Chapter 5: Bonds

Major Categories of Bonds

- US data (2014):
  - Treasury securities: $13 trillion
  - State and Local governments: $2.9 trillion
  - Corporate: $7.5 trillion
  - Mortgage-backed securities: $9.4 trillion
- Data on debt outstanding by sector here.
- Worldwide:
  - $58 trillion government
  - $56 trillion corporate

Treasury Security Characteristics

- U.S. Federal Government uses these to borrow.
- Interest is tax-exempt at state and local level.
- Maturities range from 4 weeks to 30 years.
- 10-year Treasury Note is a benchmark rate:
  - Other interest rates are guided by the 10-year.
  - The yield is typically used as a risk-free rate (r_f).

Treasury Yields and Inflation

- r_f includes compensation for expected inflation.
- (Inflation decreases purchasing power of future cash flows).
- What is the real return on a Treasury yield, net of inflation?
  - The increase in your purchasing power!

Inflation Example

- You invest $100 in a 1-year Treasury yielding 5.06%. Inflation over the holding period is 3%.
  - The investment is worth $105.06 after one year.
  - $100 today is worth $103 a year from today.
  - Therefore, your real return is $105.06 / $103 = 2%.
- Real returns are only approximately r - g in general.
- E.g. If r = 10% and i = 7%, then real return is only $110 / $107 = 2.8%.

Municipal Bonds

- State and local governments issue bonds to raise capital for projects.
  - E.g. infrastructure, schools, prisons.
  - Interest is tax exempt at the federal level, and often state and local levels, too.
  - How risky? More than treasuries (why?). Most states are rated AAA or AA
  - Iowa is AAA; Mississippi is AA; Illinois is BBB!.

Corporate Bonds

- Used to finance operation, mergers, business expansions, etc.
- Cheaper than paying tax to repatriate profits.
- Interest is taxable for investors; tax-deductible for the corporation (why?).
- Risky? More than Treasuries (why?).
- These are the main type of bond we discuss in this class.

Corporate Bond Valuation

Bond Basics

- Face value: the amount borrowed per bond issued.
- Coupon rate: stated by the bond contract.
- Frequency: number of payments per year.
- Coupon: (face value x coupon rate) / frequency.
  - E.g. 10% semi-annual makes 6% every six months.
- Maturity: length of the bond (or date of expiration).
  - At maturity the bond makes its last payment plus principal and expires.

Bond TVM Keys

- Given:
  - FV = face value
  - N = number of payments remaining
  - PMT = coupon dollar amount
- Solve for either:
  - I/Y = discount rate (**per payment period**).
    - This is called the **yield** of the bond.
  - PV = price of bond

Bond Timeline

- Remember: the coupon rate is a nominal rate—it's fixed.

- The timeline is almost the same as an annuity. We just need to include an extra FV payment on the end.

Example

- What would you pay for a $1000 (face value) bond that pays a 8% coupon with 10 years left to maturity. Suppose that you require an 8% return?

Finding the Yield

- Given the price of the bond, we can solve for its yield.
- (The yield is just whatever I/Y sets PV to the current bond price).

Yields and Prices

- Notice that 9% (yield) > 8% (coupon), and $935.82 (price) < $1(principal).
- Which direction does the price move if the yield increases, e.g. to 12%?
- If the yield decreases to 4%?

Interest Rate Sensitivity

- Bond A: 8% coupon with five years to maturity.
- Bond B: 8% coupon with ten years to maturity.
- Which bond is more sensitive to interest rates?

Yield	Price A	% Change A	Price B	% Change B
12%				
8%				
4%				

Interest Rate Sensitivity

- Bond A: 0% coupon with ten years to maturity.
- Bond B: 8% coupon with ten years to maturity.
- Which bond is more sensitive to interest rates?

Yield	Price A	% Change A	Price B	% Change B
12%				
8%				
4%				

Interest Rate Sensitivity

- What's going on? The more sensitive bond is the one where the "average" payment is further away.

