Dealing with Risk : Investment Analysis

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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.

Objective: Maximize the Value of the Firm

Inputs required to use the CAPM -

(a) the current risk-free rate

(b) the expected return on the market index and

(c) the beta of the asset being analyzed.

The Riskfree Rate

- On a riskfree asset, the actual return is equal to the expected return.
- Therefore, there is no variance around the expected return.

Riskfree Rate and Time Horizon

- 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 2, 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.
- If the analysis is being done in real terms (rather than nominal terms) use a real riskfree rate, which can be obtained in one of two ways –
  - from an inflation-indexed government bond, if one exists
  - set equal, approximately, to the long term real growth rate of the economy in which the valuation is being done.

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 6.7%
  - 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?

- Less than 6.7%
- Between 6.7 - 7.8%
- Between 8.7 - 10.7%
- Between 10.7 - 12.7%
- Between 12.7 - 14.7%
- More than 14.7%

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 Bufffet'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?

- I would demand a larger premium
- I would demand a smaller premium
- 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

Historical period	Stocks - T.Bills		Stocks - T.Bonds	
	Arith	Geom	Arith	Geom
1926-1996	8.76%	6.95%	7.57%	5.91%
1962-1996	5.74%	4.63%	5.16%	4.46%
1981-1996	10.34%	9.72%	9.22%	8.02%

What is the right premium?

Arith: This is the arithmetic average of annual returns from this period

Geom: This is the compounded annual return from investing $ 1 at the start of the period

What about historical premiums for other markets?

- Historical data for markets outside the United States tends to be sketch and unreliable.
- Ibbotson, for instance, estimates the following premiums for major markets from 1970-1990

Country	*Period*	*Stocks*	*Bonds*	*Risk Premium*
Australia	1970-90	9.60%	7.35%	2.25%
Canada	1970-90	10.50%	7.41%	3.09%
France	1970-90	11.90%	7.68%	4.22%
Germany	1970-90	7.40%	6.81%	0.59%
Italy	1970-90	9.40%	9.06%	0.34%
Japan	1970-90	13.70%	6.96%	6.74%
Netherlands	1970-90	11.20%	6.87%	4.33%
Switzerland	1970-90	5.30%	4.10%	1.20%
UK	1970-90	14.70%	8.45%	6.25%

Risk Premiums for Latin America

Country	*Rating*	*Risk Premium*
Argentina	BBB	5.5% + 1.75% = 7.25%
Brazil	BB	5.5% + 2% = 7.5%
Chile	AA	5.5% + 0.75% = 6.25%
Columbia	A+	5.5% + 1.25% = 6.75%
Mexico	BBB+	5.5% + 1.5% = 7%
Paraguay	BBB-	5.5% + 1.75% = 7.25%
Peru	B	5.5% + 2.5% = 8%
Uruguay	BBB	5.5% + 1.75% = 7.25%

Risk Premiums for Eastern Europe

Country	Rating	Premium
Czech Republic	A	5.5% + 1% = 6.5%
Lithuania	BB+	5.5% + 2% = 7.5%
Poland	AA	5.5% + 0.75% = 6.25%
Romania	BB-	5.5% + 2.5% = 8%
Russia	BB-	5.5% + 2.5% = 8%
Slovakia	BBB-	5.5% + 1.75% = 7.25%
Slovenia	A	5.5% + 1% = 6.5%
Turkey	B+	5.5% + 2.75% = 8.25%

