Module 5

Valuing Bonds and Stocks

FINE 3010, Financial Management

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Goals

- **Part 1**, bonds
  - Differences between debt and equity
  - Valuation
  - Yields
  - Returns and interest rates
  - Default risk
  - Special features of bond securities

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  - Differences between debt and equity
  - Valuation
  - Yields
  - Returns and interest rates
  - Default risk
  - Special features of bond securities
- **Part 2**, stocks
  - Valuation, dividend discount model
  - Valuation, comparables
  - Market efficiency

Module 5, Part 1

Bonds

Common Types of Corporate Financing

- **Debt**, lending to the company
  - Main forms, bonds and loans
  - Cash flow, a fixed promised amount
  - "Senior", paid back before equity in bankruptcy
  - No voting rights or control (unless in bankruptcy)

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  - "Senior", paid back before equity in bankruptcy
  - No voting rights or control (unless in bankruptcy)
- **Equity**, stock ownership in the company
  - Cash flow, dividends (and buybacks)
  - "Residual claimant", paid whatever is left after everyone who was promised money gets paid, so no guarantee of any payout
  - Voting rights

Common Types of Corporate Financing

	Debt	Equity
Payment	Fixed promised payment	Residual (whatever is left over)
Priority in bankruptcy	Highest	Lowest
Risk	Low	High
Expected return	Low	High
Voting and control rights	No	Yes
Term	Dated	Perpetual
Share of total U.S. corporate financing (market values)	About 25%	About 75%

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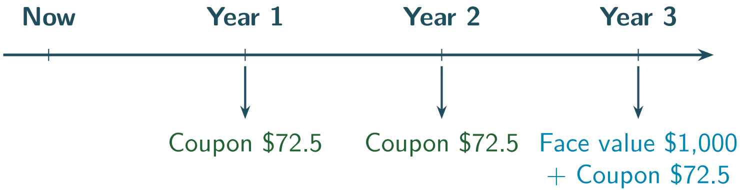
- Typically some periodic payments (the “coupon”), then a “face value” at the end
- E.g., a three-year bond with an annual coupon of \$72.5 and a face value of \$1,000, the borrower promises to pay,



Bonds, Terminology

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- **Coupon rate**,

$$\text{Coupon rate} = \frac{\text{Annual coupon}}{\text{Face value}}$$

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- **Floating-rate bonds**, bonds whose coupon payments fluctuate with short-term interest rates (the coupon is not fixed)

Bonds vs. Loans, Main Differences

Bonds

- Sold to a broad group of investors, typically mutual funds, pension funds, insurance companies
- Subdivided into "smaller pieces", usually $1,000 face value
- Intended to be tradable
- Few "covenants" (restrictions) on the borrower

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Loans

- A single source of lending, typically a bank or a bank "syndicate" (group of banks)
- Not designed to be subdivided, although investors can still own "pieces" of a loan
- No active market, so harder to trade between investors
- Usually many covenants on the borrower

Other Types of Corporate Credit

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  - Revolving credit facilities (like a corporate credit card)
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- Beyond bonds and loans,
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- The way to value all kinds of corporate debt is the same, **Module 4**’s time-value-of-money principles

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- E.g., for a risk-free bond with time to maturity T,

$$\text{Price} = \text{PV} = \frac{\text{Coupon}_1}{(1+r)^1} + \frac{\text{Coupon}_2}{(1+r)^2} + \cdots + \frac{\text{Coupon}_T + \text{Face value}}{(1+r)^T}$$

Bonds, Pricing a Risky Bond

- If a bond is risky, discount the **expected** coupon and face value payments, not the promised ones, the expectation accounts for the probability that the borrower does not pay

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- The required rate of return r is set by the opportunity cost, "what could I get investing in something else with a similar risk"
  - Depends on the time value of money and the riskiness of the bond (more on this a bit later)

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- The coupon is a payment the borrower *promises* to pay in the future, if the borrower defaults, it may pay only part of the coupon, or nothing
- **Expectation operator** $E[\cdot]$, the probability-weighted average payment the borrower will pay (which is also what the investor will receive)

