# Risk and Return Models: Equity and Debt

# First Principles

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

# The notion of a benchmark

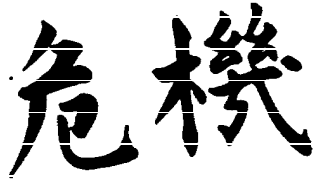
- Since financial resources are finite, there is a hurdle that projects have to cross before being deemed acceptable.
- This hurdle will be higher for riskier projects than for safer projects.
- A simple representation of the hurdle rate is as follows:

  Hurdle rate = Riskless Rate + 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



- The first symbol is the symbol for "danger", while the second is the symbol for "opportunity", making risk a mix of danger and opportunity.

# 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.

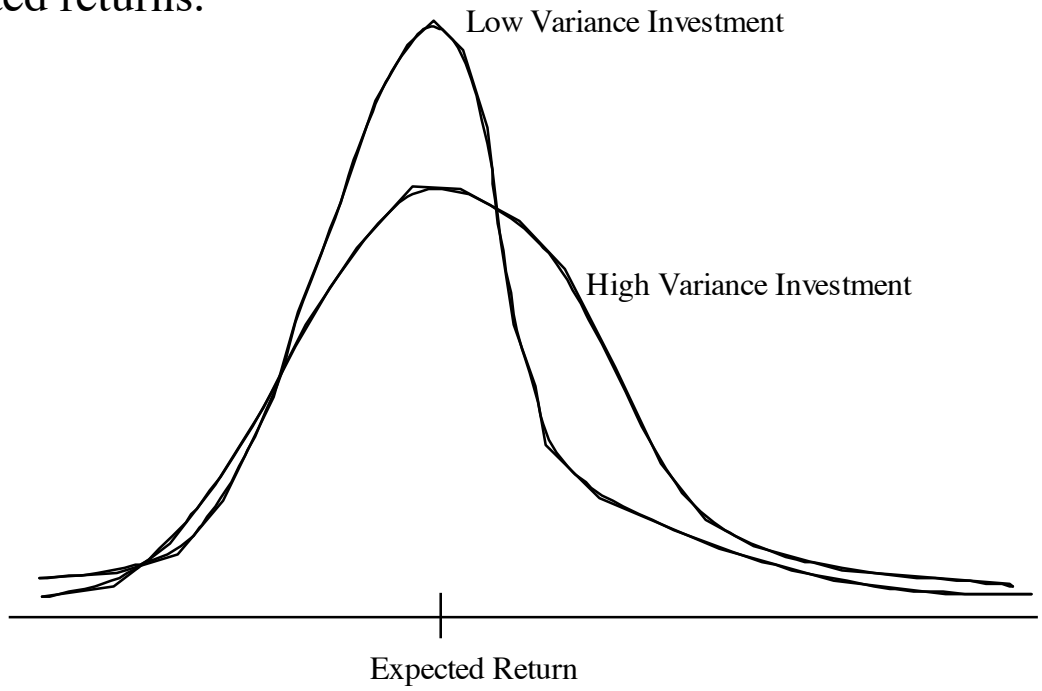
# The Capital Asset Pricing Model

- 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 -

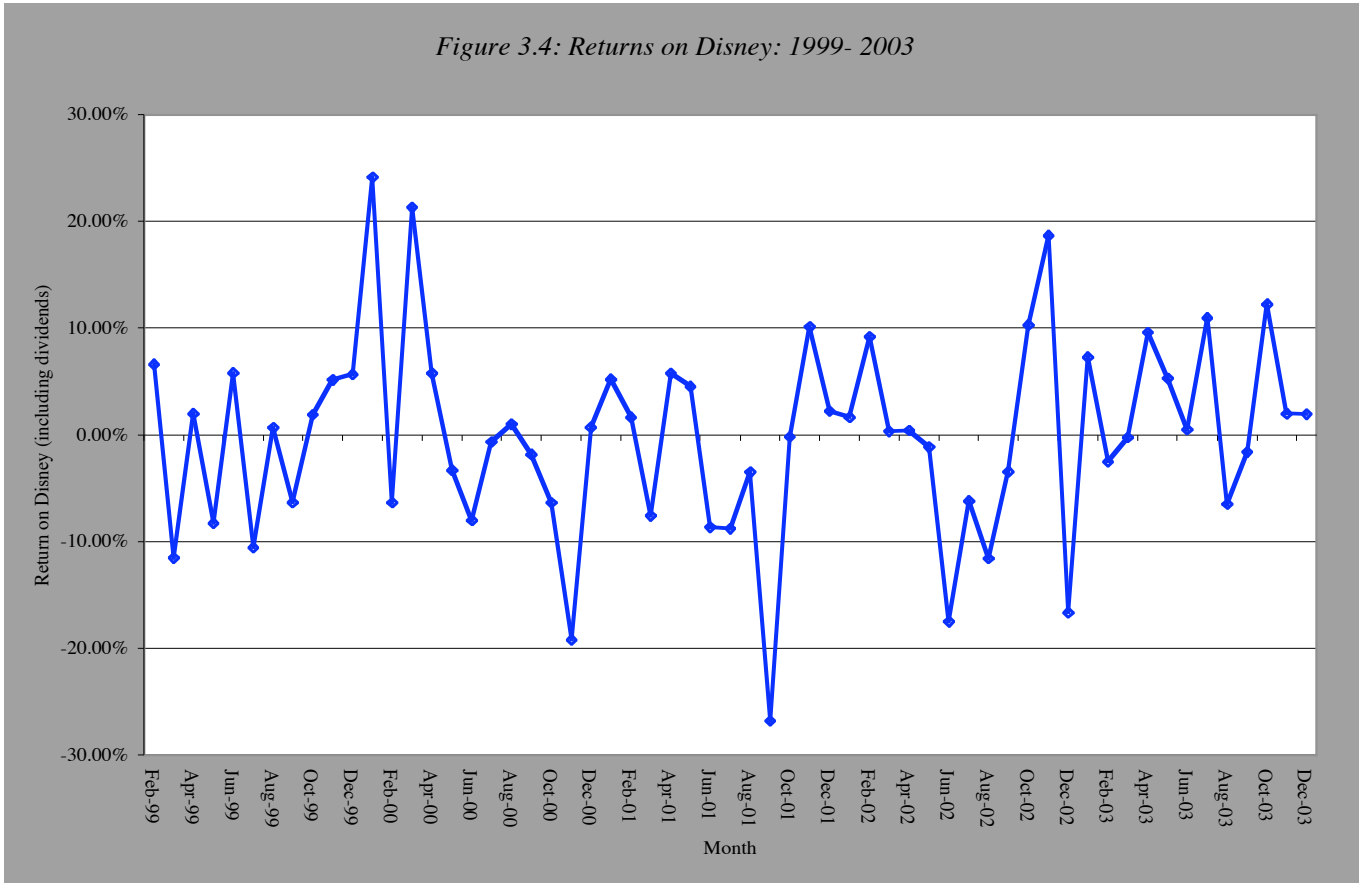
  Expected Return = Riskfree rate + Beta * Risk Premium
- Works as well as the next best alternative in most cases.

