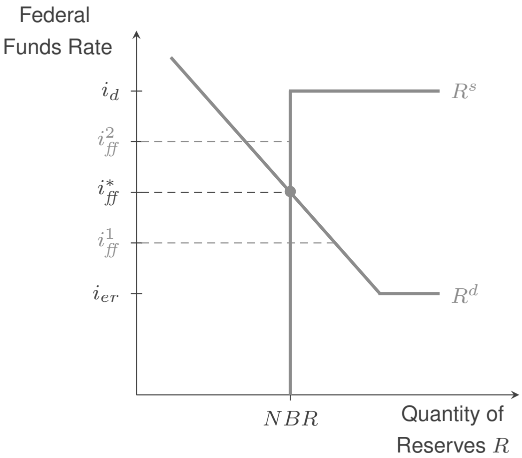
# Interbank lending market: the market for central bank reserves




Notation and remarks:

| | |
|---|---|
| $NBR$ | Non-borrowed reserves, from omo |
| $BR$ | Reserves borrowed, from dl |
| $i_d$ | discount rate |
| $i_{ff}$ | federal funds rate |
| $i_{er}$ | excess reserve rate |

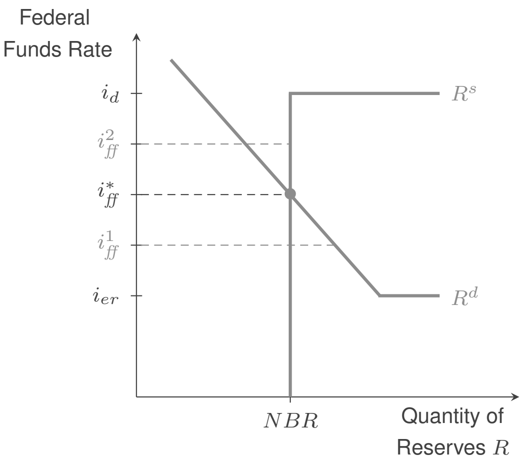
# Interbank lending market: the market for central bank reserves




Notation and remarks:

- **demand curve** slopes down $i_{ff} > i_{er}$: $i_{ff} \downarrow \Rightarrow$ excess reserve opportunity cost $\downarrow$
- demand curve flattens if $i_{ff} < i_{er}$: fed pays more than interbank market
- why flat? if fed pays more than market, banks borrow from market, deposit at fed

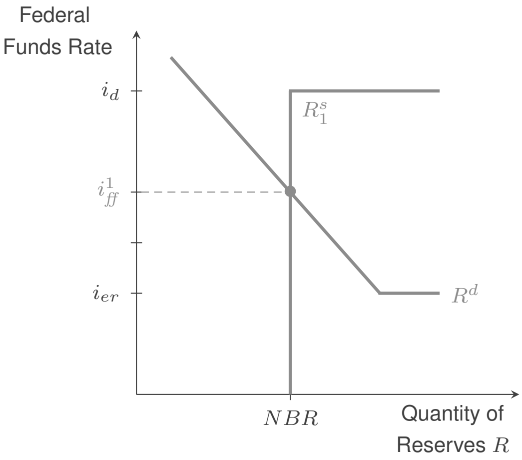
# Interbank lending market: the market for central bank reserves




Notation and remarks:

- **demand curve** slopes down $i_{ff} > i_{er}$: $i_{ff} \downarrow \Rightarrow$ excess reserve opportunity cost $\downarrow$
- demand curve flattens if $i_{ff} < i_{er}$: fed pays more than interbank market
- why flat? if fed pays more than market, banks borrow from market, deposit at fed
- **supply curve** vertical at $NBR$ if $i_{ff} < i_d$, no funds borrowed from fed, $BR = 0$
- supply curve flattens if $i_{ff} > i_d$: fed costs less than interbank market
- why flat? if fed costs less than market, banks borrow from fed, lend to market

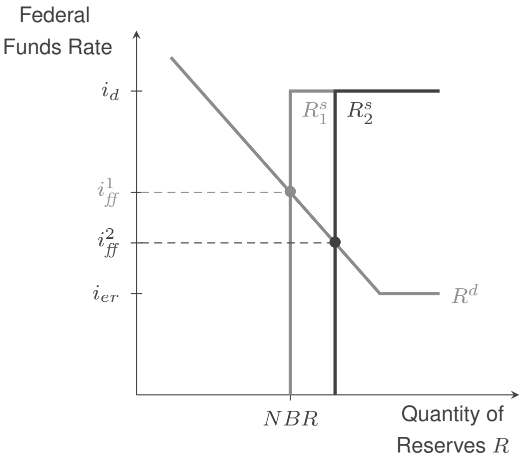
# Interbank lending market: the effects of open market operations




Remarks:

- fed arranges repurchase agreements with primary dealers (defensive omo)
- repurchase agreements are self-reversing bond sales in exchange for reserves

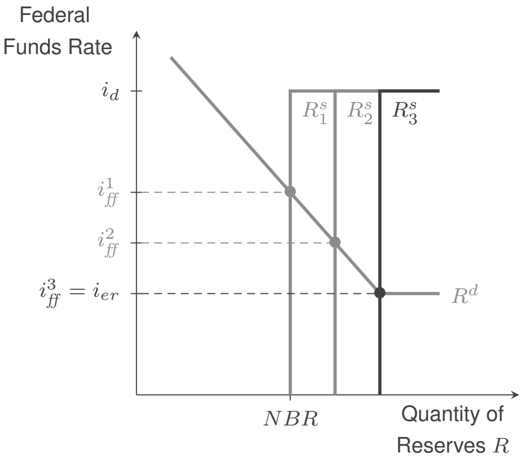
# Interbank lending market: the effects of open market operations




Remarks:

- fed arranges repurchase agreements with primary dealers (defensive omo)
- repurchase agreements are self-reversing bond sales in exchange for reserves
- transaction initially creates excess supply of reserves at current rates: $R_1^s \to R_2^s$
- excess supply of reserves puts downward pressure on the federal funds rate: $i_{ff}^1 \to i_{ff}^2$

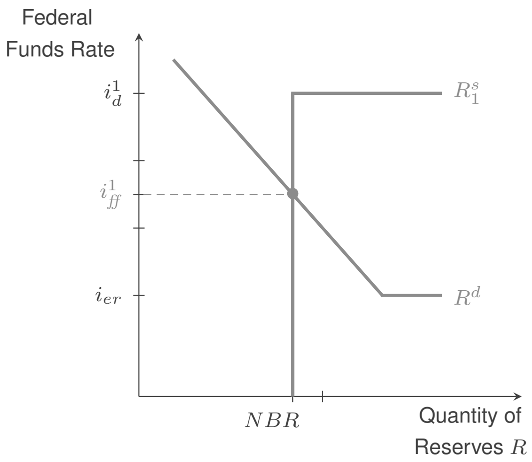
# Interbank lending market: the effects of open market operations




Remarks:

- fed arranges repurchase agreements with primary dealers (defensive omo)
- repurchase agreements are self-reversing bond sales in exchange for reserves
- transaction initially creates excess supply of reserves at current rates: $R_1^s \to R_2^s$
- excess supply of reserves puts downward pressure on the federal funds rate: $i_{ff}^1 \to i_{ff}^2$
- fed cannot push federal funds rate below $i_{er}$ because banks could arbitrage
- because defensive, primary dealers buy back treasuries typically within a week

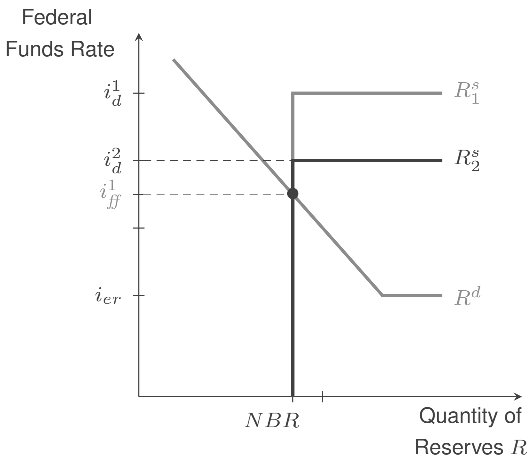
# Interbank lending market: the effects of discount rate adjustments




Remarks:

- banks borrow from discount window at the rate $i_d$ (ignore primary, secondary, seasonal)
- fed acts as lender of last resort, lending against collateral in times of financial crisis

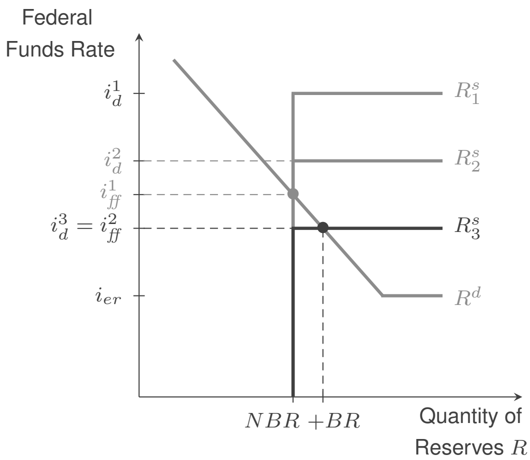
# Interbank lending market: the effects of discount rate adjustments




Remarks:

- banks borrow from discount window at the rate $i_d$ (ignore primary, secondary, seasonal)
- fed acts as lender of last resort, lending against collateral in times of financial crisis
- fed lowers $i_d$, but lower rate has no effect if $i_{ff} < i_d$ because market is cheaper
- federal funds rate remains at initial level $i_{ff}^1$ and no borrowed reserves $BR$ created

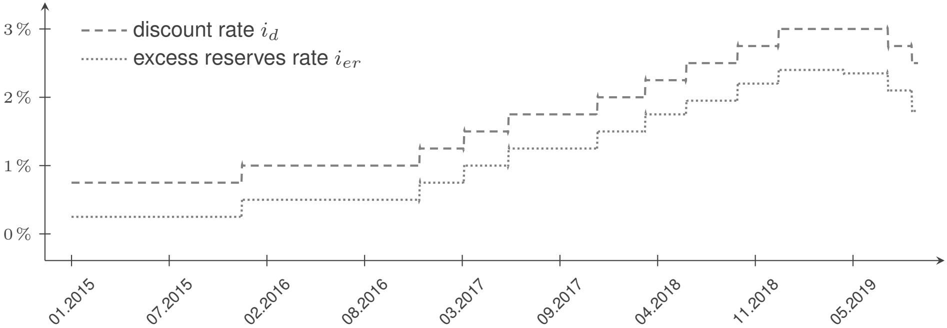
# Interbank lending market: the effects of discount rate adjustments




Remarks:

- banks borrow from discount window at the rate $i_d$ (ignore primary, secondary, seasonal)
- fed acts as lender of last resort, lending against collateral in times of financial crisis
- fed lowers $i_d$, but lower rate has no effect if $i_{ff} < i_d$ because market is cheaper
- federal funds rate remains at initial level $i_{ff}^1$ and no borrowed reserves $BR$ created
- fed lowers $i_d$ below federal funds rate, borrowing from fed cheaper than from market
- new borrowed reserves put downward pressure on federal funds rate: $i_{ff}^1 \to i_{ff}^2$

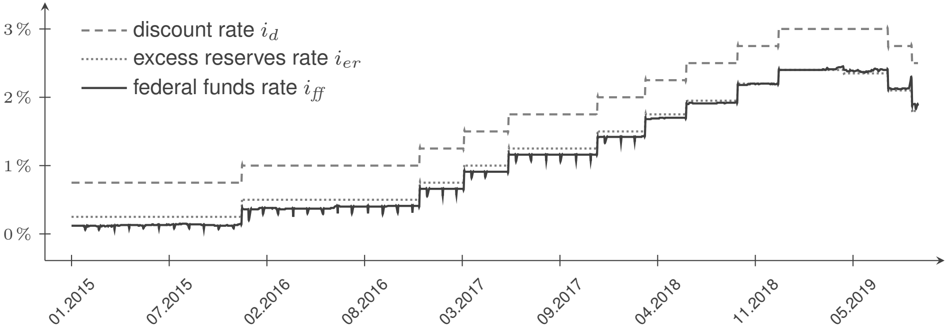
# In practice, the reverse repo rate bounds the federal funds rate below




Remarks:

- in theory, federal funds rate lies between discount rate and excess reserve rate

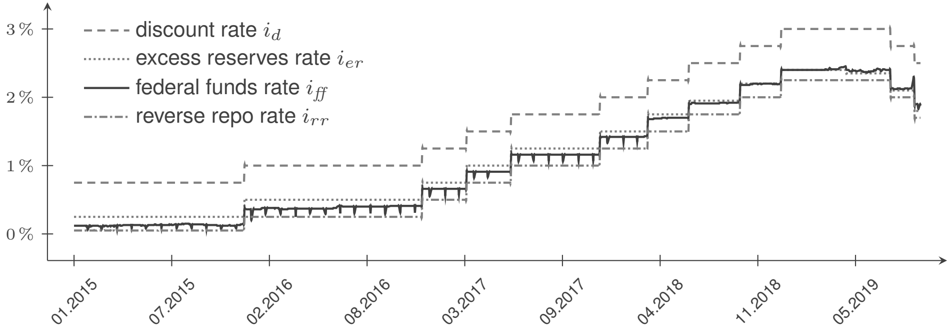
# In practice, the reverse repo rate bounds the federal funds rate below




Remarks:

- in theory, federal funds rate lies between discount rate and excess reserve rate
- in practice, federal funds rate sometimes dips below excess reserve rate

# In practice, the reverse repo rate bounds the federal funds rate below




Remarks:

- in theory, federal funds rate lies between discount rate and excess reserve rate
- in practice, federal funds rate sometimes dips below excess reserve rate
- reverse repo rate is true lower bound for federal funds, see James Hamilton's piece

# Why do conventional policy tools fail?

1. Credit rationing: risk-averse banks may hold excess reserves rather than lending to firms and households, especially when interbank trust is low

2. Zero lower bound: central bank wants lower short-term interest rates to spur investment, but nominal rates are bounded below at zero

---

Remarks:

- problems most severe in times of crises—exactly when policy most important
- when conventional policies fail, policymakers turn to unconventional policies

# A brief look at unconventional monetary policy tools

1. Liquidity provision: lower discount rates and additional lending facilities created to dramatically expand reserves in banking system
2. Asset purchases (QE): open market operations involving the purchase of assets other than U.S. treasury securities, e.g. troubled mortgage-backed securities
3. Forward guidance: policy communication strategy of committing the central bank to low or zero short-term interest rates for extended periods of time

---

Remarks:

- controversial tools, but emerging consensus that they were effective in recent crisis
- didn't provide direct interest rate stimulus, but did lower bank risk profiles
- forward guidance aimed to prevent trade-off b/w inflation and Fed credibility

# Lecture 3: Central Banks and Money Markets
## Overview of Topics



Reading: Mishkin and Eakins (2018, Chapters 9, 10, and 11), Bernanke (2013)

# What are money markets?

**Definition 13**

| | |
|---|---|
| Money markets: | Markets for securities maturing within one year of their issue date, with high liquidity and low default risk, usually sold in large denominations ($1,000,000 or more). |

Remarks:

- term “money market” slightly misleading: money proper is not traded
- instead, short-term securities that approach the liquidity of money are traded
- popular examples: treasury bills, commercial paper, negotiable CDs
- investors use money markets when cash inflows and outflows aren’t synchronized
- key players: corporations with cash, govt, banks, inst’l investors

# Why do money markets exist?

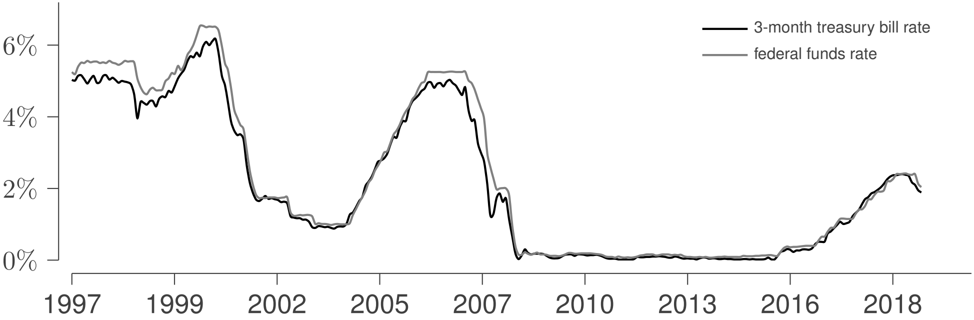
Theoretically: we don't need money markets, banks could replace them

- banks can make short-term loans, and take short-term deposits at interest
- they have an informational advantage through long-term lending relationships
- they solve many problems of information asymmetry, ex-anti and ex-post

Practically: money markets offer some institutional advantages over banks

- reserve requirements and other regulations impose costs on banks
- regulatory costs passed to customers: higher loan rates, lower deposit rates
- money markets can offer quick access to funds like banks
- but money markets can often offer better rates than banks

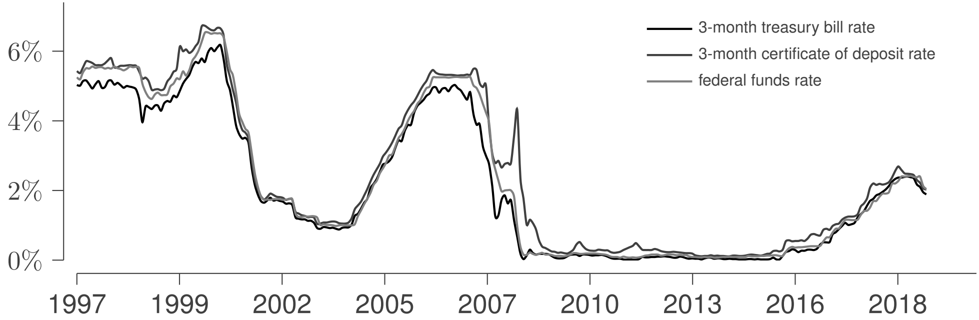
# Treasury Bills




Remarks:

- t-bills are U.S. treasury securities with short maturities, 28-days to 12-months
- because purchased below face value, t-bills are a type of discount bond
- t-bills are nearly riskless: the t-bill rate lies very near the federal funds rate

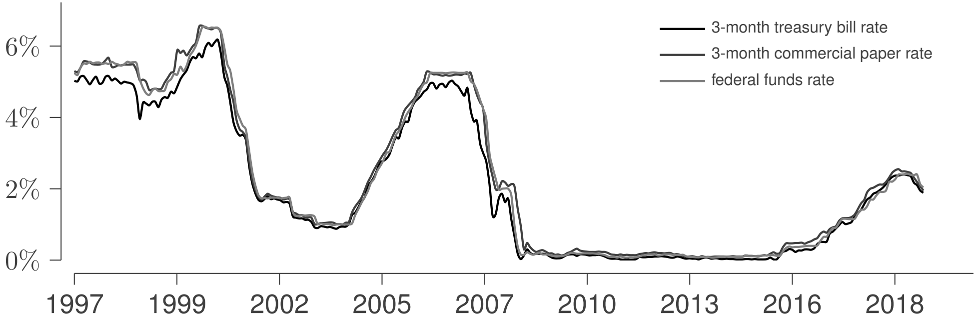
# Certificates of Deposit




Remarks:

- bank-issued security documenting fixed-term deposit amount and interest rate
- denominations from $100,000 to $10 million, traded in secondary market if negotiable
- spiked during the financial crisis of 2007-2009 as banks sought stable funding

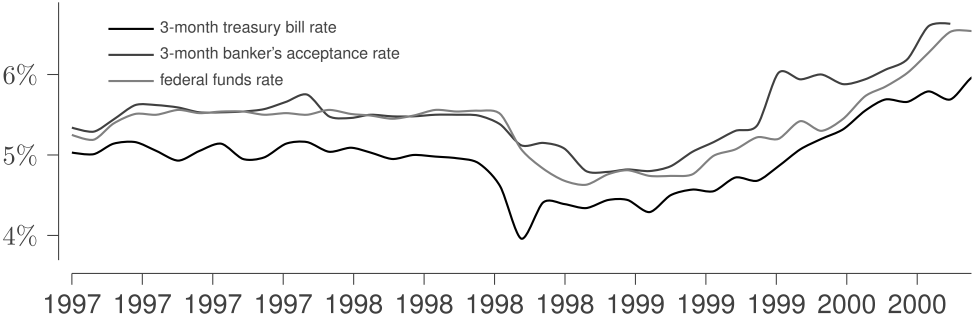
# Commercial Paper




Remarks:

- unsecured promissory notes issued by corporations maturing in $< 270$ days
- use increased significantly in early 1980s because bank loan costs rose
- less popular during the recent economic recession Kacperczyk and Schnabl (2010)

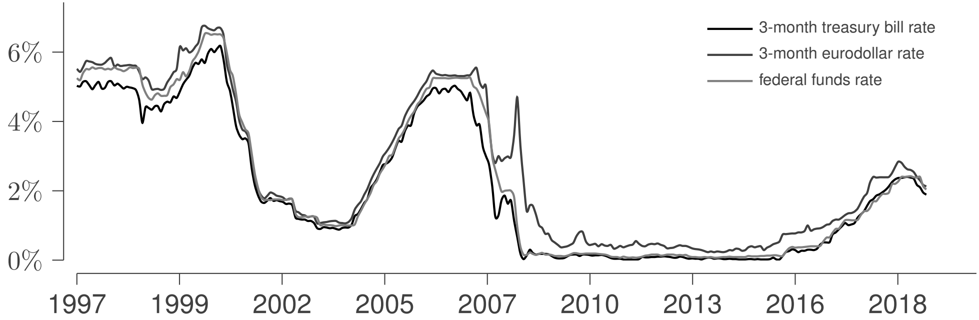
# Banker's Acceptances




Remarks:

- bank order to pay an amount on specified date if specified conditions met
- condition is usually delivery of promised goods, used in international trade
- exporter shielded from exchange rate risk and needn't assess creditworthiness

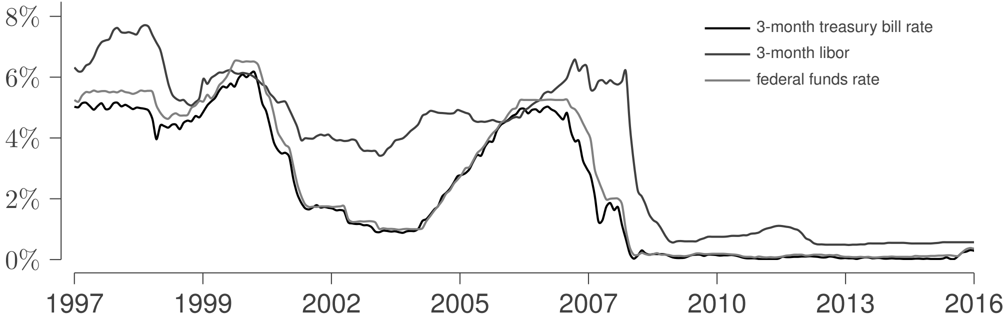
# Eurodollars




Remarks:

- eurodollars are dollar-denominated deposits held in foreign banks
- useful for foreign contracts written in terms of dollars (for fx stability)
- Eurodollar markets offer earn higher returns for higher risk (no fed support)

# London interbank lending




Remarks:

- London interbank offer rate (LIBOR) alternative to fed funds market
- roughly comparable to fed funds rate, but serves different geography
- rate set by panel of banks, recent scandal regarding rate manipulation

# Lecture 3: Central Banks and Money Markets
# Overview of Topics

---



Reading: Mishkin and Eakins (2018, Chapters 9, 10, and 11), Bernanke (2013)

# Paper of the Week: Bernanke (2013)

> *Several key episodes in the 100-year history of the Federal Reserve have been referred to in various contexts with the adjective "Great" attached to them: the Great Experiment of the Federal Reserve's founding, the Great Depression, the Great Inflation and subsequent disinflation, the Great Moderation, and the recent Great Recession. Here, I'll use this sequence of "Great" episodes to discuss the evolution over the past 100 years of three key aspects of Federal Reserve policymaking: the goals of policy, the policy framework, and accountability and communication. The changes over time in these three areas provide a useful perspective, I believe, on how the role and functioning of the Federal Reserve has changed since its founding in 1913, as well as some lessons for the present and for the future.*
>
> — **Ben S. Bernanke**

# Lecture 3: Central Banks and Money Markets

Revision Checklist

- ☐ Central Bank Goals and Structures
- ☐ Central Bank Operations
- ☐ Reserves and T-Accounts
- ☐ Reserves Supply and Demand
- ☐ Money Markets
- ☐ Paper of the Week

Reading: Mishkin and Eakins (2018, Chapters 9, 10, and 11), Bernanke (2013)

# Survey of the Financial System
# Table of Contents

# Lecture 4: The Bond Market
# Overview of Topics



Reading: Mishkin and Eakins (2018, Chapter 12), and Jiang et al. (2020, March), Krishnamurthy (2010)

# Bond: a simple definition

**Definition 14**

Bond: A borrower's obligation to pay a specified face value at a specified maturity date, along with periodic coupon payments.

