Ec 370

Money and Banking

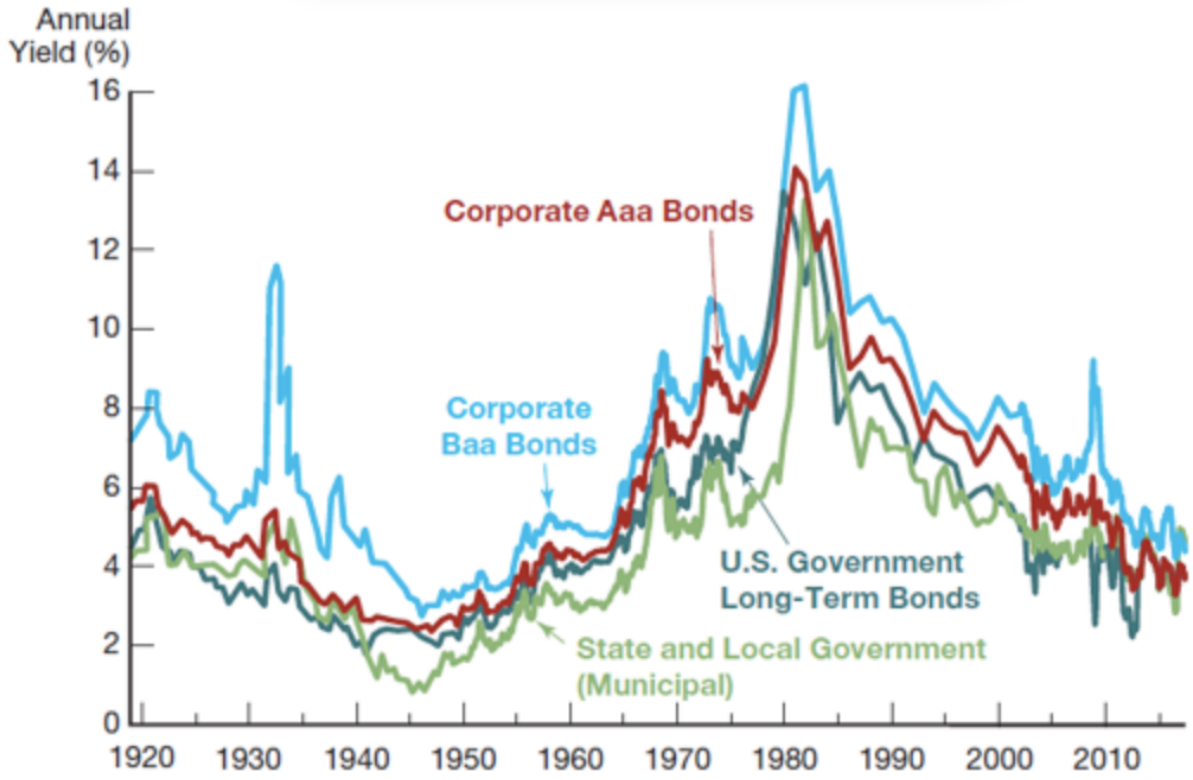
Chapter 6: The Risk and Term Structure of Interest Rates - PART I

Xiang LI
April 29, 2020

- Chapter 5: the determination of just ONE interest rate
  - supply and demand analysis of bonds market
- Chapter 6: Why do interest rates differ from bond to bond?
  - the determination of just DIFFERENT interest rates
  - Risk structure of interest rates (**Today's lecture**)
  - bonds with the same term to maturity
  - Term structure of interest rates (**Next lecture**)
  - bonds with the different term to maturity

Risk structure of interest rates

Risk Structure of Interest Rates



- interest rates on different categories of bonds generally move together
- interest rates differ from one another: Baa > Aaa > T-bonds > municipal

Risk Structure of Interest Rates

- Bonds with the **same maturity** have different interest rates due to:
  - Default Risk
  - Liquidity
  - Tax Considerations

