
ECN 135 Lecture 6 Money, Banks & Financial Institutions

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Interest Rates & Risk Structure

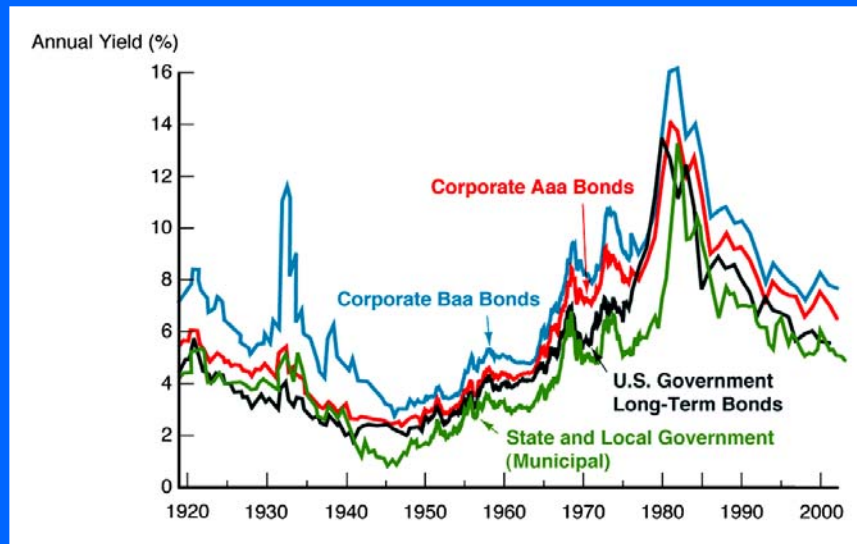
- Chapter 6. [We skip Chapter 5]
- What is Risk?
- Default risk
- Risk premium
- Explaining Yield Curve (started)

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Risk Structure of Long-Term Bonds in the United States

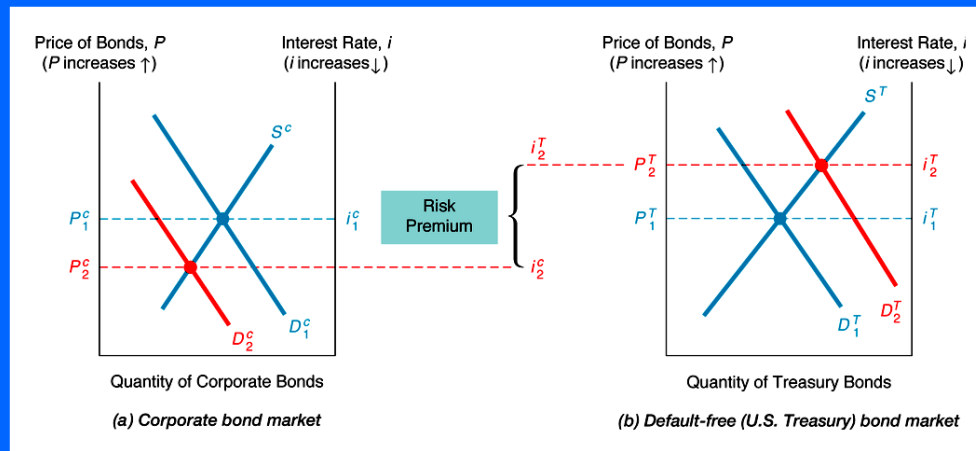


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Increase in Default Risk on Corporate Bonds [M] p. 122



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Please, notice that interest rate increases DOWN. Remember that in other diagrams in this chapter.

Risk of default occurs when issuer of the bond is unable or unwilling to make interest payments when promised (or face value when bond matures)

Analysis of Default Risk

- **Corporate Bond Market**

- 1. R^e on corporate bonds \downarrow , D^c (demand) \downarrow ,
 $\rightarrow D^c$ shifts left
- 2. Risk of corporate bonds \uparrow , $D^c \downarrow$, D^c
shifts left
- 3. Corporate bond Price $P^c \downarrow$, interest on
corporate bond $i^c \uparrow$

- **Treasury Bond Market**

- 4. Relative R^e on Treasury bonds \uparrow , D^T
(demand) \uparrow , $\rightarrow D^T$ shifts right

