Estimating Hurdle Rates: Risk Parameters

Inputs required to use the CAPM -

- The capital asset pricing model yields the following expected return:

  Expected Return = Riskfree Rate+ Beta * (Expected Return on the Market Portfolio - Riskfree Rate)

- To use the model we need three inputs:

  (a) The current risk-free rate

  (b) The expected market risk premium (the premium expected for investing in risky assets (market portfolio) over the riskless asset)

  (c) The beta of the asset being analyzed.

The Riskfree Rate and Time Horizon

- On a riskfree asset, the actual return is equal to the expected return. Therefore, there is no variance around the expected return.
- For an investment to be riskfree, i.e., to have an actual return be equal to the expected return, two conditions have to be met –
  - There has to be no default risk, which generally implies that the security has to be issued by the government. Note, however, that not all governments can be viewed as default free.
  - There can be no uncertainty about reinvestment rates, which implies that it is a zero coupon security with the same maturity as the cash flow being analyzed.

Riskfree Rate in Practice

- The riskfree rate is the rate on a zero coupon government bond matching the time horizon of the cash flow being analyzed.
- Theoretically, this translates into using different riskfree rates for each cash flow - the 1 year zero coupon rate for the cash flow in year 1, the 2-year zero coupon rate for the cash flow in year 2 ...
- Practically speaking, if there is substantial uncertainty about expected cash flows, the present value effect of using time varying riskfree rates is small enough that it may not be worth it.

The Bottom Line on Riskfree Rates

- Using a long term government rate (even on a coupon bond) as the riskfree rate on all of the cash flows in a long term analysis will yield a close approximation of the true value.
- For short term analysis, it is entirely appropriate to use a short term government security rate as the riskfree rate.
- The riskfree rate that you use in an analysis should be in the same currency that your cashflows are estimated in. In other words, if your cashflows are in U.S. dollars, your riskfree rate has to be in U.S. dollars as well.
  - Data Source: You can get riskfree rates for the US in a number of sites. Try http://www.bloomberg.com/markets.

What if there is no default-free entity?

- You could adjust the local currency government borrowing rate by the estimated default spread on the bond to arrive at a riskless local currency rate. The default spread on the government bond can be estimated using the local currency ratings that are available for many countries.
- For instance, assume that the Brazilian government bond rate (in nominal Brazilian Reals (BR)) is 14% and that the local currency rating assigned to the Brazilian government is BB+. If the default spread for BB+ rated bonds is 5%, the riskless Brazilian real rate would be 9%.
- Alternatively, you can analyze Brazilian companies in U.S. dollars and use a treasury bond rate as your riskfree rate or in real terms and do all analysis without an inflation component.

Measurement of the risk premium

- The risk premium is the premium that investors demand for investing in an average risk investment, relative to the riskfree rate.
- As a general proposition, this premium should be
  - greater than zero
  - increase with the risk aversion of the investors in that market
  - increase with the riskiness of the "average" risk investment

What is your risk premium?

- Assume that stocks are the only risky assets and that you are offered two investment options:
  - a riskless investment (say a Government Security), on which you can make 5%
  - a mutual fund of all stocks, on which the returns are uncertain

How much of an expected return would you demand to shift your money from the riskless asset to the mutual fund?

a) Less than 5%
b) Between 5 - 7%
c) Between 7 - 9%
d) Between 9 - 11%
e) Between 11- 13%
f) More than 13%

Check your premium against the survey premium on my web site.

Risk Aversion and Risk Premiums

- If this were the capital market line, the risk premium would be a weighted average of the risk premiums demanded by each and every investor.
- The weights will be determined by the magnitude of wealth that each investor has. Thus, Warren Buffet's risk aversion counts more towards determining the "equilibrium" premium than yours' and mine.
- As investors become more risk averse, you would expect the "equilibrium" premium to increase.

Risk Premiums do change..

Go back to the previous example. Assume now that you are making the same choice but that you are making it in the aftermath of a stock market crash (it has dropped 25% in the last month). Would you change your answer?

a) I would demand a larger premium
b) I would demand a smaller premium
c) I would demand the same premium

Estimating Risk Premiums in Practice

- Survey investors on their desired risk premiums and use the average premium from these surveys.
- Assume that the actual premium delivered over long time periods is equal to the expected premium - i.e., use historical data
- Estimate the implied premium in today's asset prices.

The Survey Approach

- Surveying all investors in a market place is impractical.
- However, you can survey a few investors (especially the larger investors) and use these results. In practice, this translates into surveys of money managers' expectations of expected returns on stocks over the next year.
- The limitations of this approach are:
  - there are no constraints on reasonability (the survey could produce negative risk premiums or risk premiums of 50%)
  - they are extremely volatile
  - they tend to be short term; even the longest surveys do not go beyond one year

The Historical Premium Approach

- This is the default approach used by most to arrive at the premium to use in the model
- In most cases, this approach does the following
  - it defines a time period for the estimation (1926-Present, 1962-Present....)
  - it calculates average returns on a stock index during the period
    - it calculates average returns on a riskless security over the period
      - it calculates the difference between the two
      - and uses it as a premium looking forward
- The limitations of this approach are:
  - it assumes that the risk aversion of investors has not changed in a systematic way across time. (The risk aversion may change from year to year, but it reverts back to historical averages)
  - it assumes that the riskiness of the "risky" portfolio (stock index) has not changed in a systematic way across time.

Historical Average Premiums for the United States

	Arithmetic average		*Geometric Average*	
Historical Period	Stocks - T.Bills	Stocks - T.Bonds	Stocks - T.Bills	Stocks - T.Bonds
1928-2004	7.92%	6.53%	6.02%	4.84%
1964-2004	5.82%	4.34%	4.59%	3.47%
1994-2004	8.60%	5.82%	6.85%	4.51%

What is the right premium?

- Go back as far as you can. Otherwise, the standard error in the estimate will be large. (

$$\text{Std Error in estimate} = \frac{\text{Annualized Std deviation in Stock prices}}{\sqrt{\text{Number of years of historical data}}})$$

- Be consistent in your use of a riskfree rate.
- Use arithmetic premiums for one-year estimates of costs of equity and geometric premiums for estimates of long term costs of equity.

Data Source: Check out the returns by year and estimate your own historical premiums by going to updated data on my web site.

What about historical premiums for other markets?

- Historical data for markets outside the United States is available for much shorter time periods. The problem is even greater in emerging markets.
- The historical premiums that emerge from this data reflects this and there is much greater error associated with the estimates of the premiums.

One solution: Look at a country's bond rating and default spreads as a start

- Ratings agencies such as S&P and Moody's assign ratings to countries that reflect their assessment of the default risk of these countries. These ratings reflect the political and economic stability of these countries and thus provide a useful measure of country risk. In September 2004, for instance, Brazil had a country rating of B2.
- If a country issues bonds denominated in a different currency (say dollars or euros), you can also see how the bond market views the risk in that country. In September 2004, Brazil had dollar denominated C-Bonds, trading at an interest rate of 10.01%. The US treasury bond rate that day was 4%, yielding a default spread of 6.01% for Brazil.
- Many analysts add this default spread to the US risk premium to come up with a risk premium for a country. Using this approach would yield a risk premium of 8.35% for Brazil, if we use 4.84% as the premium for the US.

Beyond the default spread

- Country ratings measure default risk. While default risk premiums and equity risk premiums are highly correlated, one would expect equity spreads to be higher than debt spreads. If we can compute how much more risky the equity market is, relative to the bond market, we could use this information. For example,
  - Standard Deviation in Bovespa (Equity) = 36%
  - Standard Deviation in Brazil C-Bond = 28.2%
  - Default spread on C-Bond = 6.01%
  - Country Risk Premium for Brazil = 6.01% (36%/28.2%) = 7.67%
- Note that this is on top of the premium you estimate for a mature market. Thus, if you assume that the risk premium in the US is 4.84%, the risk premium for Brazil would be 12.51%.

Implied Equity Premiums

- We can use the information in stock prices to back out how risk averse the market is and how much of a risk premium it is demanding.

In 2004, dividends & stock buybacks were 2.90% of the index, generating 35.15 in cashflows

Analysts expect earnings to grow 8.5% a year for the next 5 years .