Default Risk

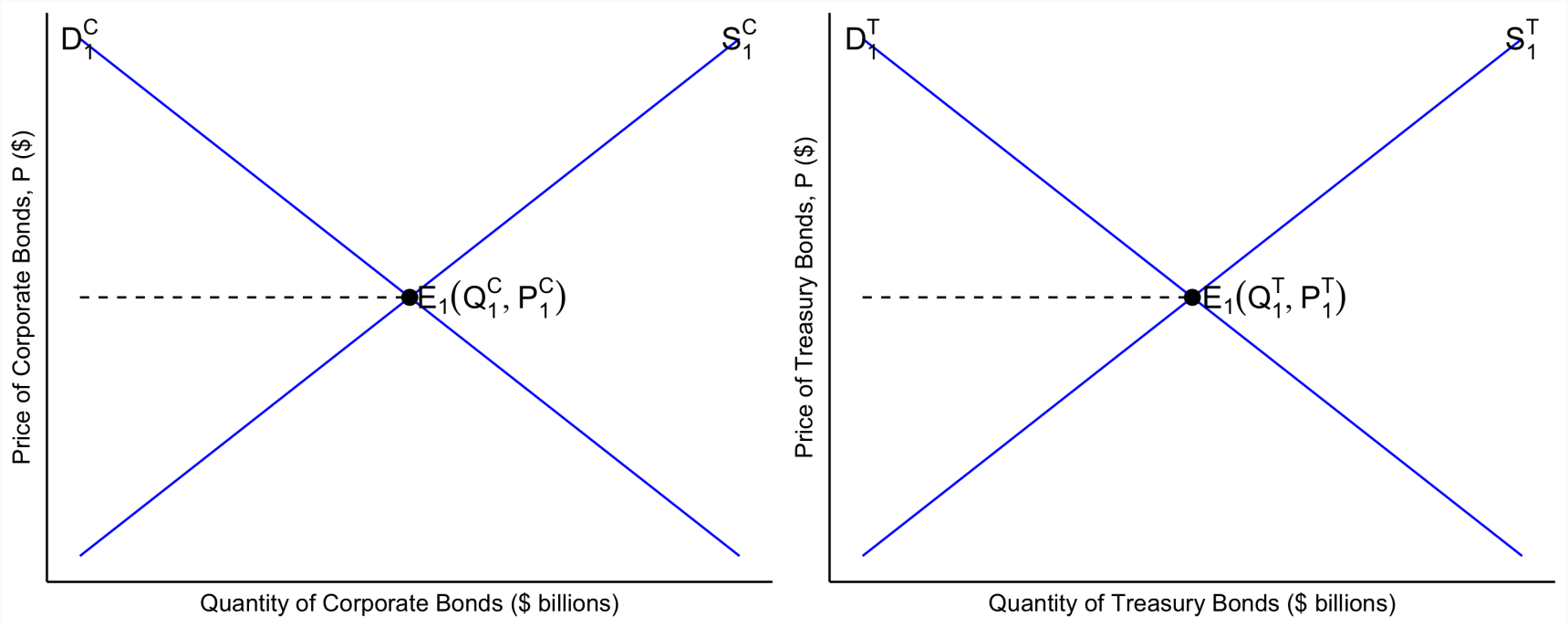
- **default**: the issuer of the bond doesn't make interest payments when promised or pay off the face value when the bond matures
- **default-free bonds**: U.S. Treasury bonds
  - the federal government can always increase taxes or print money to pay off
- bonds with default risk: corporate bonds, municipal bonds
- **risk premium**: spread between interest rates on bonds with default risk and interest rates on default-free bonds, both of the same maturity
  - how much additional interest people must earn to be willing to hold the risky bond

Participation 6: Default Risk

- Q1: use supply and demand analysis of the bond market to explain why interest rates of corporate bonds are higher than those of U.S. Treasury bonds.
- Assume: initially, corporate bonds have the same default risk as U.S. Treasury bonds