# 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…

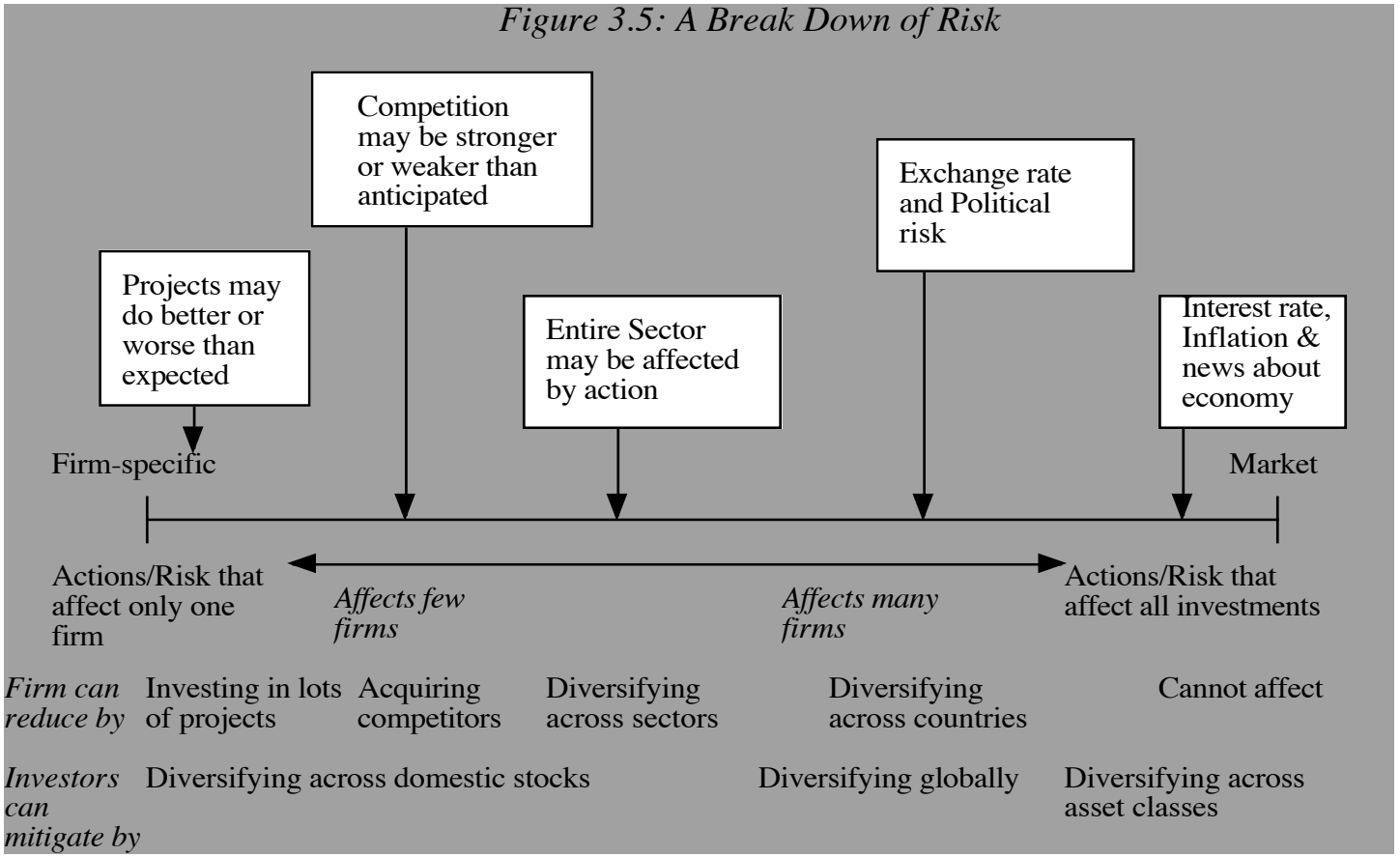


# Do you live in a mean-variance world?

- 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?

