Value: More than a Number

Aswath Damodaran
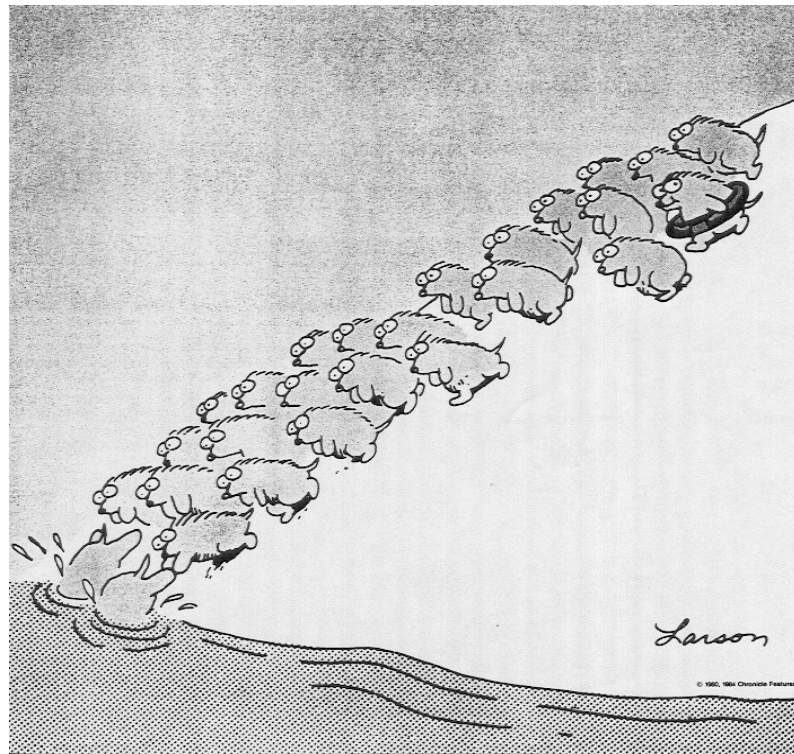
http://www.damodaran.com

Croatia and Slovenia, May 2010

A motive for valuation and corporate finance…

" One hundred thousand lemmings cannot be wrong"   *Graffiti*

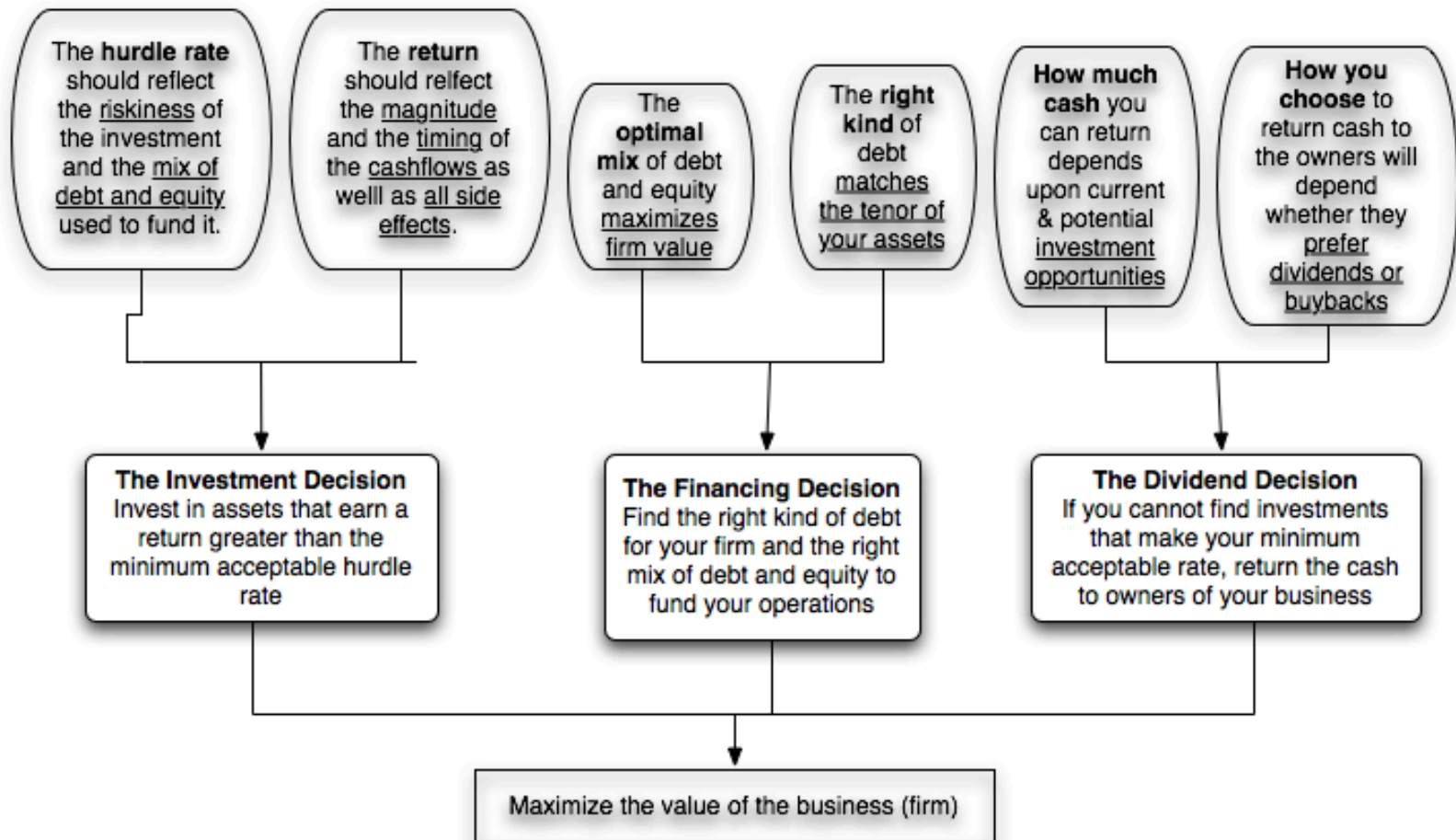# Let's start with an accounting balance sheet…

