Last time

- Talked about arbitrage
  - Riskless profit
  - Don't need to put in any of your own money
- What's the point?
  - When you have two securities/portfolios/trading strategies that have the same payoffs always, then they must have the same price
  - And if they don't?

Real-World "Arbitrage" Strategies

- Relative mispricing and convergence trades
  - index arbitrage
  - fixed-income securities, e.g. on-the-run vs. off-the-run treasuries
- Special situations
  - mergers and acquisitions ("risk arbitrage")
  - devaluations of currency
  - IPOs
  - announcements (e.g. of earnings or macro news)
- NOT ARBITRAGES!!!

Equity Valuation

Andre de Souza

Outline

- How to measure the value of a firm:
  - Valuation using balance sheet data
  - Fundamental value (Dividend Discount Model (DDM))
- The Gordon Growth Model (GGM)
- Valuation ratios (e.g. P/E ratio)
- Two-stage DDM
- Throughout:
  - We want to find the "fair value"
  - Compare to price

Balance Sheets

- What do balance sheets look like?

Assets	Liabilities
Property	Amounts we owe our creditors
Plant	Debt (bonds)
Equipment	Equity (shares)
Cash	
Amounts our debtors owe us	

- By definition, Assets=Liabilities

Where do these values come from?

- Assets:
  - Start them at, say, cost
  - Every year deduct some amount, to account for
    - Wear and tear :
    - Asset value being "used up"
  - This is called *depreciation*
- Example
- Initial value put in – total depreciation= *book value of assets*

Where do these values come from?

- Book value has little relation to what the asset is worth
  - *Market value*, the price at which it can be sold
- How about liabilities?

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Where do these values come from?

- Liabilities
  - Debt often booked at value of proceeds from sale
  - Equity is *residual*
    - Balance sheet must balance
    - So BVE= BV(assets)-BV(other liabilities)=Net Worth of firm
  - Can we find a market value of equity? How?
  - Does MV need to be near BV?
  - Is the BV a lower bound for the MV?

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Where do these values come from?

- Liquidation value
  - A lower bound. Why?
- Replacement cost
  - Tobin's *q*=Market value/replacement value
  - What happens if Tobin's q is high?

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Balance Sheet Valuation

- Book Value
- Book Value of Equity
- Market Value
- Liquidation Value
- Replacement Cost

- Next up: Fundamental/Intrinsic Value

Random HPRs on shares

- Suppose I buy a share today
- Hold it till next year, collect one dividend, sell.
- Return $= \frac{P_1 + D_1}{P_0} - 1$

- Is this known today? Can I say for certain that I will get this return?
- But I can say how much I expect to make...

Expected return

- Expected return E(r)

$$= \frac{E(D_1) + E(P_1)}{P_0} - 1 = \frac{E(D_1)}{P_0} + \frac{E(P_1)}{P_0} - 1$$

- Two parts
- Can also be rearranged to give:

$$P_0 = \frac{E(D_1) + E(P_1)}{1 + E(r)}$$

Required Return

- Not a new concept
- How much return the "average investor" needs from a stock to hold it
  - To be compensated for its risk
    - So depends on the risk
  - If we believe the CAPM, how do we measure risk?
  - And how do we obtain required return?
    - SML!
    - Just what the CAPM believes is a fair return for that much risk

Expected return and required return

- Suppose we believe the CAPM
  - Use it to obtain required returns
- What does "the stock is priced correctly" mean?
  - Alpha=0
  - Use our predictions for D and P to obtain our estimate of expected return,

$$\frac{E(D_1)+E(P_1)}{P_0}-1$$

  - and then compare to required return

Another way to make the same point

- Define "Intrinsic Value" or "Fair Value" V_0

$$V_0=\frac{E(D_1)+E(V_1)}{1+k}$$

  - Where k is required return
- Compare with

$$P_0=\frac{E(D_1)+E(P_1)}{1+E(r)}$$

- Suppose P1=V1. When is $V_0>P_0$? When is $V_0<P_0$?

Intrinsic Value: Discounting at k

- Upto now, only discounted at rf
  - Because we only talked about riskless investments
- When we have risk, can't discount at rf anymore
- Suppose Stock A and Stock B have expected payment $100 tomorrow, but B is much much riskier than A.
  - Is the value of both the same?
  - Which value is less?

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Intrinsic Value: Discounting at k

- If we want to use discounting to measure present values, we'll have to use a lower discount rate for A.
  - That is, penalize the riskier payment more
- How much do I discount at?
  - Use k.
  - Why?

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Intrinsic Value: Discounting at k

- Suppose a stock C is correctly priced by the CAPM (which we're believing for the moment), and has E(r)=k=16%, ie, the fair payment for the risk of C is 16%
- Suppose A and C have the *same* risk.
  - What does this mean?
- I know that if I invest $1 in C, I get, on average, $1.16 next year.
- So if I invest $1 in A, I should expect to make $1.16 next year too.

