INTEREST RATES AND BOND VALUATION

CHAPTER 7

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KEY CONCEPTS

1. Bond valuation (pricing a bond)
2. Bond terms and features
3. Inflation and Interest rates (Real vs Nominal)
4. Term Structure of interest rates

INTRO TO BONDS

A debt security issued (sold) by companies or government agencies

Key terms:

- Par Value (face value):principal repaid, usually $1,000 per bond;
  - Discount bond: price $<$ Face Value
  - Premium Bond: price $>$ Face Value
- Coupon rate: annual interest rate
- Coupon payment: stated interest payment
- Maturity date: specified date on which principal (face value) is repaid
- Yield to Maturity (YTM): market interest (required return) on a bond. OR the rate implied by the current bond price.

BOND VALUATION

BOND VALUATION

Good News! This is just a TVM problem.

Primary principle of valuation: value of any financial security is equal to the present value of expected future cash flows.

Bond Value=PV of Coupons + PV of Face Value

N= Time to Maturity

Rate(I%)= Yield to maturity

Present Value(PV)= Price

Payment(PMT)= Coupon payment= coupon rate*face value

Future Value (FV)= Face value or par value

EXAMPLE 1

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?

N=

Rate(I%)=

Present Value(PV)=

Payment(PMT)=

Future Value (FV)=

Try solving using PV formulas.

EXAMPLE 1

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?

N= 20

Rate(I%)= 8

Present Value(PV)= -1196.36

Payment(PMT)= 1000*.10=100

Future Value (FV)= 1000

Try solving using PV formulas.

EXAMPLE 2 - YOUR TURN

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 12%. What is the price of this bond? Why do we call it a discount bond?

EXAMPLE 3 SEMI-ANNUAL COUPONS

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 YTM?