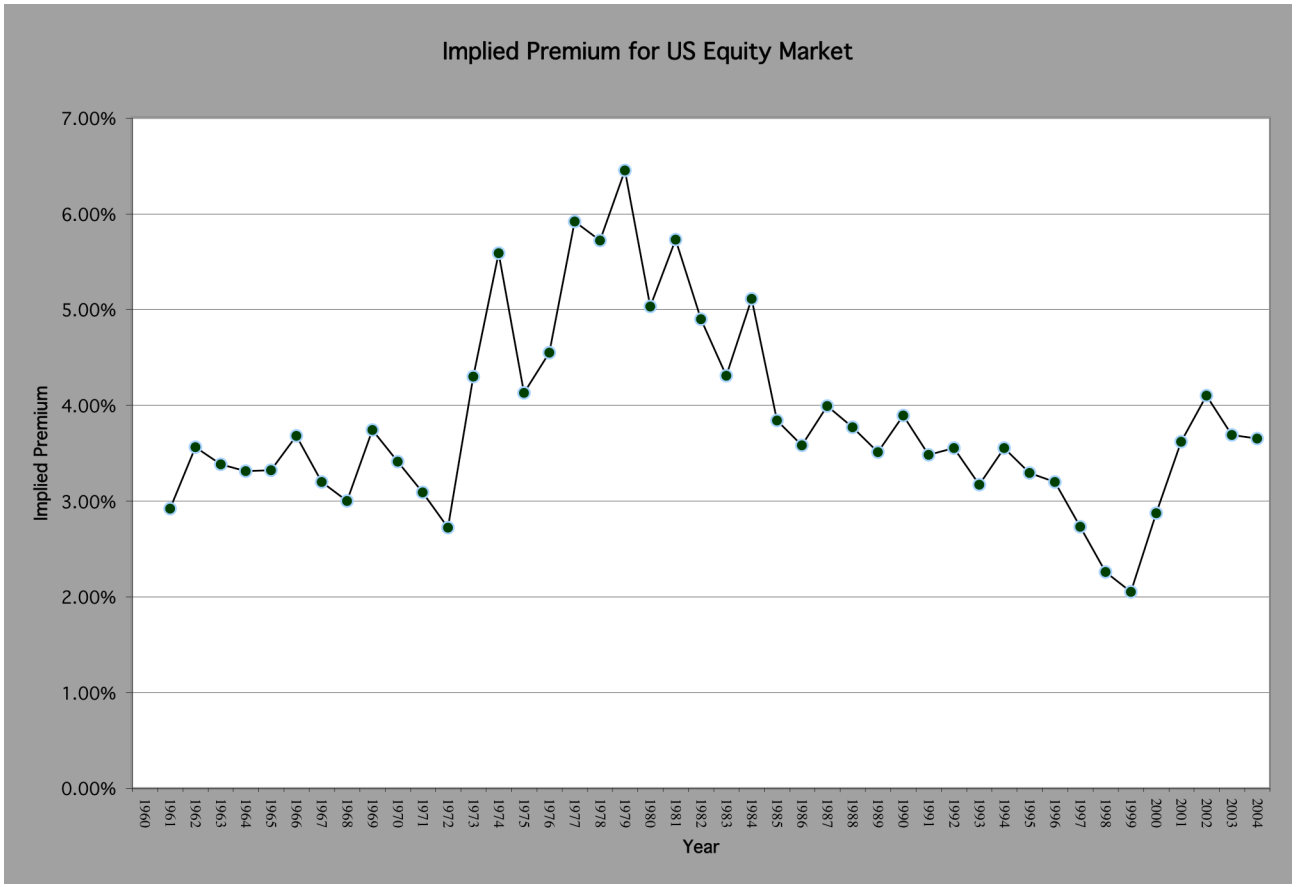
After year 5, we will assume that earnings on the index will grow at 4.22%, the same rate as the entire economy

January 1, 2005
S&P 500 is at 1211.92

- Implied Equity risk premium = Expected return on stocks - Treasury bond rate = 7.87% - 4.22% = 3.65%

$$1211.92 = \frac{38.13}{(1+r)} + \frac{41.37}{(1+r)^2} + \frac{44.89}{(1+r)^3} + \frac{48.71}{(1+r)^4} + \frac{52.85}{(1+r)^5} + \frac{52.85(1.0422)}{(r-.0422)(1+r)^5}$$

Implied Premiums in the US



Application Test: A Market Risk Premium

- Based upon our discussion of historical risk premiums so far, the risk premium looking forward should be:
  a) About 7.92%, which is what the arithmetic average premium has been since 1928, for stocks over T.Bills
  b) About 4.84%, which is the geometric average premium since 1928, for stocks over T.Bonds
  c) About 3.7%, which is the implied premium in the stock market today

Estimating Beta

- The standard procedure for estimating betas is to regress stock returns (R_j) against market returns (R_m) -

$$R_j = a + b\ R_m$$

  - where a is the intercept and b is the slope of the regression.
- The slope of the regression corresponds to the beta of the stock, and measures the riskiness of the stock.

Estimating Performance

- The intercept of the regression provides a simple measure of performance during the period of the regression, relative to the capital asset pricing model.

  $R_j = R_f + b (R_m - R_f)$

  $= R_f (1-b) + b R_m$ ..... Capital Asset Pricing Model

  $R_j = a + b R_m$ ..... Regression Equation

- If

  $a > R_f (1-b)$ .... Stock did better than expected during regression period

  $a = R_f (1-b)$ .... Stock did as well as expected during regression period

  $a < R_f (1-b)$ .... Stock did worse than expected during regression period

- The difference between the intercept and $R_f (1-b)$ is Jensen's alpha. If it is positive, your stock did perform better than expected during the period of the regression.

Firm Specific and Market Risk

- The R squared (R^2) of the regression provides an estimate of the proportion of the risk (variance) of a firm that can be attributed to market risk;
- The balance ($1 - R^2$) can be attributed to firm specific risk.

