Equity Valuation

Overview

- Dividend discount models (DDM)

- Free cash flow models

- Price/earnings ratios and relative valuation

Fundamental Value

$$PV = \sum_{t=0}^{\infty} \frac{CF_t}{(1+r)^t}$$

$$= \sum_{t=0}^{T} \frac{CF_t}{(1+r)^t} + \frac{P_T}{(1+r)^T}$$

- The fundamental value is the present value of the discounted future cash flows from holding the security

- Keys:
  - Forecast future cash flows (earnings/dividends/etc.)
  - Apply a sensible discount rate r

Dividend Discount Models (DDM)

$$V_0 = \sum_{t=0}^{\infty} \frac{E[D_t]}{(1 + r_t)^t}$$

- The present value of the stream of dividends paid by the firm

Constant Growth DDM

- If we expect dividends to grow at a fixed rate forever and always, the value of the security can be expressed:

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

Multistage DDM

- Firms go through a life-cycle
  - Start-up
  - Rapidly growing
  - Slow down
  - Decline
- Growth rates change over time
- Can use a multistage DDM

Forecasting Earnings and Payouts

- ## Alternative method:
  - Forecast earnings growth and payouts instead of dividend growth

- ## Dividends = Earnings x payout ratio
  - Note: Earnings = Net Income
    - Or net income – preferred dividends
    - Plowback rate = 1 - payout ratio

- ## Possible assumption:
  - In steady state (when growth is assumed constant), the earnings yield equals the required return on equity

Free Cash Flow Method

Free Cash Flow Method

- ## Alternative to the DDM
  - ### Especially useful for firms that do not pay dividends

- ## Two approaches:
  - ### Find the value of the firm and subtract off debt
    - Use the free cash flow for the firm as the cash flow when calculating present value of the firm

  - ### Find the value of equity
    - Use the free cash flow for equity as the cash flow when calculating present value of equity

Free Cash Flow

- Approach 1 (Free Cash Flow for the Firm):
  - Find the PV of the firm's free cash flow and subtract off value of debt

$$\text{PV of Equity} = \text{PV of Firm} - \text{Value of Debt}$$

$$\text{PV of Firm} = \sum_{t=0}^{\infty} \frac{FCFF}{(1 + wacc)^t}$$

Free Cash Flow

- Discount rate = WACC (weighted-average cost of capital)

$$WACC = \frac{\text{Value of Equity}}{\text{Value of Firm}} * \text{Cost of Equity} + \frac{\text{Value of Debt}}{\text{Value of Firm}} * \text{Cost of Debt} * (1 - t_C)$$

$$\text{Value of Firm} = \text{Value of Equity} + \text{Value of Debt}$$

- Free Cash Flow for the Firm:

$$\text{FCFF} = \text{After tax EBIT} + (\text{depreciation - capital expenditures}) - \Delta \text{ net working capital}$$

$$\text{where after-tax EBIT} = (1 - t_c) * EBIT$$

$$\text{where net working capital}_t = \text{current assets}_t - \text{current liabilities}_t$$

$$\text{and } \Delta \text{Net Working Capital}_t = \text{Net Working Capital}_t - \text{Net Working Capital}_{t-1}$$

Free Cash Flow

- Approach 2:
  - Find the PV of the firm's free cash flow to equity
    - Discount rate = cost of equity

$$FCFE = FCFF - \text{interest expense} \times (1 - t_c) + \text{increases in debt}$$

$$\text{PV of Equity} = \sum_{t=0}^{\infty} \frac{FCFE}{(1 + \text{cost of equity})^t}$$

Free Cash Flow (Expanded)

$$FCFF = EBIT*(1-t) + D - CX - \Delta NOWC - \Delta NOOLTA$$

- where:
  - D = depreciation
  - CX = capital expenditures
  - NOWC = Net operating working capital
  - NOOLTA = Net operating other long-term assets

Forecasting Free Cash Flow

- More sophisticated free cash flow forecasting:
  - Forecast each period's free cash flow

  - Forecast the individual inputs like sales, asset intensity, leverage, depreciation, etc.
    - This will help catch possible issues with simple growth forecasts
      - Where is the additional cash flow coming from? Increased sales, decreased costs, etc.