Remarks:

- *coupon rate*: coupon payment expressed as a fraction of the face value
- *indenture*: legal contract specifying coupon rate, maturity date, and face value
- issuers: federal govt, state and local govt, govt agencies, corporations
- face value (also called par or maturity value) usually \$1000 (less commonly \$100)

# How do bonds differ from stocks?

| | Bonds | Stocks |
|---|---|---|
| Booked as: | debt | equity |
| Cash flows: | pre-specified | variable |
| Horizon: | finite maturity | no maturity |
| Seniority: | senior to equity | subordinate to debt |

Remarks:

- bonds generally less risky, but still entail interest-rate, re-investment, default risk
- theory: firms may be indifferent between debt and equity (Modigliani and Miller)
- practice: bonds preferred b/c of taxes, bankruptcy costs, asymmetric information

# Lecture 4: The Bond Market
## Overview of Topics



Reading: Mishkin and Eakins (2018, Chapter 12), and Jiang et al. (2020, March), Krishnamurthy (2010)

# Treasury securities: a simple definition

**Definition 15**

| | |
|---|---|
| Treasury Security: | A government debt obligation backed by the credit and taxing power of a country. Generally, treasury securities have very little risk of default. |

Remarks:

- US treasuries: deepest market, about $21.4 trillion outstanding as of 2018
- US treasuries: Japan, China largest creditors, 35% of foreign holdings as of 2018
- UK treasuries: Moody's downgrade from Aa1 to Aa2 after 2016 Brexit referendum
- UK treasuries: Moody's downgrade from Aa2 to Aa3 after 2022 political uncertainty
- other EU treasuries: 2012 sovereign debt crisis downgrades (PIGS, Spain)

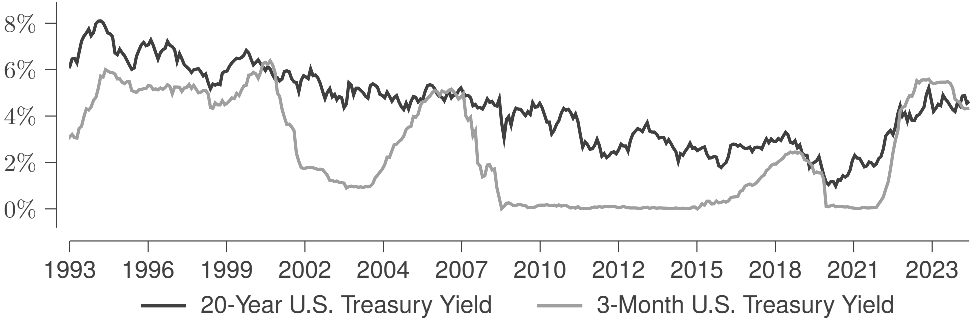
# Maturity of securities issued by the U.S. Treasury

| Type | Maturity | Market |
|---|---|---|
| Bill | less than 1 year | money |
| Note | 1 to 10 years | capital |
| Bond | 10 to 30 years | capital |

Remarks:

- investors have viewed U.S. treasuries as very safe, nearly free of default risk
- recently, higher U.S. default probability because of political budgets battles
- Aug 2011: S&P downgrades U.S. credit rating from AAA to AA+ for first time ever
- flight to safety has limited the risk premium on U.S. treasuries, viewed as safe haven

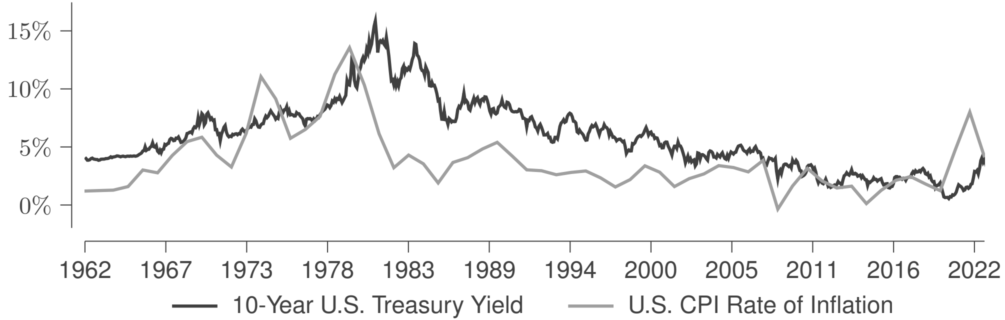
# Yield on 20-year versus 90-day treasuries




Remarks:

- short yields are typically lower than long yields (think about the liquidity premium)
- short yields are less stable than long yields b/c they respond more to current inflation
- to compare risk, would need real returns at uniform horizon (Campbell, 1995, p. 148)

# Yield on 10-year treasury vs. rate of inflation




Remarks:

- investors care about real yields, uncertain on bonds even when held to maturity
- 10-year treasury bonds usually earn positive real returns, but not always the case
- 1970s and early 1980s inflation was exceptionally high, mostly due to oil shocks

# TIPS are treasury securities that protect you from inflation

**Definition 16**

TIPS: Treasury Inflation-Protected Securities, i.e. bonds with face value indexed to inflation. Coupon payments equal a fixed coupon rate times the inflation-adjusted face value. The payoff at maturity equals the greater of the inflation-adjusted and the intial face value.

Remarks:

- old idea: first issued in the international capital markets by Israel in 1955
- relatively new market in U.S. (since 1997), older market in U.K. (since 1981)
- 5, 10, and 20-year maturities in U.S., comprising around 12% of total U.S. debt

# TIPS: A simple numerical example

**Question 10**

Two finite-maturity bonds have prices equal to initial \$1000 face values. Bond A offers 10% coupons; Bond B offers 9% coupons and inflation-indexed face value. Inflation is constant at 2%. What are the bonds' real yields to maturity?

A. Bond A: 8%, Bond B: 7%

B. Bond A: 12%, Bond B: 11%

C. Bond A: 8%, Bond B: 9%

Remarks:

- you should use the Fisher equation to approximate real interest rates in the above
- does the answer change if inflation falls to 0.5% once the bond is purchased?

# TIPS: A simple numerical example

**Question 10**

Two finite-maturity bonds have prices equal to initial \$1000 face values. Bond A offers 10% coupons; Bond B offers 9% coupons and inflation-indexed face value. Inflation is constant at 2%. What are the bonds' real yields to maturity?

A. Bond A: 8%, Bond B: 7%

B. Bond A: 12%, Bond B: 11%

C. **Bond A: 8%, Bond B: 9%**

Remarks:

- you should use the Fisher equation to approximate real interest rates in the above
- does the answer change if inflation falls to 0.5% once the bond is purchased?

# TIPS: A simple numerical example

**Solution 10**

The bonds are trading at par, so their yields to maturity equal their coupon rates:

$$i_A = 0.1\,, \quad i_B = 0.09\,.$$

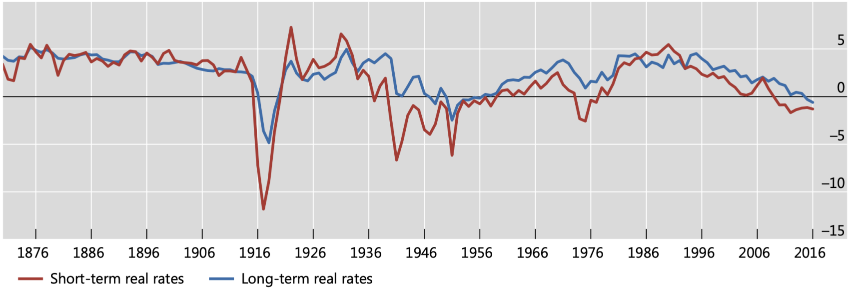
Recall that real yields are approximated as nominal yields minus the rate of 2% inflation (the Fisher equation), so for bond A,

$$r_A = 0.1 - 0.02 = 0.08\,.$$

For bond B, the face value is adjusted upward to preserve yield to maturity:

$$r_B = 0.09\,.$$

# What determines real interest rates (1/2)




Source: Borio et al. (2017)

Remarks:

- cross-country median global short- and long-term interest rates, comovement is high
- four phases: gold standard, inter-war, WWII to Great Inflation, post-Great Inflation
- many explanations proposed for long downward trend in rates since the mid-1980s

# What determines real interest rates (2/2)

| Study | Methodology | Coverage | Key factors: Growth & productivity | Demographics | Relative price of capital | Inequality | Global saving glut | Demand for safe assets | Risk premium |
|---|---|---|---|---|---|---|---|---|---|
| IMF (2014) | Narrative | Global | X | | X | | X | X | |
| Bean et al (2015) | Narrative | Global | | X | X | X | X | X | |
| Eichengreen (2015) | Narrative | US | X | X | X | | X | | |
| CEA (2015) | Narrative | Global | X | X | | | X | X | X |
| Goodhart and Pradhan (2017) | Narrative | Global | | X | | | | | |
| Gagnon et al (2016) | Calibration | US | | X | | | | | |
| Carvalho et al (2016) | Calibration | Global | | X | | | | | |
| Rachel and Smith (2017) | Calibration | Global | X | X | X | X | X | | X |

Source: Borio et al. (2017)

# Agency bonds: a simple definition

**Definition 17**

Agency Bond: Debt issued by government-sponsored agencies (GSEs), which the federal government authorizes but does not explicitly guarantee. Issuing agencies in U.S. include Sallie Mae, Freddie Mac.

Remarks:

- no explicit guarantee; implicit expectation of U.S. government bailouts
- implicit expectations met in 2008: government bailed out Sallie Mae, Freddy Mac
- implicit guarantee creates moral hazard, encourages risk taking

# Municipal bond: a simple definition

**Definition 18**

| | |
|---|---|
| Municipal bonds: | Securities issued by local, county, and state governments and used to finance public projects like schools, utilities, transportation, with interest income that is exempt from federal taxation. |

Remarks:

- types: revenue (project revenue backed), general obligation (faith and credit backed)
- tax advantage for investors, so potentially lower pre-tax yields to maturity
- the interest rate adjusted for the tax advantage is called the equivalent tax-free rate
- municipals offer higher rates b/c of higher default risk (e.g. Orange County, California)

# Lecture 4: The Bond Market
# Overview of Topics



Reading: Mishkin and Eakins (2018, Chapter 12), and Jiang et al. (2020, March), Krishnamurthy (2010)

# Corporate bonds: a simple definition

**Definition 19**

| | |
|---|---|
| Corporate bond: | Bonds issued by a corporation, with lender rights and privileges and borrower obligations specified contractually in a *bond indenture*, typically with face values of \$1000 and semiannual interest payments. |

Remarks:

- yields on corporate bonds vary greatly, because corporate risk varies greatly
- bond indenture may include covenants to restrict corporate behavior and lower risk
- bond indenture trade-off: lower capital costs, but less flexibility for the borrower

# Some corporate bond characteristics

Restrictive covenants:

- rules to govern conflicts between bondholder and shareholder interests
- examples: limit dividend payments, restrict merger activity
- bond rates fall in the restrictiveness of the covenants

Call provision:

- right of issuer to buy bond back before the bond's maturity date
- *call price* usually set above the face value by one year's interest payment
- bond called if price above call price, or if covenants become too restrictive

Conversion:

- option to convert a bond into a specified number of shares of stock
- bondholders will convert if stock price rises sufficiently, given conversion ratio
- used to avoid problems of asymmetric information involved in stock issuances

# Debt ratings: a quick overview of agencies and categories

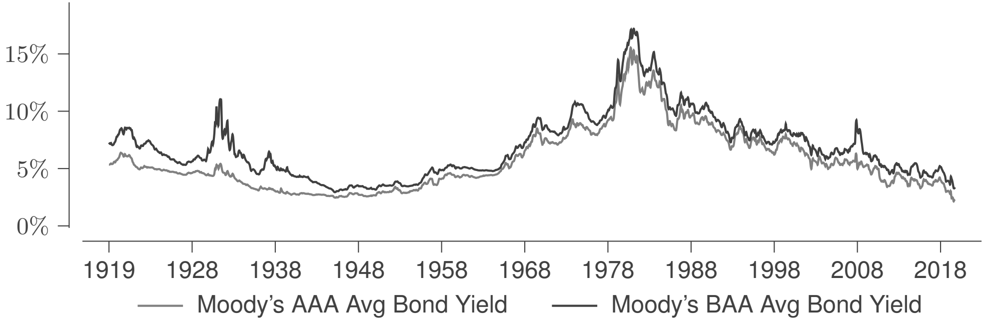
| S&P | Moody's | Avg Default Rate* | Description |
|---|---|---|---|
| AAA | Aaa | 0.00% | Best quality, extremely strong capacity to pay interest and repay principal |
| BBB | Baa | 0.15% | Medium grade, adequate ability to pay interest and repay principal |
| CCC | Caa | 24.73% | Speculative, poor capacity to pay interest and repay principal, vulnerable to default |

*Average default rates for Moody's ratings, computed for defaults within one year of rating assignment, 1970–2001.

Remarks:

- big three rating agencies: Moody's (40%), Standard and Poor's (40%), Fitch (15%)
- some intermediate categories not shown, e.g. AA, A, BB, B, CC, C, D, NR
- ratings updated regularly, downgrades can lead to large swings in bond prices

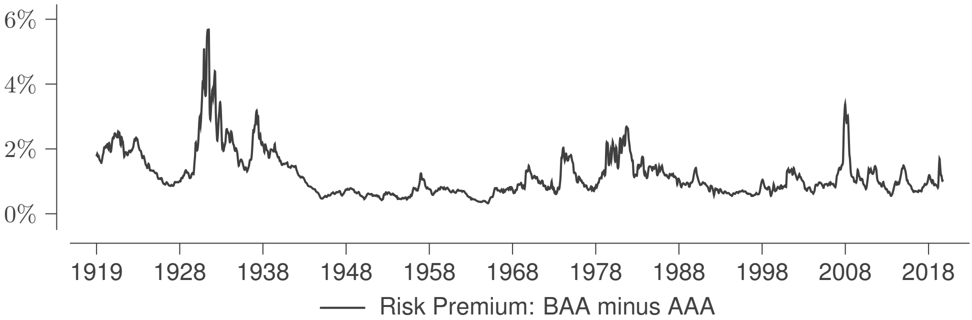
# Corporate bonds and risk premiums (1/2)




Remarks:

- risk premium varies with default risk, from investment-grade (Aaa-Baa) to junk (<Baa)
- typical Aaa–Baa risk premium of 1%–2%, but much higher for junk bonds
- risk premium spikes during crises, as default probabilities and risk aversion rise

# Corporate bonds and risk premiums (2/2)




Remarks:

- risk premium varies with default risk, from investment-grade (Aaa-Baa) to junk (<Baa)
- typical Aaa–Baa risk premium of 1%–2%, but much higher for junk bonds
- risk premium spikes during crises, as default probabilities and risk aversion rise

# Lecture 4: The Bond Market
## Overview of Topics



Reading: Mishkin and Eakins (2018, Chapter 12), and Jiang et al. (2020, March), Krishnamurthy (2010)

# Credit default swaps are financial guarantees for bonds

**Definition 20**

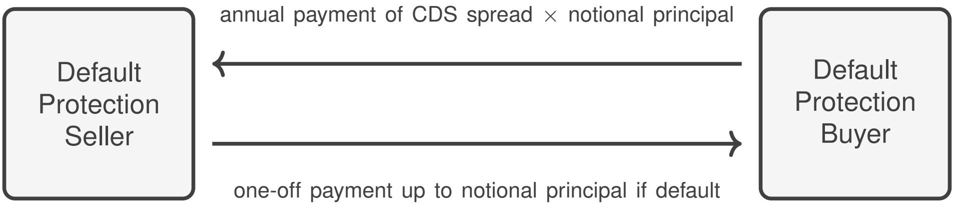
| | |
|---|---|
| Credit default swap: | A contract providing a buyer with insurance against *credit events* (default) by a *reference entity* (company or country) up to a *notional principal* (total value), in exchange for periodic payments of the notional principal $\times$ *CDS spread* (in bp). |

Remarks:

- rapid growth in 2000s: from \$800B notional principal in 2000 to \$50T in 2007
- like traditional insurance, but the buyer needn't own the reference entity's asset
- and total notional principal can exceed reference entity's total outstanding debt

Source: Hull (2015, Sections 25.1 and 25.2)

# CDS default protection diagram




Remarks:

- let CDS spread $s = 100$ bp, notional principal $L = \$100$M, recovery rate $R = 0.35$
- CDS buyer would then pay $sL = 0.01 \times \$100$M $= \$1$M annually for protection
- CDS seller would then pay $(1 - R)L = 0.65 \times \$100$M $= \$65$M if a credit event occurs
- annual payments cease and contract terminates after a credit event has occured

# Credit default swaps: a numerical example

**Question 11**

The 5-yr risk-free rate is 5%, a 5-yr corporate par bond yields 6.5%, the CDS spread on the bond is 50 basis points. Do you hold to maturity \$100M in bonds together with 5-yr CDS protection, or simply invest \$100M at the risk-free rate?

A. buy bonds and CDS

B. invest at risk-free rate

Remarks:

- the example illustrates an arbitrage opportunity: do you see how to exploit it?
- arbitrage keeps CDS spreads close to bond yield spreads over the risk-free rate
- note well: arbitrage $\Rightarrow$ CDS–bond basis $:=$ CDS spread $-$ bond yield spread $\approx 0$

# Credit default swaps: a numerical example

**Question 11**

The 5-yr risk-free rate is 5%, a 5-yr corporate par bond yields 6.5%, the CDS spread on the bond is 50 basis points. Do you hold to maturity \$100M in bonds together with 5-yr CDS protection, or simply invest \$100M at the risk-free rate?

A. **buy bonds and CDS**

B. invest at risk-free rate

Remarks:

- the example illustrates an arbitrage opportunity: do you see how to exploit it?
- arbitrage keeps CDS spreads close to bond yield spreads over the risk-free rate
- note well: arbitrage $\Rightarrow$ CDS–bond basis $:=$ CDS spread $-$ bond yield spread $\approx 0$

# Credit default swaps: a numerical example

**Solution 11**

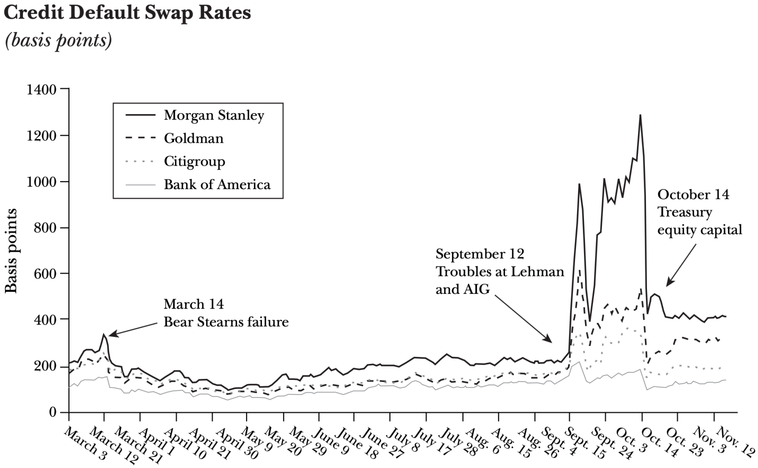
CDS buyer would pay

$$sL = 0.005 \times \$100\text{M} = \$0.5\text{M}$$

annually for protection, or 0.5% on the $100M in bonds. The bond yields 6.5%, so the bond + protection yields a riskless 6%, higher than the 5% alternative. Hence, buy bonds and CDS.

Arbitrage traders could exploit this anomaly by taking a short position at 5% and long position in the bond + CDS portfolio for 6%.

# Credit default swaps for financial institutions in crisis




Source: Krishnamurthy (2010)

# Lecture 4: The Bond Market
# Overview of Topics



Reading: Mishkin and Eakins (2018, Chapter 12), and Jiang et al. (2020, March), Krishnamurthy (2010)

# Pricing a coupon bond with semiannual payments

$$P_s = \frac{C/2}{(1+i/2)^1} + \frac{C/2}{(1+i/2)^2} + \frac{C/2}{(1+i/2)^3} + \cdots + \frac{C/2}{(1+i/2)^{2N}} + \frac{FV}{(1+i/2)^{2N}}$$

Notation and remarks:

| | |
|---|---|
| $P_s$ | price of semi-annual coupon bond |
| $C$ | annual coupon payment |
| $FV$ | face value |
| $i$ | annual market interest rate |
| $N$ | years to maturity |

# Discount factors and discounting frequency: a brief aside

For $t$-year discount factor with discounting frequency $n$ and annual yield $i$,

$$DF_{nt} = (1 + i/n)^{-nt}.$$

For continuous discounting, let $1/m := i/n$ and take the limit

$$\begin{aligned}
\lim_{n\to\infty} DF_{nt} &= \lim_{n\to\infty} (1 + i/n)^{-nt} \\
&= \lim_{n\to\infty} (1 + 1/m)^{-mit} \\
&= \left[ \lim_{m\to\infty} (1 + 1/m)^{m} \right]^{-it} = e^{-it}.
\end{aligned}$$

---

Remarks:

- last line of derivation uses the definition of Euler's number $e = \lim_{m\to\infty}(1 + 1/m)^m$
- continuously-compounded yield is mathematically convenient (cf. Campbell, 1995)

# Clean versus dirty prices

**Definition 21**

Dirty price: The price of a bond taking into account the coupon interest accrued between the purchase date and the date of the last coupon payment.

Remarks:

- bond prices quoted as “clean”, i.e. no accrued interest, so cost is understated
- between coupon dates, the relation holds: clean price $=$ dirty price $-$ accrued interest
- note well: dirty price is simply present value of cash flows discounted by market rate

# Clean vs dirty prices: a numerical example

**Question 12**

On 5 March, a Treasury bond with 11% coupon rate paid semi-annually is quoted at \$95.50 per \$100 of face value. The last coupon payment date was 10 January, 54 days ago. There are 181 days between the last coupon payment and the next payment on 10 July. What is the bond's dirty price?

A. \$98.78 = \$95.50 + \$3.28

B. \$97.14 = \$95.50 + \$1.64

C. \$113.94 = \$95.50 + \$18.44

# Clean vs dirty prices: a numerical example

**Question 12**

On 5 March, a Treasury bond with 11% coupon rate paid semi-annually is quoted at \$95.50 per \$100 of face value. The last coupon payment date was 10 January, 54 days ago. There are 181 days between the last coupon payment and the next payment on 10 July. What is the bond's dirty price?

A. \$98.78 = \$95.50 + \$3.28

B. **\$97.14 = \$95.50 + \$1.64**

C. \$113.94 = \$95.50 + \$18.44

# Clean vs dirty prices: a numerical example

**Solution 12**

The clean price is computed as

$$P_{\mathrm{C}} = P_{\mathrm{D}} - I\,,$$

where $I$ is accrued interest.