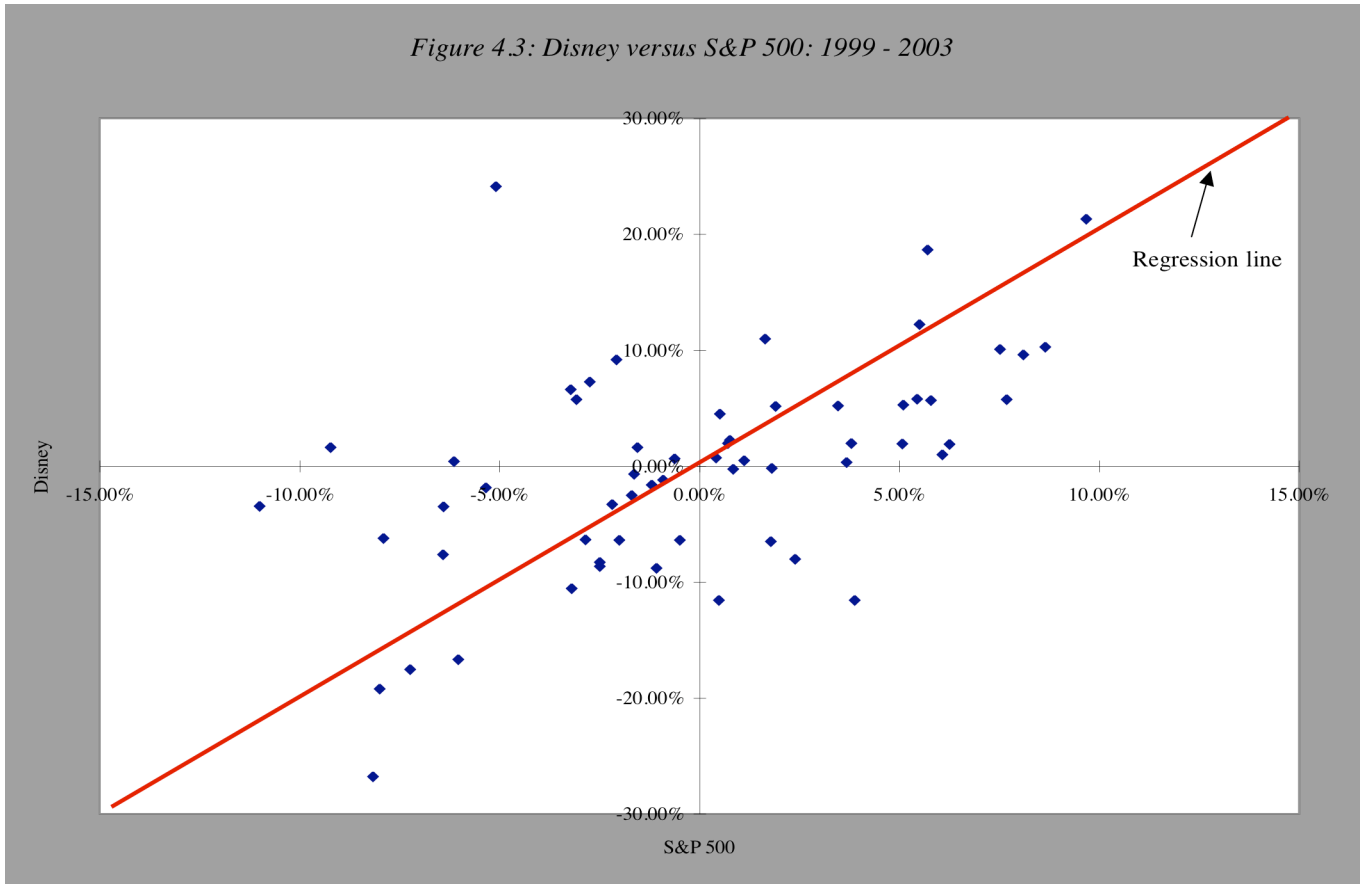
Setting up for the Estimation

- Decide on an estimation period
  - Services use periods ranging from 2 to 5 years for the regression
  - Longer estimation period provides more data, but firms change.
  - Shorter periods can be affected more easily by significant firm-specific event that occurred during the period (Example: ITT for 1995-1997)
- Decide on a return interval - daily, weekly, monthly
  - Shorter intervals yield more observations, but suffer from more noise.
  - Noise is created by stocks not trading and biases all betas towards one.
- Estimate returns (including dividends) on stock
  - Return = $(\text{Price}_{\text{End}} - \text{Price}_{\text{Beginning}} + \text{Dividends}_{\text{Period}})/ \text{Price}_{\text{Beginning}}$
  - Included dividends only in ex-dividend month
- Choose a market index, and estimate returns (inclusive of dividends) on the index for each interval for the period.

Choosing the Parameters: Disney

- Period used: 5 years
- Return Interval = Monthly
- Market Index: S&P 500 Index.
- For instance, to calculate returns on Disney in December 1999,
  - Price for Disney at end of November 1999 = $ 27.88
  - Price for Disney at end of December 1999 = $ 29.25
  - Dividends during month = $0.21 (It was an ex-dividend month)
  - Return =($29.25 - $27.88 + $ 0.21)/$27.88= 5.69%
- To estimate returns on the index in the same month
  - Index level (including dividends) at end of November 1999 = 1388.91
  - Index level (including dividends) at end of December 1999 = 1469.25
  - Return =(1469.25 - 1388.91)/ 1388.91 = 5.78%

Disney's Historical Beta



The Regression Output

- Using monthly returns from 1999 to 2003, we ran a regression of returns on Disney stock against the S*P 500. The output is below:

$$\text{Returns}_{\text{Disney}} = 0.0467\% + 1.01\ \text{Returns}_{\text{S \& P 500}} \qquad (R^2 = 29\%)$$
$$(0.20)$$

Analyzing Disney's Performance

- Intercept = 0.0467%
  - This is an intercept based on monthly returns. Thus, it has to be compared to a monthly riskfree rate.
  - Between 1999 and 2003,
    - Monthly Riskfree Rate = 0.313% (based upon average T.Bill rate: 99-03)
    - Riskfree Rate (1-Beta) = 0.313% (1-1.01) = -..0032%
- The Comparison is then between

Intercept	versus	Riskfree Rate (1 - Beta)
0.0467%	versus	0.313%(1-1.01)=-0.0032%

  - Jensen's Alpha = 0.0467% -(-0.0032%) = 0.05%
- Disney did 0.05% better than expected, per month, between 1999 and 2003.
  - Annualized, Disney's annual excess return = $(1.0005)^{12}$-1= 0.60%

More on Jensen's Alpha

If you did this analysis on every stock listed on an exchange, what would the average Jensen's alpha be across all stocks?

a) Depend upon whether the market went up or down during the period
b) Should be zero
c) Should be greater than zero, because stocks tend to go up more often than down

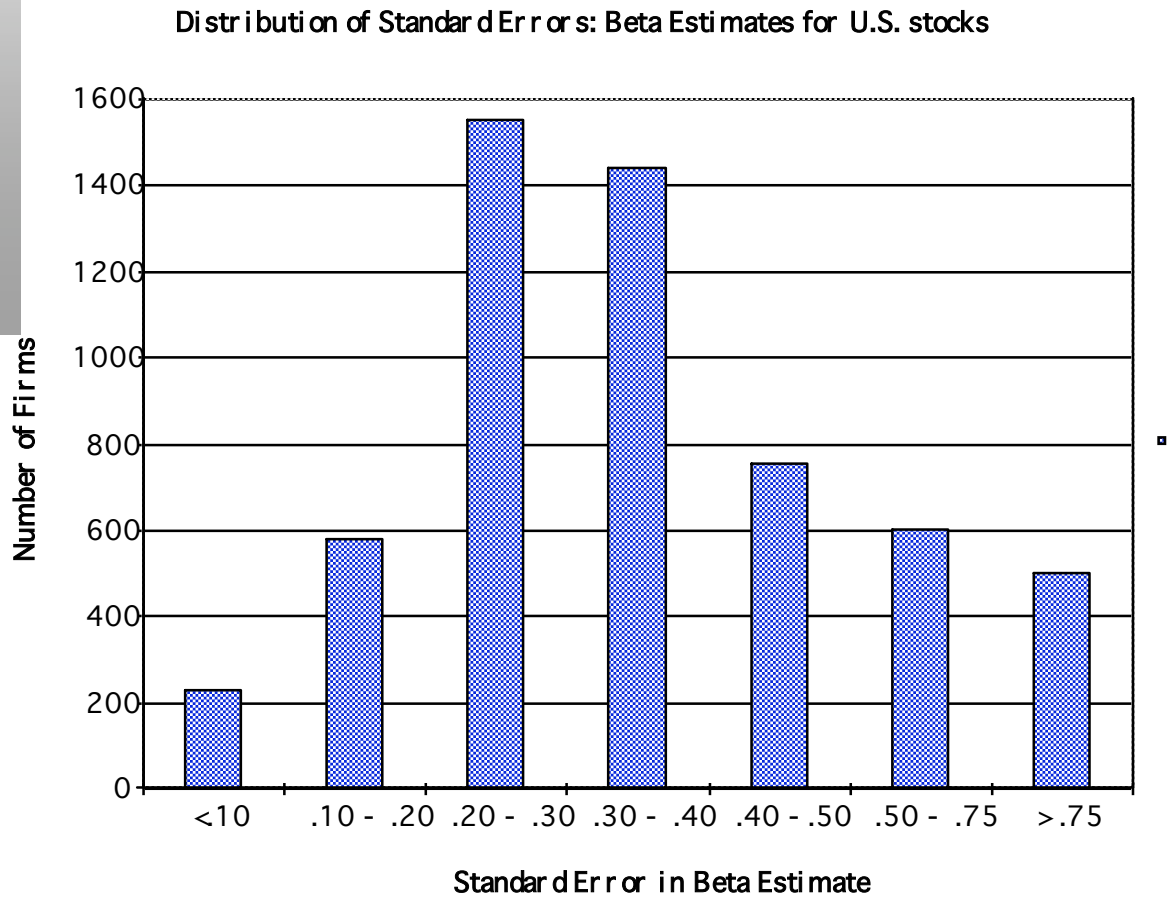
A positive Jensen's alpha… Who is responsible?