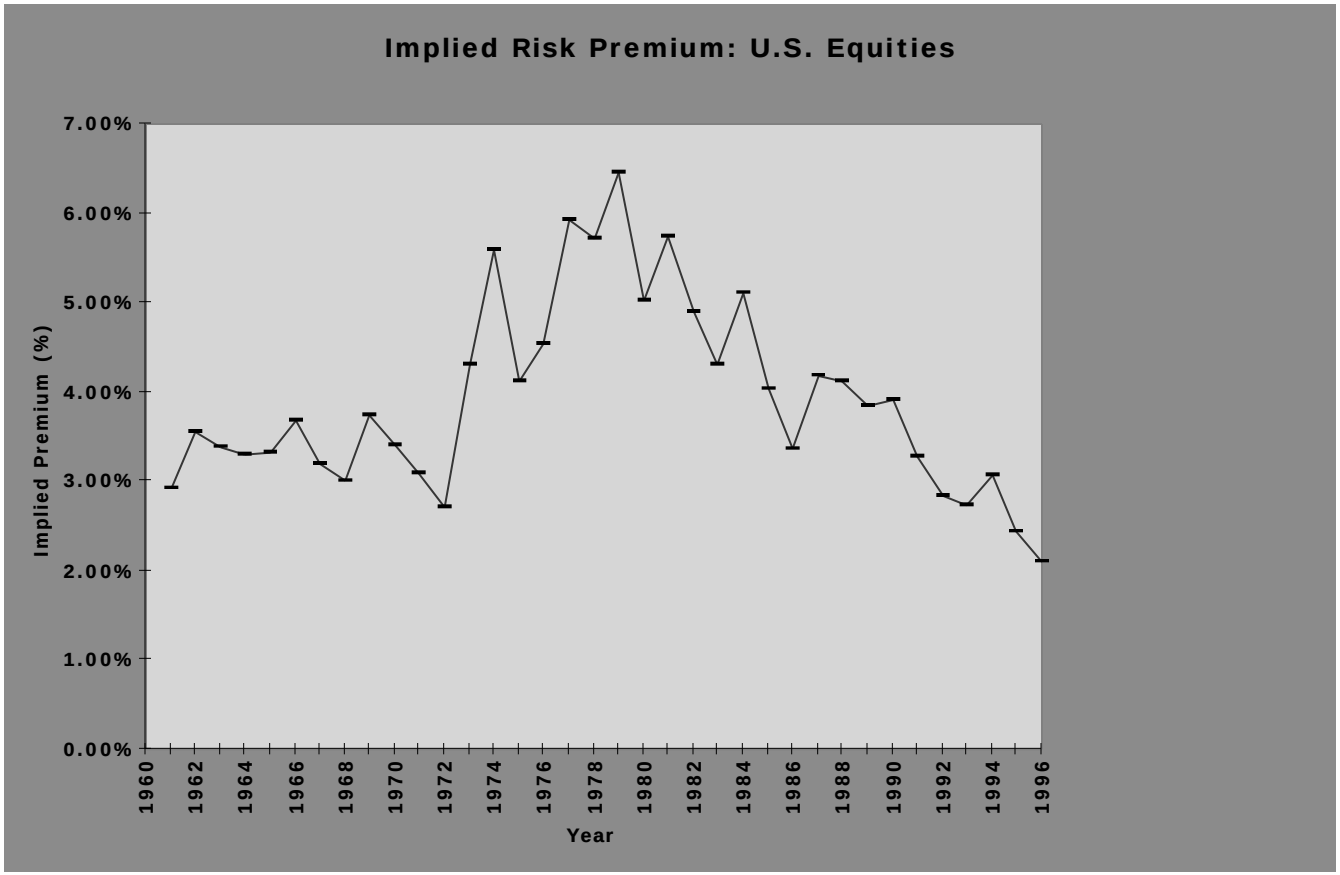
Risk Premiums for Asia

Country	*Rating*	*Risk Premium*
China	BBB+	5.5% + 1.5% = 7.00%
Indonesia	BBB	5.5% + 1.75% = 7.25%
India	BB+	5.5% + 2.00% = 7.50%
Japan	AAA	5.5% + 0.00% = 5.50%
Korea	AA-	5.5% + 1.00% = 6.50%
Malaysia	A+	5.5% + 1.25% = 6.75%
Pakistan	B+	5.5% + 2.75% = 8.25%
Phillipines	BB+	5.5% + 2.00% = 7.50%
Singapore	AAA	5.5% + 0.00% = 5.50%
Taiwan	AA+	5.5% + 0.50% = 6.00%
Thailand	A	5.5% + 1.35% = 6.85%

Implied Equity Premiums

- If we use a basic discounted cash flow model, we can estimate the implied risk premium from the current level of stock prices.
- For instance, if stock prices are determined by the simple Gordon Growth Model:
  - Value = Expected Dividends next year/ (Required Returns on Stocks - Expected Growth Rate)
  - Plugging in the current level of the index, the dividends on the index and expected growth rate will yield a “implied” expected return on stocks. Subtracting out the riskfree rate will yield the implied premium.
- The problems with this approach are:
  - the discounted cash flow model used to value the stock index has to be the right one.
  - the inputs on dividends and expected growth have to be correct
  - it implicitly assumes that the market is currently correctly valued

Implied Premiums in the US



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

- This is Jensen's alpha.

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.

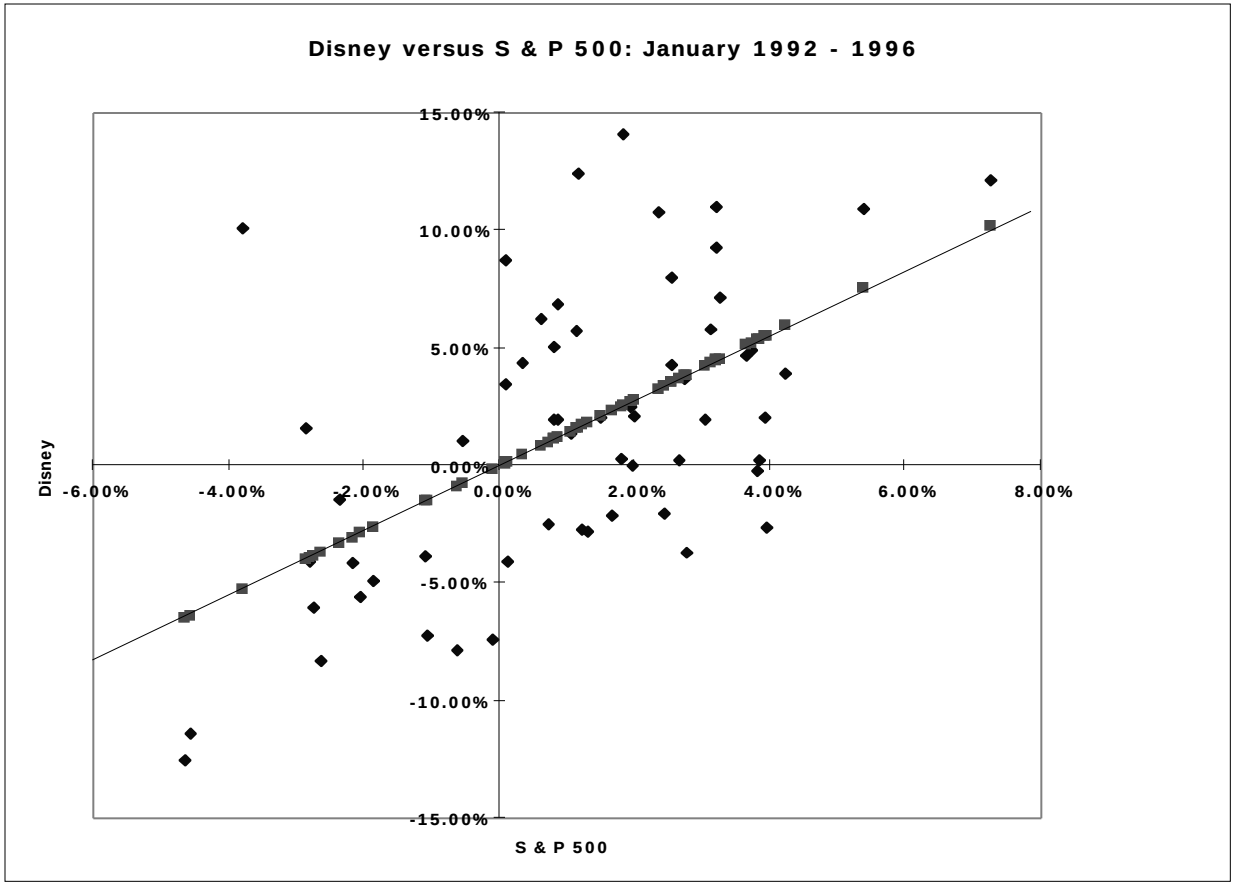
Setting up for the Estimation

- 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 April 1992,
  - Price for Disney at end of March = $ 37.87
  - Price for Disney at end of April = $ 36.42
  - Dividends during month = $0.05 (It was an ex-dividend month)
  - Return =($36.42 - $ 37.87 + $ 0.05)/$ 37.87=-3.69%
- To estimate returns on the index in the same month
  - Index level (including dividends) at end of March = 404.35
  - Index level (including dividends) at end of April = 415.53
  - Return =(415.53 - 404.35)/ 404.35 = 2.76%