The Balance Sheet

Assets		Liabilities	
Long Lived Real Assets	Fixed Assets	Current Liabilties	Short-term liabilities of the firm
Short-lived Assets	Current Assets	Debt	Debt obligations of firm
Investments in securities & assets of other firms	Financial Investments	Other Liabilities	Other long-term obligations
Assets which are not physical, like patents & trademarks	Intangible Assets	Equity	Equity investment in firm

And replace it with a financial balance sheet…

Assets		Liabilities

Assets

Existing Investments
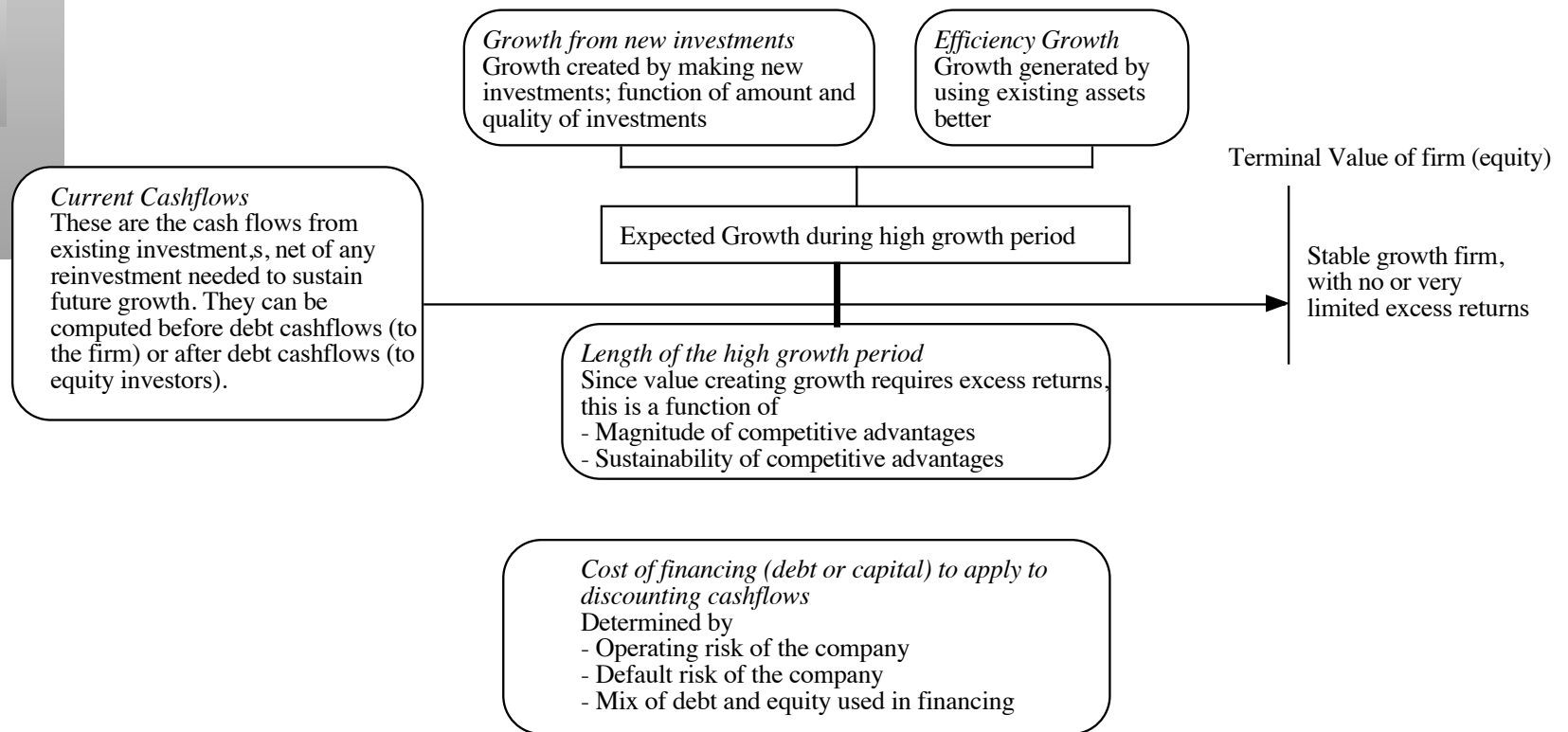Generate cashflows today
Includes long lived (fixed) and
short-lived(working
capital) assets
— Assets in Place