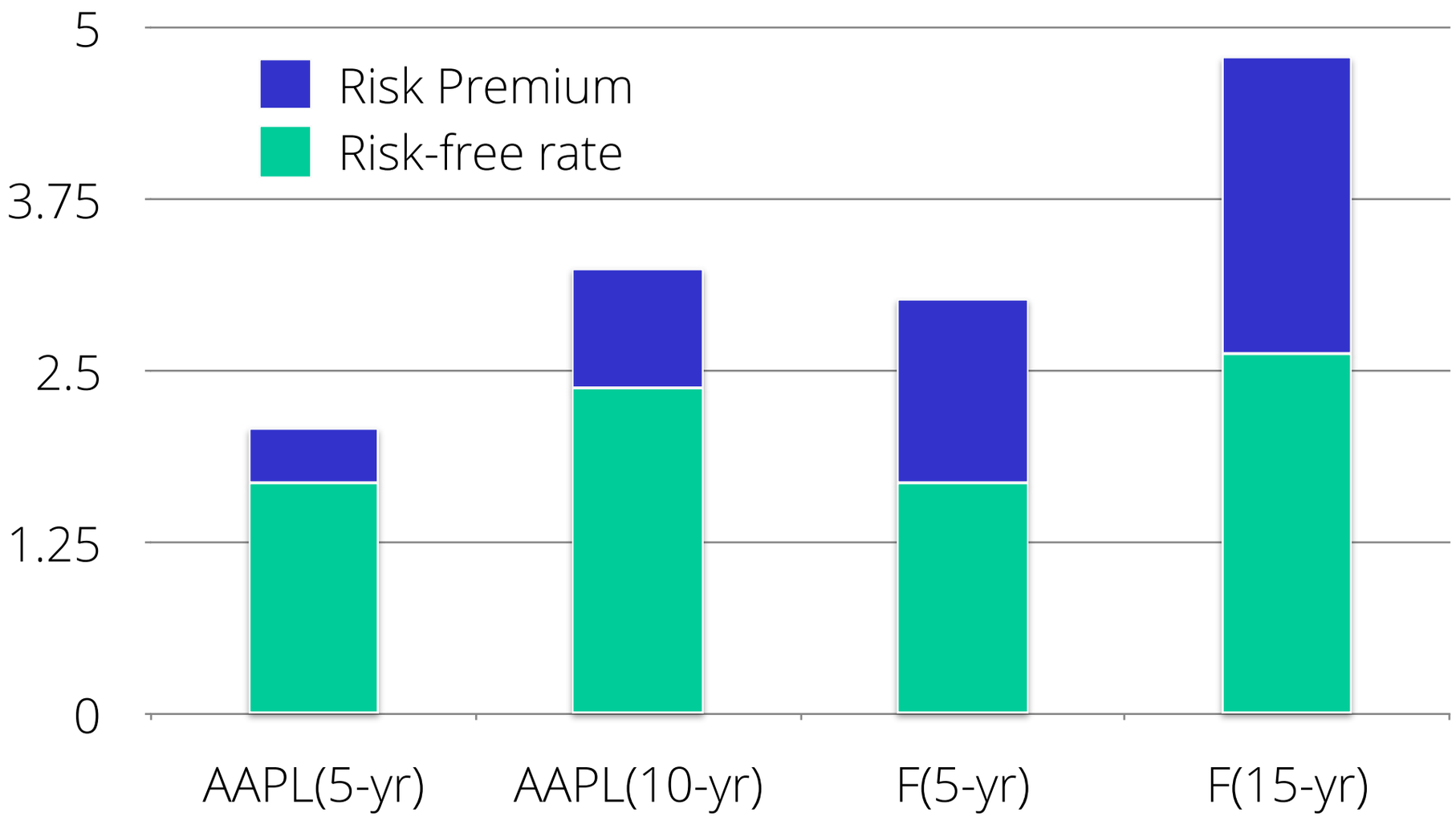
Real World Considerations

Details on Present Value-Yield Relationship

- Suppose that a bond is first sold at the same price as its face value.
- The coupons are fixed interest payments, so they **imply** a rate of return.
- Later, traders can exchange the bond at higher or lower prices. The coupons are still fixed, so there is still an implied rate of return for each price.
- The opposite is also true: if I told you what return I wanted to earn, you could tell me the price.

Comparison: AAPL v F

- Recall that **Yield = Risk-free rate + Risk Premium**



Bond Price Quotes

- Quirky reporting conventions:
  - Often in 100s (i.e. true price divided by 10).
  - May or may not reflect **accrued interest**.
    - Accrued interest = coupon x (days / period)
    - With accrued interest is called **cash price**.
    - Without is called **clean price**.
    - Clean price = cash price - accrued interest
- FINRA prices as **clean**; FINRA yields are **cash**.

Semiannual Bonds

- In reality, most bonds pay semiannual coupons.
- **Example** What would you pay for a semiannual coupon bond with a 10% coupon and three years to maturity. Assume a 10% required rate of return.

Semiannual Bonds (cont.)

- The required rate is 10% per year, but payments are every six months. We need the periods to agree.
- Calculate the periodic rate:
  - $(1 + R_{period})^2 = 1 + R_{effective}$
  - So $R_{period} = (1 + R_{effective})^{1/2} - 1 = (1.10)^{1/2} - 1 = 0.048$
  - (Sanity check: Does 4.8% make sense? Yes—should be a little bit smaller than half of the annual rate).
- Now we can use this to discount the cash flows.

Semiannual Bonds (cont.)

Summary

- Bond valuation is a straight-forward application of time value of money.
  - The value of any asset is the present value of its future cash flows.
  - The discount rate is the required return.
- The yield of a bond is the discount rate that sets the present value equal to the price paid.
  - You can solve for the price if you know the yield, and vice-a-versa.