

# The Investment Principle: Estimating Hurdle Rates

“You cannot swing upon a rope that is attached only to your own belt.”

# First Principles

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- 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.

## The notion of a benchmark

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- Since financial resources are finite, there is a hurdle that projects have to cross before being deemed acceptable.
- This hurdle will be higher for riskier projects than for safer projects.
- A simple representation of the hurdle rate is as follows:

$$\text{Hurdle rate} = \text{Riskless Rate} + \text{Risk Premium}$$

- The two basic questions that every risk and return model in finance tries to answer are:
  - How do you measure risk?
  - How do you translate this risk measure into a risk premium?

## What is Risk?

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- Risk, in traditional terms, is viewed as a ‘negative’. Webster’s dictionary, for instance, defines risk as “exposing to danger or hazard”. The Chinese symbols for risk, reproduced below, give a much better description of risk

危機

- The first symbol is the symbol for “danger”, while the second is the symbol for “opportunity”, making risk a mix of danger and opportunity. You cannot have one, without the other.

## A good risk and return model should...

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1. It should come up with a measure of risk that applies to all assets and not be asset-specific.
2. It should clearly delineate what types of risk are rewarded and what are not, and provide a rationale for the delineation.
3. It should come up with standardized risk measures, i.e., an investor presented with a risk measure for an individual asset should be able to draw conclusions about whether the asset is above-average or below-average risk.
4. It should translate the measure of risk into a rate of return that the investor should demand as compensation for bearing the risk.
5. It should work well not only at explaining past returns, but also in predicting future expected returns.

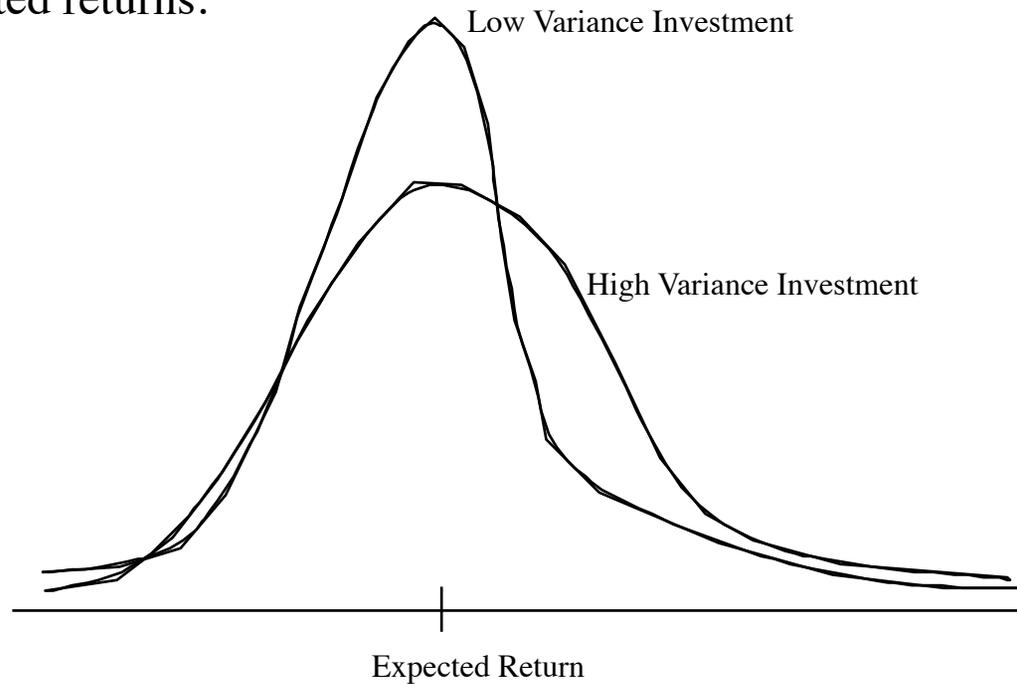
# The Capital Asset Pricing Model

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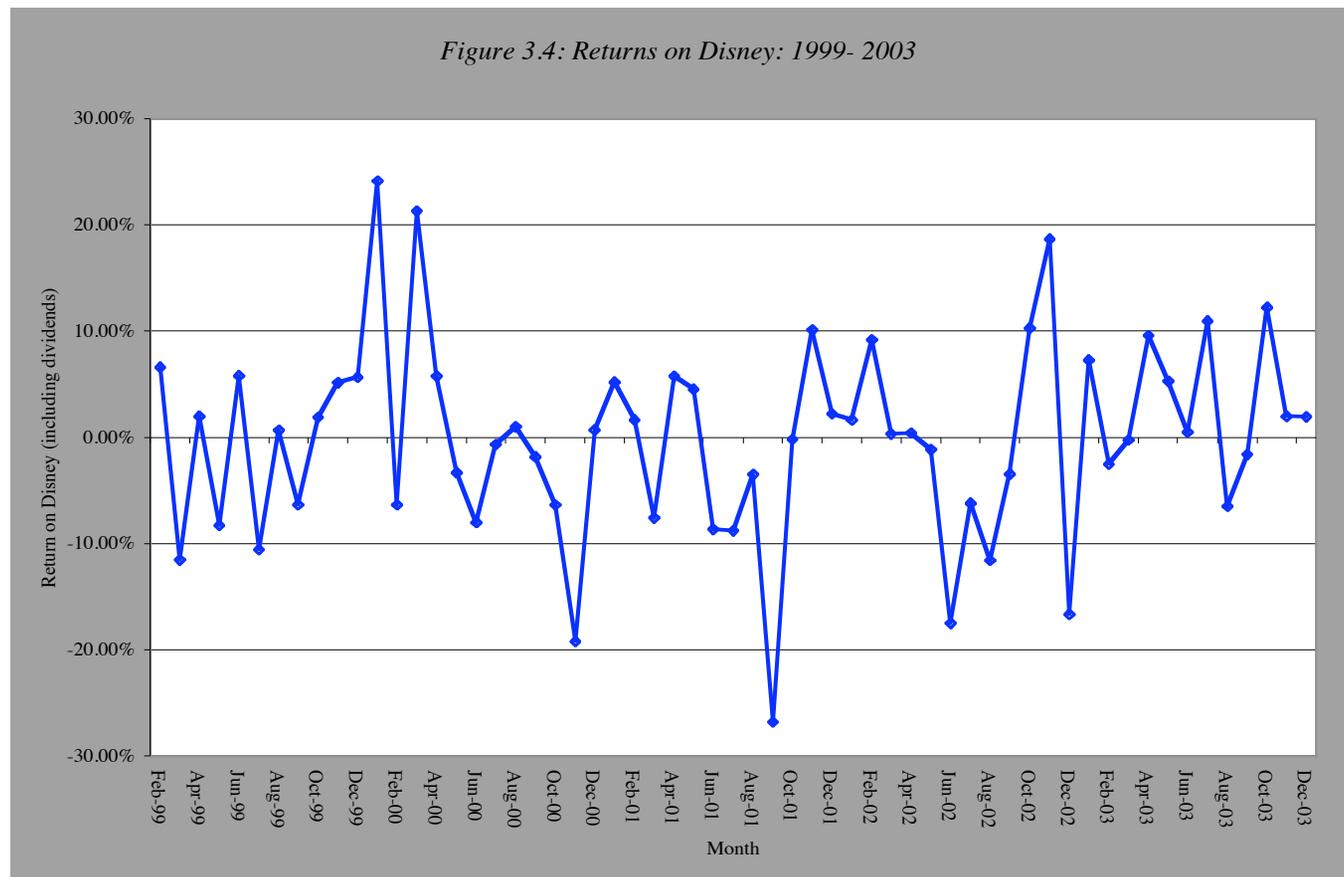
- Uses variance of actual returns around an expected return as a measure of risk.
- Specifies that a portion of variance can be diversified away, and that is only the non-diversifiable portion that is rewarded.
- Measures the non-diversifiable risk with beta, which is standardized around one.
- Translates beta into expected return -  
$$\text{Expected Return} = \text{Riskfree rate} + \text{Beta} * \text{Risk Premium}$$
- Works as well as the next best alternative in most cases.

# The Mean-Variance Framework

- The variance on any investment measures the disparity between actual and expected returns.



## How risky is Disney? A look at the past...



## Do you live in a mean-variance world?

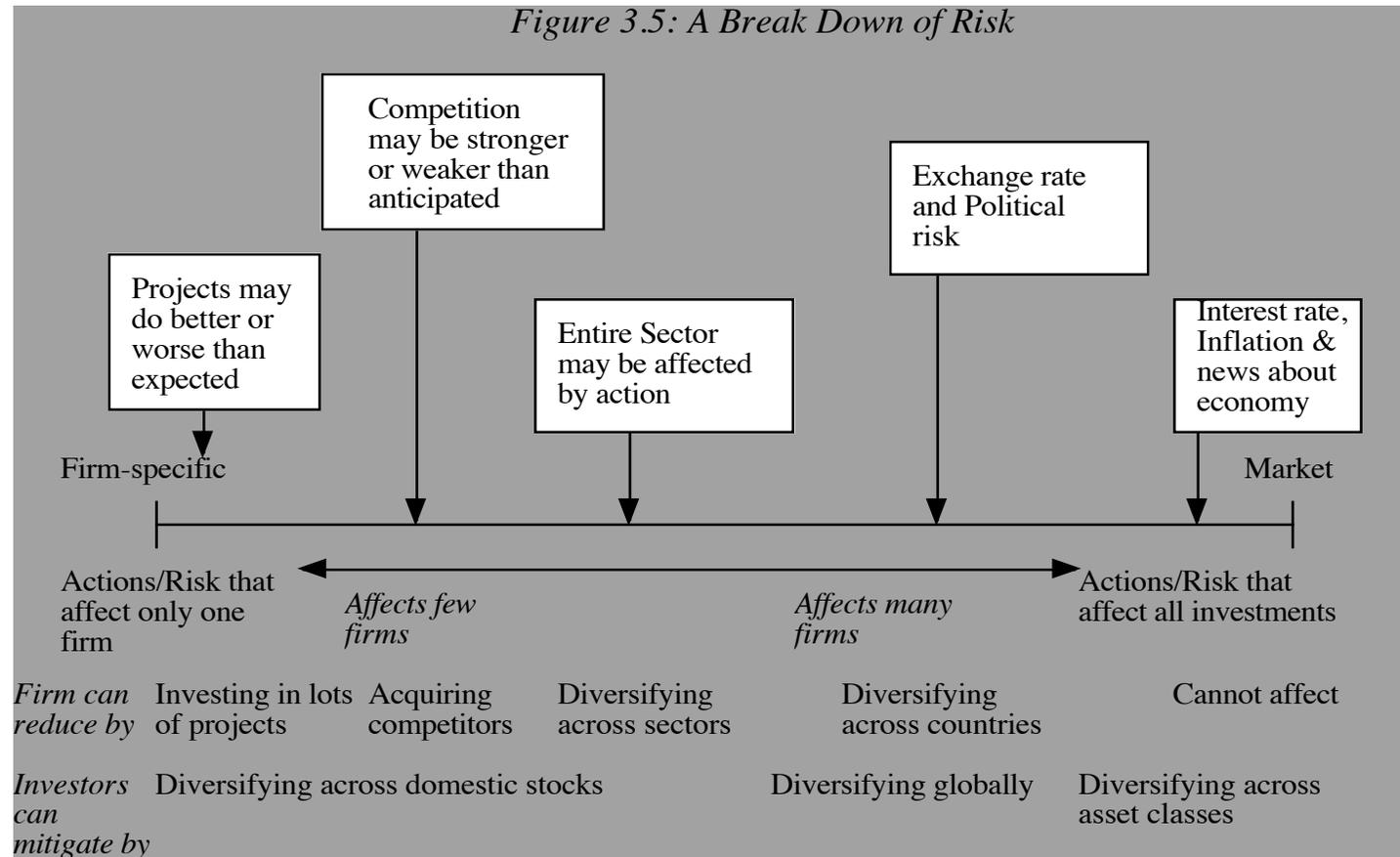
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- Assume that you had to pick between two investments. They have the same expected return of 15% and the same standard deviation of 25%; however, investment A offers a very small possibility that you could quadruple your money, while investment B's highest possible payoff is a 60% return. Would you
  - a. be indifferent between the two investments, since they have the same expected return and standard deviation?
  - b. prefer investment A, because of the possibility of a high payoff?
  - c. prefer investment B, because it is safer?