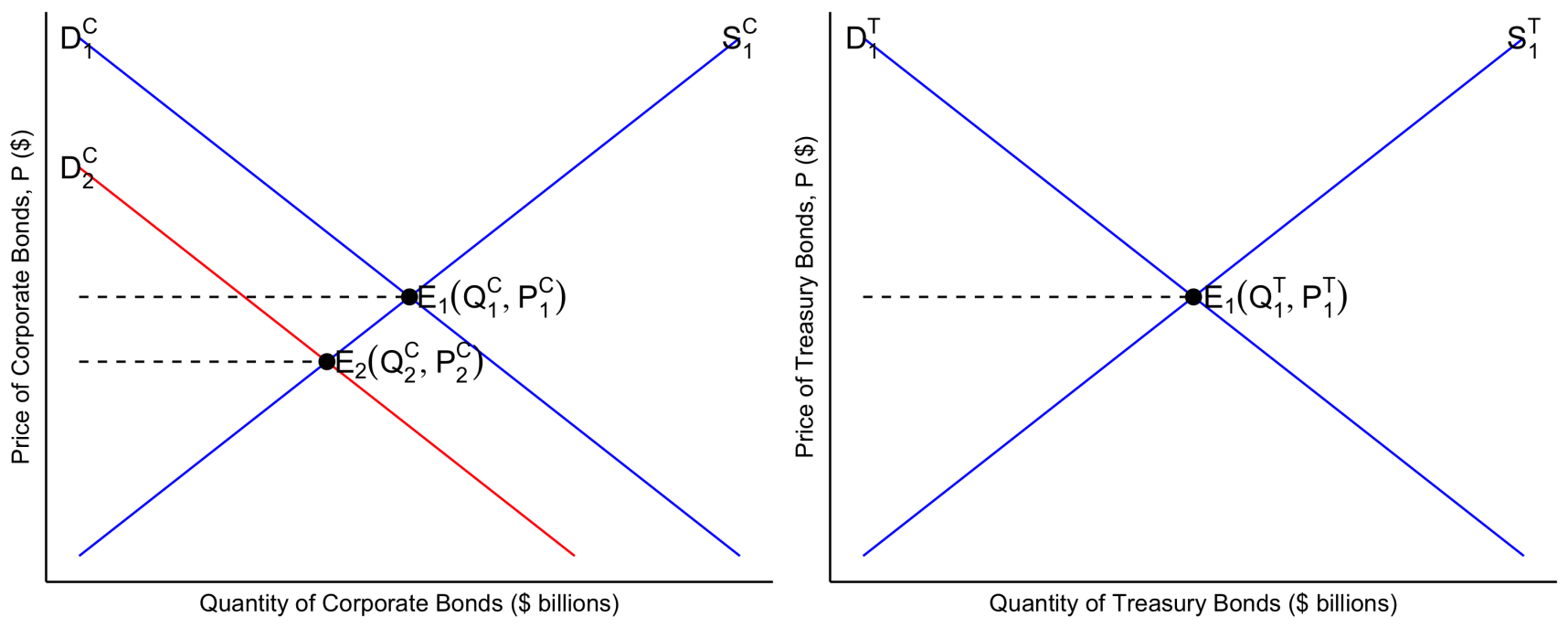
Participation 6: Default Risk

- Assume: initially zero risk premium ${P_1}^C = {P_1}^T, {i_1}^C = {i_1}^T$



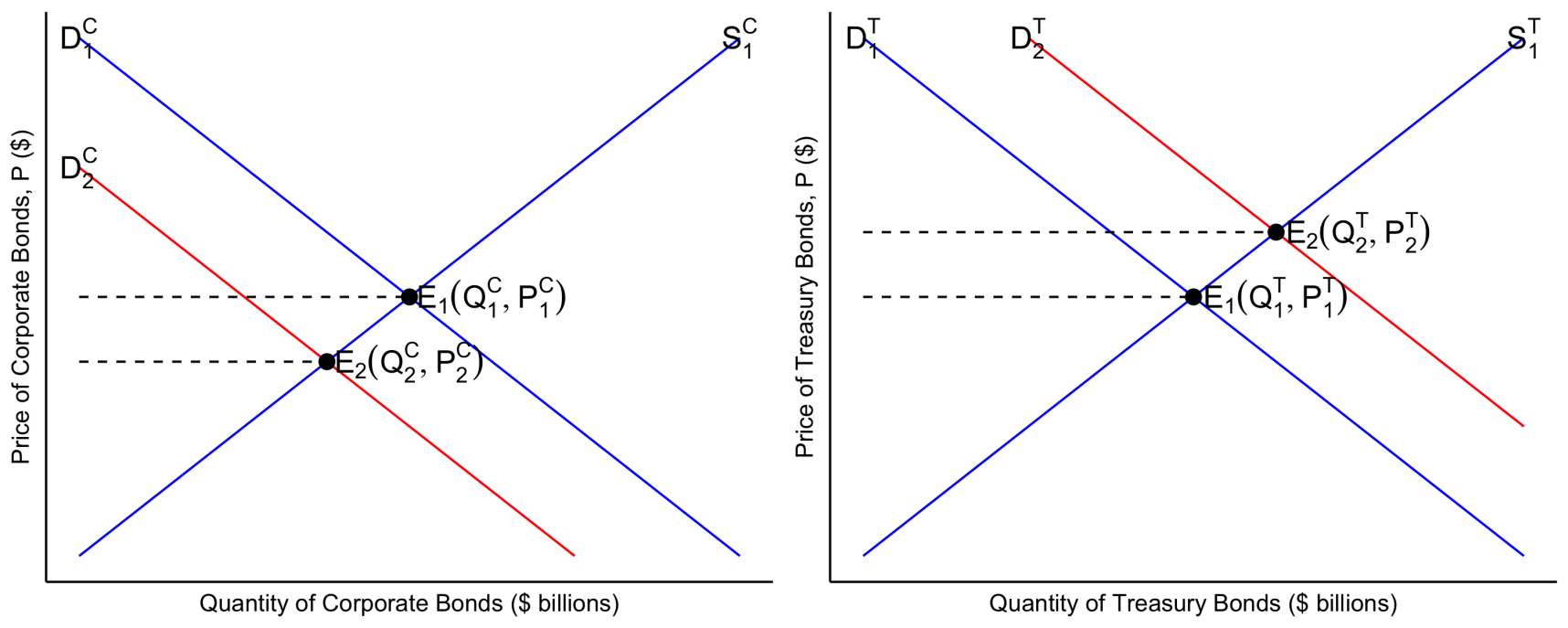
Participation 6: Default Risk

- step 1: coporation suffers losses, and default risk increases
  - demand ↓



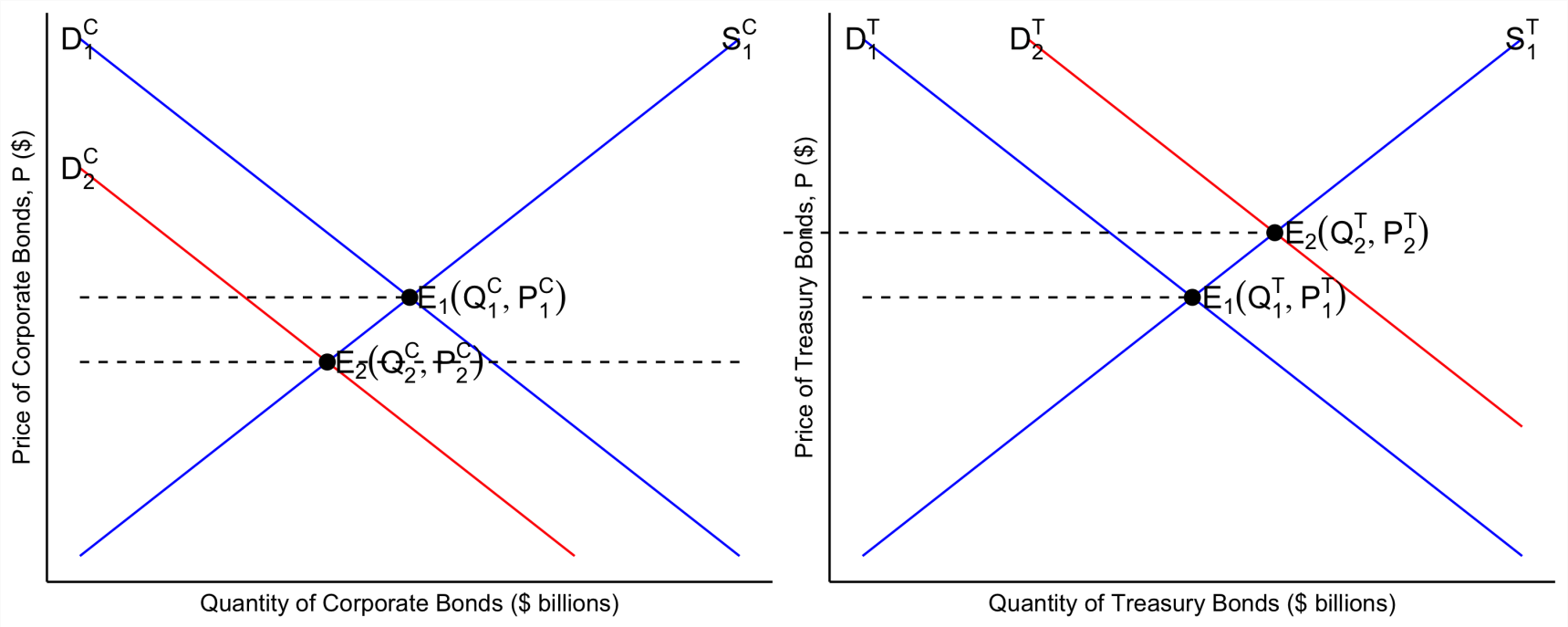
Participation 6: Default Risk

- step 2: relative riskiness of Treasury bonds declines
  - demand ↑



Participation 6: Default Risk

- net result: $P^C \downarrow, i^C \uparrow; P^T \uparrow, i^T \downarrow$
- risk premium on coporate bonds: rises from 0 to ${i_2}^C - {i_2}^T$



Default Risk

- Conclusion: **a bond with defualt risk will always have a positive risk premium, and an increase in its defualt risk will raise the risk premium**
- **Credit-rating**: a measure of default risk, indicating how likely the issuers default on the bonds
- Credit-rating agencies: rate the quality of corporate and municipal bonds in terms of default probability

Default Risk

Bond Ratings by Moody's, Standard and Poor's, and Fitch

Rating			
Moody's	**S&P**	**Fitch**	**Definitions**
Aaa	AAA	AAA	Prime Maximum Safety
Aa1	AA–	AA–	High Grade High Quality
Aa2	AA	AA	
Aa3	AA–	AA–	
A1	A+	A+	Upper Medium Grade
A2	A	A	
A3	A–	A–	
Baa1	BBB+	BBB+	Lower Medium Grade
Baa2	BBB	BBB	
Baa3	BBB–	BBB–	
Ba1	BB+	BB+	Noninvestment Grade
Ba2	BB	BB	Speculative
Ba3	BB–	BB–	
B1	B–	B–	Highly Speculative
B2	B	B	
B3	B–	B–	
Caa1	CCC+	CCC	Substantial Risk
