THE COST OF CAPITAL: MISUNDERSTOOD, MISESTIMATED AND MISUSED!

Aswath Damodaran
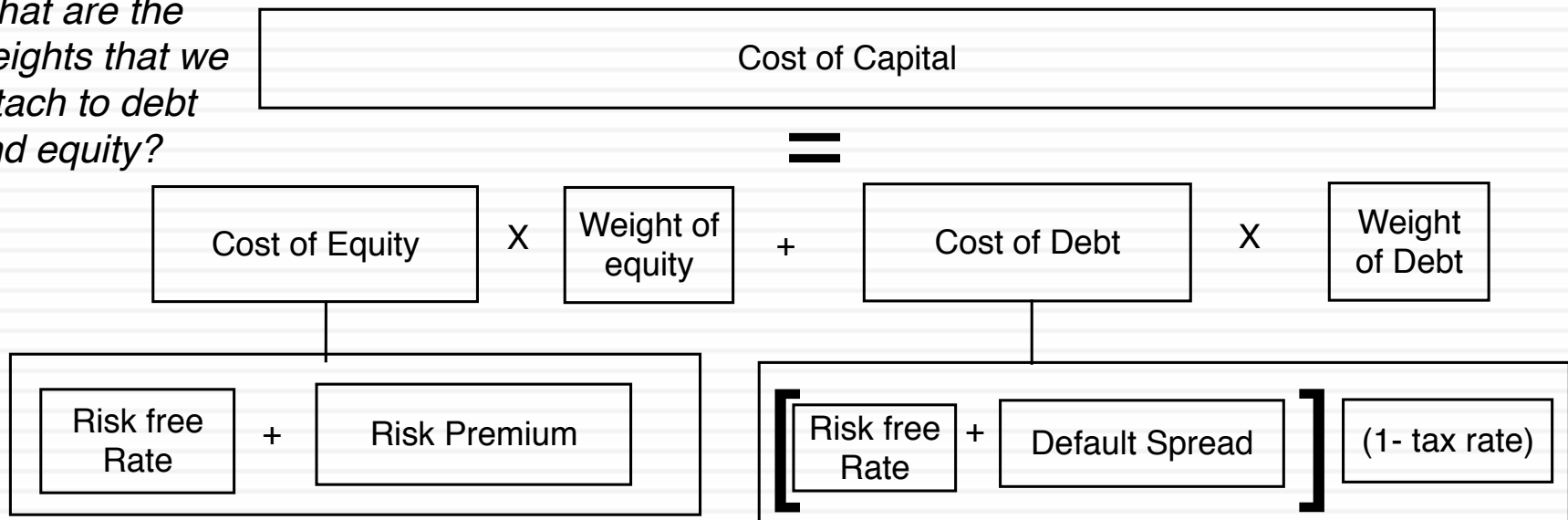
THE ULTIMATE MULTI-PURPOSE TOOL: AN OPPORTUNITY COST & OPTIMIZING TOOL

The Mechanics of Computing the Cost of Capital

What are the weights that we attach to debt and equity?

Cost of Capital

=

Cost of Equity	X	Weight of equity	+	Cost of Debt	X	Weight of Debt

Risk free Rate	+	Risk Premium		[Risk free Rate	+	Default Spread]	(1- tax rate)

What should we use as the risk free rate?
What equity risks are rewarded?
Should we scale equity risk across companies?
How do we measure the risk premium per unit of risk?

How do we estimate the default spread?
What tax rate do we use?

In investment analysis: The cost of capital as a hurdle rate & opportunity cost

Accounting Test Return on invested capital (ROIC) > Cost of Capital	**Time Weighted CF Test** NPV of the Project > 0	**Time Weighted % Return** IRR > Cost of Capital

The Hurdle Rate

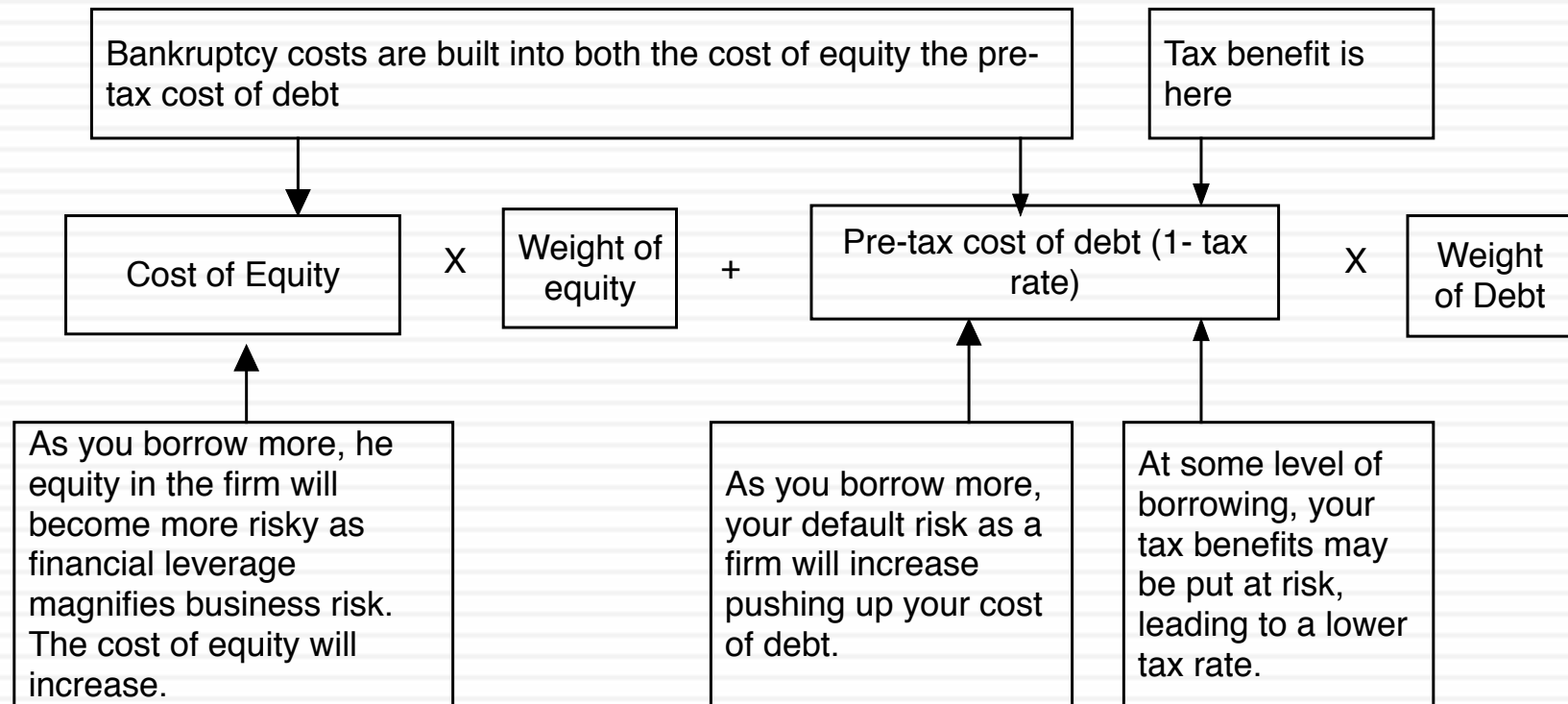| **The cost of capital for an investment** |
|---|
| Should reflect the risk of the investment, not the entity taking the investment. Should use a debt ratio that is reflective of the investment's cash flows. |

No risk subsidies
If you use the cost of capital of the company as your hurdle rate for all investments, risky investments (and businesses) will be subsidized by safe investments.(and businesses).

No debt subsidies
If you fund an investment disrprportionately with debt, you are using the company's debt capacity to subsidize the investment.

In capital structure: The cost of capital as "optimizing" tool

Bankruptcy costs are built into both the cost of equity the pre-tax cost of debt		Tax benefit is here

Cost of Equity X Weight of equity + Pre-tax cost of debt (1- tax rate) X Weight of Debt

As you borrow more, he equity in the firm will become more risky as financial leverage magnifies business risk. The cost of equity will increase.

As you borrow more, your default risk as a firm will increase pushing up your cost of debt.

At some level of borrowing, your tax benefits may be put at risk, leading to a lower tax rate.
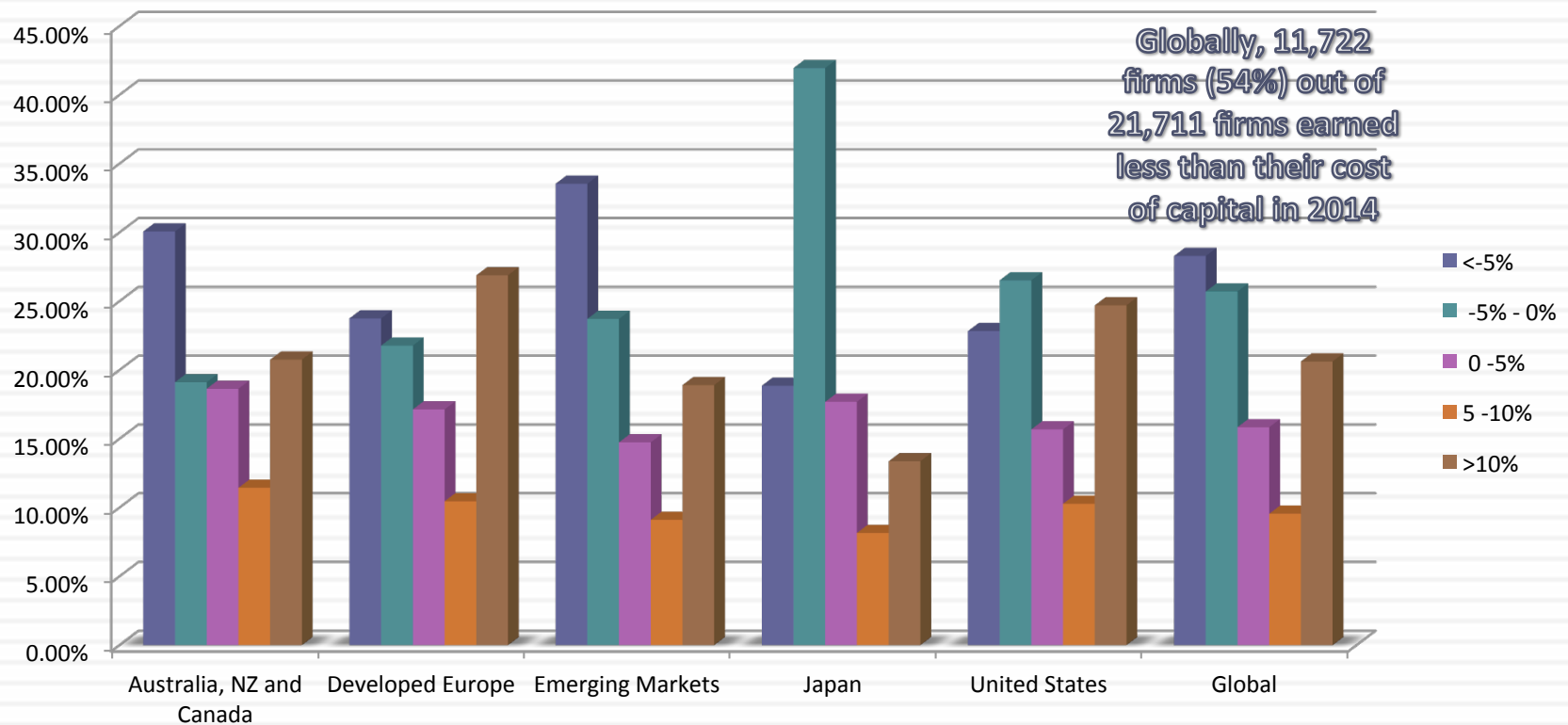
The trade off: As you use more debt, you replace more expensive equity with cheaper debt but you also increase the costs of equity and debt. The net effect will determine whether the cost of capital will increase, decrease or be unchanged as debt ratio changes.