Disney's Historical Beta



The Regression Output

- $\text{Returns}_{\text{Disney}} = -0.01\% + 1.40\ \text{Returns}_{\text{S \& P 500}}$ (R squared=32.41%)
  (0.27)
- Intercept = -0.01%
- Slope = 1.40

Analyzing Disney's Performance

- Intercept = -0.01%
- This is an intercept based on monthly returns. Thus, it has to be compared to a monthly riskfree rate.
- Between 1992 and 1996,
  - Monthly Riskfree Rate = 0.4% (Annual T.Bill rate divided by 12)
  - Riskfree Rate (1-Beta) = 0.4% (1-1.40) = -.16%
- The Comparison is then between

Intercept	versus	Riskfree Rate (1 - Beta)
-0.01%	versus	0.4%(1-1.40)=-0.16%

- Jensen's Alpha = -0.01% -(-0.16%) = 0.15%
- Disney did 0.15% better than expected, per month, between 1992 and 1996.
- Annualized, Disney's annual excess return = (1.0015)^12-1= 1.81%

More on Jensen's Alpha

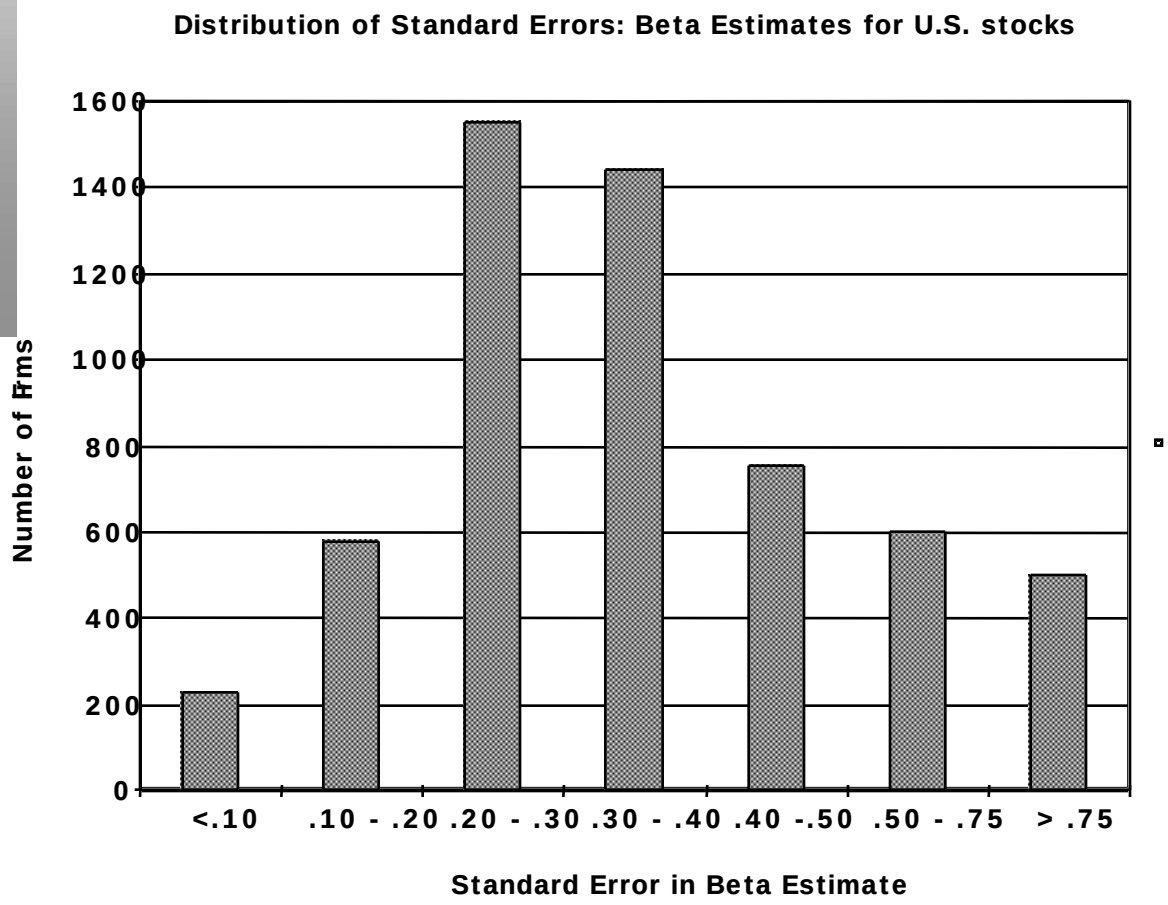
If you did this analysis on every stock listed on an exchange, what would the average Jensen's alpha be across all stocks?