# The Importance of Diversification: Risk Types

*Figure 3.5: A Break Down of Risk*



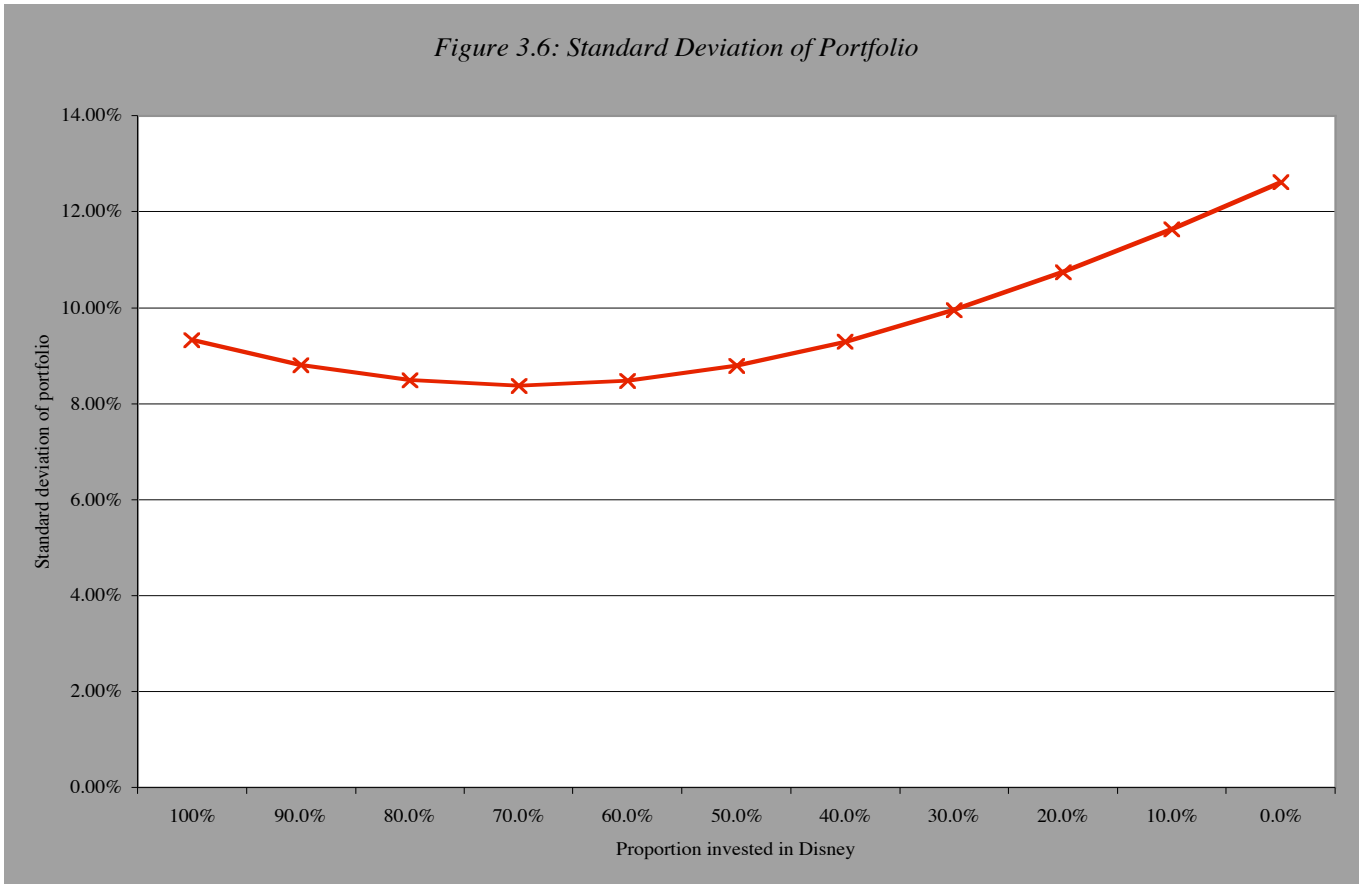
# The Effects of Diversification

- 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.)

