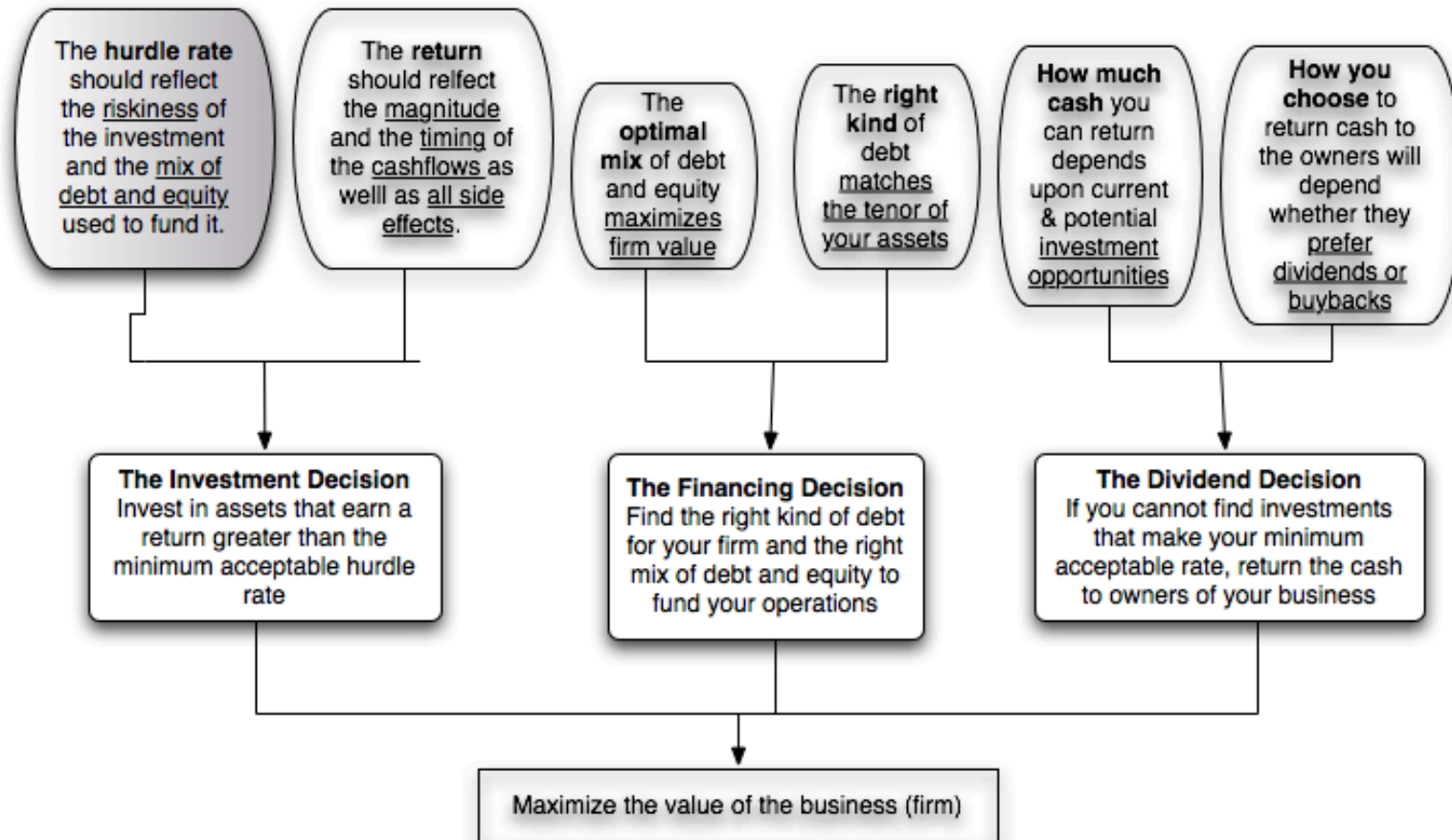


The Investment Principle: Risk and Return Models

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

First Principles

Chapters 3 & 4: Risk, Financing Mix and Hurdle Rates



The notion of a benchmark

- 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?

- 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...