Example, Expected Coupon

- Suppose in the first year, the borrower will pay,
  - \$72.50 (the full coupon) with 60% probability
  - \$50 with 20% probability (default but high "recovery")
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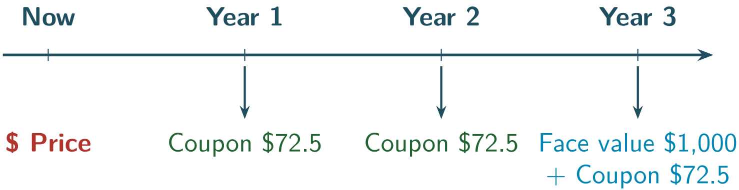
- This is what goes in the numerator when discounting (risky) bonds

Example, Bond Pricing

- A (risk-free) bond has an annual coupon of \$72.5 and a face value of \$1,000, with three years to maturity



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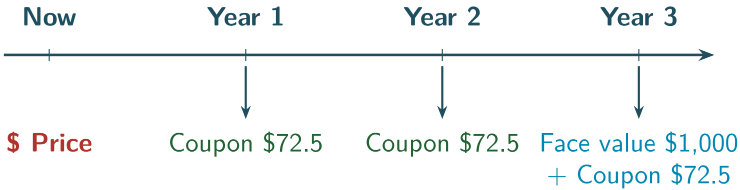

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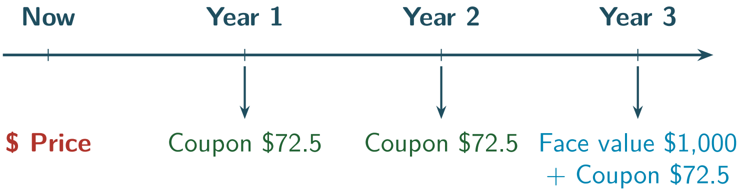

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$$\text{Price} = \frac{\$72.50}{(1+0.04)^1} + \frac{\$72.50}{(1+0.04)^2} + \frac{\$72.50 + \$1{,}000}{(1+0.04)^3} = \$1{,}090.19$$

Example, Bond Pricing with a Financial Calculator

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- Use a financial calculator to price the bond

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- The output is −\$1,090.19 (why the minus sign? recall how financial calculators get to the answer in **Module 4**)

Valuing Bonds with a Financial Calculator

- The financial calculator keys map onto a bond,
  - N, the number of periods until maturity
  - PV, the price of the bond (the present value of the coupons and the face value)
  - PMT, the coupons (in dollars)
  - FV, the face value (the lump sum paid at the end)
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- The keys MUST reference the same time periodicity (annual, semi-annual, quarterly, monthly)
  - E.g., if N is 72 months, I/Y must be the monthly interest rate

Bond Prices Are Often Quoted as a Percentage of Par

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- E.g., the bond we just analyzed, face value \$1,000 and price \$1,090.19, could be quoted as,

$$\text{Price} = 109.019\%$$

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- Why a higher price? Investors get their money a little sooner

Example, Semi-Annual Coupons

- The previous bond, coupon \$72.5, face value \$1,000, three years to maturity, $r = 4\%$
- What would the price be if the coupons were half as large but paid semi-annually ($72.5/2 = \$36.25$ every six months)?

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- Solution, first adjust the discount rate to semi-annual, if the annual (compound) rate is 4%, the semi-annual rate is

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- Around \$2 higher than with annual coupons

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- The price (value) of a bond is the discounted (expected) payments, at the required rate of return
- The frequency of the coupon payments (annual vs. semi-annual) affects the price

Bond Yields

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- Given the price of a bond (PV), its maturity T, and its coupons, find the yield to maturity by solving for y,

$$\text{Price} = \frac{\text{Coupon}}{(1+y)^1} + \frac{\text{Coupon}}{(1+y)^2} + \cdots + \frac{\text{Coupon} + \text{Face value}}{(1+y)^T}$$

Example, Bond Yields

- Solving for the YTM analytically is hard, so use the financial calculator
- What is the YTM of a bond with a 7.25% annual coupon rate, a $1,000 face value, and a 3-year maturity? Its current market price is $1,090.19