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Intrinsic Value: Discounting at k

- The value of $1.16 expected next year from an investment in any one of these assets is $1.00 today
- The value of $1 expected next year from an investment in any one of these assets is ($1/1.16) today
- Similarly for two years, and so on.
- End up with discounting at k

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Fundamental Value and Market Price

- If market is efficient, market price is equal to the fundamental value (P=V), and expected return=required return.
- Supply and Demand, and Competition makes so.
  (If market price is higher than fundamental value, it is over-valued ➔ people will sell or short sell ➔ price goes down and approaches fundamental value.
  If market price is lower than fundamental value, it is under-valued ➔ _____)
- Reminder: fundamental values you got are calculated based on the model you chose and parameters you estimated. If it is different from market price, then two possibilities: _____

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Warren Buffett

- "Intrinsic value is an all-important concept that offers the only logical approach to evaluating the relative attractiveness of investments and businesses. Intrinsic value can be defined simply: It is the discounted value of the cash that can be taken out of a business during its remaining life."
- Example: Book value and intrinsic value of a college education

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Dividend Discount Model (DDM)

- Use the fundamental-value equation repeatedly:

$$V_0 = \frac{E(D_1)+E(V_1)}{1+k}$$
$$= \frac{E(D_1)}{1+k} + \frac{E(D_2)+E(V_2)}{(1+k)^2}$$
$$= \frac{E(D_1)}{1+k} + \frac{E(D_2)}{(1+k)^2} + \frac{E(D_3)}{(1+k)^3} + \frac{E(D_4)}{(1+k)^4} + \ldots$$

- A special case: all dividends are constant (D)

➔ $V_0 = \frac{D}{k}$

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Seems to say we don't care about capital gains

- But remember, we started from

$$V_0 = \frac{E(D_1)+E(V_1)}{1+k}$$

- So capital gains are built-in
- What about non-dividend-paying stocks?
- Side issue: possible to have bubbles
  - But these are fragile

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Gordon Growth Model (GGM)

- In the previous special case, we assume dividends are constant.
- Now, instead, suppose that expected dividends grow at a rate g, that is,

$E(D_1) = (1+g)D_0$, $E(D_2) = (1+g)E(D_1) = (1+g)^2 D_0$, etc.

- Use the Dividend-Discount Model:

$$V_0 = \frac{E(D_1)}{1+k} + \frac{E(D_2)}{(1+k)^2} + \frac{E(D_3)}{(1+k)^3} + \ldots$$
$$= \frac{D_0(1+g)}{1+k} + \frac{D_0(1+g)^2}{(1+k)^2} + \frac{D_0(1+g)^3}{(1+k)^3} + \ldots$$
$$= \frac{D_0(1+g)}{k-g} = \frac{E(D_1)}{k-g}$$

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Formulae for geometric series

$$1)\ \frac{x}{1+k}+\frac{x}{(1+k)^2}+\frac{x}{(1+k)^3}+\ldots$$

$$=\frac{x}{k}$$

$$2)\ \frac{x(1+g)}{1+k}+\frac{x(1+g)^2}{(1+k)^2}+\frac{x(1+g)^3}{(1+k)^3}+\ldots$$

$$=\frac{x(1+g)}{k-g}$$

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Gordon's Growth Model (GGM)

What determines the fundamental value?

$$V_0=\frac{D_0(1+g)}{k-g}=\frac{E(D_1)}{k-g}$$

E(D1) (+)

Growth Rate of Dividend (+)

k (or discount factor) (-)

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Example 1: Texas Instruments

- In early 1999, Texas Instruments (TXN) had
  - Just paid dividends of 0.36 per share
  - From data, you estimate beta as 1.4
  - You estimate growth rate of dividends is 16.1%
  - Risk free rate is 4.75%
  - Market risk premium is 8.5%

Based on these estimates of yours, what was the fundamental value of TXN in early 1999?

Suppose the market price is $120.5 . What are the two possibilities?

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So now we've done...

- Valuing a company based on
  - Balance sheet data
  - Dividend discount models
- Next up: Valuation ratios

Valuation Ratios

- What are they?
  - Just Price/Something
  - What is this Something?
    - Dividends
    - Earnings
    - Book-value
    - Sales
  - (All per share)
- Use to estimate price, given an estimate of the denominator

Valuation Ratios

- So the denominator needs to be
  - Observable
  - Related to price somehow
- Hope that the ratio is constant across comparable firms
  - E.g. Same industry

Price-Dividend ratio

- (Price)/(Last dividend)
- If we know what the firm's P/D should be, and we know the dividend, we can get the price
- Example: AT & T

Price-Dividend ratio: relation to GGM

- Suppose the firm is correctly priced
- Then $$P_0 = V_0$$
- If we also assume the GGM holds then $$P_0 = V_0 = \frac{D_0(1+g)}{k-g} = \frac{E(D_1)}{k-g}$$
- So $$\frac{P_0}{D_0} = \frac{(1+g)}{k-g}$$

Price-Earnings Ratio (P/E)

- Can use past earnings, or E_1 (estimate of *next* year's earnings)
- What are earnings?