Would your answer change if you were not told that there is a small possibility that you could lose 100% of your money on investment A but that your worst case scenario with investment B is -50%?

# The Importance of Diversification: Risk Types

Figure 3.5: A Break Down of Risk



## The Effects of Diversification

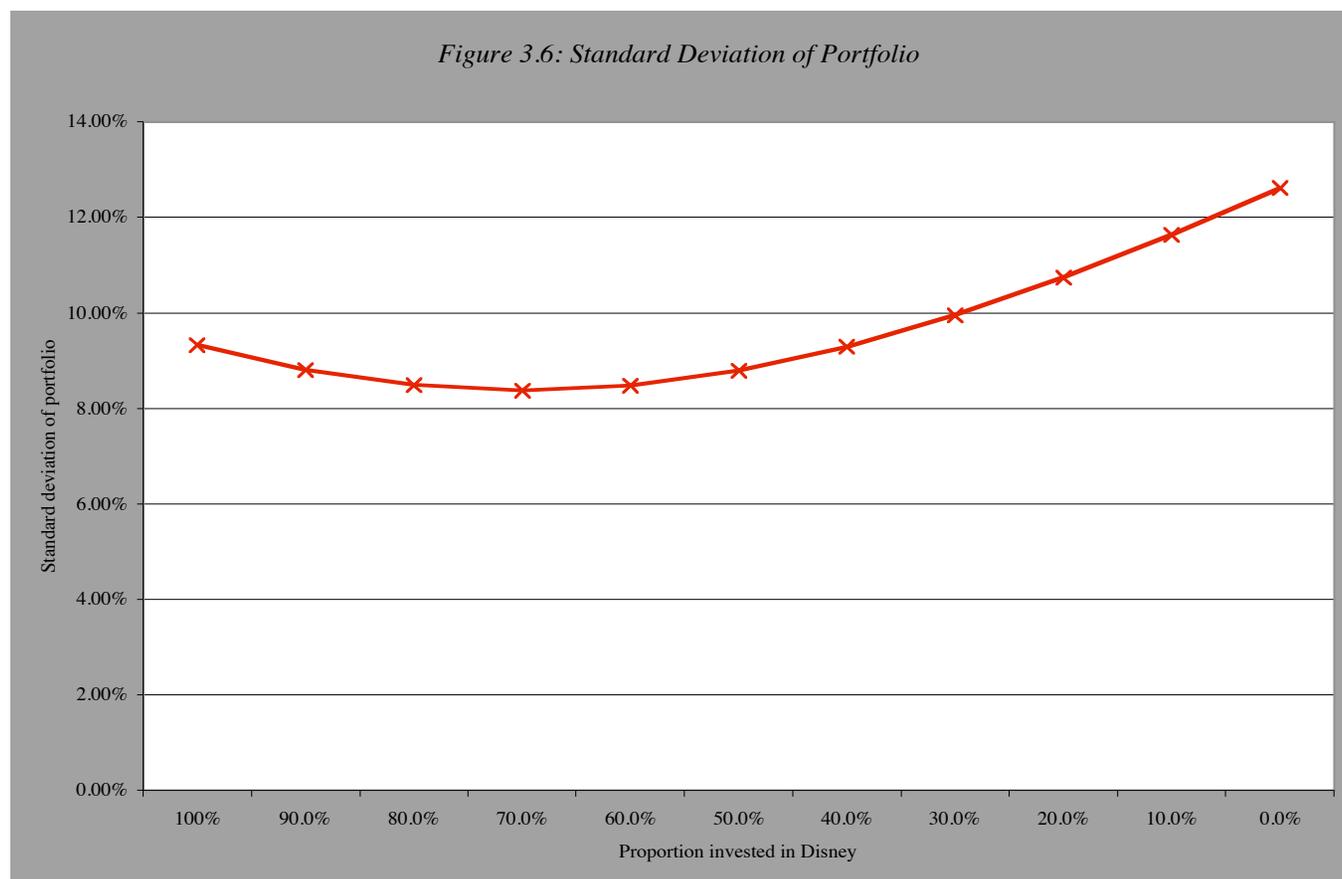
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- Firm-specific risk can be reduced, if not eliminated, by increasing the number of investments in your portfolio (i.e., by being diversified). Market-wide risk cannot. This can be justified on either economic or statistical grounds.
- On economic grounds, diversifying and holding a larger portfolio eliminates firm-specific risk for two reasons-
  - (a) Each investment is a much smaller percentage of the portfolio, muting the effect (positive or negative) on the overall portfolio.
  - (b) Firm-specific actions can be either positive or negative. In a large portfolio, it is argued, these effects will average out to zero. (For every firm, where something bad happens, there will be some other firm, where something good happens.)

## A Statistical Proof that Diversification works... An example with two stocks..

	<i>Disney</i>	<i>Aracruz</i> <i>ADR</i>
Average Monthly Return	- 0.07%	2.57%
Standard Deviation in Monthly Returns	9.33%	12.62%
Correlation between Disney and Aracruz	0.2665	

## The variance of a portfolio...



## A caveat on diversification: The lessons of 2008

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- Diversification reduces exposure to risks that are uncorrelated. It cannot eliminate your exposure to correlated risks.
- Two phenomena are undercutting the effectiveness of diversification:
  - Globalization: As companies and investors globalize, the correlation across global economies and markets is increasing. The benefits to diversification are therefore dropping.
  - Securitization: As more and more asset classes become securitized (accounts receivable, mortgages, commodities...), the correlation across asset classes is increasing.
- When there is a crisis of confidence and investors become more risk averse, the correlation across all risky assets increases, thus undercutting the benefits of diversification when you need it the most.

## The Role of the Marginal Investor

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- The marginal investor in a firm is the investor who is most likely to be the buyer or seller on the next trade and to influence the stock price.
- Generally speaking, the marginal investor in a stock has to own a lot of stock and also trade a lot.
- Since trading is required, the largest investor may not be the marginal investor, especially if he or she is a founder/manager of the firm (Michael Dell at Dell Computers or Bill Gates at Microsoft)
- In all risk and return models in finance, we assume that the marginal investor is well diversified.

## Identifying the Marginal Investor in your firm...

<i>Percent of Stock held by Institutions</i>	<i>Percent of Stock held by Insiders</i>	<i>Marginal Investor</i>
High	Low	Institutional Investor <sup>a</sup>
High	High	Institutional Investor, with insider influence
Low	High (held by founder/manager of firm)	Tough to tell; Could be insiders but only if they trade. If not, it could be individual investors.
Low	High (held by wealthy individual investor)	Wealthy individual investor, fairly diversified
Low	Low	Small individual investor with restricted diversification

## Looking at Disney's top stockholders in 2003 (again)

<HELP> for explanation. dgp Equity HDS  
 Enter #<GD> to select aggregate portfolio and see detailed information

001189650224-000		HOLDINGS SEARCH		CUSIP 25468710	
DIS	US	DISNEY (WALT) CO		Page 1 / 100	
Holder name	Portfolio Name	Source	Held	Outstd	Percent Latest Filing Change Date
1BARCLAYS GLOBAL	BARCLAYS BANK PLC	13F	83,630M	4.095	1,750M 09/02
* 2CITIGROUP INC	CITIGROUP INCORPORAT	13F	62,857M	3.078	4,811M 09/02
* 3FIDELITY MANAGEM	FIDELITY MANAGEMENT	13F	56,125M	2.748	5,992M 09/02
4STATE STREET	STATE STREET CORPORA	13F	54,635M	2.675	2,239M 09/02
* 5SOUTHEASTRN ASST	SOUTHEASTERN ASSET M	13F	47,333M	2.318	14,604M 09/02
6ST FARM MU AUTO	STATE FARM MUTUAL AU	13F	41,938M	2.054	120,599 09/02
7VANGUARD GROUP	VANGUARD GROUP INC	13F	34,721M	1.700	-83,839 09/02
8MELLON BANK N A	MELLON BANK CORP	13F	32,693M	1.601	957,489 09/02
9PUTNAM INVEST	PUTNAM INVESTMENT MA	13F	28,153M	1.379	-11,468M 09/02
10LORD ABBETT & CO	LORD ABBETT & CO	13F	24,541M	1.202	5,385M 09/02
11MONTAG CALDWELL	MONTAG & CALDWELL IN	13F	24,466M	1.198	-11,373M 09/02
12DEUTSCHE BANK AK	DEUTSCHE BANK AG	13F	23,239M	1.138	-5,002M 09/02
13MORGAN STANLEY	MORGAN STANLEY	13F	19,655M	0.962	3,482M 09/02
14PRICE T ROWE	T ROWE PRICE ASSOCIA	13F	19,133M	0.937	2,925M 09/02
15ROY EDWARD DISNE	n/a	PROXY	17,547M	0.859	-126,710 12/01
16AXA FINANCIAL	ALLIANCE CAPITAL MAN	13F	14,283M	0.699	69,353 09/02
17JP MORGAN CHASE	JP MORGAN CHASE & CO	13F	14,209M	0.695	-462,791 09/02
Sub-totals for current page:			599,159M	29.340	

\* Money market directory info available. Select portfolio, then hit IP<GD>.  
 Australia 61 2 8777 8600 Brazil 5511 3048 4500 Europe 44 20 7339 7500 Germany 49 69 928410  
 Hong Kong 852 2377 6000 Japan 81 3 3281 8900 Singapore 65 212 1800 U.S. 1 212 318 2000 Copyright 2002 Bloomberg L.P.  
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## And the top investors in Deutsche and Aracruz...

