# Lecture 4

Financial Markets and Expectations

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## 1 Introduction

### About this lecture

- In the original IS-LM model, we assume that there are only two assets: money and bonds.
- In this lecture, we expand on the options available: stocks, short-term and long-term bonds.
- We study these assets because:
  - asset prices react to current and expected future output, and
  - asset prices affect decisions that determine current output.

### What we will study

1. How bond prices and yields are determined:
   - They depend on current and expected future short-term interest rates
   - We use the yield curve to know the expected short-term interest rates
2. How stock prices are determined:
   - They depend on current and expected future dividends and interest rates

3. Bubbles and fades in stock markets:
   - They are episodes when stock prices changes seem unrelated to variations in dividends or interest rates.

## 2 Bond Prices and Bond Yields

**Bond characteristics**

Bonds differ in two basic dimensions:

**Maturity** The length of time over which the bond promises to make payments to the holder of the bond.

**Risk**
- Default risk as the risk that the issuer of the bond will not pay back the full amount promised by the bond; or
- price risk as the uncertainty about the price you can sell the bond for if you want to sell it in the future before maturity.

Bonds of different maturities each have a price and an associated interest rate called the yield to maturity, or simply the yield.

**Yield and term**

**Yield to maturity or yield:** The interest rates associated with bonds of different maturities

**Long-term interest rates:** Yields on bonds with a longer maturity than a year

**Short-term interest rates:** Yields on bonds with a short maturity, typically a year or less

**Term structure of interest rates or yield curve:** The relation between maturity and yield

**FOCUS: The Vocabulary of Bond Markets**

- **Government bonds**: Bonds issued by the governments
- **Corporate bonds**: Bonds issued by firms
- **Bond ratings**: ratings for default risk
- **Risk premium**: The difference between the interest rate paid on a given bond and the interest rate on the bond with the best rating
- **Junk bonds**: Bonds with high default risk

- **Discount bonds**: Bonds that promise a single payment at maturity called the face value
- **Coupon bonds**: Bonds that promise multiple payments before maturity and one payment at maturity
- **Coupon payments**: The payments before maturity
- **Coupon rate**: The ratio of the coupon payments to the face value

- **Current yield**: The ratio of the coupon payment to the price of the bond
- **Life**: The amount of time left until the bond matures
- **Treasury bills (T-bills)**: U.S. government bonds with a maturity up to a year
- **Treasury notes**: U.S. government bonds with a maturity of 1 to 10 years
- **Treasury bonds**: U.S. government bonds with a maturity of 10 or more years

- **Term premium**: The premium associated with longer maturities
- **Indexed bonds**: Bonds that promise payments adjusted for inflation
- **Treasury Inflation Protected Securities (TIPS)**: Indexed bonds introduced in the United States in 1997

### Price of a bond

- The price of a one-year bond that promises to pay $100 next year:

$$P_{1t}^{\$} = \frac{\$100}{1 + i_{1t}}$$

- The price of a two-year bond that promises to pay $100 in two years

$$P_{2t}^{\$} = \frac{\$100}{(1 + i_{1t})\left(1 + i_{1t+1}^{e}\right)} \tag{1}$$

### Choosing between one-year and two-year bonds

Assume that you had $1 and want to save it, using either a one-year bond or a two-year bond. *Which option would be best?*

| | Year $t$ | | Year $t+1$ |
|---|---|---|---|
| 1-year bonds | $\$1$ | $\Rightarrow$ | $\$1 \times (1 + i_{1t})$ |
| 2-year bonds | $\$1$ | $\Rightarrow$ | $\$1 \times \frac{P_{1t+1}^{e\$}}{P_{2t}^{\$}}$ |

**Arbitrage** The expected returns on two assets must be equal.

**Expectations hypothesis** Investors care only about the expected returns and do not care about risk.

### Choosing between one-year and two-year bonds 2

The two bonds must offer the same expected one-year return:

$$1 + i_{1t} = \frac{P_{1t+1}^{e\$}}{P_{2t}^{\$}} \quad \Rightarrow \quad P_{2t}^{\$} = \frac{P_{1t+1}^{e\$}}{1 + i_{1t}}$$

which means that the price of a two-year bond today is the present value of the expected price of the bond next year.