Forecasting Free Cash Flow

- Many options (more art than science)
- One option: forecast sales growth, asset intensity, and profitability

$$FCFF_t = EBIAT_t - \Delta NOA_t$$

$$FCFF_t = EBIAT_t - (NOA_t - NOA_{t-1})$$

$$FCFF_t = \frac{EBIAT_t}{Sales_t} \times Sales_t - [\frac{NOA_t}{Sales_t} \times Sales_t - \frac{NOA_{t-1}}{Sales_{t-1}} \times Sales_{t-1}]$$

$$FCFF_t = p_t \times Sales_t - [a_t \times Sales_t - a_{t-1} \times Sales_{t-1}]$$

$$FCFF_t = p_t \times Sales_{t-1} \times (1 + g_t) - [a_t \times Sales_{t-1} \times (1 + g_t) - a_{t-1} \times Sales_{t-1}]$$

- gt is sales growth, pt is profitability and at is asset

HW Problems

Forecasting Future Cash Flows

- Gather as much information as possible
  - Assess opportunities/threats, barriers to entry, R&D, new products, macroeconomic conditions, etc.

- Equity analysts have access to more information
  - They analyze all public information
  - Plus, they generate new information
    - Better access to management (e.g., earnings conference calls)
  - Analyst forecasts are especially useful in valuation

Negative Free Cash Flow Firms

- **Issue #1: Taxes**
- If the firm has negative earnings, the losses can be carried forward which will decrease future tax bills and increase future free cash flows

Negative Free Cash Flow Firms

- **Issue #2: Forecasting future free cash flows**
- Can't use expected growth rates
- We need to understand the cause of the negative free cash flows
  - If the firm is no longer going to be profitable, then it's value should be (less than) zero or at its salvage value
  - If the negative free cash flow is only in very recent periods:
    - Normalize earnings or free cash flows (you can use average in recent past) to project into the future
    - If due to a temporary shock (e.g., if the firm paid off a portion of its debt, this may not occur again in the future) , then remove the effect of the temporary shock and use the adjusted free cash flow going forward
  - If the negative free cash flow has persisted over a number of periods:
    - Estimate the transition from negative to positive free cash flow going forward
    - Analyst forecasted earnings can help
  - Further reading: http://people.stern.nyu.edu/adamodar/pdfiles/papers/HighGrow.pdf

Which Model?

Which growth pattern?

- ## Stable Growth:
  - Large, stable firms slowly growing with the economy
  - Ford

- ## 2 Stage Growth Model:
  - Large firms growing fairly quickly (~3-12%)
  - Expect growth to slow or expect an increase in competition in the near future
    - Like if patents for main product will expire

- ## 3+ Stage Growth Model
  - Firm is growing rapidly (~>12%)
  - Don't foresee a significant increase in competition (high

Implementation

- Typically, we forecast future cash flows in the near-term like 3-5 years
- We also forecast a terminal value for the firm at the end of the projected cash flow period
  - (1) Assume a stable growth rate and find the value of the growing perpetuity
  - (2) Use a multiple of the firm's projected earnings or sales at the end of the period.
    - For example, suppose the firm's P/E ratio and competitors P/E ratio is typically close to 14 and our projected earnings in 5 years is $10. Then we can use a terminal value of 14 x $10 = $140.

Which Model Should We Use?

- Value the firm versus value equity?
  - Most of the time you'll value equity directly
    - Unless we expect the firm's leverage to change dramatically
    - Or we're missing information on leverage like interest expenses

- Dividend discount model vs. free cash flow models
  - Use DDM for firms that pay dividends and the dividends are close to FCFE (80-120%) for a number of periods
  - Otherwise use free cash flow

- Best approach: use all appropriate valuation methods and compare across

Hierarchy of Valuation

- Most reliable:
  - Balance sheet assets with fairly precise estimates of market value
    - E.g., real estate, cash, PP&E, long-term debt outstanding, etc.