Caa2	CCC	—	In Poor Standing
Caa3	CCC–	—	
Ca	—	—	Extremely Speculative
C	—	—	May Be in Default
—	—	DDD	Default
—	—	DD	—
—	D	D	

investment-grade bonds: low default risk

Default Risk

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Aa2	AA	AA	
Aa3	AA–	AA–	
A1	A+	A+	Upper Medium Grade
A2	A	A	
A3	A–	A–	
Baa1	BBB+	BBB+	Lower Medium Grade
Baa2	BBB	BBB	
Baa3	BBB–	BBB–	
Ba1	BB+	BB+	Noninvestment Grade
Ba2	BB	BB	Speculative
Ba3	BB–	BB–	
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—	—	DD	—
—	D	D	

speculative-grade or junk bonds: high default risk (Such bonds always have higher interest rates than investment-grade bonds, so they are also called high-yield bonds)

Default Risk

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—	D	D	

US government bonds in 1780s (US had lots of debt), General Motors, IBM, JP Morgan in early 1900s (start-ups firms) used to be junk bonds

Default Risk

- What role did credit ratings play in the 2008 crisis?

https://www.youtube.com/watch?v=uM19CBGhhas

- During the 2008 financial crisis, a lot of worthless subprime-mortgage securities were given AAA ratings: the highest and safest investment grade.
- The agencies have been blamed for exaggerated ratings of risky mortgage-backed securities, giving investors false confidence that they were safe for investing.
- Paul Krugman: “The skewed assessments, in turn, helped the financial system take on far more risk than it could safely handle.”