N= 20x2=40

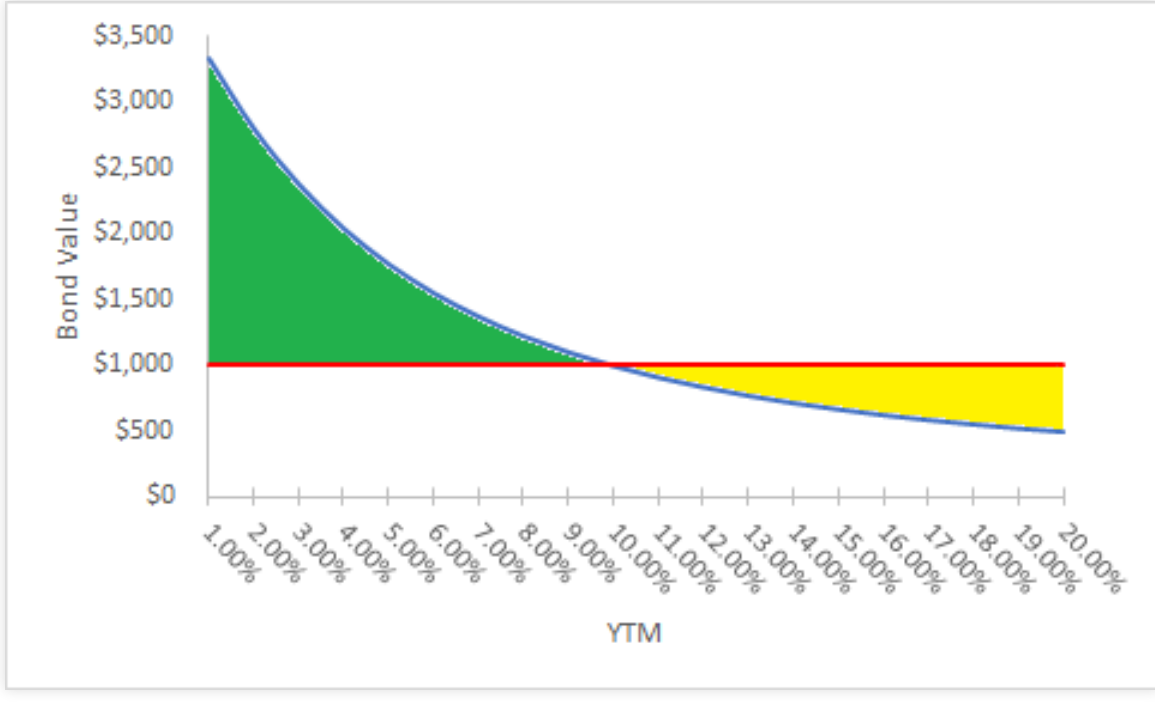
Rate(I%)= 3.99 x 2 = 8

Present Value(PV)= -1197.93

Payment(PMT)= (1000*.10)/2=50

Future Value (FV)= 1000

BOND PRICES AND INTEREST RATES



Green: YTM＜Coupon Bond is trading at a ?

Yellow: YTM＞ Coupon Bond is trading at a ?

Intersection: YTM=Coupon Bond is trading at ?

Bond prices and market interest rates move in opposite directions!

INTEREST RATE RISK

Risk for bondholders from fluctuating interest rates.

All else equal..

- the longer the time to maturity, the greater the interest rate risk.
- the lower the coupon rate, the greater the interest rate risk.

CURRENT YIELD VS YTM

$$YTM = CurrentYield + CapitalGainsYield,$$

where:

$$CurrentYield = \frac{AnnualCouponPmt}{Price}$$

$$CapitalGainsYield = \frac{P_1 - P_0}{P_0}$$

CURRENT YIELD EXAMPLE

Consider a 10% coupon bond with semi-annual coupons, face value of 1,000, and 20 years to maturity is selling for $1,197.93. What is the Current Yield, Capital Gains Yield, Yield to Maturity?

BOND TERMS AND FEATURES

THE PLAYERS

1. The person or firm making the loan is called the creditor or lender.
2. The person or firm borrowing the money is called the debtor or borrower.

The money being lent(borrowed) is called a debt security.

DEBT VS EQUITY

- Debt is an NOT an ownership interest. (Creditors have no voting power)
- Payment of interest is considered “cost of doing business” and is thus tax deductible. (Dividends are not)
- 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.

APPLE EXAMPLE

BOND FORMS

1. Registered form: Registrar of the company records ownership of each bond; payment is made directly to the owner of record.
   - Example: Interest is payable semiannually on July 1 and January 1 of each year to the person in whose name the bond is registered at the close of business on June 15 or December 15, respectively.
2. Bearer form: The bond is issued without record of the owner's name; payment is made to whomever holds the bond.

SECURITY

What is used to protect the bondholder

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

BOND TYPES

GOVERNMENT

- US government is biggest borrower in the world
  - Currently 21.5 Trillion (about 65,441 per citizen or 176,475 per taxpayer)
- Government debt known as Treasury Bill(< 1 year), Note(1-10 years) or Bond(>10 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

Example: Taxable US treasury bond vs Tax Exempt Muni

Bond Type	**Pre-tax return**	**After-tax return**
Taxable Bond	8%	8%(1-.40)=4.8%
Muni Bond	6%	6%

ZERO COUPON BONDS (ZEROES)

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

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 (tied to an interest rate index)
- Most floaters have the following:
  1. Put provision: Holder has the right to redeem the note at par on the coupon payment date after some specified amount of time
  2. Collar: Coupon rate has a floor and a ceiling. Coupon rate is "capped"
- Example: Inflation linked bond: coupons adjusted according to rate of inflation ex. TIPS (Treasury Inflation Protected Securities)

OTHER TYPES/FEATURES

Note: a bond can have many features (only limited by imagination of parties involved.

- 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.

