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Chapter 7

Finance 300

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Bond Definitions

- Bond: a debt security issued by companies or government agencies
- **Par value** (**face value**): principal repaid, usually $1,000 per bond;
  - Discount bond: price < par value;
  - Premium bond: price > par value
- **Coupon rate**: annual interest rate
- **Coupon** payment: stated interest payment
- **Maturity** date: specified date on which principal is repaid
- **Yield** or **Yield to Maturity** (**YTM**): *market* interest rate (= required return) on a bond (or Rate implied by the current bond price)

Bond Valuation Principle

- Primary Principle:
  - *Value of financial securities = PV of expected future cash flows*
- Bond value is, therefore, determined by the present value of the coupon payments plus the present value of the par (face) value
- Bonds of similar **risk** will be priced to yield the same **return**.
- If you know the price of one bond, you can estimate its YTM and use that to find the price of another bond of similar risk.
- This is a useful concept that can be transferred to valuing assets ***other than bonds.***
- Interest rates are inversely related to present values (i.e., prices).

The Bond Pricing Equation

$$\text{Bond Value} = C\left[\frac{1-\frac{1}{(1+r)^t}}{r}\right] + \frac{FV}{(1+r)^t}$$

Bond Price = PV of coupons + PV of face value

Formula => TVM:

value or price => PV; r => I% ; C => PMT, F (or FV) => FV

Bond Valuation Example 1: Valuing a Discount Bond with Annual Coupons

- Consider a bond with a coupon rate of 10% and annual coupons. The par value is $1,000, and the bond has 5 years to maturity. The yield to maturity is 11%. What is the value of the bond?

Bond Valuation Example 2: Valuing a **Premium Bond** with Annual Coupons

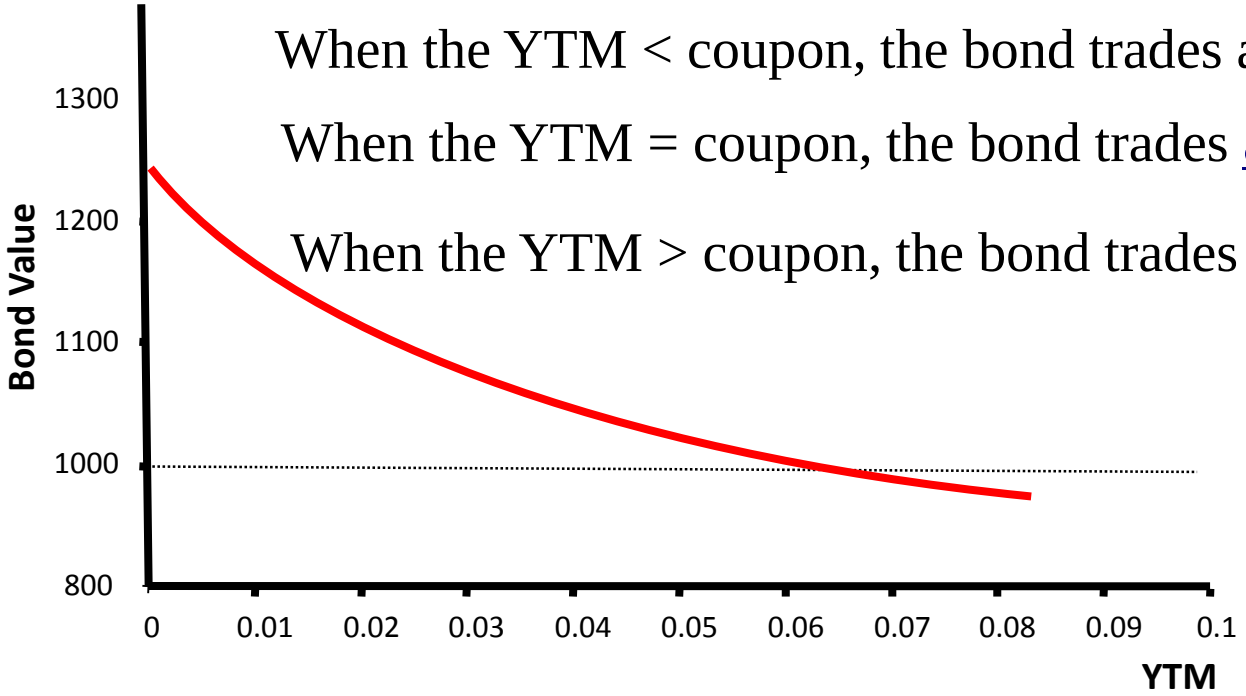
- Suppose you are reviewing a bond that has a 10% annual coupon and a face value of $1,000. There are 20 years to maturity, and the yield to maturity is 8%. **What is the price of this bond? Why do we call it a premium bond?**

Bond Valuation Example 3: Calculating YTM for a *Semiannual* Coupon Bond

- Suppose a bond with a 10% coupon rate and semiannual coupons, has a face value of $1,000, 20 years to maturity and is selling for $1,197.93.
- What is the semiannual coupon payment?

