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

危机

- 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.

- Risk is therefore neither good nor bad. It is just a fact of life. The question that businesses have to address is therefore not whether to avoid risk but how best to incorporate it into their decision making.

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A good risk and return model should…

1. It should come up with a <u>measure of risk that applies to all assets</u> and not be asset-specific.

2. It should clearly <u>delineate what types of risk are rewarded and what are not</u>, and provide a rationale for the delineation.

3. It should come up with <u>standardized risk measures</u>, 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 <u>translate the measure of risk into a rate of return</u> that the investor should demand as compensation for bearing the risk.

5. It should <u>work well</u> not only at explaining past returns, but also in predicting future expected returns.
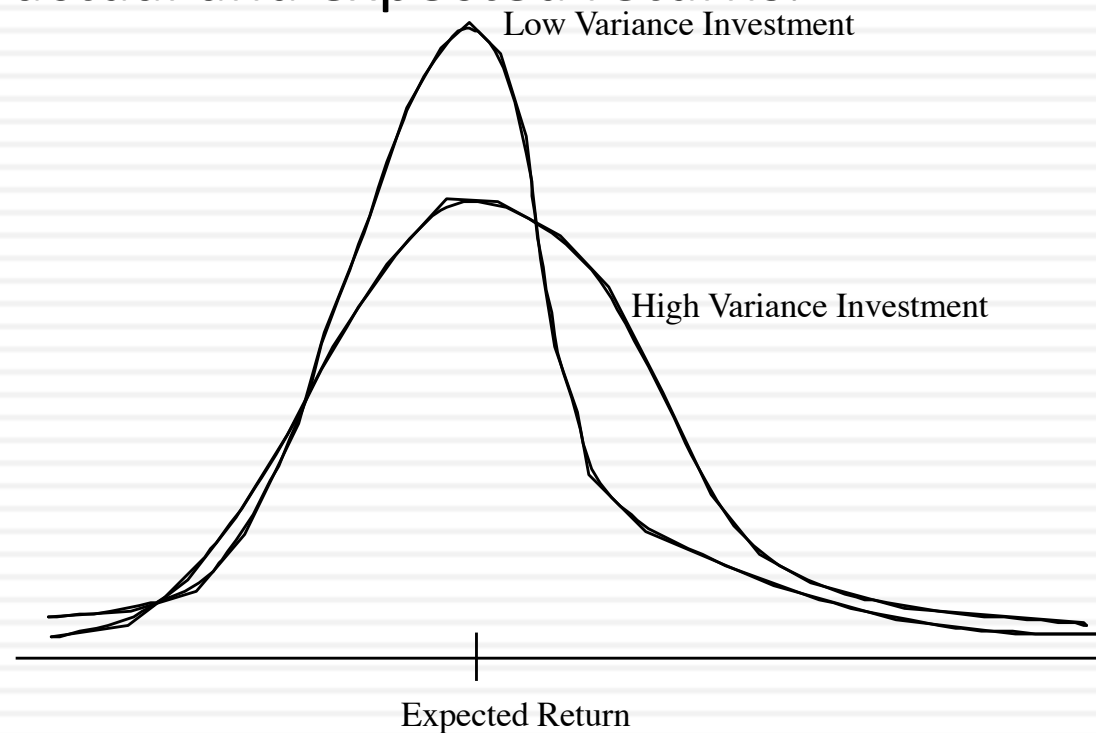
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The Capital Asset Pricing Model

1. Uses variance of actual returns around an expected return as a measure of risk.

2. Specifies that a portion of variance can be diversified away, and that is only the non-diversifiable portion that is rewarded.