<i>Deutsche Bank</i>	<i>Aracruz - Preferred</i>
Allianz (4.81%)	Safra (10.74%)
La Caixa (3.85%)	BNDES (6.34%)
Capital Research (1.35%)	Scudder Kemper (1.03%)
Fidelity (0.50%)	BNP Paribas (0.56%)
Frankfurt Trust (0.43%)	Barclays Global (0.29%)
Aviva (0.37%)	Vanguard Group (0.18%)
Daxex (0.31%)	Banco Itau (0.12%)
Unifonds (0.29%)	Van Eck Associates (0.12%)
Fidelity (0.28%)	Pactual (0.11%)
UBS Funds (0.21%)	Banco Bradesco (0.07%)

## As well as in Tata Chemicals...

Distribution of Shareholding as on March 31, 2007

Category	No. of Shares	Percentage	No. of Shareholders	Percentage
1 - 500	2,25,07,207	10.46	1,75,703	88.20
501 - 1000	96,48,263	4.49	12,926	6.49
1001 - 2000	87,86,211	4.09	6,155	3.09
2001 - 3000	46,01,699	2.14	1,855	0.93
3001 - 4000	27,70,825	1.29	786	0.39
4001 - 5000	24,11,227	1.12	528	0.27
5001 - 10000	57,32,258	2.66	809	0.41
Greater than 10000	15,86,44,961	73.75	442	0.22
<b>Total</b>	<b>21,51,02,651</b>	<b>100.00</b>	<b>199204</b>	<b>100.00</b>

Tata companies and trusts: 31.6%

Institutions & Funds: 34.68%

Foreign Funds: 5.91%

## Analyzing the investor bases...

	Disney	Deutsche Bank	Aracruz	Tata Chemicals
Mutual funds	<b>31%</b>	<b>16%</b>	29%	34%
Other institutional investors	<b>42%</b>	<b>50%</b>	24%	6%
Other companies	0%	8%	2%	<b>32%</b>
Individuals	27%	26%	<b>45%</b>	28%

# The Market Portfolio

- Assuming diversification costs nothing (in terms of transactions costs), and that all assets can be traded, the limit of diversification is to hold a portfolio of every single asset in the economy (in proportion to market value). This portfolio is called the market portfolio.
- Individual investors will adjust for risk, by adjusting their allocations to this market portfolio and a riskless asset (such as a T-Bill)

*Preferred risk level*

*Allocation decision*

No risk

100% in T-Bills

Some risk

50% in T-Bills; 50% in Market Portfolio;

A little more risk

25% in T-Bills; 75% in Market Portfolio

Even more risk

100% in Market Portfolio

A risk hog..

Borrow money; Invest in market portfolio

- Every investor holds some combination of the risk free asset and the market portfolio.

## The Risk of an Individual Asset

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- The risk of any asset is the risk that it adds to the market portfolio. Statistically, this risk can be measured by how much an asset moves with the market (called the covariance)
- Beta is a standardized measure of this covariance, obtained by dividing the covariance of any asset with the market by the variance of the market. It is a measure of the non-diversifiable risk for any asset can be measured by the covariance of its returns with returns on a market index, which is defined to be the asset's beta.
- The required return on an investment will be a linear function of its beta:  
Expected Return = Riskfree Rate + Beta \* (Expected Return on the Market Portfolio - Riskfree Rate)

# Limitations of the CAPM

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1. The model makes unrealistic assumptions
2. The parameters of the model cannot be estimated precisely
  - Definition of a market index
  - Firm may have changed during the 'estimation' period'
3. The model does not work well
  - If the model is right, there should be
    - a linear relationship between returns and betas
    - the only variable that should explain returns is betas
  - The reality is that
    - the relationship between betas and returns is weak
    - Other variables (size, price/book value) seem to explain differences in returns better.

# Alternatives to the CAPM

**Step 1: Defining Risk**

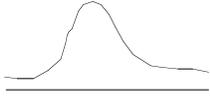
The risk in an investment can be measured by the variance in actual returns around an expected return

*Riskless Investment*



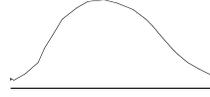
E(R)

*Low Risk Investment*



E(R)

*High Risk Investment*



E(R)

**Step 2: Differentiating between Rewarded and Unrewarded Risk**

<p><i>Risk that is specific to investment (Firm Specific)</i> Can be diversified away in a diversified portfolio</p> <ol style="list-style-type: none"> <li>1. each investment is a small proportion of portfolio</li> <li>2. risk averages out across investments in portfolio</li> </ol> <p><b>The marginal investor is assumed to hold a “diversified” portfolio. Thus, only market risk will be rewarded and priced.</b></p>	<p><i>Risk that affects all investments (Market Risk)</i> Cannot be diversified away since most assets are affected by it.</p>
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**Step 3: Measuring Market Risk**

<b>The CAPM</b>	<b>The APM</b>	<b>Multi-Factor Models</b>	<b>Proxy Models</b>
<p>If there is</p> <ol style="list-style-type: none"> <li>1. no private information</li> <li>2. no transactions cost</li> </ol> <p>the optimal diversified portfolio includes every traded asset. Everyone will hold this <u>market portfolio</u></p> <p><b>Market Risk = Risk added by any investment to the market portfolio:</b></p>	<p>If there are no arbitrage opportunities then the market risk of any asset must be captured by betas relative to factors that affect all investments.</p> <p><b>Market Risk = Risk exposures of any asset to market factors</b></p>	<p>Since market risk affects most or all investments, it must come from macro economic factors.</p> <p><b>Market Risk = Risk exposures of any asset to macro economic factors.</b></p>	<p>In an efficient market, differences in returns across long periods must be due to market risk differences. Looking for variables correlated with returns should then give us proxies for this risk.</p> <p><b>Market Risk = Captured by the Proxy Variable(s)</b></p>
<p>Beta of asset relative to Market portfolio (from a regression)</p>	<p>Betas of asset relative to unspecified market factors (from a factor analysis)</p>	<p>Betas of assets relative to specified macro economic factors (from a regression)</p>	<p>Equation relating returns to proxy variables (from a regression)</p>

## Why the CAPM persists...

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- The CAPM, notwithstanding its many critics and limitations, has survived as the default model for risk in equity valuation and corporate finance. The alternative models that have been presented as better models (APM, Multifactor model..) have made inroads in performance evaluation but not in prospective analysis because:
  - The alternative models (which are richer) do a much better job than the CAPM in explaining past return, but their effectiveness drops off when it comes to estimating expected future returns (because the models tend to shift and change).
  - The alternative models are more complicated and require more information than the CAPM.
  - For most companies, the expected returns you get with the the alternative models is not different enough to be worth the extra trouble of estimating four additional betas.

## ⌚ Application Test: Who is the marginal investor in your firm?

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You can get information on insider and institutional holdings in your firm from:

<http://finance.yahoo.com/>

Enter your company's symbol and choose profile.

- Looking at the breakdown of stockholders in your firm, consider whether the marginal investor is
  - a) An institutional investor
  - b) An individual investor
  - c) An insider

## Inputs required to use the CAPM -

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- 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

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- 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

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- 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

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- 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.
  - If your cash flows are in Euros, your riskfree rate should be a Euro riskfree rate.
- The conventional practice of estimating riskfree rates is to use the government bond rate, with the government being the one that is in control of issuing that currency. In US dollars, this has translated into using the US treasury rate as the riskfree rate. In September 2004, for instance, the ten-year US treasury bond rate was 4%.

## What if there is no default-free entity?

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- The conventional practice of using the government bond rate as the riskfree rate works only if the government is perceived to have no default risk.
- If the government is perceived to have default risk, the government bond rate will have a default spread component in it and not be riskfree. There are three choices we have, when this is the case.
  - Adjust the local currency government borrowing rate for default risk to get a riskless local currency rate. In September 2007, the Indian government rupee bond rate was 7.91%. India's local currency rating from Moody's was Baa2 and the typical default spread for a Baa2 rated country bond was 1.15%.  
Riskfree rate in rupees =  $7.91\% - 1.15\% = 6.76\%$
  - Do the analysis in an alternate currency, where getting the riskfree rate is easier. With Aracruz in 2003, we were unable to even get a long term Brazilian real denominated bond rate, and chose to do the analysis in US dollars. The riskfree rate is then the US treasury bond rate.
  - Do your analysis in real terms, in which case the riskfree rate has to be a real riskfree rate. The inflation-indexed treasury rate is a measure of a real riskfree rate.

## Measurement of the risk premium

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- 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?

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- 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

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- If this were the entire market, 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 wealth that each investor brings to the market. Thus, Warren Buffett'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..

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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

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- 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

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- Surveying all investors in a market place is impractical.
- However, you can survey a few individuals and use these results. In practice, this translates into surveys of the following:
  - Mutual fund managers about equity returns in the future
  - A random sample of investors about what they think stocks will do in the future
  - CFOs about a reasonable equity risk premium
  - Academics about a reasonable equity risk premium
- The limitations of this approach are:
  - there are no constraints on reasonability (the survey could produce negative risk premiums or risk premiums of 50%)
  - The survey results are extremely volatile
  - they tend to be short term; even the longest surveys do not go beyond one year.

# The Historical Premium Approach

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- 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
  - Defines a time period for the estimation (1928-Present, 1962-Present....)
  - Calculates average returns on a stock index during the period
  - Calculates average returns on a riskless security over the period
  - Calculates the difference between the two averages 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	
	Stocks - T. Bills	Stocks - T. Bonds	Stocks - T. Bills	Stocks - T. Bonds
1928-2008	7.30%	5.65%	5.32%	3.88%
	(2.29%)	(2.40%)		
1959-2008	5.14%	3.33%	3.77%	2.29%
	(2.39%)	(2.63%)		
1999-2008	-2.53%	-6.26%	-4.53%	-7.96%
	(6.36%)	(8.85%)		

*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?

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- 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 reflect this data problem 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

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- 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 10.83% for Brazil, if we use 4.82% as the premium for the US.

