

1 Bonds

- Objectives:

- To describe institutional detail related to bonds and bond markets.
- To compute and assess discounted cash flow (YTM-IRR) analysis on bonds.
- To assess factors influencing bond yields across issuers and maturities.

- Money and Bond Markets

- Bond Pricing and Risk

- YTM (IRR on bond) – Excel and Calculator
- Interest Rate Risk

- Bonds Concepts

- Yield Curve and Term Structure of interest rates

- Historical Data and Recent Developments

- Note: real interest rate = $(1+\text{nominal})/(1+\text{infl}) - 1 \approx \text{nominal} - \text{infl}$

- Ex. If nominal=5% and infl=2%, then
- real interest rate = $1.05/1.02 - 1 = 2.94\% \approx .05 - .03\% = 2\%$

2 Money and Bond Markets

- Money Market – debt maturing in less than one year
 - CD (large/small) – time deposit with bank.
 - Treasury bills – pure discount short-term (\leq one year) debt.
 - Commercial Paper – short-term unsecured corporate debt. Direct or indirect.
 - Other – Eurodollars, repos (and reverse), bankers acceptance.
- Bond Market – total market more than \$22B.
 - Treasury bonds (17%) – issued by U.S. Treasury.
 - Municipal bonds (11%) – issued by state and local govt
 - Corporate bonds (13%) –
 - Asset Backed (10%) –
 - Govt Agencies and Govt Sponsored Enterprises (14%) – issued by quasi govt entities that buy mortgages
 - Mortgage Backed Securities + Collateralized Mortgage Obligations (25%) – Bonds backed by pools of mortgages. CMOs splits cash flows from pool by specific allocation rules (e.g., IOs, POs, Sequential CMOs).

3 Corporate Bond Overview I

- Bond Indenture – legal agreement between borrower and lender.
 - Specifies whether bond is secured or unsecured (debenture) and covenants.
 - Senior Secured bonds – financing for projects, equipment, recapitalization. Collateral may be real assets (building or equip for mortgage bonds) or financial assets
 - Senior Unsecured bonds – financing for acquisitions and recapitalization, not risky projects.
 - Mezzanine/Subordinated debenture – financing for acquisition; growth; recapitalization, when senior debt capacity is limited. No collateral, so borrower needs stable history.
- Examples of covenants
 - Pay interest, principle, premium on timely basis;
 - Maintain all properties in good condition and working order.
 - Submit periodic certificates to trustee on whether debtor in compliance.

4 Corporate Bond Overview II

- Other common covenants
 - total debt < 60% of total mkt capitalization; Dividends < 10% of NI.
 - Stock repurchases limited; Subordination of future bond issues.
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- Other Corporate Bond Characteristics
 - Call and put provisions – many corporate bonds can be called by issuer, after initial *call protected* period.
 - .
- Default risk – Credit agencies examine character, capacity, collateral, covenants.
 - Character – examines mgt strategy, conservatism, history, control systems...
 - Investment Grade: S&P: AAA, AA, A, BBB (Moody: Aaa, Aa, A, Baa).
BBB – normally adequate capacity to repay, but subject to adverse economic conditions or changing circumstances.
 - Speculative, Junk – BB, B, CCC, C, D (M: Ba, B, Caa, C, D).
BB – predominantly speculative capacity to repay. Quality and protective characteristics outweighed by uncertainties or risk exposures.

5 Corporate Bond – Example and Yld to Maturity

Bond	Cur Yld	Vol	Close	Net Chg	
F 7.125 25	15.49%	---	46.00	-0.94	
Coupon = 7.125% of par annually (usually assume half is paid semi-annually) Par = 1,000 (assume) 2025 = Maturity Cur Yld = (annual coupon / price) Net Chg = change from previous day Close = price at market close. NASDbondinfo.com; Yahoo screener.					
Time yr	0	0.5	1	1.5	...
CF		35.625	35.625	35.625	... 35.625+1000

YTM – rate that equates bond price with present value of all payments.

Prices and yields (internal rate of return) are inversely related.