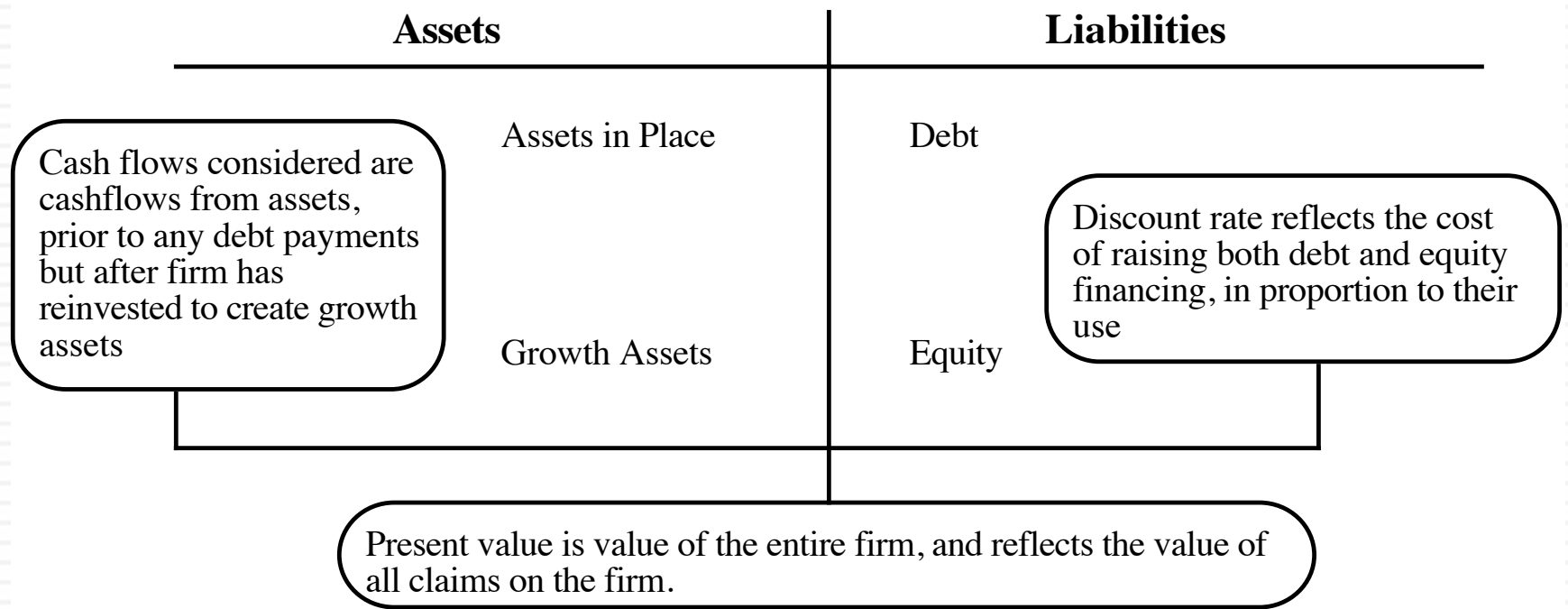*The optimal debt ratio is the one at which the cost of capital is minimized*

In dividend policy: It is the divining rod for returning cash

Excess Return (ROC minus Cost of Capital) for firms with market capitalization> $50 million: Global in 2014

Globally, 11,722 firms (54%) out of 21,711 firms earned less than their cost of capital in 2014

Legend:
- <-5%
- -5% - 0%
- 0 -5%
- 5 -10%
- >10%

6

In valuation, it is the mechanism for adjusting for risk..

Figure 5.6: Firm Valuation

Assets	Liabilities
Assets in Place	Debt
Growth Assets	Equity

Cash flows considered are cashflows from assets, prior to any debt payments but after firm has reinvested to create growth assets

Discount rate reflects the cost of raising both debt and equity financing, in proportion to their use

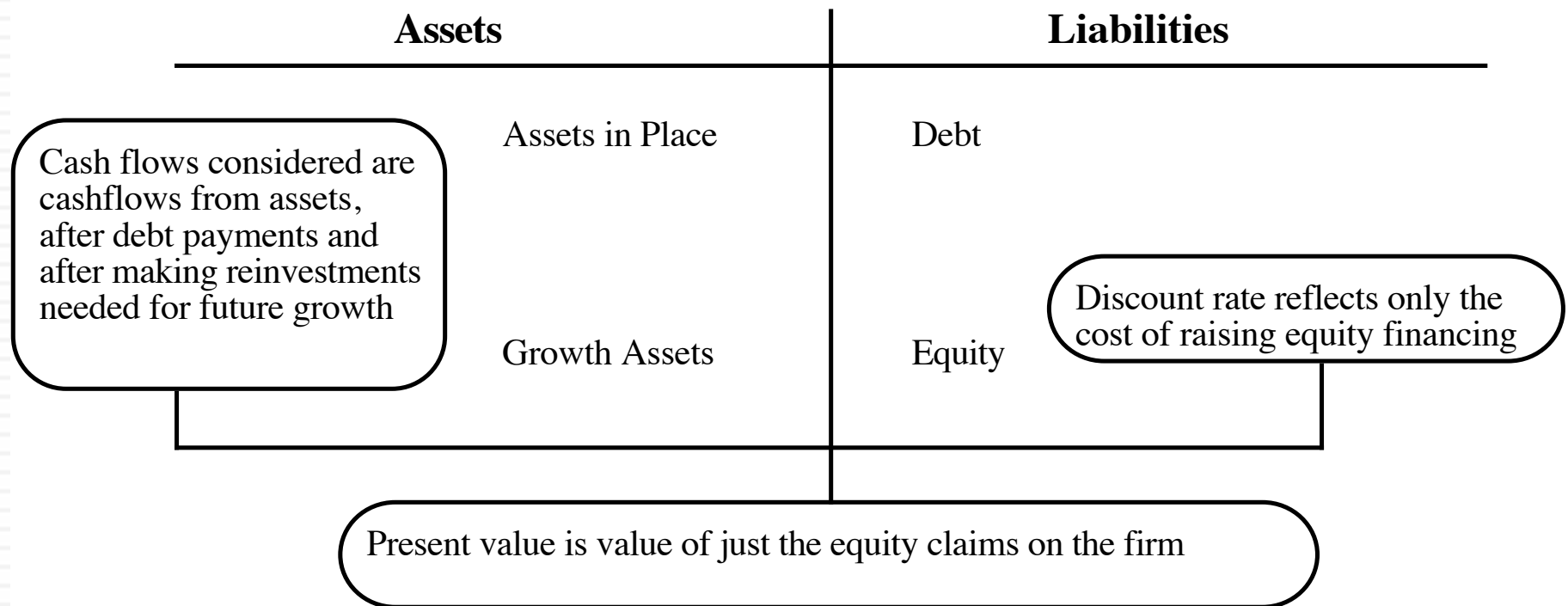Present value is value of the entire firm, and reflects the value of all claims on the firm.

$$\text{Value of asset } = \frac{E(CF_1)}{(1+r)} + \frac{E(CF_2)}{(1+r)^2} + \frac{E(CF_3)}{(1+r)^3} ..... + \frac{E(CF_n)}{(1+r)^n}$$

Though you can value with just an equity focus..

Figure 5.5: Equity Valuation

Assets	**Liabilities**
Assets in Place	Debt
Growth Assets	Equity

Cash flows considered are cashflows from assets, after debt payments and after making reinvestments needed for future growth

Discount rate reflects only the cost of raising equity financing

Present value is value of just the equity claims on the firm

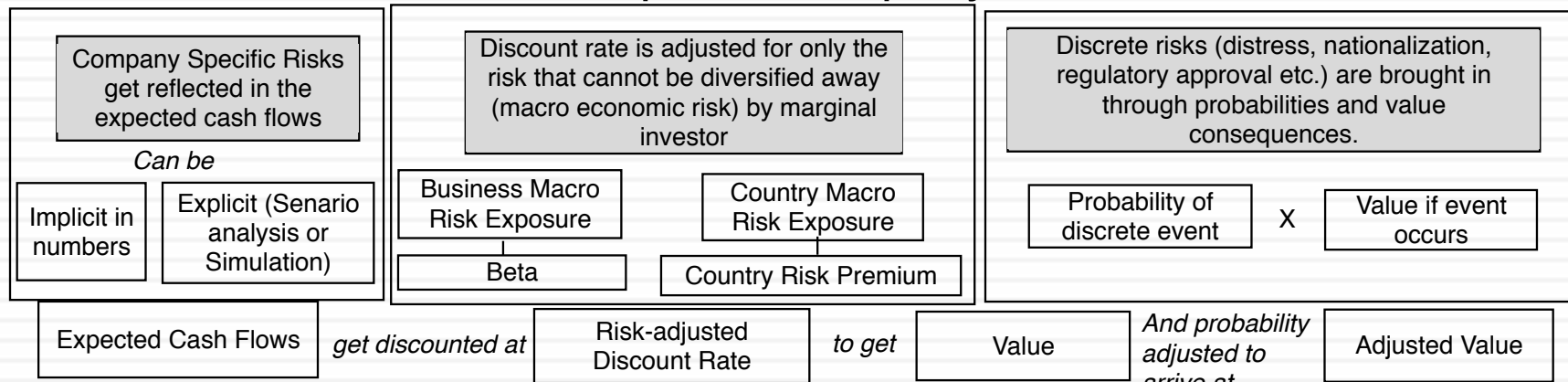# Both costs are sometimes disguised under a different names..

□ In real estate, the cost of equity or capital is often called a "capitalization" or "cap" rate. It is used to capitalize the income on a real estate property to get to its value:

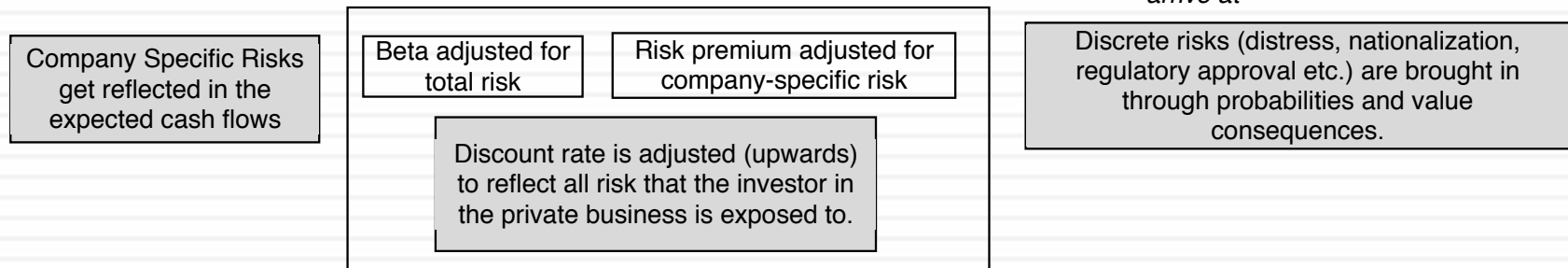Value of property (or business) = Income/ Cap Rate

□ Since the cap rate is just a euphemism for discount rate, to understand what cap rate to use, you have to look at the numerator:

- ◻ If the numerator is net income (after interest expenses and taxes), it is the cost of equity.
- ◻ If the numerator is pre-tax net income (after interest expenses but before taxes), is a pre-tax cost of equity.
- ◻ If the numerator is operating income after taxes (before interest expenses), it is the cost of capital.
- ◻ If the numerator is operating income before taxes, it is the pre-tax cost of capital.

