# Application Test: Analyzing the Risk Regression

- Using your Bloomberg risk and return print out, answer the following questions:
  - How well or badly did your stock do, relative to the market, during the period of the regression?
  - Intercept - (Riskfree Rate/n) (1- Beta) = Jensen's Alpha
    - where n is the number of return periods in a year (12 if monthly; 52 if weekly)
  - What proportion of the risk in your stock is attributable to the market? What proportion is firm-specific?
  - What is the historical estimate of beta for your stock? What is the range on this estimate with 67% probability? With 95% probability?
  - Based upon this beta, what is your estimate of the required return on this stock?
  - Riskless Rate + Beta * Risk Premium

Aswath Damodaran

A Quick Test

□ You are advising a very risky software firm on the right cost of equity to use in project analysis. You estimate a beta of 3.0 for the firm and come up with a cost of equity of 20%. The CFO of the firm is concerned about the high cost of equity and wants to know whether there is anything he can do to lower his beta.

□ How do you bring your beta down?

□ Should you focus your attention on bringing your beta down?

  ▪ Yes

  ▪ No

Regression Diagnostics for Tata Motors
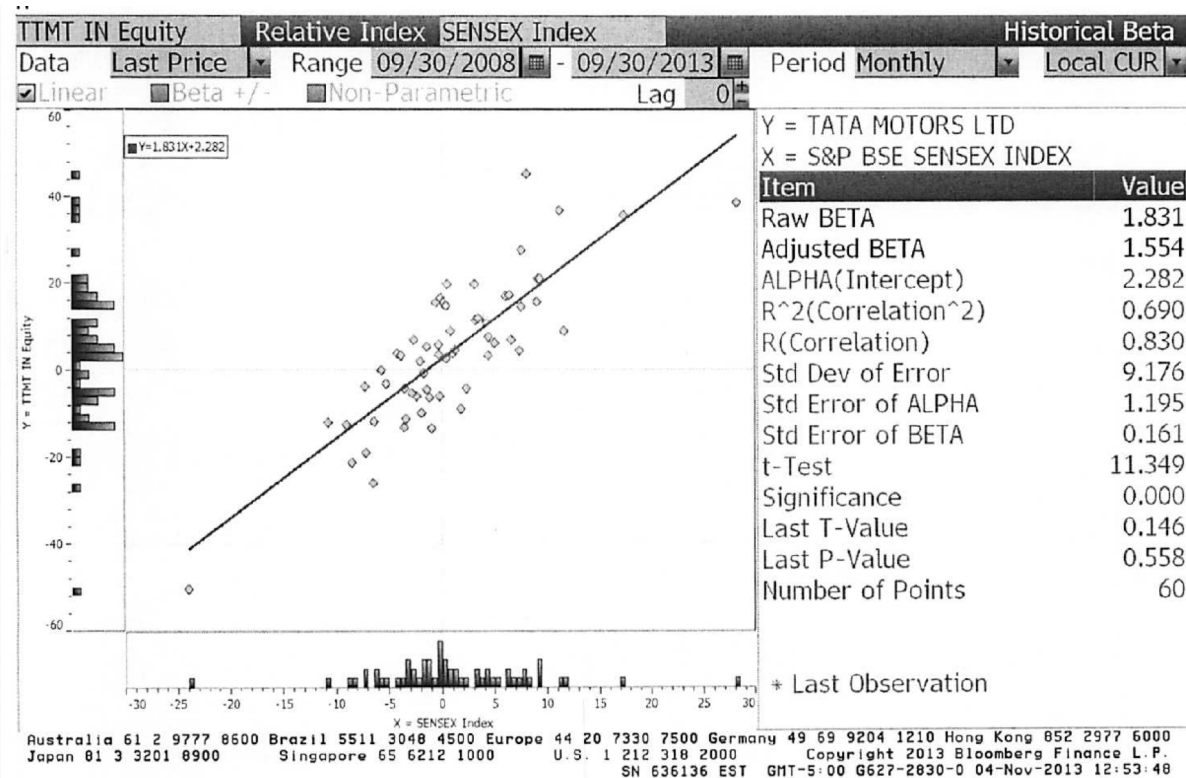
Beta = 1.83
67% range
1.67-1.99