- Disney has a positive Jensen's alpha of 0.60% a year between 1999 and 2003. This can be viewed as a sign that management in the firm did a good job, managing the firm during the period.
  a) True
  b) False

Estimating Disney's Beta

- Slope of the Regression of 1.01 is the beta
- Regression parameters are always estimated with error. The error is captured in the standard error of the beta estimate, which in the case of Disney is 0.20.
- Assume that I asked you what Disney's true beta is, after this regression.
  - What is your best point estimate?
  - What range would you give me, with 67% confidence?
  - What range would you give me, with 95% confidence?

The Dirty Secret of "Standard Error"



Breaking down Disney's Risk

- R Squared = 29%
- This implies that
  - 29% of the risk at Disney comes from market sources
  - 71%, therefore, comes from firm-specific sources
- The firm-specific risk is diversifiable and will not be rewarded

The Relevance of R Squared

You are a diversified investor trying to decide whether you should invest in Disney or Amgen. They both have betas of 1.01, but Disney has an R Squared of 29% while Amgen's R squared of only 14.5%. Which one would you invest in?

a) Amgen, because it has the lower R squared
b) Disney, because it has the higher R squared
c) You would be indifferent

Would your answer be different if you were an undiversified investor?

Beta Estimation: Using a Service (Bloomberg)

<HELP> for explanation. N166 Equity BETA

HISTORICAL BETA

Number of points may be insufficient for an accurate beta.

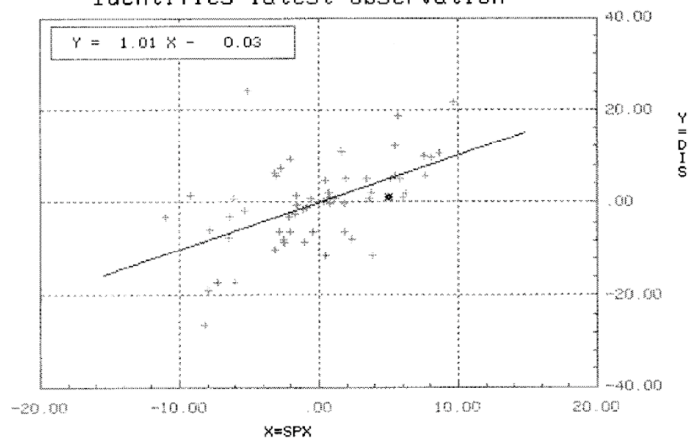
DIS US Equity — THE WALT DISNEY CO.

Relative Index SPX — S&P 500 INDEX

*Identifies latest observation

Period M Monthly
Range 1/29/99 To 12/31/03
Market T Trade

ADJ BETA	1.01
RAW BETA	1.01
Alpha(Intercept)	-0.03
R2 (Correlation)	0.29
Std Dev of Error	7.95
Std Error of Beta	0.21
Number of Points	59



ADJ BETA = (0.67) * RAW BETA
+ (0.33) * 1.0

Australia 61 2 9777 8600 Brazil 5511 3048 4500 Europe 44 20 7330 7500 Germany 49 69 920410
Hong Kong 852 2977 6000 Japan 81 3 3201 8900 Singapore 65 6212 1000 U.S. 1 212 318 2000 Copyright 2004 Bloomberg L.P.
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Estimating Expected Returns for Disney in September 2004

- Inputs to the expected return calculation
  - Disney's Beta = 1.40
  - Riskfree Rate = 4.00% (U.S. ten-year T.Bond rate)
  - Risk Premium = 4.82% (Approximate historical premium: 1928-2003)
- Expected Return = Riskfree Rate + Beta (Risk Premium)
  = 4.00% + 1.01(4.82%) = 8.87%

Use to a Potential Investor in Disney

As a potential investor in Disney, what does this expected return of 8.87% tell you?

a) This is the return that I can expect to make in the long term on Disney, if the stock is correctly priced and the CAPM is the right model for risk,

b) This is the return that I need to make on Disney in the long term to break even on my investment in the stock

c) Both

Assume now that you are an active investor and that your research suggests that an investment in Disney will yield 12.5% a year for the next 5 years. Based upon the expected return of 8.87%, you would

a) Buy the stock

b) Sell the stock

How managers use this expected return

- Managers at Disney
  - need to make at least 8.87% as a return for their equity investors to break even.
  - this is the hurdle rate for projects, when the investment is analyzed from an equity standpoint
- In other words, Disney's cost of equity is 8.87%.
- What is the cost of not delivering this cost of equity?

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? (You can assume an annualized riskfree rate of 4.8% during the regression period)

    Intercept - (4.8%/n) (1- Beta) = Jensen's Alpha

    Where n is the number of return periods in a year (12 if monthly; 52 if monthly)
  - 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

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 18.46%. 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?

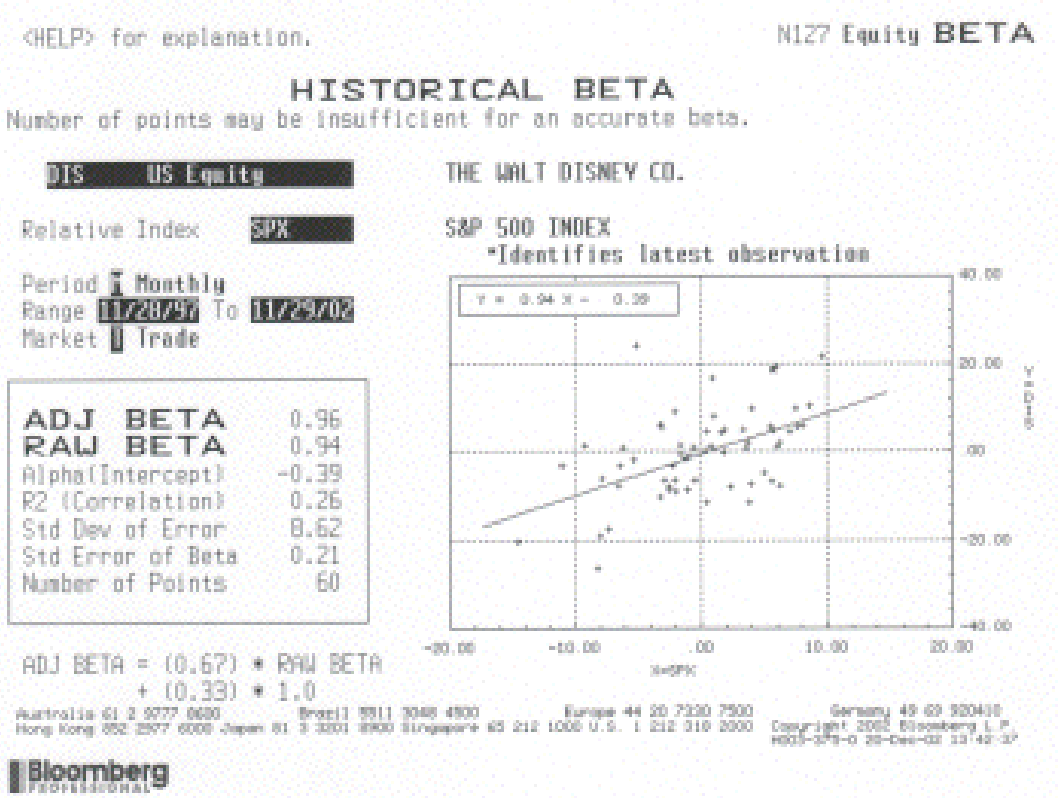
Should you focus your attention on bringing your beta down?