## Beyond the default spread

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- While default risk premiums and equity risk premiums are highly correlated, one would expect equity spreads to be higher than debt spreads.
- Risk Premium for Brazil in 2004 (for Aracruz)
  - Standard Deviation in Bovespa (Equity) = 36%
  - Standard Deviation in Brazil \$ denominated Bond = 28.2%
  - Default spread on \$ denominated Bond = 6.01%
  - Country Risk Premium (CRP) for Brazil = 6.01% (36%/28.2%) = 7.67%
  - Total Risk Premium for Brazil = US risk premium (in '03) + CRP for Brazil  
= 4.82% + 7.67% = 12.49%
- Risk Premium for India in September 2007 (for Tata Chemicals)
  - Standard Deviation in Sensex (Equity) = 24%
  - Standard Deviation in Indian government bond = 16%
  - Default spread based upon rating = 1.15%
  - Country Risk Premium for India = 1.15% (24%/16%) = 1.72%
  - Total Risk Premium for India = US risk premium (in '06) + CRP for Brazil  
= 4.91% + 1.72% = 6.63%

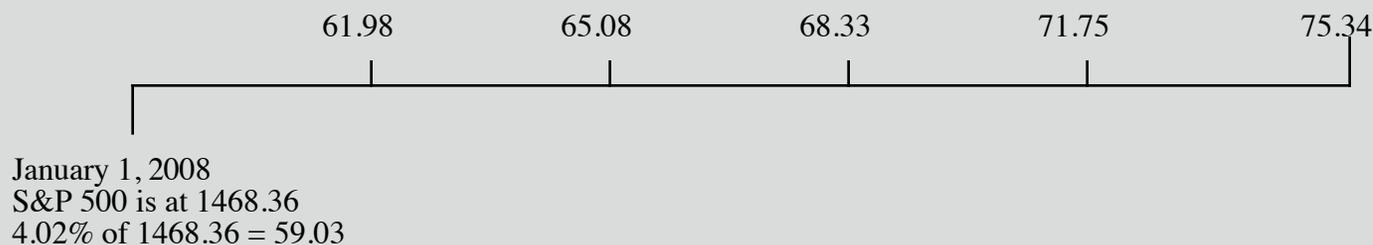
## An alternate view of ERP: Watch what I pay, not what I say..

Year	Dividend Yield	Buybacks/Index	Yield
2001	1.37%	1.25%	2.62%
2002	1.81%	1.58%	3.39%
2003	1.61%	1.23%	2.84%
2004	1.57%	1.78%	3.35%
2005	1.79%	3.11%	4.90%
2006	1.77%	3.38%	5.15%
2007	1.89%	4.00%	5.89%
Average yield between 2001-2007 =			4.02%

Between 2001 and 2007 dividends and stock buybacks averaged 4.02% of the index each year.

Analysts expect earnings to grow 5% a year for the next 5 years. We will assume that dividends & buybacks will keep pace..  
Last year's cashflow (59.03) growing at 5% a year

After year 5, we will assume that earnings on the index will grow at 4.02%, the same rate as the entire economy (= riskfree rate).



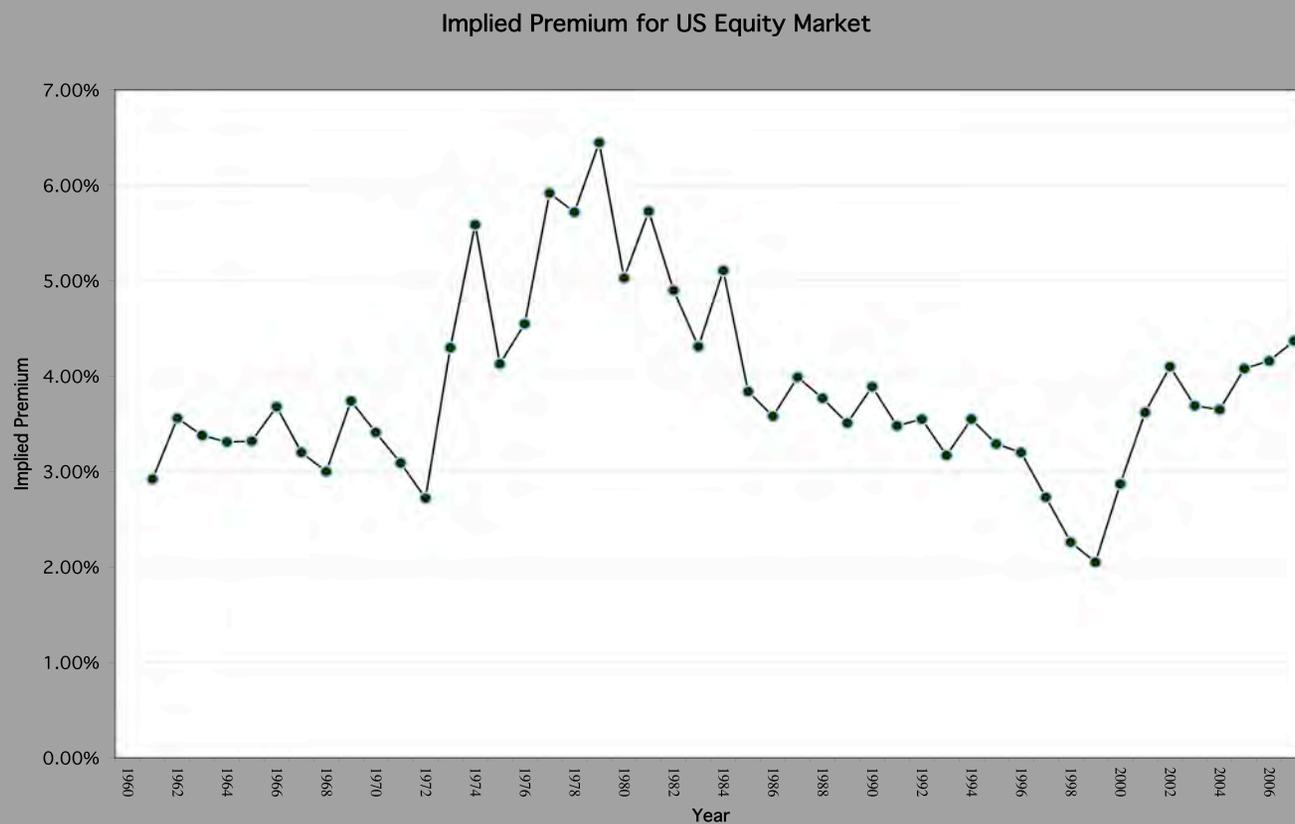
## Solving for the implied premium...

- If we know what investors paid for equities at the beginning of 2007 and we can estimate the expected cash flows from equities, we can solve for the rate of return that they expect to make (IRR):

$$1468.36 = \frac{61.98}{(1+r)} + \frac{65.08}{(1+r)^2} + \frac{68.33}{(1+r)^3} + \frac{71.75}{(1+r)^4} + \frac{75.34}{(1+r)^5} + \frac{75.35(1.0402)}{(r - .0402)(1+r)^5}$$

- Expected Return on Stocks = 8.39%
- Implied Equity Risk Premium = Expected Return on Stocks - T.Bond Rate  
= 8.39% - 4.02% = 4.37%

# Implied Premiums in the US: 1960-2007



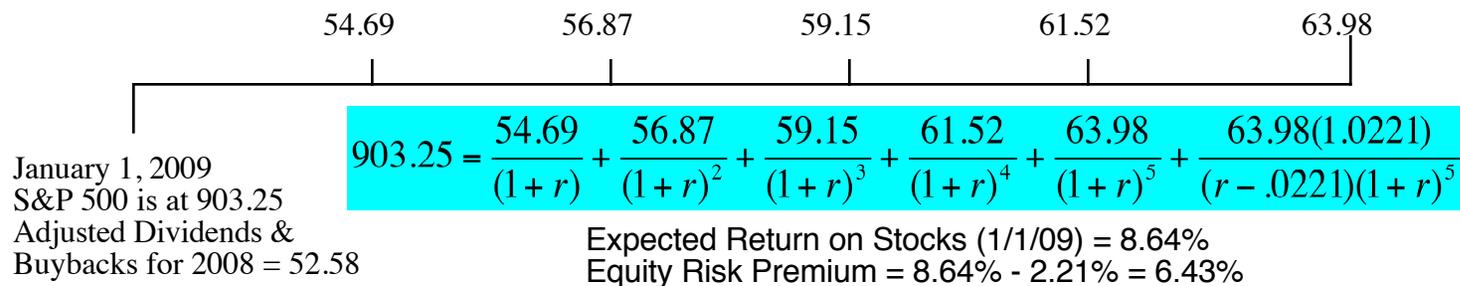
## A year that made a difference.. The implied premium in January 2009

Year	Market value of index	Dividends	Buybacks	Cash to equity	Dividend yield	Buyback yield	Total yield
2001	1148.09	15.74	14.34	30.08	1.37%	1.25%	2.62%
2002	879.82	15.96	13.87	29.83	1.81%	1.58%	3.39%
2003	1111.91	17.88	13.70	31.58	1.61%	1.23%	2.84%
2004	1211.92	19.01	21.59	40.60	1.57%	1.78%	3.35%
2005	1248.29	22.34	38.82	61.17	1.79%	3.11%	4.90%
2006	1418.30	25.04	48.12	73.16	1.77%	3.39%	5.16%
2007	1468.36	28.14	67.22	95.36	1.92%	4.58%	6.49%
2008	903.25	28.47	40.25	68.72	3.15%	4.61%	7.77%
Normalized	903.25	28.47	24.11	52.584	3.15%	2.67%	5.82%

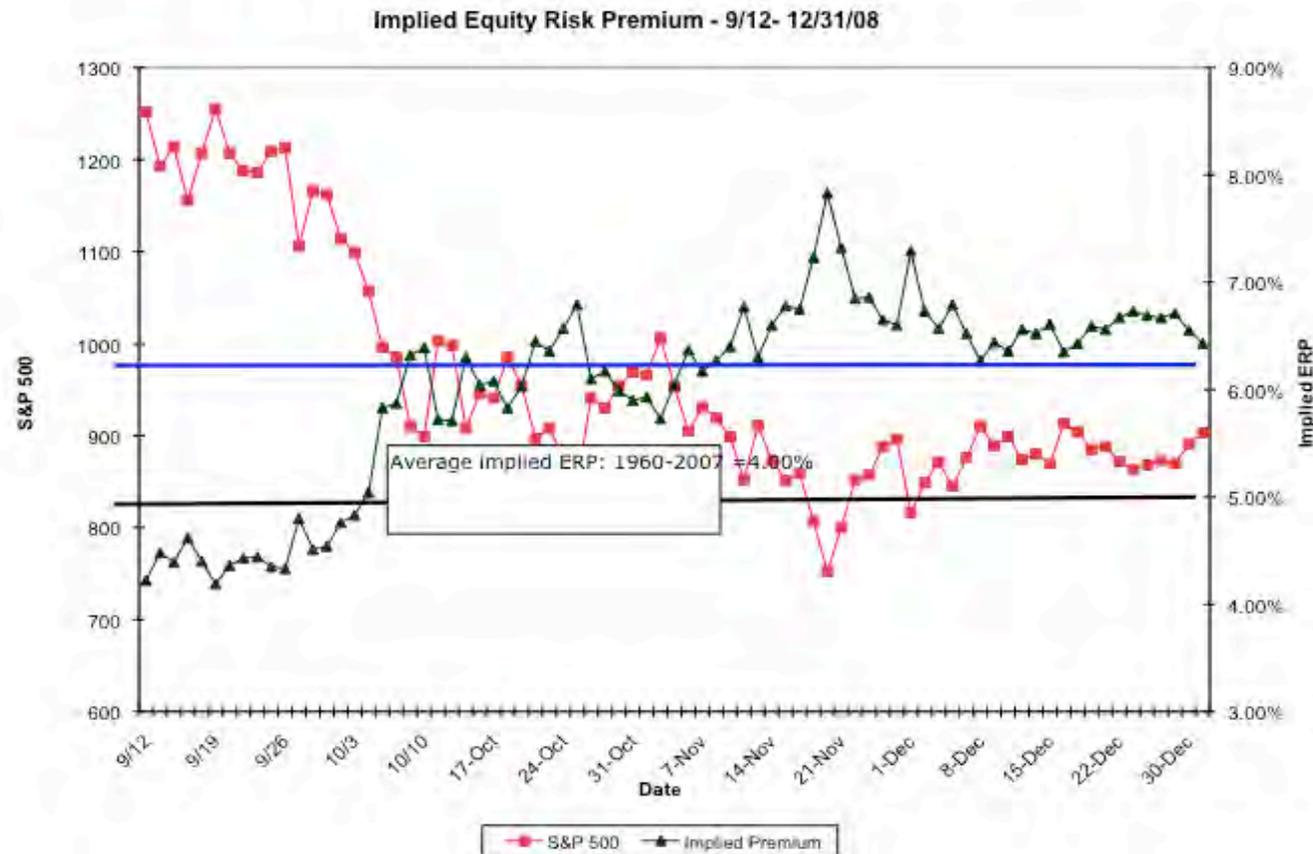
*In 2008, the actual cash returned to stockholders was 68.72. However, there was a 41% dropoff in buybacks in Q4. We reduced the total buybacks for the year by that amount.*