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

Estimating Disney's Beta

- Slope of the Regression of 1.40 is the beta
- Regression parameters are always estimated with noise. The noise is captured in the standard error of the beta estimate, which in the case of Disney is 0.27.
- 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 = 32%
- This implies that
  - 32% of the risk at Disney comes from market sources
  - 68%, 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 1.35, but Disney has an R Squared of 32% while Amgen's R squared of only 15%. Which one would you invest in:

- Amgen, because it has the lower R squared
- Disney, because it has the higher R squared
- You would be indifferent

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

Beta Estimation in Practice: Bloomberg

10 DG28 Equity **BETA**

HISTORICAL BETA

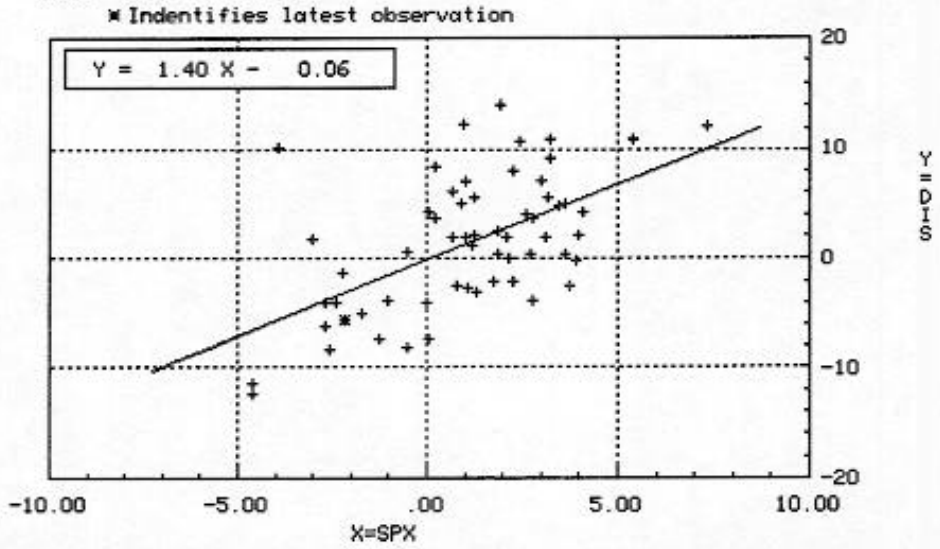
Number of points may be insufficient for an accurate beta.

DIS **US** THE WALT DISNEY CO.

Market SPX S&P 500 INDEX

Period M (D-W-M-Q-Y)
Range 1/31/92 To 12/31/96
T (T=Trade, B=Bid, A=Ask)

ADJ BETA	1.27
RAW BETA	1.40
Alpha (Intercept)	-.06
R2 (Correlation)	.32
Std Dev of Error	5.09
Std Error of Beta	.27
Number of Points	59



Adj beta = (0.67) * Raw Beta
+ (0.33) * 1.0

Estimating Expected Returns: September 30, 1997

- Disney's Beta = 1.40
- Riskfree Rate = 7.00% (Long term Government Bond rate)
- Risk Premium = 5.50% (Approximate historical premium)
- Expected Return = 7.00% + 1.40 (5.50%) = 14.70%

Use to a Potential Investor in Disney

As a potential investor in Disney, what does this expected return of 14.70% tell you?

- 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,
- This is the return that I need to make on Disney in the long term to break even on my investment in the stock
- Both

Assume now that you are an active investor and that your research suggests that an investment in Disney will yield 25% a year for the next 5 years. Based upon the expected return of 14.70%, you would

- Buy the stock
- Sell the stock

How managers use this expected return

- Managers at Disney
  - need to make at least 14.70% 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 14.70%.
- What is the cost of not delivering this cost of equity?

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 2.0 for the firm and come up with a cost of equity of 18%. 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

Beta Estimation and Index Choice

HISTORICAL BETA

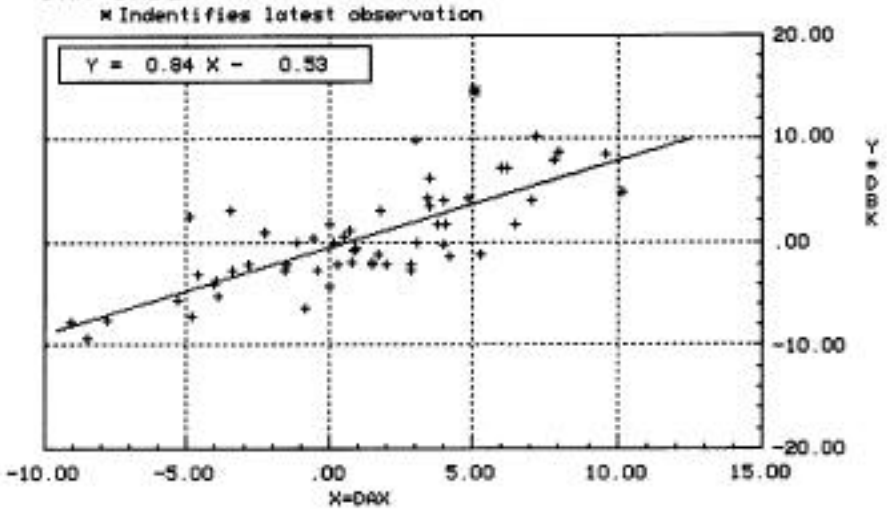
Number of points may be insufficient for an accurate beta.

DBK **GR** DEUTSCHE BANK AG

Market DAX DAX INDEX

Period M (D-W-M-Q-Y)
Range 1/31/92 To 1/31/97
T (T=Trade, F=Fixing)

ADJ BETA	.90
RAW BETA	.84
Alpha (Intercept)	-.53
R2 (Correlation)	.57
Std Dev of Error	3.22
Std Error of Beta	.10
Number of Points	60



Adj beta = (0.67) * Raw Beta
+ (0.33) * 1.0

A Few Questions

- The R squared for Deutsche Bank is very high (57%), at least relative to U.S. firms. Why is that?
- The beta for Deutsche Bank is 0.84.
  - 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: To a U.S. Investor?