a) Yes
b) No

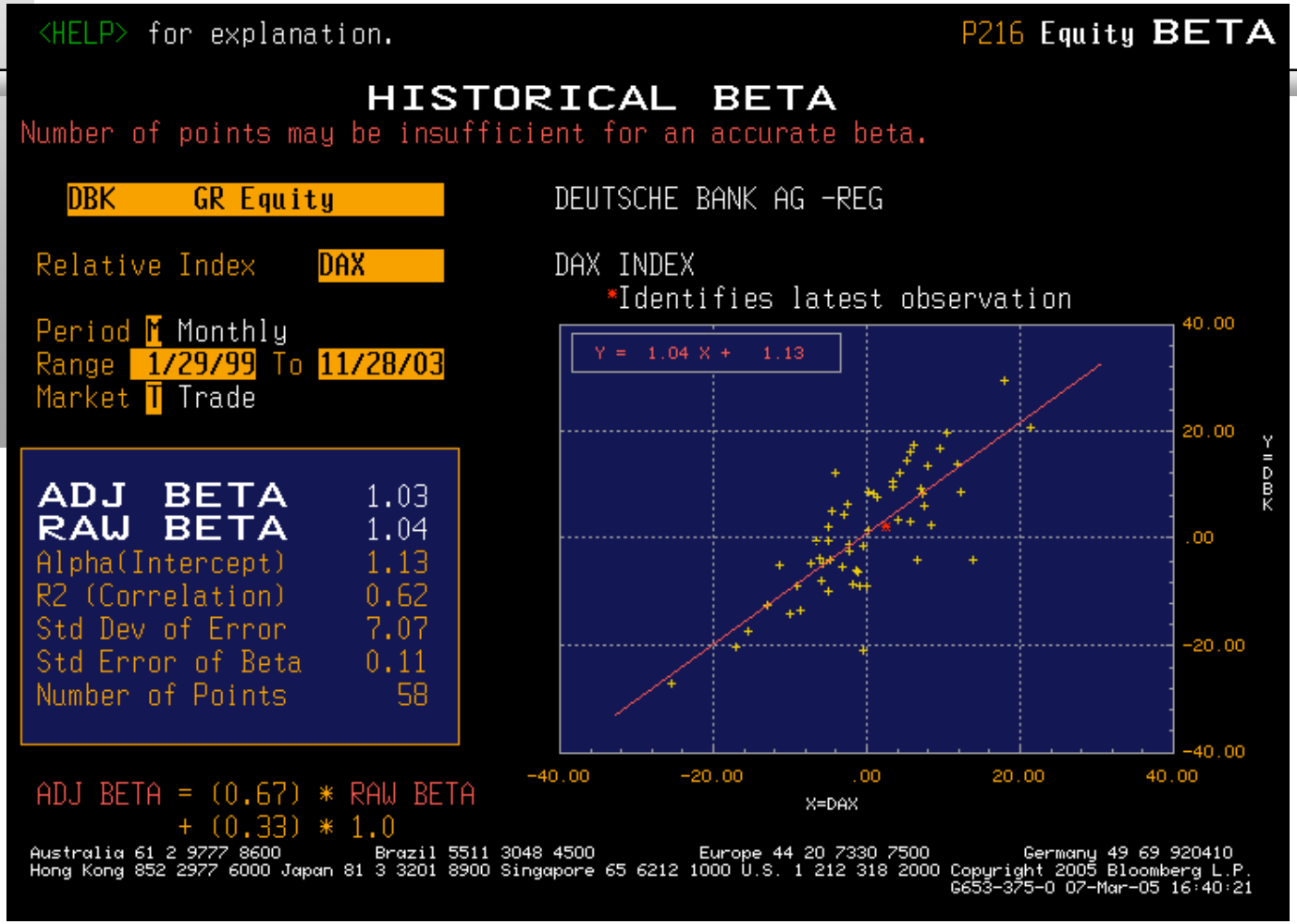
Disney's Beta Calculation: A look back at 1997-2002

Jensen's alpha = -0.39% - 0.30 (1 - 0.94) = -0.41%

Annualized = (1-.0041)^12-1 = -4.79%



Beta Estimation and Index Choice: Deutsche Bank



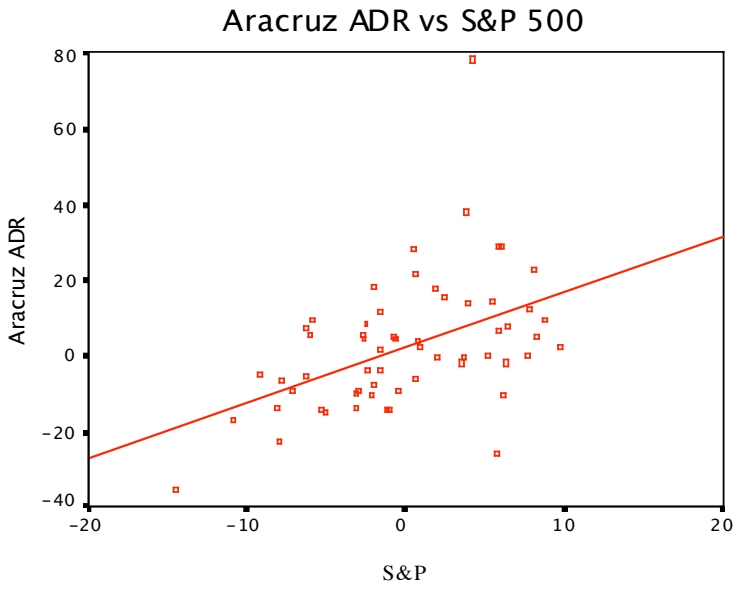
A Few Questions

- The R squared for Deutsche Bank is very high (62%), at least relative to U.S. firms. Why is that?
- The beta for Deutsche Bank is 1.05.
  - Is this an appropriate measure of risk?
  - If not, why not?
- If you were an investor in primarily U.S. stocks, would this be an appropriate measure of risk?

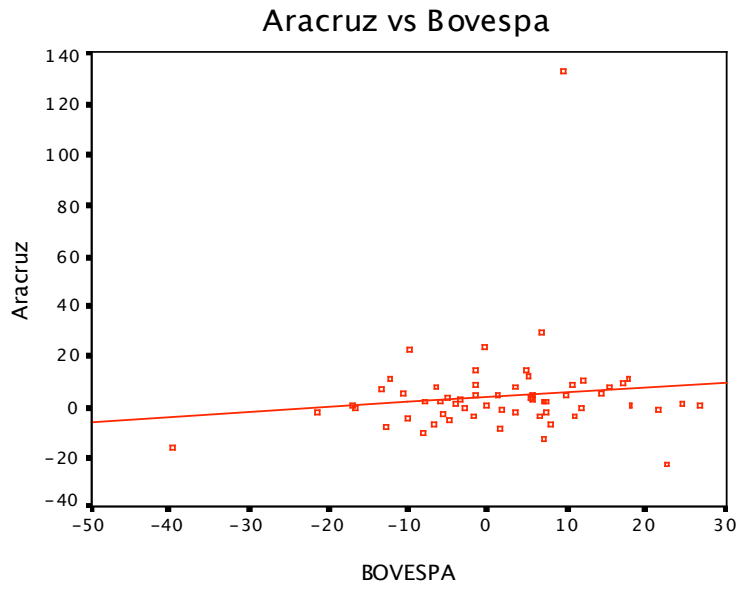
Deutsche Bank: Alternate views of Risk

	DAX	*FTSE Euro 300*	*MSCI*
Intercept	1.24%	1.54%	1.37%
Beta	1.05	1.52	1.23
Std Error of Beta	0.11	0.19	0.25
R Squared	62%	52%	30%

Aracruz's Beta?

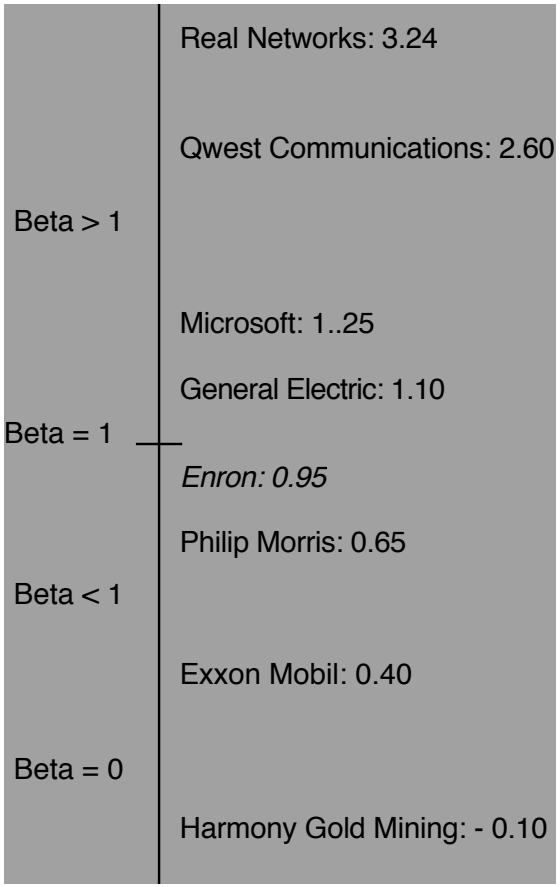


Aracruz ADR = 2.80% + 1.00 S&P



Aracruz = 2.62% + 0.22 Bovespa

Beta: Exploring Fundamentals



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

Consider an investment in Tiffany's. What kind of beta do you think this investment will have?