Analysts expect earnings to grow 4% a year for the next 5 years. We will assume that dividends & buybacks will keep pace..  
Last year's cashflow (52.58) growing at 4% a year

After year 5, we will assume that earnings on the index will grow at 2.21%, the same rate as the entire economy (= riskfree rate).



# The Anatomy of a Crisis: Implied ERP from September 12, 2008 to January 1, 2009



## Implied premium for the Sensex (September 2007)

### ■ Inputs for the computation

- Sensex on 9/5/07 = 15446
- Dividend yield on index = 3.05%
- Expected growth rate - next 5 years = 14%
- Growth rate beyond year 5 = 6.76% (set equal to riskfree rate)

### ■ Solving for the expected return:

$$15446 = \frac{537.06}{(1+r)} + \frac{612.25}{(1+r)^2} + \frac{697.86}{(1+r)^3} + \frac{795.67}{(1+r)^4} + \frac{907.07}{(1+r)^5} + \frac{907.07(1.0676)}{(r - .0676)(1+r)^5}$$

- Expected return on stocks = 11.18%
- Implied equity risk premium for India = 11.18% - 6.76% = 4.42%



## Application Test: Estimating a Market Risk Premium

---

- Based upon our discussion of historical risk premiums so far, the risk premium looking forward for the US should be:
  - a) About 3.9%, which is the geometric average premium since 1928, for stocks over treasury bonds.
  - b) About 6.5%, which is the implied premium in the US market at the start of the year.
- What would you use for another developed market (say Germany or France)?
  - a) The historical risk premium for that market
  - b) The risk premium for the United States
- What would you use for an emerging market?
  - a) The historical risk premium for that market
  - b) The risk premium for the United States
  - c) The risk premium for the United States + Country Risk premium

## 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.

$$\begin{array}{llll}
 R_j = R_f + b (R_m - R_f) & & & \\
 = R_f (1-b) + b R_m & \dots\dots\dots & \text{Capital Asset Pricing Model} & \\
 R_j = a + b R_m & \dots\dots\dots & \text{Regression Equation} & 
 \end{array}$$

- If
  - a > R<sub>f</sub> (1-b) .... Stock did better than expected during regression period
  - a = R<sub>f</sub> (1-b) .... Stock did as well as expected during regression period
  - a < R<sub>f</sub> (1-b) .... Stock did worse than expected during regression period
- The difference between the intercept and R<sub>f</sub> (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

---

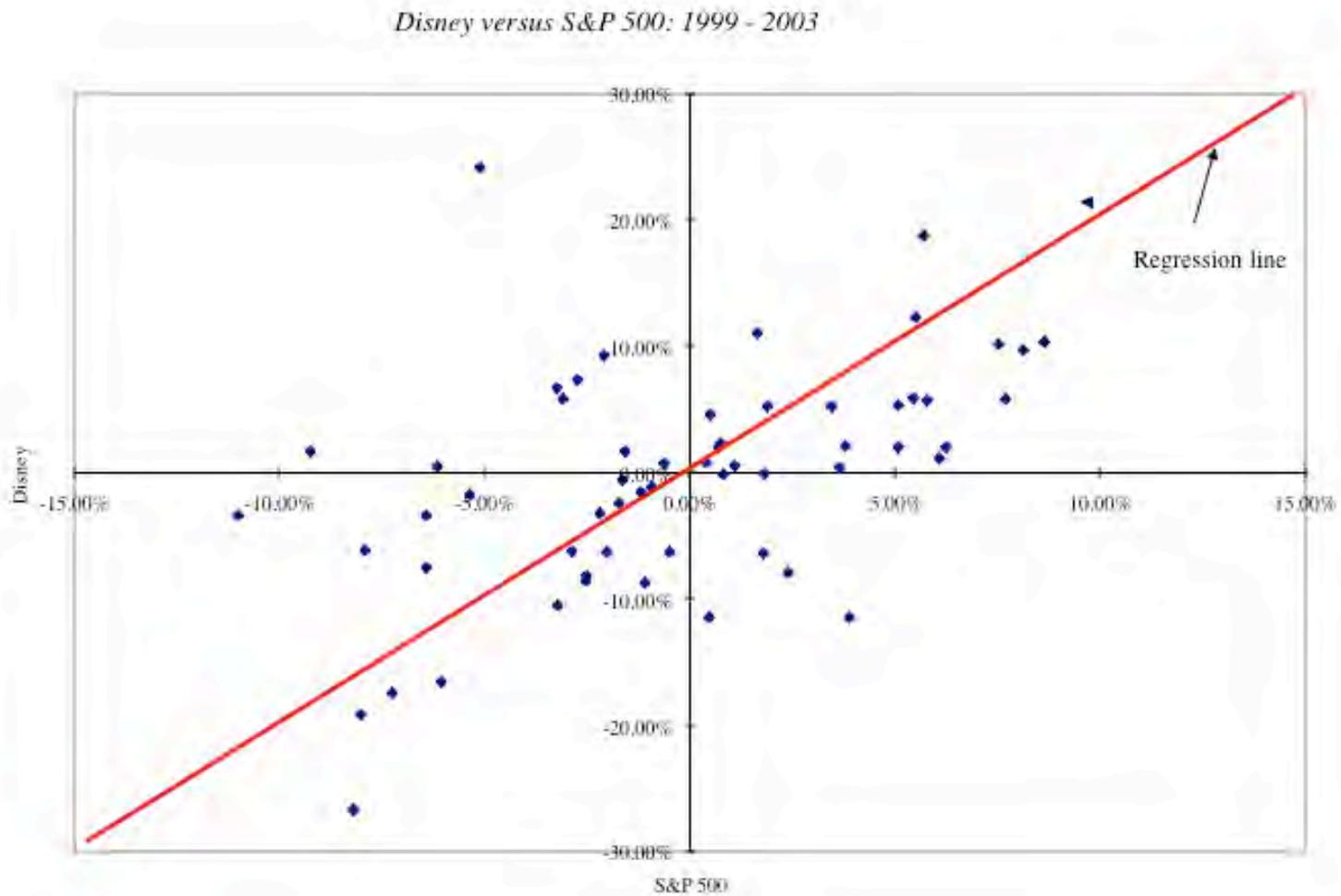
- Decide on an estimation period
  - Services use periods ranging from 2 to 5 years for the regression
  - Longer estimation period provides more data, but firms change.
  - Shorter periods can be affected more easily by significant firm-specific event that occurred during the period (Example: ITT for 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
  - $\text{Return} = (\text{Price}_{\text{End}} - \text{Price}_{\text{Beginning}} + \text{Dividends}_{\text{Period}}) / \text{Price}_{\text{Beginning}}$
  - 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:

$$\text{Returns}_{\text{Disney}} = 0.0467\% + 1.01 \text{Returns}_{\text{S \& P 500}} \quad (\text{R squared} = 29\%)$$

(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?

---

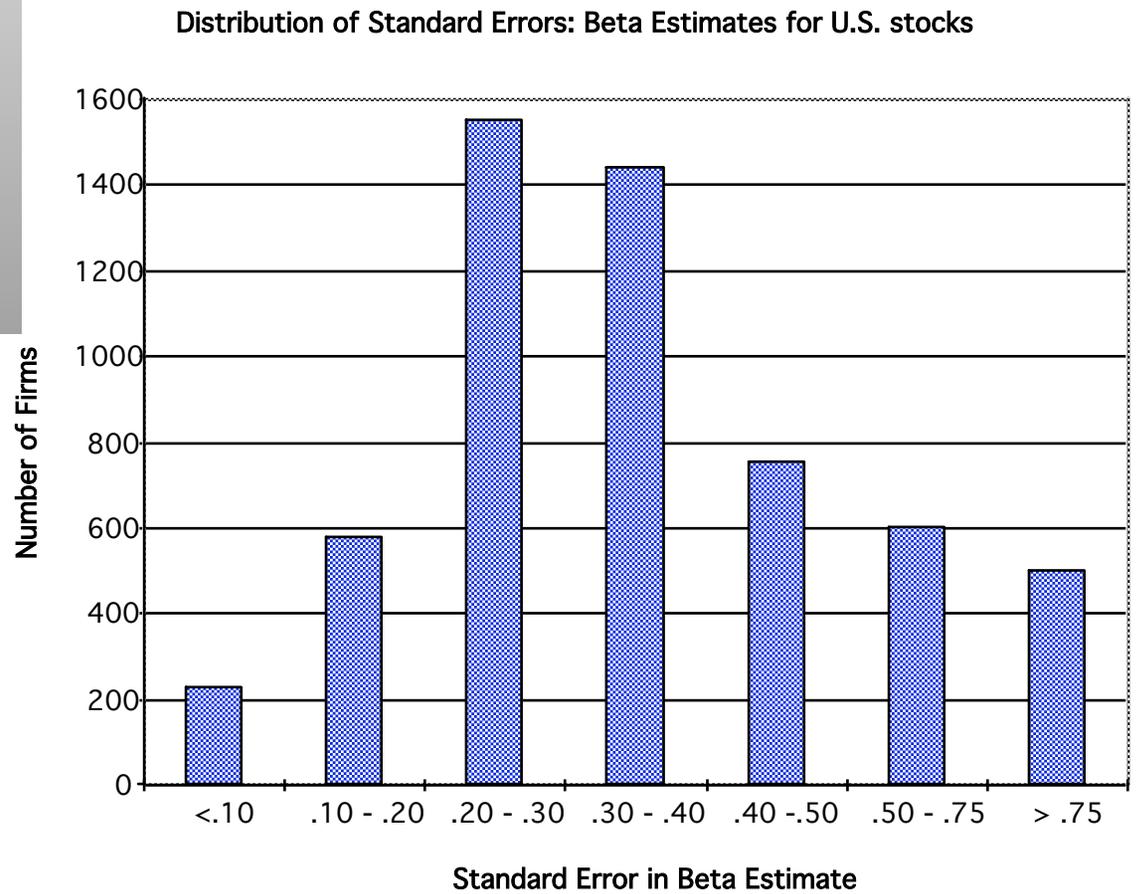
- Disney has a positive Jensen's alpha of 0.60% a year between 1999 and 2003. This can be viewed as a sign that management in the firm did a good job, managing the firm during the period.
  - a) True
  - b) False