**Price of a two-year bond**

- The expected price of one-year bonds next year with a payment of \$100:

$$P^{e\$}_{1t+1} = \frac{\$100}{1 + i^e_{1t+1}}$$

- so that

$$P^{\$}_{2t} = \frac{P^{e\$}_{1t+1}}{1 + i_{1t}} = \frac{\$100}{(1 + i_{1t})\left(1 + i^e_{1t+1}\right)}$$

- which is the same as equation (1).
- In words, the price of two-year bonds is the present value of the payment in two years—discounted using current and next year's expected one-year interest rate.

**From Bond Prices to Bond Yields**

- The yield to maturity on an n-year bond (n-year interest rate) is the constant annual interest rate that makes the bond price today equal to the present value of future payments on the bond.
- The yield to maturity on a two-year bond that satisfies:

$$P^{\$}_{2t} = \frac{\$100}{(1 + i_{2t})^2} = \frac{\$100}{(1 + i_{1t})\left(1 + i^e_{1t+1}\right)}$$

- Therefore

$$(1 + i_{2t})^2 = (1 + i_{1t})\left(1 + i^e_{1t+1}\right) \quad \Rightarrow \quad i_{2t} \approx \frac{i_{1t} + i^e_{1t+1}}{2}$$

- which means that the two-year interest rate is (approximately) the average of the current one-year interest rate and next year's expected one-year interest rate.

**Interpreting the Yield Curve**

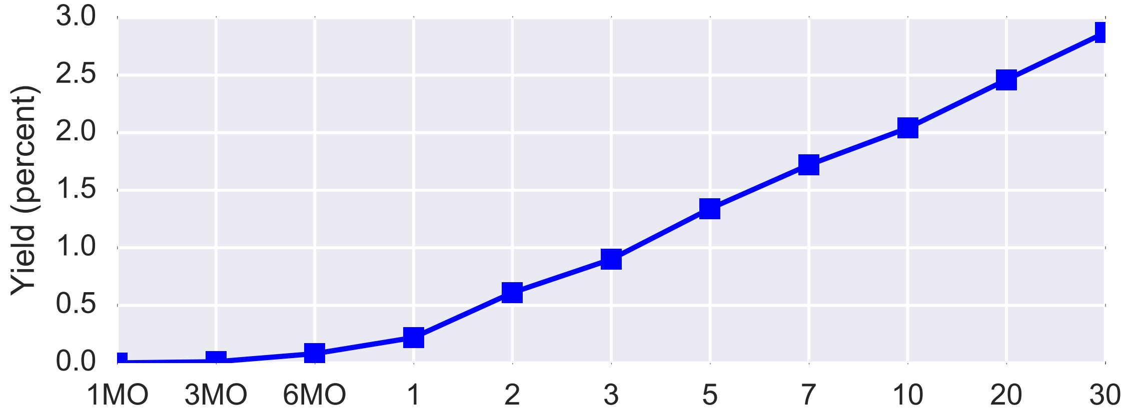
$$i_{2t} \approx \frac{i_{1t} + i^e_{1t+1}}{2} \quad \Rightarrow \quad i_{2t} - i_{1t} \approx \frac{i^e_{1t+1} - i_{1t}}{2}$$
$$i_{2t} - i_{1t} > 0 \quad \Leftrightarrow \quad i^e_{1t+1} - i_{1t} > 0$$

- An upward sloping yield curve means that long-term interest rates are higher than short-term interest rates. Financial markets expect short-term rates to be higher in the future.
- A downward sloping yield curve means that long-term interest rates are lower than short-term interest rates. Financial markets expect short-term rates to be lower in the future.