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- The yield is 4%

Bond Prices Are Often Quoted as Yields

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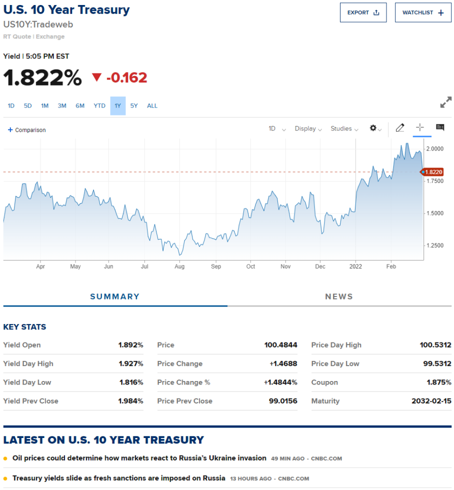

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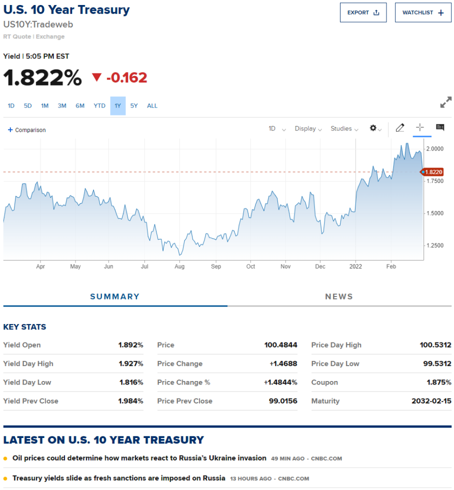

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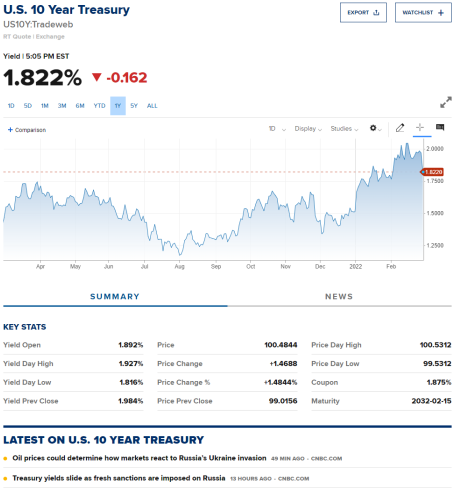
- E.g., the 10-year U.S. Treasury bond is quoted as a yield of 1.822% (its price is 100.48%)



Is the YTM the Same as the Required Rate of Return r?

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- For risk-free bonds, YTM and r are the same
- For risky bonds, YTM and r are different (specifically, YTM $> r$)

YTM vs. r, Promised vs. Expected Payments

- When calculating r, use **expected** payments, $E[\cdot]$ accounts for the probability that the borrower pays less or nothing,

$$\text{Price} = \frac{E[\text{Coupon}]}{(1+\boldsymbol{r})^1} + \frac{E[\text{Coupon}]}{(1+\boldsymbol{r})^2} + \cdots + \frac{E[\text{Coupon} + \text{Face value}]}{(1+\boldsymbol{r})^T}$$

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- When calculating the YTM, always use **promised** payments, even for risky bonds,

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Example, YTM vs. r on a Financial Calculator

- A one-year zero-coupon bond has a probability of default (the issuer does not pay the face value) of $p_{\text{default}} = 10\%$. Its face value is \$1,000 and its price is \$850
- What are the yield y and the expected (required) return r?

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- r is 5.88%

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- A bond priced **equal** to its face value trades at **par**
  - When will this happen?
  - Happens if coupon rate $=$ yield to maturity

Example, Bond Premiums and Discounts

- A (risk-free) bond has a \$1,000 face value, five years to maturity, and pays annual coupons. Its yield is 5%
- What is the price of the bond if the annual coupon rate is,
    1. 7%?
    2. 3%?
    3. 5%?

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- What is the price of the bond if the annual coupon rate is,
  1. 7%?
  2. 3%?
  3. 5%?