a) Much higher than one
b) Close to one
c) Much lower than one

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- 2003

Year	Net Sales	% Change in Sales	EBIT	% Change in EBIT
1987	2877		756	
1988	3438	19.50%	848	12.17%
1989	4594	33.62%	1177	38.80%
1990	5844	27.21%	1368	16.23%
1991	6182	5.78%	1124	-17.84%
1992	7504	21.38%	1287	14.50%
1993	8529	13.66%	1560	21.21%
1994	10055	17.89%	1804	15.64%
1995	12112	20.46%	2262	25.39%
1996	18739	54.71%	3024	33.69%
1997	22473	19.93%	3945	30.46%
1998	22976	2.24%	3843	-2.59%
1999	23435	2.00%	3580	-6.84%
2000	25418	8.46%	2525	-29.47%
2001	25172	-0.97%	2832	12.16%
2002	25329	0.62%	2384	-15.82%
2003	27061	6.84%	2713	13.80%
1987-2003		15.83%		10.09%
1996-2003		11.73%		4.42%

Reading Disney's Operating Leverage

- Operating Leverage = % Change in EBIT/ % Change in Sales
  = 10.09% / 15.83% = 0.64
- This is lower than the operating leverage for other entertainment firms, which we computed to be 1.12. This would suggest that Disney has lower fixed costs than its competitors.
- The acquisition of Capital Cities by Disney in 1996 may be skewing the operating leverage. Looking at the changes since then:

  Operating Leverage$_{1996\text{-}03}$ = 4.42%/11.73% = 0.38

  Looks like Disney's operating leverage has decreased since 1996.

A Test

Assume that you are comparing a European automobile manufacturing firm with a U.S. automobile firm. European firms are generally much more constrained in terms of laying off employees, if they get into financial trouble. What implications does this have for betas, if they are estimated relative to a common index?

a) European firms will have much higher betas than U.S. firms
b) European firms will have similar betas to U.S. firms
c) European firms will have much lower betas than U.S. firms

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

Equity Betas and Leverage

- 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

β_u = Unlevered Beta

t = Corporate marginal tax rate

D = Market Value of Debt

E = Market Value of Equity

Effects of leverage on betas: Disney

- The regression beta for Disney is 1.01. 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 (1999 to 2003)
- The average debt equity ratio during this period was 27.5%.
- The unlevered beta for Disney can then be estimated (using a marginal tax rate of 37.3%)

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

  = 1.01 / (1 + (1 - 0.373)) (0.275) = 0.8615

Disney : Beta and Leverage

Debt to Capital	Debt/Equity Ratio	Beta	Effect of Leverage
0.00%	0.00%	0.86	0.00
10.00%	11.11%	0.92	0.06
20.00%	25.00%	1.00	0.14
30.00%	42.86%	1.09	0.23
40.00%	66.67%	1.22	0.36
50.00%	100.00%	1.40	0.54
60.00%	150.00%	1.67	0.81
70.00%	233.33%	2.12	1.26
80.00%	400.00%	3.02	2.16
90.00%	900.00%	5.72	4.86

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.

The Disney/Cap Cities Merger: Pre-Merger

Disney:

- Beta = 1.15
- Debt = $ 3,186 million Equity = $ 31,100 million Firm = $34,286
- D/E = 0.10

ABC:

- Beta = 0.95
- Debt = $ 615 million Equity = $ 18,500 million Firm= $ 19,115
- D/E = 0.03

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

  [Remember to calculate the weights using the firm values of the two firms]

Disney Cap Cities Beta Estimation: Step 2

- If Disney had used all equity to buy Cap Cities
  - Debt = $ 615 + $ 3,186 = $ 3,801 million
  - Equity = $ 18,500 + $ 31,100 = $ 49,600
  - 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
  - Debt = $ 615 + $ 3,186 + $ 10,000 = $ 13,801 million
  - Equity = $ 39,600
  - D/E Ratio = 13,801/39600 = 34.82%
  - New Beta = 1.026 (1 + 0.64 (.3482)) = 1.25

Firm Betas versus divisional Betas

- Firm Betas as weighted averages: The beta of a firm is the weighted average of the betas of its individual projects.
- At a broader level of aggregation, the beta of a firm is the weighted average of the betas of its individual division.

Bottom-up versus Top-down Beta

- The top-down beta for a firm comes from a regression
- The bottom up beta can be estimated by doing the following:
  - Find out the businesses that a firm operates in
  - Find the unlevered betas of other firms in these businesses
  - Take a weighted (by sales or operating income) average of these unlevered betas
  - Lever up using the firm's debt/equity ratio
- The bottom up beta will give you a better estimate of the true beta when
  - the standard error of the beta from the regression is high (and) the beta for a firm is very different from the average for the business
  - the firm has reorganized or restructured itself substantially during the period of the regression
  - when a firm is not traded

Disney's business breakdown

Business	*Comparable firms*	*Number of firm*	*Average levered beta*	*Median D/E*	*Unlevered beta*	*Cash/Firm Value*	*Unlevered beta corrected for cash*
Media Networks	Radia and TV broadcasting companies	24	1.22	20.45%	1.0768	0.75%	1.0850
Parks and Resorts	Theme park & Entertainment firms	9	1.58	120.76%	0.8853	2.77%	0.9105
Studio Entertainmen	Movie companies	11	1.16	27.96%	0.9824	14.08%	1.1435
Consumer Products	Toy and apparel retailers; Entertainment software	77	1.06	9.18%	0.9981	12.08%	1.1353

Disney's bottom up beta

Business	*Revenues in 2002*	*EV/Sales*	*Estimated Value*	*Firm Value Proportion*	*Unlevered beta*
Media Networks	$10,941	3.41	$37,278.62	49.25%	1.0850
Parks and Resorts	$6,412	2.37	$15,208.37	20.09%	0.9105
Studio Entertainment	$7,364	2.63	$19,390.14	25.62%	1.1435
Consumer Products	$2,344	1.63	$3,814.38	5.04%	1.1353
Disney	$27,061		$75,691.51	100.00%	1.0674

Disney's Cost of Equity

Business	*Unlevered Beta*	*D/E Ratio*	*Levered Beta*	*Cost of Equity*
Media Networks	1.0850	26.62%	1.2661	10.10%
Parks and Resorts	0.9105	26.62%	1.0625	9.12%
Studio Entertainment	1.1435	26.62%	1.3344	10.43%
Consumer Products	1.1353	26.62%	1.3248	10.39%
Disney	1.0674	26.62%	1.2456	10.00%

Discussion Issue

- If you were the chief financial officer of Disney, what cost of equity would you use in capital budgeting in the different divisions?
  a) The cost of equity for Disney as a company
  b) The cost of equity for each of Disney's divisions?