69% market risk
31% firm specific

Jensen's α
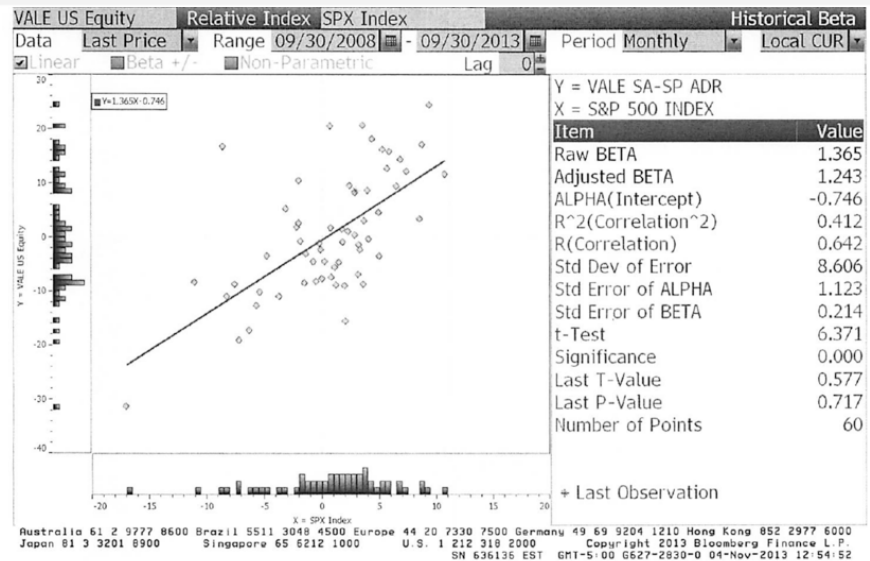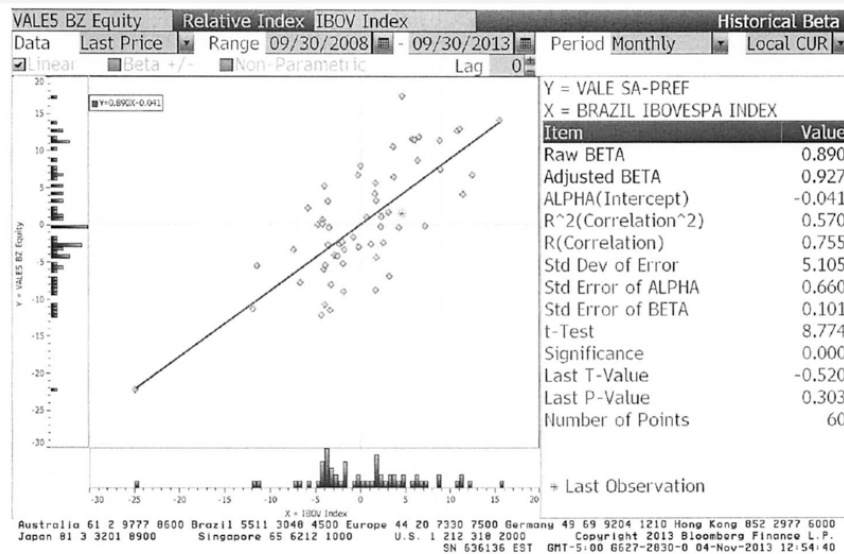= 2.28% - 4%/12 (1-1.83) = 2.56%
 Annualized = $(1+.0256)^{12}-1= 35.42\%$
Average monthly riskfree rate (2008-13) = 4%

Expected Return (in Rupees)
= Riskfree Rate+ Beta*Risk premium
= 6.57%+ 1.83 (7.19%) = 19.73%

Aswath Damodaran

141

A better beta? Vale

Deutsche Bank and Baidu: Index Effects on Risk Parameters

□ For Deutsche Bank, a widely held European stock, we tried both the DAX (German index) and the FTSE European index.

	DAX	FTSE Euro 100
Intercept	-0.90%	-0.15%
Beta	1.58	1.98
Std Error of beta	0.21	0.29
R^2	51%	29%

□ For Baidu, a NASDAQ listed stock, we ran regressions against both the S&P 500 and the NASDAQ.