- Solution, 1. if the coupon rate is 7%, the coupons are $7\% \times \$1{,}000 = \$70$ per year,
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- The price is \$1,087, a "premium bond"
- Bonds 2 and 3 are worth \$913 (a "discount bond") and \$1,000 ("par"), respectively

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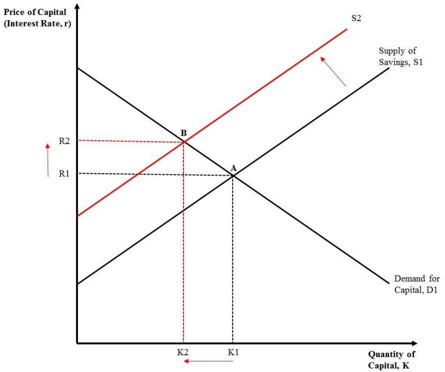
- The Federal Reserve does not "set" the interest rate, but tilts supply and demand by buying and selling bonds, essentially by choosing whether to create "money" with which it buys bonds

Example, a Negative Supply Shock

- The market starts at equilibrium point A, interest rate R_1 and quantity of lending K_1



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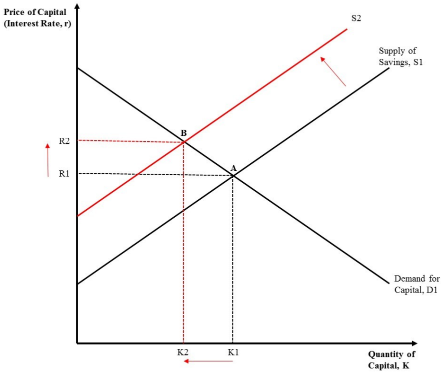

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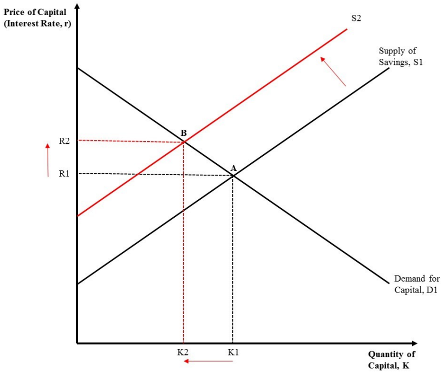
- See also Investopedia, Forces Behind Interest Rates



Interest Rates and Bond Prices Move in Opposite Directions

- Because the bond price is (the chart shows the running example, $T = 3$, coupon 7.25%, FV \$1,000)

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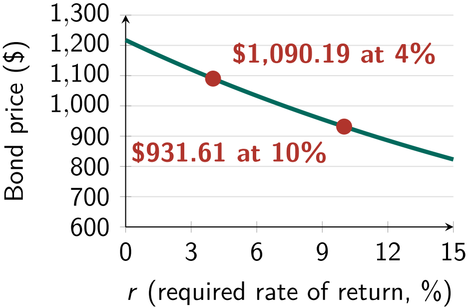

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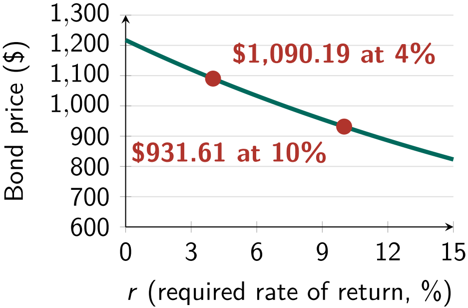

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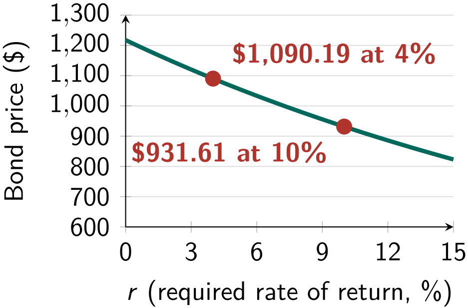

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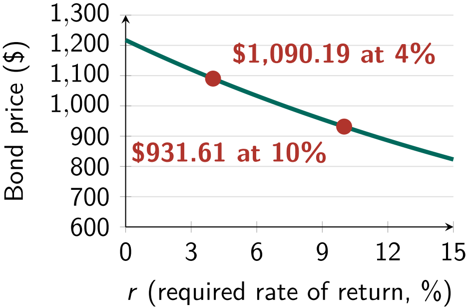