Estimating Aracruz's Bottom Up Beta

Comparables	No	Avg β	D/E	β_{Unlev}	Cash/Val	$\beta_{Correct}$
Emerging Markets	111	0.6895	38.33%	0.5469	6.58%	0.5855
US	34	0.7927	83.57%	0.5137	2.09%	0.5246
Global	288	0.6333	38.88%	0.5024	6.54%	0.5375

- Aracruz has a cash balance which was 7.07% of the market value :

  Unlevered Beta for Aracruz = (0.9293) (0.585) + (0.0707) (0) = 0.5440

- Using Aracruz's gross D/E ratio of 44.59% & a tax rate of 34%:

  Levered Beta for Aracruz = 0.5440 (1+ (1-.34) (.4459)) = 0.7040

- The levered beta for just the paper business can also be computed:

  Levered Beta for paper business = 0.585 (1+ (1-.34) (.4459))) = 0.7576

Aracruz: Cost of Equity Calculation

- We will use a risk premium of 12.49% in computing the cost of equity, composed of the U.S. historical risk premium (4.82% from 28-03) and the Brazil country risk premium of 7.67% (estimated earlier in the package)
- U.S. $ Cost of Equity

  Cost of Equity = 10-yr T.Bond rate + Beta * Risk Premium

  = 4% + 0.7040 (12.49%) = 12.79%

- Real Cost of Equity

  Cost of Equity = 10-yr Inflation-indexed T.Bond rate + Beta * Risk Premium

  = 2% + 0.7040 (12.49%) = 10.79%

- Nominal BR Cost of Equity

  Cost of Equi

$$(1+\$\text{ Cost of Equity})\frac{(1+\text{Inflation Rate}_{\text{Brazil}})}{(1+\text{Inflation Rate}_{\text{US}})}-1$$

  = 1.1279 (1.08/1.06) -1 = .1943 or 19.43%

Estimating Bottom-up Beta: Deutsche Bank

- Deutsche Bank is in two different segments of business - commercial banking and investment banking.
  - To estimate its commercial banking beta, we will use the average beta of commercial banks in Germany.
  - To estimate the investment banking beta, we will use the average bet of investment banks in the U.S and U.K.
- To estimate the cost of equity in Euros, we will use the German 10-year bond rate of 4.05% as the riskfree rate and the US historical risk premium (4.82%) as our proxy for a mature market premium.

Business	Beta	Cost of Equity	Weights
Commercial Banking	0.7345	7.59%	69.03%
Investment Banking	1.5167	11.36%	30.97%
Deutsche Bank		8.76%	

Estimating Betas for Non-Traded Assets

- The conventional approaches of estimating betas from regressions do not work for assets that are not traded.
- There are two ways in which betas can be estimated for non-traded assets
  - using comparable firms
  - using accounting earnings

Using comparable firms to estimate beta for Bookscape

Assume that you are trying to estimate the beta for a independent bookstore in New York City.

Firm	Beta	Debt	Equity	Cash
Books-A-Million	0.532	$45	$45	$5
Borders Group	0.844	$182	$1,430	$269
Barnes & Noble	0.885	$300	$1,606	$268
Courier Corp	0.815	$1	$285	$6
Info Holdings	0.883	$2	$371	$54
John Wiley &Son	0.636	$235	$1,662	$33
Scholastic Corp	0.744	$549	$1,063	$11
Sector	0.7627	$1,314	$6,462	$645

Unlevered Beta = 0.7627/(1+(1-.35)(1314/6462)) = 0.6737

Corrected for Cash = 0.6737 (1 – 645/(1314+6462)) = 0.7346

Estimating Bookscape Levered Beta and Cost of Equity

- Since the debt/equity ratios used are market debt equity ratios, and the only debt equity ratio we can compute for Bookscape is a book value debt equity ratio, we have assumed that Bookscape is *close to the industry average* debt to equity ratio of 20.33%.
- Using a marginal tax rate of 40% (based upon personal income tax rates) for Bookscape, we get a levered beta of 0.82.

  Levered beta for Bookscape = 0.7346 (1 +(1-.40) (.2033)) = 0.82
- Using a riskfree rate of 4% (US treasury bond rate) and a historical risk premium of 4.82%:

  Cost of Equity = 4% + 0.82 (4.82%) = 7.95%

Using Accounting Earnings to Estimate Beta

Year	S&P 500	Bookscape	Year	S&P 500	Bookscape
1980	3.01%	3.55%	1991	-12.08%	-32.00%
1981	1.31%	4.05%	1992	-5.12%	55.00%
1982	-8.95%	-14.33%	1993	9.37%	31.00%
1983	-3.84%	47.55%	1994	36.45%	21.06%
1984	26.69%	65.00%	1995	30.70%	11.55%
1985	-6.91%	5.05%	1996	1.20%	19.88%
1986	-7.93%	8.50%	1997	10.57%	16.55%
1987	11.10%	37.00%	1998	-3.35%	7.10%
1988	42.02%	45.17%	1999	18.13%	14.40%
1989	5.52%	3.50%	2000	15.13%	10.50%
1990	-9.58%	-10.50%	2001	-14.94%	-8.15%
			2002	6.81%	4.05%

The Accounting Beta for Bookscape

- Regressing the changes in profits at Bookscape against changes in profits for the S&P 500 yields the following:

  Bookscape Earnings Change Change = 0.1003 + 0.7329 (S & P 500 Earnings Change)

  Based upon this regression, the beta for Bookscape's equity is 0.73.
- Using operating earnings for both the firm and the S&P 500 should yield the equivalent of an unlevered beta.

Is Beta an Adequate Measure of Risk for a Private Firm?

- The owners of most private firms are not diversified. Beta measures the risk added on to a diversified portfolio. Therefore, using beta to arrive at a cost of equity for a private firm will
  a) Under estimate the cost of equity for the private firm
  b) Over estimate the cost of equity for the private firm
  c) Could under or over estimate the cost of equity for the private firm

Total Risk versus Market Risk

- Adjust the beta to reflect total risk rather than market risk. This adjustment is a relatively simple one, since the R squared of the regression measures the proportion of the risk that is market risk.

  Total Beta = Market Beta / Correlation of the sector with the market

- In the Bookscape example, where the market beta is 0.82 and the average R-squared of the comparable publicly traded firms is 16%,

$$\frac{\text{Market Beta}}{\sqrt{\text{R squared}}} = \frac{0.82}{\sqrt{.16}} = 2.06$$

  - Total Cost of Equity = 4% + 2.06 (4.82%) = 13.93%

Application Test: Estimating a Bottom-up Beta

- Based upon the business or businesses that your firm is in right now, and its current financial leverage, estimate the bottom-up unlevered beta for your firm.

- *Data Source*: You can get a listing of unlevered betas by industry on my web site by going to updated data.

From Cost of Equity to Cost of Capital

- The cost of capital is a composite cost to the firm of raising financing to fund its projects.
- In addition to equity, firms can raise capital from debt

What is debt?

- General Rule: Debt generally has the following characteristics:
  - Commitment to make fixed payments in the future
  - The fixed payments are tax deductible
  - Failure to make the payments can lead to either default or loss of control of the firm to the party to whom payments are due.
- As a consequence, debt should include
  - Any interest-bearing liability, whether short term or long term.
  - Any lease obligation, whether operating or capital.

Estimating the Cost of Debt

- If the firm has bonds outstanding, and the bonds are traded, the yield to maturity on a long-term, straight (no special features) bond can be used as the interest rate.
- If the firm is rated, use the rating and a typical default spread on bonds with that rating to estimate the cost of debt.
- If the firm is not rated,
  - and it has recently borrowed long term from a bank, use the interest rate on the borrowing or
  - estimate a synthetic rating for the company, and use the synthetic rating to arrive at a default spread and a cost of debt
- The cost of debt has to be estimated in the same currency as the cost of equity and the cash flows in the valuation.

Estimating Synthetic Ratings

- The rating for a firm can be estimated using the financial characteristics of the firm. In its simplest form, the rating can be estimated from the interest coverage ratio

  Interest Coverage Ratio = EBIT / Interest Expenses

- For a firm, which has earnings before interest and taxes of $ 3,500 million and interest expenses of $ 700 million

  Interest Coverage Ratio = 3,500/700= 5.00

- In 2003, Bookscape had operating income of $ 2 million after interest expenses of 5000,000. The resulting interest coverage ratio is 4.00.
  - Interest coverage ratio = 2,000,000/500,000 = 4.00

Interest Coverage Ratios, Ratings and Default Spreads: Small Companies

Interest Coverage Ratio	Rating	Typical default spread
> 12.5	AAA	0.35%
9.50 - 12.50	AA	0.50%
7.50 – 9.50	A+	0.70%
6.00 – 7.50	A	0.85%
4.50 – 6.00	A-	1.00%
4.00 – 4.50	BBB	1.50%
3.50 - 4.00	BB+	2.00%
3.00 – 3.50	BB	2.50%
2.50 – 3.00	B+	3.25%
2.00 - 2.50	B	4.00%
1.50 – 2.00	B-	6.00%
1.25 – 1.50	CCC	8.00%
0.80 – 1.25	CC	10.00%
0.50 – 0.80	C	12.00%
< 0.65	D	20.00%