	S&P 500	NASDAQ
Intercept	2.84%	2.15%
Beta	1.63	1.65
Std Error of beta	0.28	0.23
R^2	37%	47%

Beta: Exploring Fundamentals

Beta > 2

Bulgari: 2.45

Beta between 1 and 2

Qwest Communications: 1.85

Microsoft: 1.25

GE: 1.15

Beta <1

Exxon Mobil: 0.70

Altria (Philip Morris): 0.60

Beta <0

Harmony Gold Mining: -0.15

Aswath Damodaran

Determinant 1: Product Type

□ Industry Effects: The beta value for a firm depends upon the sensitivity of the demand for its products and services and of its costs to macroeconomic factors that affect the overall market.

- ◻ Cyclical companies have higher betas than non-cyclical firms

- ◻ Firms which sell more discretionary products will have higher betas than firms that sell less discretionary products

A Simple Test

- Phone service is close to being non-discretionary in the United States and Western Europe. However, in much of Asia and Latin America, there are large segments of the population for which phone service is a luxury.

- Given our discussion of discretionary and non-discretionary products, which of the following conclusions would you be willing to draw:

  - Emerging market telecom companies should have higher betas than developed market telecom companies.

  - Developed market telecom companies should have higher betas than emerging market telecom companies

  - The two groups of companies should have similar betas

Aswath Damodaran

Determinant 2: Operating Leverage Effects

- Operating leverage refers to the proportion of the total costs of the firm that are fixed.

- Other things remaining equal, higher operating leverage results in greater earnings variability which in turn results in higher betas.

Measures of Operating Leverage

□ Fixed Costs Measure = Fixed Costs / Variable Costs

  ◻ This measures the relationship between fixed and variable costs. The higher the proportion, the higher the operating leverage.

□ EBIT Variability Measure = % Change in EBIT / % Change in Revenues

  ◻ This measures how quickly the earnings before interest and taxes changes as revenue changes. The higher this number, the greater the operating leverage.

Disney's Operating Leverage: 1987- 2013

Year	Net Sales	% Change in Sales	EBIT	% Change in EBIT
1987	$2,877		$756	
1988	$3,438	19.50%	$848	12.17%
1989	$4,594	33.62%	$1,177	38.80%
1990	$5,844	27.21%	$1,368	16.23%
1991	$6,182	5.78%	$1,124	-17.84%
1992	$7,504	21.38%	$1,287	14.50%
1993	$8,529	13.66%	$1,560	21.21%
1994	$10,055	17.89%	$1,804	15.64%
1995	$12,112	20.46%	$2,262	25.39%
1996	$18,739	54.71%	$3,024	33.69%
1997	$22,473	19.93%	$3,945	30.46%
1998	$22,976	2.24%	$3,843	-2.59%
1999	$23,435	2.00%	$3,580	-6.84%
2000	$25,418	8.46%	$2,525	-29.47%
2001	$25,172	-0.97%	$2,832	12.16%
2002	$25,329	0.62%	$2,384	-15.82%
2003	$27,061	6.84%	$2,713	13.80%
2004	$30,752	13.64%	$4,048	49.21%
2005	$31,944	3.88%	$4,107	1.46%
2006	$33,747	5.64%	$5,355	30.39%
2007	$35,510	5.22%	$6,829	27.53%
2008	$37,843	6.57%	$7,404	8.42%
2009	$36,149	-4.48%	$5,697	-23.06%
2010	$38,063	5.29%	$6,726	18.06%
2011	$40,893	7.44%	$7,781	15.69%
2012	$42,278	3.39%	$8,863	13.91%
2013	$45,041	6.54%	$9,450	6.62%
Average: 87-13		11.79%		11.91%	Operating Leverage 11.91/11.79 =1.01
Average: 96-13		8.16%		10.20%	10.20/8.16 =1.25

Average across entertainment companies = 1.35

Given Disney's operating leverage measures (1.01 or 1.25), would you expect Disney to have a higher or a lower beta than other entertainment companies?
a. Higher
b. Lower
c. No effect

Aswath Damodaran

Determinant 3: Financial Leverage

□ As firms borrow, they create fixed costs (interest payments) that make their earnings to equity investors more volatile. This increased earnings volatility which increases the equity beta.

□ The beta of equity alone can be written as a function of the unlevered beta and the debt-equity ratio

$$\beta_L = \beta_u (1 + ((1-t)D/E))$$

where

□ β_L = Levered or Equity Beta   D/E = Market value Debt to equity ratio

□ β_u = Unlevered or Asset Beta   t = Marginal tax rate

□ Earlier, we estimated the beta for Disney from a regression. Was that beta a levered or unlevered beta?

a. Levered

b. Unlevered

Aswath Damodaran

Effects of leverage on betas: Disney

- The regression beta for Disney is 1.25. This beta is a levered beta (because it is based on stock prices, which reflect leverage) and the leverage implicit in the beta estimate is the average market debt equity ratio during the period of the regression (2008 to 2013)

- The average debt equity ratio during this period was 19.44%.