Default Risk

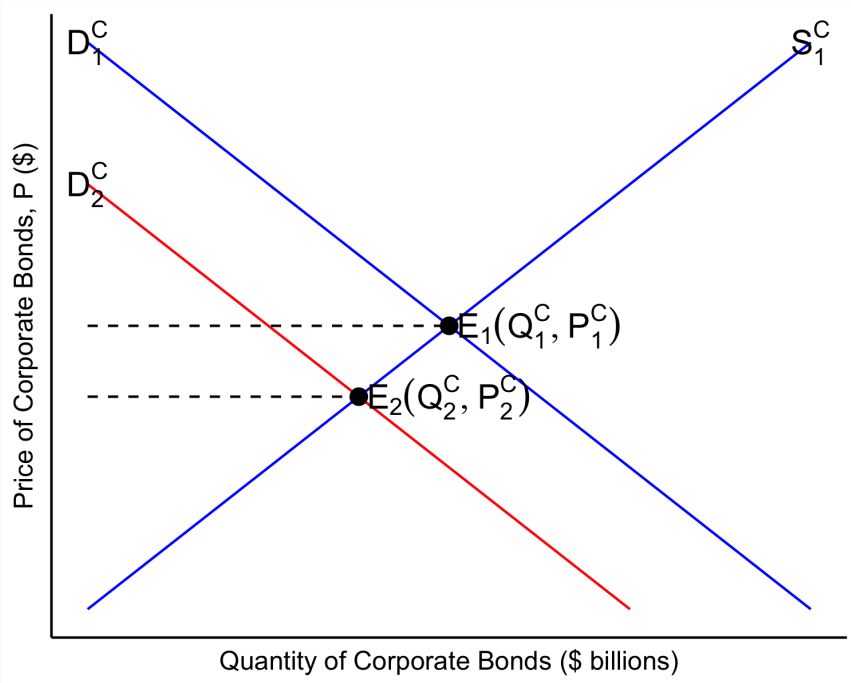
- In 2011, the Financial Crisis Inquiry Commission found that these ratings agencies “were key enablers of the financial meltdown.”
- 2015: Standard & Poor’s paying $1.5 billion to settle suits with the U.S. Justice Department
- 2017: Moody's paying out nearly $864m to U.S. justice department, 21 states and District of Columbia

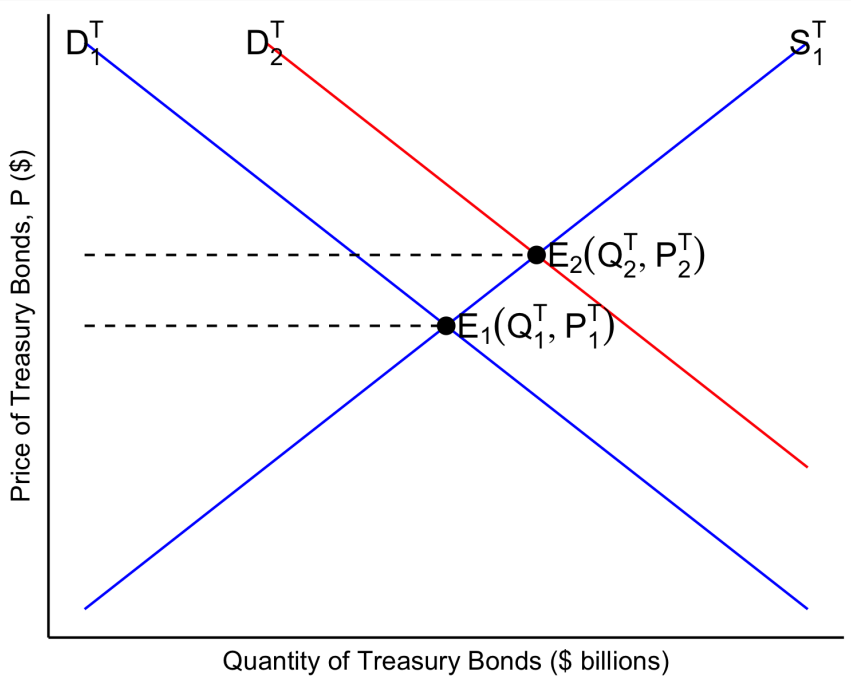
Liquidity

- liquid assets: can be quickly and cheaply converted into cash
- The more liquid an asset is, the more desirable it is (holding everything else constant)
- Liquidity of a bond depends on
  - Cost of selling that bond (e.g. brokerage commissions)
  - Number of buyers/sellers in a bond market
- U.S. Treasury bonds are the most liquid of all long-term bonds
  - widely traded, easy to sell quickly, low cost of selling
- Corporate bonds are not as liquid

Participation 6: Liquidity

- Q2: use supply and demand analysis to show that the lower liquidity of corporate bonds relative to Treasury bonds increases the spread between the interest rates on these two bonds





Liquidity

Coporate bonds vs. Treasury bonds:

- Treasury bonds less defualt risk, while coporate bonds more defualt risk
- Treasury bonds more liquid, while coporate bonds less liquid
- Conclusion: the spread between interest rates on corporate bonds and Treasury bonds reflect not only the corporate bonds' **default risk** but also their lesser **liquidity**

Income Tax Considerations

- Municipal bonds are bonds issued by state and local governments
  - Municipal bonds are not default-free (Detroit, 2013)
  - Municipal bonds are not as liquid as U.S. T-bonds either
- Hence, municipal bonds should have had a higher interest rate than Treasury bonds, just like corporation bonds
- But why municipal bond have had lower interest rates than U.S. Treasury bonds?
- Because interest payments on municipal bonds are exempt from **federal income taxes**

Income Tax Considerations

- Let's imagine that your income is high enough to put you in the 40% income tax bracket, where for every extra dollar of income you earn you have to pay 40 cents to the government
- If you own a $1,000-face-value U.S. Treasury bond that has a coupon payment of $100, you keep only $60 of the coupon payment after taxes
  - Although the bond has a 10% interest rate, you actually earn only 6% after taxes
- Suppose, however, that you put your savings into a $1,000-face-value municipal bond that pays only $80 in coupon payments
  - because it is a tax-exempt security, you pay no taxes on the $80 coupon payment, so you earn 8% after taxes