Default Risk

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- **Default premium**, the additional yield on a bond that investors require for bearing credit risk

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- **Investment-grade bonds**, rated Baa or higher by Moody's, or BBB or higher by Standard & Poor's
- **High-yield bonds** ("junk" bonds), rated Ba or BB and lower

Default Risk, Credit Ratings

Moody's	S&P	Default within 10 yr	Safety
Investment-grade bonds			
Aaa	AAA	0.1%	The strongest rating, ability to repay interest and principal is very strong
Aa	AA	0.7%	Very strong likelihood that interest and principal will be repaid
A	A	2.2%	Strong ability to repay, but some vulnerability to changes in circumstances
Baa	BBB	3.5%	Adequate capacity to repay, more vulnerability to changes in economic circumstances

Source, Brealey, Myers, and Marcus, Table 6.2

Default Risk, Credit Ratings

Moody's	S&P	Default within 10 yr	Safety
High-yield bonds			
Ba	BB	15.7%	Considerable uncertainty about ability to repay
B	B	35.5%	Likelihood of interest and principal payments over sustained periods is questionable
Caa, Ca	CCC, CC	48.9%	Bonds that may already be in default or in danger of imminent default
C	C	—	Little prospect for interest or principal on the debt ever to be repaid

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Default Risk and Bond Yields

Issuer	Ticker	Coupon (%)	Maturity	Rating	Yield (%)
Microsoft	MSFT	2.40	2022	AAA	2.89
Walmart	WMT	6.75	2023	AA	2.92
Bristol Myers	BMY	6.80	2023	A	3.43
Corning	GLW	7.73	2024	BBB	4.00
Southwestern Energy	SWN	4.10	2022	BB	4.80
AMD	AMD	7.00	2024	B	5.28

Source, FINRA, senior corporate bonds, March 2018 (Brealey, Myers, and Marcus, Table 6.3)

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- Yields tend to be higher (prices lower) for lower-rated bonds

Rate of Return of Holding a Bond

- An investor's **rate of return** from holding a bond, the realized return over a certain period

$$\text{Rate of return} = \frac{\text{Coupon income} + \text{Price change}}{\text{Investment}}$$

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- It is the "holding period return" of the bond, as in **Module 4**

Example, Rate of Return of Holding a Bond

- You purchase an 8% annual coupon, 20-year maturity bond when its YTM is 9%
- You sell it one year later, when the YTM is 10%. What is your rate of return over the year?

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  - $P_0 = 908.71$ (N = 20, PMT = 80, FV = 1000, I/Y = 9, CPT PV)
  - $P_1 = 832.70$ (N = 19, PMT = 80, FV = 1000, I/Y = 10, CPT PV)

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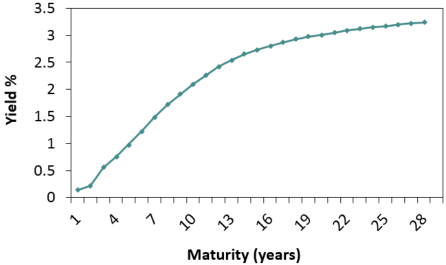
  - $P_1 = 832.70$ (N = 19, PMT = 80, FV = 1000, I/Y = 10, CPT PV)
- Then,

$$\text{Rate of return} = \frac{\text{Coupon income} + \text{Price change}}{\text{Investment}} = \frac{80 + (832.70 - 908.71)}{908.71} = 0.44\%$$

The Yield Curve

- **Term structure of interest rates**, how interest rates vary across bond maturities



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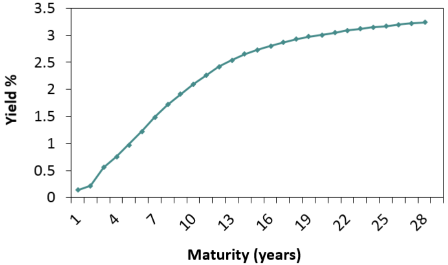
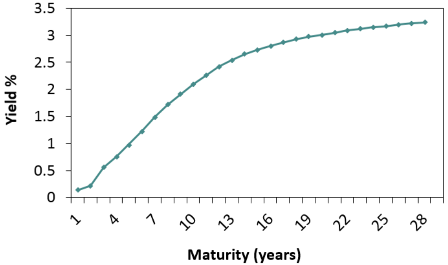