- The unlevered beta for Disney can then be estimated (using a marginal tax rate of 36.1%)

  = Current Beta / (1 + (1 - tax rate) (Average Debt/Equity))

  = 1.25 / (1 + (1 - 0.361)(0.1944))= 1.1119

Disney : Beta and Financial Leverage

Debt to Capital	Debt/Equity Ratio	Beta	Effect of Leverage
0.00%	0.00%	1.11	0.00
10.00%	11.11%	1.1908	0.08
20.00%	25.00%	1.29	0.18
30.00%	42.86%	1.42	0.30
40.00%	66.67%	1.59	0.47
50.00%	100.00%	1.82	0.71
60.00%	150.00%	2.18	1.07
70.00%	233.33%	2.77	1.66
80.00%	400.00%	3.95	2.84
90.00%	900.00%	7.51	6.39

Aswath Damodaran

Betas are weighted Averages

- ☐ The beta of a portfolio is always the market-value weighted average of the betas of the individual investments in that portfolio.

- ☐ Thus,

  - ◻ the beta of a mutual fund is the weighted average of the betas of the stocks and other investment in that portfolio

  - ◻ the beta of a firm after a merger is the market-value weighted average of the betas of the companies involved in the merger.

Aswath Damodaran

The Disney/Cap Cities Merger (1996): Pre-Merger

Disney: The Acquirer

Equity Beta
1.15

Debt = $3,186 million
Market value of equity = $31,100 million
Debt + Equity = Firm value = $31,100
+ $3186 = $34,286 million
D/E Ratio = 3186/31100 = 0.10

+

Capital Cities: The Target

Equity Beta
0.95

Debt = $ 615 million
Market value of equity = $18, 500 million
Debt + Equity = Firm value = $18,500 +
$615 = $19,115 million
D/E Ratio = 615/18500 = 0.03

Aswath Damodaran

Disney Cap Cities Beta Estimation: Step 1

- ☐ Calculate the unlevered betas for both firms
  - ◘ Disney's unlevered beta = 1.15/(1+0.64*0.10) = 1.08
  - ◘ Cap Cities unlevered beta = 0.95/(1+0.64*0.03) = 0.93
- ☐ Calculate the unlevered beta for the combined firm
  - ◘ Unlevered Beta for combined firm

    = 1.08 (34286/53401) + 0.93 (19115/53401)

    = 1.026
  - ◘ The weights used are the firm values (and not just the equity values) of the two firms, since these are unlevered betas and thus reflects the risks of the entire businesses and not just the equity]

Disney Cap Cities Beta Estimation: Step 2

- If Disney had used all equity to buy Cap Cities equity, while assuming Cap Cities debt, the consolidated numbers would have looked as follows:
  - Debt = $ 3,186+ $615 = $ 3,801 million
  - Equity = $ 31,100 + $18,500 = $ 49,600 m (Disney issues $18.5 billion in equity)
  - D/E Ratio = 3,801/49600 = 7.66%
  - New Beta = 1.026 (1 + 0.64 (.0766)) = 1.08

- Since Disney borrowed $ 10 billion to buy Cap Cities/ABC, funded the rest with new equity and assumed Cap Cities debt:
  - The market value of Cap Cities equity is $18.5 billion. If $ 10 billion comes from debt, the balance ($8.5 billion) has to come from new equity.
  - Debt = $ 3,186 + $615 million + $ 10,000 = $ 13,801 million
  - Equity = $ 31,100 + $8,500 = $39,600 million
  - D/E Ratio = 13,801/39600 = 34.82%
  - New Beta = 1.026 (1 + 0.64 (.3482)) = 1.25

Aswath Damodaran

Firm Betas versus divisional Betas

- <u>Firm Betas as weighted averages</u>: The beta of a firm is the weighted average of the betas of its individual projects.

- <u>Firm Betas and Business betas</u>: At a broader level of aggregation, the beta of a firm is the weighted average of the betas of its individual division.

Aswath Damodaran