# Clean vs dirty prices: a numerical example

**Solution 12**

The clean price is computed as

$$P_{\mathrm{C}} = P_{\mathrm{D}} - I\,,$$

where $I$ is accrued interest. The Treasury pays semi-annual coupons of $5.5 = 11\% \times \$100/2$. There are 181 days between semi-annual coupon payments, and 54 days have past, so

$$I = \frac{54}{181} \times \$5.5 \approx 1.64\,.$$

# Clean vs dirty prices: a numerical example

**Solution 12**

The clean price is computed as

$$P_{\mathrm{C}} = P_{\mathrm{D}} - I\,,$$

where $I$ is accrued interest. The Treasury pays semi-annual coupons of $5.5 = 11\% \times \$100/2$. There are 181 days between semi-annual coupon payments, and 54 days have past, so

$$I = \frac{54}{181} \times \$5.5 \approx 1.64\,.$$

The dirty price is therefore $\$97.14 = \$95.50 + \$1.64$.

# Lecture 4: The Bond Market
# Overview of Topics



Reading: Mishkin and Eakins (2018, Chapter 12), and Jiang et al. (2020, March), Krishnamurthy (2010)

# Paper of the Week: Krishnamurthy (2010)

> “*The financial crisis that began in 2007 is especially a crisis in debt markets. For example, the stock market peaked in October 2007 with the Dow Jones Industrial Average near 14,000 and was still near 12,000 in August 2008. While the Dow Jones eventually fell to 6,600 by March 2009, most of that fall happened in late 2008. However, problems in debt markets like the mortgage-backed securities market had been in full swing since August of 2007. A full understanding of what happened in the financial crisis requires inquiring into the plumbing of debt markets.*”
>
> — **Arvind Krishnamurthy**

# Lecture 4: The Bond Market

Revision Checklist

- ☐ Introduction
- ☐ Government Bonds
- ☐ Corporate Bonds
- ☐ Credit Default Swaps
- ☐ Clean vs Dirty Prices
- ☐ Paper of the Week

Reading: Mishkin and Eakins (2018, Chapter 12), and Jiang et al. (2020, March), Krishnamurthy (2010)

Survey of the Financial System
Table of Contents

# Lecture 5: The Stock Market
# Overview of Topics

5.1. Stock Types and Indices
5.2. Initial Public Offerings
5.3. Stock Exchanges and Trading Process
5.4. Market Efficiency and Regulation
5.5. Paper of the Week

Reading: Mishkin and Eakins (2018, Chapter 13), Saunders and Cornett (2015, Chapter 8), Hong and Stein (2007)

# Stock: a simple definition

**Definition 22**

Stock: An ownership share in a firm, usually entitling the holder to voting rights, discretionary dividend payments, limited liability, and a residual claim on the firm's assets.

Remarks:

- residual claim: claim on remaining assets, subordinate to debt-holder asset claims
- crucial: residual claim feature makes stock investments riskier than bond investments
- stock issuances are second to debt issuances in terms of volume, but get more media

# Types of stock: common vs. preferred

Common Stock:

- most common form of stock ($> 75\%$ of new equity issues are common)
- different classes distribute dividends and voting rights differently

Preferred Stock:

- less common form of stock ($< 25\%$ of new equity issues are preferred)
- usually senior to common stock, with fixed and often high dividend but no vote

---

Remarks:

- preferred and common share classes help firms cater to investor preferences
- risk-averse low-tax investors gain insolvency protection and high dividends
- firms gain some flexibility to tailor voting right structure and leverage ratio

# Voting rights and corporate governance at Mitsubishi


Remarks:

- Mitsubishi has 2,147,201,551 of shares of common stock outstanding, no classes
- shareholders vote to appoint board of directors at general shareholder's meeting
- board of directors appoints and supervises executive officers who manage business

Source: Mitsubishi Electric Investor Relations

# Shareholder voting conventions

**Definition 23**

| | |
|---|---|
| Cumulative voting: | Each shareholder's number of votes equals their number of shares $\times$ the number of open board positions. All board positions are voted on together in one combined election. |
| Straight voting: | Each shareholder's votes equal their number of shares, and elections are separate for each of the open board position. |

Remarks:

- voting convention differs by state; importantly, Delaware allows only straight voting
- straight voting: helps large shareholders, so most firms incorporate in Delaware
- cumulative voting: helps minority shareholders elect their chosen candidate

# Cumulative voting: a simple example

**Question 13**

A firm with 1 million shareholders and 1 million shares outstanding has four candidates for three open board positions. Voting is cumulative. All minority shareholders vote for $A$. No majority shareholders vote for $A$. What minimum fraction of shareholders must belong to the minority to guarantee $A$'s election?

A. 25%

B. 33%

Remarks:

- Minimum number $N$ of votes needed to elect $p$ candidates: $N = (pPS)/(P+1) + 1$
- The variable $P$ is the number of open positions, $S$ the number of outstanding shares
- For details of the formula above, see Mills (1968) from the optional reading

# Cumulative voting: a simple example

**Question 13**

A firm with 1 million shareholders and 1 million shares outstanding has four candidates for three open board positions. Voting is cumulative. All minority shareholders vote for $A$. No majority shareholders vote for $A$. What minimum fraction of shareholders must belong to the minority to guarantee $A$'s election?

A. **25%**

B. 33%

Remarks:

- Minimum number $N$ of votes needed to elect $p$ candidates: $N = (pPS)/(P+1)+1$
- The variable $P$ is the number of open positions, $S$ the number of outstanding shares
- For details of the formula above, see Mills (1968) from the optional reading

# Cumulative voting: a simple example

**Solution 13**

There are $S = 1$m shares outstanding. There are $P = 3$ open board positions. The minority seeks to elect $p = 1$ candidate.

# Cumulative voting: a simple example

**Solution 13**

There are $S = 1$m shares outstanding. There are $P = 3$ open board positions. The minority seeks to elect $p = 1$ candidate.

Hence, the minority needs

$$N = 1(1 \times 3 \times 1\text{m})/(3 + 1) = 750,001\,,$$

so the minority needs 750,001 votes.

# Cumulative voting: a simple example

**Solution 13**

There are $S = 1$m shares outstanding. There are $P = 3$ open board positions. The minority seeks to elect $p = 1$ candidate.

Hence, the minority needs

$$N = 1(1 \times 3 \times 1\text{m})/(3+1) = 750,001\,,$$

so the minority needs 750,001 votes.

Each shareholder has three votes, so only $V = 750,001/3 \approx 250,000$, or 25% of minority voters are needed.

# Cumulative voting: a simple example

**Solution 13**

There are $S = 1$m shares outstanding. There are $P = 3$ open board positions. The minority seeks to elect $p = 1$ candidate.

Hence, the minority needs

$$N = 1(1 \times 3 \times 1\text{m})/(3+1) = 750,001\,,$$

so the minority needs 750,001 votes.

Each shareholder has three votes, so only $V = 750,001/3 \approx 250,000$, or 25% of minority voters are needed.

Notice that a 25% minority of shareholders can *guarantee* the election of a chosen candidate. This would not be possible under straight voting.

# Stock indices: a simple definition

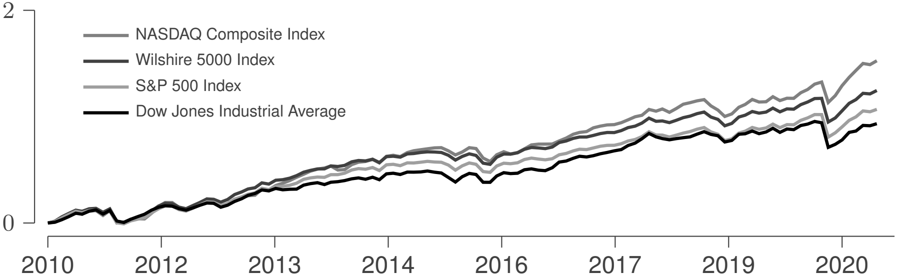
**Definition 24**

| | |
|---|---|
| Stock index: | A summary measure used to monitor the performance of multiple individual stocks, selected based on common characteristics such as size or industry. |

Remarks:

- index types: price-weighted or value-weighted, price-return or total-return indices
- some indices claim better representation of overall market performance
- in practice, the movement in major indices is highly correlated over time

# Stock indices: a few examples




Remarks:

- NASDAQ: value-weighted, NASDAQ-traded tech, industrials, banks, and insurers
- Wilshire: value-weighted,  3,500 stocks, as broad as possible to better track market
- S&P: value-weighted, 500 largest corporations on NYSE and NASDAQ exchanges
- Dow Jones: price-weighted, 30 large firms chosen by Wall Street Journal editors

# Computing price-weighted and value-weighted stock indices

Price-weighted index: $$PWI_t = \frac{1}{D_t} \sum_{n=1}^{N_t} P_{nt}$$

Value-weighted index: $$VWI_t = \frac{1}{N_t} \sum_{n=1}^{N_t} P_{nt} S_{nt}$$

---

Notation:

- $D_t$ divisor, equals $N_0$ initially, then adjusted for stock splits
- $N_t$ total number of firms in index at time $t$
- $P_{nt}$ share price of firm $n$ at time $t$
- $S_{nt}$ shares outstanding of firm $n$ at time $t$

# Price and value-weighted stock indices: a numerical example

**Question 14**

Consider price-weighted index $PWI$ and value-weighted index $VWI$ on $N = 2$ firms. Firm $A$ has share price $P_{At} = 20$ and $S_{At} = 1$ million shares. Firm $B$ has share price $P_{Bt} = 20$, and $S_{Bt} = 1/4$ million shares. Firm $B$'s share price rises by 5% in $t + 1$. Suppose $D_t = N$. Which index responds more?

A. $PWI$

B. $VWI$

Remarks:

- the indices weight firms differently, and therefore respond differently to price changes
- in this example, $PWI$ puts more weight on smaller firm $B$, but not a general result

# Price and value-weighted stock indices: a numerical example

**Question 14**

Consider price-weighted index $PWI$ and value-weighted index $VWI$ on $N = 2$ firms. Firm $A$ has share price $P_{At} = 20$ and $S_{At} = 1$ million shares. Firm $B$ has share price $P_{Bt} = 20$, and $S_{Bt} = 1/4$ million shares. Firm $B$'s share price rises by 5% in $t + 1$. Suppose $D_t = N$. Which index responds more?

A. $\boldsymbol{PWI}$

B. $VWI$

Remarks:

- the indices weight firms differently, and therefore respond differently to price changes
- in this example, $PWI$ puts more weight on smaller firm $B$, but not a general result

# Price and value-weighted stock indices: a numerical example

**Solution 14**

Firm $B$'s share price rises from 20 to 21. Therefore,

$$PWI = \frac{1}{2}(20 + 20) = 20\,, \quad PWI' = \frac{1}{2}(20 + 21) = 20.5\,.$$

# Price and value-weighted stock indices: a numerical example

**Solution 14**

Firm $B$'s share price rises from 20 to 21. Therefore,

$$PWI = \frac{1}{2}(20 + 20) = 20\,, \quad PWI' = \frac{1}{2}(20 + 21) = 20.5\,.$$

For the value-weighted index,

$$VWI = \frac{1}{2}(20 \cdot 1 + 20 \cdot 0.25) = 12.5\,, \quad VWI' = \frac{1}{2}(20 \cdot 1 + 21 \cdot 0.25) = 12.63\,.$$

# Price and value-weighted stock indices: a numerical example

**Solution 14**

Firm $B$'s share price rises from 20 to 21. Therefore,

$$PWI = \frac{1}{2}(20 + 20) = 20\,, \quad PWI' = \frac{1}{2}(20 + 21) = 20.5\,.$$

For the value-weighted index,

$$VWI = \frac{1}{2}(20 \cdot 1 + 20 \cdot 0.25) = 12.5\,, \quad VWI' = \frac{1}{2}(20 \cdot 1 + 21 \cdot 0.25) = 12.63\,.$$

Hence,

$$\%\Delta PWI = (20.5 - 20)/20 = 2.50\%\,, \quad \%\Delta VWI = (12.63 - 12.5)/12.5 = 1.04\%\,.$$

# Exchange traded funds: a simple definition

**Definition 25**

ETF: Exchange Traded Fund, a basket of securities tied to an index and bundled transparently to create a new composite stock that is traded on an exchange at low cost.

Remarks:

- fairly recent innovation, similar to mutual funds but traded like stocks
- like stocks, ETFs allow stop-loss orders, short sales, margin trading
- advantages: lower cost and usually no minimum investment required
- disadvantages: like stocks, ETF trading usually entails broker fees

# How are foreign stocks traded on American exchanges?

**Definition 26**

ADR: American Depository Receipt, receipts that trade in U.S. Dollar on U.S. exchanges and represent claims on foreign stocks that banks buy and hold as vault assets. ADRs allow foreign firms to trade on American exchanges without meeting U.S. disclosure requirements.

Remarks:

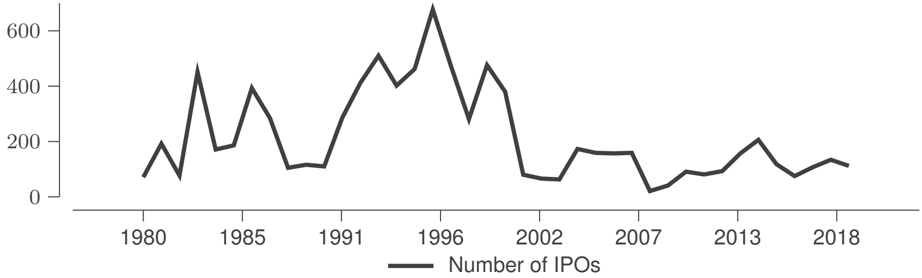
- ADRs allow investors to diversify internationally, but spillovers limit benefits in practice
- European ERDs and global GDRs also exist (but are less common)

# Lecture 5: The Stock Market
# Overview of Topics



Reading: Mishkin and Eakins (2018, Chapter 13), Saunders and Cornett (2015, Chapter 8), Hong and Stein (2007)

# Number of IPOs by Year

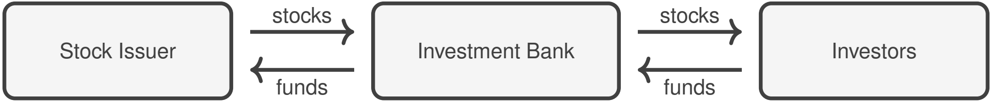



Remarks:

- IPO activity is highly volatile and has been lower in recent decades than in 90s
- sample: IPOs with an offer price of at least $5.00 listed on Amex, NYSE, or NASDAQ
- excludes: ADRs, closed-end funds, REITs, small best efforts offers, banks, etc.

Source: 2019 update to Loughran and Ritter (2002), data from Professor Jay Ritter's website.

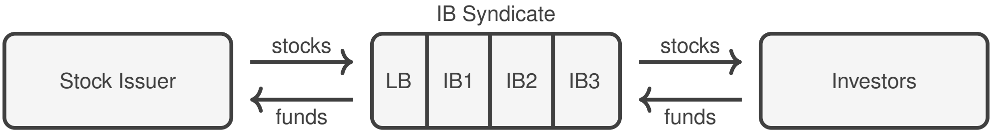
# Investment banks intermediate primary stock market transactions




Remarks:

- firms raise funds through issuances of *new* stock in primary market transactions
- an investment bank or syndicate of investment banks facilitates the transaction
- lead banks negotiate and originate the share offering, member banks help sell shares
- bank syndicates spread risk across banks and yield larger pools of potential investors

# Investment banks intermediate primary stock market transactions




Remarks:

- firms raise funds through issuances of *new* stock in primary market transactions
- an investment bank or syndicate of investment banks facilitates the transaction
- lead banks negotiate and originate the share offering, member banks help sell shares
- bank syndicates spread risk across banks and yield larger pools of potential investors

# Underwriting an IPO: the investment bank's commitment

**Definition 27**

| | |
|---|---|
| Best effort underwriting: | Investment bank makes no share price guarantee to the issuer, but acts as a distributor of shares for a fee. The bank faces less share price risk. |
| Firm commitment underwriting: | Investment bank guarantees a fixed share price at which it buys all newly issued shares. Investment bank then sells shares for profit. The bank faces more share price risk. |

Remarks:

- best effort underwriting shifts initial stock price risk onto the issuing corporation
- firm commitment underwriting shifts initial stock price risk onto the investment bank

# Underwriting an IPO: profit from a firm commitment

**Definition 28**

| | |
|---|---|
| Net proceeds: | guaranteed price at which the IB purchases the stock issuance. |
| Gross proceeds: | uncertain price at which the IB sells the stock issuance. |
| Underwriter's spread: | gross minus net proceeds, reward for IB's risk and expense. |

Remarks:

- underwriter's spread represents the premium that the underwriter charges investors
- this spread is earned on firm commitments only, and usually comes in addition to fees

# Firm commitment vs. best effort: numerical example (1/2)

**Question 15**

A risk-averse founder wants to issue $1$ new share. Investors will pay either $\$0.99$ or $\$1.01$. These potential prices have equal probability. IB $A$ offers to underwrite at best effort for free. IB $B$ offers a firm commitment to underwrite at fixed price $\$0.9999$. Which IB has higher expected profit? Which has higher variance of profit?

A. $A$ has higher expected profit, $B$ has higher variance of profit

B. $B$ has higher expected profit, $A$ has higher variance of profit

C. $B$ has higher expected profit, $B$ has higher variance of profit

# Firm commitment vs. best effort: numerical example (1/2)

**Question 15**

A risk-averse founder wants to issue $1$ new share. Investors will pay either $\$0.99$ or $\$1.01$. These potential prices have equal probability. IB $A$ offers to underwrite at best effort for free. IB $B$ offers a firm commitment to underwrite at fixed price $\$0.9999$. Which IB has higher expected profit? Which has higher variance of profit?

A. $A$ has higher expected profit, $B$ has higher variance of profit

B. $B$ has higher expected profit, $A$ has higher variance of profit

C. **$B$ has higher expected profit, $B$ has higher variance of profit**

# Firm commitment vs. best effort: numerical example (1/2)

**Solution 15**

Investment bank $A$ earns zero profit with zero variance: $\mathrm{E}[\pi_A] = \mathrm{Var}(\pi_A) = 0$.

# Firm commitment vs. best effort: numerical example (1/2)

**Solution 15**

Investment bank $A$ earns zero profit with zero variance: $\mathrm{E}[\pi_A] = \mathrm{Var}(\pi_A) = 0$.

Investment bank $B$ earns an expected profit of $\mathrm{E}[\pi_B] = 1 - 0.9999 = 0.0001$, because the expected issue price is $\$1$.

# Firm commitment vs. best effort: numerical example (1/2)

**Solution 15**

Investment bank $A$ earns zero profit with zero variance: $\mathrm{E}[\pi_A] = \mathrm{Var}(\pi_A) = 0$.

Investment bank $B$ earns an expected profit of $\mathrm{E}[\pi_B] = 1 - 0.9999 = 0.0001$, because the expected issue price is $\$1$. The variance of profit for $B$ is

$$\begin{aligned}\mathrm{Var}(\pi_B) &= \mathrm{E}\Big[\big(\pi_B - \mathrm{E}[\pi_B]\big)\Big] \\ &= (1/2)(0.99 - 0.9999 - 0.0001)^2 \\ &+ (1/2)(1.01 - 0.9999 - 0.0001)^2 = 0.0001\,.\end{aligned}$$

# Firm commitment vs. best effort: numerical example (1/2)

**Solution 15**

Investment bank $A$ earns zero profit with zero variance: $\mathrm{E}[\pi_A] = \mathrm{Var}(\pi_A) = 0$.

Investment bank $B$ earns an expected profit of $\mathrm{E}[\pi_B] = 1 - 0.9999 = 0.0001$, because the expected issue price is $\$1$. The variance of profit for $B$ is

$$\begin{aligned}\mathrm{Var}(\pi_B) &= \mathrm{E}\Big[\big(\pi_B - \mathrm{E}[\pi_B]\big)\Big] \\ &= (1/2)(0.99 - 0.9999 - 0.0001)^2 \\ &+ (1/2)(1.01 - 0.9999 - 0.0001)^2 = 0.0001\,.\end{aligned}$$

Investment bank $B$ faces more risk and expects higher profit.

# Firm commitment vs. best effort: numerical example (2/2)

**Question 16**

A risk-averse founder with utility of wealth $U(W) = 1 + \ln(W)$ wants to issue $1$ new share. Investors will pay either $\$0.99$ or $\$1.01$. These potential prices have equal probability. IB $A$ offers to underwrite at best effort for free. IB $B$ offers a firm commitment to underwrite at fixed price $\$0.99999$. Which IB does the founder choose?

A. they choose $A$

B. they choose $B$

# Firm commitment vs. best effort: numerical example (2/2)

**Question 16**

A risk-averse founder with utility of wealth $U(W) = 1 + \ln(W)$ wants to issue $1$ new share. Investors will pay either $\$0.99$ or $\$1.01$. These potential prices have equal probability. IB $A$ offers to underwrite at best effort for free. IB $B$ offers a firm commitment to underwrite at fixed price $\$0.99999$. Which IB does the founder choose?

A. they choose $A$

B. **they choose $B$**

# Firm commitment vs. best effort: numerical example (2/2)

**Solution 16**

The founder maximizes expected utility. For the best-effort offer from $A$,

$$\mathrm{E}\big[U(W)\big] = 1 + \mathrm{E}\big[\ln(W)\big] = 1 + (1/2)\ln(0.99) + (1/2)\ln(1.01) = 0.9999499975\,.$$

# Firm commitment vs. best effort: numerical example (2/2)

**Solution 16**

The founder maximizes expected utility. For the best-effort offer from $A$,

$$\mathrm{E}\big[U(W)\big] = 1 + \mathrm{E}\big[\ln(W)\big] = 1 + (1/2)\ln(0.99) + (1/2)\ln(1.01) = 0.9999499975\,.$$

For the firm commitment offer from $B$, utility is certain:

$$\mathrm{E}\big[U(W)\big] = 1 + \ln(0.99999) = 0.99998999995\,.$$

# Firm commitment vs. best effort: numerical example (2/2)

**Solution 16**

The founder maximizes expected utility. For the best-effort offer from $A$,

$$\mathrm{E}\big[U(W)\big] = 1 + \mathrm{E}\big[\ln(W)\big] = 1 + (1/2)\ln(0.99) + (1/2)\ln(1.01) = 0.9999499975\,.$$

For the firm commitment offer from $B$, utility is certain:

$$\mathrm{E}\big[U(W)\big] = 1 + \ln(0.99999) = 0.99998999995\,.$$

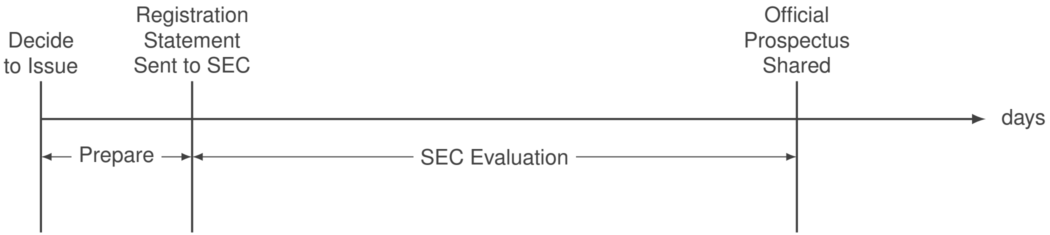
The safer offer from investment bank $B$ gives the risk-averse founder (slightly) higher expected utility.