The Yield Curve

- **Term structure of interest rates**, how interest rates vary across bond maturities
- **Yield curve**, a plot of yields to maturity (YTM) against time to maturity
- The yield curve is usually (but not always) upward-sloping



Practice Problem

- The table shows data for three bonds. Each bond has a coupon of zero and a face value of \$1,000

Bond	Price	Maturity (years)	Yield to maturity
A	\$310	25	—
B	\$310	—	9%
C	—	11	8%

a. What is the yield to maturity of bond A?

b. What is the maturity of bond B?

c. What is the price of bond C?

Practice Problem

- Solution, on the financial calculator (the highlighted key is the one solved for),

	N	I/Y	PV	PMT	FV
a. Bond A	25	?	−310	0	1,000
b. Bond B	?	9	−310	0	1,000
c. Bond C	11	8	?	0	−1,000

Practice Problem

- Solution, on the financial calculator (the highlighted key is the one solved for),

	N	I/Y	PV	PMT	FV
a. Bond A	25	4.796	−310	0	1,000
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- Solution, on the financial calculator (the highlighted key is the one solved for),

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- a. The yield to maturity of bond A is 4.796%
- b. The maturity of bond B is 13.59 years
- c. The price of bond C is $428.88

Practice Problem

- A firm has issued 6.8% annual coupon bonds that are now selling at a yield to maturity of 9.50%
- If the bond price is \$795.69, what is the remaining maturity of these bonds? Assume the face value is \$1,000

Practice Problem

- Solution, the bond price is the PV of the coupon payments plus the PV of the face value,

$$\text{Bond price} = \text{PV of coupon payments} + \text{PV of face value}$$
$$\text{Bond price} = C \times ((1 \div r) - \{1 \div [r(1 + r)^t]\}) + FV \div (1 + r)^t$$
$$\$795.69 = (0.068 \times \$1{,}000) \times ((1 \div 0.095) - \{1 \div [0.095 \times (1 + 0.095)^t]\}) + \$1{,}000 \div (1.095)^t$$

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- On the financial calculator,
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- The remaining maturity is about 14 years ($N = 13.98$)

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- r rises with prevailing interest rates and with default risk, lower-rated bonds carry higher yields

Module 5, Part 2

Stocks

Goals

- **Part 1**, bonds
  - Differences between debt and equity
  - Valuation
  - Yields
  - Returns and interest rates
  - Default risk
  - Special features of bond securities
- **Part 2**, stocks
  - Valuation, dividend discount model
  - Valuation, comparables
  - Market efficiency

Valuing Stocks

- Two alternative ways to value stocks,
    1. Dividend discount model
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- You will learn more in "FINE 4100 Advanced Financial Management" and "FINE 4110 Investments in Equities"

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- Note, when we say Div_1 etc., we really mean *expected* dividends

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- The latter formula is often called the "**Gordon growth model**"

Example, Gordon Growth Model

- 1. ABC will pay a \$3.00 dividend forever (the first dividend exactly a year from now). Investors require a rate of return of 12%. What will they pay for the stock?
- 2. What if ABC's stock pays a \$3.00 dividend a year from now, and then the dividend grows at 8% forever?

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$$2. \quad P_0 = \frac{\text{Div}_1}{r_e - g} = \frac{\$3.00}{0.12 - 0.08} = \$75$$

Valuing Stocks, One Period

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- What price should you pay for the stock today (P_0)?