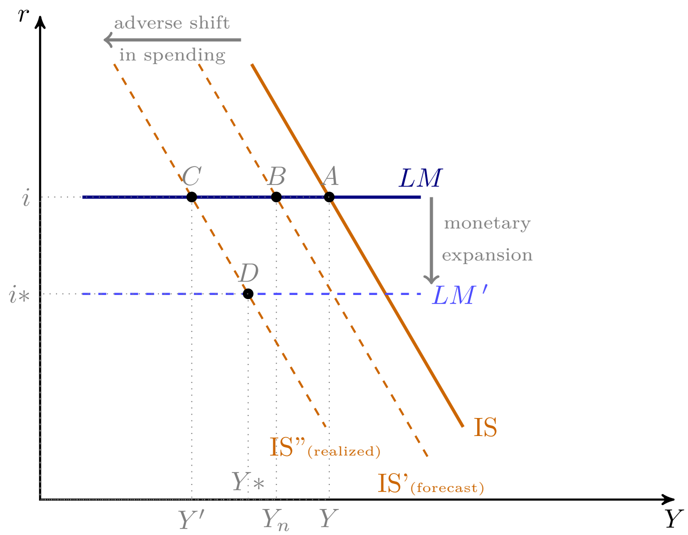
**The yield curve in October 2015**

- In October 2015, the yield curve was upward sloping, suggesting that investors expect the Fed to increase the policy rate or "liftoff".
- However, the yield curve was flat up to maturities of six months, meaning that investors did not expect the Fed to increase the policy rate before April 2016.

The yield curve as of October 15, 2015

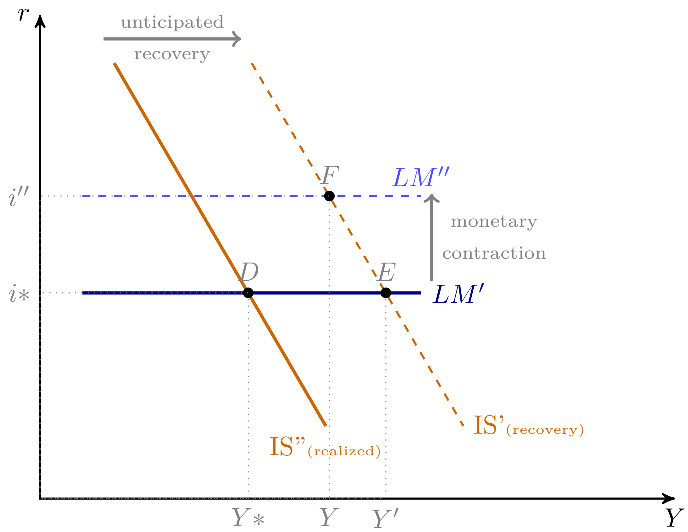



**The yield curve and economic activity**




- Economy above full employment; soft landing expected.
- Adverse shift in spending hits the economy.
- To prevent sharp decline in output, central bank lowers the interest rate.
- Agents expect decline in interest rate ⇒ yield curve with negative slope.

**The path to recovery**




- Economy below full employment; recovery expected.
- To prevent sharp increase in inflation, central bank tightens money supply.
- Agents expect increase in interest rate ⇒ yield curve with positive slope.

## 3 The Stock Market and Movements in Stock Prices

**Firm financing options**

Firms raise funds in two ways:

- Through debt finance —bonds and loans; and
- Through equity finance, through issues of stocks —or shares. Instead of paying predetermined amounts as bonds do, stocks pay dividends in an amount decided by the firm.