Synthetic Rating and Cost of Debt for Bookscape

- Rating based on interest coverage ratio = BBB
- Default Spread based upon rating = 1.50%
- Pre-tax cost of debt = Riskfree Rate + Default Spread = 4% + 1.50% = 5.50%
- After-tax cost of debt = Pre-tax cost of debt (1- tax rate) = 5.50% (1-.40) = 3.30%

Estimating Cost of Debt with rated companies

- For the three publicly traded firms in our sample, we will use the actual bond ratings to estimate the costs of debt:

	S&P Rating	*Riskfree Rate*	*Default Spread*	*Cost of Debt*	*Tax Rate*	*After-tax Cost of Debt*
Disney	BBB+	4% ($)	1.25%	5.25%	37.3%	3.29%
Deutsche Bank	AA-	4.05% (Eu)	1.00%	5.05%	38%	3.13%
Aracruz	B+	4% ($)	3.25%	7.25%	34%	4.79%

- We computed the synthetic ratings for Disney and Aracruz using the interest coverage ratios:
  - Disney: Coverage ratio = 2,805/758 =3.70 Synthetic rating = A-
  - Aracruz: Coverage ratio = 888/339= 2.62 Synthetic rating = BBB
  - Disney's synthetic rating is close to its actual rating. Aracruz has two ratings – one for its local currency borrowings of BBB- and one for its dollar borrowings of B+.

Application Test: Estimating a Cost of Debt

- Based upon your firm's current earnings before interest and taxes, its interest expenses, estimate
  - An interest coverage ratio for your firm
  - A synthetic rating for your firm (use the table from previous page)
  - A pre-tax cost of debt for your firm
  - An after-tax cost of debt for your firm

Costs of Hybrids

- Preferred stock shares some of the characteristics of debt - the preferred dividend is pre-specified at the time of the issue and is paid out before common dividend -- and some of the characteristics of equity - the payments of preferred dividend are not tax deductible. If preferred stock is viewed as perpetual, the cost of preferred stock can be written as follows:
  - k_{ps} = Preferred Dividend per share/ Market Price per preferred share
- Convertible debt is part debt (the bond part) and part equity (the conversion option). It is best to break it up into its component parts and eliminate it from the mix altogether.

Weights for Cost of Capital Calculation

- The weights used in the cost of capital computation should be market values.
- There are three specious arguments used against market value
  - *Book value is more reliable than market value because it is not as volatile*: While it is true that book value does not change as much as market value, this is more a reflection of weakness than strength
  - *Using book value rather than market value is a more conservative approach to estimating debt ratios:* For most companies, using book values will yield a lower cost of capital than using market value weights.
  - *Since accounting returns are computed based upon book value, consistency requires the use of book value in computing cost of capital:* While it may seem consistent to use book values for both accounting return and cost of capital calculations, it does not make economic sense.

Estimating Market Value Weights

- Market Value of Equity should include the following
  - Market Value of Shares outstanding
  - Market Value of Warrants outstanding
  - Market Value of Conversion Option in Convertible Bonds
- Market Value of Debt is more difficult to estimate because few firms have only publicly traded debt. There are two solutions:
  - Assume book value of debt is equal to market value
  - Estimate the market value of debt from the book value
  - For Disney, with book value of 13,100 million, interest expenses of $666 million, a current cost of borrowing of 5.25% and an weighted average maturity of 11.53 years.

Estimated MV of Disney Debt = $$666\left[\frac{(1-\frac{1}{(1.0525)^{11.53}}}{.0525}\right]+\frac{13,100}{(1.0525)^{11.53}}=\$12,915 \text{ million}$$

Converting Operating Leases to Debt

- The "debt value" of operating leases is the present value of the lease payments, at a rate that reflects their risk.
- In general, this rate will be close to or equal to the rate at which the company can borrow.

Operating Leases at Disney

- The pre-tax cost of debt at Disney is 5.25%

Year	Commitment	Present Value
1	$ 271.00	$ 257.48
2	$ 242.00	$ 218.46
3	$ 221.00	$ 189.55
4	$ 208.00	$ 169.50
5	$ 275.00	$ 212.92
6 –9	$ 258.25	$ 704.93
Debt Value of leases =		$ 1,752.85

- Debt outstanding at Disney = $12,915 + $ 1,753= $14,668 million

Application Test: Estimating Market Value

- Estimate the
  - Market value of equity at your firm and Book Value of equity
  - Market value of debt and book value of debt (If you cannot find the average maturity of your debt, use 3 years): Remember to capitalize the value of operating leases and add them on to both the book value and the market value of debt.
- Estimate the
  - Weights for equity and debt based upon market value
  - Weights for equity and debt based upon book value

Current Cost of Capital: Disney

- Equity
  - Cost of Equity = Riskfree rate + Beta * Risk Premium
    = 4% + 1.25 (4.82%) = 10.00%
  - Market Value of Equity = $55.101 Billion
  - Equity/(Debt+Equity) = 79%
- Debt
  - After-tax Cost of debt =(Riskfree rate + Default Spread) (1-t)
    = (4%+1.25%) (1-.373) = 3.29%
  - Market Value of Debt = $ 14.668 Billion
  - Debt/(Debt +Equity) = 21%
- Cost of Capital = 10.00%(.79)+3.29%(.21) = 8.59%

55.101(55.101+14.668)

Disney's Divisional Costs of Capital

Business	Cost of Equity	After-tax cost of debt	E/(D+E)	D/(D+E)	Cost of capital
Media Networks	10.10%	3.29%	78.98%	21.02%	8.67%
Parks and Resorts	9.12%	3.29%	78.98%	21.02%	7.90%
Studio Entertainment	10.43%	3.29%	78.98%	21.02%	8.93%
Consumer Products	10.39%	3.29%	78.98%	21.02%	8.89%
Disney	**10.00%**	**3.29%**	**78.98%**	**21.02%**	**8.59%**

Aracruz's Cost of Capital

	Levered Beta	*Cost of Equity*	*After-tax Cost of Debt*	*D/(D+E)*	*Cost of Capital*
In Real Terms					
Paper & Pulp	0.7576	11.46%	3.47%	30.82%	9.00%
Cash	0	2.00%			2.00%
Aracruz	0.7040	10.79%	3.47%	30.82%	8.53%
In US Dollar Terms					
Paper & Pulp	0.7576	13.46%	4.79%	30.82%	10.79%
Cash	0	4.00%			4.00%
Aracruz	0.7040	12.79%	4.79%	30.82%	10.33%

Bookscape Cost of Capital

	Beta Equity	Cost of cost of debt	After-tax	D/(D+E) Capital	Cost of
Market Beta	0.82	7.97%	3.30%	16.90%	7.18%
Total Beta	2.06	13.93%	3.30%	16.90%	12.14%

Application Test: Estimating Cost of Capital

- Using the bottom-up unlevered beta that you computed for your firm, and the values of debt and equity you have estimated for your firm, estimate a bottom-up levered beta and cost of equity for your firm.
- Based upon the costs of equity and debt that you have estimated, and the weights for each, estimate the cost of capital for your firm.
- How different would your cost of capital have been, if you used book value weights?

Choosing a Hurdle Rate

- Either the cost of equity or the cost of capital can be used as a hurdle rate, depending upon whether the returns measured are to equity investors or to all claimholders on the firm (capital)
- If returns are measured to equity investors, the appropriate hurdle rate is the cost of equity.
- If returns are measured to capital (or the firm), the appropriate hurdle rate is the cost of capital.

Back to First Principles

- Invest in projects that yield a return greater than the **minimum acceptable hurdle rate**.
  - **The hurdle rate should be higher for riskier projects and reflect the financing mix used - owners' funds (equity) or borrowed money (debt)**
  - Returns on projects should be measured based on cash flows generated and the timing of these cash flows; they should also consider both positive and negative side effects of these projects.
- Choose a financing mix that minimizes the hurdle rate and matches the assets being financed.
- If there are not enough investments that earn the hurdle rate, return the cash to stockholders.
  - The form of returns - dividends and stock buybacks - will depend upon the stockholders' characteristics.