- How many **periods** are there till the bond matures?

Relationship Between YTM and Bond Value



When the YTM < coupon, the bond trades at a premium.

When the YTM = coupon, the bond trades at par.

When the YTM > coupon, the bond trades at a discount.

Bond prices and market interest rates move in opposite directions

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Current Yield vs. Yield to Maturity

- Current Yield = annual coupon ÷ price
- Yield to maturity = current yield + capital gains yield
- Example: A 10% coupon bond with semi-annual coupons, face value of 1,000, and 20 years to maturity is selling for $1,197.93

Current Yield vs. Yield to Maturity

- Continue with the same example: A 10% coupon bond with semi-annual coupons, face value of 1,000, and 20 years to maturity is selling for $1,197.93
- Assuming no change in YTM, price in one year = 1,193.68
  - N=38, PMT = 50, FV = 1000, I% = 3.99999, solve for PV
- Capital gain yield = (1193.68 – 1197.93) ÷ 1197.93 = -0.35%
- YTM = 8.35% - 0.35% = 8%.
- **Current yield > YTM in this case because CY ignores built-in loss from the premium price.**

- **YTM= Capital yield + capital gains yield**

Bond terms and features

- Securities: A corporate issues both debt and equity securities
  - Equity securities: represent ownership interest and has a residual claim. Think stocks.
  - Debt securities: represents something that must be repaid. Think bonds.
- The person or firm making the loan is called the creditor or lender
- The person or firm borrowing the money is called the debtor or borrower

Differences in Debt vs Equity

1. Debt is an NOT an ownership interest. (Creditors have no voting power)
2. Payment of interest is considered “cost of doing business” and is thus tax deductible. (Dividends are not)
3. Unpaid debt is a liability to the firm. Therefore cost of issuing debt is financial failure(bankruptcy) causing liquidation or reorganization. Equity is not a liability.

Fun fact: Firms try really hard to make/create securities that have features of equity but are treated like debt.

Long-term Debt

Promises made by the issuing firm to pay the principal when due and to make timely interest payments on the unpaid balance.

- One-year typically distinction between short-term and long-term
- Debt securities typically called notes, debentures, or bonds.
- Typically issue maturities with <10 years= Note and >10years=Bonds
- Two types of forms: Public Issue and Privately placed.
  - We focus on public issue
  - Terms of privately placed long term debt determined by the parties involved.

The Indenture

The written agreement between the corporation and the lender detailing the terms of the debt issue.

- Trustee represents bondholders and must
  - Ensure terms are obeyed
  - Manage sinking fund (described later)
  - Represent bondholder in default
- This is a legal document
- Generally includes: Basic terms of the bond, total amount of bonds issued, description of property used as security(collateral), repayment arrangements, call provisions, protective covenants.

Terms of a bond

Registered form: Registrar of the company records ownership of each bond; payment is made directly to the owner of record.

Bearer form: The bond is issued without record of the owner's name; payment is made to whomever holds the bond.

Security

- **Collateral:** securities that are pledged as security for payment of debt. (Commonly used to refer to asset pledges on a debt.)

- **Mortgage securities:** Secured by a mortgage on a real property of the borrower(your house).
  - Legal document describing mortgage is called Mortgage trust indenture or trust deed
  - Blanket mortgage: pledges ALL the real property owned by the company. (Land and fixtures not cash and inventories)

Debenture

Unsecured bond for which no specific pledge of property is made.

- Referred to as Note if original maturity is less than 10 years.
- Only claim is on property not otherwise pledged.

Seniority

Preference in position over other lenders.

- Labeled as senior or junior
- Subordinated: paid off only after specified creditors have been compensated.

Note: Debt CANNOT be subordinated to equity.