HISTORICAL BETA

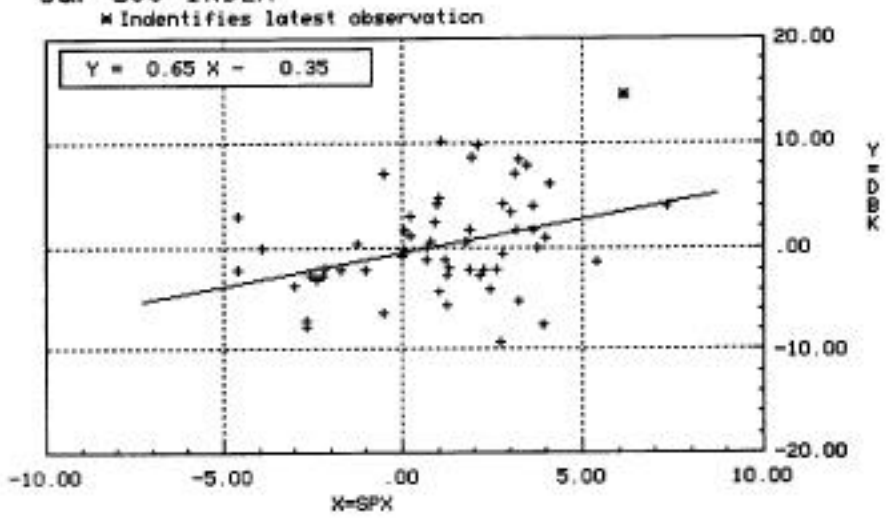
Number of points may be insufficient for an accurate beta.

DBK **GR** DEUTSCHE BANK AG

Market SPX S&P 500 INDEX

Period M (D-W-M-Q-Y)
Range 1/31/92 To 1/31/97
T (T=Trade,F=Fixing)

ADJ BETA	.77
RAW BETA	.65
Alpha (Intercept)	-.35
R2 (Correlation)	.12
Std Dev of Error	4.62
Std Error of Beta	.23
Number of Points	60



Adj beta = (0.67) * Raw Beta
+ (0.33) * 1.0

Deutsche Bank: To a Global Investor

HISTORICAL BETA

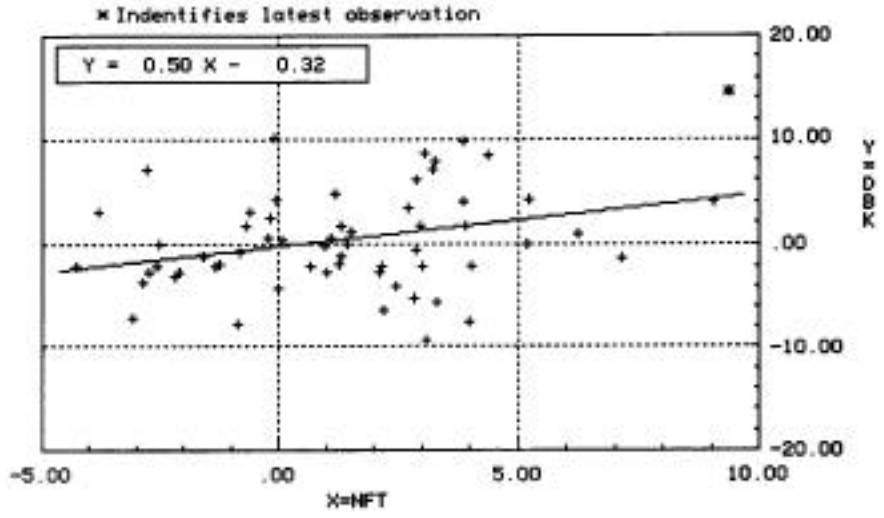
Number of points may be insufficient for an accurate beta.

DBK **GR** DEUTSCHE BANK AG

Market NFT MS MULTINATIONAL INDEX

Period M (D-W-M-Q-Y)
Range 1/31/92 To 1/31/97
T (T=Trade, F=Fixing)

ADJ BETA	.67
RAW BETA	.50
Alpha (Intercept)	-.32
R2 (Correlation)	.10
Std Dev of Error	4.67
Std Error of Beta	.20
Number of Points	60