## 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.

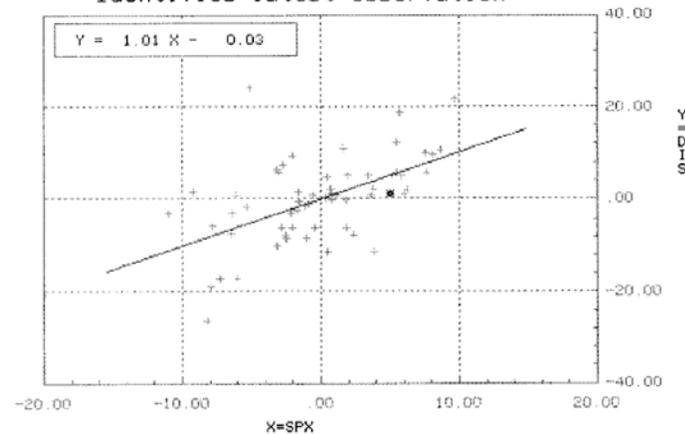
Relative Index SPX

S&P 500 INDEX

\*Identifies latest observation

Period  Monthly  
 Range 1/29/99 To 12/31/03  
 Market  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 = 1.01
  - Riskfree Rate = 4.00% (U.S. ten-year T.Bond rate in September 2004)
  - 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?

$$\text{Intercept} - (\text{Riskfree Rate}/n) (1 - \text{Beta}) = \text{Jensen's Alpha}$$

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?

$$\text{Riskless Rate} + \text{Beta} * \text{Risk Premium}$$

## A Quick Test

---

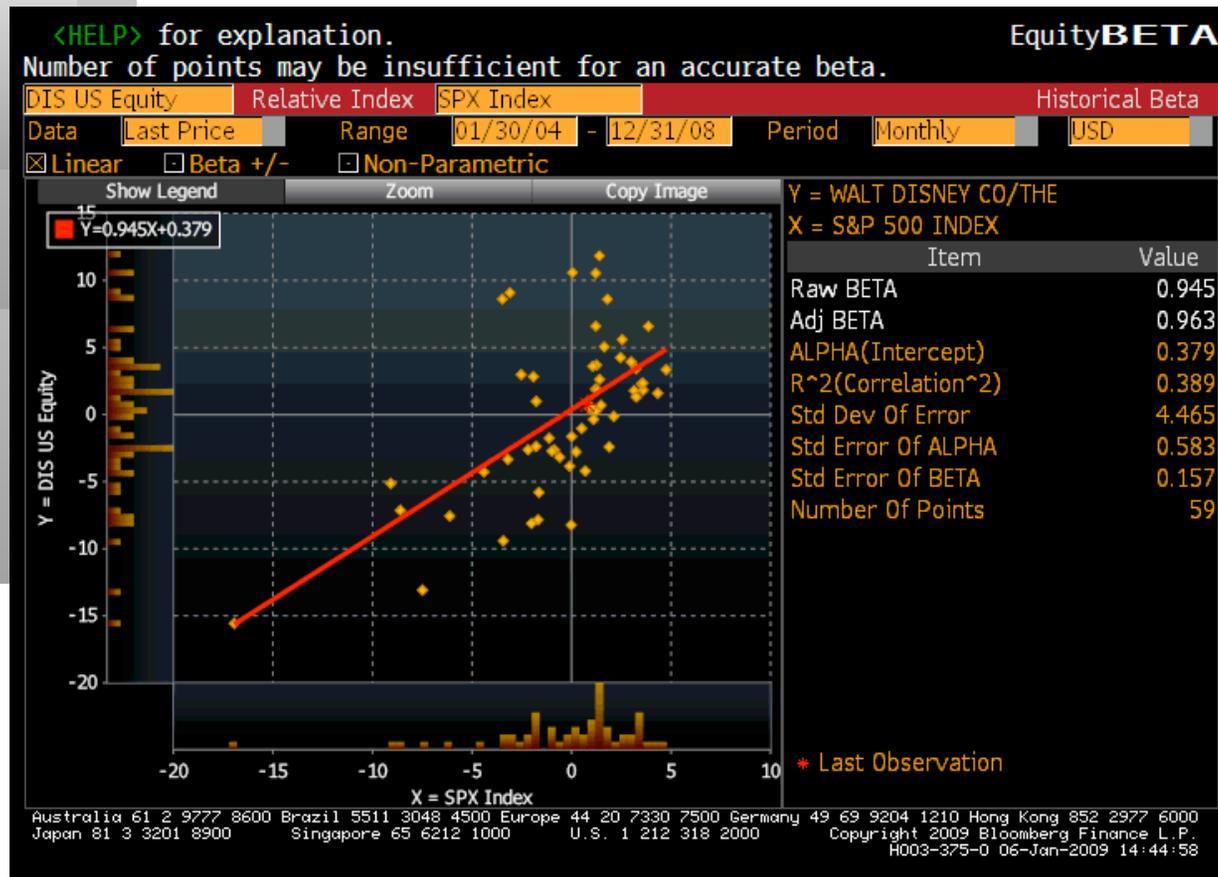
You are advising a very risky software firm on the right cost of equity to use in project analysis. You estimate a beta of 3.0 for the firm and come up with a cost of equity of 18.46%. The CFO of the firm is concerned about the high cost of equity and wants to know whether there is anything he can do 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: Updated to 2004-2008



Jensen's alpha = 0.38% -  
0.25% (1 - 0.945) = 0.37%  
Annualized = (1+.0037)^12-1  
= 4.48%

Jensen's  $\alpha$

$$= -0.22\% - 6.00\%/52 (1-0.88) = -0.23\%$$

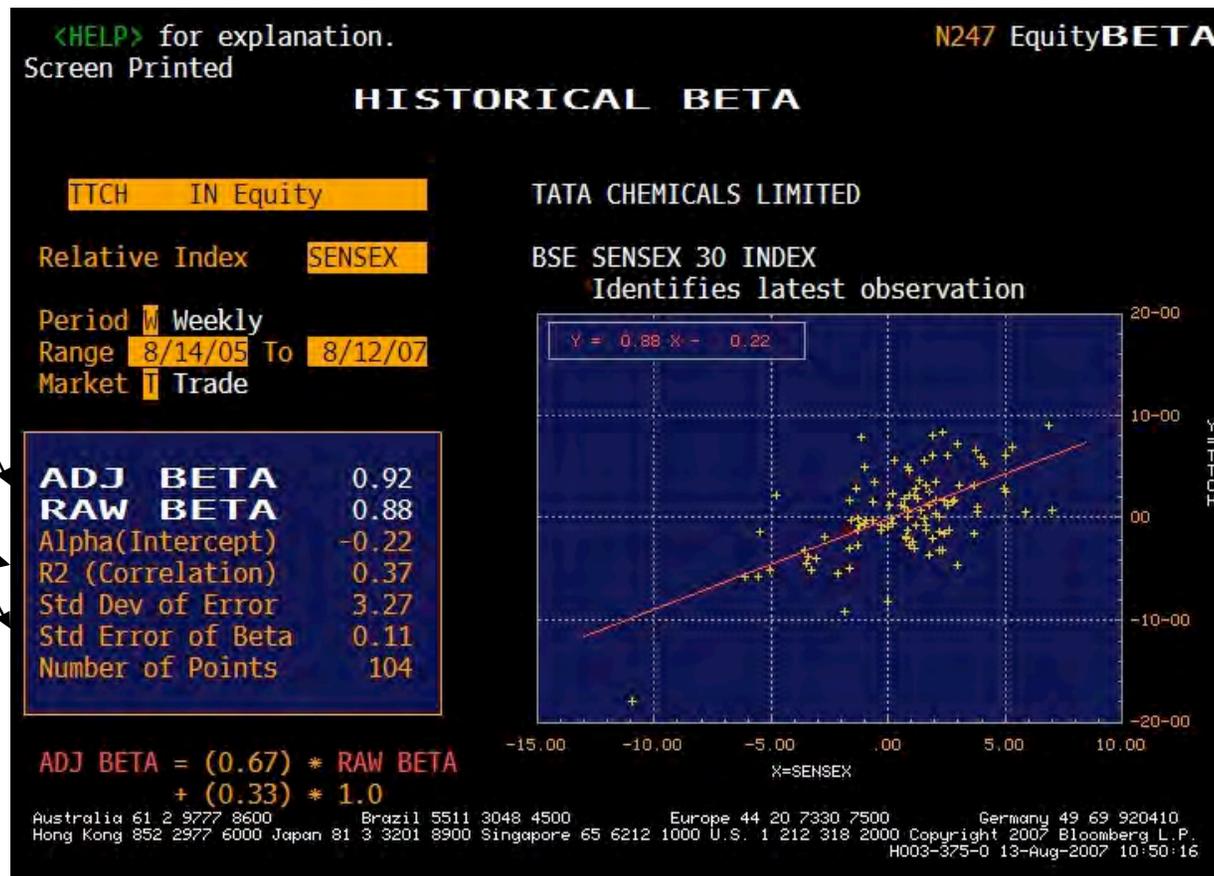
$$\text{Annualized} = (1-.0023)^{52}-1 = -11.46\%$$