**Choosing between bonds and stocks**

Assume that you had \$1 and want to save it, using either a one-year bond or a share. *Which option would be best?*

| | Year $t$ | | Year $t+1$ |
|---|---|---|---|
| 1-year bonds | \$1 | ⇒ | $\$1 \times (1 + i_{1t})$ |
| stocks | \$1 | ⇒ | $\$1 \times \frac{D^{e\$}_{t+1} + Q^{e\$}_{t+1}}{Q^{\$}_t}$ |

- $Q^{\$}$ is the price (in dollars) of the stock
- $D^{e\$}$ is the expected dividend
- Ex-dividend price: The stock price after the dividend has been paid this year

**Choosing between bonds and stocks**

Equilibrium requires that the expected rate of return from holding stocks for one year be the same as the rate of return on one-year bonds plus the equity premium $\theta$:

$$\frac{D^{e\$}_{t+1} + Q^{e\$}_{t+1}}{Q^{\$}_t} = 1 + i_{1t} + \theta$$

or

$$Q_t^{\$} = \frac{D_{t+1}^{e\$}}{1 + i_{1t} + \theta} + \frac{Q_{t+1}^{e\$}}{1 + i_{1t} + \theta}$$

We define the *real* risk premium by $\tilde{\theta} = \frac{\theta}{1+\pi^e}$. But, to simplify notation, we assume that expected inflation is small and then $\theta \approx \tilde{\theta}$.

**Some nomenclature**

- In what follows, we define $P^e$, $\Psi$ and $\psi$ by

$$\Psi_n \equiv \prod_{j=0}^{n} \left(1 + i_{1t+j}^e + \theta\right) = \left(1 + i_{1t} + \theta\right)\left(1 + i_{1t+1}^e + \theta\right) \ldots \left(1 + i_{1t+n}^e + \theta\right)$$

$$\psi_n \equiv \prod_{j=0}^{n} \left(1 + r_{1t+j}^e + \theta\right) = \left(1 + r_{1t} + \theta\right)\left(1 + r_{1t+1}^e + \theta\right) \ldots \left(1 + r_{1t+n}^e + \theta\right)$$

$$P_{t+n+1}^e \equiv P_t \prod_{j=0}^{n} \left(1 + \pi_{t+j+1}^e\right) = P_t \left(1 + \pi_{t+1}^e\right) \ldots \left(1 + \pi_{t+n+1}^e\right)$$

- We use these terms to discount future nominal ($\Psi$) and real ($\psi$) flows.
- Notice that $i_{1t}^e = i_{1t}$ and $r_{1t}^e = r_{1t}$ because we know their actual values as of time $t$.

**Some nomenclature 2**

Remember that

$$1 + r_{1t+j}^e + \theta = \frac{1 + i_{1t+j}^e + \theta}{1 + \pi_{t+j+1}^e}$$

therefore

$$\left(1 + r_{1t} + \theta\right) \ldots \left(1 + r_{1t+n}^e + \theta\right) = \frac{\left(1 + i_{1t} + \theta\right) \ldots \left(1 + i_{1t+n}^e + \theta\right)}{\left(1 + \pi_{t+1}^e\right) \ldots \left(1 + \pi_{t+n+1}^e\right)}$$

$$\psi_n = \frac{P_t \Psi_n}{P_{t+n}^e} \Rightarrow \Psi_n = \frac{P_{t+n+1}^e \psi_n}{P_t}$$

**Stock price as discounted present value of dividends**

- The price of stock today equals the expected discounted value of payoff (dividend plus the price of the stock) one period ahead

$$Q_t^{\$} = \frac{D_{t+1}^{e\$}}{1 + i_{1t} + \theta} + \frac{Q_{t+1}^{e\$}}{1 + i_{1t} + \theta}$$

- We expect that future stock prices will follow the same rule, so

$$Q_{t+1}^{e\$} = \frac{D_{t+2}^{e\$}}{1 + i_{1t+1}^e + \theta} + \frac{Q_{t+2}^{e\$}}{1 + i_{1t+1}^e + \theta}$$