Repayment

- Bonds can be repaid:
  - At maturity
  - Repaid in part or in entirety before maturity
- **Sinking fund:** Account managed by the bond trustee for the purpose of repaying the bonds.
  - Firm makes annual payments to the trustee, who then uses funds to retire portion of the debt
  - Arrangements for repayment come in many different forms.

Call provision

An agreement giving the corporation the option to repurchase a bond at a specified price prior to maturity.

- Corporate bonds typically callable
- **Call premium:** Difference between call price and stated value (par value)
- **Deferred call provision:** Prohibiting the company from redeeming a bond prior to a certain date.
- **Call protected bond:** A bond that, during a certain period, cannot be redeemed by the issuer.

Protective Covenants

A part of the indenture limiting certain actions that might be taken during the terms of the loan

- Usually to protect investors
- Two types: Positive covenants (thou shalt) and negative covenants (thou shalt not).
- Ex. Negative: limit dividends, cannot pledge assets to other lender, cannot do a merger, cannot sell or lease major assets without approval, cannot issue additional long term debt
- Ex. Positive: Must maintain certain level of working capital, furnish audited financial statements, maintain securities.

Bond Ratings

- Debt rating: Assessment of the creditworthiness of the corporate issuer.
  - Based on how likely the firm is to default and protection creditors have in the event of default
- Rated by Standard & Poor's (S&P) and Moody's
  - High grade is AAA(Aaa) (fairly rare)
  - AA(Aa) much more common, very good quality debt(i.e. low risk)
- Investment-Quality grade: High: AAA, AA Medium: A, BBB
- Speculative (Junk) grade: BB, B, CCC, CC, (Very low grade:C, D)

Types of Bonds -Government

- So far “plain vanilla” corporate bonds
- US government is biggest borrower in the world
  - Currently 19.26 Trillion (about 59,560 per citizen or 161,000 per taxpayer)
- Government debt known as Treasury Bill(< 1 year), Note(1-10 years) or Bond(>10 years)
  - Maturities range from 2 to 30 years
- No default risk: assume US gov’t will pay its debts
- Exempt from state taxes (only pay federal)

Municipal (Munis)

- These do have default risk
- Coupons are exempt from FEDERAL income tax

Ex Taxable US treasury bond vs Tax Exempt Muni

Assume

Taxable bond 8%

Muni 6%

After taxes

Taxable bond: 8% X (1-.40)=4.8%

Muni 6%

Muni is preferred is this scenario!

Zero coupon bonds(Zeroes)

A bond that makes no coupon payments and is thus initially priced at a deep discount.

Un-Fun fact: Still pay taxes as if you were earning interest

Year	Beginning Value	Ending Value	Implicit Interest Expense	Straight-Line Interest Expense
1	$508.35	$ 582.01	$ 73.66	$ 98.33
2	582.01	666.34	84.33	98.33
3	666.34	762.90	96.56	98.33
4	762.90	873.44	110.54	98.33
5	873.44	1,000.00	126.56	98.33
Total			$491.65	$491.65

Floating rate bonds (floaters)

- Coupon rates are adjustable
  - Adjustments made off of some base rate
- **Put provision:** Holder has the right to redeem the note at par on the coupon payment date after some specified amount of time
- **Collar:** Coupon rate has a floor and a ceiling. Coupon rate is "capped"
- **Inflation linked bond:** coupons adjusted according to rate of inflation ex. TIPS (Treasury Inflation Protected Securities)

Some other terms

Warrant: gives the buyer of the bond the right to purchase shares of stock in the company at a fixed price

Income bonds: coupon depends on income of corporation

Convertible bond: can be swapped for a fixed number of shares

Put bond: allows holder to force issuer to buy back the bond at a stated price.

Structured notes: bonds based on stocks, bonds, commodities, or currencies, Ex. Based off stock index.

Bond Market

What is the largest securities market in the world?

U.S. Treasury market (in terms of trading volume)

- Bonds are traded OTC
- The bond market is NOT transparent (don't typically observe prices and volume)
- TRACE (Trade Reporting and Compliance Engine)
  - Required reporting of trade info
  - FINRA (Financial Industry Regulatory Agency)
    - Provide daily snapshot of TRACE

Treasury Quotation

Maturity	Coupon	Bid	Asked	Chg	Asked yield
5/15/2030	6.250	136.8359	136.9141	-0.7813	3.289

- What is the coupon rate on the bond?
- When does the bond mature?
- What is the bid price? (The price the dealer is willing to pay)
- What is the ask price? (The price the dealer is willing to take)
- How much did the price change from the previous day?
- What is the yield based on the ask price?