MORTGAGE BACKED SECURITIES

THE BOND MARKET

OVERVIEW

- What is the largest securities market in the world?
  - U.S. Treasury Market (in terms of trading volume)
- Bonds are traded over-the-counter
- Bond market is NOT transparent
- TRACE
  - Trade Reporting and Compliance Engine
  - Provided by FINRA (Financial Industry Regulatory Agency)

TREASURY QUOTATIONS

Maturity	Coupon	Bid	Asked	Chg	Ask Yiel
2/15/2019	8.875	102.3594	102.3750	-0.0156	2.32

- 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?

Current Government Bond Yields

INFLATION AND INTEREST RATES

REAL VS NOMINAL RATES

- Nominal: Have not been adjusted for inflation
- Real: Have been adjusted for inflation

REESE'S EXAMPLE

- 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.

$1 + R = (1 + r)x(1 + h)$, 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? (HINT: use nominal cash flows and nominal rate or real cash flows and real rate)

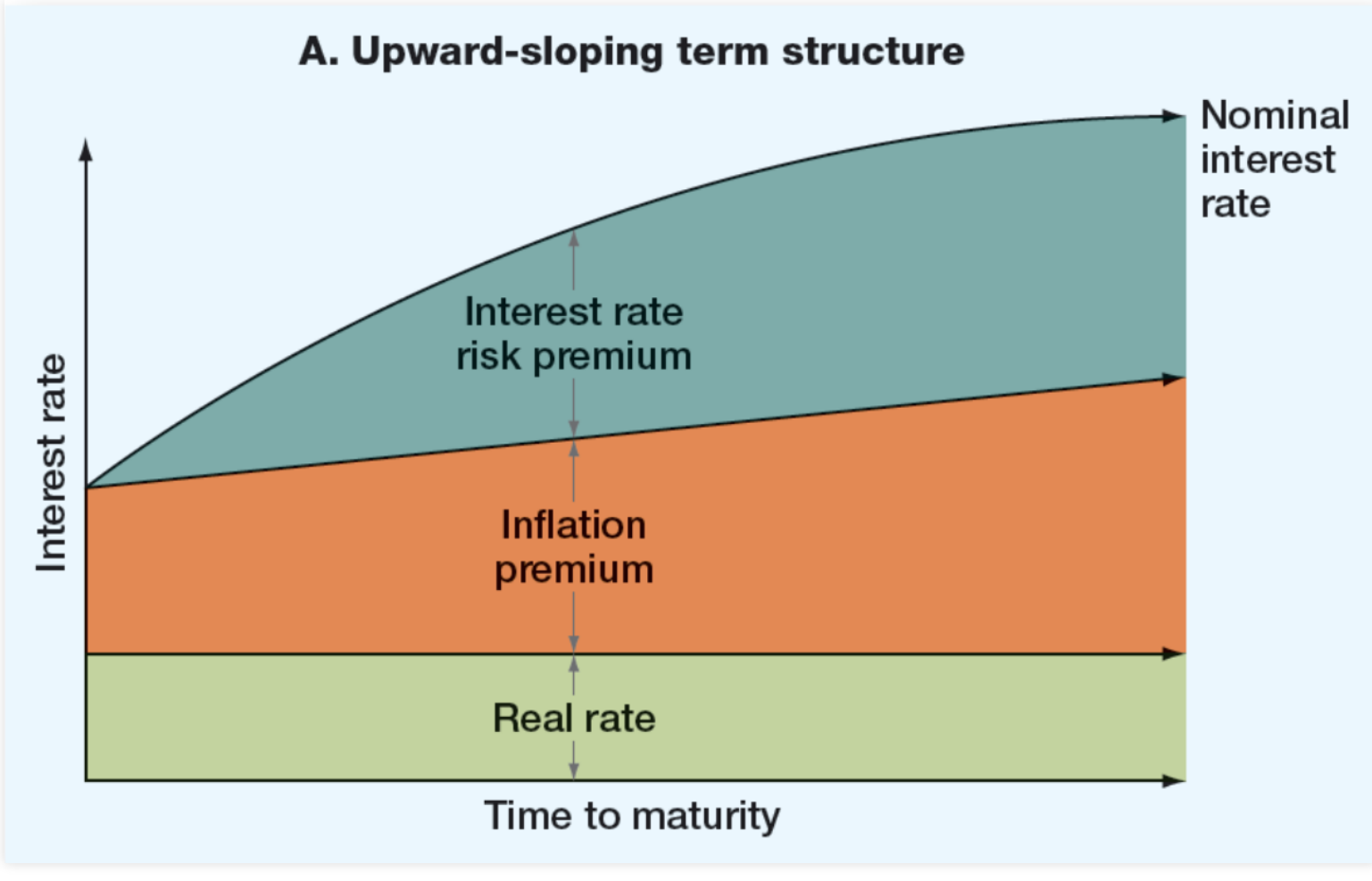
DETERMINANTS OF BOND YIELDS

TERM STRUCTURE OF INTEREST RATES

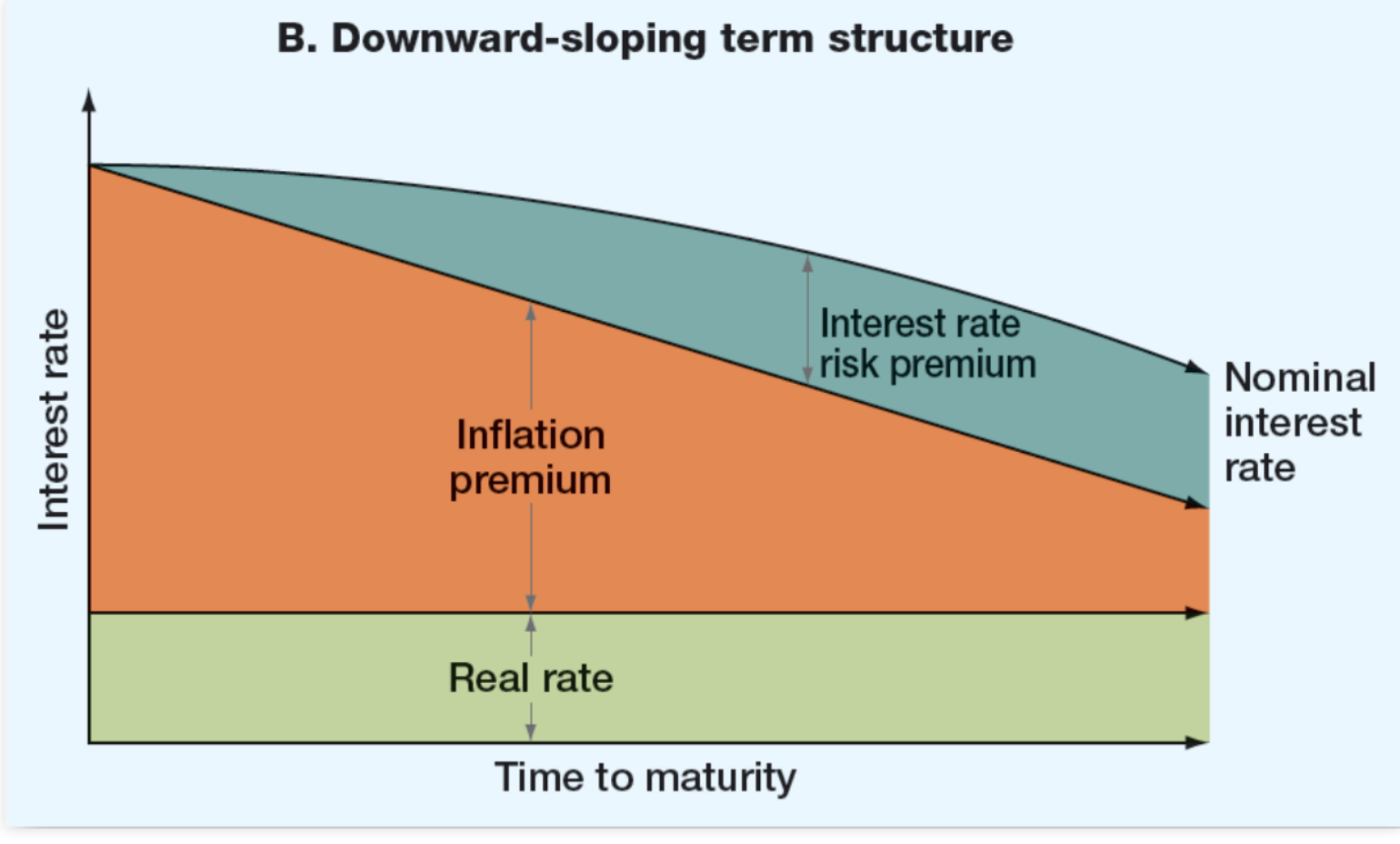
Relationship between nominal interest rates on default free pure discount securities and time to maturity. "Pure time value of money".