A Template for Risk Adjusting Value

For a public company

Company Specific Risks get reflected in the expected cash flows	**Discount rate is adjusted for only the risk that cannot be diversified away (macro economic risk) by marginal investor**	**Discrete risks (distress, nationalization, regulatory approval etc.) are brought in through probabilities and value consequences.**

Can be

Implicit in numbers	Explicit (Senario analysis or Simulation)

Business Macro Risk Exposure	Country Macro Risk Exposure
Beta	Country Risk Premium

Probability of discrete event	X	Value if event occurs

Expected Cash Flows	*get discounted at*	Risk-adjusted Discount Rate	*to get*	Value	*And probability adjusted to arrive at*	Adjusted Value

Company Specific Risks get reflected in the expected cash flows		**Discrete risks (distress, nationalization, regulatory approval etc.) are brought in through probabilities and value consequences.**

Beta adjusted for total risk	Risk premium adjusted for company-specific risk

Discount rate is adjusted (upwards) to reflect all risk that the investor in the private business is exposed to.

For a private business

What the cost of capital is not..

1. <u>It is not the cost of equity</u>: There is a time and a place to use the cost of equity and a time a place for the cost of capital. You cannot use them interchangeably.

2. <u>It is not a return that you would like to make</u>: Both companies and investors mistake their "hopes" fore expectations. The fact that you would like to make 15% is nice but it is not your cost of capital.

3. <u>It is not a receptacle for all your hopes and fears</u>: Some analysts take the "risk adjusting" in the discount rate too far, adjusting it for any and all risks in the company and their "perception" of those risks.

4. <u>It is not a mechanism for reverse engineering a desired value</u>: A cost of capital is not that discount rate that yields a value you would like to see.

5. <u>It is not the most important input in your valuation</u>: The discount rate is an input into a discounted cash flow valuation but it is definitely not the most critical.

6. <u>It is not a constant</u> across time, companies or even in your company's valuation.
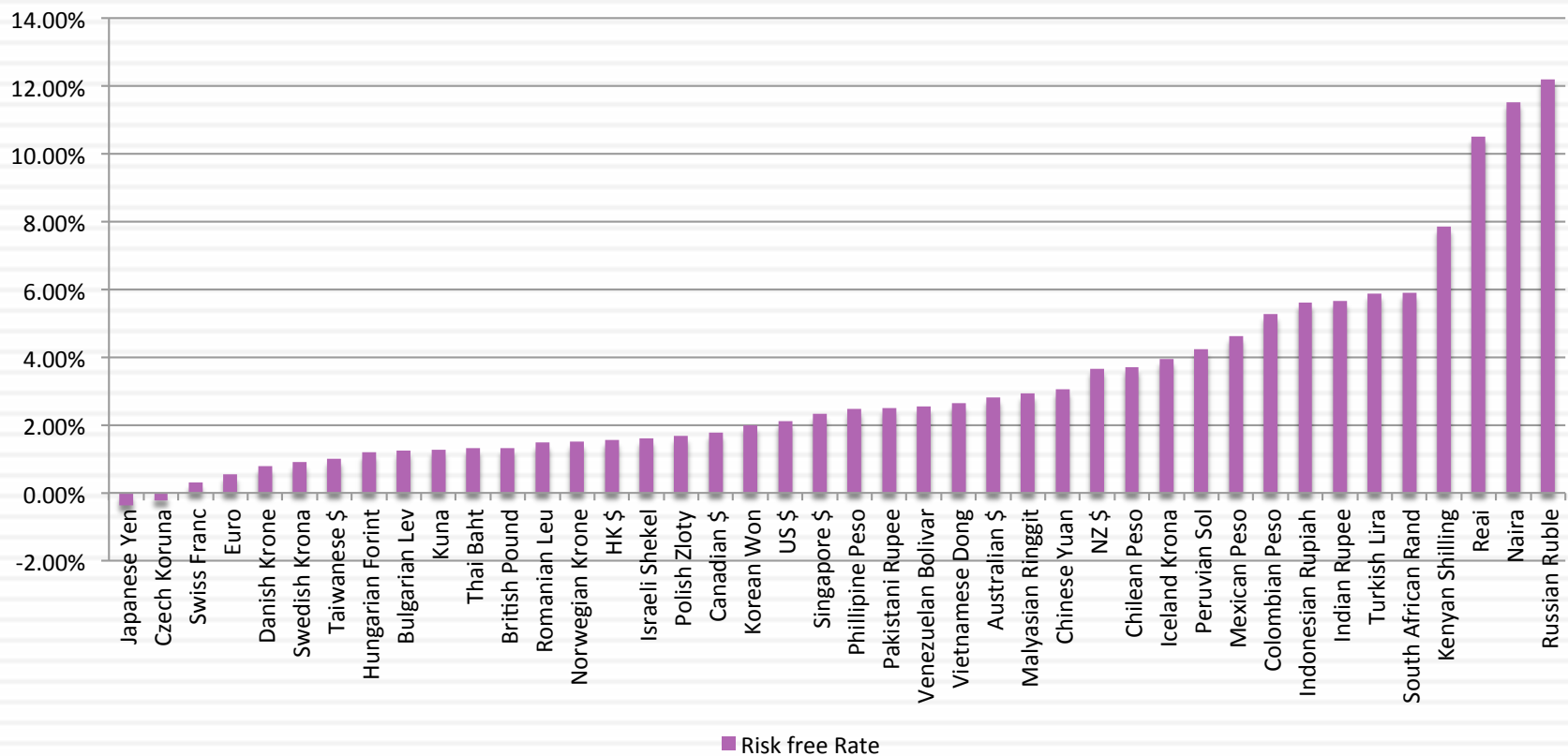
I. THE RISK FREE RATE

Feel the urge to normalize?
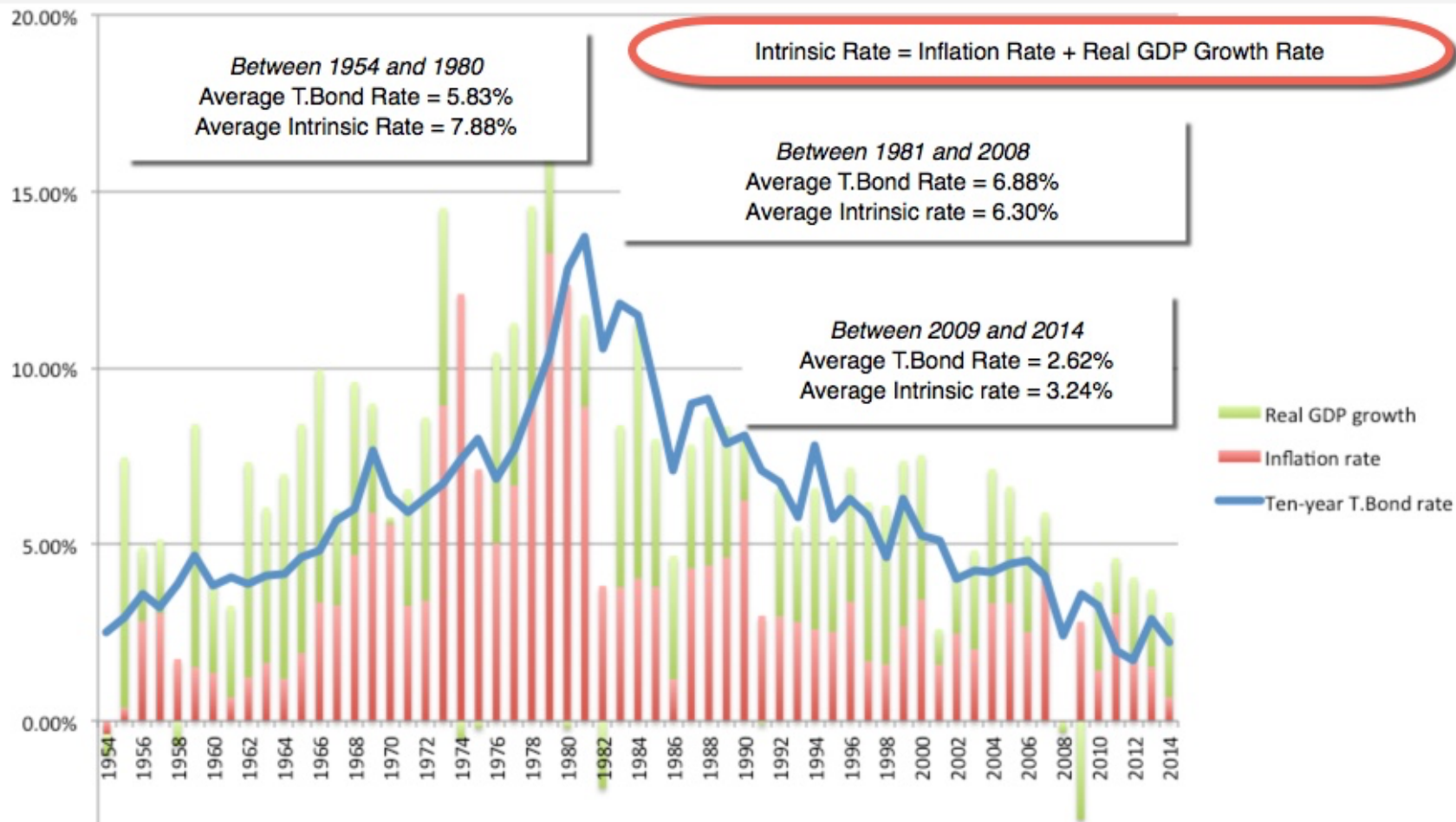
What is the risk free rate?

- 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, then, it has to have

  - No default risk
  - No reinvestment risk

- Following up, here are three broad implications:

  1. Time horizon matters: Thus, the riskfree rates in valuation will depend upon when the cash flow is expected to occur and will vary across time.

  2. Currency matters: The risk free rate will vary across currencies.

  3. Not all government securities are riskfree: Some governments face default risk and the rates on bonds issued by them will not be riskfree.

Risk free rate by currency

Riskfree Rates: January 2015

Why is the risk free rate so low?

Between 1954 and 1980
Average T.Bond Rate = 5.83%
Average Intrinsic Rate = 7.88%

Intrinsic Rate = Inflation Rate + Real GDP Growth Rate

Between 1981 and 2008
Average T.Bond Rate = 6.88%
Average Intrinsic rate = 6.30%

Between 2009 and 2014
Average T.Bond Rate = 2.62%
Average Intrinsic rate = 3.24%

Real GDP growth
Inflation rate
Ten-year T.Bond rate

When the risk free rate changes, the rest of your inputs will as well!