Expected Return

$$= \text{Riskfree Rate} + \text{Beta} * \text{Risk premium}$$

$$= 6.76\% + 0.88 (4.91\% + 1.72\%) = 12.59\%$$

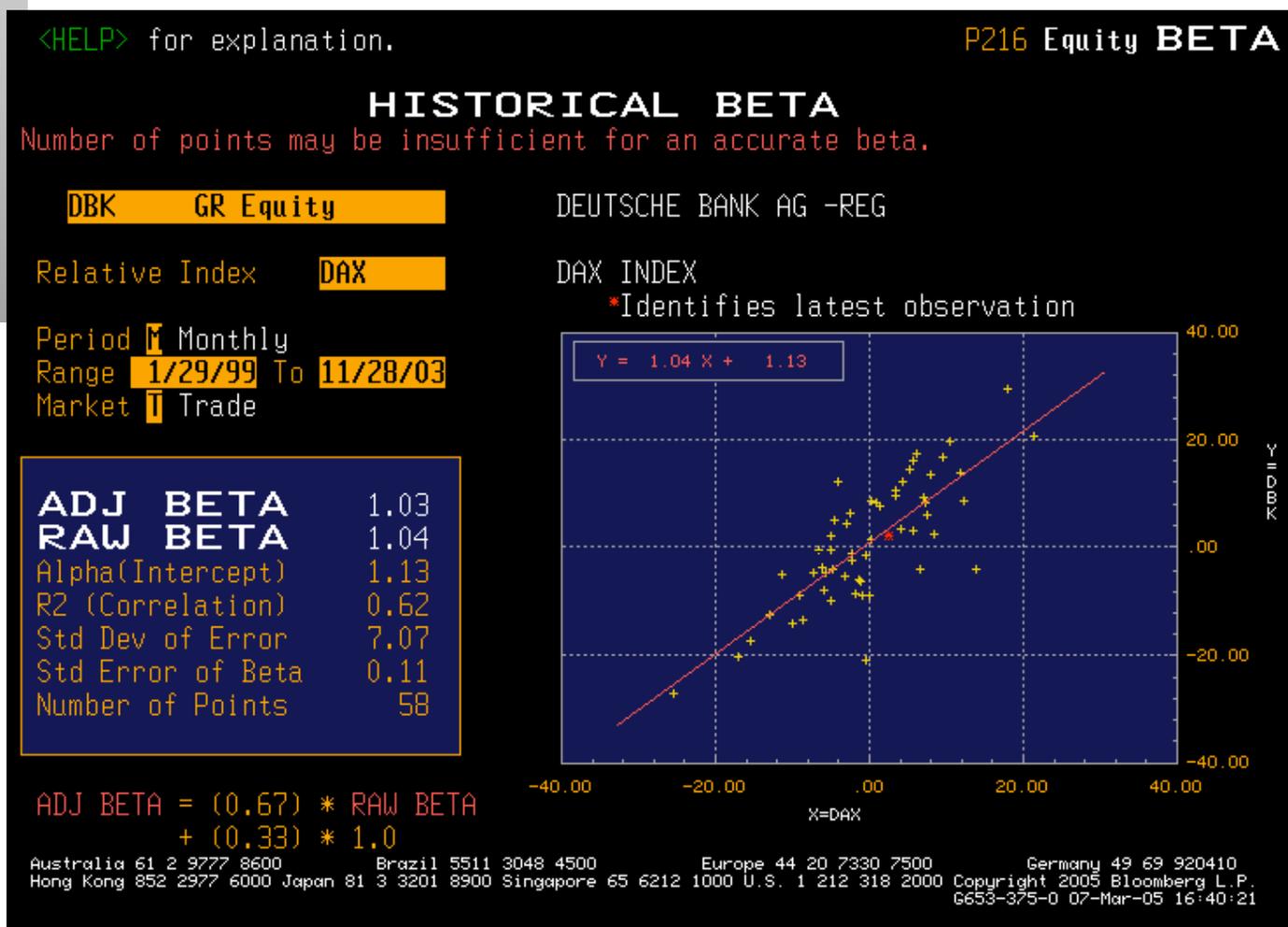
## Regression Diagnostics for Tata Chemicals



Beta = 0.88  
67% range  
0.77 - 0.99

37% market risk  
63% firm specific

# Beta Estimation and Index Choice: Deutsche Bank



## A Few Questions

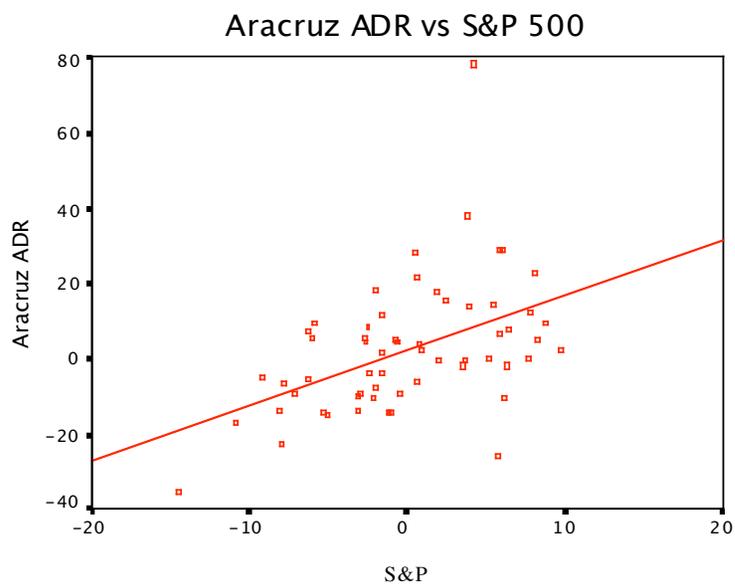
---

- 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 1.04.
  - 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?

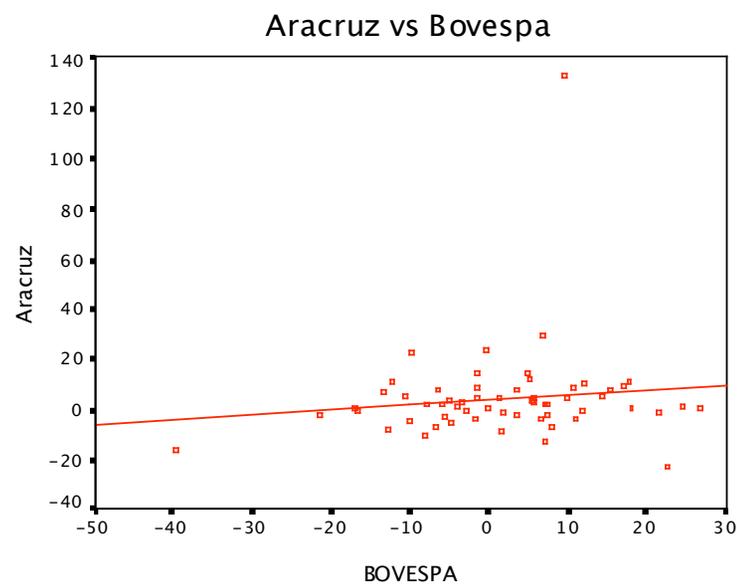
## Deutsche Bank: Alternate views of Risk

	<i>DAX</i>	<i>FTSE Euro 300</i>	<i>MSCI</i>
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 Squa red	62%	52%	30%

# Aracruz's Beta?



$$Aracruz\ ADR = 2.80\% + 1.00\ S\&P$$



$$Aracruz = 2.62\% + 0.22\ Bovespa$$

# Beta: Exploring Fundamentals

Beta > 1	Real Networks: 3.24
	Qwest Communications: 2.60
Beta = 1	Microsoft: 1.25
	General Electric: 1.10
Beta < 1	<i>Enron: 0.95</i>
	Philip Morris: 0.65
	Exxon Mobil: 0.40
Beta = 0	Harmony Gold Mining: - 0.10

## 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:

- a) Emerging market telecom companies should have higher betas than developed market telecom companies.
- b) Developed market telecom companies should have higher betas than emerging market telecom companies
- c) The two groups of companies should have similar betas

## 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<sub>1996-03</sub> =  $4.42\% / 11.73\% = 0.38$   
Looks like Disney's operating leverage has decreased since 1996.

## 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

$\beta_L$  = Levered or Equity Beta

$\beta_u$  = Unlevered or Asset Beta

t = 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 (and not just the equity 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 is a better estimate than the top down beta for the following reasons
  - The standard error of the beta estimate will be much lower
  - The betas can reflect the current (and even expected future) mix of businesses that the firm is in rather than the historical mix

## Disney's business breakdown

$$\frac{\text{Unlevered Beta}}{(1 - \text{Cash/ Firm Value})}$$



<i>Business</i>	<i>Comparable firms</i>	<i>Number of firms</i>	<i>Average levered beta</i>	<i>Median D/E</i>	<i>Unlevered beta</i>	<i>Cash/Firm Value</i>	<i>Unlevered beta corrected for cash</i>
Media Networks	Radio 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 Entertainment	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

$$EV/Sales = \frac{(\text{Market Value of Equity} + \text{Debt} - \text{Cash})}{\text{Sales}}$$

Estimated by looking at comparable firms



<i>Business</i>	<i>Disney's Revenues</i>	<i>EV/Sales</i>	<i>Estimated Value</i>	<i>Firm Value Proportion</i>	<i>Unlevered beta</i>
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

Riskfree Rate = 4%

Risk Premium = 4.82%



<i>Business</i>	<i>Unlevered Beta</i>	<i>D/E Ratio</i>	<i>Levered Beta</i>	<i>Cost of Equity</i>
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

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- 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

<i>Comparables</i>	<i>No</i>	<i>Avg <math>\beta</math></i>	<i>D/E</i>	<i><math>\beta_{Unlev}</math></i>	<i>Cash/Val</i>	<i><math>\beta_{Correct}</math></i>
Emerging Markets	111	0.6895	38.33%	0.5469	6.58%	0.585
US	34	0.7927	83.57%	0.5137	2.09%	0.525
Global	288	0.6333	38.88%	0.5024	6.54%	0.538

- 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 as a company =  $0.5440 (1 + (1 - .34) (.4459)) = 0.7040$
- 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 1928-2003 time period) and the Brazil country risk premium of 7.67% (estimated earlier in the package)

- U.S. \$ Cost of Equity

$$\begin{aligned}\text{Cost of Equity} &= 10\text{-yr T.Bond rate} + \text{Beta} * \text{Risk Premium} \\ &= 4\% + 0.7040 (12.49\%) = 12.79\%\end{aligned}$$

- Real Cost of Equity

$$\begin{aligned}\text{Cost of Equity} &= 10\text{-yr Inflation-indexed T.Bond rate} + \text{Beta} * \text{Risk Premium} \\ &= 2\% + 0.7040 (12.49\%) = 10.79\%\end{aligned}$$

- Nominal BR Cost of Equity

$$\begin{aligned}\text{Cost of Equity} &= (1 + \$ \text{ Cost of Equity}) \frac{(1 + \text{Inflation Rate}_{\text{Brazil}})}{(1 + \text{Inflation Rate}_{\text{US}})} - 1 \\ &= 1.1279 (1.08/1.02) - 1 = .1943 \text{ or } 19.43\%\end{aligned}$$

## The bottom up beta for Tata Chemicals

- Tata Chemicals is in two businesses: chemicals and fertilizers, with the following breakdown of operating income and betas:

Business	Revenues	EV/Sales	Value	Weight	Unlevered Beta
Chemicals(93)	\$2,117	1.52	\$3,217.54	43.35%	0.88
Fertilizers(94)	\$1,836	2.29	\$4,204.12	56.65%	0.96
<i>Company</i>			<i>\$7,421.66</i>		<i>0.93</i>

(The unlevered betas across publicly traded companies in emerging markets in each of the businesses were used as estimates.)