If price > par (coupon > YTM), bonds sells at premium. Investor takes capital loss.

$$PV = C \left(\frac{1 - \left(\frac{1+g}{1+r} \right)^T}{r-g} \right) + \frac{Par_T}{(1+r)^T}$$

$$YTM = 2 * r =$$

6 Bond Pricing with Excel

Bond Pricing		Yields	Prices	
MDuration	6.62			
YTM (BEY)		16.11%	16.110%	
Pr (Price)	46.00		46.00	
Settlement	7/15/2008			
Maturity	7/15/2028			
Rate (Coupon rate)	7.000%			
Redemption (Maturity Value)	100			
Frequency (Coupons per yr)	2			
=YIELD(settlement,maturity,rate,pr,redemption,frequency,basis)				
=PRICE(settlement,maturity,rate,yld,redemption,frequency,basis)				

- Be sure to load Analysis Toolpak! (may have to restart Excel after loading.)
 - **Excel 03:** Start Excel, click "Tools" "Add-ins" check "Analysis Toolpak".)
 - **Excel 07:** search help for "Load the Analysis ToolPak"
- Examples: 20-year bond offers coupon of 7%. Investors require 5% return.
 Q: What is the price? What happens to price/YTM if default risk increases?
 A:

7 Bond Pricing with Financial Calculator

- Setting up the HP10B
 - Clear registers: CLEAR ALL
 - Setting compounding freq to 1x/period: 1 SHIFT P/YR
 - Set payments to end of period: SHIFT BEG/END (“begin” not in display).

- Setting up the TI-BAII+
 - 2nd CLR TVM
 - Set compounding freq to 1x/period: [2nd] P/Y, then 1 ENTER ↓ 1 ENTER.
 - Set payments to end of period [2nd] BGN [2nd] SET (“begin” not in display).

Data

(current price)
(number of periods)
1000 (future value)

compute yield (TI BAII Plus)
compute yield (HP10B)

Button

PV
N
FV
PMT
CPT I/Y
I/YR

Your answer will be the semi-annual yield (multiply by 2 to get BEY)

8 Factors affecting Bond Yields (YTM)s

- Anything that affects risk or timing of cash flows will affect bond yields, such as
 - Default risk – already discussed
- Taxes – corporate bonds pay all applicable tax.
 - Treasuries not subject to state and local tax.
 - Munis generally not subject to federal or own state and local taxes
- Maturity – bonds with short maturities usually have lower yields (more later).
 - Often summarized by “yield curve”
- Embedded options – many corporate bonds have a call provision.
 - Call price usually starts as par plus one coupon, then converges to par.
 - Initial period often *call protected*.
- Reinvestment risk – what rate will coupons be reinvested?
 - Pension funds like zeros. Why?
- Interest rate risk – risk that, over time, changing yields cause bond prices to fall.
 - increases with longer maturity and lower coupons (more later).

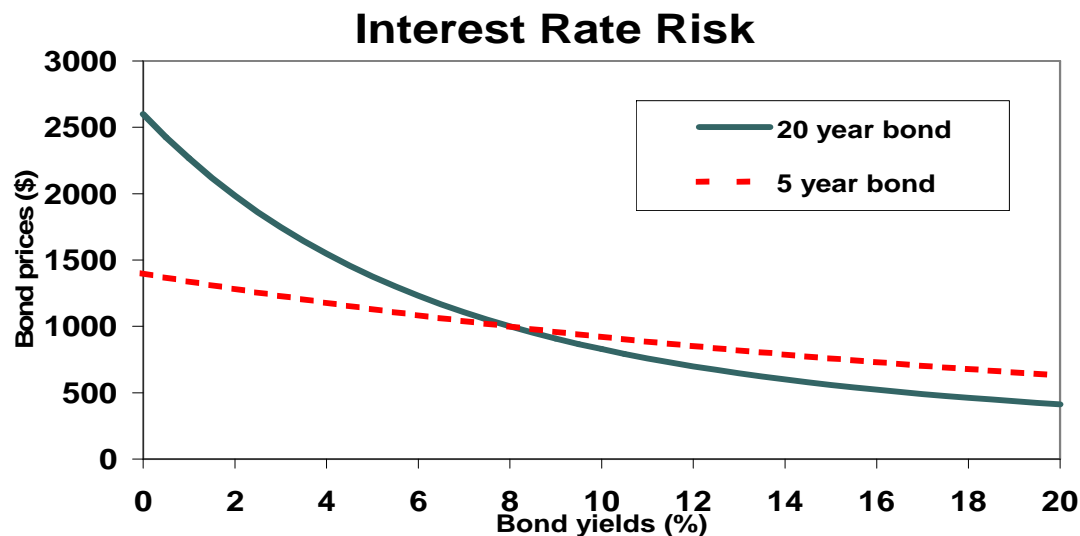
9 Factors affecting YTMs - Interest Rate Risk

- Interest Rate Risk often measured by Modified Duration (D^*) (Excel: mduration)
 - Gives percent change in bond price due to 1% rise in YTM.
 - Mduration of zero coupon bond is equal to its maturity.
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- Q: Find mduration of 3 yr zero.
- A:

