

1 Ch. 9 Interest Rates

- Sources of information for interest rates
 - Short vs. long-term quotes
- Various ways to quote interest rates
- What are the forces that determine interest rates?

2 Money Market Interest Rates

- Prime rate is the benchmark interest rate charged to banks' best customers for short-term loans
- Call money is the interest rate charge to brokers
- Commercial paper (CP)
 - Short-term, unsecured debt (well known issuers only)
 - Escapes SEC registration if less than 270 days
- Negotiable certificates of deposit (CDs)
 - Time deposits
 - Penalties apply if funds are withdrawn early

3 Federal Funds Market (or Fed Funds)

- Banks are required to hold some reserves with the Federal Reserve
- Bank with excess reserves loan (sell Fed Funds) to banks with too few reserves
 - Interest rate is fed funds rate
- Most activity is on an overnight basis
- Fed “targets” this rate

4 Other money market instruments

- Bankers' acceptances are used in foreign trade
 - Like a letter of credit
 - Can be sold
- Eurodollars are dollar-denominated deposits in non-US banks
 - Not just in Europe

5 More Money Market Securities

- LIBOR (London Interbank Offer Rate)
 - Loosely, international Fed Funds
 - Interest rate for dollar loans/deposits
 - International reference interest rate
- Repurchase agreements (repos)
 - Alternative to fed funds market
 - Amounts to short-term, collateralized loan
 - Lender buys securities and agrees to resell

6 Treasury Bills (T-bills)

- Leads all other short-term credit markets
- Issued by the US Treasury and backed by the US Government
- Regularly scheduled auctions
- T-bills are discount notes

7 Quoting Money Market Interest Rates

- Each market has a different method to quote prices
- Equates to different ways to present interest rate information
- T-bill quotes are annualized discount from face value
 - Called Bankers' discount rate
- Bond equivalent yield is APR

8 Zero Coupon Bonds

- Aka, Pure discount bonds
- Single cash flows – at maturity
- US Treasury STRIPs created from coupon bonds

9 Pricing STRIPs

- “Yields” are interest rates (discount rates) stated as APR, compounded semiannually
- Price is PV of single cash flow
- Yield is also known as a spot rate
- r_n is the spot rate (or discount rate) for single cash flows at time n

10 Term Structure of Interest Rates

- Depicts relationship between spot rates and maturity
 - Other characteristics held constant (e.g., default risk)
- NOTE: “Yield curve” and “term structure” are terms that are (loosely) used interchangeably
 - They are related, but different
 - Chapter 10 we'll define yields

11 Unbiased (or Pure) Expectations Theory

- Assumes the yield curve is a reflection of market expectations of future interest rates
- No other systematic explanations predicting shape
- Yield curve is then a result of expectations and the forces of supply and demand

12 Spot vs. Forward rates

- The “spot rate” is the interest rate that is observed today
 - 1 year spot rate, 2 year spot rate, etc
- The “forward rate” is a rate that is agreed to today that applies to a future period
 - The one year rate, one year from now
 - The two year rate, three years from now

13 Forecasting future interest rates under unbiased expectations

- We can determine the expected interest rate (implied forward rate) from relationship of spot rates
- What is the expected one year interest rate, one year from now if the one year spot rate is 3% and the two year spot rate is 4%?
 - In other words, what is the forward rate?

14 Liquidity Premium Theory

(or Maturity Preference)

- Predicting long term yields is more risky
- Long term yields must include a risk premium or maturity premium
 - Increasing with maturity
- Called liquidity theory because investors are believed to prefer short term securities over long term uses of savings
 - Must entice them to save long term
- Explaining prevalence of normal yield curve: expectations theory plus maturity premium

15 Market Segmentation

- Institutions are “forced” into a certain maturity
 - Banks are main users of short-term funds
 - Life insurers and pension funds are users of long-term funds
- Supply and demand among suppliers/users determines market rates and shape of term structure

16 Explaining nominal interest rates

- Nominal rates is the quoted rate
- Comprised of three main parts
 - 1) Real (inflationless) rate of interest (r) – loanable funds theory
 - 2) Inflation premium (IP)
 - 3) Risk premia
 - Liquidity (LRP), default (DRP), and maturity (MP)

17 Risk premia

- Different financial markets and securities have different interest rates
 - Levels/movement of risk premia vary
- DRP compensates for possibility of default
 - If unable to pay back loan
 - Measured by premium over Treasuries
- LRP exists if resale is difficult
- MP is maturity premium