# Registration with the SEC


Remarks:

- IB files Form S-1 registration statement with SEC to request new stock issuance
- issuer must disclose business information and draft red herring prospectus to register
- up to twenty-day wait for initial review, up to several-month wait for SEC registration
- upon registration, the share price is set, prospectus printed and shared, shares sold

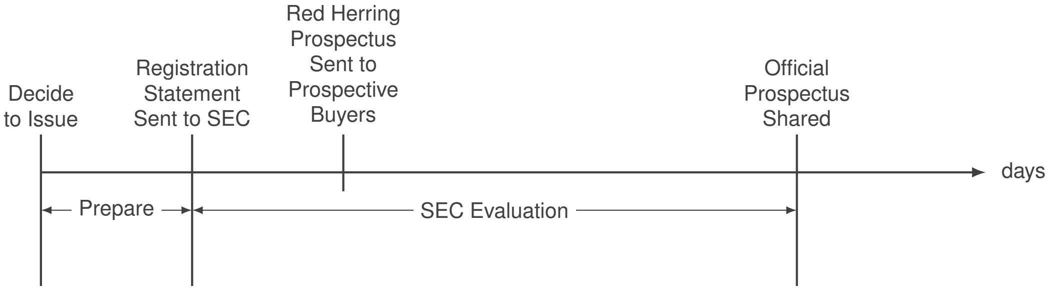
# Registration with the SEC




Remarks:

- IB files Form S-1 registration statement with SEC to request new stock issuance
- issuer must disclose business information and draft red herring prospectus to register
- up to twenty-day wait for initial review, up to several-month wait for SEC registration
- upon registration, the share price is set, prospectus printed and shared, shares sold

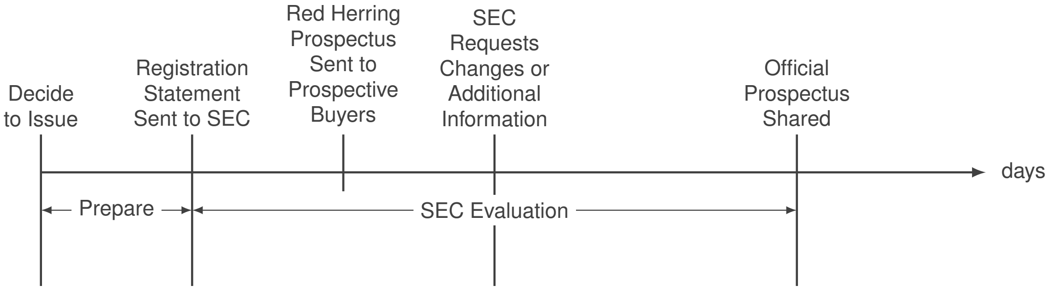
# Registration with the SEC




Remarks:

- IB files Form S-1 registration statement with SEC to request new stock issuance
- issuer must disclose business information and draft red herring prospectus to register
- up to twenty-day wait for initial review, up to several-month wait for SEC registration
- upon registration, the share price is set, prospectus printed and shared, shares sold

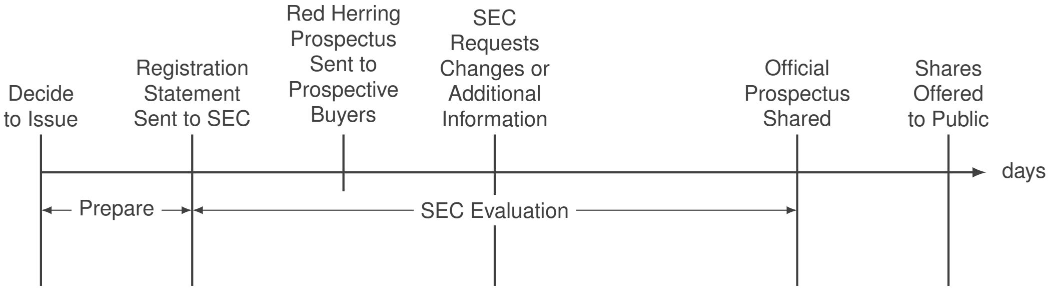
# Registration with the SEC




Remarks:

- IB files Form S-1 registration statement with SEC to request new stock issuance
- issuer must disclose business information and draft red herring prospectus to register
- up to twenty-day wait for initial review, up to several-month wait for SEC registration
- upon registration, the share price is set, prospectus printed and shared, shares sold

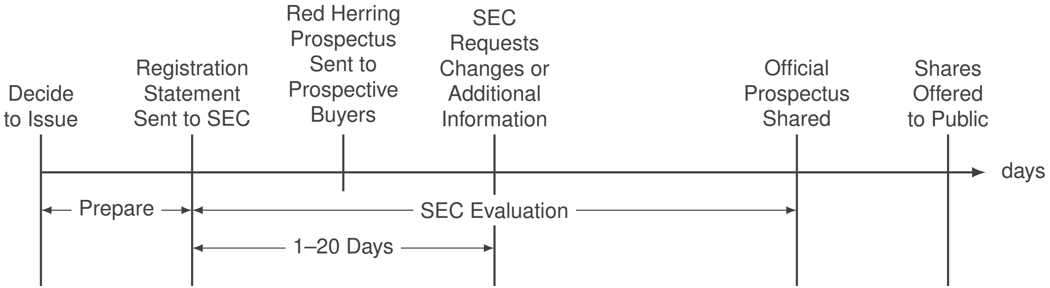
# Registration with the SEC




Remarks:

- IB files Form S-1 registration statement with SEC to request new stock issuance
- issuer must disclose business information and draft red herring prospectus to register
- up to twenty-day wait for initial review, up to several-month wait for SEC registration
- upon registration, the share price is set, prospectus printed and shared, shares sold

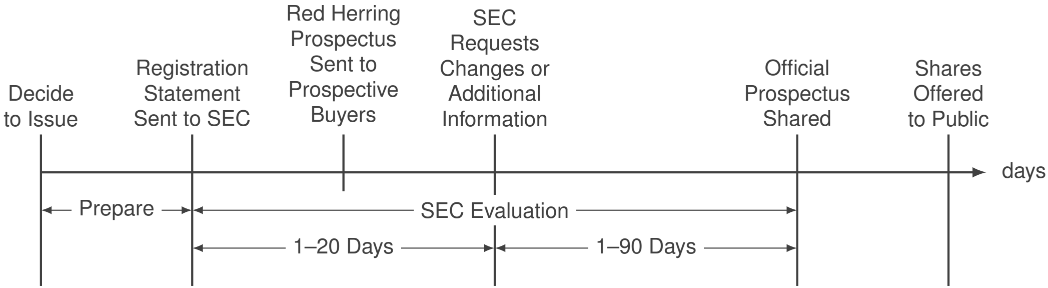
# Registration with the SEC




Remarks:

- IB files Form S-1 registration statement with SEC to request new stock issuance
- issuer must disclose business information and draft red herring prospectus to register
- up to twenty-day wait for initial review, up to several-month wait for SEC registration
- upon registration, the share price is set, prospectus printed and shared, shares sold

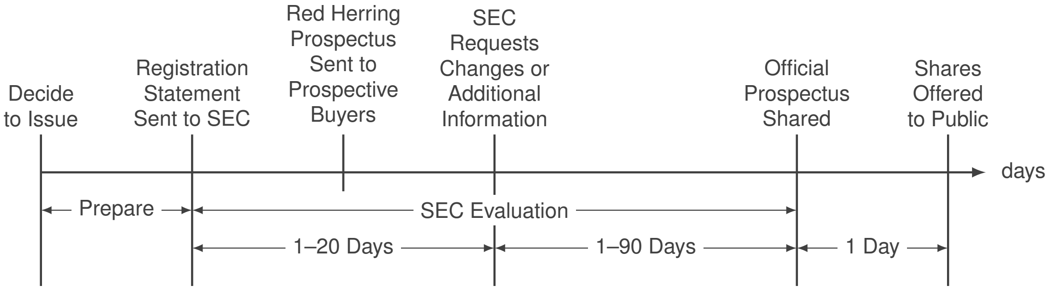
# Registration with the SEC




Remarks:

- IB files Form S-1 registration statement with SEC to request new stock issuance
- issuer must disclose business information and draft red herring prospectus to register
- up to twenty-day wait for initial review, up to several-month wait for SEC registration
- upon registration, the share price is set, prospectus printed and shared, shares sold

# Registration with the SEC




Remarks:

- IB files Form S-1 registration statement with SEC to request new stock issuance
- issuer must disclose business information and draft red herring prospectus to register
- up to twenty-day wait for initial review, up to several-month wait for SEC registration
- upon registration, the share price is set, prospectus printed and shared, shares sold

# Shelf Registration with the SEC


Remarks:

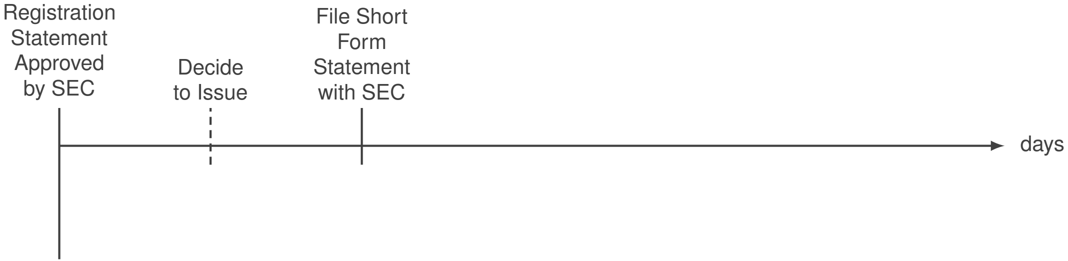
- shelf registration statement describes firm's financing plans for a two-year period
- firms issue shares multiple times over two-year period by filing short forms with SEC
- reduces time and cost of registration, allows firms to wait for ideal conditions to issue

# Shelf Registration with the SEC


Remarks:

- shelf registration statement describes firm's financing plans for a two-year period
- firms issue shares multiple times over two-year period by filing short forms with SEC
- reduces time and cost of registration, allows firms to wait for ideal conditions to issue

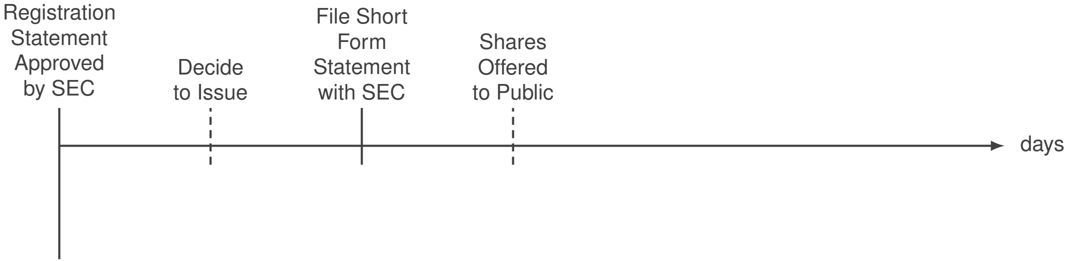
# Shelf Registration with the SEC




Remarks:

- shelf registration statement describes firm's financing plans for a two-year period
- firms issue shares multiple times over two-year period by filing short forms with SEC
- reduces time and cost of registration, allows firms to wait for ideal conditions to issue

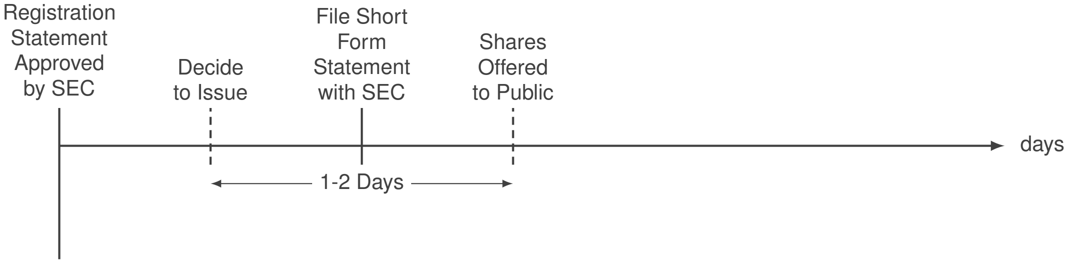
# Shelf Registration with the SEC




Remarks:

- shelf registration statement describes firm's financing plans for a two-year period
- firms issue shares multiple times over two-year period by filing short forms with SEC
- reduces time and cost of registration, allows firms to wait for ideal conditions to issue

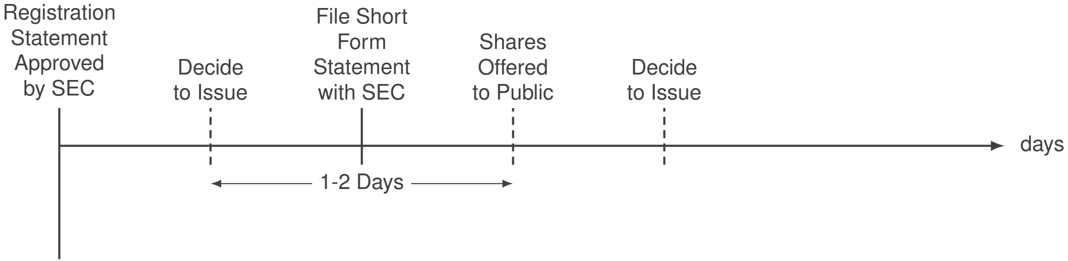
# Shelf Registration with the SEC




Remarks:

- shelf registration statement describes firm's financing plans for a two-year period
- firms issue shares multiple times over two-year period by filing short forms with SEC
- reduces time and cost of registration, allows firms to wait for ideal conditions to issue

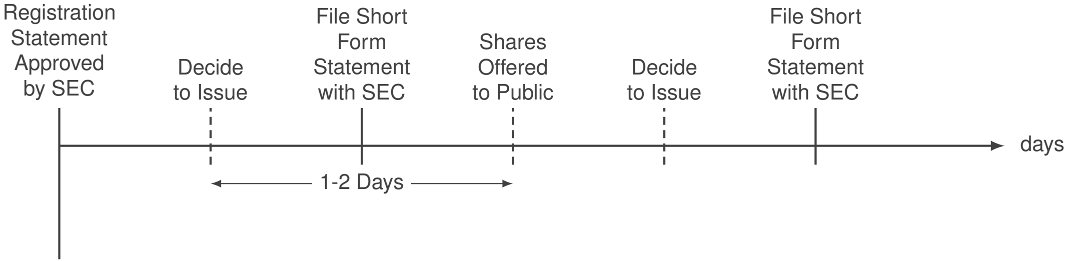
# Shelf Registration with the SEC




Remarks:

- shelf registration statement describes firm's financing plans for a two-year period
- firms issue shares multiple times over two-year period by filing short forms with SEC
- reduces time and cost of registration, allows firms to wait for ideal conditions to issue

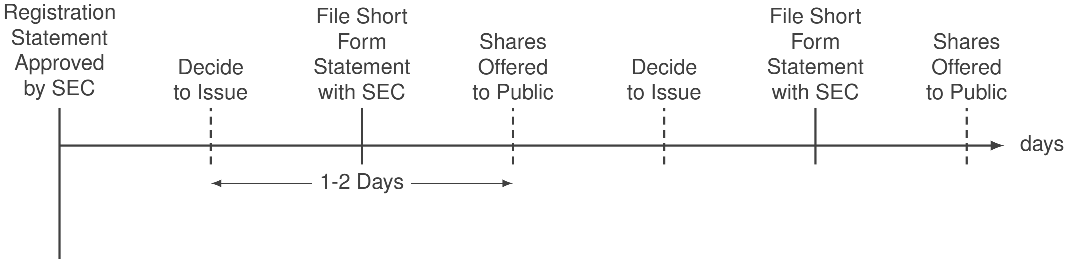
# Shelf Registration with the SEC




Remarks:

- shelf registration statement describes firm's financing plans for a two-year period
- firms issue shares multiple times over two-year period by filing short forms with SEC
- reduces time and cost of registration, allows firms to wait for ideal conditions to issue

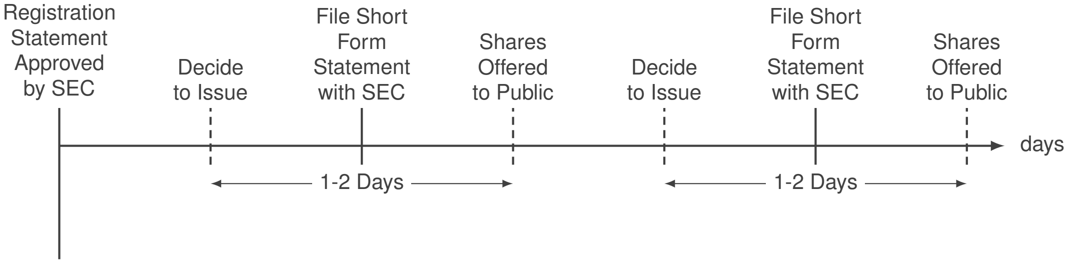
# Shelf Registration with the SEC




Remarks:

- shelf registration statement describes firm's financing plans for a two-year period
- firms issue shares multiple times over two-year period by filing short forms with SEC
- reduces time and cost of registration, allows firms to wait for ideal conditions to issue

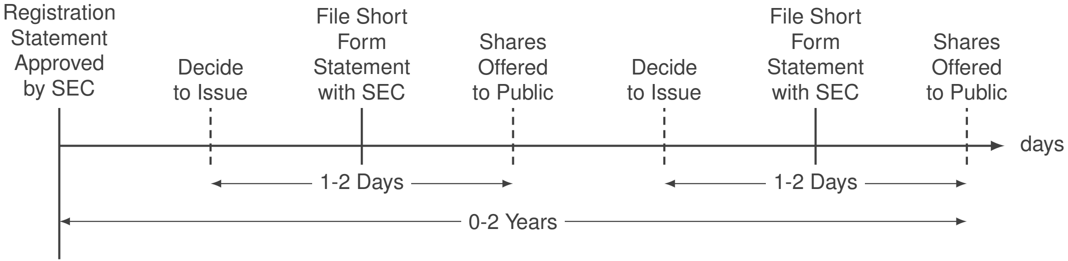
# Shelf Registration with the SEC




Remarks:

- shelf registration statement describes firm's financing plans for a two-year period
- firms issue shares multiple times over two-year period by filing short forms with SEC
- reduces time and cost of registration, allows firms to wait for ideal conditions to issue

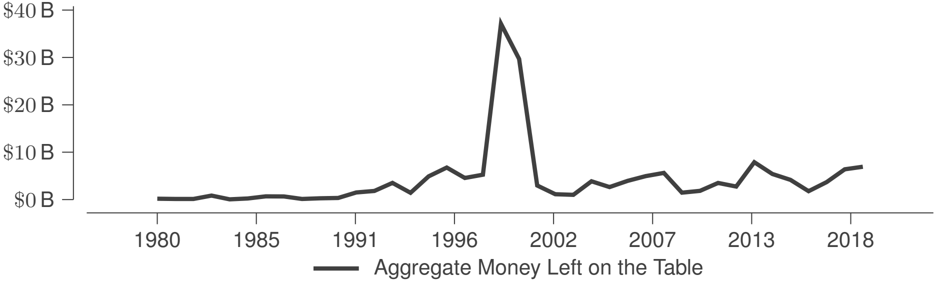
# Shelf Registration with the SEC




Remarks:

- shelf registration statement describes firm's financing plans for a two-year period
- firms issue shares multiple times over two-year period by filing short forms with SEC
- reduces time and cost of registration, allows firms to wait for ideal conditions to issue

# IPOs and Money on the Table




Remarks:

- money on the table is defined as first-day price gain $\times$ number of shares sold
- money left on the table is positive in every year, with clear spiked in 1999-2000
- underwriters under-price to oversubscribe issuances and drive commissions up

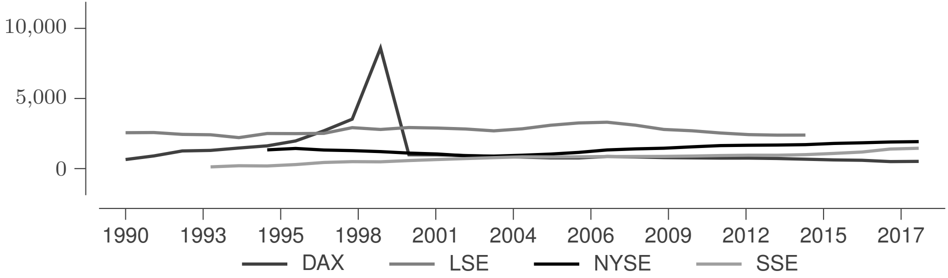
Source: 2019 update to Loughran and Ritter (2002), data from Professor Jay Ritter's website.

# Lecture 5: The Stock Market
# Overview of Topics

5.1. Stock Types and Indices
5.2. Initial Public Offerings
5.3. Stock Exchanges and Trading Process
5.4. Market Efficiency and Regulation
5.5. Paper of the Week

Reading: Mishkin and Eakins (2018, Chapter 13), Saunders and Cornett (2015, Chapter 8), Hong and Stein (2007)

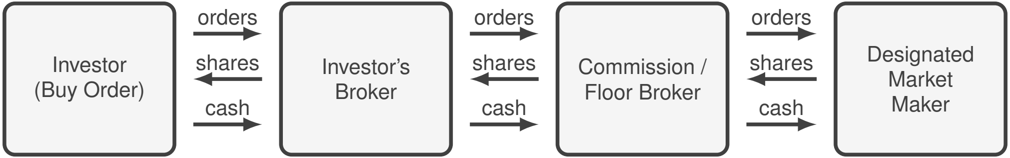
# Organized exchanges: NYSE, LSE, DAX, NSE, SSE




Remarks:

- examples of major international organized exchanges: NYSE, LSE, SSE, NSE, DAX
- traditionally, physical location where buyers and sellers regularly trade securities
- traditionally, trade by open-cry auction, but increasingly electronic now
- to trade, firms must meet size and transparency requirements set by exchanges

# The trading process on the New York Stock Exchange (2/2)




Remarks:

- investors place buy orders with their brokers to be carried out at the exchange
- big brokerages own licenses that commission brokers use to trade for the brokerage
- commission brokers represent brokerages at exchanges, transact with market makers
- floor brokers work for themselves at exchanges and transact with market makers

# Market vs Limit Orders (1/2)

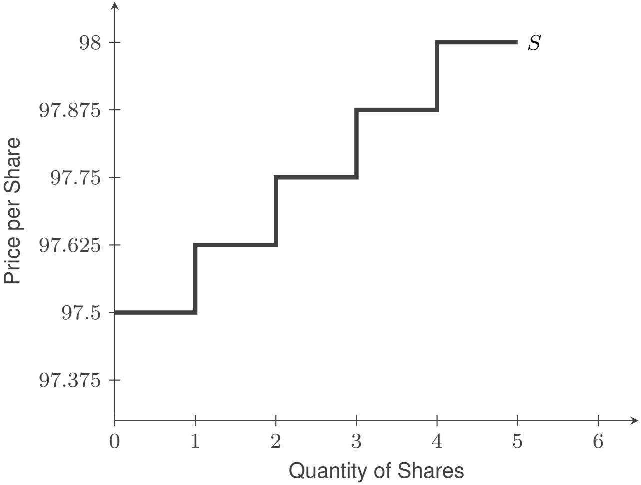
**Definition 29**

| | |
|---|---|
| Market order: | An order for the broker and market maker to transact at the best price available when the order reaches the trading post. |
| Limit order: | An order to transact only at a specified price (the limit price). Some limit orders are submitted with a time limit. |

Remarks:

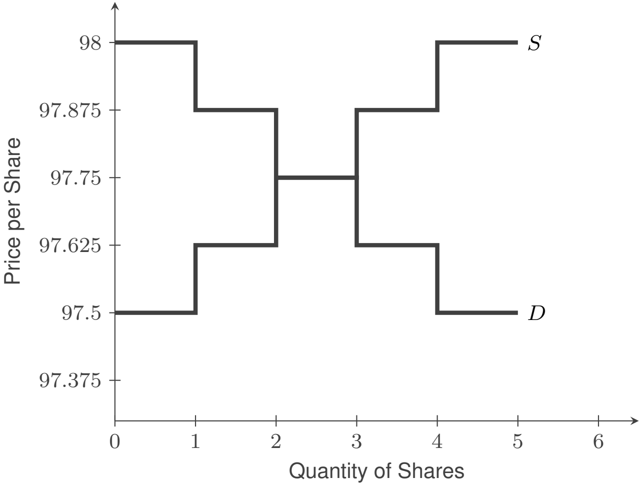
- these two order types represent the vast majority of orders sent to the trading floor
- market makers add to an order book the limit orders above or below current prices