Participation 6: Income Tax

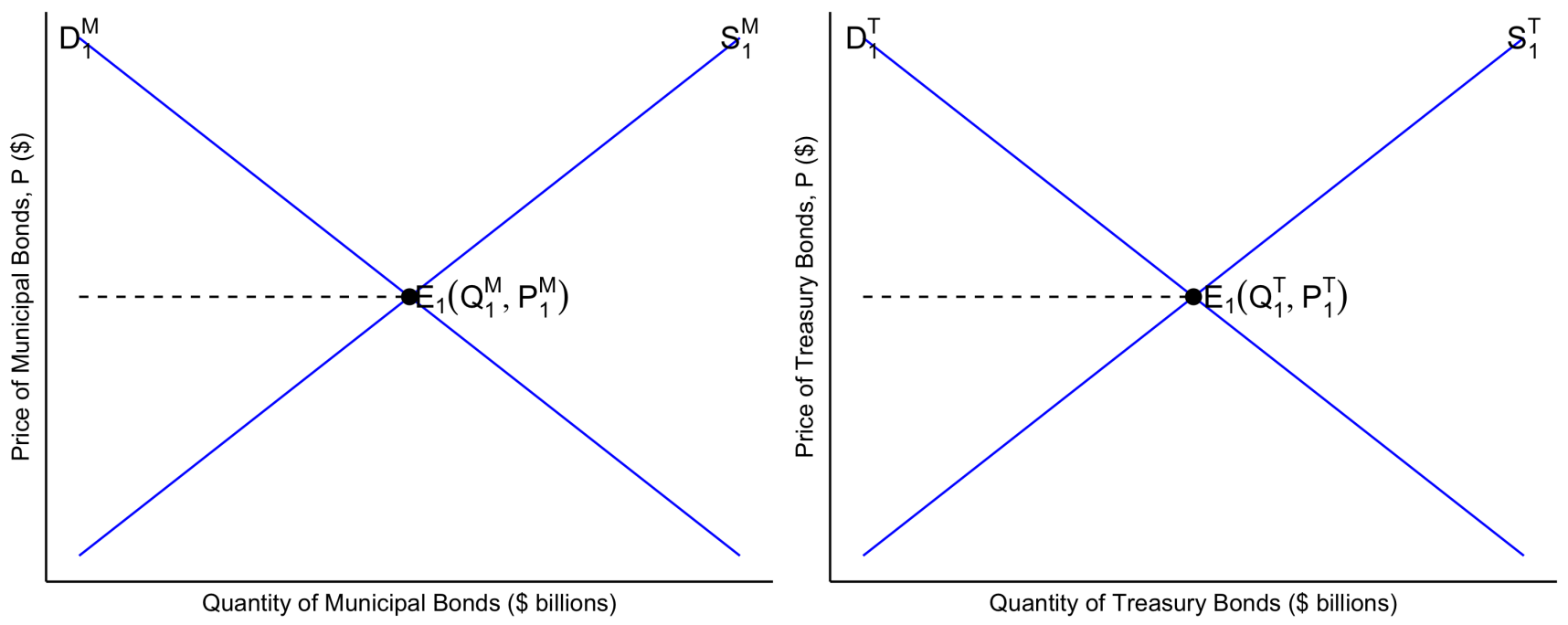
- you earn more on the municipal bond **after taxes**, so you are willing to hold the **riskier and less liquid** municipal bond rate than the U.S. Treasury bond

- Q3: use supply and demand analysis to show that municipal bonds have lower interest rates than Treasury bonds.

    - Assume: initially, municipal and Treasury bonds have identical attributes
    - municipal bonds have no default risk, and are as liquid as Treasury bonds