Quoted Bond prices

Clean Price : Price of a bond net of accrued interest (price that is typically quoted.

Dirty Price: price of bond including accrued interest. Known as full or invoice price. Price buyer actually pays

Accrued interest: taking fraction of time that has passed between coupons and multiplying by next coupon.

Ex:

Inflation and interest rates

Real vs. Nominal

Nominal: Have not been adjusted for inflation

Real: Have been adjusted for inflation

Reese's example!!

Again

Nominal: percentage change in the number of dollars you have

Real rate: Percentage change in how much you could buy with your dollars. (percentage change in buying power.

Fisher effect

The relationship between nominal returns, real returns, and inflation.

$$1 + R = (1 + r) \times (1 + h)$$

Where:

R = Nominal rate

r = Real rate

h = Inflation rate

Example

- If we require a 10% real return and we expect inflation to be 8%, what is the nominal rate?

Example with PV

Want to withdraw $25,000 worth of purchasing power each year for next 3 years. Inflation rate is 4%. Nominal rate is 10% . What is the present value?

Term Structure of Interest Rates

Relationship between nominal interest rates on default free pure discount securities and time to maturity. "Pure time value of money".

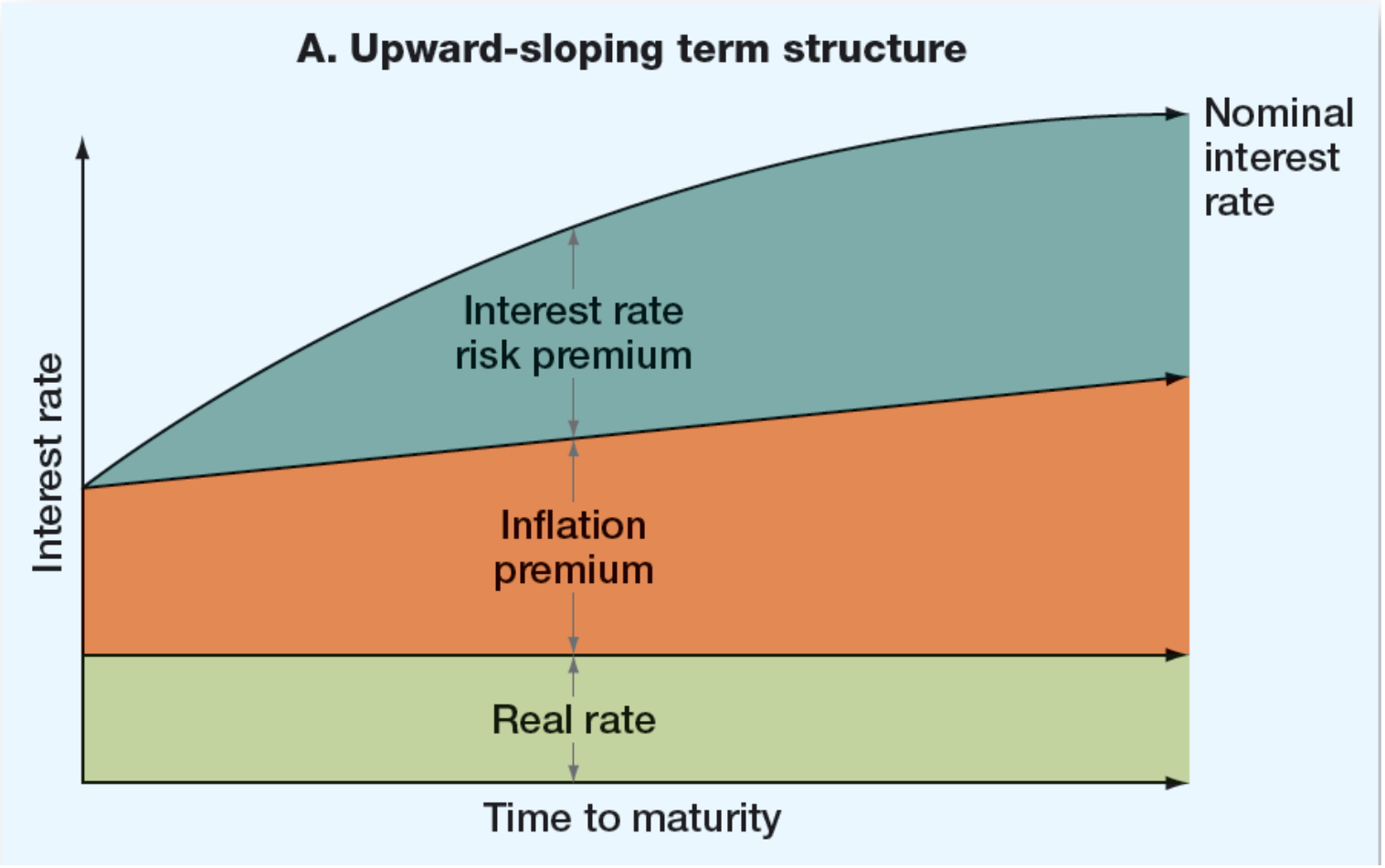
- *Upward sloping(normal):* long-term rates are higher than short term rates (most common)
- *Downward sloping(inverted):* Short-term rates are higher than long term rates.