- Therefore

$$Q_t^{\$} = \frac{D_{t+1}^{e\$}}{1 + i_{1t} + \theta} + \frac{D_{t+2}^{e\$}}{\left(1 + i_{1t} + \theta\right)\left(1 + i_{1t+1}^e + \theta\right)} + \frac{Q_{t+2}^{e\$}}{\left(1 + i_{1t} + \theta\right)\left(1 + i_{1t+1}^e + \theta\right)}$$

### Stock price as discounted present value of dividends 2

- Iterating

$$Q_t^{\$} = \frac{D_{t+1}^{e\$}}{\Psi_0} + \frac{D_{t+2}^{e\$}}{\Psi_1} + \cdots + \frac{D_{t+n+1}^{e\$}}{\Psi_n} + \frac{Q_{t+n+1}^{e\$}}{\Psi_n}$$

- If the interest rate is positive (so that $\Psi_n$ grows exponentially) and $Q^{e\$}$ is bounded,

$$Q_t^{\$} = \sum_{j=0}^{\infty} \frac{D_{t+j+1}^{e\$}}{\Psi_j} \tag{2}$$

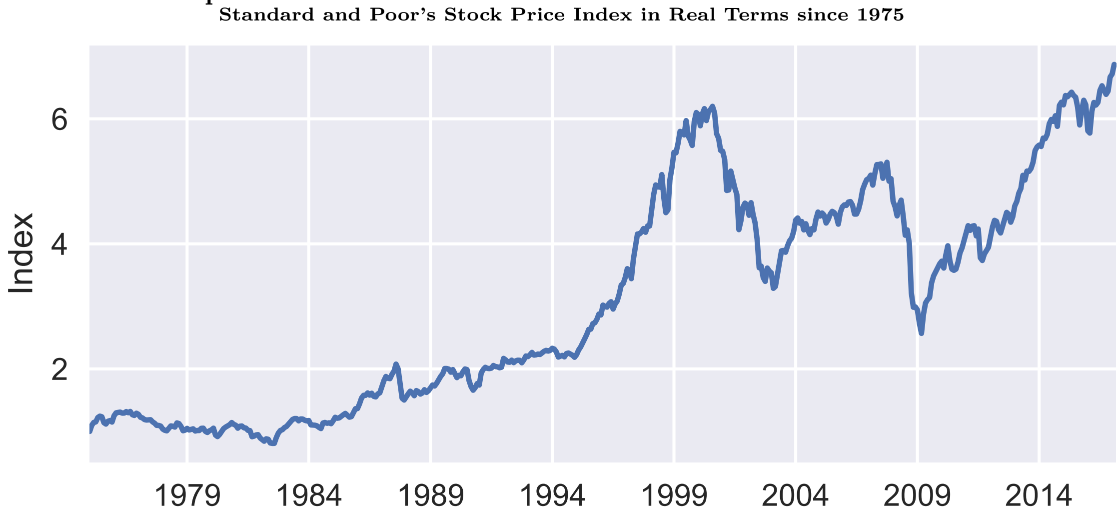
- The price of a share equals the expected discounted value of all future dividends.
- Deflating by the price index

$$Q_t = \frac{Q_t^{\$}}{P_t} = \sum_{j=0}^{\infty} \frac{D_{t+j+1}^{e\$}}{P_{t+j+1}^{e}\psi_j} = \sum_{j=0}^{\infty} \frac{D_{t+j+1}^{e}}{\psi_j}$$

### Stock price as discounted present value of dividends 3

- The *real* price of a share equals the expected discounted value of all future *real* dividends.
- Implications:
  - Higher expected future real dividends lead to a higher real stock price.
  - Higher current and expected future one-year real interest rates lead to a lower real stock price.