Precipitating factor	Effect of precipitating factor on			
	Interest rates	Equity Risk Premium	Expected growth	Value
A crisis	Decrease (Flight to quality)	Increase (Fear Factor)	Decrease (Feedback to real economy)	Decrease
Bad economic news	Decrease	Increase	Decrease	Depends on whether rates drop more or less than expected growth.
Lower inflation or deflation	Decrease	Unclear	Decrease (in nominal terms)	Depends on which effect (interest rate or growth) dominates.
Central Bank action (Lower Fed rate or QE)	Decrease	Unclear	Decrease (since the central bank is signaling that growth is low now.	Increase, if the economy responds quickly and positively to interest rate drop.

II. THE EQUITY RISK PREMIUM

Using history as a crutch?
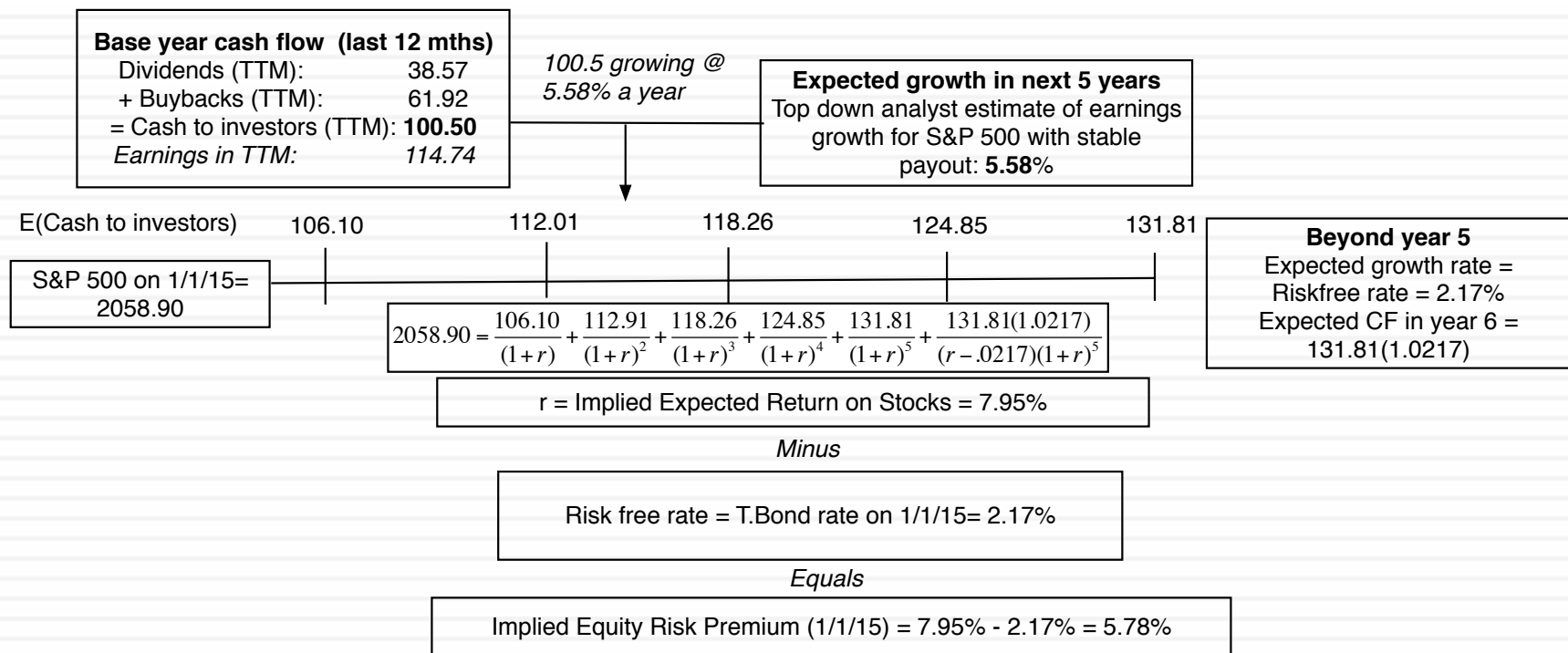
What is the Equity Risk Premium?

- Intuitively, the equity risk premium measures what investors demand over and above the riskfree rate for investing in equities as a class. Think of it as the market price for taking on average equity risk.

- It should depend upon
  - The risk aversion of investors
  - The perceived risk of equity as an investment class

- Unless you believe that investor risk aversion and/or that the perceived risk of equity as a class does not change over time, the equity risk premium is a dynamic number (not a static one).

The Historical Risk Premium

- The historical premium is the premium that stocks have historically earned over riskless securities.

- While the users of historical risk premiums act as if it is a fact (rather than an estimate), it is sensitive to

    - How far back you go in history…

    - Whether you use T.bill rates or T.Bond rates

    - Whether you use geometric or arithmetic averages.

- For instance, looking at the US:

	Arithmetic Average		Geometric Average	
	Stocks - T. Bills	Stocks - T. Bonds	Stocks - T. Bills	Stocks - T. Bonds
1928-2014	8.00%	6.25%	6.11%	4.60%
	2.17%	2.32%		
1965-2014	6.19%	4.12%	4.84%	3.14%
	2.42%	2.74%		
2005-2014	7.94%	4.06%	6.18%	2.73%
	6.05%	8.65%		

A forward-looking ERP?

Base year cash flow (last 12 mths)
Dividends (TTM): 38.57
+ Buybacks (TTM): 61.92
= Cash to investors (TTM): **100.50**
Earnings in TTM: 114.74

100.5 growing @ 5.58% a year

Expected growth in next 5 years
Top down analyst estimate of earnings growth for S&P 500 with stable payout: **5.58**%

E(Cash to investors)   106.10   112.01   118.26   124.85   131.81

S&P 500 on 1/1/15= 2058.90

Beyond year 5
Expected growth rate = Riskfree rate = 2.17%
Expected CF in year 6 = 131.81(1.0217)

$$2058.90 = \frac{106.10}{(1+r)} + \frac{112.91}{(1+r)^2} + \frac{118.26}{(1+r)^3} + \frac{124.85}{(1+r)^4} + \frac{131.81}{(1+r)^5} + \frac{131.81(1.0217)}{(r-.0217)(1+r)^5}$$