- 5. Relative risk of Treasury bonds \downarrow , $D^T \uparrow$

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Bond Ratings

Table 1 Bond Ratings by Moody's and Standard and Poor's

Rating		Descriptions	Examples of Corporations with Bonds Outstanding in 2003
Moody's	Standard and Poor's		
Aaa	AAA	Highest quality (lowest default risk)	General Electric, Pfizer Inc., North Carolina State, Mobil Oil
Aa	AA	High quality	Wal-Mart, McDonald's, Credit Suisse First Boston
A	A	Upper medium grade	Hewlett-Packard, Anheuser-Busch, Ford, Household Finance
Baa	BBB	Medium grade	Motorola, Albertson's, Pennzoil, Weyerhaeuser Co., Tommy Hilfiger
Ba	BB	Lower medium grade	Royal Caribbean, Levi Strauss
B	B	Speculative	Rite Aid, Northwest Airlines Inc., Six Flags
Caa	CCC, CC	Poor (high default risk)	Revlon, United Airlines
Ca	C	Highly speculative	US Airways, Polaroid
C	D	Lowest grade	Enron, Oakwood Homes

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Junk bonds if rated below Baa (or BBB)

Enron (7-th largest US corporation) declares bankruptcy in December, 2001

→ "Flight to quality" → spread in interest rates between Aaa bonds and Baa bonds raises by 44 basic points, (spread was 0.84 before and 1,28 after the bankruptcy)

Corporate Bonds & Liquidity

- **Corporate Bond Market (see Slide 5)**
 - 1. Less liquid corporate bonds $D^c \downarrow$, D^c shifts left
 - 2. $P^c \downarrow$, $r^c \uparrow$
- **Treasury Bond Market (see Slide 5)**
 - 1. Relatively more liquid Treasury bonds, $D^T \uparrow$, D^T shifts right
 - 2. $P^T \uparrow$, $r^T \downarrow$
- **Outcome:**
 - Risk premium, $r^c - r^T$, rises
 - Risk premium reflects not only corporate bonds' default risk, but also lower liquidity
- Co-movements of risk premium & liquidity premium

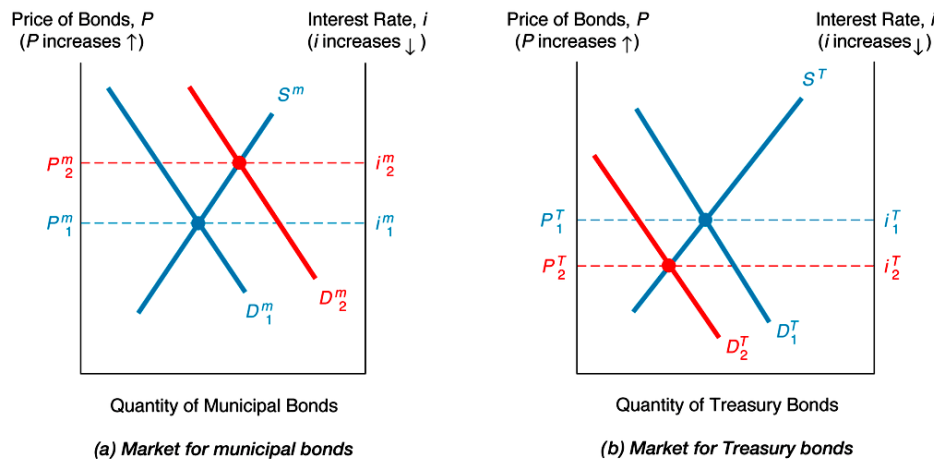
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When demand decreases, bonds are traded LESS. → liquidity decreases. Same effects as on diagram of Slide 4.

Tax Advantages of Municipal Bonds



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1. Municipal bonds are tax exempt. This matters a lot if one's tax bracket is about 35%.
2. Example: if US treasury bond has 10% (effective 6.5%) \rightarrow Municipal bond with 8% is preferred (if default risk is the same).
3. On the diagram above: start from identical municipal & federal bonds. Then, let municipal bonds have a tax break.