Note: Based on pure discount bonds

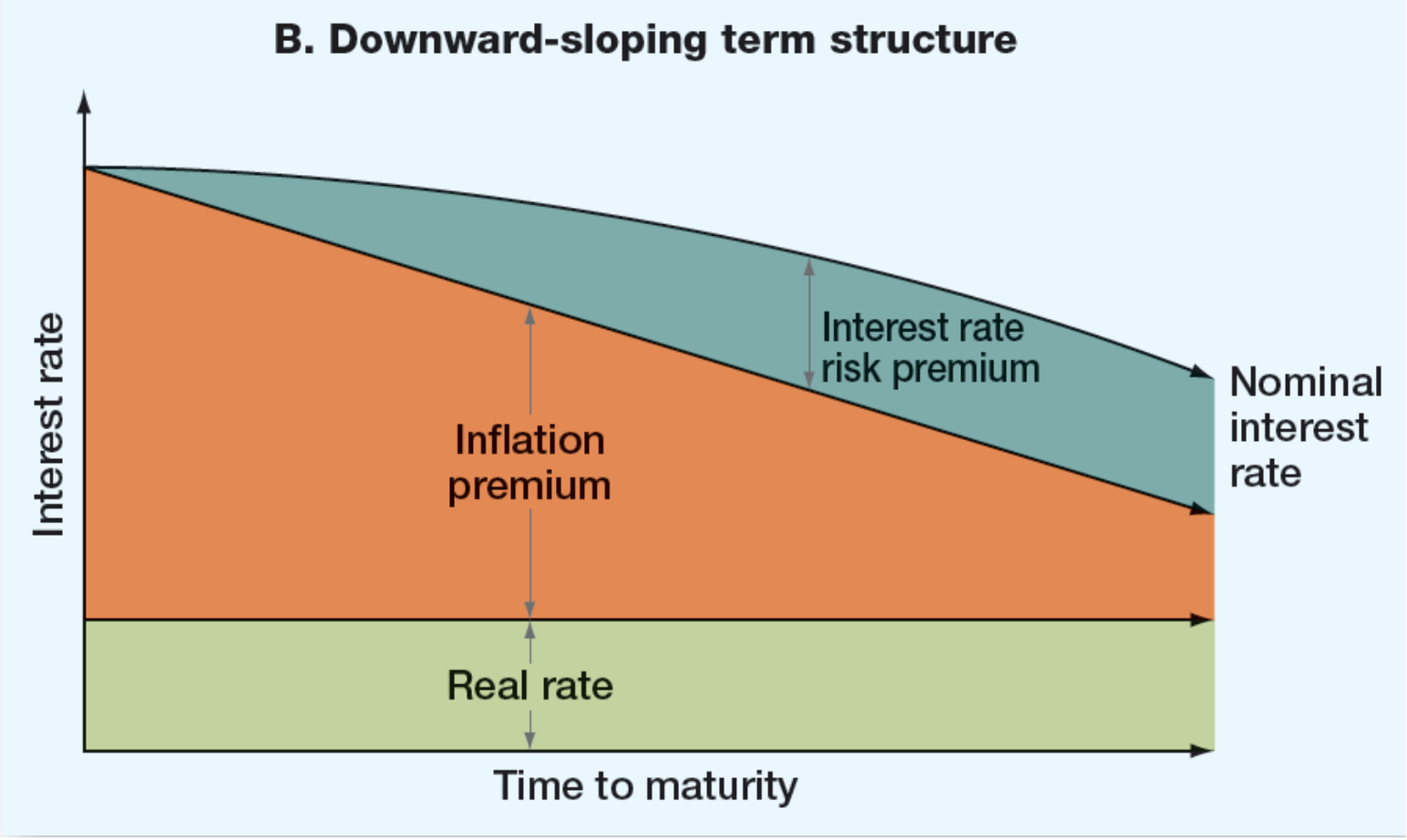
Components of Term structure

1. Real rate of interest: compensation investor demand for forgoing the use of their money. (Pure TVM)
    1. Primarily influences the level not the shape
2. Inflation premium: compensation investors demand for reduction in purchasing power due to inflation (expected future inflation).
    1. Expectation high(low) leads to upward(downward) sloping
3. Interest rate risk premium: compensation for holding long-term bonds and bearing risk of loss resulting from change in interest rates
    1. Increases at a decreasing rate