- Using the current market debt to equity ratio for the company of 19.17%, we estimated a levered beta of 1.05 for the firm.

$$\text{Levered beta} = 0.93 (1 + (1 - .3366) (.1917)) = 1.05$$

## 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

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- 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

<i>Firm</i>	<i>Beta</i>	<i>Debt</i>	<i>Equity</i>	<i>Cash</i>
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

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- 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.

$$\text{Levered beta for Bookscape} = 0.7346 (1 + (1 - .40) (.2033)) = 0.82$$

- Using a riskfree rate of 4% (US treasury bond rate) and a historical risk premium of 4.82%:

$$\text{Cost of Equity} = 4\% + 0.82 (4.82\%) = 7.95\%$$

## 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

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

Bookscape Earnings 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.
- The cost of equity based upon the accounting beta is:  
Cost of equity =  $4\% + 0.73 (4.82\%) = 7.52\%$

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

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- Beta measures the risk added on to a diversified portfolio. The owners of most private firms are not diversified. 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

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- 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

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- 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?

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- 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

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- 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

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

$$\text{Interest Coverage Ratio} = \text{EBIT} / \text{Interest Expenses}$$

- In 2003, Bookscape had operating income of \$ 2 million and interest expenses of 500,000. The resulting interest coverage ratio is 4.00.
  - Interest coverage ratio =  $2,000,000/500,000 = 4.00$
- In 2003, Disney had operating income of \$2,805 million and modified interest expenses of \$ 758 million:
  - Interest coverage ratio =  $2805/758 = 3.70$
- In 2003, Aracruz had operating income of 887 million BR and interest expenses of 339 million BR
  - Interest coverage ratio =  $887/339 = 2.62$
- In 2007, Tata Chemicals had operating income of 5,855 million INR and interest expenses of 470 million INR

$$\text{Interest Coverage Ratio} = 5855/470 = 12.46$$

# 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% ← Tata Chemicals
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% ← Bookscape
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%

# Interest Coverage Ratios, Ratings and Default Spreads: Large Companies

Interest Coverage Ratio	Rating	Default Spread	
>8.5	AAA	0.35%	
6.50-8.50	AA	0.50%	
5.5-6.5	A+	0.70%	
4.25-5.5	A	0.85%	
3-4.25	A-	1.00%	
2.5-3	BBB	1.50%	← Disney
2.25-2.5	BB+	2.00%	
2-2.25	BB	2.50%	← Aracruz
1.75-2	B+	3.25%	
1.5-1.75	B	4.00%	
1.25-1.5	B-	6.00%	
0.8-1.25	CCC	8.00%	
0.65-0.80	CC	10.00%	
0.2-0.65	C	12.00%	
<0.2	D	20.00%	

## Synthetic versus Actual Ratings: Disney and Aracruz

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- Disney and Aracruz are rated companies and their actual ratings are different from the synthetic rating.
- Disney's synthetic rating is A-, whereas its actual rating is BBB+. The difference can be attributed to any of the following:
  - Synthetic ratings reflect only the interest coverage ratio whereas actual ratings incorporate all of the other ratios and qualitative factors
  - Synthetic ratings do not allow for sector-wide biases in ratings
  - Synthetic rating was based on 2003 operating income whereas actual rating reflects normalized earnings
- Aracruz's synthetic rating is BBB, but its actual rating for dollar debt is B+. The biggest factor behind the difference is the presence of country risk. In fact, Aracruz has a local currency rating of BBB-, closer to the synthetic rating.

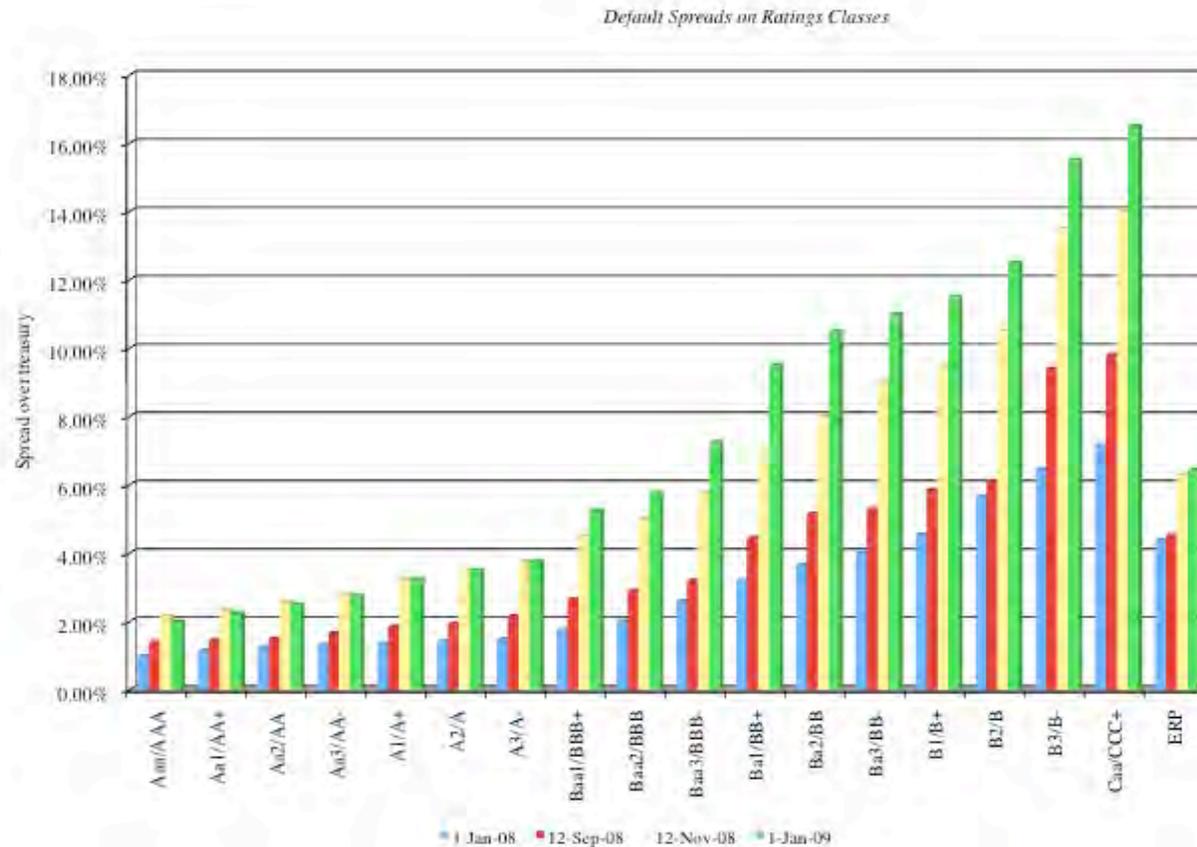
## Estimating Cost of Debt

- For Bookscope, we will use the synthetic rating to estimate the cost of debt:
  - 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%
- For the three publicly traded firms that are rated in our sample, we will use the actual bond ratings to estimate the costs of debt:

	Rating	Riskfree Rate	Default Spread	Cosrt of debt	Tax Rate	After-tax Cost
Disney	BBB+	4% (\$)	1.25%	5.25%	37.30%	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%

- Tata Chemicals (2007)
  - Synthetic Rating = AA
  - Pre-tax cost of debt = Riskfree Rate + Country Spread + Company spread  
 $= 6.76\% + 1.15\% + 0.50\% = 8.41\%$
  - After-tax cost of debt = Pre-tax cost of debt (1- tax rate) = 8.41% (1-.3366) = 5.58%

# Default looms larger.. And spreads widen.. The effect of the market crisis – January 2009



## Application Test: Estimating a Cost of Debt

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- 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 tables from prior pages)
  - A pre-tax cost of debt for your firm
  - An after-tax cost of debt for your firm

## Costs of Hybrids

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- 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:
  - $k_{ps} = \text{Preferred Dividend per share} / \text{Market Price per preferred share}$
- 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

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- 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.

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

PV of Annuity,  $r=5.25\%$ ,  $n=11.53$  yrs

## 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  
= MV of Interest bearing Debt + PV of Operating Leases  
= \$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%

$$55.101(55.101+14.668)$$


## What if?

### Updating default spreads and ERP

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- Earlier, we noted that equity risk premiums and default spreads increased dramatically between September 2008 and December 2008. Holding the riskfree rate, debt weight, tax rate, rating and beta fixed, estimate the cost of capital for Disney using an equity risk premium of 6.5% (Jan 2009) and a default spread of 5% (for BBB rated bonds).

New cost of equity =  $4\% + 1.25 (6.5\%) =$

New after-tax cost of debt =  $(4\% + 5\%) (1 - .373) =$

Cost of capital =  $( \quad ) (.79) + ( \quad ) (.21) =$

- One factor that has moved in your favor is that the riskfree rate has dropped to 2.2%. How would that using that lower riskfree rate change your cost of capital?

## Divisional Costs of Capital

### Disney

	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%
<b>Disney</b>	<b>10.00%</b>	<b>3.29%</b>	<b>78.98%</b>	<b>21.02%</b>	<b>8.59%</b>

### Tata Chemicals

	Cost of equity	After-tax cost of debt	E/(D+E)	D/(D+E)	Cost of capital
Chemical division	13.32%	5.58%	84.00%	16.00%	12.08%
Fertilizer division	13.92%	5.58%	84.00%	16.00%	12.59%
<b>Tata Chemicals</b>	<b>13.72%</b>	<b>5.58%</b>	<b>84.00%</b>	<b>16.00%</b>	<b>12.42%</b>

## Aracruz and Bookscape: Currency and Diversification effects..

### Aracruz

	Cost of equity	After-tax cost of debt	E/(D+E)	D/(D+E)	Cost of capital
Aracruz (US \$)	13.46%	4.79%	69.1800%	30.82%	10.79%
Aracruz (Braz Reais)	19.43%	10.95%	69.1800%	30.82%	16.82%
Aracruz (Real)	11.46%	3.47%	69.1800%	30.82%	9.00%

### Bookscape

	Cost of equity	After-tax cost of debt	E/(D+E)	D/(D+E)	Cost of capital
Bookscape (private)	13.93%	3.30%	83.10%	16.90%	12.14%
Bookscape (public)	7.97%	3.30%	83.10%	16.90%	7.18%

- Earlier we computed a cost of equity of 8.87% for Deutsche Bank. We won't even try to estimate the cost of capital. Why?

## Bookscape Cost of Capital

Beta	Cost of Equity	After-tax cost of debt	D/(D+E)	Cost of Capital	
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

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- 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

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- 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

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- 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.