r = Implied Expected Return on Stocks = 7.95%

Minus

Risk free rate = T.Bond rate on 1/1/15= 2.17%

Equals

Implied Equity Risk Premium (1/1/15) = 7.95% - 2.17% = 5.78%
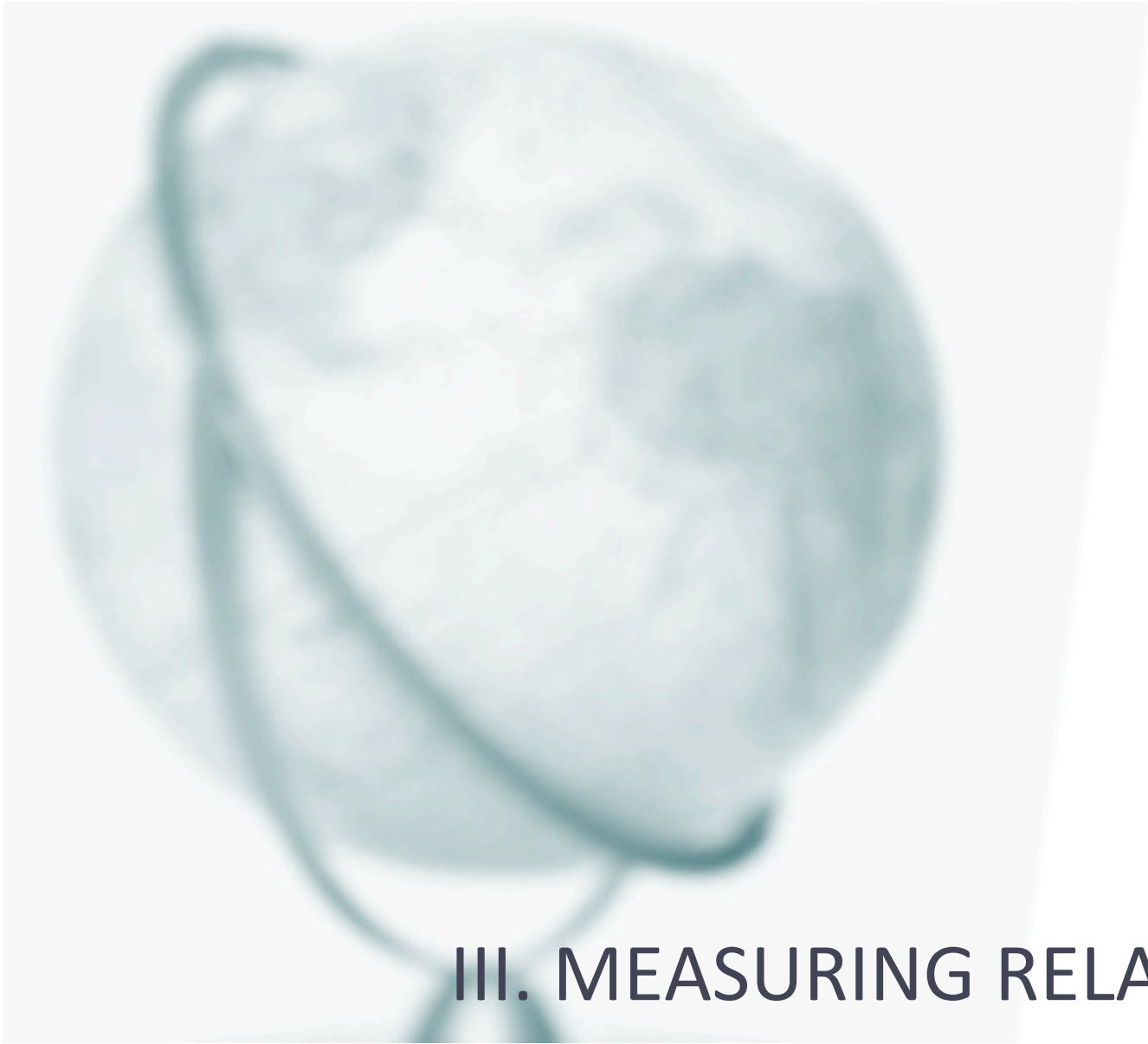
The Implied ERP over time.. Relative to a historical premium
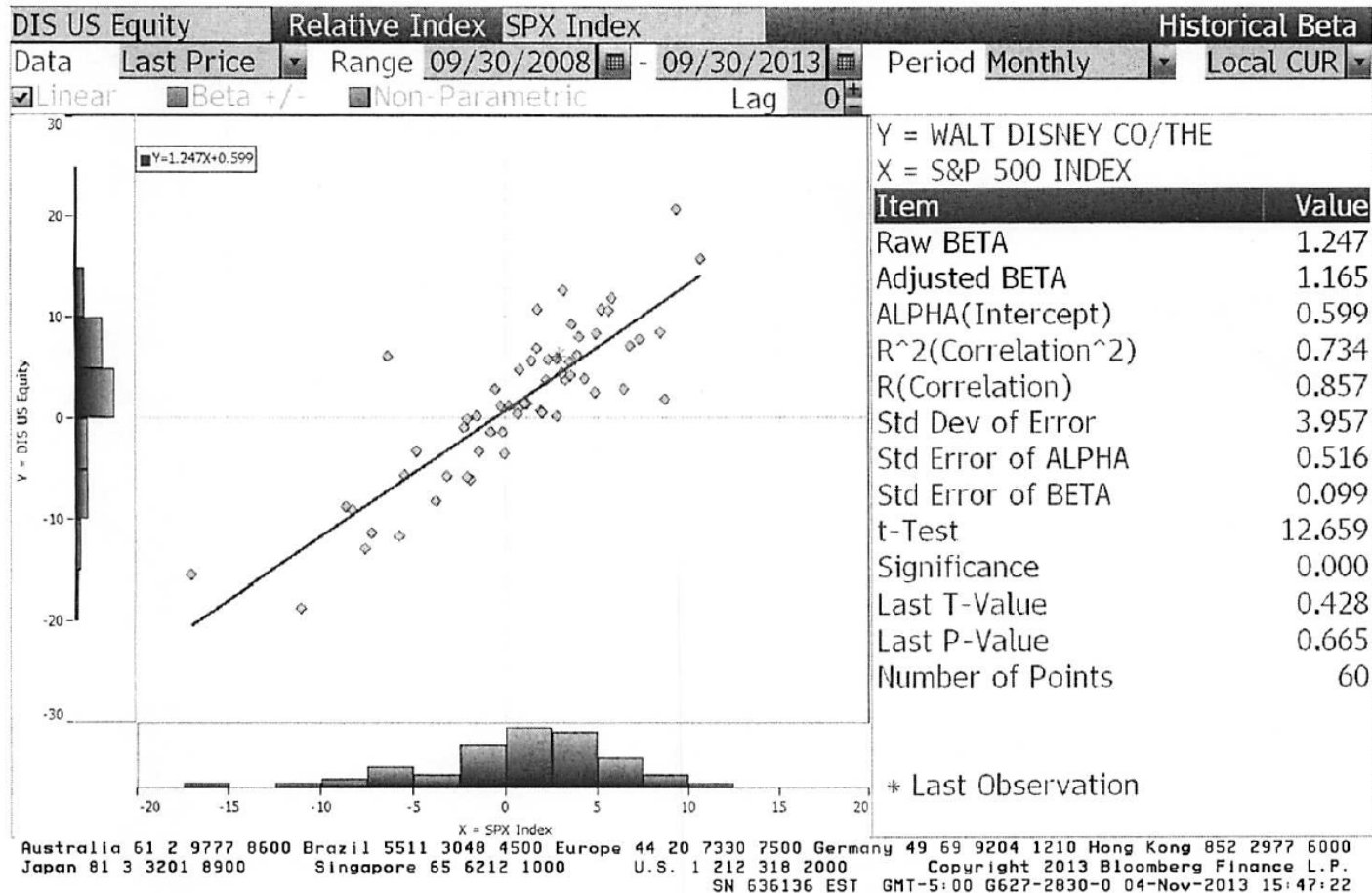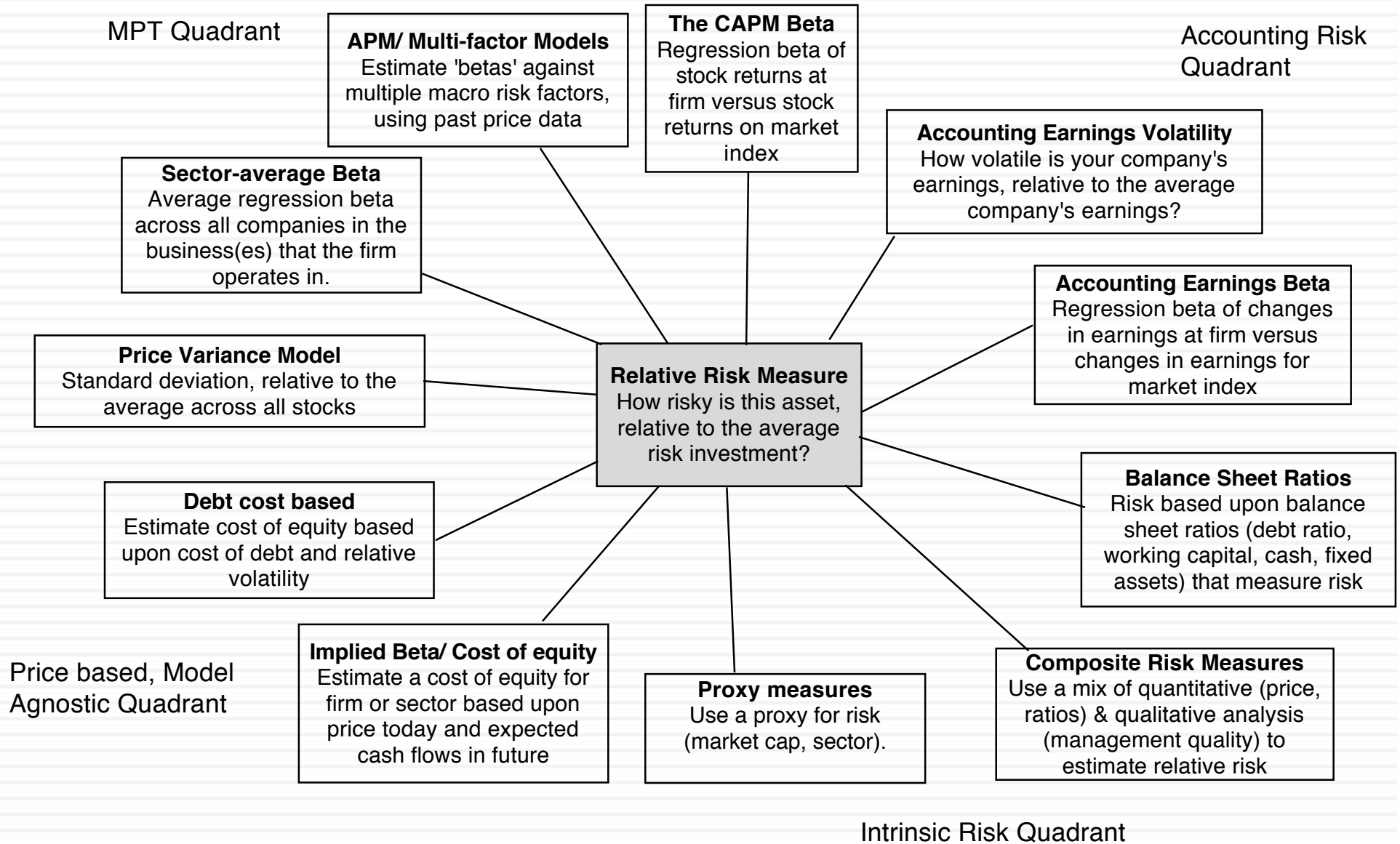
Figure 10: Historical versus Implied Premium - 1961- 2014

III. MEASURING RELATIVE RISK

It should not be Greek to you!
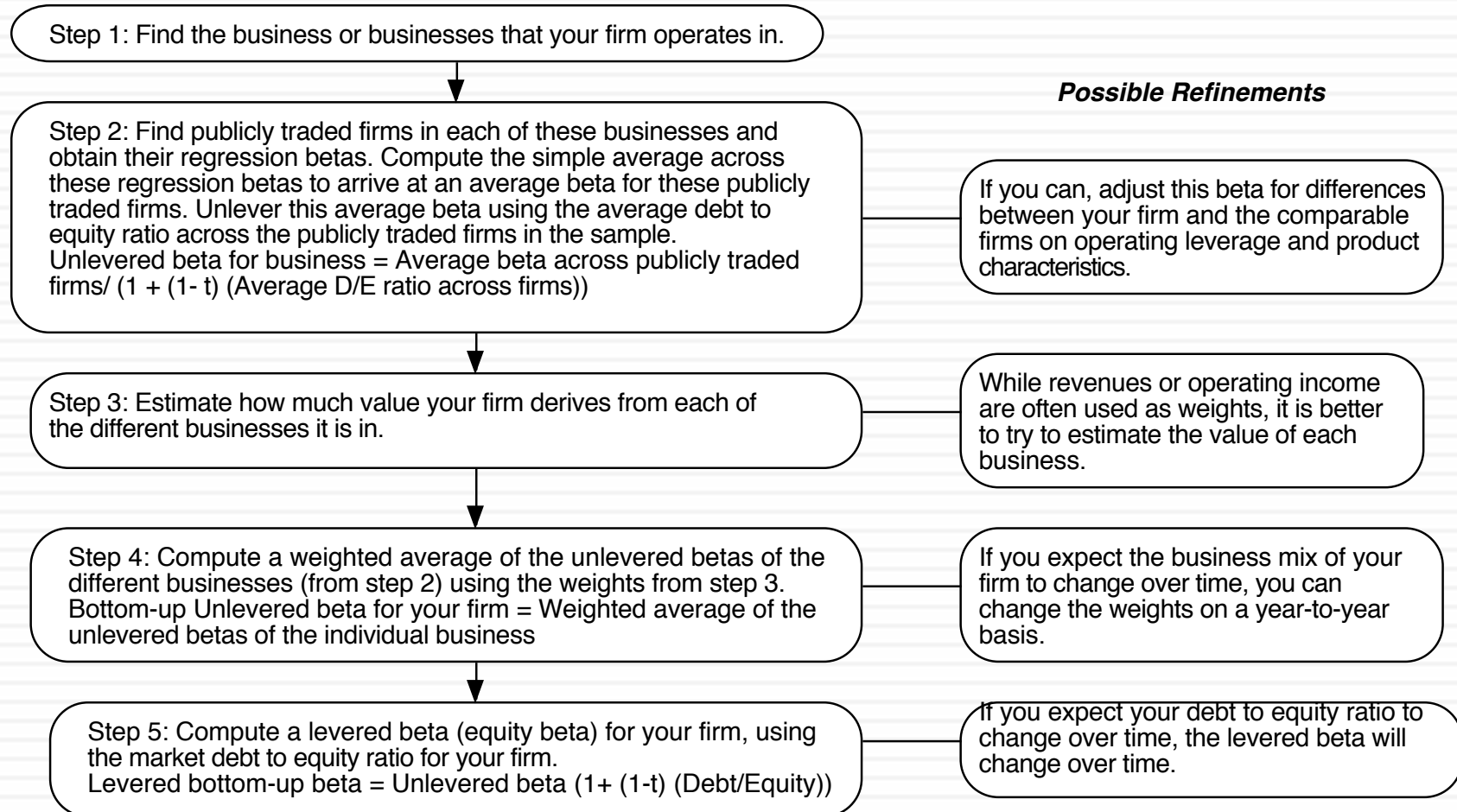
Beta Estimation: Using a Service (Bloomberg)

Aswath Damodaran

Measuring Relative Risk

MPT Quadrant

Accounting Risk Quadrant

APM/ Multi-factor Models
Estimate 'betas' against multiple macro risk factors, using past price data

The CAPM Beta
Regression beta of stock returns at firm versus stock returns on market index

Accounting Earnings Volatility
How volatile is your company's earnings, relative to the average company's earnings?

Sector-average Beta
Average regression beta across all companies in the business(es) that the firm operates in.

Accounting Earnings Beta
Regression beta of changes in earnings at firm versus changes in earnings for market index

Price Variance Model
Standard deviation, relative to the average across all stocks

Relative Risk Measure
How risky is this asset, relative to the average risk investment?

Balance Sheet Ratios
Risk based upon balance sheet ratios (debt ratio, working capital, cash, fixed assets) that measure risk

Debt cost based
Estimate cost of equity based upon cost of debt and relative volatility

Price based, Model Agnostic Quadrant

Implied Beta/ Cost of equity
Estimate a cost of equity for firm or sector based upon price today and expected cash flows in future

Proxy measures
Use a proxy for risk (market cap, sector).