3. Measures the non-diversifiable risk with beta, which is standardized around one.

4. Translates beta into expected return -

    Expected Return = Riskfree rate + Beta * Risk Premium

5. Works as well as the next best alternative in most cases.

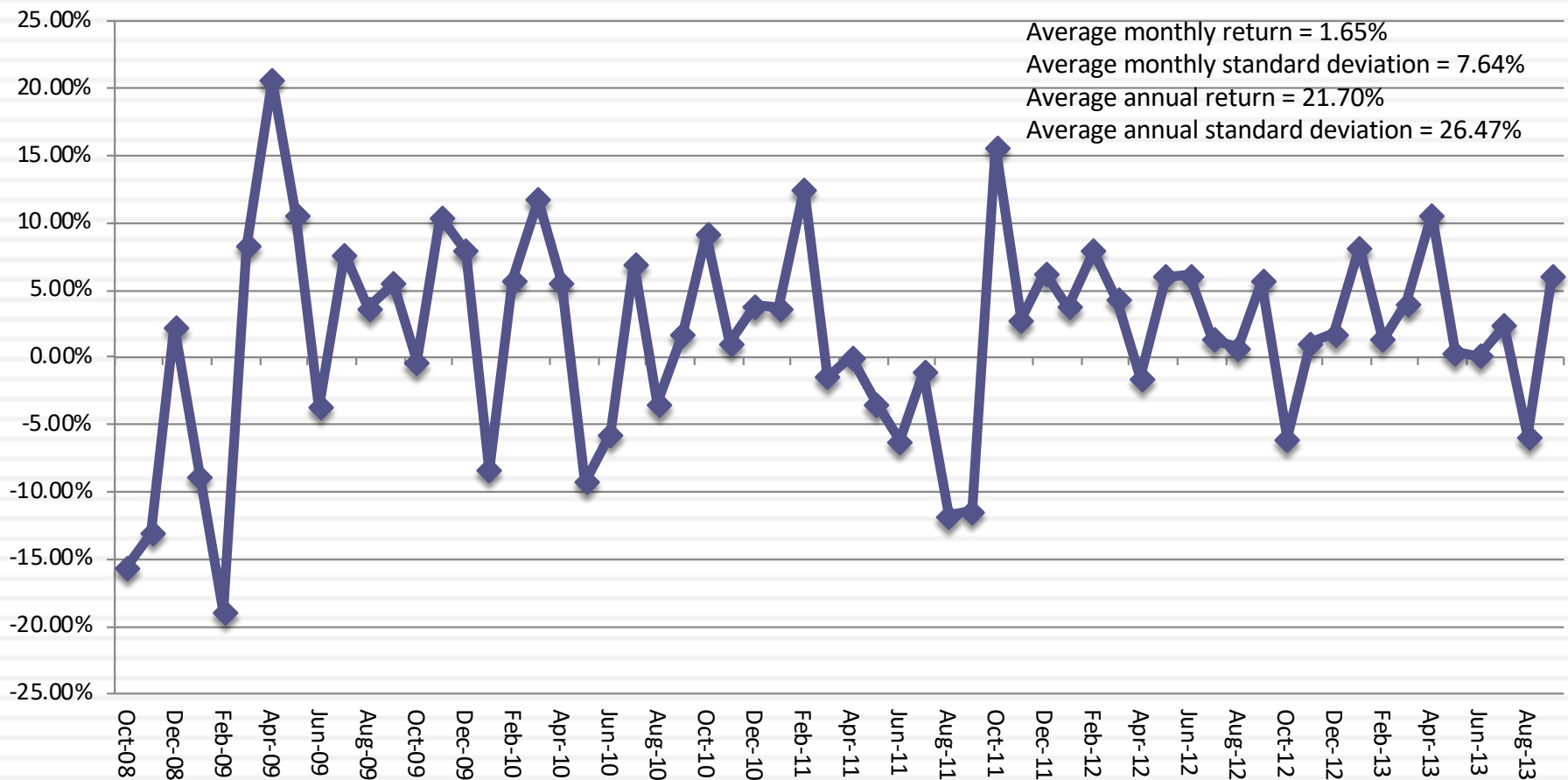*Aswath Damodaran*

1. The Mean-Variance Framework

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

Low Variance Investment

High Variance Investment

Expected Return

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

Returns on Disney - 2008-2013

Average monthly return = 1.65%
Average monthly standard deviation = 7.64%
Average annual return = 21.70%
Average annual standard deviation = 26.47%

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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?

   b. 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%?