Analysis of Figure 3 [M] p. 126

- **Municipal Bond Market**

- 1. Tax exemption raises relative RET^e on municipal bonds, $D^m \uparrow$, \rightarrow demand for municipal bonds D^m shifts right
- 2. $P^m \uparrow$, $i^m \downarrow$

- **Treasury Bond Market**

- 1. Relative RET^e on Treasury bonds \downarrow , $D^T \downarrow$, \rightarrow demand for treasury bonds D^T shifts left
- 2. $P^T \downarrow$, $i^T \uparrow$

- **Outcome:**

- $i^m < i^T$ *treasury bonds pay higher interest*

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Application: Effects of Bush tax cuts

In 2001 from 39% to 35% \rightarrow

we expect less demand for Municipal Bonds \rightarrow

Interest rates on municipal bonds increases and prices falls

relative to treasury bonds (price increases & interest rates get lower)

(If all else is fixed)

Term Structure & Related Facts

- 1. Interest rates for different maturities move together over time
- 2. Yield curves tend to have steep upward slope when short rates are low and downward slope when short rates are high
- 3. Yield curve is typically upward sloping=
- **Three Theories of Term Structure**
 - 1. Expectations Theory (different maturity bonds are perfect substitutes)
 - 2. Segmented Markets Theory (NO substitutability between bond markets)
 - 3. Liquidity Premium (Preferred Habitat) Theory
- A. Expectations Theory explains 1 and 2, but not 3
- B. Segmented Markets explains 3, but not 1 and 2
- C. Solution: Combine features of both Expectations Theory and Segmented Markets Theory to get Liquidity Premium (Preferred Habitat) Theory and explain all facts
- **yield curve, i.e. description of term structure of interest rates for particular bonds**

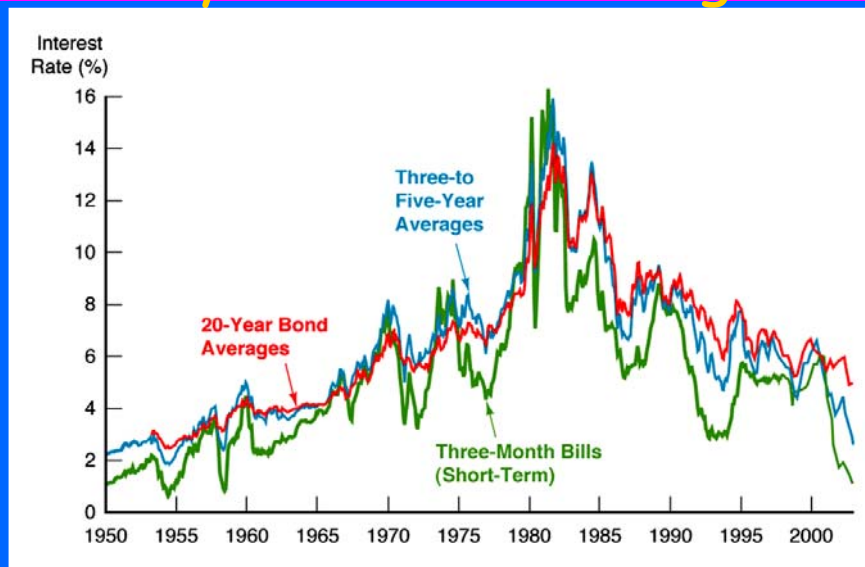
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All considerations: risk, liquidity and tax → **yield curve, i.e. description of term structure of interest rates for particular bonds.**

Interest Rates on Different Maturity Bonds Move Together



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Figure 4, p. 129

Yield Curves

Following the Financial News

Yield Curves

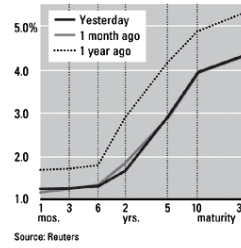
The *Wall Street Journal* publishes a daily plot of the yield curves for Treasury securities, an example of which is presented here. It is typically found on page 2 of the "Money and Investing" section.

The numbers on the vertical axis indicate the interest rate for the Treasury security, with the maturity given by the numbers on the horizontal axis. For example, the yield curve marked "Yesterday" indicates that the interest rate on the three-month Treasury bill yesterday was 1.25%, while the one-year bill had an interest rate of 1.35% and the ten-year bond had an interest rate of 4.0%. As you can see, the yield curves in the plot have the typical upward slope.