Composite Risk Measures
Use a mix of quantitative (price, ratios) & qualitative analysis (management quality) to estimate relative risk

Intrinsic Risk Quadrant

Bottom-up Betas

Step 1: Find the business or businesses that your firm operates in.

Possible Refinements

Step 2: Find publicly traded firms in each of these businesses and obtain their regression betas. Compute the simple average across these regression betas to arrive at an average beta for these publicly traded firms. Unlever this average beta using the average debt to equity ratio across the publicly traded firms in the sample.
Unlevered beta for business = Average beta across publicly traded firms/ (1 + (1- t) (Average D/E ratio across firms))

If you can, adjust this beta for differences between your firm and the comparable firms on operating leverage and product characteristics.

Step 3: Estimate how much value your firm derives from each of the different businesses it is in.

While revenues or operating income are often used as weights, it is better to try to estimate the value of each business.

Step 4: Compute a weighted average of the unlevered betas of the different businesses (from step 2) using the weights from step 3.
Bottom-up Unlevered beta for your firm = Weighted average of the unlevered betas of the individual business

If you expect the business mix of your firm to change over time, you can change the weights on a year-to-year basis.

Step 5: Compute a levered beta (equity beta) for your firm, using the market debt to equity ratio for your firm.
Levered bottom-up beta = Unlevered beta (1+ (1-t) (Debt/Equity))

If you expect your debt to equity ratio to change over time, the levered beta will change over time.

Aswath Damodaran

Estimating Bottom Up Betas & Costs of Equity: Disney

Business	Revenues	EV/Sales	Value of Business	Proportion of Disney	Unlevered beta	Value	Proportion
Media Networks	$20,356	3.27	$66,580	49.27%	1.03	$66,579.81	49.27%
Parks & Resorts	$14,087	3.24	$45,683	33.81%	0.70	$45,682.80	33.81%
Studio Entertainment	$5,979	3.05	$18,234	13.49%	1.10	$18,234.27	13.49%
Consumer Products	$3,555	0.83	$2,952	2.18%	0.68	$2,951.50	2.18%
Interactive	$1,064	1.58	$1,684	1.25%	1.22	$1,683.72	1.25%
Disney Operations	$45,041		$135,132	100.00%	0.9239	$135,132.11	

Business	Unlevered beta	Value of business	D/E ratio	Levered beta	Cost of Equity
Media Networks	1.0313	$66,580	10.03%	1.0975	9.07%
Parks & Resorts	0.7024	$45,683	11.41%	0.7537	7.09%
Studio Entertainment	1.0993	$18,234	20.71%	1.2448	9.92%
Consumer Products	0.6752	$2,952	117.11%	1.1805	9.55%
Interactive	1.2187	$1,684	41.07%	1.5385	11.61%
Disney Operations	0.9239	$135,132	13.10%	1.0012	8.52%

Aswath Damodaran

Bottom up Betas: Sampling Issues

- What are comparable firms, if you just want to extract betas?
  - A comparable firm, at least for measuring betas (exposure to macro risk), is one that does well when your company does well and badly when it does badly.
  - It follows then that a comparable firm does not have to be in the same sector as you do.
  - If you decide to add other criteria to get to comparable firms, you must have an a priori reason that you are willing to state (and defend) that those criteria are related to what you are trying to measure (exposure to macro risk)
- How big a sample?
  - The big advantage of "bottom up" betas is that you are averaging across many betas. It is thus the law of large numbers that you are benefiting from, not theory.
  - As long as your betas are not systematically biased up or down, the standard error of the average beta across a sample can be written as follows:

  $$\text{Standard Error of Beta} = \frac{\text{Average Standard Error of Beta}}{\sqrt{\text{Number of firms in sample}}}$$

  - With 100 firms in your sample, your beta will ten times more precise than a single regression beta. Even with 10 firms, it will be about three times more precise.

An Implied Cost of Equity: The DDM version

- If you have a discounted cash flow model and are willing to assume that the price paid is a fair value, you can extract the cost of equity from the price paid.

- In its simplest version, this takes the form of a stable growth dividend discount model:

$$Value\ of\ Stock = Price\ of\ Stock = \frac{Expected\ Divdends\ per\ share}{(Cost\ of\ Equity - Expected\ growth\ rate)}$$

- In this model, the cost of equity can then be solved for as follows:

  Cost of Equity = D/P + g = Dividend Yield + Expected growth rate

- To use this model, you have to assume that your company is
  - A mature company growing at a rate less than equal to the economy (< Risk free Rate)
  - Is paying out its potential dividends as actual dividends
  - Is correctly priced by the market

III. THE GARNISHING

Here a premium, there a premium..

The Build up Approach

☐ For many analysts, the risk free rate and equity risk premium are just the starting points to get to a cost of equity. The required return that you obtain is then augmented with premiums for "other" risks to arrive at a built up cost of equity.

☐ The justifications offered for these premiums are varied but can be broadly classified into:

- ❑ Historical premium: The historical data justifies adding a premium (for small capitalization, illiquidity)
- ❑ Intuition: There are risks that are being missed that have to be built in
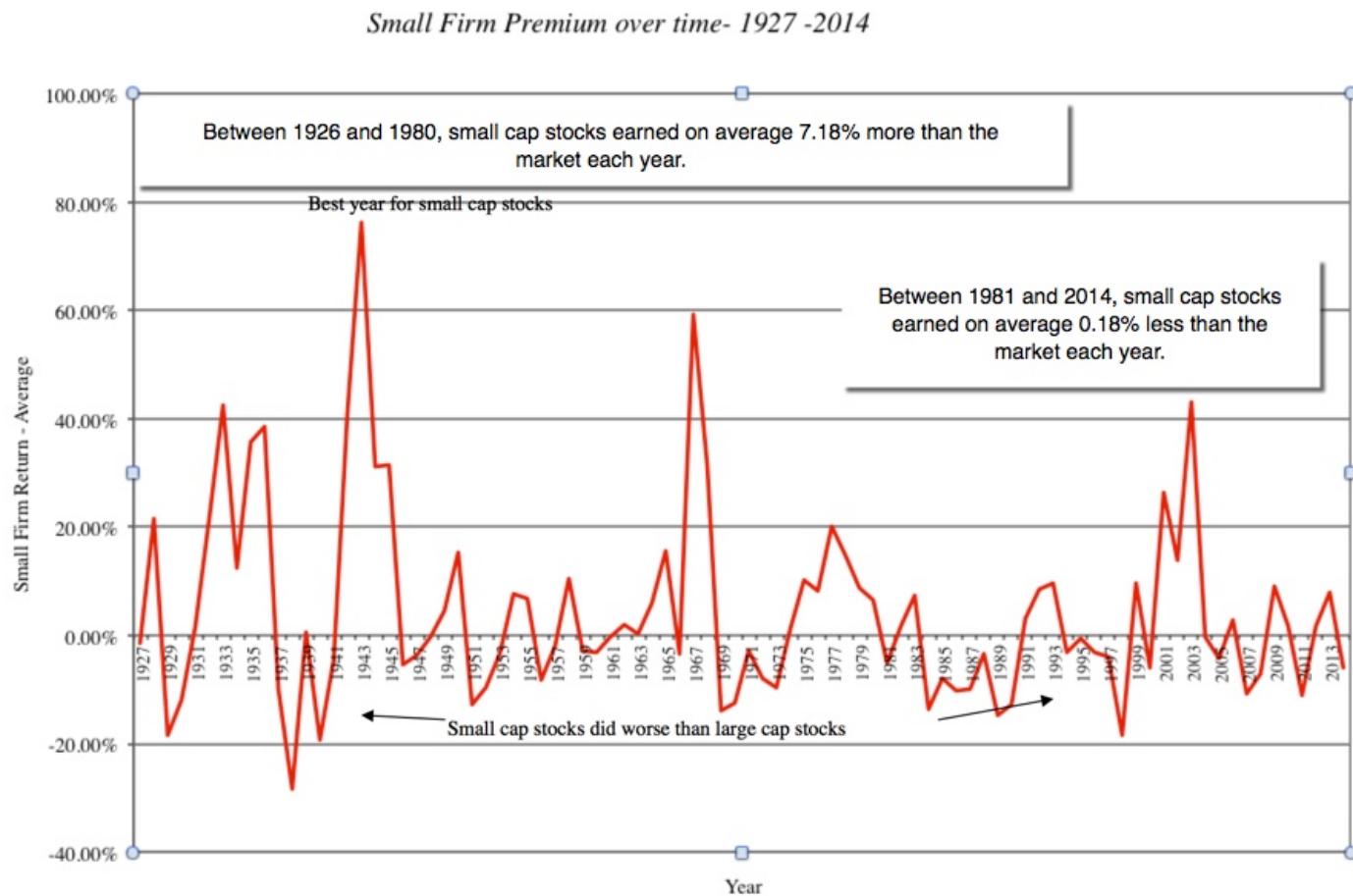- ❑ Reasonableness: The discount rate that I am getting looks too low.
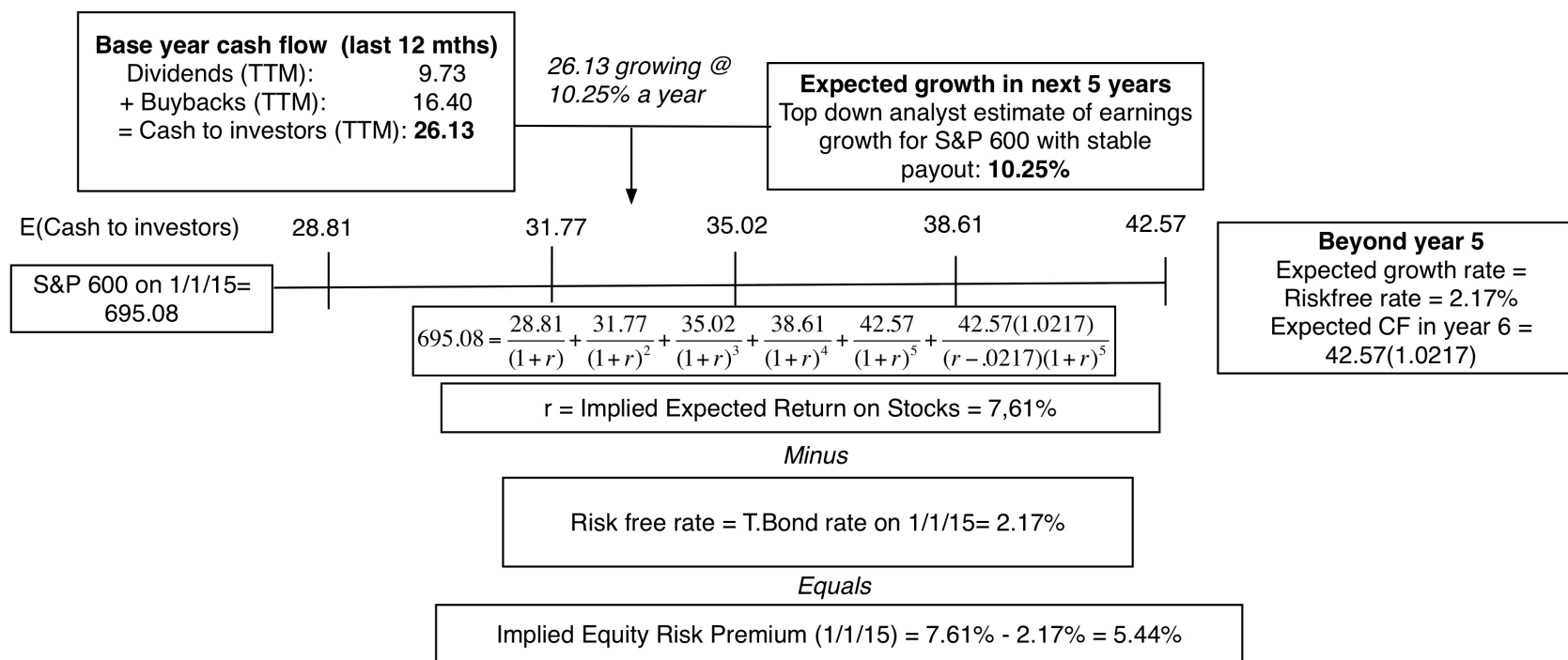
The Most Added Premium: The Small Cap Premium
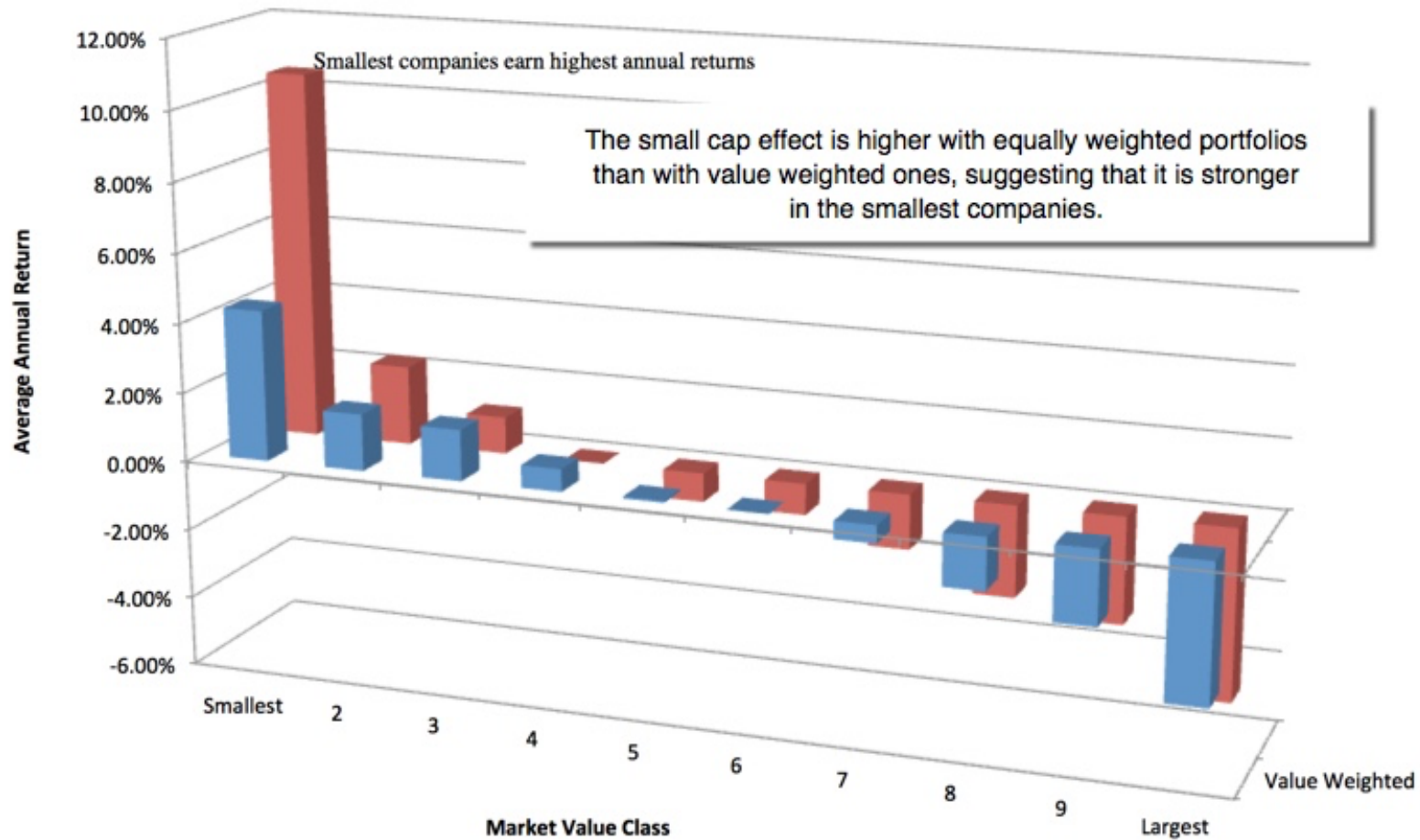
Historical premiums are noisy..