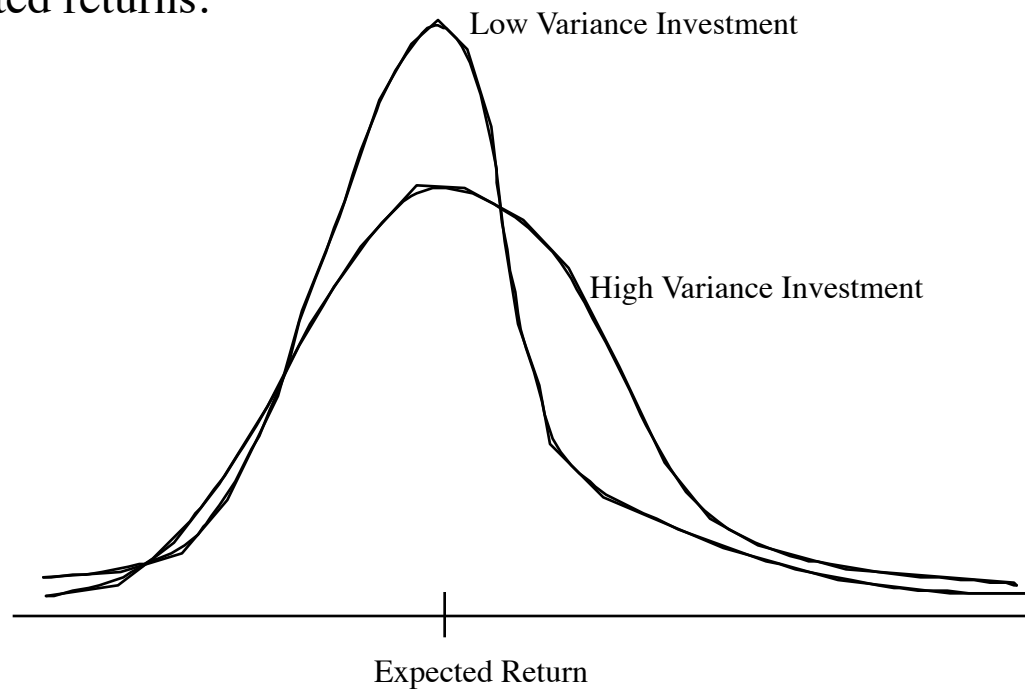
1. It should come up with a measure of risk that applies to all assets and not be asset-specific.
2. It should clearly delineate what types of risk are rewarded and what are not, and provide a rationale for the delineation.
3. It should come up with standardized risk measures, i.e., an investor presented 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

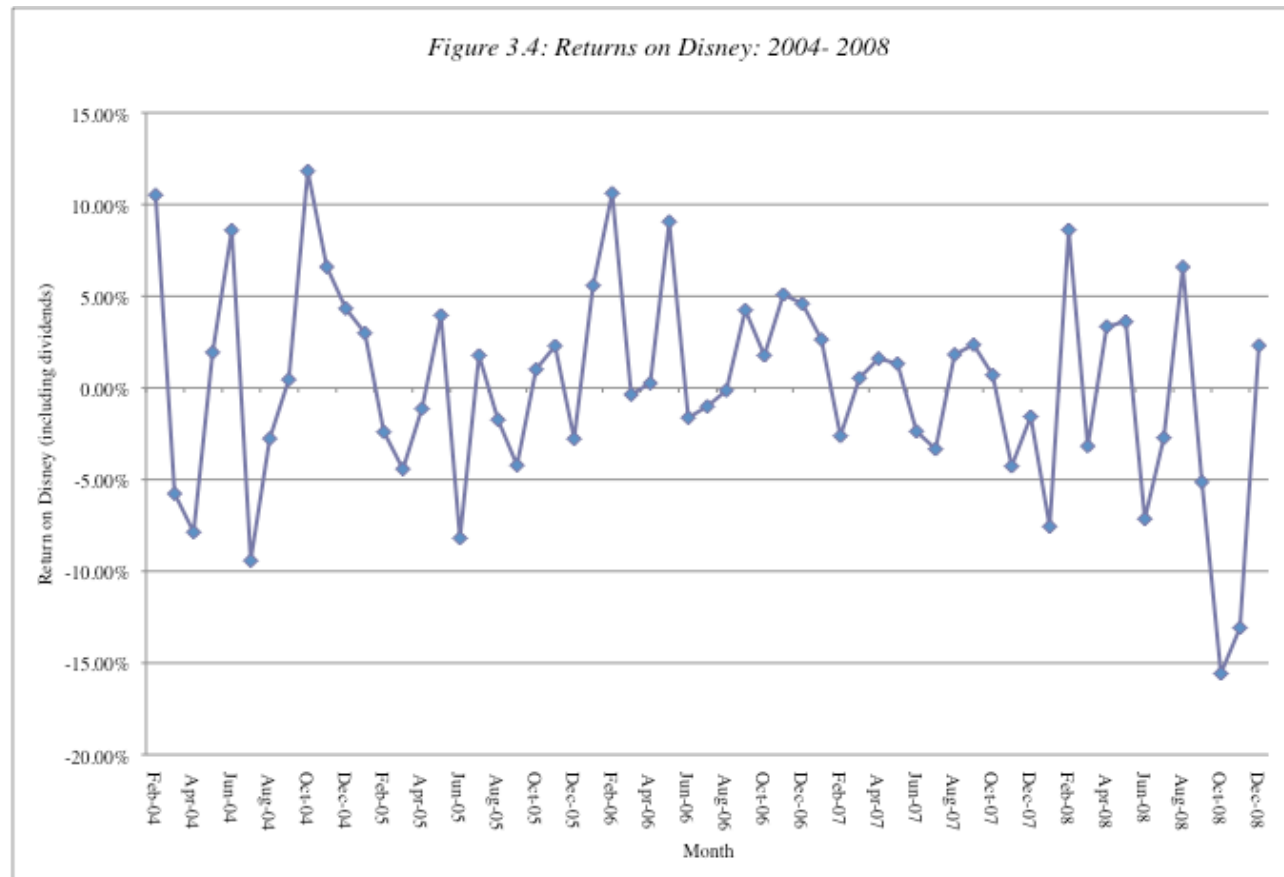
- Uses variance of actual returns around an expected return as a measure of risk.
- Specifies that a portion of variance can be diversified away, and that is only the non-diversifiable portion that is rewarded.
- Measures the non-diversifiable risk with beta, which is standardized around one.
- Translates 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?