Source: *Wall Street Journal*, Wednesday, January 22, 2003, p. C2.

Treasury Yield Curve

Yield to maturity of current bills, notes and bonds.



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Yield curves can be: upward sloping, flat or downward sloping (or inverted)

Flat is when short & long term rates are the same.

Facts:

1. Yield curves move TOGETHER (see slide 11 or [M], p. 129)
2. If short term rates are low slope is upward, if high → more likely to be downward sloping (i.e., inverted)
3. In reality, Yield curves are almost always sloped UPWARD

Expectations Hypothesis

Key Assumption: Bonds of different maturities are perfect substitutes

Implication: RET^e on bonds of different maturities are equal
Investment strategies for two-period horizon

1. Buy \$1 of one-year bond and when it matures buy another one-year bond
2. Buy \$1 of two-year bond and hold it

Expected return from strategy 2

$$\frac{(1 + i_{2t})(1 + i_{2t}) - 1}{1} = \frac{1 + 2(i_{2t}) + (i_{2t})^2 - 1}{1}$$

Since $(i_{2t})^2$ is extremely small, expected return is approximately $2(i_{2t})$

Expected Return from Strategy 1

$$\frac{(1 + i_t)(1 + \tilde{r}_{t+1}) - 1}{1} = \frac{1 + i_t + \tilde{r}_{t+1} + i_t(\tilde{r}_{t+1}) - 1}{1}$$

Since $i_t(\tilde{r}_{t+1})$ is also extremely small, expected return is approximately

$$i_t + \tilde{r}_{t+1}$$

From implication above expected returns of two strategies are equal: Therefore

$$2(i_{2t}) = i_t + \tilde{r}_{t+1}$$

Solving for i_{2t}

$$i_{2t} = \frac{i_t + \tilde{r}_{t+1}}{2}$$

Expected Return from Strategy 1

More generally for n -period bond:

$$i_{nt} = \frac{i_t + \hat{r}_{t+1} + \hat{r}_{t+2} + \dots + \hat{r}_{t+(n-1)}}{n}$$

In words: Interest rate on long bond = average short rates expected to occur over life of long bond

Numerical example:

One-year interest rate over the next five years 5%, 6%, 7%, 8% and 9%:

Interest rate on two-year bond:

$$(5\% + 6\%)/2 = 5.5\%$$

Interest rate for five-year bond:

$$(5\% + 6\% + 7\% + 8\% + 9\%)/5 = 7\%$$

Interest rate for one to five year bonds:

5%, 5.5%, 6%, 6.5% and 7%.

Expectations & Term Structure

- **Explains why yield curve has different slopes:**
 - 1. When short rates expected to rise in future, average of future short rates = i_{nt} is above today's short rate: therefore yield curve is upward sloping
 - 2. When short rates expected to stay same in future, average of future short rates are same as today's, and yield curve is flat
 - 3. Only when short rates expected to fall will yield curve be downward sloping
- **Expectations Hypothesis explains Fact 1 that short and long rates move together**
 - 1. Short rate rises are persistent
 - 2. If $i_t \uparrow$ today, i_{t+1}, i_{t+2} etc. $\uparrow \Rightarrow$ average of future rates $\uparrow \Rightarrow i_{nt} \uparrow$
 - 3. Therefore: $i_t \uparrow \Rightarrow i_{nt} \uparrow$, i.e., short and long rates move together

Explains Fact 2 that yield curves tend to have steep slope when short rates are low and downward slope when short rates are high

1. When short rates are low → expected to rise to normal level, and long rate = average of future short rates will be well above today's short rate: yield curve will have steep upward slope
2. When short rates are high → expected to fall in future, and long rate will be below current short rate: yield curve will have downward slope

Doesn't explain Fact 3 that yield curve usually has upward slope

Short rates as likely to fall in future as rise, so average of future short rates will not usually be higher than current short rate → yield curve will not usually slope upward

Summary of Today

- Default risk
- Risk premium
- Explaining Yield Curves
 - Started
- Your preparation Read [M], Ch. 6-7
- Have a Nice Night