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- Two sources of cash flow from owning the stock,
  1. Dividends paid during the year (Div_1), assume the dividend is paid at the end of the year
  2. The expected price from selling the shares at the end of the year ($E[P_1]$)

Valuing Stocks, One Period

- Suppose you plan to invest in a stock for only one year, and you want a fair expected return for the risk you take
- What price should you pay for the stock today (P_0)?
- Two sources of cash flow from owning the stock,
    1. Dividends paid during the year (Div_1), assume the dividend is paid at the end of the year
    2. The expected price from selling the shares at the end of the year ($E[P_1]$)
- The value of the stock today is the present value of these cash flows,

$$P_0 = \frac{\text{Div}_1 + E[P_1]}{1 + r_e}$$

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- That is, dividend yield plus expected capital appreciation (in %)

Example, Expected Return over One Year

- Fledgling Electronics plans to pay a dividend of \$5.00 this year
- Its shares sell for \$100 today and are expected to sell for \$110 one year from now
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$$= \frac{5}{100} + \frac{110 - 100}{100} = 5\% + 10\% = 15\%$$

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- How to value non-dividend-paying stocks?
  - If the firm is only temporarily not paying dividends, the dividend discount model still applies
  - But future dividends are then probably even more uncertain!

Valuing Dividends with Non-Constant Growth

- Estimate the dividends year by year over a horizon of H years, then assume constant growth after year H,

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- You will learn more in "FINE 4100 Advanced Financial Management" and "FINE 4110 Investments in Equities"

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- What is the value of a stock with the following dividends, an 8.5% discount rate, and a growth rate of 6% beginning in year 6?

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$$\mathrm{PV}_{\text{Stock}} = 10.23 + 89.11 = \$99.33$$

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- E.g., a 2,000 sqft house in New Orleans sells for \$400,000. What is your estimate for a neighboring house of 2,500 sqft?

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- Underlying idea, we can "scale" prices!

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4. Back out Company X's implied value (the numerator) as the average multiple times Company X's denominator

$$P_X = (\text{Average P/E of comparables}) \times \text{EPS}_X$$

Example, Valuation by Comparables

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- Solution, multiply Herman Miller's EPS by the P/E of comparable firms,

$$P = (\text{Average P/E of comparables}) \times \text{EPS} = 21.3 \times 1.38 = \$29.39$$

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- Citigroup has a book value of equity of $23 billion and 1.2 billion shares outstanding. The average market-to-book ratio of similar banks is 1.6
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- The question asks for the share price, not the market cap,

$$P = \frac{\text{Market cap}}{\text{Number of shares outstanding}} = \frac{36.8 \text{ billion}}{1.2 \text{ billion}} = \$30.67$$

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- Assumes the comparables are priced correctly
  - Cannot tell if an entire industry is overvalued or undervalued
  - E.g., no help in valuing tech firms during the late-1990s “dot-com bubble”

Buying and Selling Stock on the Stock Market

- Current stock price

FedEx Corporation (FDX) ☆ Add to watchlist

NYSE - Nasdaq Real Time Price. Currency in USD

239.98 -9.04 (-3.63%)

As of 1:02PM EDT. Market open.

Summary | Chart | Conversations | Statistics | Profile | Fina

Previous Close	249.02	Market Cap	64.318B
Open	246.00	Beta	1.57
Bid	239.98 x 100	PE Ratio (TTM)	22.11
Ask	240.10 x 100	EPS (TTM)	10.86
Day's Range	236.00 - 246.00	Earnings Date	Mar 19, 2018 - Mar 23, 2018
52 Week Range	182.89 - 274.66	Forward Dividend & Yield	2.00 (0.80%)
Volume	2,359,358	Ex-Dividend Date	N/A
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- Market capitalization
- **Beta**, a measure of risk (how much the stock moves with the overall market)
- Price/earnings
- EPS
- Dividend and dividend yield

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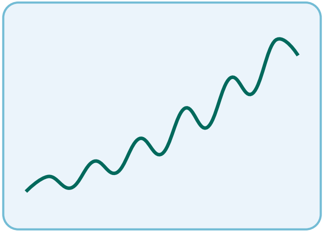
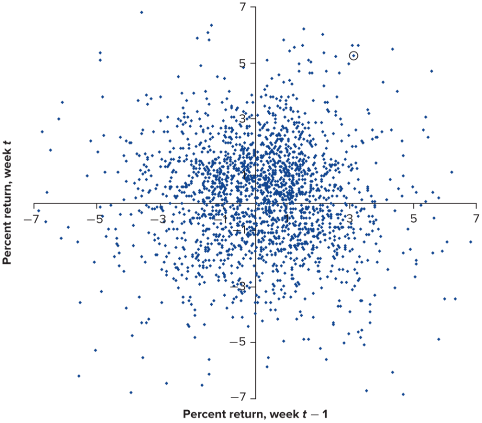
- **Technical analysis**, investors who attempt to forecast stock prices by watching the fluctuations in historical prices ("wiggle watchers")



Discuss, Where Is the Pattern?