- 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 Effects of Diversification

- 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.)

The Role of the Marginal Investor

- 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 ^a
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

Analyzing the investor bases...

	<i>Disney</i>	<i>Deutsche Bank</i>	<i>Aracruz (non-voting)</i>	<i>Tata Chemicals</i>
Institutions	72%	76%	32%	47%
Individuals	21%	23%	60%	24%
Insiders	7%	1%	8%	29%*

Looking at Disney's top stockholders in 2009 (again)

DIS US \$ ↑ **24.2422** +.7422 D 2s EquityHDS
DELAY 14:27 Vol 6,135,972 Op 23.81 Z Hi 24.34 T Lo 23.8 T ValTrd 148.014m
 DIS US Equity 95) Saved Searches 96) Default Settings Page 1/150 Holdings Search
 Walt Disney Co/The CUSIP 25468710

21) Sources 22) Types 23) Countries 24) Metro Areas 25) Advanced Filters
 Name Filter Sort By **Mkt Val**

	Holder Name	Portfolio Name	Source	Mkt Val	% Out	Mkt Val Chg	File Dt
1)	JOBS STEVEN PAUL	n/a	Form 4	3.34BLN	7.46	0	5/5/06
2)	FIDELITY MANAGEMENT &	FIDELITY MANAGEMEN	13F	2.05BLN	4.58	-36.12MLN	9/30/08
3)	STATE STREET CORP	STATE STREET CORPO	13F	1.7BLN	3.79	-18.6MLN	9/30/08
4)	BARCLAYS GLOBAL INVES	BARCLAYS GLOBAL IN	13F	1.66BLN	3.70	-160.12MLN	9/30/08
5)	VANGUARD GROUP INC	VANGUARD GROUP IN	13F	1.38BLN	3.08	-6.82MLN	9/30/08
6)	SOUTHEASTERN ASSET M	SOUTHEASTERN ASSE	13F	1.12BLN	2.50	-14.03MLN	9/30/08
7)	STATE FARM MUTUAL AU	STATE FARM MUTUAL	13F	1.02BLN	2.28	0	9/30/08
8)	WELLINGTON MANAGEMEN	WELLINGTON MANAGE	13F	939.38MLN	2.09	110.6MLN	9/30/08
9)	CLEARBRIDGE ADVISORS	CLEARBRIDGE ADVISO	13F	815.91MLN	1.82	-47.04MLN	9/30/08
10)	JP MORGAN CHASE & CO	JP MORGAN CHASE &	13F	693.31MLN	1.55	-18.89MLN	9/30/08
11)	MASSACHUSETTS FINANCI	MASSACHUSETTS FINA	13F	682.16MLN	1.52	112.29MLN	9/30/08
12)	BANK OF NEW YORK MELL	BANK OF NEW YORK	13F	681.68MLN	1.52	-57.13MLN	9/30/08
13)	NORTHERN TRUST CORP	NORTHERN TRUST CO	13F	610.26MLN	1.36	-4.81MLN	9/30/08
14)	AXA	AXA	13F	486.28MLN	1.08	47.05MLN	9/30/08
15)	BLACKROCK INVESTMENT	BLACKROCK INVESTME	13F	476.12MLN	1.06	-47.11MLN	9/30/08
16)	JENNISON ASSOCIATES L	JENNISON ASSOCIATE	13F	428.85MLN	0.96	-102.77MLN	9/30/08
17)	T ROWE PRICE ASSOCIAT	T ROWE PRICE ASSOC	13F	351.61MLN	0.78	-9.94MLN	9/30/08