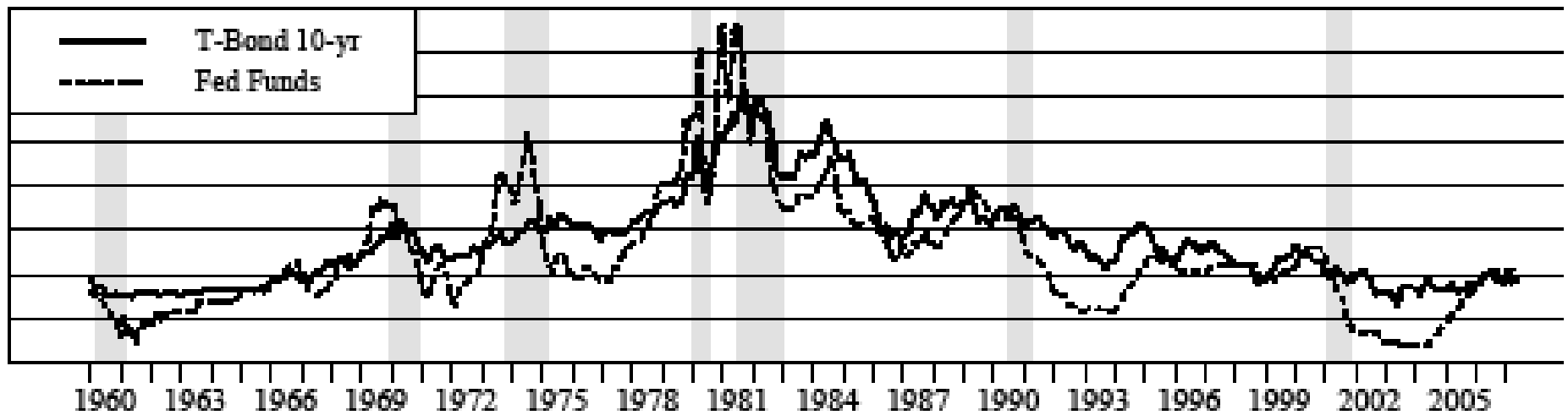
- Q: Find mduration of 3 yr, 8% bond selling at par (YTM=8%).
- A:
- Q: You expect interest rates to rise. How to adjust your bond portfolio?

Par = 1000; Coupon = 8%		
YTM	Price T=5	Price T=20
0	1400	2600
8	1000	1000
20	631.30	413.30

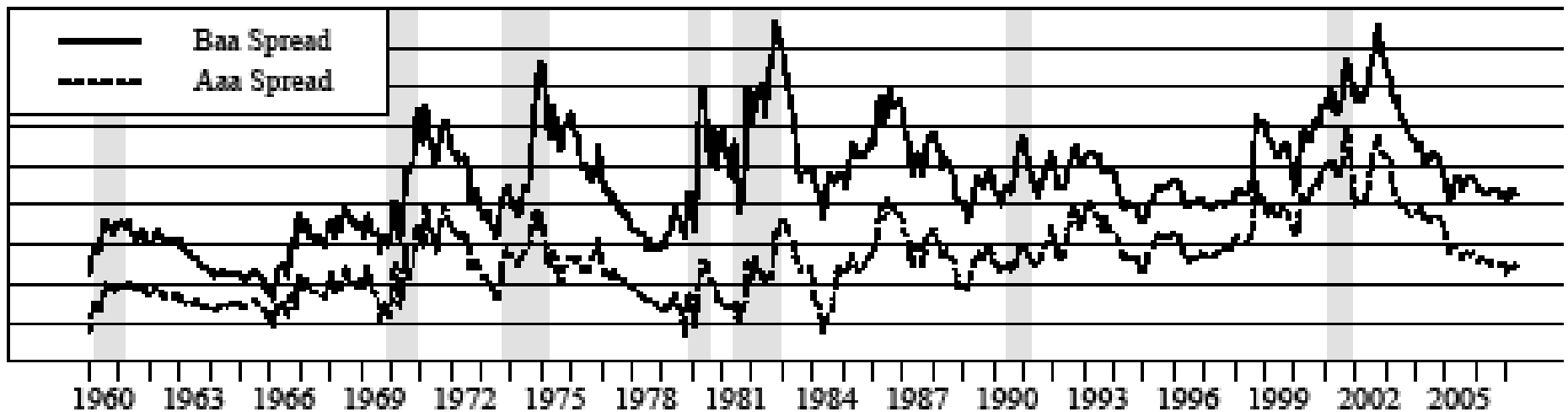


Historical Yields

T-bond Yield (7.0% avg) and Fed Funds Rate (6.1% avg)