# Market vs Limit Orders (2/2)



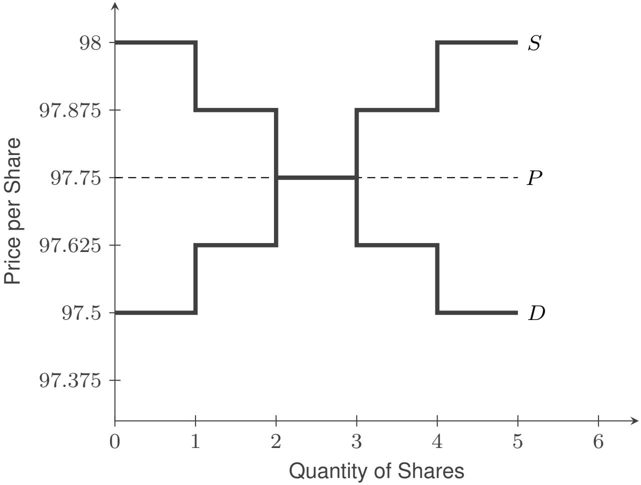

$S$ investors' aggregate supply of the stock

# Market vs Limit Orders (2/2)



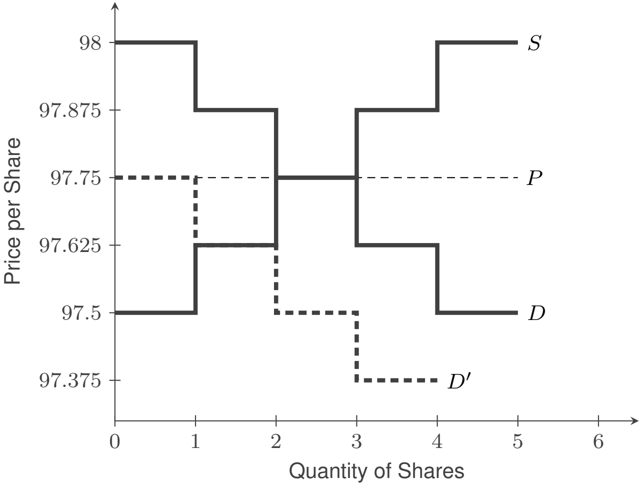

- $S$ investors' aggregate supply of the stock
- $D$ investors' aggregate demand of the stock

# Market vs Limit Orders (2/2)



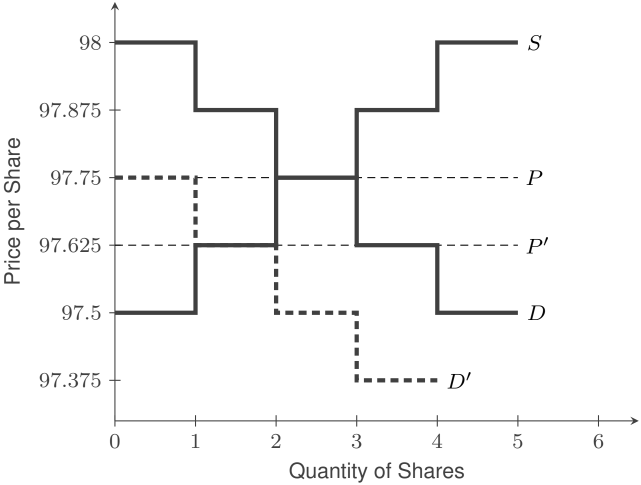

- $S$ investors' aggregate supply of the stock
- $D$ investors' aggregate demand of the stock
- $P$ equilibrium price where supply intersects demand

# Market vs Limit Orders (2/2)




- $S$ investors' aggregate supply of the stock
- $D$ investors' aggregate demand of the stock
- $P$ equilibrium price where supply intersects demand
- ▶ If demand curve shifts from $D$ to $D'$, the equilibrium price falls to 97.625

# Market vs Limit Orders (2/2)




- $S$ investors' aggregate supply of the stock
- $D$ investors' aggregate demand of the stock
- $P$ equilibrium price where supply intersects demand
- $P'$ new price where supply intersects new demand

- ► If demand curve shifts from $D$ to $D'$, the equilibrium price falls to 97.625
- ► At new lower equilibrium price, market maker may complete limit orders from order book

# Lecture 5: The Stock Market
## Overview of Topics



Reading: Mishkin and Eakins (2018, Chapter 13), Saunders and Cornett (2015, Chapter 8), Hong and Stein (2007)

# Market Efficiency

**Definition 30**

| | |
|---|---|
| Market efficiency: | The extent and speed with which financial security prices reflect unexpected news events. Markets are efficient if prices reflect current information. |

Forms of efficiency:

- Weak form: historical information (news, prices, volumes) does not consistently predict future stock price changes
- Semi-strong form: all public information, including forecasts, does not consistently predict future stock price changes
- Strong form: all information, including “insider” information, does not predict future stock price changes

# SEC: increasing market efficiency since 1933

- mission statement: protect investors and maintain market integrity
- main strategy: give investors constant, timely, accurate information
- main result: put investors in good position to judge firm value themselves

---

Remarks:

- SEC is small ($\approx$500 enforcement actions per year), can't monitor all firms
- instead, focus on information disclosures that reduce information asymmetries
- timely disclosure of accurate information leads to more efficient markets

# Lecture 5: The Stock Market
# Overview of Topics



Reading: Mishkin and Eakins (2018, Chapter 13), Saunders and Cornett (2015, Chapter 8), Hong and Stein (2007)

# Paper of the Week: Hong and Stein (2007)

> *"In this paper, we do not attempt to be either as balanced or as comprehensive as these authors. Rather, we adopt the role of advocates, and argue in favor of one particular class of heterogeneous-agent models, which we call "disagreement" models. This category is fairly broad, encompassing work that has focused on the following underlying mechanisms: i) gradual information flow; ii) limited attention; and iii) heterogeneous priors, that is, differences in the (Bayesian) prior beliefs that investors hold."*
>
> — **Harrison Hong and Jeremy C. Stein**

# Lecture 5: The Stock Market

Revision Checklist

- ☐ Stock Types and Indices
- ☐ Initial Public Offerings
- ☐ Stock Exchanges and Trading Process
- ☐ Market Efficiency and Regulation
- ☐ Paper of the Week

Reading: Mishkin and Eakins (2018, Chapter 13), Saunders and Cornett (2015, Chapter 8), Hong and Stein (2007)

# Survey of the Financial System
# Table of Contents

# Lecture 6: The Mortgage Market
# Overview of Topics



Reading: Mishkin and Eakins (2018, Chapter 14), and Siriwardane et al. (2020, July), Mayer et al. (2009)

# Mortgage: a simple definition

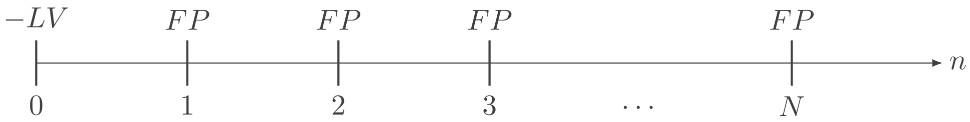
**Definition 31**

Mortgage: A long-term loan secured by real estate and amortized, i.e. repaid over time through a combination of principle and interest payments that achieve full repayment by maturity.

Remarks:

- many different types of mortgage and repayment scheme, here we cover the basics
- we focus on residential mortgages and briefly discuss the securitization of these
- mortgage securitization played an important role in the financial crisis of 2007–09
- Mayer et al. (2009) discuss mortgages and the financial crisis in our weekly paper

# Example: mortgage loan with fixed annual payments (1/3)




Notation:

- $LV$ loan value, paid out in year $0$
- $FP$ fixed payment paid each year $n = 1, 2, \ldots, N$
- $N$ years until mortgage matures

# Example: mortgage loan with fixed annual payments (2/3)

$$LV = \frac{FP}{(1+i)^1} + \frac{FP}{(1+i)^2} + \frac{FP}{(1+i)^3} + \cdots + \frac{FP}{(1+i)^N} = \sum_{n=1}^{N} \frac{FP}{(1+i)^n}$$

Remarks:

- given three of the four variables $LV$, $FP$, $i$, and $N$, you can find the fourth
- but not always in closed form—you may need numerical solution methods
- remember that we have assumed annual payments rather than monthly payments

# Example: mortgage loan with fixed annual payments (3/3)

**Question 17**

You borrow \$100,000 for five years, your annual interest rate is 7%, and you make fixed annual payments. How much are the payments?

A. 71,298.62

B. 23,578.61

C. 24,389.07

Remarks:

- your fixed payments represent a stream of equal yearly cash flows to the bank
- the present value of this cash flow stream should equal to the initial loan amount
- in practice, payments are monthly and interest is quoted as a simple annual rate

# Example: mortgage loan with fixed annual payments (3/3)

**Question 17**

You borrow \$100,000 for five years, your annual interest rate is 7%, and you make fixed annual payments. How much are the payments?

A. 71,298.62

B. 23,578.61

C. **24,389.07**

Remarks:

- your fixed payments represent a stream of equal yearly cash flows to the bank
- the present value of this cash flow stream should equal to the initial loan amount
- in practice, payments are monthly and interest is quoted as a simple annual rate

# Example: mortgage loan with fixed annual payments (2/2)

## Solution 17

From the present value formula:

$$LV = \sum_{t=1}^{N} \frac{FP}{(1+i)^t} \quad \Leftrightarrow \quad FP = LV \left( \sum_{t=1}^{N} \frac{1}{(1+i)^t} \right)^{-1},$$

where $LV$ is loan value and $FP$ is fixed payment. The summation can be written more compactly, letting $a = 1/(1+i)$, as

$$\sum_{t=1}^{N} a^t = \frac{a - a^{N+1}}{1-a}, \quad \text{where } a = 1/1.07 = 0.93457944\,.$$

Hence,

$$FP = \$100\,000 \times \left( \frac{0.93457944 - 0.93457944^6}{1 - 0.93457944} \right)^{-1} = \$24\,389.07\,.$$

# Simple Versus Effective Annual Interest Rates

**Definition 32**

| | |
|---|---|
| Simple Annual Rate ($APR$) | An annual interest rate, often quoted on mortgages, that ignores within-year interest compounding. |
| Effective Annual Rate ($EAR$) | An annual interest rate that accounts for the effect of within-year interest compounding. |

Remarks:

- mortgages are typically paid monthly, and interest also compounds monthly
- the effective annual rate ($EAR$) accounts for within-year compounding
- with monthly compounding, $EAR$ is computed as $EAR = (1 + APR/12)^{12} - 1$
- APR is based on simple annual rate but typically includes origination fees

# Example: mortgage loan with fixed monthly payments

$$\boxed{LV = \sum_{n=1}^{12\times N} \frac{FP}{\left(1 + \frac{APR}{12}\right)^{n}}}$$

Remarks:

- interest is compounded monthly rather than annually on most standard mortgages
- the monthly rate can be computed from the simple annual rate as $APR/12$
- the number of monthly compounding periods equals the years to maturity $N$ times 12

# Mortgage interest rates & points: a few details

**Definition 33**

**Discount points:** Interest payments made at the beginning of a loan, in exchange for an interest rate reduction over the life of the loan. One discount point is typically one percent of the loan value.

Remarks:

- the attendant interest rate reduction is typically chosen strategically by banks
- borrowers who repay in 5 years should be indifferent between points and no points
- why five years? average homes sell every five years in the United States

# Mortgage interest rates & points: a simple example

**Question 18**

You will hold a five-year \$200,000 mortgage to maturity. Should you choose a 4.2% simple annual rate mortgage without discount points or a 2.9616% simple annual rate mortgage for 3 discount points (cost included in \$200,000)?

A. you choose the 4.2% simple rate for 0 discount points

B. you choose the 2.9616% simple rate for 3 discount points

C. you are indifferent between them

Remarks:

- to compare the mortgages, you should compute the effective annual rates for each
- recall that effective annual rate is computed as $EAR = (1 + APR/12)^{12} - 1$
- to solve this numerically, you will need to use a financial calculator

# Mortgage interest rates & points: a simple example

**Question 18**

You will hold a five-year \$200,000 mortgage to maturity. Should you choose a 4.2% simple annual rate mortgage without discount points or a 2.9616% simple annual rate mortgage for 3 discount points (cost included in \$200,000)?

A. you choose the 4.2% simple rate for 0 discount points

B. you choose the 2.9616% simple rate for 3 discount points

C. **you are indifferent between them**

Remarks:

- to compare the mortgages, you should compute the effective annual rates for each
- recall that effective annual rate is computed as $EAR = (1 + APR/12)^{12} - 1$
- to solve this numerically, you will need to use a financial calculator

# Mortgage interest rates & points: a simple example

**Solution 18**

We will compare the EAR on both loans.

# Mortgage interest rates & points: a simple example

**Solution 18**

We will compare the EAR on both loans. For loan $A$, $\mathrm{EAR}_A = (1+0.042/12)^{12} - 1 = 4.2818\%$.

# Mortgage interest rates & points: a simple example

### Solution 18

We will compare the EAR on both loans. For loan $A$, $\mathrm{EAR}_A = (1+0.042/12)^{12} - 1 = 4.2818\%$. The monthly rate for loan $B$ is $r_B = 0.029616/12 = 0.2468\%$. The monthly rate $r_B$ then implies a fixed payment:

$$LV = FP \sum_{t=1}^{5\cdot 12} \left( \frac{1}{1+r_B} \right)^t \quad \Leftrightarrow \quad FP = 3,590.3259\,.$$

# Mortgage interest rates & points: a simple example

## Solution 18

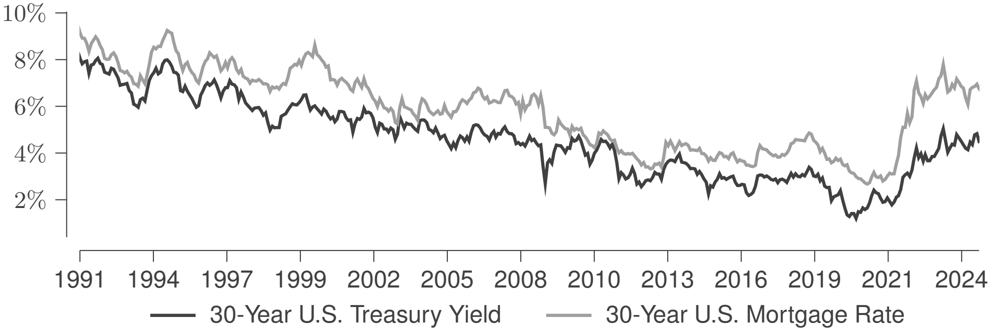
We will compare the EAR on both loans. For loan $A$, $\mathrm{EAR}_A = (1+0.042/12)^{12} - 1 = 4.2818\%$. The monthly rate for loan $B$ is $r_B = 0.029616/12 = 0.2468\%$. The monthly rate $r_B$ then implies a fixed payment:

$$LV = FP \sum_{t=1}^{5\cdot 12} \left(\frac{1}{1+r_B}\right)^t \quad \Leftrightarrow \quad FP = 3,590.3259\,.$$

Buying points implies $LV' = LV - 6,000$. Now $LV'$ and $FP$ imply $r'_B$:

$$LV' = FP \sum_{t=1}^{5\cdot 12} \left(\frac{1}{1+r'_B}\right)^t \quad \Leftrightarrow \quad r'_B = 0.0035 \quad \Rightarrow \quad \mathrm{EAR}_B = 4.2818\%\,.$$

# Mortgage interest rates: a few key determinants




Remarks:

- mortgage rates comove strongly with long-term bond yields (esp. treasury yields)
- but also depend on mortgage length: longer-term mortgage rates are often higher
- and also depend on borrower risk: employment history, credit score, down payment

# Mortgages have a specialized vocabulary that you should know

| | |
|---|---|
| Down payment: | A portion of the real estate purchase price that the buyer pays up front that then represents buyer equity |
| Discount points: | Lower rates negotiated for cash upfront; 1 point = 1% of loan amount paid upfront |
| Collateral: | An asset that lenders have recourse to in the event of default, usually the real estate being financed |
| FICO Score: | Model-based credit score based on payment history, outstanding debt, and other factors; ranges from 300–850 |
| PMI: | private mortgage insurance against borrower default, required when loan-to-value ratio too high |

# Lecture 6: The Mortgage Market
# Overview of Topics



Reading: Mishkin and Eakins (2018, Chapter 14), and Siriwardane et al. (2020, July), Mayer et al. (2009)

# Full amortization: 30-year, \$130,000 loan, 8.5% simple annual rate

| Payment Number | Beginning Balance | Monthly Payment | Applied to Interest | Applied to Principle | Ending Balance |
|---|---|---|---|---|---|
| 1 | 130,000 | 1000 | 921 | 79 | 129,921 |
| 60 | 124,257 | 1000 | 880 | 120 | 124,137 |
| 180 | 101,786 | 1000 | 721 | 279 | 101,508 |
| 360 | 992 | 1000 | 8 | 992 | 0 |

Remarks:

- early payments barely cover accrued interest, don't reduce principle much
- but later payments are applied mostly to principle, with little interest owed
- payment 1: interest $= 130,000 \cdot 0.085/12 \approx 921 \Rightarrow$ principle $\approx 1,000 - 921 \approx 79$

# Full amortization: 30-year, $130,000 loan, 8.5% simple annual rate

| Payment Number | Beginning Balance | Monthly Payment | Applied to Interest | Applied to Principle | Ending Balance |
|---|---|---|---|---|---|
| 1 | 130,000 | 1000 | 921 | 79 | 129,921 |
| 60 | 124,257 | 1000 | 880 | 120 | 124,137 |
| 180 | 101,786 | 1000 | 721 | 279 | 101,508 |
| 360 | 992 | 1000 | 8 | 992 | 0 |

Remarks:

- early payments barely cover accrued interest, don't reduce principle much
- but later payments are applied mostly to principle, with little interest owed
- payment 1: interest $= 130,000 \cdot 0.085/12 \approx 921 \Rightarrow$ principle $\approx 1,000 - 921 \approx 79$

# Full amortization: 30-year, \$130,000 loan, 8.5% simple annual rate

| Payment Number | Beginning Balance | Monthly Payment | Applied to Interest | Applied to Principle | Ending Balance |
|---|---|---|---|---|---|
| 1 | 130,000 | 1000 | 921 | 79 | 129,921 |
| 60 | 124,257 | 1000 | 880 | 120 | 124,137 |
| 180 | 101,786 | 1000 | 721 | 279 | 101,508 |
| 360 | 992 | 1000 | 8 | 992 | 0 |

Remarks:

- early payments barely cover accrued interest, don't reduce principle much
- but later payments are applied mostly to principle, with little interest owed
- payment 60: interest $= 124,257 \cdot 0.085/12 \approx 880 \Rightarrow$ principle $\approx 1,000 - 880 \approx 120$

# Full amortization: 30-year, \$130,000 loan, 8.5% simple annual rate

| Payment Number | Beginning Balance | Monthly Payment | Applied to Interest | Applied to Principle | Ending Balance |
|---|---|---|---|---|---|
| 1 | 130,000 | 1000 | 921 | 79 | 129,921 |
| 60 | 124,257 | 1000 | 880 | 120 | 124,137 |
| 180 | 101,786 | 1000 | 721 | 279 | 101,508 |
| 360 | 992 | 1000 | 8 | 992 | 0 |

Remarks:

- early payments barely cover accrued interest, don't reduce principle much
- but later payments are applied mostly to principle, with little interest owed
- payment 180: interest $= 101,786 \cdot 0.085/12 \approx 721 \Rightarrow$ principle $\approx 1,000 - 721 \approx 279$

# Full amortization: 30-year, \$130,000 loan, 8.5% simple annual rate

| Payment Number | Beginning Balance | Monthly Payment | Applied to Interest | Applied to Principle | Ending Balance |
|---|---|---|---|---|---|
| 1 | 130,000 | 1000 | 921 | 79 | 129,921 |
| 60 | 124,257 | 1000 | 880 | 120 | 124,137 |
| 180 | 101,786 | 1000 | 721 | 279 | 101,508 |
| 360 | 992 | 1000 | 8 | 992 | 0 |

Remarks:

- early payments barely cover accrued interest, don't reduce principle much
- but later payments are applied mostly to principle, with little interest owed
- payment 360: interest $= 992 \cdot 0.085/12 \approx 8 \Rightarrow$ principle $\approx 1,000 - 8 \approx 992$

# Lecture 6: The Mortgage Market
## Overview of Topics



Reading: Mishkin and Eakins (2018, Chapter 14), and Siriwardane et al. (2020, July), Mayer et al. (2009)

# There are several common types of mortgage loan

Insured and conventional mortgage:

- insured: guaranteed by govt to protect lender, so down payment smaller
- conventional: no govt guarantee, PMI needed if loan-to-value $>$80%

Fixed-rate mortgage:

- interest rate fixed for the life of mortgage, less uncertainty for borrower
- but borrower can no longer benefit from falling rates $\Rightarrow$ possible trade off

Adjustable-rate mortgage:

- interest rises and falls over life of loan, more uncertainty for borrower
- mortgage rate indexed to some base rate, typically long-term Treasuries

Other types:

- graduated payment (payment rises over time), growing equity (pay off early)
- second mortgages (junior to original loan), reverse annuity (for retired people)

# Mortgages terms and characteristics differ across countries

| | *Typical LTV* | *Maximum LTV* | *For 2nd mortgage* | *Mortgage debt to GDP* | *Fixed-term range 10–20 years* | *Fixed-term range 20+ years* | *Repayment by fee-free redemption* |
|---|---|---|---|---|---|---|---|
| U.S. | 75% | 97% | A | 69% | A | A | A |
| Denmark | 80% | 80% | A | 70% | A | A | A |
| France | 67% | 100% | L | 25% | A | L | N |
| Germany | 67% | 80% | A | 53% | A | L | N |
| Italy | 55% | 80% | A | 13% | L | L | N |
| Netherlands | 90% | 115% | A | 100% | A | L | N |
| Portugal | 83% | 90% | A | 51% | N | N | N |
| Spain | 70% | 100% | A | 42% | L | L | N |
| UK | 69% | 110% | A | 69% | L | N | L |
| Japan | 80% | 80% | | 36% | A | A | L |
| Korea | 40% | 75% | N | 14% | L | N | A |
| Canada | 65% | 90% | A | 44% | N | N | N |
| Australia | 63% | 80% | A | 74% | N | N | L |

*Notes:* Key A = available; L = limited availability; N = no availability.

Source: Green and Wachter (2005, Table 2)

# When were the first secondary mortgage markets established?

**Question 19**

The U.S. secondary market for mortgages is relatively deep and well-developed in international comparison (Green and Wachter, 2005). When do you think the secondary market for mortgages was established in the United States?

A. 1930s

B. 1950s

C. 1970s

D. 1990s

# When were the first secondary mortgage markets established?

Question 19

The U.S. secondary market for mortgages is relatively deep and well-developed in international comparison (Green and Wachter, 2005). When do you think the secondary market for mortgages was established in the United States?

A. **1930s**

B. 1950s

C. 1970s

D. 1990s

# Origins of the secondary mortgage market and securitization

1. Market created by federal government after Great Depression
   - Fannie Mae created to buy mortgages, FHA created to insure them
   - idea was to buy mortgages from thrifts, so thrifts could originate more
   - this govt involvement lead to standardized loan contracts, easily resold
2. Market gave rise to securitization through new intermediaries: mortgage banks
   - mortgage banks take no deposits, fund initial loans with equity
   - after origination fees collected, loans bundled and sold to GSEs
   - economies of scale $+$ more competition $=$ lower rates for borrowers

---

Remarks:

- In the Great Depression about 10% of homes foreclosed and 9,000 banks failed
- secondary mortgage markets established to stabilize banks and benefit borrowers
- the secondary mortgage markets and securitization are therefore old technologies

# Lecture 6: The Mortgage Market
# Overview of Topics



Reading: Mishkin and Eakins (2018, Chapter 14), and Siriwardane et al. (2020, July), Mayer et al. (2009)

# Loan servicing: a loan is originated, now what?

What is loan servicing?