- Somewhat reliable:
  - Cash flow from assets already in place
    - E.g., no-growth value of the firm or value
  - Uncertainty due to competition or other threats to these profits

- Least reliable:

Discount Rates

Discount rate

- For now, we'll use the CAPM model to estimate discount rates

  - Later in the semester we'll learn other models to estimate the discount rate

$$E[r] = r_f + \beta \times (E[r_m] - r_f)$$

  - Example: what is the discount rate of GOOGL (beta = 0.98)? Assume the market risk premium (E[rm] – rf) is 6% and the risk-free rate is 0.25%.

$$E[r] = 0.25\% + 0.98 \times (6\%) = 6.13\%$$

CAPM

- Cost of equity:

$$E[r_E] = r_f + \beta^E (E[r_{mkt}] - r_f)$$

- Cost of debt:

$$E[r_D] = r_f + \beta^D (E[r_{mkt}] - r_f)$$

- Betas capture the covariance between asset returns and the market index

  - Insight: investors demand higher returns on assets that covary more with the market

Leveraged Beta

$$WACC = \frac{\text{Value of Equity}}{\text{Value of Firm}} * \text{Cost of Equity} + \frac{\text{Value of Debt}}{\text{Value of Firm}} * \text{Cost of Debt} * (1 - t_C)$$

- The amount of leverage will affect the beta of equity

$$\beta^U = \beta^E \frac{E}{D+E} + \beta^D \frac{D}{D+E}$$

$$\beta^E > \beta^U > \beta^D$$

- Rearranging:

$$\beta^E = \beta^U + \frac{D}{E}(\beta^U - \beta^D)$$

- Equity beta is increasing in leverage
- If leverage is forecasted to increase, need to adjust

Example

Unlevered Beta	0.5
Risk-free	3%
Market return	10%
Tax-Rate	0.35

Debt	Equity	Debt +Equity	Equity Beta	Debt Beta	Cost of Equity	Cost of Debt (pre-tax)	WACC (pre-tax)	WACC (after-tax)
0	3	3	0.500	0	6.50%	3.00%	6.50%	6.50%
0.2	2.8	3	0.534	0.02	6.74%	3.14%	6.50%	6.43%
0.4	2.6	3	0.571	0.04	7.00%	3.28%	6.50%	6.35%
0.6	2.4	3	0.610	0.06	7.27%	3.42%	6.50%	6.26%
0.8	2.2	3	0.653	0.08	7.57%	3.56%	6.50%	6.17%
1	2	3	0.700	0.1	7.90%	3.70%	6.50%	6.07%
1.2	1.8	3	0.753	0.12	8.27%	3.84%	6.50%	5.96%
1.4	1.6	3	0.815	0.14	8.71%	3.98%	6.50%	5.85%
1.6	1.4	3	0.889	0.16	9.22%	4.12%	6.50%	5.73%
1.8	1.2	3	0.980	0.18	9.86%	4.26%	6.50%	5.61%