- 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.

UPWARD SLOPING



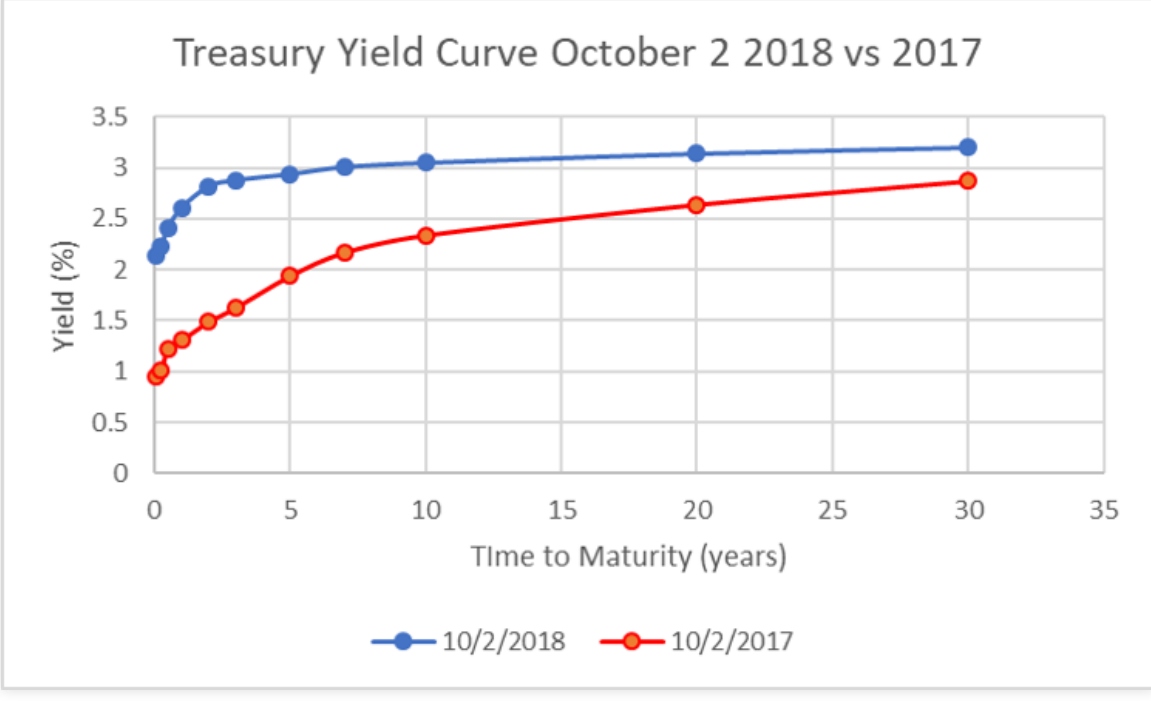
DOWNWARD SLOPING



TERM STRUCTURE COMPONENTS

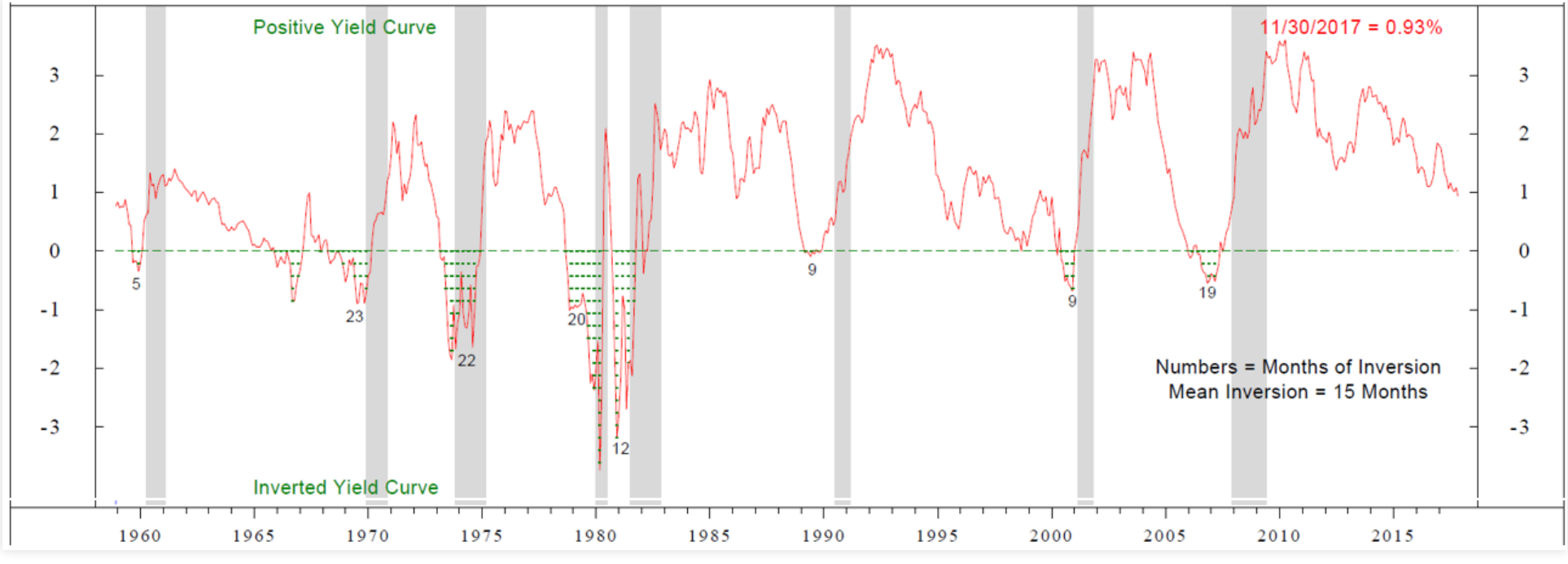
1. Real rate: the compensation for investors foregoing use of money.
2. Inflation Premium: compensation for loss in value of a dollar.
3. Interest rate risk premium: compensation for risk of changing interest rates. (increasing at a decreasing rate)

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.