- Scatter plot of the NYSE Composite Index return in one week against its return in the previous week



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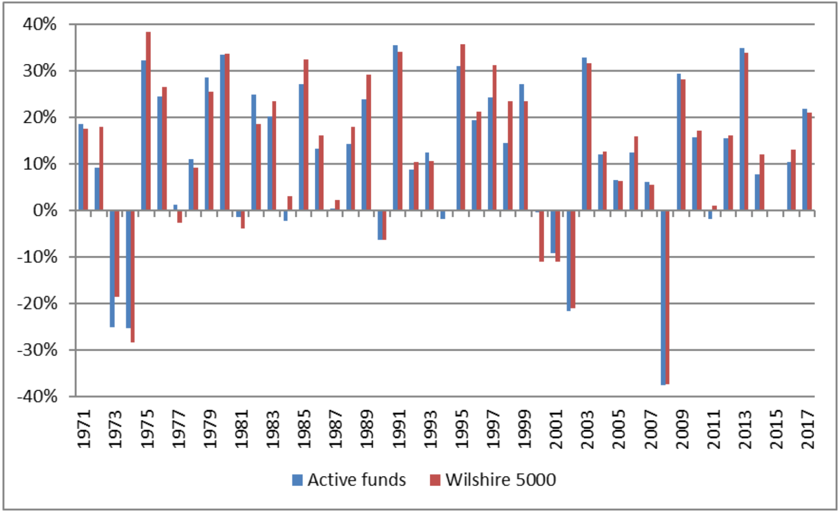
Professional Fund Managers Don't Generally Beat the Index!



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- **Efficient markets hypothesis**, "securities are fairly priced, given all information that is available to investors"
- What **type** of information is captured in the stock price?
  1. All historical price information? ("weak" efficiency)
  2. All public, easily available information? ("semi-strong" efficiency)
  3. Also all private or difficult-to-interpret information? ("strong" efficiency)

What Does This Mean for Investors?

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- **Bright side**, if stocks are fairly priced, even an investor who **knows nothing** can buy **any** stock and expect it to fairly compensate them for the risk they take
- **Downside**, to *consistently* make money above the *fair (risk-compensating) return* by betting on publicly traded shares, an investor needs a very distinct competitive advantage
  - E.g., expertise or access to information that only a few people can figure out

Practice Problem

- Consider the following three stocks,

a. Stock A is expected to pay a dividend of \$10 a share forever
b. Stock B is expected to pay a dividend of \$5 next year. Thereafter, dividend growth is expected to be 4% a year forever
c. Stock C is expected to pay a dividend of \$5 next year. Thereafter, dividend growth is expected to be 20% a year for 5 years (years 2 through 6) and zero thereafter

- If the market capitalization rate for each stock is 10%, which stock is the most valuable? What if the capitalization rate is 7%?

Practice Problem

- Solution, at a 10% capitalization rate,

10% capitalization rate:

$P_A = \text{DIV}_1/r = \$10/0.1 = \$100$

$P_B = \text{DIV}_1/(r - g) = \$5/(0.1 - 0.04) = \$83.33$

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$P_C = \$104.51$

At a 10% capitalization rate, Stock C has the largest present value.

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- At a 7% capitalization rate, $P_A = \$142.86$, $P_B = \$166.67$, and $P_C = \$156.50$, so Stock B is the most valuable

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- Beating the market is really hard, prices already reflect available information (the efficient markets hypothesis)

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- Bonds and stocks are both valued as the present value of their expected cash flows, coupons and face value for a bond, dividends for a stock

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- A bond's yield to maturity discounts the promised payments, the required return r discounts the expected payments, and prices fall when rates rise
- Stock values come from the dividend discount model or from comparables, and efficient markets make it hard to beat the index

Thank you!

Please let me know if you have any questions.