Equity Beta

Equity Beta
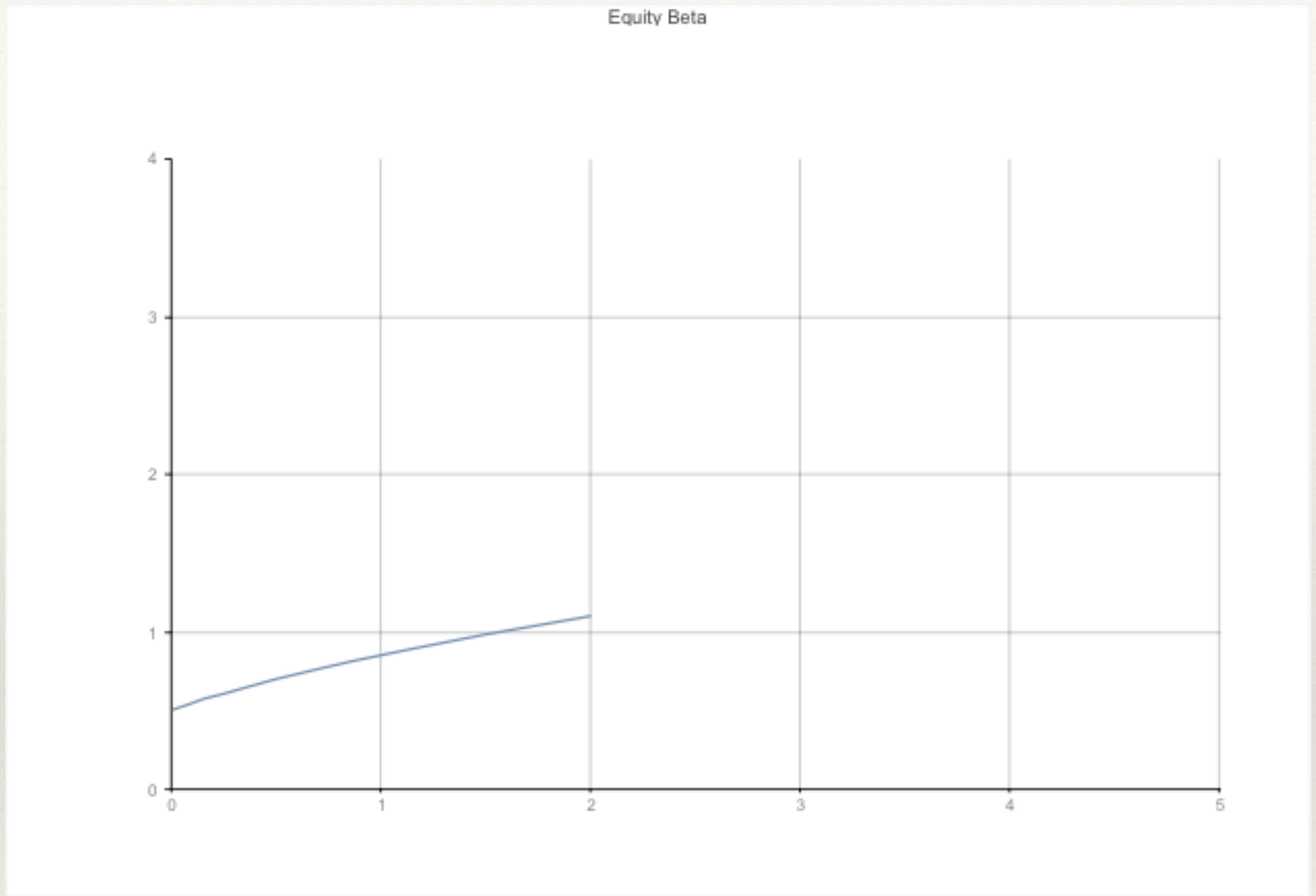
Debt-to-Equity Ratio (D/E)

Implementation

- Forecast future leverage ratios and adjust discount rates accordingly

- Discount rate can vary over time:
  - Discount rate for year 1 may be different from discount rate for year 3
    - Using numbers from previous example:
      - If today the firm's D/E ratio is 0 and in one year it is 2, then:
        - The first year discount rate should be 6.50% and the second year it should be 5.47%

Other Discount Rate Considerations

$$E[r_i] = r_{f,t} + \beta_{i,t}(E[r_{m,t}] - r_{f,t})$$

- Will the risk-free rate change in the future?
- Will the market risk-premium change in the future?
- Will the firm's unlevered beta change in the future?