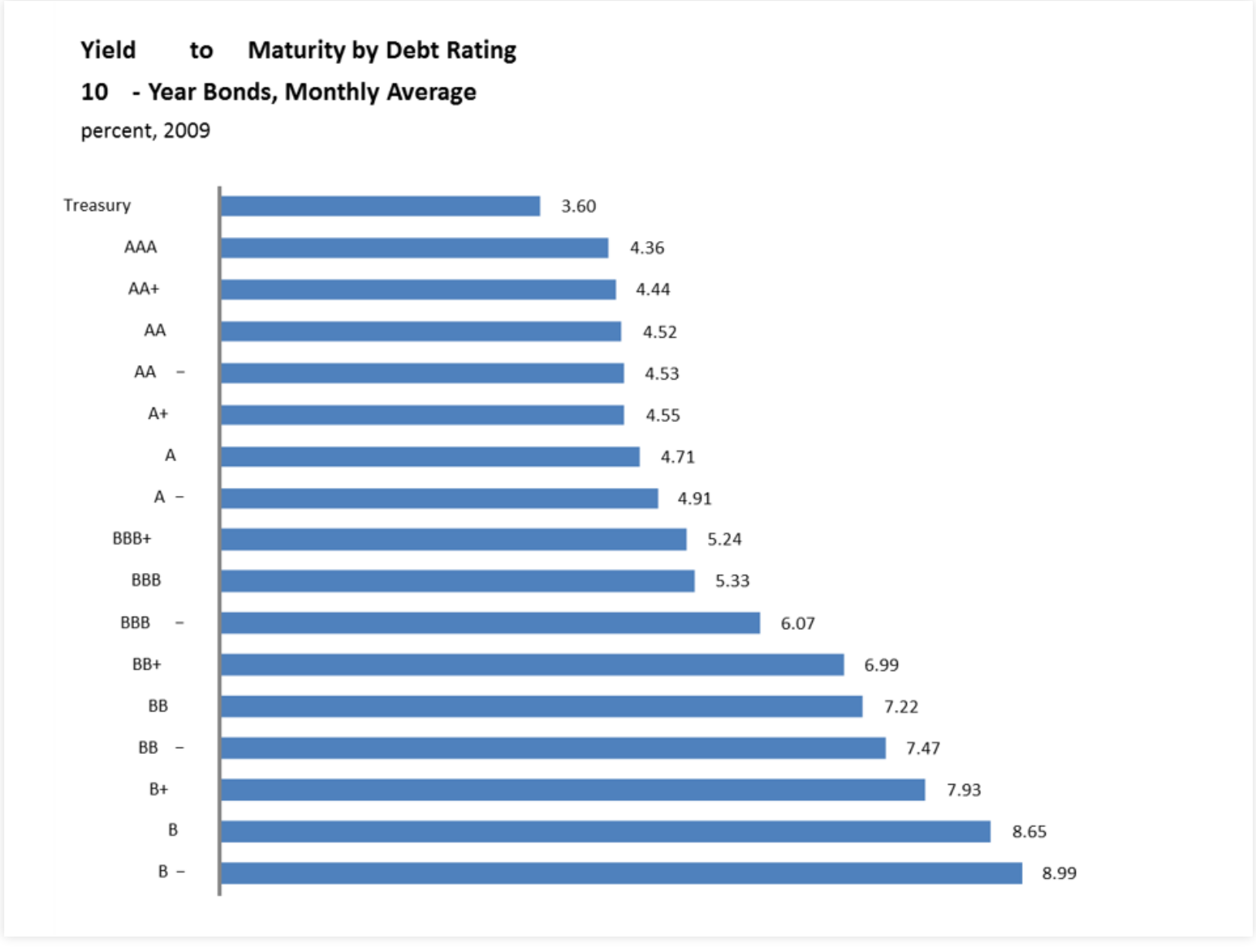
YIELD CURVE AND RECESSIONS



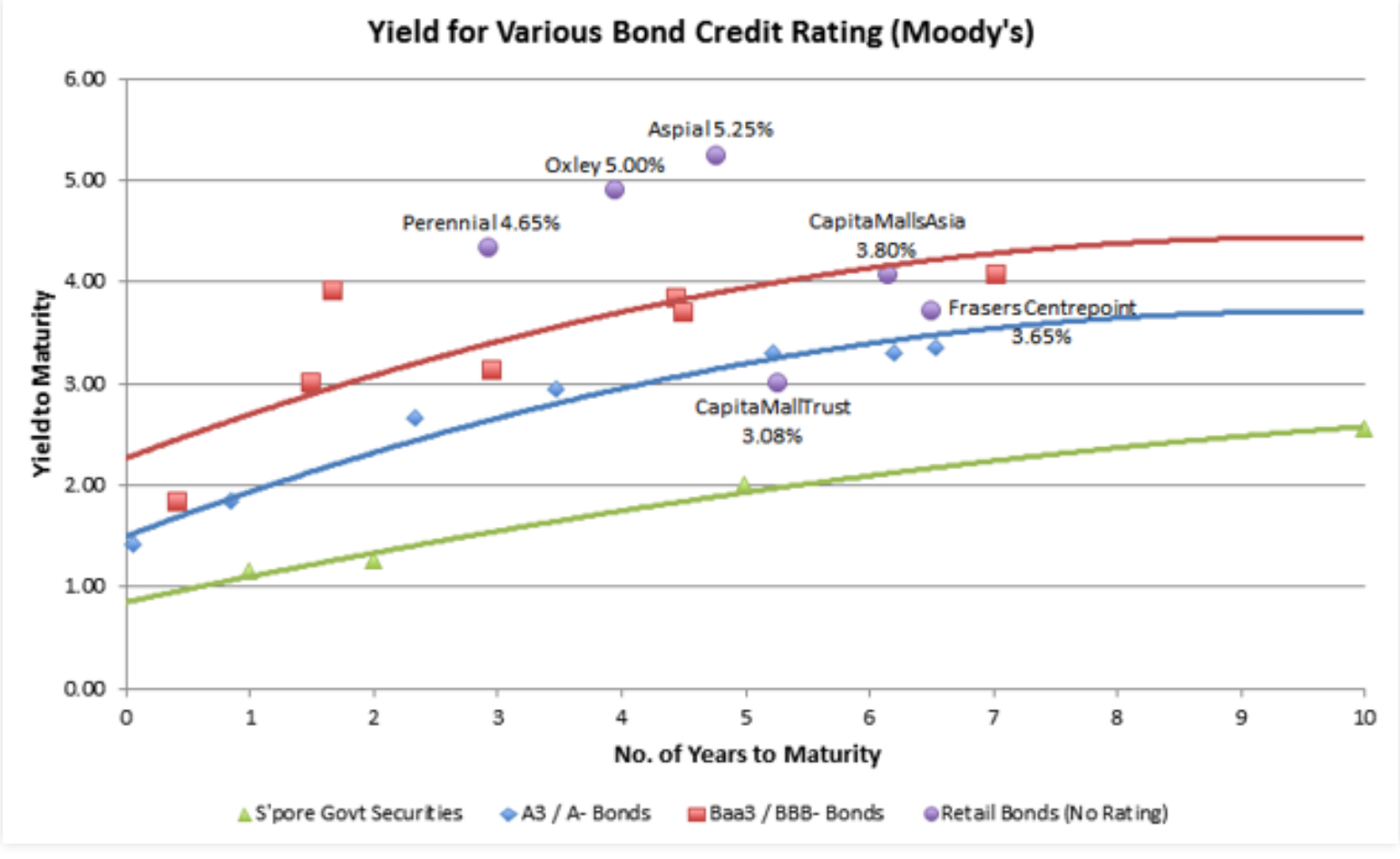
WHAT ABOUT OTHER FACTORS?

1. 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.
2. Taxability premium: compensation for unfavorable tax treatment.
3. Liquidity premium: compensation for lack of liquidity (some bonds are easily tradeable without losing value)

DEFAULT PREMIUMS AND YTM



YIELD FOR DIFFERENT BOND RATINGS



KEY LEARNING OUTCOMES

- Bond valuation: price, YTM, coupon payment, face value, time to maturity
- Bond terms
- Bond ratings
- Bond types
- Bond market
- Inflation and interest rates
- Term structure

NEXT TIME

Chapter 9: Net Present Value and Other Investment Criteria