Credit Spreads: Baa (181 bp avg) and Aaa (83 bp avg)



11 Factors affecting YTM's – Maturity (1)

- Yield curve - graph of yields versus time to maturity, usually for Treasury bonds. Usually slopes up, as long-term rates are usually greater than short-term rates.
 - See FRBSL; nasdbondinfo.com for graphs.
 - Three possible explanations for shape of yield curve

- (1) Market Segmentation hypoth– Short- and long-term bonds trade in distinct markets, and rates are determined independently.
- (2) Liquidity Preference hypoth - investors require risk premium to induce them to hold long-term bonds, since most investors prefer short horizons.
- (3) Expectations hypoth – observed long-term rate is an average of today's short-term rate and expected future short-term rates.

Q: Suppose 1-yr bond yields 2% today, and is expected to yield 4% next year. What should be the yield on 2-yr bond?

A: .

- Q: What factors determine next year's expected rates?

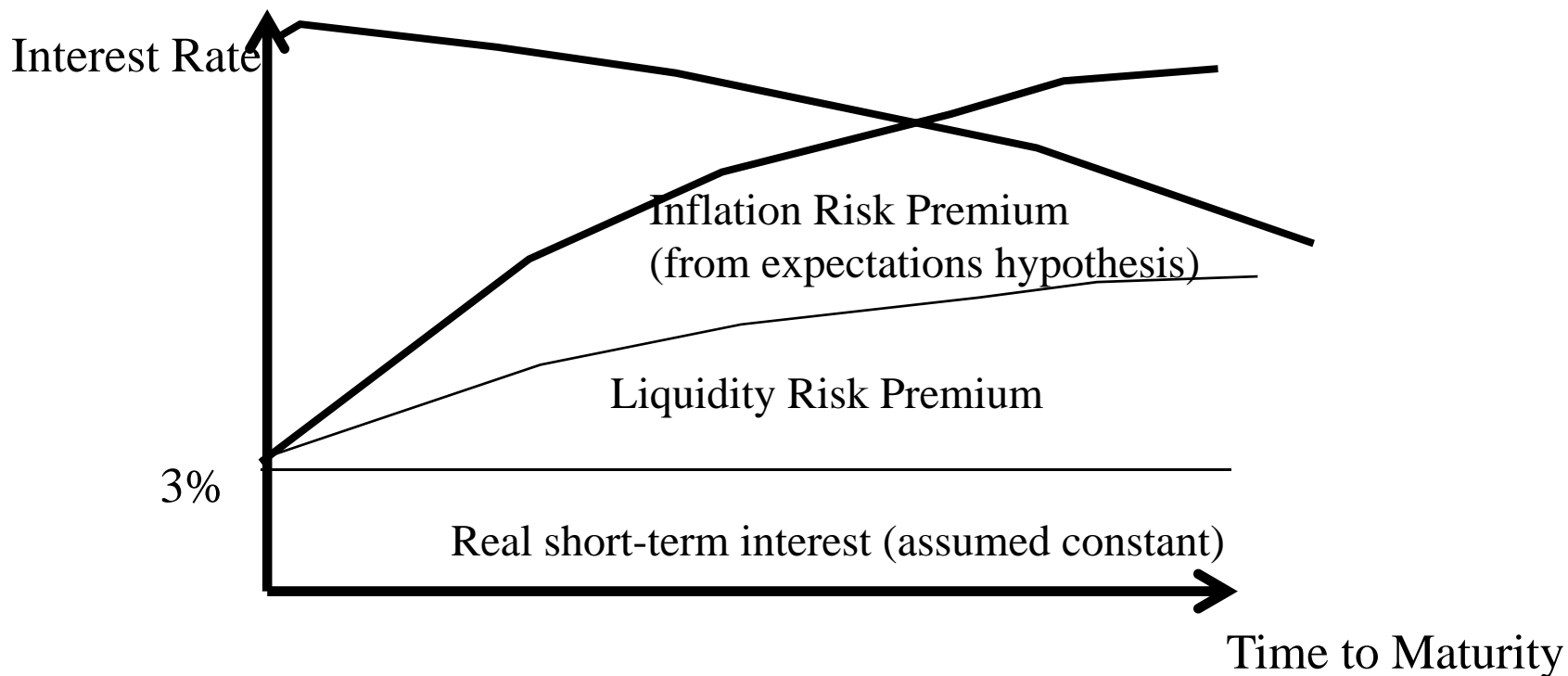
A:



Factors affecting YTM – Maturity (2)

This is a simple way to think about the zero-coupon yield curve.