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

| | *Disney* | *Aracruz ADR* |
|---|---|---|
| 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…



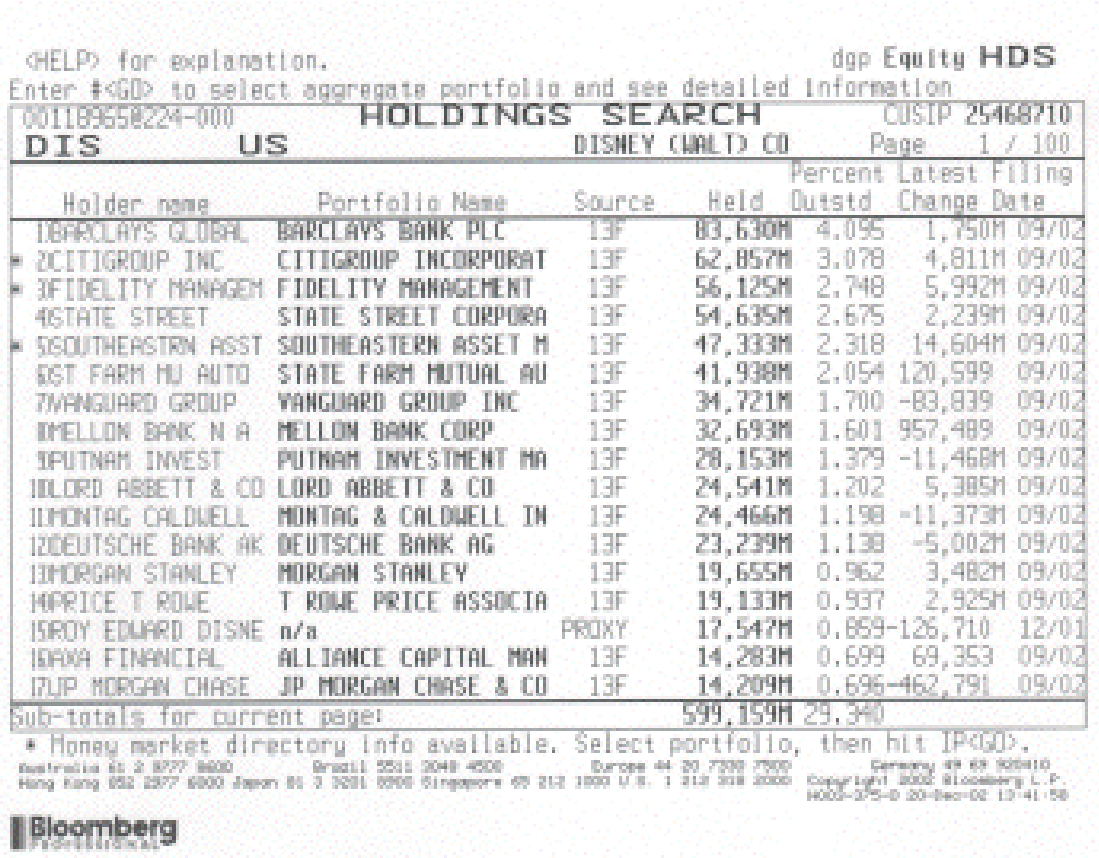
# The Role of the Marginal Investor

- 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…

| *Percent of Stock held by Institutions* | *Percent of Stock held by Insiders* | *Marginal Investor* |
|---|---|---|
| High | Low | Institutional Investor[a] |
| High | High | Institutional Investor, with insider influence |
| Low | High (held by founder/manager of firm) | Insider (often undiversified) |
| 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 (again)



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

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DIS US DISNEY (WALT) CO Page 1 / 100