Decile	Average	Standard Error	Maximum	Minimum
Smallest	4.33%	1.96%	76.28%	-28.42%
2	1.63%	1.14%	41.25%	-17.96%
3	1.47%	0.77%	41.98%	-13.54%
4	0.64%	0.55%	15.56%	-7.33%
5	0.05%	0.53%	11.63%	-16.05%
6	-0.01%	0.51%	15.21%	-14.01%
7	-0.51%	0.55%	7.48%	-19.50%
8	-1.50%	0.81%	11.20%	-29.42%
9	-2.13%	1.02%	21.96%	-36.09%
Largest	-3.98%	1.56%	31.29%	-65.57%

Historical data can hide trends..

Small Firm Premium over time- 1927 -2014

Between 1926 and 1980, small cap stocks earned on average 7.18% more than the market each year.

Best year for small cap stocks

Between 1981 and 2014, small cap stocks earned on average 0.18% less than the market each year.

Small cap stocks did worse than large cap stocks

And the market does not seem to be pricing it in..

Base year cash flow (last 12 mths)
Dividends (TTM): 9.73
+ Buybacks (TTM): 16.40
= Cash to investors (TTM): **26.13**

26.13 growing @ 10.25% a year

Expected growth in next 5 years
Top down analyst estimate of earnings growth for S&P 600 with stable payout: **10.25%**

E(Cash to investors) 28.81 31.77 35.02 38.61 42.57

S&P 600 on 1/1/15= 695.08

Beyond year 5
Expected growth rate = Riskfree rate = 2.17%
Expected CF in year 6 = 42.57(1.0217)

$$695.08 = \frac{28.81}{(1+r)} + \frac{31.77}{(1+r)^2} + \frac{35.02}{(1+r)^3} + \frac{38.61}{(1+r)^4} + \frac{42.57}{(1+r)^5} + \frac{42.57(1.0217)}{(r-.0217)(1+r)^5}$$

r = Implied Expected Return on Stocks = 7,61%

Minus

Risk free rate = T.Bond rate on 1/1/15= 2.17%

Equals

Implied Equity Risk Premium (1/1/15) = 7.61% - 2.17% = 5.44%

The implied ERP for the S&P 500 was 5.78%. If there is a small cap premium, where is it?

But, but.. My company is risky..

- Estimation versus Economic uncertainty
  - Estimation uncertainty reflects the possibility that you could have the "wrong model" or estimated inputs incorrectly within this model.
  - Economic uncertainty comes the fact that markets and economies can change over time and that even the best models will fail to capture these unexpected changes.
- Micro uncertainty versus Macro uncertainty
  - Micro uncertainty refers to uncertainty about the potential market for a firm's products, the competition it will face and the quality of its management team.
  - Macro uncertainty reflects the reality that your firm's fortunes can be affected by changes in the macro economic environment.
- Discrete versus continuous uncertainty
  - Discrete risk: Risks that lie dormant for periods but show up at points in time. (Examples: A drug working its way through the FDA pipeline may fail at some stage of the approval process or a company in Venezuela may be nationalized)
  - Continuous risk: Risks changes in interest rates or economic growth occur continuously and affect value as they happen.
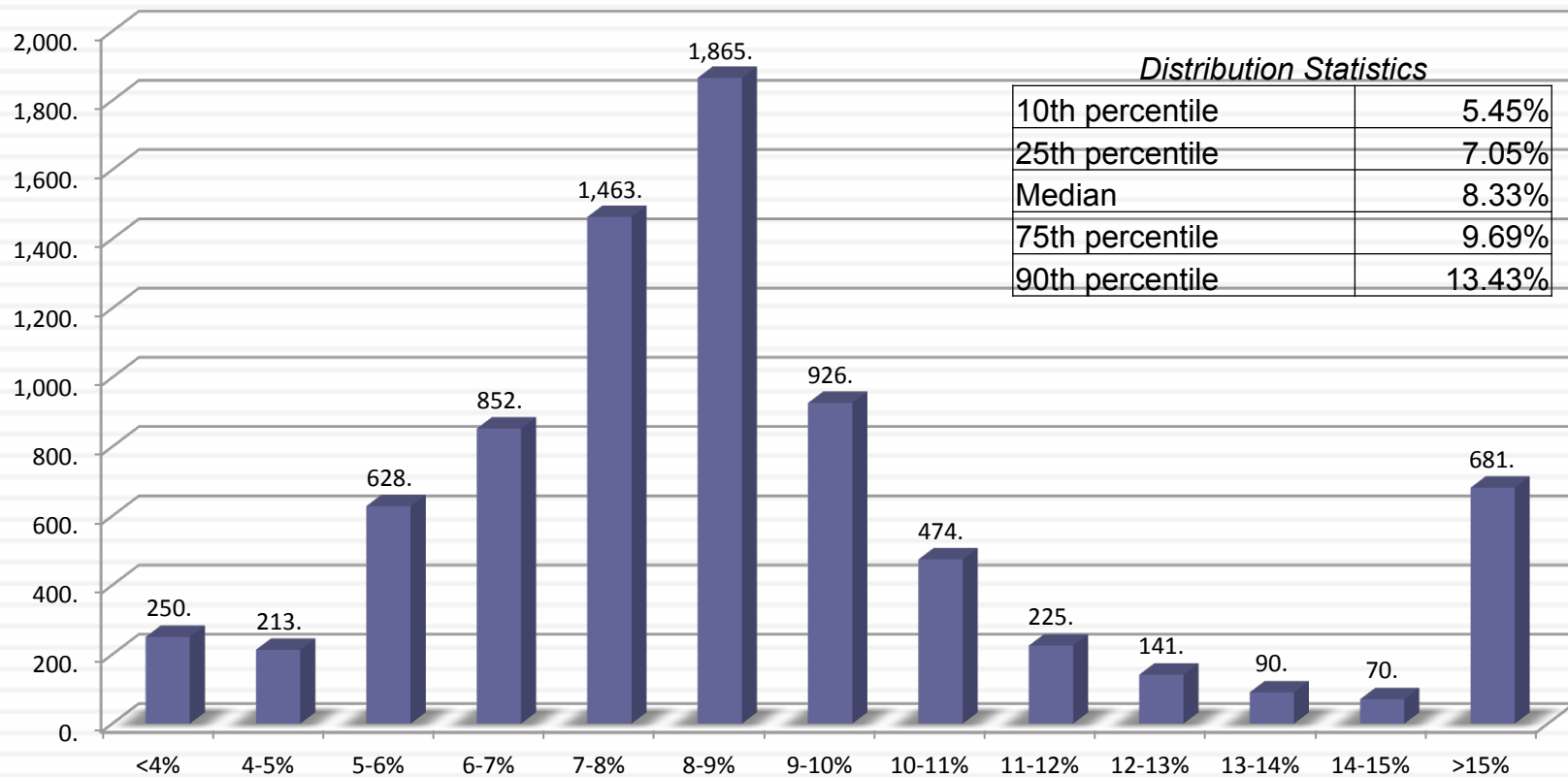
Risk and Cost of Equity: The role of the marginal investor

- Not all risk counts: While the notion that the cost of equity should be higher for riskier investments and lower for safer investments is intuitive, what risk should be built into the cost of equity is the question.