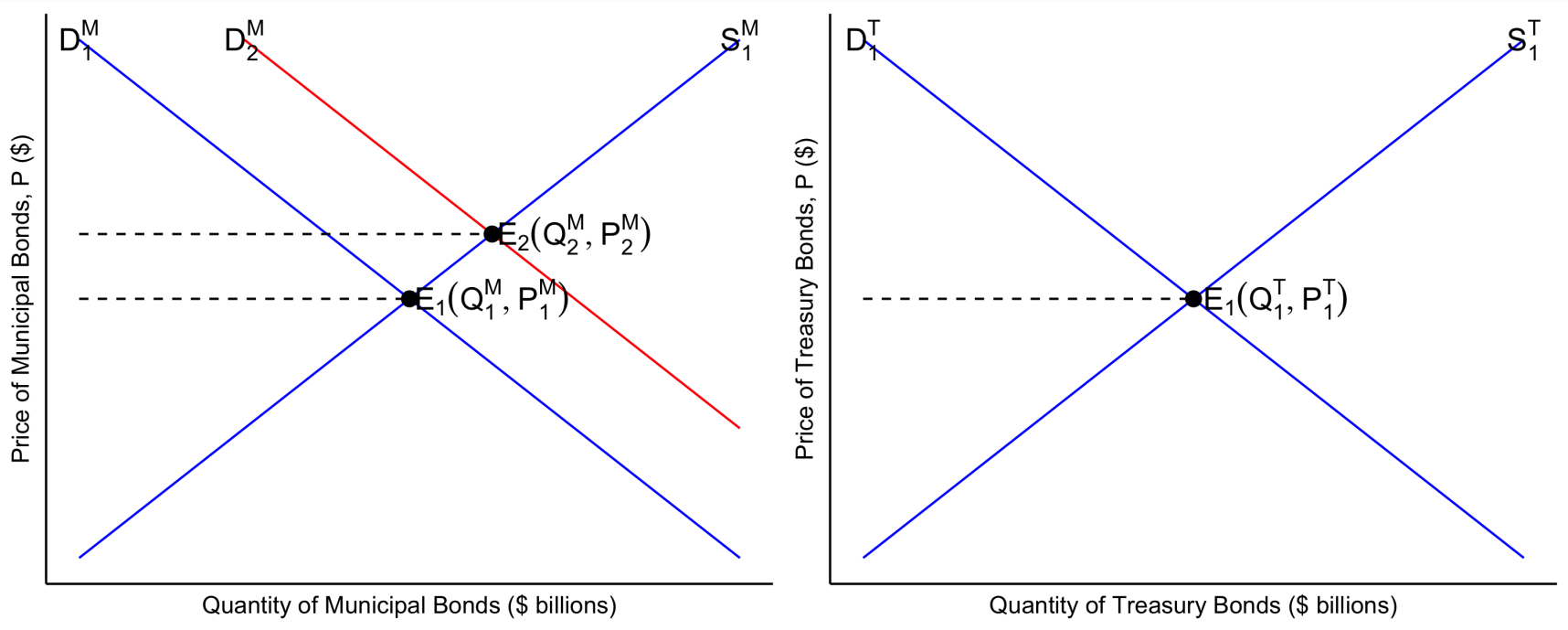
Participation 6: Income Tax

- Initially, $P_1{}^m = P_1{}^T, i_1{}^m = i_1{}^T$



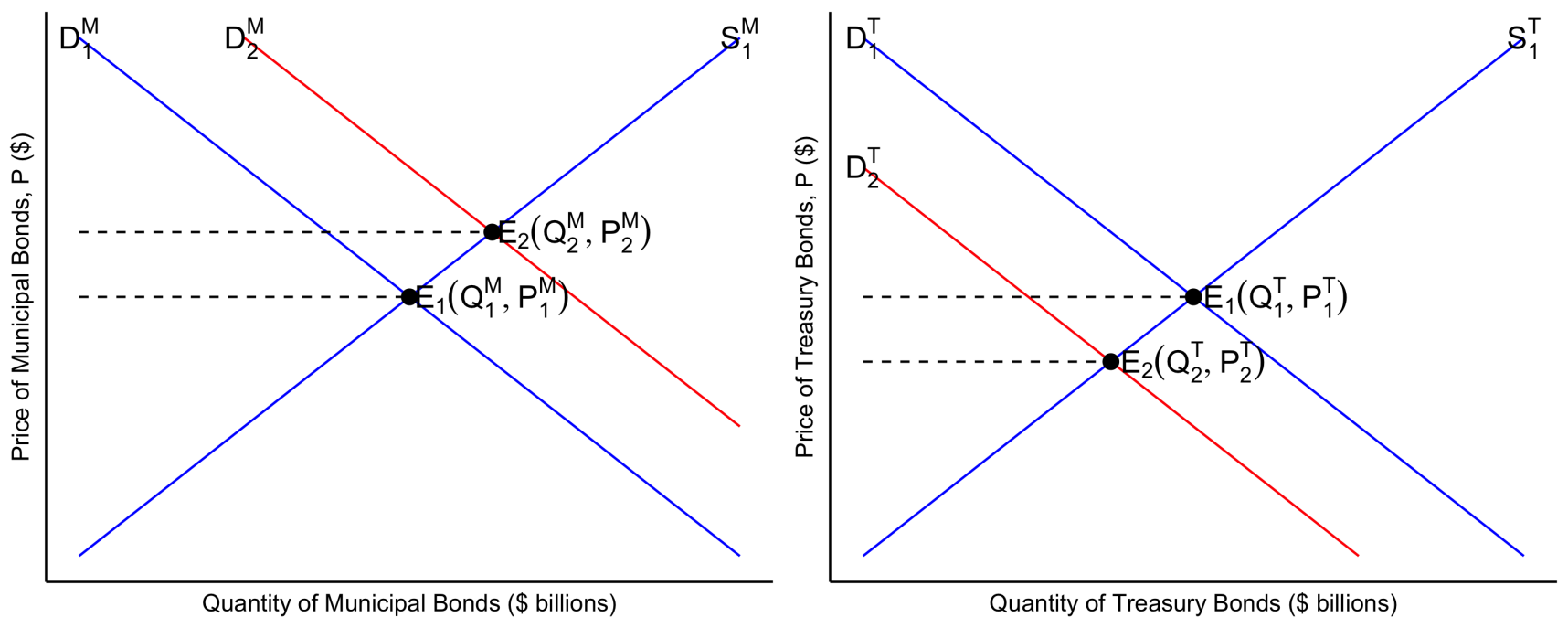
Participation 6: Income Tax

- step 1: municipal bonds are given tax advantage, and hence after-tax expected return relative to Treasury bonds rises
    - demand ↑