Adj beta = (0.67) * Raw Beta
+ (0.33) * 1.0

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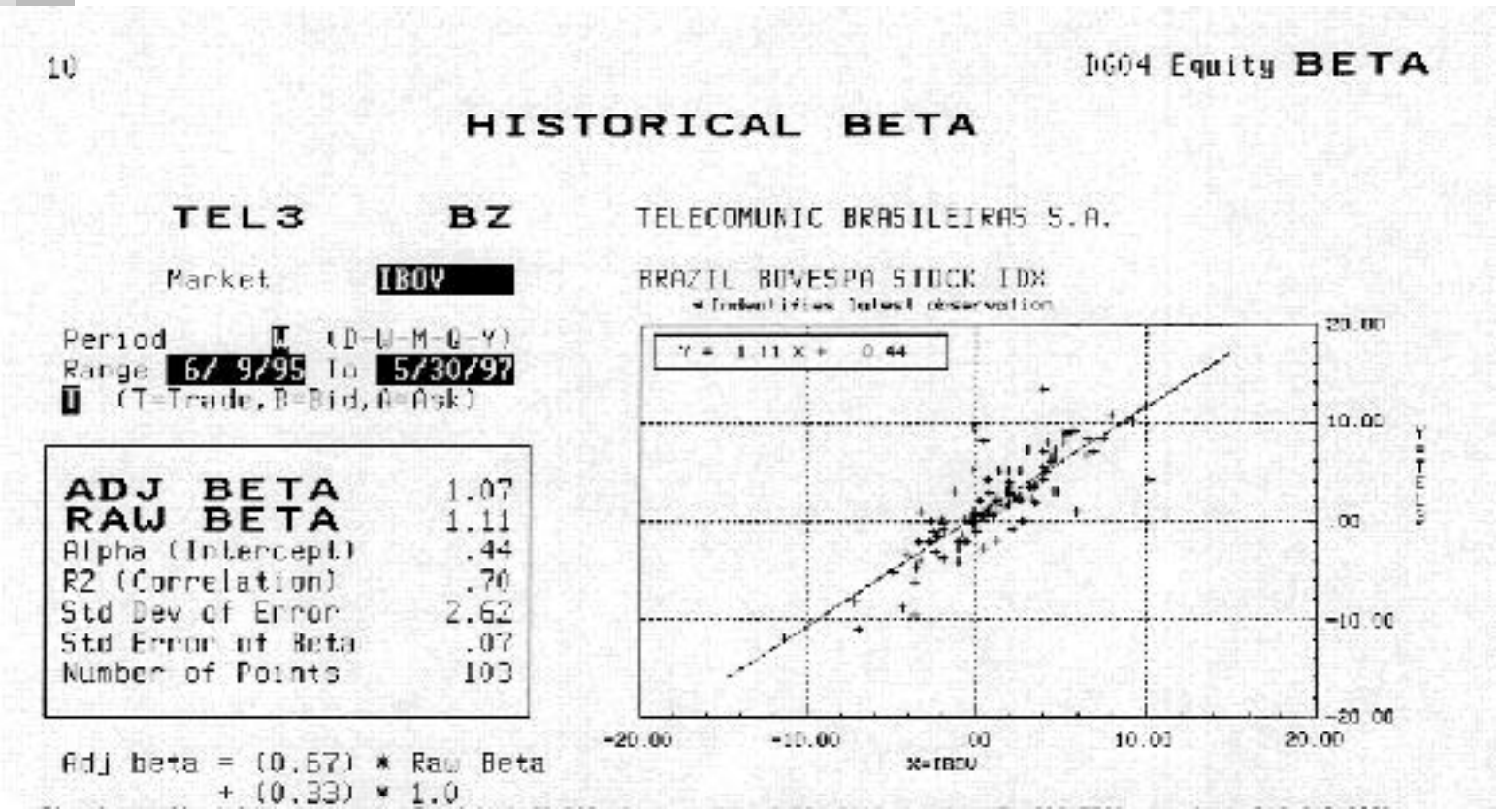
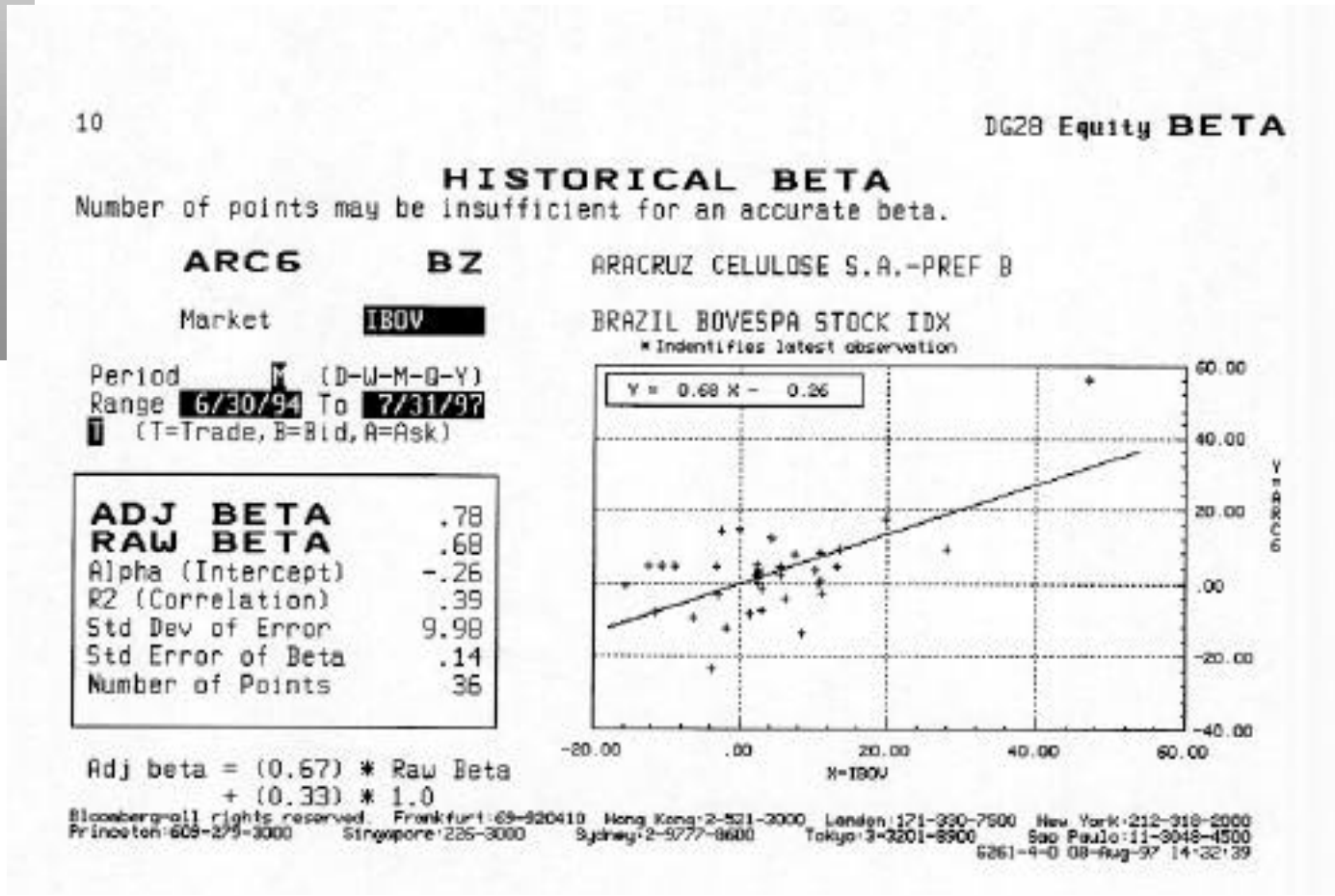
Telebras: The Index Effect Again