Estimating Dividend Growth Rates

Estimating Dividend Growth Rates

- How can we estimate g?
  - Firm's that reinvest more of their current earnings will have higher future earnings and dividends

$$g = ROE \times b$$

  - g = growth rate in dividends
  - ROE = Firm's return on equity

Estimating Dividend Growth Rates

- The plowback rate (b) is the fraction of earnings reinvested in the firm

$$b = \frac{\text{Net Income} - \text{Dividends}}{\text{Net Income}}$$

$$b = 1 - \frac{\text{Dividends}}{\text{Net Income}}$$
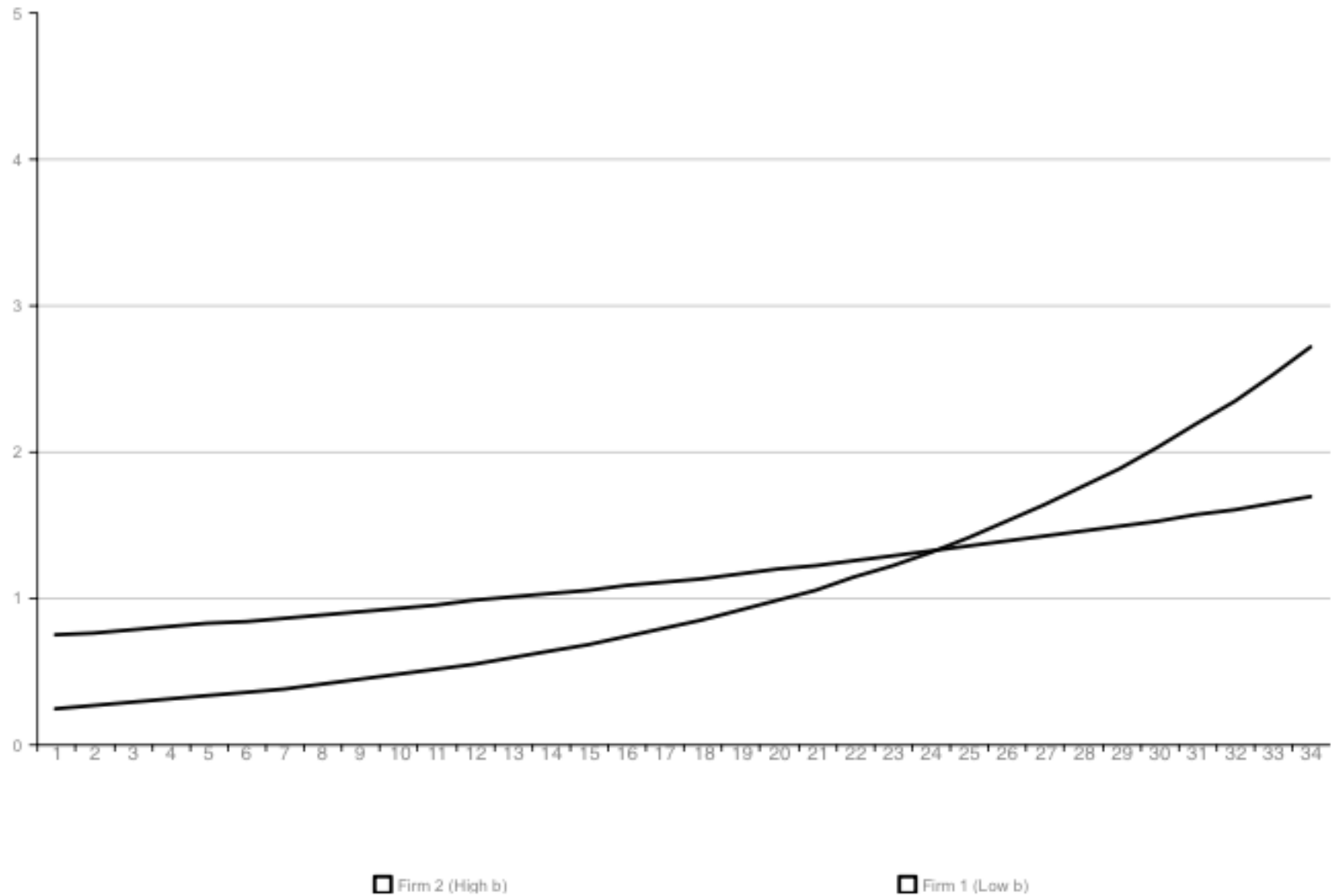
$$b = 1 - \text{Payout ratio}$$

Where does this formula come from?