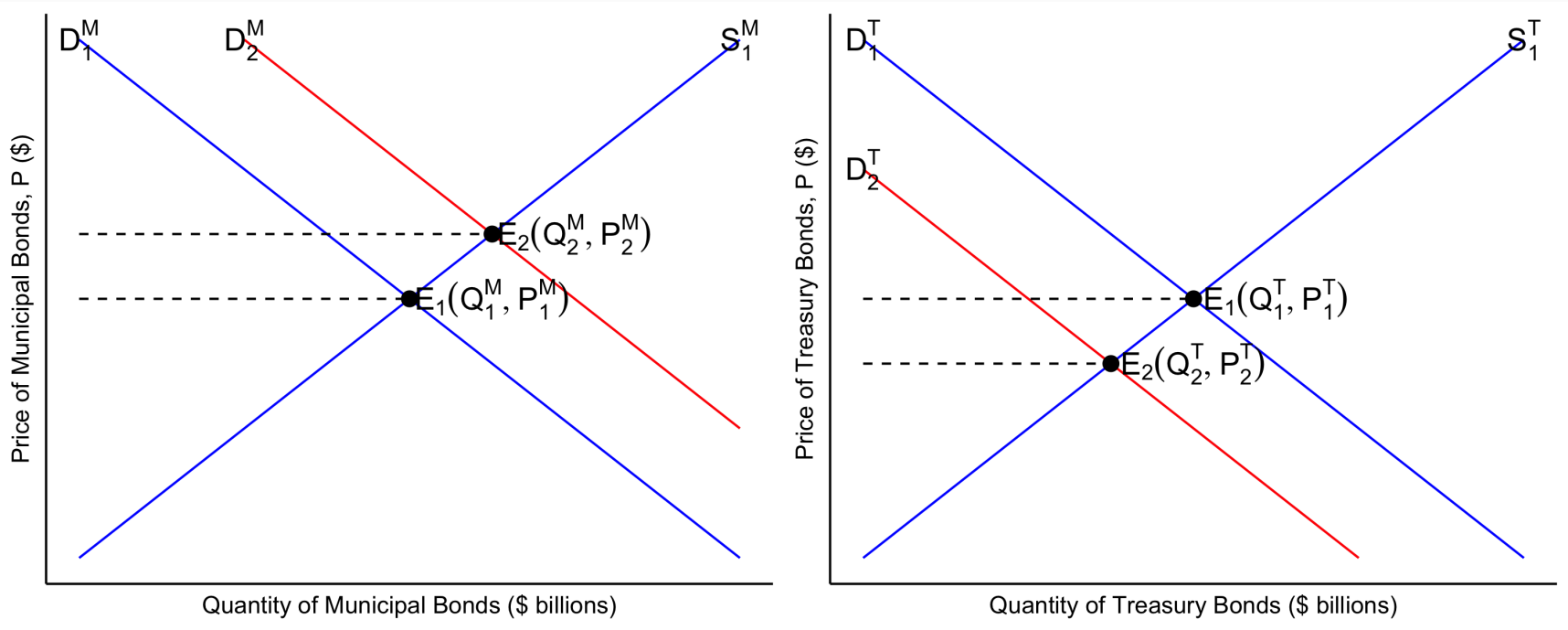
Participation 6: Income Tax

- step 2: Treasury bonds become less desirable relatively
  - demand ↓



Participation 6: Income Tax

- net result: $P^m \uparrow, i^m \downarrow; P^T \downarrow, i^T \uparrow$
  - municipal bonds end up with lower interest rates than Treasury bonds



Income Tax Considerations

Effects of the Obama Tax Increase on Bond Interest Rates:

- In 2013, Congress approved legislation favored by the Obama administration to increase the income tax rate on high-income taxpayers from 35% to 39%
- Consistent with supply and demand analysis, the increase in income tax rates for wealthy people helped to lower the interest rates on municipal bonds relative to the interest rate on Treasury bonds

How does U.S. corporate bonds perform during the coronavirus pandemic?

- Since late March 2020, as ratings firms reassessed the ability of corporate borrowers to repay their debts, U.S. corporate bonds are being downgraded at breakneck speeds, due to fears of:
  - bankruptcies spurred by the crisis
  - a prolonged recession
- Investors are being compensated more to hold corporate bonds. Adjusted for options, the spread, or extra yield investors demanded to hold investment-grade U.S. corporate bonds

News source: Wall Street Journal

How does Treasury bills/notes/bonds perform during the coronavirus pandemic?

- U.S. government bonds held firm, reflecting continued demand for safer assets among investors
- The price on these bonds increases, and the yield on these bonds declines

News source: Wall Street Journal

How does municipal bonds perform during the coronavirus pandemic?

- U.S. state and local governments borrow from investors in the form of municipal bonds, pledging a range of taxes and fees to repay the debt.
- But with many businesses shut down, cities and counties are collecting far less in taxes on restaurant meals, hotel stays and car rentals.
- Meanwhile, states are being forced to distribute hundreds of millions of dollars in unemployment checks to residents from whom they recently collected income taxes.
- Major ratings firms are lowering municipal bonds outlooks

News source: Wall Street Journal

Summary

- The risk structure of interest rates (the relationships among interest rates on bonds with the same maturity) is explained by three factors:
  - if default risk $\uparrow$, then risk premium $\uparrow$, and interest rate $\uparrow$
  - if liquidity $\uparrow$, then interest rate $\downarrow$
  - if favorable tax treatment $\uparrow$, then interest rate $\downarrow$

- Practice problem and answer key for today's content have been uploaded
- Problem set 3 has been posted
    - Make full use of the practice problem to help you with this problem set
    - Submit one legible pdf document to Canvas by 11:59pm (PDT), **Sunday, May 3**
- Today's participation exercise (Participation #6) is due on Sunday of week 10. But you are strongly encouraged to submit it now
- We will finish chapter 6 in the next lecture, and the content covered in the second part of chapter 6 will be included in Problem set #4