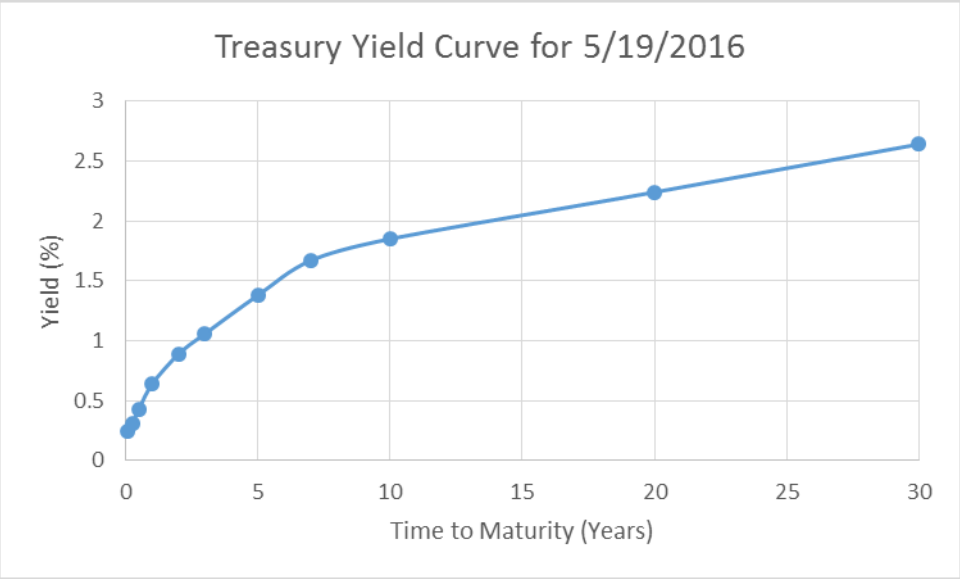
Term Structure Graphs - Upward



Term Structure Graphs - Downward

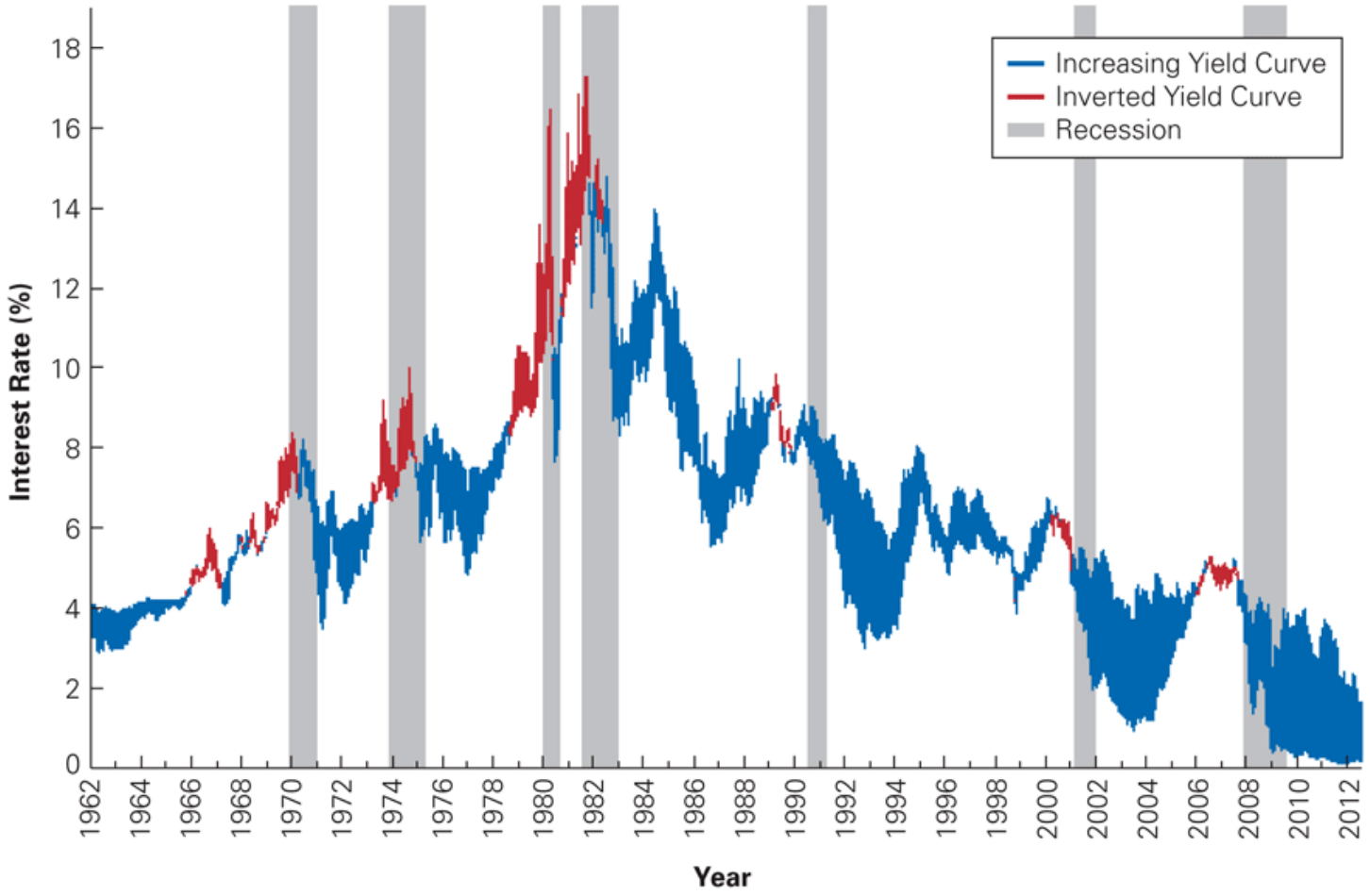


Treasury Yield Curve



Based on coupon bond yields (Only difference to term structure)
Three components: Real rate, expected future inflation, interest rate risk premium.
Three key features: Default free, taxable, highly liquid.

Yield Curve and Economy



What about risk factors?

Default risk premium(credit risk): compensation for possibility of default. Demand a higher yield as risk won't receive promised payments.

Fun fact: "Junk" bonds are called high-yield (Marketing tactic) but really its high promised yield.

Taxability premium: compensation for unfavorable tax treatment.