- Essentially, we are assuming that dividends will grow at the same rate as the book value of equity

$$g = ROE \times b$$

$$ROE \times b = \frac{Net\ Income}{Equity} \times \frac{Reinvested\ Earnings}{Net\ Income} = \frac{Reinvested\ Earnings}{Equity}$$

Dividends (High vs. Low Plowback Rates)

Example

- ROE
  - Microsoft's Annual Net Income = $39.24B
  - Microsoft's Shareholder's Equity = $102.33B

- Plowback ratio
  - Microsoft's most recent annual EPS = $5.03
  - Microsoft's annual dividend per share = $0.46/qtr x 4 qtrs. = $1.84

- Discount rate = 5.28%

Example

Valuing Growth

Present Value of Growth Opportunities

$$Price = \frac{E_1}{r} + PVGO$$

- (E1/r) captures the value if the firm paid out all of it's earnings each period and earnings never grew (No-growth)
  - If earnings and dividends were equal to E1 forever
  - Value of assets already in place
- PVGO captures added value from growth opportunities

Example

- Microsoft's Projected Earnings This Year = $5.23/share
- Discount rate = 5.28%
- Current Market Price = $136.31
- What is Microsoft's PVGO?
  - Calculate the no-growth value (E1/r)
  - Find the difference

Example

$$Price = \frac{E_1}{r} + PVGO$$

Price-to-Earnings

Price-to-earnings

- Price-earnings ratio is commonly used in stock valuation analysis
  - Forward: P_0/E_1
  - Trailing: P_0/E_0

- What determines a stock's price-to-earnings ratio?

P/E and Growth Opportunities

- Captures fairly well a firm's growth opportunities
  - High growth firms will have higher P/E

$$\frac{P_0}{E_1} = \frac{\frac{E_1}{r} + PVGO}{E_1} = \frac{1}{r}\left(1 + \frac{PVGO}{\frac{E_1}{r}}\right)$$

Ratio of growth opportunities to value of assets already in place

Breaking Down P/E

$$\frac{P_0}{E_1} = \frac{\frac{D_1}{r-g}}{E_1} = \frac{\frac{(1-b)E_1}{r-g}}{E_1} = \frac{1-b}{r-g} = \frac{1-b}{r-(ROE \times b)}$$

- This comes from the dividend growth model
  - P/E is increasing in ROE
  - Plowback ratio is ambiguous
    - If ROE>r, the P/E is increasing in the plowback ratio

P/E

Assume r=10%

Growth rate (g)

ROE/b	0	.25	.50	.75
5%	0	1.25%	2.5%	3.75%
10%	0	2.5%	5.0%	7.5%
15%	0	3.75%	7.5%	11.25%

$g = ROE \times b$

P/E

ROE/b	0	.25	.50	.75
5%	10	8.57	6.67	4
10%	10	10	10	10
15%	10	12	20	-

$$\frac{P_0}{E_1} = \frac{1-b}{r-g}$$

- Want firm to reinvest as long as ROE>r

P/E

$$\frac{P_0}{E_1} = \frac{1-b}{r-g}$$

- P/E is decreasing in the discount rate r, therefore:
  - P/E is lower the greater the firm's beta
  - P/E is lower the greater the risk-free rate
  - P/E is lower the greater the market excess return $r = E[r_i] = r_f + \beta_i(E[r_m] - r_f)$
- CAPM:

Trailing P/E and nominal 10-year Treasury yield

P/E has increased since 2009 while interest rates have stayed low

Trailing P/E multiple and nominal 10-year Treasury yield

PEG
Ratio

PEG Ratio

- Wall Street rule of thumb: growth rate (g) is roughly equal to the P/E ratio
  - This should only be true in certain circumstances