2. The Importance of Diversification: Risk Types

Figure 3.5: A Break Down of Risk
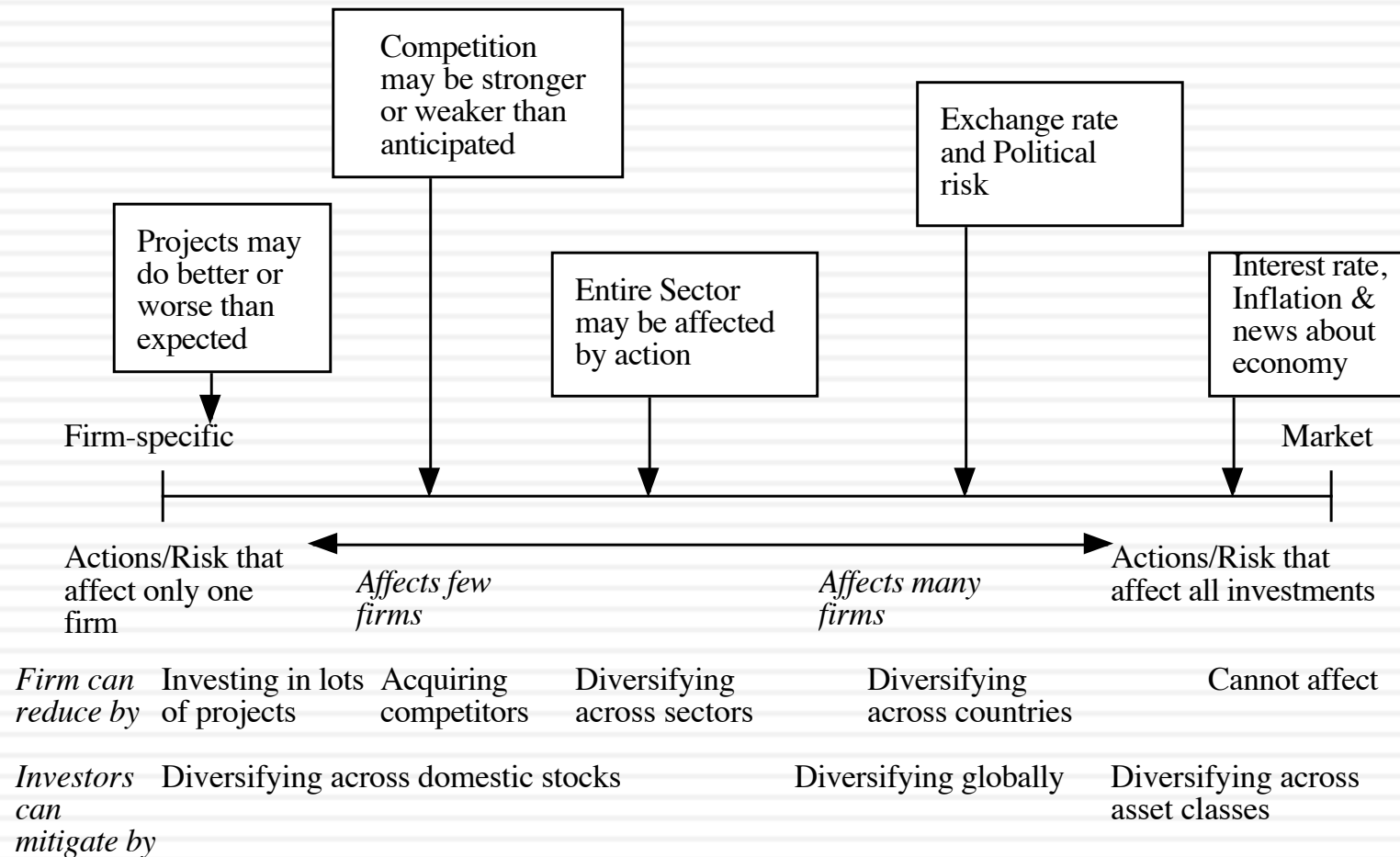
Why diversification reduces/eliminates firm specific risk

□ 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 <u>most likely to be the buyer or seller on the next trade and to influence the stock price</u>.

- Generally speaking, the marginal investor in a stock has to <u>own a lot of stock and also trade that stock on a regular basis</u>.

- Since trading is required, <u>the largest investor may not be the marginal investor</u>, especially if he or she is a founder/manager of the firm (Larry Ellison at Oracle, Mark Zuckerberg at Facebook)

- **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
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

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Gauging the marginal investor: Disney in 2013

Extending the assessment of the investor base

□ In all five of the publicly traded companies that we are looking at, institutions are big holders of the company's stock.