### Historical stock prices



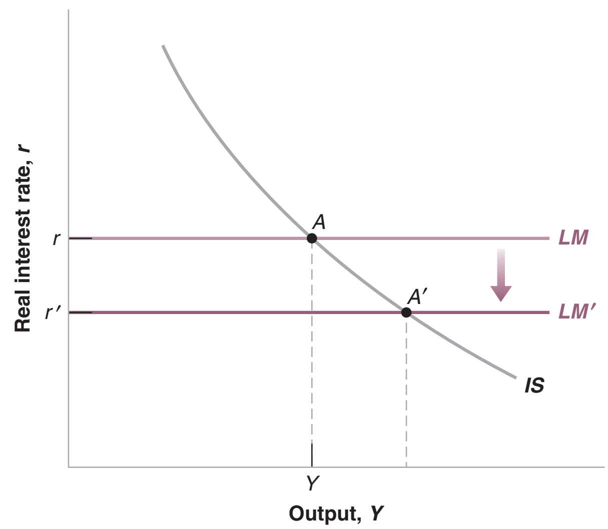

- For the most part, major movements in stock prices are unpredictable.
- Note the sharp fluctuations in stock prices since the mid-1990s.

**Stocks as random walks**

- Stock prices follow a random walk if each step they take is as likely to be up as it is to be down. Their movements are therefore unpredictable.
- Even though major movements in stock prices cannot be predicted, we can still do two things:
  - We can look back and identify the news to which the market reacted.
  - We can ask "what if" questions.

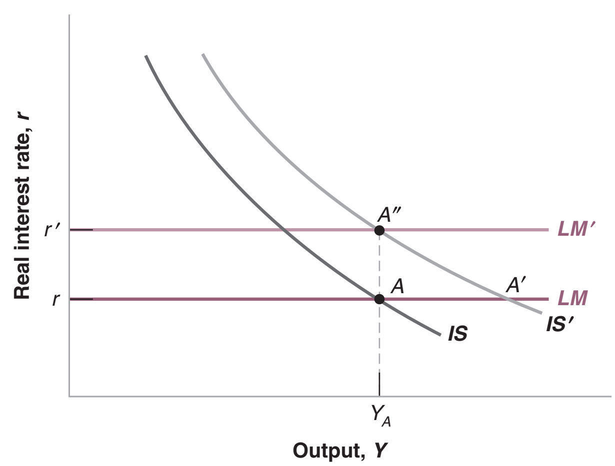
**An Expansionary Monetary Policy and the Stock Market**

- A monetary expansion decreases the interest rate and increases output.
- What it does to the stock market depends on whether financial markets anticipated the monetary expansion.




**An Increase in Consumption Spending and the Stock Market**

- The increase in consumption leads to a higher level of output.
- What happens to the stock market depends on what investors expect the central bank will do.



- If investors expect that the central bank *will not respond* and will keep the policy rate unchanged, output will increase, as the economy moves to $A'$.
- With an unchanged policy rate and higher output, stock prices will go up.

- If instead investors expect that the central bank *will respond* by raising the policy rate, output may remain unchanged as the economy moves to $A''$.
- With unchanged output, and a higher policy rate, stock prices will go down.

**In summary**

- Stock prices depend on current and future movements in activity.
- But this does not imply any simple relation between stock prices and output.
- How stock prices respond to a change in output depends on:
  1. what the market expected in the first place,
  2. the source of the shocks behind the change in output, and
  3. how the market expects the central bank to react to the output change.

**Making sense of the news**

**April 1997 Good news on the economy, leading to an increase in stock prices:** "Bullish investors celebrated the release of market friendly economic data by stampeding back into stock and bond markets, pushing the Dow Jones Industrial Average to its second-largest point gain ever and putting the bluechip index within shooting distance of a record just weeks after it was reeling."

**December 1999 Good news on the economy, leading to a decrease in stock prices:** "Good economic news was bad news for stocks and worse news for bonds…The announcement of stronger-than-expected November retail-sales numbers wasn't welcome. Economic strength creates inflation fears and sharpens the risk that the Federal Reserve will raise interest rates again."

**September 1998 Bad news on the economy, leading to a decrease in stock prices:** "Nasdaq stocks plummeted as worries about the strength of the U.S. economy and the profitability of U.S. corporations prompted widespread selling."