- PEG Ratio = (P/E ratio)/Growth

- If PEG ratio less than 1, seen as a signal stock is underpriced

PEG Ratio

- "If the P/E ratio of Coca Cola is 15, you'd expect the company to be growing at about 15% per year, etc. But if the P/E ratio is less than the growth rate, you may have found yourself a bargain." - Peter Lynch in *One Up on Wall Street.*

PEG Ratio in the wild

- https://www.cnbc.com/video/2018/08/28/now-is-a-good-opportunity-to-get-involved-with-chinese-internet-stocks-says-alphaone-capitals-niles.html

- Around 1:45 minute mark

PEG Ratio Example

- Assume:
  - Risk-free rate = 10%
  - Market excess return = market risk premium = E[rm] - rf = 10%
  - Stock beta = 1
  - Firm's ROE = 20%
  - Plowback ratio = .4

- What is this firm's PEG Ratio?
  - Calculate the appropriate discount rate r

Answer

$$\frac{P}{E} = \frac{1-b}{r-g} \qquad r = r_f + \beta(r_m - r_f) \qquad g = ROE \times b$$

$$r = 10\% + 1(10\%) = 20\% \quad g = 20\% \times .4 = 8\%$$

$$\frac{P}{E} = \frac{1 - .4}{20\% - 20\% \times .4} = 5$$

$$PEG = \frac{\frac{P}{E}}{g} = \frac{5}{8}$$

PEG Ratio Example

- Assume:
  - **Risk-free rate = 1%**
  - Market excess return = 10%
  - Stock beta = 1
  - Firm's ROE = 20%
  - Plowback ratio = .4

- What is this firm's PEG Ratio?

Answer

$$\frac{P}{E} = \frac{1-b}{r-g} \qquad r = r_f + \beta(r_m - r_f) \qquad g = ROE \times b$$

Relative PEG Ratio

- PEG ratio can be above or below one without being under or overpriced – the 1.0 cut-off for undervaluation is hard to justify

- The PEG ratio may be more useful in a relative sense.

- Roughly, the PEG ratio tells us the price per unit of growth

- "Twitter has a lower PEG ratio than any of its peers. Twitter is currently sitting at a PEG of 1.18 when Facebook has 1.48, Google has 1.4, and LinkedIn at 1.55."

  - – Seeking Alpha, "Twitter: Undervalued And Poised For An Acquisition" 10/23/2015

Relative Valuation

Relative Valuation

- P/E can be compared across similar firms to examine relative valuation

- Other comparative value approaches:
  - Price-to-book ratio
  - Price-to-cash flow ratio
  - Price-to-sales ratio
    - Especially useful for start-up companies
    - Less likely to have positive earnings
  - Enterprise value-to-earnings (or cash flow or

Relative Valuation

PE Ratio (TTM) Chart

View Full Chart

| 1d | 5d | 1m | 3m | 6m | YTD | 1y | 5y | 10y | Max |

Export Data   Save Image   Print Image

For advanced charting, view our full-featured Fundamental Chart

2015   2016   2017   2018   2019

60.00
45.00
30.00
27.00
15.00

PE Ratio (TTM) Benchmarks

Benchmarks

Adobe Inc	53.30
Activision Blizzard Inc	23.31
Cadence Design Systems Inc	45.22

PE Ratio (TTM) Range, Past 5 Years

Minimum	16.29	Jan 30 2015
Maximum	62.43	Mar 12 2018
Average	32.01	

Ycharts.com

Enterprise Value

P/E affected by Leverage

- P/E can be affected by leverage
  - Debt affects P/E in a variety of ways
  - Increasing debt leads to a greater interest expense, a greater tax shield, a greater cost of equity, leverages earnings growth
  - Usually P/E is decreasing in leverage

- Can use Enterprise Value to EBITDA as relative valuation multiple
  - Financing won't affect comparisons unlike P/E ratio

Enterprise Value

- Enterprise value:
  - Market capitalization
  - + debt
  - - cash and cash equivalents
  - + minority interest
  - + preferred shares

- Market capitalization = share price x number of shares outstanding

Next Class

- Equity valuation analysis