26) Latest Chg 27) Hist Held % Out on Page **41.12**
 Australia 61 2 9277 8600 Brazil 5511 3048 4500 Europe 44 20 7330 7500 Germany 49 69 9204 1210 Hong Kong 852 2977 6000
 Japan 81 3 3201 8900 Singapore 65 6212 1000 U.S. 1 212 318 2000 Copyright 2009 Bloomberg Finance L.P.
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And the top investors in Deutsche and Aracruz...

<i>Disney</i>	<i>Deutsche Bank</i>	<i>Aracruz Preferred</i>	<i>-Tata Chemicals</i>
Steven Jobs (7.43%)	Deutsche Post (8.05%)	BB DTVM (0.89%)	Tata Sons (14.26%)
Fidelity (4.86%)	Allianz (6.81%)	Barclays(0.34%)	Life Insurance Co (11.71%)
State Street (3.97%)	AXA (4.64%)	Banco Itau (0.32%)	Tata Investment (6.8%)
Barclays (3.79%)	Credit Suisse (3.55%)	Banco Barclays (0.19%)	Tata Tea (6.54%)
Vanguard Group (3.07%)	Deutsche Bank (3.52%)	Vanguard Group (0.18%)	New India Assur. (2.58%)
Southeastern Asset (2.40%)	Barclays (3.02%)	UBS Strategy (0.17%)	Hindustan Lever (2.14%)
State Farm Mutual (2.27%)	Blackrock (2.35%)	Banco Itau (0.17%)	General Insurance (2.12%)
AXA (2.13%)	UBS (1.65%)	Dimensional Fund (0.10%)	United India Insur. (1.13%)
Wellington Mgmt (1.87%)	Deka (1.52%)	Banco Bradesco (0.09%)	National Insurance (1.01%)
Massachusetts Finl (1.57%)	Dekabank (1.44%)	Landesbank (0.08%)	Templeton Funds (1.01%)

Taking a closer look at 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
Total	21,51,02,651	100.00	199204	100.00

Tata companies and trusts: 31.6%

Institutions & Funds: 34.68%

Foreign Funds: 5.91%

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

- 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:
$$\text{Expected Return} = \text{Riskfree Rate} + \text{Beta} * (\text{Expected Return on the Market Portfolio} - \text{Riskfree Rate})$$

Limitations of the CAPM


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

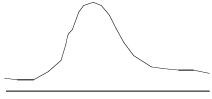
The risk in an investment can be measured by the variance in actual returns around an expected return

Riskless Investment



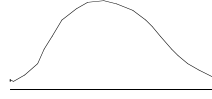
E(R)

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"> 1. each investment is a small proportion of portfolio 2. risk averages out across investments in portfolio <p>The marginal investor is assumed to hold a “diversified” portfolio. Thus, only market risk will be rewarded and priced.</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

<p style="text-align: center;">The CAPM</p> <p>If there is</p> <ol style="list-style-type: none"> 1. no private information 2. no transactions cost <p>the optimal diversified portfolio includes every traded asset. Everyone will hold this <u>market portfolio</u></p> <p>Market Risk = Risk added by any investment to the market portfolio:</p>	<p style="text-align: center;">The APM</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>Market Risk = Risk exposures of any asset to market factors</p>	<p style="text-align: center;">Multi-Factor Models</p> <p>Since market risk affects most or all investments, it must come from macro economic factors.</p> <p>Market Risk = Risk exposures of any asset to macro economic factors.</p>	<p style="text-align: center;">Proxy Models</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>Market Risk = Captured by the Proxy Variable(s)</p>
Beta of asset relative to Market portfolio (from a regression)	Betas of asset relative to unspecified market factors (from a factor analysis)	Betas of assets relative to specified macro economic factors (from a regression)	Equation relating returns to proxy variables (from a regression)

Why the CAPM persists...

- 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?

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