18 Ch. 10 Bond Valuation (to p. 345)

- Compute prices of bonds given yields
 - Equivalently compute yields given prices
- Distinguish different kinds of yields (call, realized)
- Determine the sensitivity of bond prices to interest rate risk
- How yields vary by strength of issuer

19 Bond basics

- Bonds are debt
 - Issuer is borrower and investor/buyer is creditor
- Instead of interest at the end, bonds pay periodic interest called “coupons”
 - Usually semiannual coupons
- Face value = underlying principal of the loan
- Maturity date = when face value is paid back

20 Pricing Bonds

- Discount the cash flows
 - PV of coupons plus PV of FV
- Bonds are negotiable debt
 - What interest rate do investors charge for the loan?
- NOTE: i is the periodic interest rate

21 Determining the Discount Rate

- How can we determine the “market” rate?
- We only see transaction prices
- Prices paid by investors imply an interest rate that can be used to discount all cash flows
 - Called the “yield-to-maturity”, YTM, or yield
- Assume that the yield is compounded semi-annually

22 Coupons vs. Yields

- At issue, coupon is set near required interest rate (yield)
 - If yield is 8.53%, coupon probably 8.50%
- After issue, interest rates (yields) change
- Coupon > yield => Premium bond (Price>FV)
- Coupon < yield => Discount bond (Price<FV)
- Coupon = yield => Par bond (Price=FV)

23 Callable Bonds

- Allows issuer to redeem bond prior to maturity (“call the bond”)
- Typically there is call protection in the first few years
- Usually “call price” includes a “premium” that declines over time
- Bondholder owns a bond and has sold a call

24 Callable Bond Example:

Why call a bond?

- Suppose in 1994, IBM issues 30 year bonds with a face value of \$1,000 that pays a coupon of 7% and yields 7%
 - Price = \$1,000
- Callable after ten years at par plus 10% but the call premium declines by ½% per year

25 In 2004...

- Yields have dropped to 5%
- Value of non-callable bond is \$1,251
- But the call price is \$1,100
- IBM can issue new 20 year bonds at 5% to pay off old bonds (refinance)
- Annual savings in interest:

26 Investor’s point of view

- The issuer likes call options because it can reduce interest costs
- The investor is put in a lose-lose situation:
 - If interest rates increase, the bond price declines
 - If rates decrease, the price appreciation is capped at call price

- 27 **Yield to call**
- In YTM, we calculated the yield assuming the bond was held to maturity
 - Using yield to call, assume that the bond is called at the first possible call date
 - Get call price on first call date instead of face value at maturity
- 28 **Accrued Interest**
- Suppose that a 5%, \$1,000 bond matures on December 15 and today is March 19
 - Kurt sells the bond to Belinda
 - Accrual basis in accounting
- 29 **Dividing the coupon**
- 30 **Example continued**
- Kurt owned the bond for 94 out of 182 days
- 31 **Bond movements over time**
- If required yield stayed the same, how would bond price change?
 - First, what is value at maturity?
- 32 **YTM vs. Realized Yield**
- 33 **Interest rate sensitivity**
1. As interest rates go up, bond prices go down
 2. The price/yield curve is convex
 3. Longer maturity bonds have greater interest rate sensitivity
 4. Higher coupon bonds have lower interest rate sensitivity
- 34 **Macaulay Duration**
- Weighted average time to maturity
 - Weights are PV of the cash flows
 - Let's look at a 2-year, 8%, \$1000 par bond
- 35 **Using Duration to Predict Price Changes**
- Modified duration (MD) is Macaulay duration (D) divided by $(1+y)$
 - To predict changes in bond prices based on duration
- 36 **Rules of Duration**
- Macaulay duration of zero coupon bonds are equal to its maturity
 - Holding all else constant:
 - Duration increases with bond maturity
 - Duration decreases as the coupon increases
 - Duration decreases as YTM increases
- 37 **Default risk (pp.575-577)**
- Default means failure to meet obligations of interest and/or principal
 - Firms that are financially weak have higher default risk

- Treasury bonds are default free

38  **Bond ratings**

- Bonds are given ratings based on the (estimated) ability of firms to meet obligations
- Assist investors in assessing default risk
- Moody's and Standard and Poor's (S&P) are two rating agencies
- S&P: AAA, AA, A, BBB, BB, B, CCC, ..., D
- Moody: Aaa, Aa, A, Baa, Ba, B, Caa, Ca, C, D
- BBB and above: investment grade
- BB and below: speculative grade or junk