**August 2001 Bad news on the economy, leading to an increase in stock prices:** "Investors shrugged off more gloomy economic news, and focused instead on their hope that the worst is now over for both the economy and the stock market. The optimism translated into another 2% gain for the Nasdaq Composite Index."

# 4 Bubbles, Fads, and Stock Prices

**Some definitions**

- Fundamental value: The present value of expected dividends given in equation (2) and that stocks are sometimes underpriced or overpriced.
- Rational speculative bubbles: Stock prices increase just because investors expect them to.
- Fads: Stocks become high priced for no reason other than its price has increased in the past.

**The Increase in U.S. Housing Prices: Fundamentals or Bubble?**

- In real time, there was little agreement whether the large increase in housing prices in the 2000s was a bubble.
- Pessimists argued that the increase in house prices was not matched by a parallel increase in rents.
- Optimists argued that the increasing price-to-rent ratio reflects the decreasing real interest rate and changing mortgage market.

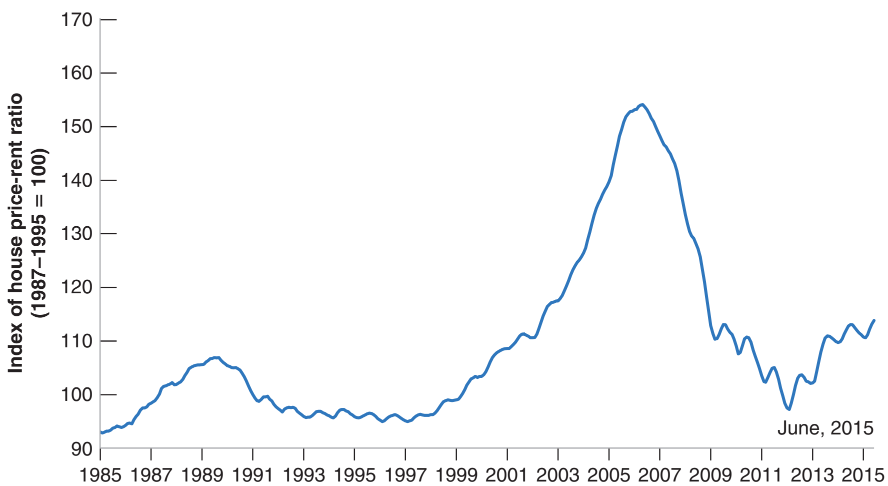



**Figure 1** *The U.S. Housing Price-to-Rent Ratio since 1985*

**Summary**

- The expected present discounted value of a sequence of payments depends positively on current and future expected (C&FE) payments and negatively on C&FE interest rates.
- When discounting nominal payments, use nominal interest rates. In discounting real payments, use real interest rates.
- Arbitrage between bonds of different maturities implies that the price of a bond is the present value of the payments on the bond. Higher C&FE short-term interest rates lead to lower bond prices.

- The yield to maturity on a bond: average of short-term interest rates over the life of a bond, plus a risk premium.
- The slope of the yield curve tells us what financial markets expect to happen to short-term interest rates in the future.
- The fundamental value of a stock is the present value of expected future real dividends. In the absence of bubbles or fads, the price of a stock is equal to its fundamental value.

- An increase in expected dividends leads to an increase in the fundamental value of stocks; an increase in C&FE one-year interest rates leads to a decrease in their fundamental value.
- Changes in output may or may not be associated with changes in stock prices in the same direction. Whether they are or not depends on (1) what the market expected in the first place, (2) the source of the shocks, and (3) how the market expects the central bank to react to the output change.

This presentation is mostly based on Blanchard, Amighini, and Giavazzi (2012, chapter 15). Data for United States is from FRED and YAHOO.

## References

Blanchard, Olivier, Alessia Amighini, and Francesco Giavazzi (2012). *Macroeconomía.*