Is it possible for the yield curve slope downward? How?



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Yield Curve and Monetary Policy

- Fed affects short-term (ST) interest rates directly, but not long-term (LT) rates.
 - Policy affects long-term rates primarily through expectations hypothesis
 - Expected real rate (credit mkts) and expected inflation.
- Q1: What happens if Fed temporarily lowers funds rate below LT average?
- A1:
- Q2: What happens if Fed persistently lowers funds rate below LT average?
- A2:
- Q3: How can the Fed keep long-term rates as low as possible?
- A3:
- Q4: You are corporate treasurer. Should you borrow long-term or short-term?
- A4:

14 Pricing: Imputed Interest

- Problem: Some bonds, like 30-yr zeros, pay nothing until maturity, but gov't collects taxes each year (also OID coupon bonds). Solution: *imputed* interest

- Consider: 30-yr bond; zero coupon; YTM=10% BEY; Par=\$1000.
 - Find market price at issue, imputed price and interest after 1 year.
 - Find capital gain/loss if bond is sold for \$70 after one year

- Market price at issue ($t=0$):

- Imputed price is *hypothetical* price at constant YTM ($t=1$):

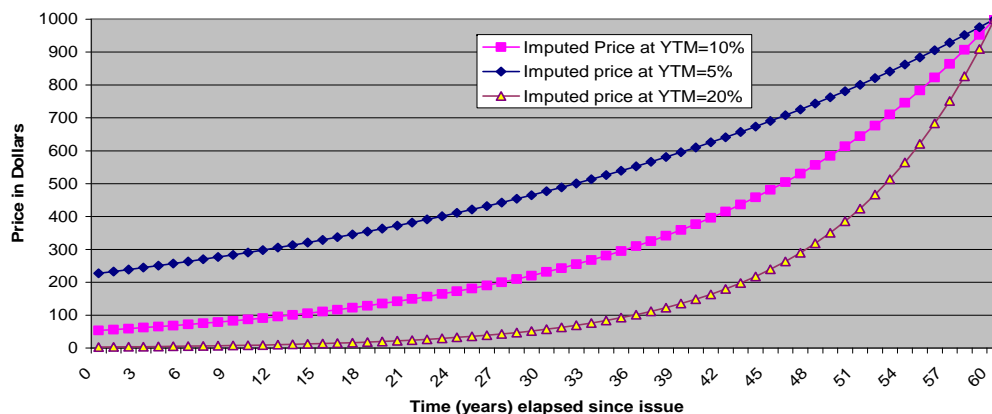
- Imputed interest: Change in imputed price($t+1$) + coupon:

- Capital gain at $t+1$ is actual price($t+1$) – imputed price($t+1$):

- Holding Period Return (IRR)

- Make time line and equate price with PV of cash flows.
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Imputed Prices for Zero Coupon bond



16 | Bonds: Other Examples

- Inflation-Indexed Treasury Securities (TIPS) – Par value adjusts with CPI
 - \$1000 par 5% coupon. If $\text{infl}=3\%$, then $\text{par}=\$1030$ and $\text{coupon}=5\%$ of \$1030.
 - YTM quoted on accrued principal. Interpreted as “real yield”.
- Treasury Separate Trading of Registered Interest and Principal (STRIPS)
 - Strips *each* coupon from principal on existing T-notes and bonds
 - 10 yr bond strips to 21 securities. Quotes reflect “ci” or “bp” (or “np”).
- Hybrids: Trust-preferred securities – Preferred stock \$25 par; 7% interest.
 - Bank holding co issues “debt” to trust. Regulators count as “equity” capital.
 - Trust issues preferred stock, passing through interest and principal.
 - What about default risk (subordinated)? Maturity (extendable)?
 - Credit rating (private placement)? Defer interest (up to 5 yrs)?
 -
- LYON (liquid yield option note) – Convertible & Floating rate Zero
 - Contingent coupon – pay if *bond price* > 120% of “contingent prin” after 5 yrs
 - Principal adjusted upward by interest (no actual coupon).
 - Reset quarterly at LIBOR *minus* 2%; capped at 5.5% after 5 ys.
 - Matures in 30 yrs; Call protected for 5 yrs; Puttable in 3, 5, 10, 15, 20 yrs.