Aracruz Cellulose: The Contrast



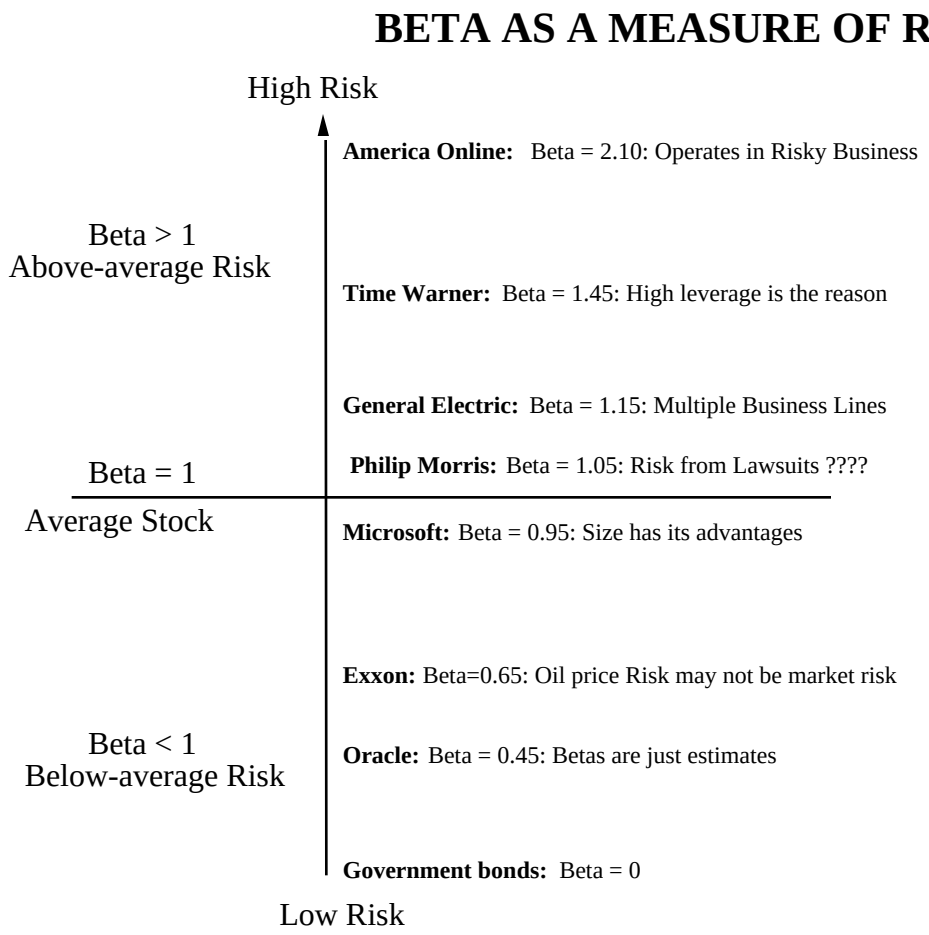
Beta Estimation With an Index Problem

- **The Local Solution**: Estimate the beta relative to a local index, that is equally weighted or more diverse than the one in use.
- **The U.S. Solution**: If the stock has an ADR listed on the U.S. exchanges, estimate the beta relative to the S&P 500.
- **The Global Solution**: Use a global index to estimate the beta
- For Aracruz,

Index	**Beta**
Brazil I-Senn	0.69
S & P 500 (with ADR)	0.46
Morgan Stanley Capital Index (with ADR)	0.35

- An Alternative Solution: Do not use a regression to estimate the firm's beta.

Beta Differences: A First Look Behind Betas



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?

- Much higher than one
- Close to one
- 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.

A Look at Disney's Operating Leverage

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%	1429	27.14%
1993	8529	13.66%	1232	-13.79%
1994	10055	17.89%	1933	56.90%
1995	12112	20.46%	2295	18.73%
1996	18739	54.71%	2540	10.68%
Average		**23.80%**		**16.56%**

Reading Disney's Operating Leverage

- Operating Leverage = % Change in EBIT/ % Change in Sales
  = 16.56% / 23.80 % = 0.70
- This is lower than the operating leverage for other entertainment firms, which we computed to be 1.15. 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 downwards. For instance, looking at the operating leverage for 1987-1995:

  Operating Leverage1987-96 = 17.29%/19.94% = 0.87

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?

- European firms will have much higher betas than U.S. firms
- European firms will have similar betas to U.S. firms
- 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 1.40. 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 (1992 to 1996)
- The average debt equity ratio during this period was 14%.
- The unlevered beta for Disney can then be estimated:(using a marginal tax rate of 36%)

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

  = 1.40 / (1 + (1 - 0.36) (0.14)) = 1.28

Disney : Beta and Leverage

Debt to Capital	Debt/Equity Ratio	Beta	Effect of Leverage
0.00%	0.00%	1.28	0.00
10.00%	11.11%	1.38	0.09
20.00%	25.00%	1.49	0.21
30.00%	42.86%	1.64	0.35
40.00%	66.67%	1.83	0.55
50.00%	100.00%	2.11	0.82
60.00%	150.00%	2.52	1.23
70.00%	233.33%	3.20	1.92
80.00%	400.00%	4.57	3.29
90.00%	900.00%	8.69	7.40

- Riskfree Rate = 7.00% Risk Premium = 5.50%

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.

Betas of Conglomerates

- Suppose a firm follows a policy of taking over companies in different industries with the intention of becoming a conglomerate. What will happen to its beta as it continues through this policy?
  - The beta will go up
  - The beta will go down
  - The beta will converge towards one
- Does it matter how the takeover is financed?

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

Decomposing Disney's Beta

Business	Unlevered Beta	D/E Ratio	Levered Beta	Riskfree Rate	Risk Premium	Cost of Equity
Creative Content	1.25	20.92%	1.42	7.00%	5.50%	14.80%
Retailing	1.50	20.92%	1.70	7.00%	5.50%	16.35%
Broadcasting	0.90	20.92%	1.02	7.00%	5.50%	12.61%
Theme Parks	1.10	20.92%	1.26	7.00%	5.50%	13.91%
Real Estate	0.70	50.00%	0.92	7.00%	5.50%	12.08%
Disney	1.09	21.97%	1.25	7.00%	5.50%	13.85%

Business	Estimated V	Comparable Firms	Unlevered	Division Weight
Creative Content	$22,167	Motion Picture and TV program producers	1.25	35.71%
Retailing	$ 2,217	High End Specialty Retailers	1.5	3.57%
Broadcasting	$18,842	TV Broadcasting companies	0.9	30.36%
Theme Parks	$16,625	Theme Park and Entertainment Complexes	1.1	26.79%
Real Estate	$ 2,217	REITs specializing in hotel and vacation propertiers	0.7	3.57%
Firm	$62,068			100.00%

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?
  - The cost of equity for Disney as a company
  - The cost of equity for each of Disney's divisions?