Profit and Loss Account/Income Statement

Revenues (or Sales)	$100
Less:Cost of Goods Sold	$75
Gross Margin /Gross Profit	**$25**
Less: SG &A expenses	$15
Operating Profit/EBIT	**$10**
Less: Interest	$5
EBT	**$5**
Less: Taxes (@40%)	$2
Earnings after tax/Net Income	**$3**

P/E Ratios

- *Earnings* are what the income statement calls *net income*
- EPS
- What can I do with earnings?
  - Pay them out (Dividends)
  - Reinvest them
- Example: AT &T
- P/E tells you how much you're going to pay for every dollar of earnings the company generates

P/E and GGM

- Suppose I reinvest a fixed proportion "*b*" of my earnings
  - Plowback ratio or reinvestment ratio
- Then how much do I pay out as dividends?
  - $D_0=(1-b)E_0$
- Hence, if $V_0=P_0$ and GGM applies then

$$\frac{P_0}{E_0}=\frac{(1+g)(1-b)}{k-g}$$

P/E ratios are higher...

- Lower the k:
  - Lower beta
  - Lower rf
  - Lower market risk premium
- Higher the dividend growth (or earnings growth, *g* is both)
- Lower the plowback ratio *b*

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P/E and GGM

- What happens if b=0?
- What happens if b=1?

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Example 2: Texas Instruments

- In early 1999, companies "like" Texas Instruments (TXN) were trading at P/E ratios of 43.5
- Suppose GGM applies
- Suppose beta= 1.4, so k=16.65%
- The payout ratio was known to be 0.13. What is the retention ratio b?

  What is the market's (implicit) estimate of Texas Instrument's growth rate?

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Two-Stage DDM

- GGM: assume company grows at same rate forever
- Life-cycle of a company: a company grows exceptionally for a while, but at some point the company matures and its growth slows.
- Suppose that you estimate that a company's growth will reach its "long-run" level of g after, say, 3 years.
- Then, in 3 years its price is $P_3 = \frac{(1+g)D_3}{k-g}$
- Based on estimates of the next 3 years' dividends, the earnings after 4 years, the long-run earnings growth and retention rate, today's value is:

$$P_0 = \frac{E(D_1)}{1+k} + \frac{E(D_2)}{(1+k)^2} + \frac{E(D_3)+E(P_3)}{(1+k)^3}$$

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Example 3: Texas Instruments

- Suppose in 1999 you estimated
  - TXN's 2000 dividend per share will be 0.360
  - TXN's 2001 dividend per share will be 0.457
  - TXN's 2002 dividend per share will be 0.533
  - TXN's 2003 dividend per share will be 0.650
  - TXN's required return is constant at 16.65% (from Example 1)
  - After 2003, TXN's (dividend) growth rate will be 16.1%
- Using the two-stage DDM, what is the fundamental value in year 1999?

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Price and NPV

- Future dividends can come from not only existing projects running now (*assets in place*) but also new projects.
- P_0=PV (future dividends)
  =PV (future net cash flows from assets in place) + NPV (new projects)

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Price and NPV

- NPV(new projects) is also called the NPV(growth opportunities), or PVGO
- Recall how to get NPV of a project:
  - use the CAPM to compute the required return
  - use the required return as discount rate to compute PV
  - NPV=PV-Initial Investment
  - capital budgeting: take positive NPV projects

Price and PVGO

- Suppose the only way for a company to increase earnings is to grow its assets
- Suppose the only way a company can grow its assets is to reinvest
  - Could also raise money, but then some part of money goes to other claimants (new shareholders)
- Not reinvesting=>Pays out all earnings
- If b=0, $P_0 = \frac{D_1}{k} = \frac{E_1}{k}$
- Difference between this and the actual price is PVGO

Optional: The relationship between *g* and *b*

- Suppose b=0. Think of the firm as a bank account: put in $P (and leave it there), and it pays you a stream of $E forever (a perpetuity). Suppose P=$100, E=$10. Every dollar I invest makes me $0.1 per year, which I withdraw
  - Return on Equity (ROE)=10%
- Suppose now b=0.7
  - How much are dividends in year 1?
  - How much is reinvested in year 1?

Optional: The relationship between *g* and *b*

- Year 1: My earnings are $10, I reinvest $7. Dividends are $3
  - The $7 now goes into my capital and increases my earnings *every year from year 2 on*
- Year 2: My earnings from the original capital= $10
- Earnings from the $7 I invested: $7x$0.1=$0.7
- Total earnings=$10.7
- How much are dividends, how much is reinvested?
- How much did dividends grow?
- Repeat for year 3.

Optional: The relationship between *g* and *b*

- *g*=ROE x *b*

Readings

- Today: BKM: 12 CP:13
- Not for evaluation: Subsection 12.5 (But read "Comparing the valuation models"
- Next class: BKM 9.3-9.4, 9.6, 10.1
  CP: 15-18