- third party “services” offered to help administer an existing loan contract
- basically, collect and pass along payments, pay taxes, keeps records
- originating banks often retain right to service after loan resold

Why do banks need loan servicing?

- originating banks like to earn loan fees, dislike interest rate risk
- solution: originate a loan, then package it and sell to a risk-tolerant investor
- investor doesn’t want to service the loan, so third party hired for $\approx$0.5% fee

---

Remarks:

- remember the three parties: originator, investor, and servicing company
- this arrangement makes possible a huge secondary market for mortgages

# Securitization solves problems in the secondary mortgage market

1. Small lot sizes: securitization makes possible larger lot sizes, important for institutional investors
2. Standardization: securitization helps standardize maturities, interest rates, different contract terms
3. Servicing costs: securitization gives rise to specialized servicing companies with scale economies
4. Default risks: securitization of mortgages developed because of the idiosyncratic risks involved, e.g., risk of default

# The mortgage pass-through security: a simple definition

**Definition 34**

Mortgage Pass-through: A security that passes the borrower's mortgage payments through a trustee before disbursing to end investors.

Remarks:

- a mortgage pass-through is one simple type of mortgage-backed security (MBS)
- the trustee is the holder of the mortgage pool—a large assemblage of mortgages
- pass-throughs are subject to prepayment risk—rates fall and borrowers refinance

# Types of pass-through security

GNMA Pass-Through:

- guaranteed by Ginnie Mae, supporting commercial + mortgage banks
- federally-insured loans, $25,000 denomination and pool size of $1 million

FHLMC Pass-Through:

- guaranteed by Freddie Mac, supporting savings and loans banks
- larger pools with heterogeneous loans, $100,000 denominations

Private Pass-Through:

- private sector pass-throughs not subject to government restrictions
- for instance, can include underlying mortgages of larger sizes

See FED note for comparison b/w Treasury and Agency MBS markets.

# Lecture 6: The Mortgage Market
# Overview of Topics



Reading: Mishkin and Eakins (2018, Chapter 14), and Siriwardane et al. (2020, July), Mayer et al. (2009)

# Paper of the Week: Mayer et al. (2009)

> *"Unorthodox mortgage features such as rate resets, prepayment penalties, or negative amortization provisions do not appear to be significant contributors to date to the defaults [...] Our conclusions run counter to the popular perception that unorthodox mortgage features are responsible for the surge in defaults."*
>
> — **Christopher Mayer et al.**

# Lecture 6: The Mortgage Market

Revision Checklist

- ☐ Mortgage Basics
- ☐ Mortgage Amortization
- ☐ Mortgage Types and Mortgage Lenders
- ☐ Securitization
- ☐ Paper of the Week

Reading: Mishkin and Eakins (2018, Chapter 14), and Siriwardane et al. (2020, July), Mayer et al. (2009)

# Survey of the Financial System
Table of Contents

# Lecture 7: The Foreign Exchange Markets
# Overview of Topics

---



Reading: Mishkin and Eakins (2018, Chapter 15), Froot and Thaler (1990)

# What are foreign exchange rates?

**Definition 35**

| | |
|---|---|
| Exchange rate: | The rate at which one currency is exchanged for another. For immediate exchange, the rate is the *spot exchange rate*; for exchange at a specified future date, the rate is the *forward exchange rate*. |

Remarks:

- domestic currency appreciates when it costs more units of foreign currency
- domestic currency depreciates when it costs fewer units of foreign currency
- define spot exchange rates as $E_t = \frac{\text{units of foreign}}{1 \text{ unit of domestic}}$, so $E_t \uparrow \Rightarrow$ domestic appreciation

# Why are foreign exchange rates important?

**Question 20**

French wine costs 1,000 EUR and the spot exchange rate is $E_t = \frac{1.11 \text{ USD}}{1 \text{ EUR}}$. The spot exchange rate rises to $E_{t+1} = \frac{1.40 \text{ USD}}{1 \text{ EUR}}$. What is the percentage change in the dollar price of French wine after the exchange rate rises?

A. $25.13\%$

B. $26.13\%$

Remarks:

- Euro price of French wine unchanged, but now costlier to buy in dollars
- exchange rates affect trade through relative price of home and foreign goods
- Euro appreciation: EU goods costlier in US; US goods cheaper in EU

# Why are foreign exchange rates important?

**Question 20**

French wine costs 1,000 EUR and the spot exchange rate is $E_t = \frac{1.11 \text{ USD}}{1 \text{ EUR}}$. The spot exchange rate rises to $E_{t+1} = \frac{1.40 \text{ USD}}{1 \text{ EUR}}$. What is the percentage change in the dollar price of French wine after the exchange rate rises?

A. $25.13\%$

B. $\mathbf{26.13\%}$

Remarks:

- Euro price of French wine unchanged, but now costlier to buy in dollars
- exchange rates affect trade through relative price of home and foreign goods
- Euro appreciation: EU goods costlier in US; US goods cheaper in EU

# Why are foreign exchange rates important?

**Solution 20**

Let $P_t^{\$}$ denote prices in USD and $P_t$ denote prices in EUR. Prices in USD and EUR are related as follows:

$$P_t^{\$} = P_t E_t \,.$$

# Why are foreign exchange rates important?

**Solution 20**

Let $P_t^{\$}$ denote prices in USD and $P_t$ denote prices in EUR. Prices in USD and EUR are related as follows:

$$P_t^{\$} = P_t E_t \, .$$

The percentage change in the dollar price is therefore given by

$$\begin{aligned} \frac{P_{t+1}^{\$} - P_t^{\$}}{P_t^{\$}} &= \frac{P_{t+1} E_{t+1} - P_t E_t}{P_t E_t} \\ &= \frac{1000 E_{t+1} - 1000 E_t}{1000 E_t} = \frac{E_{t+1} - E_t}{E_t} = \frac{1.4 - 1.11}{1.11} \approx \mathbf{26.13\%} \, . \end{aligned}$$

# Why are foreign exchange rates important?

## Solution 20

Let $P_t^{\$}$ denote prices in USD and $P_t$ denote prices in EUR. Prices in USD and EUR are related as follows:

$$P_t^{\$} = P_t E_t \,.$$

The percentage change in the dollar price is therefore given by

$$\begin{aligned}\frac{P_{t+1}^{\$} - P_t^{\$}}{P_t^{\$}} &= \frac{P_{t+1}E_{t+1} - P_t E_t}{P_t E_t} \\ &= \frac{1000E_{t+1} - 1000E_t}{1000E_t} = \frac{E_{t+1} - E_t}{E_t} = \frac{1.4 - 1.11}{1.11} \approx \mathbf{26.13\%} \,.\end{aligned}$$

French wine is more expensive because EUR has appreciated against USD.

# How is foreign exchange traded? A brief overview

Type of exchange:

- mainly “over-the-counter”: dealers (primarily banks) stand ready to buy / sell
- electronic networks (Reuters, EBS) link over-the-counter buyers and sellers

Trading volume:

- by far the largest financial market by volume (turnover): over 5 trillion USD / day
- most transactions involve bank deposits denominated in different currencies

Trading centers:

- Australasia: Tokyo, Sydney, Hong Kong, Singapore, and Bahrain
- Europe: London, Zurich, Frankfurt, Paris
- North America: New York, Toronto, Chicago, and San Francisco

# The bid-ask spread: a simple definition

**Definition 36**

**Bid-ask spread:** The difference between the exchange rate at which over-the-counter dealers are willing to buy currency (bid rate) and sell currency (ask rate).

Remarks:

- a helpful memory device: buy = bid and ask = sell
- the ask rate is higher than the bid rate, allowing dealers to profit from transactions
- a useful summary rate is the midquote, which averages the bid and ask rates

# What determines the bid-ask spread?

- Dealer services:
  - the cost of acquiring the specialized know-how (e.g. trader salaries)
  - subscriptions to electronic trading systems (e.g. EBS, Thompson Reuters)
- Adverse selection:
  - dealers and customers may have access to different information sets
  - the dealers can’t tell if customers have private information or liquidity needs
- Inventory risk:
  - dealers stand ready to buy and sell by holding inventory in different currencies
  - there are risks and opportunity costs associated with holding currency inventory

# Lecture 7: The Foreign Exchange Markets
# Overview of Topics



Reading: Mishkin and Eakins (2018, Chapter 15), Froot and Thaler (1990)

# Are goods prices the same throughout the world?

**Definition 37**

| | |
|---|---|
| Law of one price: | The theory that two identical goods produced in two different countries must sell at the same price if transportation costs and trade barriers are low. |

Remarks:

- violations should cause excess demand for the relatively cheaper good
- disequilibrium causes exchange rates to adjust and eliminate excess demand
- trade barriers and transportation costs can explain the violations we observe

# The law of one price: an example

**Question 21**

The JPY price of steel increased by 10% to JPY 11,000. The USD price of steel is unchanged at $100. Under the law of one price, what was the exchange rate before the price rise? What is the exchange rate after the price rise?

A. before: JPY 100 per USD 1; after: JPY 100 per USD 1 dollar

B. before: JPY 100 per USD 1; after: JPY 110 per USD 1

C. before: JPY 91 per USD 1; after: JPY 100 per USD 1

Remarks:

- the law of one price applies to price differences for individual goods
- what do you think should happen to U.S. demand for Japanese steel exports?

# The law of one price: an example

**Question 21**

The JPY price of steel increased by 10% to JPY 11,000. The USD price of steel is unchanged at $100. Under the law of one price, what was the exchange rate before the price rise? What is the exchange rate after the price rise?

A. before: JPY 100 per USD 1; after: JPY 100 per USD 1 dollar

B. **before: JPY 100 per USD 1; after: JPY 110 per USD 1**

C. before: JPY 91 per USD 1; after: JPY 100 per USD 1

Remarks:

- the law of one price applies to price differences for individual goods
- what do you think should happen to U.S. demand for Japanese steel exports?

# The law of one price: an example

**Solution 21**

Let $P_S^{\$}$ denote the USD price of steel and $P_S$ denote JPY price of steel.

# The law of one price: an example

**Solution 21**

Let $P_S^{\$}$ denote the USD price of steel and $P_S$ denote JPY price of steel. The law of one price requires that USD and JPY prices satisfy

$$P_S = P_S^{\$} E \,,$$

where $E$ is the exchange rate, defined as JPY per USD.

# The law of one price: an example

**Solution 21**

Let $P_S^{\$}$ denote the USD price of steel and $P_S$ denote JPY price of steel. The law of one price requires that USD and JPY prices satisfy

$$P_S = P_S^{\$} E \,,$$

where $E$ is the exchange rate, defined as JPY per USD. Let $P_S' = 11,000$, $P_S = 10,000$, and $P_S^{\$\prime} = 100$, and $P_S^{\$} = 100$. Now,

$$\begin{aligned} P_S = P_S^{\$} E \quad &\Leftrightarrow \quad 10,000 = 100E \quad \Leftrightarrow \quad E = 100 \,, \\ P_S' = P_S^{\$\prime} E' \quad &\Leftrightarrow \quad 11,000 = 100E' \quad \Leftrightarrow \quad E' = 110 \,. \end{aligned}$$

# The law of one price: an example

**Solution 21**

Let $P_S^{\$}$ denote the USD price of steel and $P_S$ denote JPY price of steel. The law of one price requires that USD and JPY prices satisfy

$$P_S = P_S^{\$} E\,,$$

where $E$ is the exchange rate, defined as JPY per USD. Let $P_S' = 11,000$, $P_S = 10,000$, and $P_S^{\$\prime} = 100$, and $P_S^{\$} = 100$. Now,

$$\begin{aligned} P_S = P_S^{\$} E \quad &\Leftrightarrow \quad 10,000 = 100E \quad \Leftrightarrow \quad E = 100\,, \\ P_S' = P_S^{\$\prime} E' \quad &\Leftrightarrow \quad 11,000 = 100E' \quad \Leftrightarrow \quad E' = 110\,. \end{aligned}$$

Thus the exchange rate rose from JPY 100 per USD 1 to JPY 110 per USD 1.

# Do exchange rates reflect differences in national price levels?

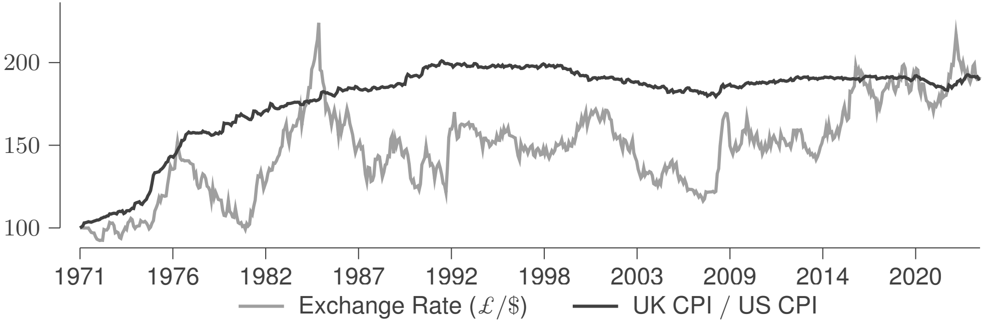
**Definition 38**

| | |
|---|---|
| Purchasing power parity: | The theory that exchange rates between two currencies adjust to reflect changes in the price levels of two countries. Often abbreviated to PPP. |

Remarks:

- PPP is the law of one price applied to aggregate price levels, not individual goods
- PPP suggests that home inflation should cause home currency to depreciate
- why? if home prices rise, demand for home goods and home currency falls

# Purchasing power parity: an illustration for U.S. and U.K.




Remarks:

- PPP: the real exchange rate for these countries ($Q := P^{\$}E/P^{£}$) should equal one
- long-run success: US and UK price levels rose equally, adjusting for exchange rate
- short-run failure: clearly, SR changes in price levels and exchange rates differ

# What factors affect exchange rates in the long run?

Relative price levels:

- PPP predicts that exchange rates adjust to changes in price levels
- a rise in the home price level causes home currency to depreciate

Trade barriers:

- trade barriers like import taxes (tariffs) and quantity restrictions (quotas)
- a rise in home trade barrier can cause home currency to appreciate

Home bias:

- preferences for home versus foreign goods may change over time
- a rise in demand for home goods causes home currency to appreciate

Productivity:

- higher productivity at home tends to lower the price of home goods
- demand for home goods rises as a result, and home currency appreciates

# Lecture 7: The Foreign Exchange Markets
## Overview of Topics

---



Reading: Mishkin and Eakins (2018, Chapter 15), Froot and Thaler (1990)

# Financial markets determine short-run exchange rates

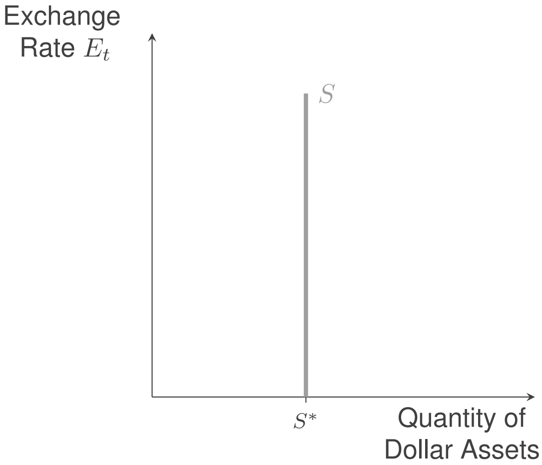
- Long-run theory of exchange rates focuses on slow-moving goods markets
- Short-run theory of exchange rates focuses on fast-moving financial markets
- Export and import flows are small compared to financial market flows

---

Remarks:

- We will develop a supply and demand framework to think about exchange rates
- In our analysis, we will distinguish between spot and expected future prices
- Remember: exchange rate $E$ denotes foreign currency per unit of domestic currency

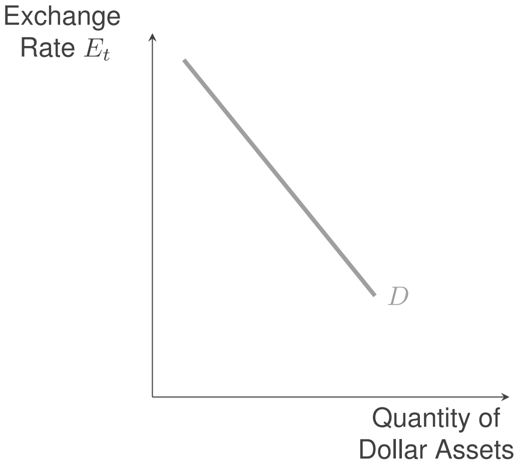
# The supply of domestic assets is fixed




Remarks:

- take quantity supplied to be domestic bank deposits, bonds, and equities
- supply of these assets is roughly independent of exchange rates
- therefore, the supply curve should be vertical in this space

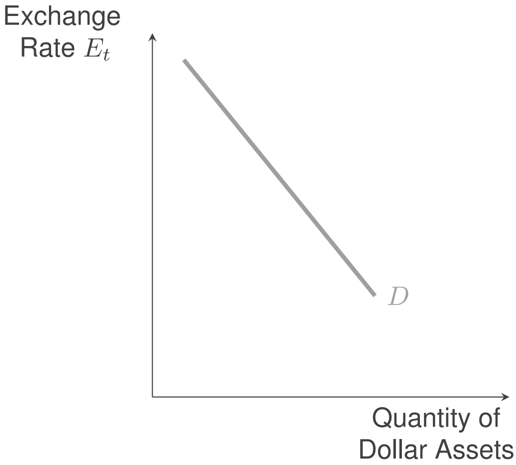
# Demand for domestic assets depends on the spot exchange rate




Remarks:

- demand for dollar assets depends on the expected return on dollar assets
- demand curve: demand at each spot exchange rate, *ceteris paribus*
- *ceteris paribus* fixes expected future asset prices and exchange rates

# Demand for domestic assets depends on the spot exchange rate

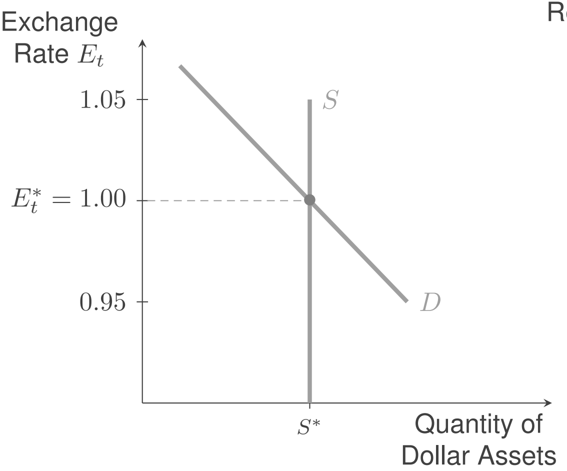



Remarks:

- demand for dollar assets depends on the expected return on dollar assets
- demand curve: demand at each spot exchange rate, *ceteris paribus*
- *ceteris paribus* fixes expected future asset prices and exchange rates
- expected return therefore depends solely on the spot exchange rate
- with price $P$ in dollar, foreign investors expect:

$$\text{return}^e_{t+1} = \frac{E^e_{t+1}P^e_{t+1} - E_t P_t}{E_t P_t} \approx \%\Delta E^e_{t+1} + \%\Delta P^e_{t+1}$$

# Equilibrium in the foreign exchange market




Remarks:

- the equilibrium $E_t^*$ balances supply and demand for dollar assets
- exchange rates above $E_t^*$, say at $E_t = 1.05$, yield excess supply
- exchange rates below $E_t^*$, say $E_t = 0.95$, yield excess demand

# Shifts in demand for domestic assets

Domestic and foreign interest rates:

- higher domestic interest $i^D$ means domestic assets pay investors more
- an increase in domestic interest $i^D$ shifts demand to the right

- higher foreign interest $i^F$ means domestic assets pay relatively less
- an increase in foreign interest $i^F$ shifts demand to the left

Expected future exchange rate:

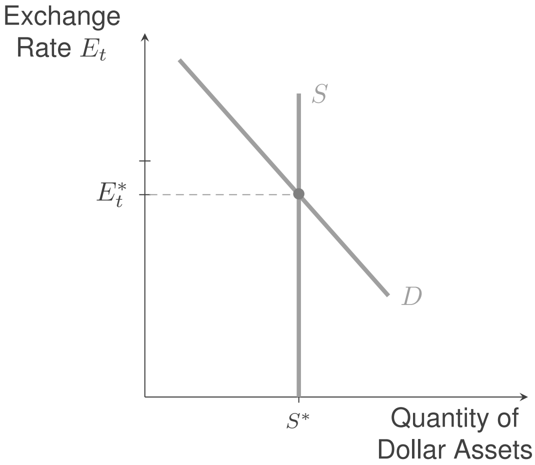
- home returns depend on expected asset prices $P^e_{t+1}$ and exchange rates $E^e_{t+s}$
- a rise in $E^e_{t+1}$, holding $P^e_{t+1}$ fixed, shifts demand to the right

---

Remarks:

- nominal interest rates can change because real rates change or inflation changes
- the effect on exchange rates will depend on the reason that nominal rates change

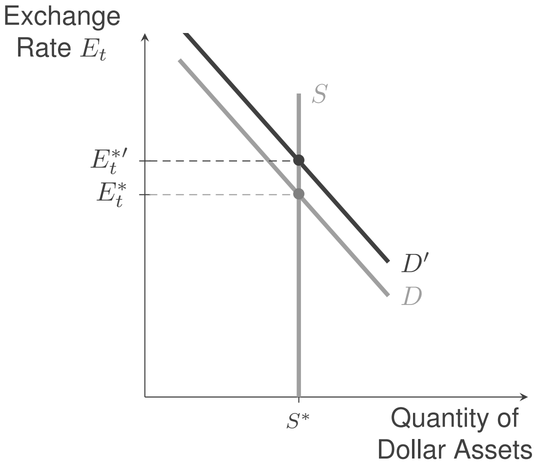
# Impact of rising real interest rates on exchange rates




Remarks:

- recall the Fisher equation: $i^D \approx r + \pi^e$
- suppose $i^D$ rises in response to a rise in $r$
- real interest rates best represent true economic incentives to invest
- rising real interest rates make domestic assets better investments
- thus rising real rates cause home currency to appreciate

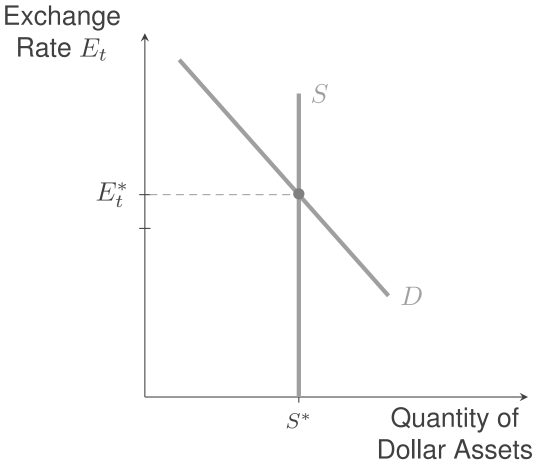
# Impact of rising real interest rates on exchange rates




Remarks:

- recall the Fisher equation: $i^D \approx r + \pi^e$
- suppose $i^D$ rises in response to a rise in $r$
- real interest rates best represent true economic incentives to invest
- rising real interest rates make domestic assets better investments
- thus rising real rates cause home currency to appreciate

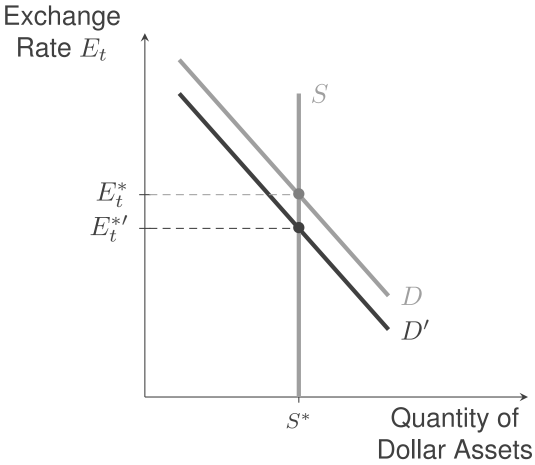
# Impact of rising inflation expectations on exchange rates