	Disney	*Deutsche Bank*	*Vale (preferred)*	*Tata Motors*	*Baidu (Class A)*
Institutions	70.2%	40.9%	71.2%	44%	70%
Individuals	21.3%	58.9%	27.8%	25%	20%
Insiders	7.5%	0.2%	1.0%	31%*	10%

Company	*Largest holder*	*Number of institutional investors in top ten holdings*
Disney	Laurene Jobs (7.3%)	8
Deutsche Bank	Blackrock (4.69%)	10
Vale Preferred	Aberdeen (7.40%)	8
Tata Motors	Tata Sons (26.07%)	7
Baidu (Class A)	Capital Group (12.46%)	10

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3. The Limiting Case: The Market Portfolio

□ <u>The big assumptions & the follow up:</u> 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.

□ <u>The consequence:</u> 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

4. The Risk & Expected Return of an Individual Asset

☐ The essence: 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)

☐ The measure: 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 result: 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
   - The market index used can be wrong.
   - The 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.

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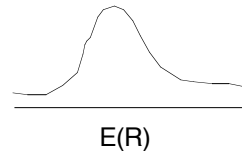
Alternatives to the CAPM

Step 1: Defining Risk

The risk in an investment can be measured by the variance in actual returns around an expected return
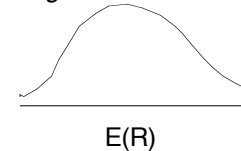
Riskless Investment	Low Risk Investment	High Risk Investment
E(R)	E(R)	E(R)

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 1. no private information 2. no transactions cost the optimal diversified portfolio includes every traded asset. Everyone will hold this market portfolio **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. **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. **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. **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…

- <u>The CAPM, notwithstanding its many critics and limitations, has survived as the default model for risk in equity valuation and corporate finance</u>. 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.

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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
  - An institutional investor
  - An individual investor
  - An insider

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From Risk Models to Hurdle Rates: Estimation Challenges

"The price of purity is purists…"

Anonymous

Inputs required to use the CAPM -

- The capital asset pricing model yields the following expected return:
    - Expected Return = Riskfree Rate+ Beta * (Expected Return on the Market Portfolio - Riskfree Rate)
- To use the model we need three inputs:
    a. The current risk-free rate
    b. The expected market risk premium, the premium expected for investing in risky assets, i.e. the market portfolio, over the riskless asset.
    c. The beta of the asset being analyzed.

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The Riskfree Rate and Time Horizon

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

- For an investment to be riskfree, i.e., to have an actual return be equal to the expected return, two conditions have to be met –

  - There has to be no default risk, which generally implies that the security has to be issued by the government. Note, however, that not all governments can be viewed as default free.

  - There can be no uncertainty about reinvestment rates, which implies that it is a zero coupon security with the same maturity as the cash flow being analyzed.

Riskfree Rate in Practice

- ☐ <u>Definition</u>: The riskfree rate is the rate on a zero coupon default-free bond matching the time horizon of the cash flow being analyzed.

- ☐ <u>Implication</u>: 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 …

- ☐ <u>A Practical Solution</u>: 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.