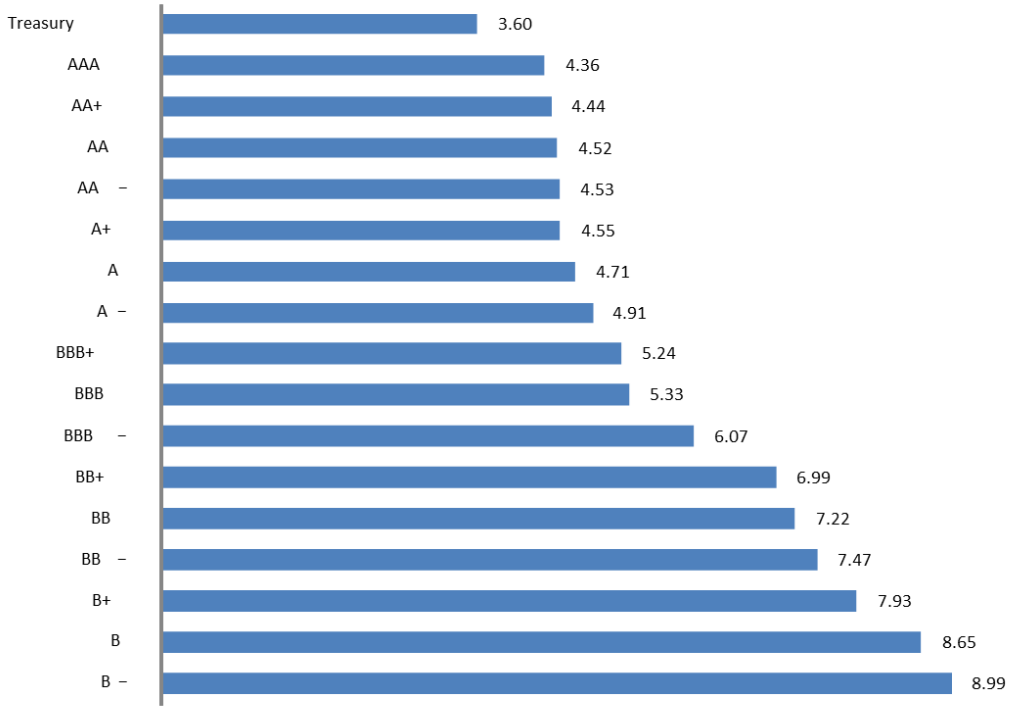
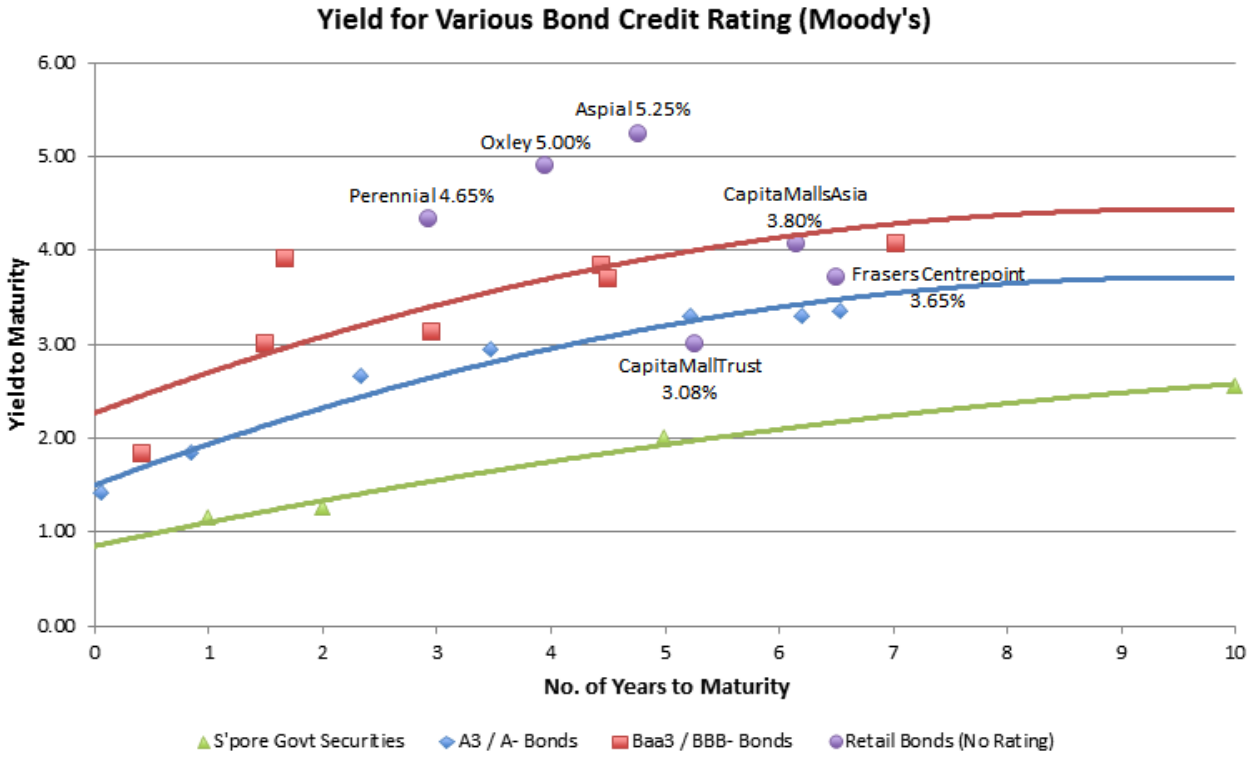
Liquidity premium: compensation for lack of liquidity (some bonds are easily tradeable without losing value)

Default Premiums and YTM

Yield to Maturity by Debt Rating

10 - Year Bonds, Monthly Average

percent, 2009



Yield for Different Bond Ratings