Remarks:

- recall the Fisher equation: $i^D \approx r + \pi^e$
- suppose $i^D$ rises in response to a rise in $\pi^e$
- higher expected home inflation should lower the expected exchange rate $E^e_{t+1}$
- lower $E^e_{t+1}$ is a consequence of PPP: less expected demand for home exports
- empirically the fall in $E^e_{t+1}$ tends to exceed the rise in $i^D$
- thus inflation lowers the expected return on dollar assets and depreciates currency

# Impact of rising inflation expectations on exchange rates




Remarks:

- recall the Fisher equation: $i^D \approx r + \pi^e$
- suppose $i^D$ rises in response to a rise in $\pi^e$
- higher expected home inflation should lower the expected exchange rate $E^e_{t+1}$
- lower $E^e_{t+1}$ is a consequence of PPP: less expected demand for home exports
- empirically the fall in $E^e_{t+1}$ tends to exceed the rise in $i^D$
- thus inflation lowers the expected return on dollar assets and depreciates currency

# Lecture 7: The Foreign Exchange Markets
## Overview of Topics



Reading: Mishkin and Eakins (2018, Chapter 15), Froot and Thaler (1990)

# Interest parity condition: a simple definition

**Definition 39**

| | |
|---|---|
| Interest Parity Condition | The condition that the domestic interest rate equals the foreign interest rate minus the expected appreciation of the domestic currency in markets with perfect capital mobility. |

Remarks:

- condition assumes capital mobility and domestic and foreign asset substitutablity
- exchange rate adjusts to make investors indifferent between home and foreign assets
- if home asset pays higher return, then investors expect foreign currency appreciation

# Comparing expected returns on domestic and foreign assets

$$\text{Relative } R^D = i^D - i^F + \frac{E^e_{t+1} - E_t}{E_t}$$

---

Notation and remarks:

| | |
|---|---|
| $R^D$ | Expected return on domestic assets, in terms of foreign currency |
| $i^D$ | Interest rate that domestic assets pay, in terms of domestic currency |
| $i^F$ | Interest rate that foreign assets pay, in terms of foreign currency |
| $E^e_t$ | Expected time-$t$ exchange rate |
| $E_t$ | Time-$t$ exchange rate |

- Foreigners holds more dollar assets when relative expected return increases
- Greater dollar asset demand should drive $i^D$ down and relative $R_D$ to zero

# Relative expected returns should be zero if capital is mobile

$$\text{Relative } R^D = 0 \quad \Leftrightarrow \quad i^D = i^F - \frac{E^e_{t+1} - E_t}{E_t}$$

Remarks:

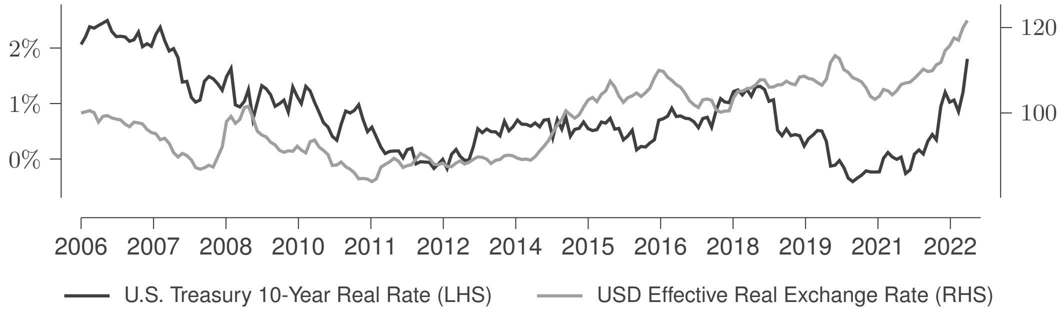
- if the domestic interest rate is higher than the foreign interest rate, there is a positive expected appreciation of the foreign currency
- the positive appreciation of foreign currency compensates investors for the lower foreign interest rate
- note that interest parity means simply that the expected returns are the same on both dollar assets and foreign assets (after currency conversion)

# Lecture 7: The Foreign Exchange Markets
# Overview of Topics



Reading: Mishkin and Eakins (2018, Chapter 15), Froot and Thaler (1990)

# The U.S. dollar and real interest rates




Remarks:

- USD real exchange rate and real interest rate are weakly correlated (from FRED)
- USD exchange rate: weighted average against broad group of U.S. trading partners
- U.S. Treasury real rate: based on Fed estimates of expected inflation and risk premia

# The U.S. dollar and the global financial crisis of 2007–09

Fall of the Dollar in 2007:

- In 2007, crisis largely confined to United States
- summer: dollar fell 9% against EUR
- decline probably due to fall in short-term interest rates
- Fed lowered interest rates in response to financial crisis

Rise of the Dollar in 2008:

- By 2008, crisis begins to spread to other countries
- summer of 2008: dollar rose 20% against EUR
- foreign central banks began also lowering short-term rates
- flight to quality: U.S. treasuries viewed as safe haven

# The U.S. dollar during and after the pandemic: 2020–22

Fall of the Dollar During Pandemic: 2020

- Broad USD index fell by 9% in the second half of 2020
- Fed policy looked relatively accommodative around this time
- U.S. pandemic response was poor in international comparison

Rise of the Dollar Post Pandemic: 2021-22

- By 2021, lowest EUR and JPY exchange rates against USD in two decades
- USD rising despite high U.S. inflation and terrible trade balance
- But: high inflation everywhere, strong U.S. economy, energy independence

---

Remarks:

- Nice Roubini article on fall of USD published in Project Syndicate, Aug 2020
- Nice Rogoff article on USD recovery published in Project Syndicate, Sep 2022

# Lecture 7: The Foreign Exchange Markets
# Overview of Topics

---



Reading: Mishkin and Eakins (2018, Chapter 15), Froot and Thaler (1990)

# Paper of the Week: Froot and Thaler (1990)

> *Partly as a result of the sheer volume of trading, many researchers have focused on the foreign exchange market to examine questions of speculative efficiency. One view—argued initially by Friedman (1953)—is that because speculators buy low and sell high their activity ensures that exchange rates reflect the fundamental or long-run determinants of currency values. A second strand of literature, often attributed to Nurske (1944), holds that speculation in foreign exchange can be destabilizing, and that excess volatility imposes large costs on producers and consumers who as a consequence make less efficient allocative decisions. Recently this debate has escalated [. . .]*
>
> — **Kenneth A. Froot and Richard H. Thaler**

# Lecture 7: The Foreign Exchange Markets

Revision Checklist

- ☐ Foreign Exchange Market
- ☐ Exchange Rates in the Long Run
- ☐ Exchange Rates in the Short Run
- ☐ Interest Parity Condition
- ☐ The Special Role of the U.S. Dollar
- ☐ Paper of the Week

Reading: Mishkin and Eakins (2018, Chapter 15), Froot and Thaler (1990)

# Survey of the Financial System
# Table of Contents

# Lecture 8: Risk Management and Derivatives
# Overview of Topics



Reading: Mishkin and Eakins (2018, Chapters 23 and 24), and Nagel (2015, August), Stulz (2004)

# Why do credit risks arise?

**Definition 40**

| | |
|---|---|
| Credit risk: | The risk that borrowers default on the loans that lenders make. Credit risk is made worse when lenders have imperfect information on the characteristics and activities of borrowers. |

Remarks:

- loans are profit sources for traditional banks, generating fees and interest
- but loans are less profitable if too many borrowers default on loans
- information asymmetries increase the risk that borrowers default on loans

# First line of defense: screening and monitoring

Screening

- problem: riskiest borrowers are most likely to ask for loans (adverse selection)
- response: collect information on borrowers to screen out bad risks

Specialization

- problem: screening out bad risks may require specialized knowledge
- response: lend in specific industries or locations, despite lack of diversification

Monitoring

- problem: after loan is made, borrower incentivized to take risks (moral hazard)
- response: impose restrictive covenants and monitor borrower compliance

# Other common methods of managing credit risk (x5) I

1. Long-term relationships
   - repeated interactions between lenders and borrowers over long periods of time
   - better chance to gathering information: account and repayment history, etc.
2. Loan commitments
   - promise by bank to provide loans up to a pre-specified amount under conditions
   - promotes long-term relationship, requires firm to provide ongoing information
3. Collateral
   - property promised to lender as compensation for borrower default
   - reduces adverse selection and moral hazard: borrower has more to lose

# Other common methods of managing credit risk (x5) II

4. Compensating balances
   - requirement that borrowers keep a portion of lent funds as deposits with lender
   - forces borrower to open an account with lender, allows bank to monitor
5. Credit rationing
   - refusing to make loans despite borrower willingness to pay the quoted rate
   - limits adverse selection problem: higher rates cause worse selection

# Lecture 8: Risk Management and Derivatives
# Overview of Topics



Reading: Mishkin and Eakins (2018, Chapters 23 and 24), and Nagel (2015, August), Stulz (2004)

# Counting interest-sensitive assets and liabilities

**Definition 41**

Interest-sensitivity: Assets and liabilities are *interest-sensitive* if they have interest rates that can reset within one year. Interest rates can reset because debt instruments mature, because rates are variable, or because instruments are called / repaid early.

Remarks:

- assets: e.g. bonds with maturity $< 1$ year, variable-rate mortgages, early repayments
- liabilities: e.g. federal funds, variable rate CDs, or loans with maturity $< 1$ year
- interest-sensitive liabilities $>$ interest-sensitive assets $\Rightarrow$ income $\downarrow$ if interest rates $\uparrow$

# Two helpful tools for measuring interest rate risk

- Income Gap Analysis: simple approach to measuring sensitivity of a bank's *income* to changes in interest rates
- Duration Gap Analysis: simple approach to measuring sensitivity of a bank's *net worth* to changes in interest rates

---

Remarks:

- both methods are *simple* but imperfect—not the last word on interest rate risk
- problems with both methods can be addressed by more complex risk models

# Income gap analysis: computing the change in income

$$GAP = RSA - RSL, \qquad \Delta I = GAP \times \Delta i$$

Notation and remarks:

| | |
|---|---|
| $GAP$ | rate-sensitive asset-liability gap, defined above |
| $RSA$ | rate-sensitive assets |
| $RSL$ | rate-sensitive liabilities |
| $\Delta I$ | change in income |
| $\Delta i$ | change in interest rate |

- two steps: first measure asset-liability gap, then multiply by rate change
- for assets with different maturities, use the *maturity bucket approach*

# Income gap analysis: a simple example

**Question 22**

A bank has \$17m in rate-sensitive assets and \$14.5m in rate sensitive liabilities. How does the bank's income respond to a 1% fall in the interest rate?

A. $-\$2,500$

B. $-\$25,000$

C. $-\$250,000$

Remarks:

- gains and losses could be much greater if longer maturities also considered
- given this exposure to interest rate risk, what steps could the bank now take?

# Income gap analysis: a simple example

**Question 22**

A bank has \$17m in rate-sensitive assets and \$14.5m in rate sensitive liabilities. How does the bank's income respond to a 1% fall in the interest rate?

A. $-\$2,500$

B. $\mathbf{-\$25,000}$

C. $-\$250,000$

Remarks:

- gains and losses could be much greater if longer maturities also considered
- given this exposure to interest rate risk, what steps could the bank now take?

# Income gap analysis: a simple example

**Solution 22**

First compute the gap between rate-sensitive assets and liabilities:

$$GAP = RSA - RSL = \$17\text{m} - \$14.5\text{m} = \$2.5\text{m}\,.$$

Now compute the change in income $\Delta I$ that results from a 1% change in interest $\Delta i = -0.01$:

$$\Delta I = GAP \times \Delta i = \$2.5\text{m}(-0.01) = -\$0.025\text{m}\,,$$

or $-\$25\,000$.

# Duration gap analysis for individual securities

The single security duration gap approximation is:

$$\boxed{\%\Delta P \approx -DUR \times \frac{\Delta i}{1+i}}$$

Notation and remarks:

| | |
|---|---|
| $\%\Delta P$ | percentage change in price of security |
| $DUR$ | Macaulay duration of security |
| $\Delta i$ | change in interest rate |

- recall that duration measures the average maturity of cash flows for a security
- alternatively: duration measures a security's price sensitivity to rate changes

# Duration gap analysis for bank balance sheets

The balance sheet duration gap and approximate change in net worth are

$$DUR_g = DUR_a - \frac{L}{A} \times DUR_l, \qquad \frac{\Delta NW}{A} \approx -DUR_g \times \frac{\Delta i}{1+i}$$

Notation and remarks:

| | |
|---|---|
| $DUR_g$ | duration gap, defined above |
| $DUR_a$ | (weighted) average duration of assets |
| $DUR_l$ | (weighted) average duration of liabilities |
| $L$ | liabilities |
| $A$ | assets |
| $NW$ | market value of net worth |

# Some problems with income and duration gap analysis

Assumes a static and flat yield curve

- here, we've implicitly assumed that all interest rates change by the same amount
- but normally the yield curve is sloped and changes slope when $i$ changes

Potentially miscounts rate-sensitive assets and liabilities

- income gap analysis requires counting the interest-sensitive assets and liabilities
- "counting" requires estimating prepayment rates, demand for deposits, etc.

---

Remarks:

- gap analyses are simple tools to give first-approximations to interest risk
- more complex tools offer better approximations: scenario analysis, VaR, ES, etc.

# Lecture 8: Risk Management and Derivatives
# Overview of Topics



Reading: Mishkin and Eakins (2018, Chapters 23 and 24), and Nagel (2015, August), Stulz (2004)

# Hedging with financial derivatives

**Definition 42**

| | |
|---|---|
| Hedge: | A financial transaction that reduces or eliminates risk by offsetting long (short) positions with additional short (long) positions in financial assets. |

Remarks:

- derivatives are a useful alternative for institutions with no *natural hedges*
- example: banks use financial hedges to avoid costly balance sheet restructuring
- *micro-hedge*: hedge specific asset risk; *macro-hedge*: hedge portfolio risk

# Financial derivatives help institutions manage risks

**Definition 43**

| | |
|---|---|
| Financial derivative: | Financial assets with payoffs that are linked to previously issued securities, and that are commonly used for risk reduction (and speculative investment). |

Remarks:

- financial derivatives allow banks to avoid costly balance sheet restructuring
- financial derivatives are *technology*, very much the result of R&D and innovation
- derivatives markets grew 100-fold over the last half-century, now 10 times U.S. GDP

# Lecture 8: Risk Management and Derivatives
# Overview of Topics



Reading: Mishkin and Eakins (2018, Chapters 23 and 24), and Nagel (2015, August), Stulz (2004)

# Forwards and futures: a simple definition

**Definition 44**

| | |
|---|---|
| Forwards and futures: | Two types of financial derivative, each representing a contract by two parties to engage in a financial transaction at a future point in time at a pre-specified price, with no exchange of funds today. |

Remarks:

- forwards: very flexible, because underlying can be anything—not standardized
- futures: extremely popular, because standardized and centrally cleared

# How do forwards and futures contracts differ?

Forwards: tailored contracts

- less liquid, because underlying assets very specific
- more default risk, because not centrally cleared
- actual delivery of underlying asset required at expiry

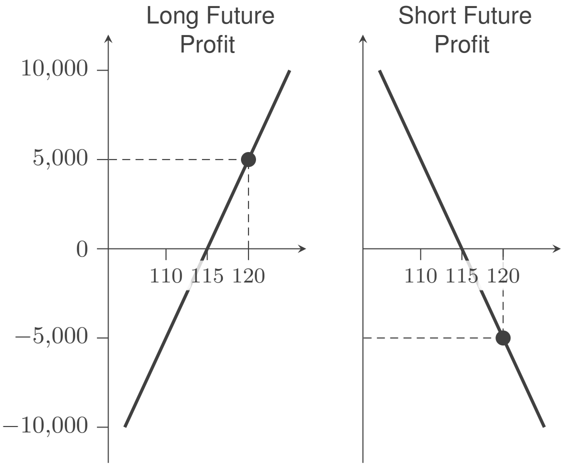
Futures: standardized contracts

- more liquid, because standardized assets, quantities, delivery dates
- less default risk, because centrally cleared
- no actual delivery, traders make offsetting purchase at expiry

Remarks:

- forwards less liquid, but tailored exactly to specific needs of buyer
- futures more liquid: arbitrage $\Rightarrow$ futures price converges to price of underlying

# Buying and selling interest-rate futures




- \$100,000 Treasury bond future, forward price = 115
- units on horizontal axis are points, 1 point = \$1,000
- profit from buying / selling futures, shown in blue
- for buyer: if price at expiration = 120, profit = \$5,000 (left)
- for seller: if price at expiration = 120, profit = −\$5,000 (right)

# Interest rate futures: an example

**Question 23**

You own \$5 million in 20-year Treasury bonds selling at par. The Chicago Board of Trade has 20-year Treasury bond futures in \$100,000 contracts, also selling at par. To hedge your bond position, should you buy or sell futures, and how many contracts do you need?

A. sell 500

B. buy 500

C. sell 50

Remarks:

- buy: take future delivery (long position); sell: make future delivery (short position)
- futures contract prices quoted in *points*: 1 point = \$1,000, so 100 points = \$100,000

# Interest rate futures: an example

**Question 23**

You own \$5 million in 20-year Treasury bonds selling at par. The Chicago Board of Trade has 20-year Treasury bond futures in \$100,000 contracts, also selling at par. To hedge your bond position, should you buy or sell futures, and how many contracts do you need?

A. sell 500

B. buy 500

C. **sell 50**

Remarks:

- buy: take future delivery (long position); sell: make future delivery (short position)
- futures contract prices quoted in *points*: 1 point = \$1,000, so 100 points = \$100,000

# Interest rate futures: an example

**Solution 23**

You should offset your long treasury position with a short futures position:

| Position | Payoff at time $T$ |
|---|---|
| Long treasuries | $+(S_T - S_0)$ |
| Short futures | $-(S_T - F_0)$ |
| Portfolio | $+(F_0 - S_0)$ |

The total payoff for a hedged portfolio should be zero, so

$$F_0 - S_0 = 0 \quad \Leftrightarrow \quad F_0 = S_0 \, .$$

You need 50 futures contracts: $F_0 = 50 \times \$100,000 = \$5\mathrm{m} = S_0$.

# Stock index futures: a simple definition

**Definition 45**

| | |
|---|---|
| Stock index futures: | Futures contracts written on the value of a stock index, settled in cash at a fixed dollar amount per index point of the underlying index. |

Remarks:

- widely-traded futures for managing market risk (pension funds, mutual funds, etc.)
- points: for S&P 500 futures, 1 point equals \$250, settlement = \$250 $\times$ index value

# Stock index futures: an example

**Question 24**

You see the following entry for S&P 500 futures contracts quoted in the July 28th morning financial news:

| | Open | High | Low | Settle | Change | Open Interest |
|---|---|---|---|---|---|---|
| Nov. | 2083.00 | 2112.508 | 2083.00 | 2105.26 | +29.10 | 64,616 |

All values are in points. To hedge a $100 million short position in the S&P 500 index, how many contracts do you need, and should they be long or short?

A. 190 long contracts

B. 0.19 short contracts

C. 0.19 long contracts

# Stock index futures: an example

## Question 24

You see the following entry for S&P 500 futures contracts quoted in the July 28th morning financial news:

| | Open | High | Low | Settle | Change | Open Interest |
|---|---|---|---|---|---|---|
| Nov. | 2083.00 | 2112.508 | 2083.00 | 2105.26 | +29.10 | 64,616 |

All values are in points. To hedge a $100 million short position in the S&P 500 index, how many contracts do you need, and should they be long or short?

A. **190 long contracts**

B. 0.19 short contracts

C. 0.19 long contracts

# Stock index futures: an example

**Solution 24**

You should offset your short S&P 500 position with a long futures position:

| Position | Payoff at time $T$ |
|---|---|
| Short S&P 500 | $-(S_T - S_0)$ |
| Long futures | $+(S_T - F_0)$ |
| Portfolio | $+(S_0 - F_0)$ |

The total payoff for a hedged portfolio should be zero, so

$$F_0 - S_0 = 0 \quad \Leftrightarrow \quad F_0 = S_0 \,.$$

You need 190 futures contracts: $F_0 = 190 \times \$250 \times 2105.26 \approx \$100\text{m} = S_0$.

# Lecture 8: Risk Management and Derivatives
# Overview of Topics



Reading: Mishkin and Eakins (2018, Chapters 23 and 24), and Nagel (2015, August), Stulz (2004)

# Options: a simple definition

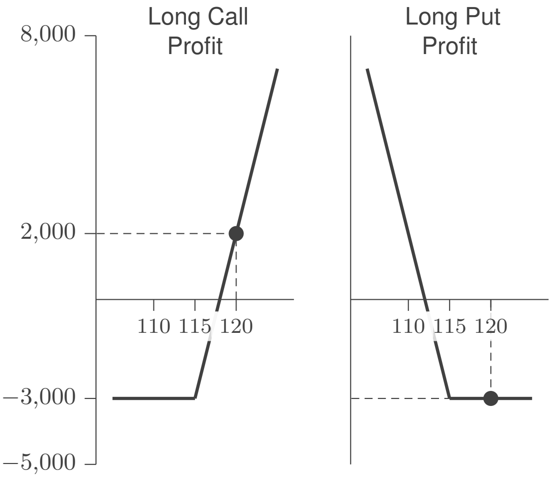
**Definition 46**

Options: Contracts that give the purchaser the option, or right, to buy or sell an underlying financial instrument at a specified price, called exercise price or strike price, within a specified period of time.

Remarks:

- call options give the owner the right to buy, put options give the owner the right to sell
- American options: exercised before expiry, European options only at expiry
- underlying assets: usually stocks, but also financial derivative likes futures
- when you buy an option, you pay a premium, which reduces your profit

# Put and call options on interest-rate futures




- $100,000 Treasury bond option, exercise price $=$ 115
- profit from buying long call option (left) and long put option (right)
- units on horizontal axis are points, 1 point $=$ \$1 000
- premium for buying call or put assumed to equal \$3 000
- call buyer: if expiration price $=$ 120, profit $=$ 2 000, (left)
- put buyer: if expiration price $=$ 120, profit $= -3\,000$, (right)

# The three factors affecting option premiums

1. Strike price:
   - a higher strike price lowers profits on call options, so premiums fall
   - a higher strike price raises profits on put options, so premiums rise
2. Expiration date:
   - call and put premiums rise in the term to expiration of an option
   - as term lengthens, greater chance of large changes in underlying price
3. Underlying Volatility:
   - call and put premiums rise in the volatility of the underlying asset
   - options protect investors from downside risk in underlying asset price

# Interest rate swaps: a simple definition

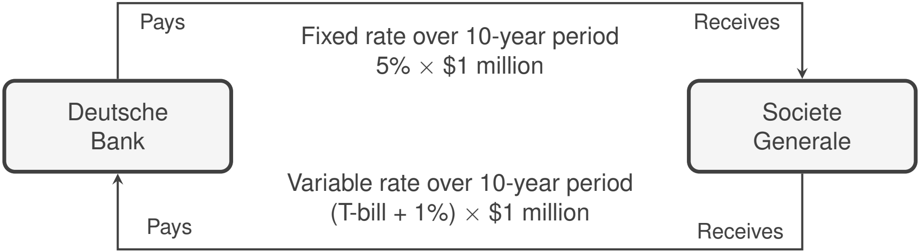
**Definition 47**

Swaps: Financial contracts that oblige one party to exchange (swap) a set of payments it owns for another set of payments owned by the counterparty.