- Risk through whose eyes? While risk is usually defined in terms of the variance of actual returns around an expected return, risk and return models in finance assume that the risk that should be rewarded (and thus built into the discount rate) in valuation should be the risk perceived by the marginal investor in the investment

- The diversification effect: Most risk and return models in finance also assume that the marginal investor is well diversified, and that the only risk that he or she perceives in an investment is risk that cannot be diversified away (i.e, market or non-diversifiable risk). In effect, it is primarily economic, macro, continuous risk that should be incorporated into the cost of equity.
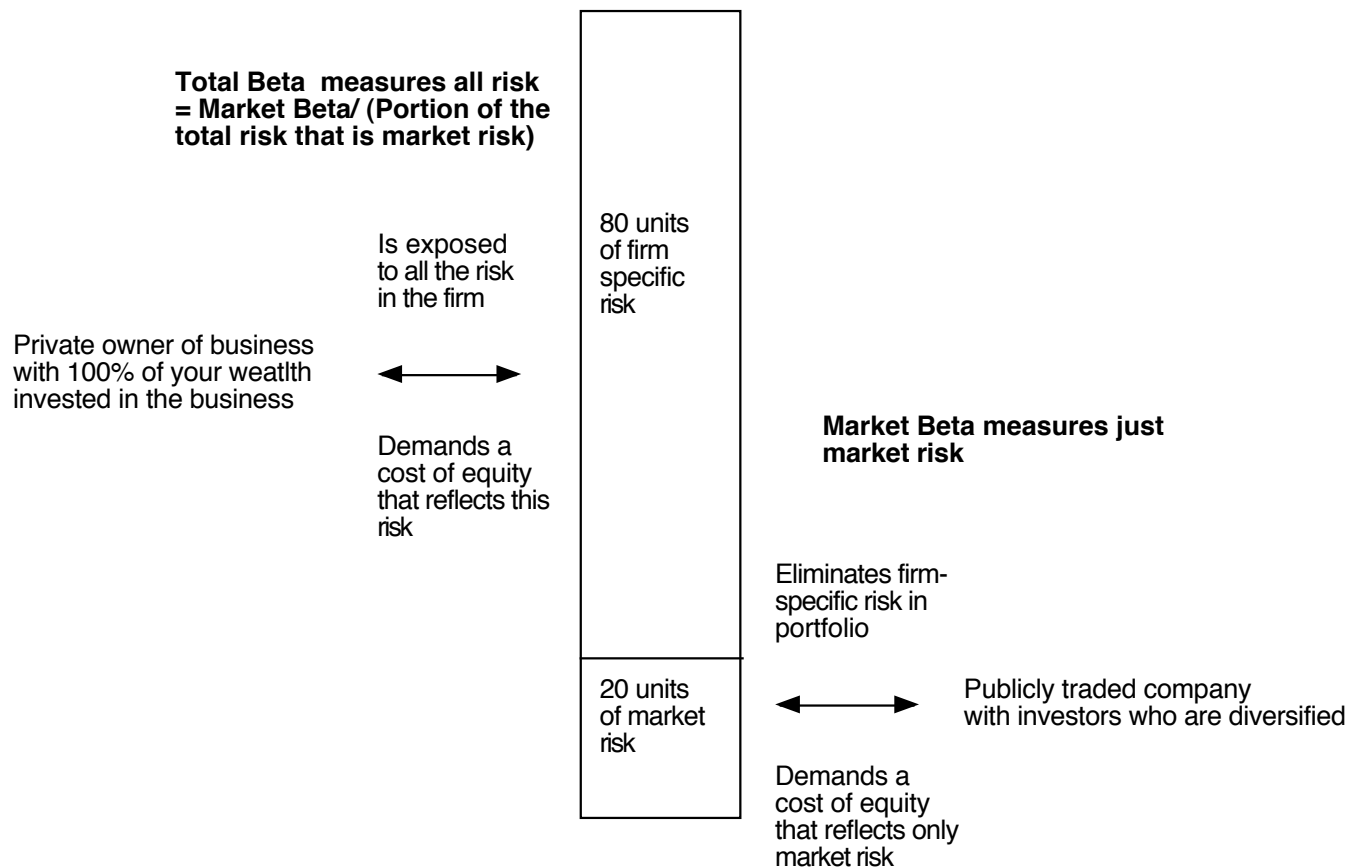
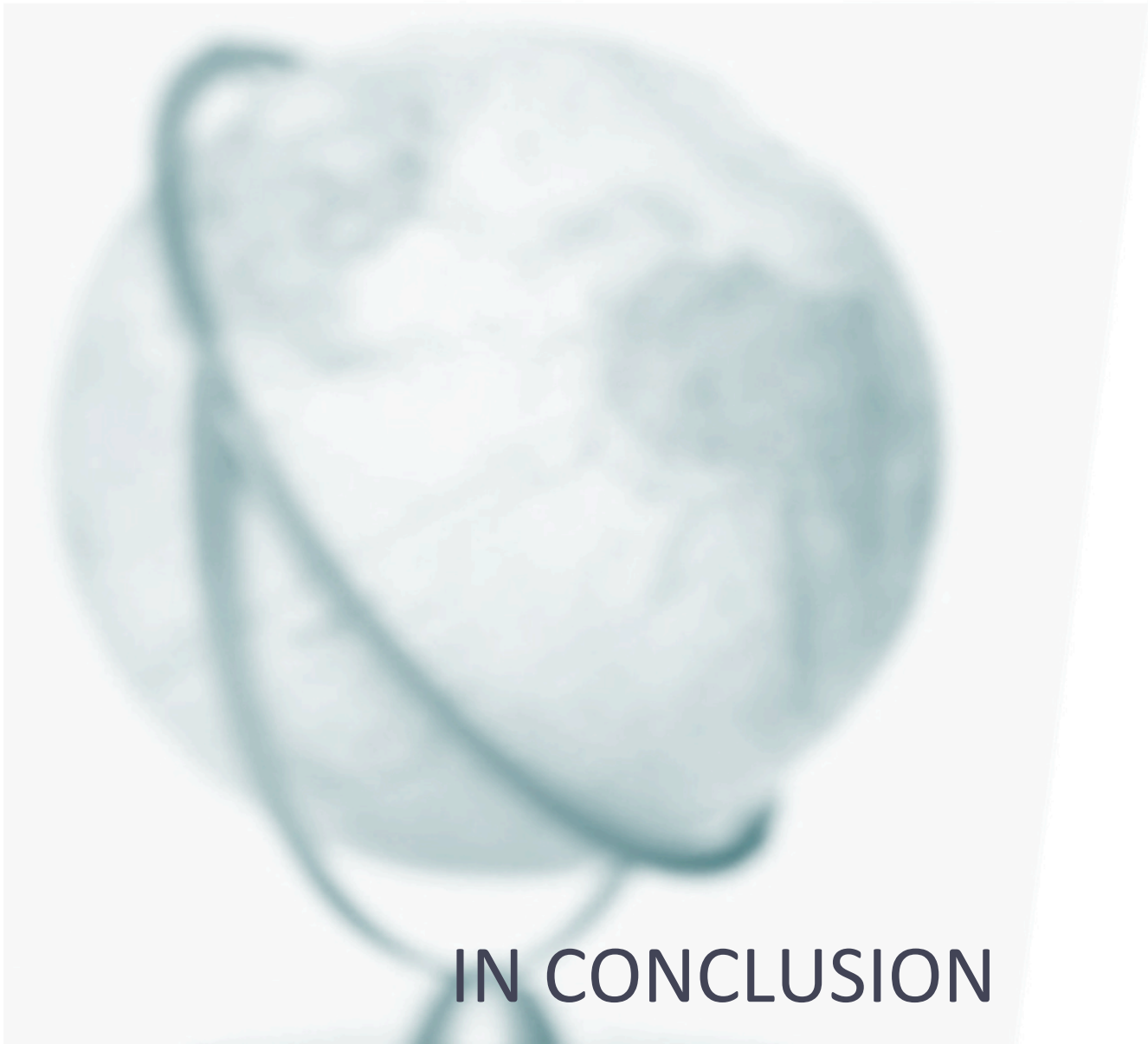*Aswath Damodaran*

The Cost of Equity (for diversified investors)

Cost of equity for Publicly traded US firms - January 2015

Distribution Statistics	
10th percentile	5.45%
25th percentile	7.05%
Median	8.33%
75th percentile	9.69%
90th percentile	13.43%

Bar chart values:
- <4%: 250.
- 4-5%: 213.
- 5-6%: 628.
- 6-7%: 852.
- 7-8%: 1,463.
- 8-9%: 1,865.
- 9-10%: 926.
- 10-11%: 474.
- 11-12%: 225.
- 12-13%: 141.
- 13-14%: 90.
- 14-15%: 70.
- >15%: 681.

If the "buyer" is not diversified..

Private Owner versus Publicly Traded Company Perceptions of Risk in an Investment

Total Beta measures all risk = Market Beta/ (Portion of the total risk that is market risk)

80 units of firm specific risk

Is exposed to all the risk in the firm

Private owner of business with 100% of your weatlth invested in the business

Demands a cost of equity that reflects this risk

Market Beta measures just market risk

Eliminates firm-specific risk in portfolio

20 units of market risk

Publicly traded company with investors who are diversified

Demands a cost of equity that reflects only market risk

IN CONCLUSION

Less rules, more first principles

Lesson 1: It's important, but not that important..

- The cost of capital is a driver of value but it is not as much of a driver as you think.

- This is particularly true, with young growth companies and when there is a great deal of uncertainty about the future.

- As a general rule, we spend far too much time on the cost of capital and far too little on cash flows and growth rates.

Lesson 2: There are many ways of estimating cost of capital, but most of them are wrong or inconsistent

- It is true that there are competing risk and return models, that a wide variety of estimation practices exist for estimating inputs to these model and that there are multiple data sources for each input.
- That does not imply that you have license to mix and match models, practices and data sources to get whatever number you want.
- Many estimates of cost of capital are just plain wrong, because they are based on bad data, ignore basic statistical rules or just don't pass the common sense test.
- Other estimates of cost of capital are internally inconsistent, because they mix and match models and practices that were never meant to be mixed.

Lesson 3: Just because a practice is established does not make it right

- There is a valuation establishment and it likes writing rules that lay out the templates for established or acceptable practice.

- Those rules are then enforced by legal and regulatory systems that insist that everyone follow the rules.

- At some point, the strongest rationale for why we do what we do is that everyone does it and has always done it.

- In the legal and regulatory settings, this gets reinforced by the fact that it is easier to defend a bad practice of long standing than it is to argue for a better practice.

Lesson 4: Watch out for agenda-driven (or bias-driven) costs of capital

- Much as we would like to pose as objective analysts with no interest in tilting the value of a company of an asset one way or the other, once we are paid to do valuations, bias will follow.

- The strongest determinant of what practices you will use to get a cost of capital is that bias that you have to push the value up (or down).

  - If your bias is upwards (to make value higher), you will find every rationale you can for reducing your cost of capital.

  - If your bias is downwards (to make value lower), you will find every rationale you can for increasing your cost of capital.