Estimating Aracruz's Bottom Up Beta

Comparable Firms	*Average Beta*	*D/E Ratio*	*Unlevered Beta*
Latin American Paper & Pulp (5)	0.70	65.00%	0.49
U.S. Paper and Pulp (45)	0.85	35.00%	0.69
Global Paper & Pulp (187)	0.80	50.00%	0.61

Unlevered Beta for Paper and Pulp is 0.61

- Aracruz has a cash balance which was 20% of the market value in 1997, much higher than the typical cash balance at other paper firms

  Unlevered Beta for Aracruz = (0.8) (0.61) + 0.2 (0) = 0.488

- Using Aracruz's gross D/E ratio of 66.67% & a tax rate of 33%:

  Levered Beta for Aracruz = 0.49 (1+ (1-.33) (.6667)) = 0.71

- Real Cost of Equity for Aracruz = 5% + 0.71 (7.5%) = 10.33%

Real Riskfree Rate = 5% (Long term Growth rate in Brazilian economy)

Estimating Cost of Equity: 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.

Comparable Firms	*Average Beta*	*Weight*
Commercial Banks in Germany	0.90	90%
U.K. and U.S. investment banks	1.30	10%

- Beta for Deutsche Bank = 0.9 (.90) + 0.1 (1.30)= 0.94
- Cost of Equity for Deutsche Bank (in DM) = 7.5% + 0.94 (5.5%)
  = 12.67%

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 betas

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

Company Name	*Beta*	*D/E Ratio*	*Market Cap $ (Mil)*
Barnes & Noble	1.10	23.31%	$ 1,416
Books-A-Million	1.30	44.35%	$ 85
Borders Group	1.20	2.15%	$ 1,706
Crown Books	0.80	3.03%	$ 55
Average	**1.10**	**18.21%**	**$ 816**

- Unlevered Beta of comparable firms 1.10/(1 + (1-.36) (.1821)) = 0.99
- If independent bookstore has similar leverage, beta = 1.10
- If independent bookstore decides to use a debt/equity ratio of 25%:

Beta for bookstore = 0.99 (1+(1-..42)(.25)) = 1.13 (Tax rate used=42%)

Using Accounting Earnings to Estimate Beta

Year	*S&P 500*	*Bookscape*	*Year*	*S&P 500*	*Bookscap*
1980	-2.10%	3.55%	1989	2.60%	3.50%
1981	-6.70%	4.05%	1990	-18.00%	-10.50%
1982	-45.50%	-14.33%	1991	-47.40%	-32.00%
1983	37.00%	47.55%	1992	64.50%	55.00%
1984	41.80%	65.00%	1993	20.00%	31.00%
1985	-11.80%	5.05%	1994	25.30%	21.06%
1986	7.00%	8.50%	1995	15.50%	11.55%
1987	41.50%	37.00%	1996	24.00%	19.88%
1988	41.80%	45.17%			

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 = -.085 + 1.11 (S & P 500 Earnings Change)

- Based upon this regression, the beta for Bookscape's equity is 1.11.
- 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
  - Under estimate the cost of equity for the private firm
  - Over estimate the cost of equity for the private firm
  - 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 / R squared

- In the Bookscapes example, where the market beta is 1.10 and the average R-squared of the comparable publicly traded firms is 33%,
  - Total Beta = 1.10/0.33 = 3.30
  - Total Cost of Equity = 7% + 3.30 (5.5%)= 25.05%

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.
- It is the discount rate that will be applied to capital budgeting projects within the firm

The Cost of Capital

Choice	*Cost*
1. Equity	Cost of equity
- Retained earnings	- depends upon riskiness of the stock
- New stock issues	- will be affected by level of interest rates
- Warrants	

*Cost of equity = riskless rate + beta * risk premium*

2. Debt	Cost of debt
- Bank borrowing	- depends upon default risk of the firm
- Bond issues	- will be affected by level of interest rates
	- provides a tax advantage because interest is tax-deductible

Cost of debt = Borrowing rate (1 - tax rate)

Debt + equity = Capital	Cost of capital = Weighted average of cost of equity and cost of debt; weights based upon market value.

Cost of capital $= k_d\,[D/(D+E)] + k_e\,[E/(D+E)]$

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 $12.342 million, interest expenses of $479 million, and a current cost of borrowing of 7.5% (from its rating)

Estimated MV of Disney Debt $= 479\left[\frac{1-\frac{1}{(1.075)^3}}{.075}\right] + \frac{12,342}{(1.075)^3} = \$11,180$

Estimating Cost of Capital: Disney

- Equity
  - Cost of Equity = 13.85%
  - Market Value of Equity = $50.88 Billion
  - Equity/(Debt+Equity) = 82%
- Debt
  - After-tax Cost of debt = 7.50% (1-.36) = 4.80%
  - Market Value of Debt = $ 11.18 Billion
  - Debt/(Debt +Equity) = 18%
- Cost of Capital = 13.85%(.82)+4.80%(.18) = 12.22%

Disney's Divisional Costs of Capital

Business	E/(D+E)	Cost of Equity	D/(D+E)	After-tax Cost of Debt	Cost of Capital
Creative Content	82.70%	14.80%	17.30%	4.80%	13.07%
Retailing	82.70%	16.35%	17.30%	4.80%	14.36%
Broadcasting	82.70%	12.61%	17.30%	4.80%	11.26%
Theme Parks	82.70%	13.91%	17.30%	4.80%	12.32%
Real Estate	66.67%	12.08%	33.33%	4.80%	9.65%
Disney	**81.99%**	**13.85%**	**18.01%**	**4.80%**	**12.22%**

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.