- ☐ **In corporate finance, almost everything we do is long term. So, using a long term default free rate as the risk free rate makes sense.**
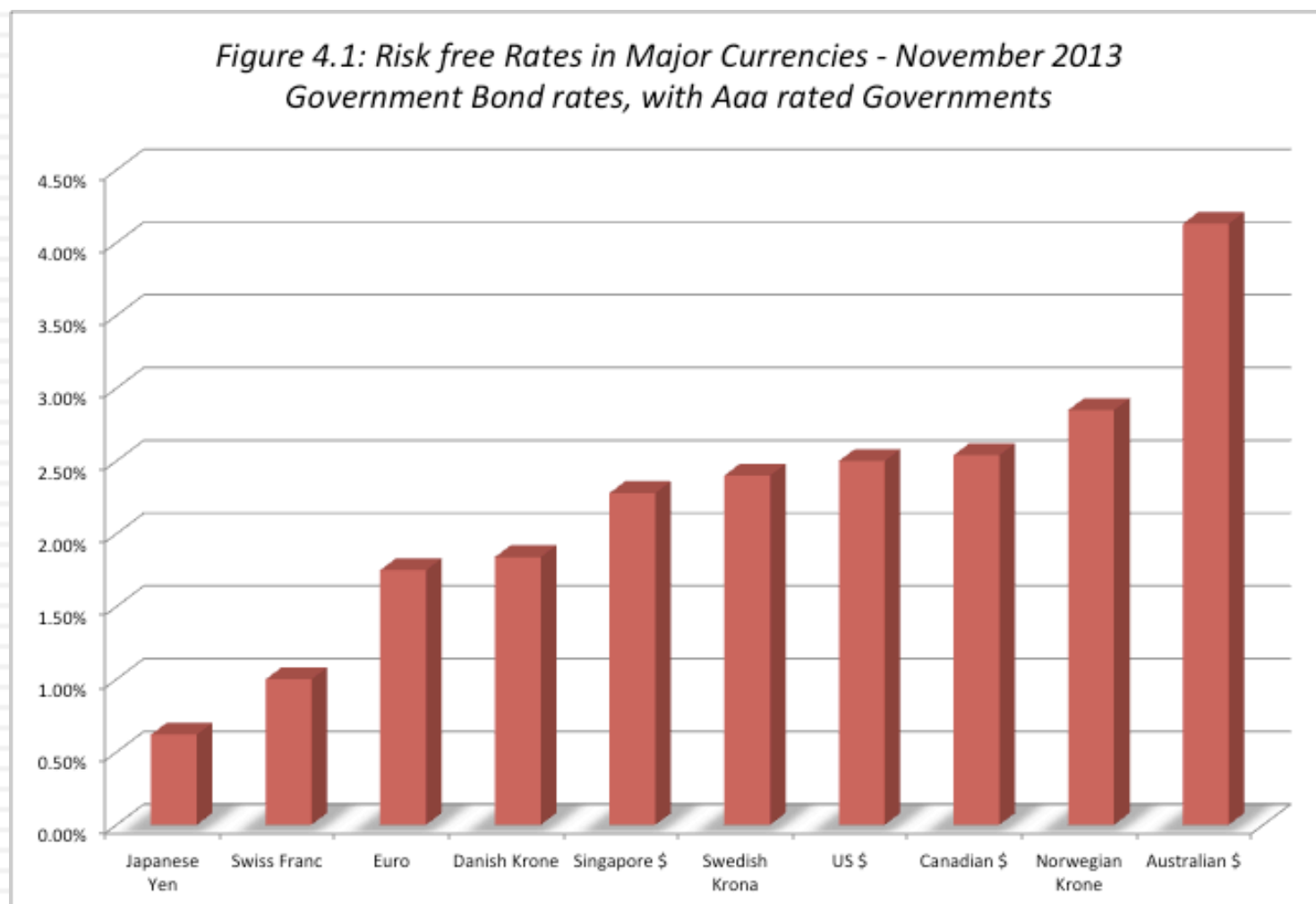
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The Bottom Line on Riskfree Rates

- **Currency Matching**: 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.

- **Just use the government bond 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 November 2013**, for instance, the rate on a ten-year US treasury bond (2.75%) is used as the risk free rate in US dollars.

- **If the government is default-fre**e, using a long term government rate (even on a coupon bond) as the risk free 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.