| | Holder name | Portfolio Name | Source | Held | Percent Outstd | Latest Change | Filing Date |
|---|---|---|---|---|---|---|---|
| 1 | BARCLAYS GLOBAL | BARCLAYS BANK PLC | 13F | 83,630M | 4.055 | 1,750M | 09/02 |
| * 2 | CITIGROUP INC | CITIGROUP INCORPORAT | 13F | 62,857M | 3.078 | 4,811M | 09/02 |
| * 3 | FIDELITY MANAGEM | FIDELITY MANAGEMENT | 13F | 56,125M | 2.748 | 5,992M | 09/02 |
| 4 | STATE STREET | STATE STREET CORPORA | 13F | 54,635M | 2.675 | 2,239M | 09/02 |
| * 5 | SOUTHEASTRN ASST | SOUTHEASTERN ASSET M | 13F | 47,333M | 2.318 | 14,604M | 09/02 |
| 6 | ST FARM MU AUTO | STATE FARM MUTUAL AU | 13F | 41,938M | 2.054 | 120,599 | 09/02 |
| 7 | VANGUARD GROUP | VANGUARD GROUP INC | 13F | 34,721M | 1.700 | -83,839 | 09/02 |
| 8 | MELLON BANK N A | MELLON BANK CORP | 13F | 32,693M | 1.601 | 957,489 | 09/02 |
| 9 | PUTNAM INVEST | PUTNAM INVESTMENT MA | 13F | 28,153M | 1.379 | -11,468M | 09/02 |
| 10 | LORD ABBETT & CO | LORD ABBETT & CO | 13F | 24,541M | 1.202 | 5,385M | 09/02 |
| 11 | MONTAG CALDWELL | MONTAG & CALDWELL IN | 13F | 24,466M | 1.198 | -11,373M | 09/02 |
| 12 | DEUTSCHE BANK AK | DEUTSCHE BANK AG | 13F | 23,239M | 1.138 | -5,002M | 09/02 |
| 13 | MORGAN STANLEY | MORGAN STANLEY | 13F | 19,655M | 0.962 | 3,482M | 09/02 |
| 14 | PRICE T ROWE | T ROWE PRICE ASSOCIA | 13F | 19,133M | 0.937 | 2,925M | 09/02 |
| 15 | ROY EDWARD DISNE | n/a | PROXY | 17,547M | 0.859 | -126,710 | 12/01 |
| 16 | AXA FINANCIAL | ALLIANCE CAPITAL MAN | 13F | 14,283M | 0.699 | 69,353 | 09/02 |
| 17 | JP MORGAN CHASE | JP MORGAN CHASE & CO | 13F | 14,209M | 0.696 | -462,791 | 09/02 |
| Sub-totals for current page: | | | | 599,159M | 29.340 | | |

* Money market directory info available. Select portfolio, then hit IP<GO>.



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# And the top investors in Deutsche and Aracruz…

| *Deutsche Bank* | *Aracruz - Preferred* |
|---|---|
| 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%) |

# Analyzing the investor bases…

| | *Disney* | *Deutsche Bank* | *Aracruz (non-voting)* |
|---|---|---|---|
| *Mutual Funds* | *31%* | *16%* | *29%* |
| *Other Institutional Investors* | *42%* | *58%* | *26%* |
| *Individuals* | *27%* | *26%* | *45%* |

# 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:

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


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

*Risk that is specific to investment (Firm Specific)*
Can be diversified away in a diversified portfolio
1. each investment is a small proportion of portfolio
2. risk averages out across investments in portfolio

*Risk that affects all investments (Market Risk)*
Cannot be diversified away since most assets are affected by it.

**The marginal investor is assumed to hold a "diversified" portfolio. Thus, only market risk will be rewarded and priced.**

**Step 3: Measuring Market Risk**

| **The CAPM** | **The APM** | **Multi-Factor Models** | **Proxy Models** |
|---|---|---|---|
| If there is<br>1. no private information<br>2. no transactions cost<br>the optimal diversified portfolio includes every traded asset. Everyone will hold this market portfolio<br>**Market Risk = Risk added by any investment to the market portfolio:** | 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.<br>**Market Risk = Risk exposures of any asset to market factors** | Since market risk affects most or all investments, it must come from macro economic factors.<br>**Market Risk = Risk exposures of any asset to macro economic factors.** | 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.<br>**Market Risk = Captured by the Proxy Variable(s)** |
| 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