Remarks:

- main swap types: currency swaps and interest rate swaps, we focus on the latter
- plain vanilla swaps specify fixed or variable interest rate, notional principle, expiry

# Interest rate swaps: an illustration




Remarks:

- Deutsche Bank hedges interest-sensitive gap of $-$\$1 million ($GAP = RSA - RSL$)
- Societe Generale converts \$1 million in assets from fixed to variable interest
- notional principle: amount on which interest is being paid, here \$1 million
- above contract swaps fixed for variable interest payments over 10 years

# Some advantages and disadvantages of interest rate swaps

Advantages:

- alternative is costly rearrangement of balance sheet positions
- swaps thus avoid transaction costs and allow banks to cater to demand
- swaps also have long horizons (up to 20 years), so tailored to banks

Disadvantages:

- few counterparties looking for your exact opposite hedge (low liquidity)
- no central clearance, so swaps entail some counterpatry risk
- scale economies: more information means less counterpatry risk

---

Remarks:

- short-comings of interest-rate swaps led to further innovations (much like forwards)
- one such innovation, credit default swaps (CDS), played a major role in financial crisis

# Credit derivatives: a few simple examples

Credit options:

- just like interest-rate options, but used to hedge *credit risk*
- example: option paying Baa interest rate spread to hedge Baa risk premium

Credit swaps:

- swaps used to hedge credit risk on specific loans held by an institution
- example: swap regular small payments for a large payment contingent on default

Credit-linked notes:

- bonds with coupon payments and face value *plus* the right to lower the coupon
- example: Ford sells 5% coupon bond, but coupon falls if GDP growth $< 3\%$

# Lecture 8: Risk Management and Derivatives
# Overview of Topics

---



Reading: Mishkin and Eakins (2018, Chapters 23 and 24), and Nagel (2015, August), Stulz (2004)

# Paper of the Week: Stulz (2004)

> “*Do derivatives mostly threaten firms and the economy, or do they increase welfare? I first explain the main types of derivatives and describe how they are priced. I then show how the markets for derivatives grew to their current size and what this size means. Next, I discuss the benefits from derivatives usage and examine the evidence on who uses derivatives and why. I finally address the issue of the impact of derivatives on systemic risks.*”
>
> — **René M. Stulz**

# Lecture 8: Risk Management and Derivatives

Revision Checklist

- ☐ Managing Credit Risk
- ☐ Managing Interest Rate Risk
- ☐ Hedging with Financial Derivatives
- ☐ Forwards and Futures Markets
- ☐ Options, Swaps, and Credit Derivatives
- ☐ Paper of the Week

Reading: Mishkin and Eakins (2018, Chapters 23 and 24), and Nagel (2015, August), Stulz (2004)

# Survey of the Financial System
# Table of Contents

# Lecture 9: Financial Intermediation
# Overview of Topics

---

9.1. Market Microstructure
9.2. The Banking Industry
9.3. The Mutual Fund Industry
9.4. Investment Banks
9.5. Securities Brokers and Dealers
9.6. Paper of the Week

Reading: Mishkin and Eakins (2018, Chapters 19, 20, and 22), Stulz (2007)

# Market microstructure: the visible hands that guide markets

**Definition 48**

| | |
|---|---|
| Market micro-structure: | The institutions of exchange and intermediation that help match buyers with sellers, select bid and ask prices, negotiate transaction terms, manage payments and record keeping, hold securities inventories, or otherwise help make markets. |

Remarks:

- we look broadly at the main financial intermediaries that help markets function
- the microstructure here complements the macrostructure we saw in lecture one

Source: Spulber (1996)

# Four main functions of financial intermediaries:

1. Setting prices and clearing markets
2. Providing liquidity and immediacy
3. Coordinating buyers and sellers
4. Providing guarantees and monitoring

---

Remarks:

- classical economics focuses on market-taking firms that take price signals as given
- microstructure focuses on market-making firms that set and coordinate transactions

# Lecture 9: Financial Intermediation
## Overview of Topics



Reading: Mishkin and Eakins (2018, Chapters 19, 20, and 22), Stulz (2007)

# Financial innovation and the banking industry

Three basic types of financial innovation:

1. Responses to changes in demand conditions
2. Responses to changes in supply conditions
3. Avoidance of regulations

---

Remarks:

- to maximize profits, financial institutions develop new products to satisfy their own needs as well as those of their customers
- a change in the financial environment will stimulate a search by financial institutions for innovations that are likely to be profitable

# Financial innovation in response to demand conditions

**Demand condition**: dramatic increase in the volatility of interest rates. The three-month Treasury bills rate fluctuated:

- in 1950s from 1% to 3.5%
- in 1970s from 4% to 11%
- in 1980s from 5% to 15%

**Innovation response**: development of financial products to help firms and households cope with rising interest rate risk

- Adjustable-rate mortgages: mortgages created in 1970s with variable rates that rise / fall with some underlying market rate
- Financial derivatives: forwards / futures on commodities had existed, but CBOT created forwards / futures on financial instruments in 1975

# Financial innovation in response to supply conditions

**Supply condition**: rapid improvement in computer and telecommunications technology, called *information technology*

- lower transactions processing costs, raises profit on new financial products
- easier information acquisition for investors, helps firms issue new securities

**Innovation response**: development of new products and services that take advantage of improved information flow and processing

- Credit and debit cards: Credit cards had existed pre-WWII, but lower transaction costs made cards profitable for many banks
- Junk bonds: Improved investor access to information let Drexel Burnham Lambert create junk bond market in 1977

# Financial innovation to avoid regulation

**Regulations**: two sets of regulations have seriously restricted the ability of banks to make profits:

- requirements that force banks to hold a fraction of deposits in reserve
- restrictions on the interest rates that can be paid on deposits

**Innovation response**:

- Sweep accounts: accounts with balances "swept out" into overnight interest-paying securities and thus not subject to reserve requirements
- Money-market mutual funds: mutual fund shares that are redeemable at a fixed price and that pay interest above the bank deposit rate

# Lecture 9: Financial Intermediation
# Overview of Topics



Reading: Mishkin and Eakins (2018, Chapters 19, 20, and 22), Stulz (2007)

# Five key benefits of mutual funds

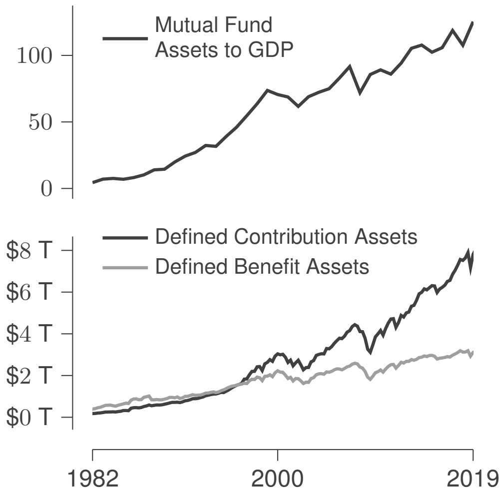
1. Liquidity intermediation
2. Denomination intermediation
3. Diversification
4. Cost advantages
5. Managerial expertise

---

Remarks:

- these benefits of mutual funds help explain their dramatic rise in the 1980s-90s
- $\approx$ 7,500 mutual funds exist—more than the stocks trading on NYSE plus NASDAQ

# Household ownership of mutual funds




- About 44% of U.S. households own mutual funds, holding 89% of mutual fund assets
- Tremendous increase since 1980, when only 5.7% of households held mutual fund shares
- The median mutual fund investor is middle class, 51 years old, married, employed, and possesses financial assets of $190,000
- Demand for professional asset management drove mutual fund growth
- The rise of defined-contribution pension plans drove demand for expertise

# Fee structure of mutual funds

- Contingent deferred sales charge: fee at redemption, if redemption occurs in first few years of ownership
- Redemption fee: a back-end charge for redeeming shares. It is expressed as a dollar amount or a percentage of the redemption price
- Exchange fee: charged when transferring money from one fund to another within the same fund family
- Account maintenance fee: charged by some funds to maintain low balance accounts
- 12b-1 fee: charged to cover marketing and advertising expenses or to compensate sales professionals; cannot exceed 1% of average net assets per year

# Regulation of mutual funds

**Four federal laws** regulating mutual funds and protecting investors:

1. Securities Act of 1933: mandates that funds make certain disclosures
2. Securities Exchange Act of 1934: anti-fraud rules on buying / selling fund shares
3. Investment Company Act of 1940: register with and meet SEC operating standards
4. Investment Advisers Act of 1940: regulates fund advisers

**Two documents** funds must provide investors free of charge:

- Prospectus: description of the fund's goals, fees and expenses, and investment strategies and risks; it also gives information on how to buy and sell shares
- Shareholder reports: description of the fund's recent performance, and other important information, such as the fund's financial statements

# Hedge funds and arbitrage strategies

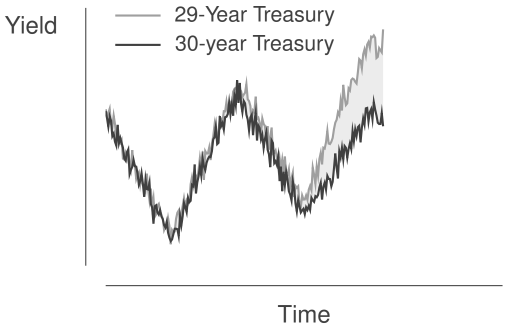
**Definition 49**

Hedge fund: A type of mutual fund that seeks opportunities for arbitrage profit by constructing hedged portfolios, often with market-neutral return characteristics. Market-neutrality protects funds from changes in the overall market, but does not eliminate risk.

Remarks:

- market-neutral isn't riskless, as Long Term Capital Management has shown
- the hedge fund made the news in 1998 when it nearly collapsed from a bet it took
- the fund attempted to exploit mis-pricing of corporate bonds relative to treasuries
- the fund expected the corporate bond to treasury spread to fall, but in 1998 it rose

# Hedge funds: the Long-Term Capital Management case

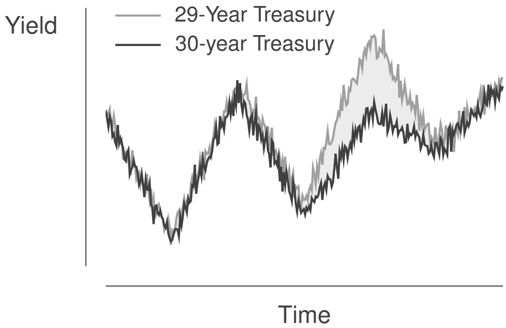



- LTCM noticed 29-year Treasuries were cheaper than 30-year Treasuries, despite nearly identical risk (stylized illustration, left)
- They expected prices to converge naturally over time, creating an arbitrage opportunity

Remarks:

- Hedge funds seek arbitrage opportunities by exploiting temporary pricing anomalies
- These strategies involve high leverage and complex positions across asset classes

# Hedge funds: the Long-Term Capital Management case

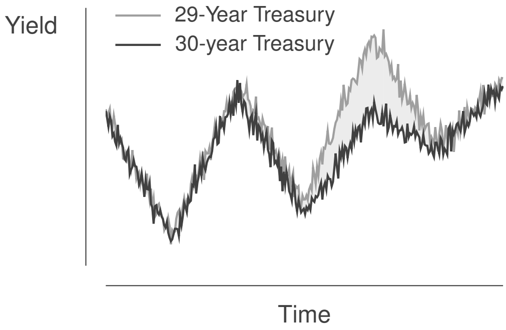



- LTCM noticed 29-year Treasuries were cheaper than 30-year Treasuries, despite nearly identical risk (stylized illustration, left)
- They expected prices to converge naturally over time, creating an arbitrage opportunity
- LTCM bought $2 billion of 29-year bonds and sold short $2 billion of 30-year bonds
- Six months later, prices converged and LTCM closed positions, turning $12 million investment into $25 million profit

Remarks:

- Hedge funds seek arbitrage opportunities by exploiting temporary pricing anomalies
- These strategies involve high leverage and complex positions across asset classes

# Hedge funds: the Long-Term Capital Management case




- LTCM noticed 29-year Treasuries were cheaper than 30-year Treasuries, despite nearly identical risk (stylized illustration, left)
- They expected prices to converge naturally over time, creating an arbitrage opportunity
- LTCM bought $2 billion of 29-year bonds and sold short $2 billion of 30-year bonds
- Six months later, prices converged and LTCM closed positions, turning $12 million investment into $25 million profit
- However, LTCM collapsed in 1998 after a Russian default event

Remarks:

- Hedge funds seek arbitrage opportunities by exploiting temporary pricing anomalies
- These strategies involve high leverage and complex positions across asset classes

# Hedge fund restrictions, fees, regulations

- Hedge funds accumulate money from many people and invest on their behalf, but several features distinguish them from traditional mutual funds
- Hedge funds often charge large fees to investors. The typical fund charges a 1% annual asset management fee plus 20% of profits.
- Hedge funds have a minimum investment requirement of between $100,000 and $20 million, and $1 million on average
- Investors usually required to commit their money for long periods of time, often several years, to give managers breathing room to attempt long-range strategies
- Hedge funds are usually limited partnerships, and law limits them to 99 partners with steady annual incomes of $200,000+ or $1 million net worth (or 499 limited partners if each has $5 million invested)
- The restrictions are aimed at allowing hedge funds to exist largely unregulated, on the theory that the rich can look out for themselves
- Despite the argument regulatory protection unnecessary, SEC passed regulation in 2006 to limit fraud and protect increasing numbers of retail investors

# Lecture 9: Financial Intermediation
# Overview of Topics



Reading: Mishkin and Eakins (2018, Chapters 19, 20, and 22), Stulz (2007)

# Investment banking services

**Underwriting stocks and bonds**:

- Giving advice: help for firms on what (debt vs equity) and when to issue, and at what price
- Filing documents: IB handles interactions with SEC filing registration statement and prospectus
- Underwriting: IB finds buyers for the stock / bond that the issuing firm is using to raise capital

**Mergers and acquisitions**:

- Advising the acquiring firm: locating attractive targets, soliciting shareholders to sell shares in tender offers
- Advising the target firm: help in warding off undesired takeover attempts made by acquiring firms

**Equity sales**:

- Establishing firm value: analysis of similar companies and sophisticated modeling to estimate value
- Buyer-seller coordination: drafting seller's confidential memorandum, buyer's letter of intent, due diligence

# Lecture 9: Financial Intermediation
# Overview of Topics

9.1. Market Microstructure

9.2. The Banking Industry

9.3. The Mutual Fund Industry

9.4. Investment Banks

9.5. Securities Brokers and Dealers

9.6. Paper of the Week

Reading: Mishkin and Eakins (2018, Chapters 19, 20, and 22), Stulz (2007)

# Securities broker and dealer services

- Brokerage services
  - Securities orders: three main types are market, limit, and short orders
  - Margin credit: loans made by brokerage houses to help investors buy securities
- Dealer services
  - Securities inventory: stock of securities held by dealer to ensure liquidity
  - Market making: readiness to buy / sell securities from inventory at any time

---

Remarks:

- dealers provide liquidity, while brokers coordinate buyers and sellers
- brokers coordinate without buying/selling themselves, while dealers hold inventories

# Margin trading: a brief description

- Investors have easy access to a source of debt financing called broker's call loans. The act of taking advantage of broker's call loans is called buying on margin.
- Buying on margin means borrowing part of the purchase price of an asset from a broker. The margin in the account is what the investor contributes to the purchase
- Brokers in turn borrow money from banks at the call money rate to finance these purchases; they then charge their clients that rate plus a service charge
- All securities purchased on margin must be maintained with the brokerage firm in street name, for the securities are collateral for the loan

---

Remarks:

- Fed sets percentage of purchase price that brokerages can lend (currently 50%)
- interest rates on margin loans are usually 1–2 percentage points over prime

# Margin trading: a few useful definitions

**Definition 50**

| | |
|---|---|
| Margin: | The fraction of portfolio value in a brokerage account that represents investor equity |
| Maintenance margin: | Minimum ratio of equity to portfolio value that must be maintained in brokerage account |
| Margin call: | Demand by broker for additional equity as necessary to meet maintenance margin |

# Example: buying on margin

**Question 25**

You open a brokerage account and buy 50 shares of Tesla Motors (TSLA) at $200 per share. You borrow $4 000 from your broker to help pay for the shares. There is no interest on the broker's call loan, but you have a 50% maintenance margin. What is your initial margin, and what is your margin if the price falls to $150 per share? What is your return if the price falls to $150 per share?

A. initial margin = 60%; new margin = 46.67%; return = – 41.67%

B. initial margin = 60%; new margin = 46.67%; return = – 25%

C. initial margin = 40%; new margin = -41.67%; return = 46.67%

# Example: buying on margin

**Question 25**

You open a brokerage account and buy 50 shares of Tesla Motors (TSLA) at \$200 per share. You borrow \$4 000 from your broker to help pay for the shares. There is no interest on the broker's call loan, but you have a 50% maintenance margin. What is your initial margin, and what is your margin if the price falls to \$150 per share? What is your return if the price falls to \$150 per share?

A. **initial margin = 60%; new margin = 46.67%; return = – 41.67%**

B. initial margin = 60%; new margin = 46.67%; return = – 25%

C. initial margin = 40%; new margin = -41.67%; return = 46.67%

# Example: buying on margin

**Solution 25**

The investor's equity before and after the price change are

$$E = 50 \times \$200 - \$4\,000 = \$6\,000 \quad E' = 50 \times \$150 - \$4\,000 = \$3\,500\,.$$

The investor's margin before and after the price change are then

$$M = \$6\,000/(50 \times \$200) = 0.6 \quad M' = \$3\,500/(50 \times \$150) = 0.4667\,.$$

The investor's return is computed as

$$R = (E' - E)/E = (\$3\,500 - \$6\,000)/\$6\,000 = -0.4167\,.$$

Leverage has magnified the loss.

# Private equity and venture capital

**Definition 51**

| | |
|---|---|
| Venture capital: | Money supplied to start-up firms, usually raised by limited partnerships and invested by the general partner in firms showing promise of high future returns. |

Remarks:

- uncertainty and information asymmetries accompany start-ups, especially in tech
- venture capital can reduce the information gap and give new firms access to funds
- VC partners take board seats and monitor the firm and safeguard their investment
- VC investments in private firms are illiquid, so the investments are longer term

# Lecture 9: Financial Intermediation
# Overview of Topics



Reading: Mishkin and Eakins (2018, Chapters 19, 20, and 22), Stulz (2007)

# Paper of the Week: Stulz (2007)

> “ *Can hedge funds and mutual funds coexist in the long-run? Will regulators or market forces make these two vehicles more similar? I will argue that the bulk of the hedge fund industry will experience some convergence towards the traditional mutual fund model.* ”
>
> — **René M. Stulz**

# Lecture 9: Financial Intermediation

Revision Checklist

- ☐ Market Microstructure
- ☐ The Banking Industry
- ☐ The Mutual Fund Industry
- ☐ Investment Banks
- ☐ Securities Brokers and Dealers
- ☐ Paper of the Week

Reading: Mishkin and Eakins (2018, Chapters 19, 20, and 22), Stulz (2007)

# References I


- Bernanke, B. S. (2013). A Century of US Central Banking: Goals, Frameworks, Accountability. *Journal of Economic Perspectives*, *27*(4), 3–16.
- Borio, C. E., Disyatat, P., Juselius, M., & Rungcharoenkitkul, P. (2017). Why so low for so long? A long-term view of real interest rates. *BIS Working Paper*.
- Campbell, J. Y. (1995). Some lessons from the yield curve. *Journal of Economic Perspectives*, *9*(3), 129–152.
- Froot, K. A., & Thaler, R. H. (1990). Anomalies: Foreign exchange. *Journal of Economic Perspectives*, *4*(3), 179–192.
- Green, R. K., & Wachter, S. M. (2005). The American mortgage in historical and international context. *Journal of Economic Perspectives*, *19*(4), 93–114.
- Greenwood, R., & Scharfstein, D. (2013). The growth of finance. *Journal of Economic Perspectives*, *27*(2), 3–28.
- Hong, H., & Stein, J. C. (2007). Disagreement and the stock market. *Journal of Economic Perspectives*, *21*(2), 109–128.
- Hull, J. C. (2015). *Options, futures, and other derivatives* (9th). Pearson Education.
- Jiang, J., Li, F., & Yang, Z. Q. (2020). Green Trend: The road to an overseas red-chip IPO.

# References II


- Kacperczyk, M., & Schnabl, P. (2010). When safe proved risky: Commercial paper during the financial crisis of 2007-2009. *Journal of Economic Perspectives*, *24*(1), 29–50.
- Krishnamurthy, A. (2010). How debt markets have malfunctioned in the crisis. *Journal of Economic Perspectives*, *24*(1), 3–28.
- Loughran, T., & Ritter, J. R. (2002). Why don't issuers get upset about leaving money on the table in IPOs? *The Review of Financial Studies*, *15*(2), 413–444.
- Mayer, C., Pence, K., & Sherlund, S. M. (2009). The rise in mortgage defaults. *Journal of Economic Perspectives*, *23*(1), 27–50.
- Mills, L. R. (1968). The mathematics of cumulative voting. *Duke Law Journal*, 28.
- Misawa, M. (2020). Negative Interest Rates: The Bank of Japan Experience.
- Mishkin, F., & Eakins, S. (2018). *Financial markets and institutions, global edition* (9th ed.). Pearson.
- Nagel, S. (2015). Hedging at Porsche.
- Philippon, T., & Reshef, A. (2013). An international look at the growth of modern finance. *Journal of Economic Perspectives*, *27*(2), 73–96.

# References III


- Saunders, A., & Cornett, M. (2015). *Financial markets and institutions, international edition* (6th ed.). McGraw-Hill Education.
- Siriwardane, E. N., Viceira, L. M., & Xu, D. (2020). Mortgage backed securities and the covid-19 pandemic.
- Spulber, D. F. (1996). Market microstructure and intermediation. *Journal of Economic Perspectives*, *10*(3), 135–152.
- Stulz, R. M. (2004). Should we fear derivatives? *Journal of Economic Perspectives*, *18*(3), 173–192.
- Stulz, R. M. (2007). Hedge funds: Past, present, and future. *Journal of Economic Perspectives*, *21*(2), 175–194.

# IB9Y00 Revision Checklist

Lecture 1: Introduction to Financial Markets

☐ Module Introduction

☐ Financial System Functions

☐ Financial Markets

☐ Financial Intermediation

☐ The Growth of Finance

☐ Paper of the Week

Lecture 2: Interest Rates and Term Structure

☐ Yield to Maturity

☐ Term Structure

☐ Forecasting

☐ Paper of the Week

Lecture 3: Central Banks and Money Markets

☐ Central Bank Goals and Structures

☐ Central Bank Operations

☐ Reserves and T-Accounts

☐ Reserves Supply and Demand

☐ Money Markets

☐ Paper of the Week

Lecture 4: The Bond Market

☐ Introduction

☐ Government Bonds

☐ Corporate Bonds

☐ Credit Default Swaps

☐ Clean vs Dirty Prices

☐ Paper of the Week

Lecture 5: The Stock Market

☐ Stock Types and Indices

☐ Initial Public Offerings

☐ Stock Exchanges and Trading Process

☐ Market Efficiency and Regulation

☐ Paper of the Week

Lecture 6: The Mortgage Market

☐ Mortgage Basics

☐ Mortgage Amortization

☐ Mortgage Types and Mortgage Lenders

☐ Securitization

☐ Paper of the Week

Lecture 7: The Foreign Exchange Markets

☐ Foreign Exchange Market

☐ Exchange Rates in the Long Run

☐ Exchange Rates in the Short Run

☐ Interest Parity Condition

☐ The Special Role of the U.S. Dollar

☐ Paper of the Week

Lecture 8: Risk Management and Derivatives

☐ Managing Credit Risk

☐ Managing Interest Rate Risk

☐ Hedging with Financial Derivatives

☐ Forwards and Futures Markets

☐ Options, Swaps, and Credit Derivatives

☐ Paper of the Week

Lecture 9: Financial Intermediation

☐ Market Microstructure

☐ The Banking Industry

☐ The Mutual Fund Industry

☐ Investment Banks

☐ Securities Brokers and Dealers

☐ Paper of the Week