What is the Euro riskfree rate? An exercise in November 2013

Rate on 10-year Euro Government Bonds: November 2013

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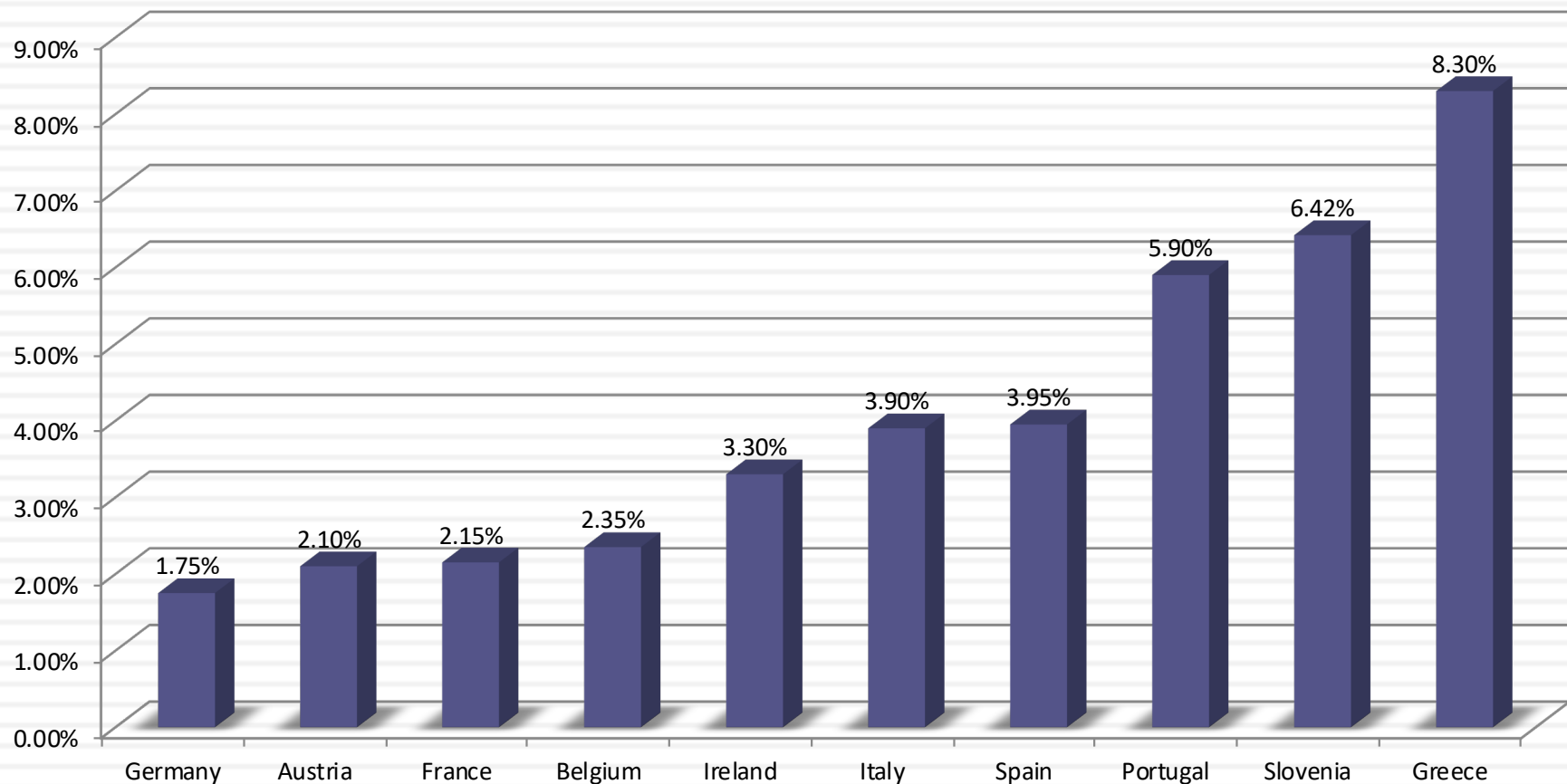
When the government is default free: Risk free rates – in November 2013

Figure 4.1: Risk free Rates in Major Currencies - November 2013
Government Bond rates, with Aaa rated Governments

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What if there is no default-free entity? Risk free rates in November 2013

- **Adjust the local currency government borrowing rate** for default risk to get a riskless local currency rate.
  - In November 2013, the Indian government rupee bond rate was 8.82%. the local currency rating from Moody's was Baa3 and the default spread for a Baa3 rated country bond was 2.25%.

  Riskfree rate in Rupees = 8.82% - 2.25% = 6.57%
  - In November 2013, the Chinese Renmimbi government bond rate was 4.30% and the local currency rating was Aa3, with a default spread of 0.8%.

  Riskfree rate in Chinese Renmimbi = 4.30% - 0.8% = 3.5%

- **Do the analysis in an alternate currency**, where getting the riskfree rate is easier. With Vale in 2013, we could choose to do the analysis in US dollars (rather than estimate a riskfree rate in R$). 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.

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Three paths to estimating sovereign default spreads

- Sovereign dollar or euro denominated bonds: The difference between the interest rate on a sovereign US $ bond, issued by the country, and the US treasury bond rate can be used as the default spread. For example, in November 2013, the 10-year Brazil US $ bond, denominated in US dollars had a yield of 4.25% and the US 10-year T.Bond rate traded at 2.75%.

Default spread = 4.25% - 2.75% = 1.50%

- CDS spreads: Obtain the default spreads for sovereigns in the CDS market. The CDS spread for Brazil in November 2013 was 2.50%.

- Average spread: If you know the sovereign rating for a country, you can estimate the default spread based on the rating. In November 2013, Brazil's rating was Baa2, yielding a default spread of 2%.

Risk free rates in currencies: Sovereigns with default risk in November 2013

Figure 4.2: Risk free rates in Currencies where Governments not Aaa rated