Expected Value that will be
created by future investments
— Growth Assets

Liabilities

Debt — Fixed Claim on cash flows
Little or No role in management
Fixed Maturity
Tax Deductible

Equity — Residual Claim on cash flows
Significant Role in management
Perpetual Lives

Corporate Finance: First Principles

Corporate Finance: The Big Picture

The **hurdle rate** should reflect the riskiness of the investment and the mix of debt and equity used to fund it.

The **return** should relfect the magnitude and the timing of the cashflows as welll as all side effects.

The **optimal mix** of debt and equity maximizes firm value

The **right kind** of debt matches the tenor of your assets

How much cash you can return depends upon current & potential investment opportunities

How you choose to return cash to the owners will depend whether they prefer dividends or buybacks

The Investment Decision
Invest in assets that earn a return greater than the minimum acceptable hurdle rate

The Financing Decision
Find the right kind of debt for your firm and the right mix of debt and equity to fund your operations

The Dividend Decision
If you cannot find investments that make your minimum acceptable rate, return the cash to owners of your business

Maximize the value of the business (firm)

Connecting to Valuation…

Growth from new investments
Growth created by making new investments; function of amount and quality of investments

Efficiency Growth
Growth generated by using existing assets better

Terminal Value of firm (equity)

Current Cashflows
These are the cash flows from existing investment,s, net of any reinvestment needed to sustain future growth. They can be computed before debt cashflows (to the firm) or after debt cashflows (to equity investors).

Expected Growth during high growth period

Stable growth firm, with no or very limited excess returns

Length of the high growth period
Since value creating growth requires excess returns, this is a function of
- Magnitude of competitive advantages
- Sustainability of competitive advantages

Cost of financing (debt or capital) to apply to discounting cashflows
Determined by
- Operating risk of the company
- Default risk of the company
- Mix of debt and equity used in financing

Misconceptions about Valuation

- Myth 1: A valuation is an objective search for "true" value
  - Truth 1.1: All valuations are biased. The only questions are how much and in which direction.
  - Truth 1.2: The direction and magnitude of the bias in your valuation is directly proportional to who pays you and how much you are paid.
- Myth 2.: A good valuation provides a precise estimate of value
  - Truth 2.1: There are no precise valuations
  - Truth 2.2: The payoff to valuation is greatest when valuation is least precise.
- Myth 3: . The more quantitative a model, the better the valuation
  - Truth 3.1: One's understanding of a valuation model is inversely proportional to the number of inputs required for the model.
  - Truth 3.2: Simpler valuation models do much better than complex ones.

Valuation: The Big Picture

If you get the big picture, the details will follow…

Discounted Cash Flow Valuation

- **What is it**: In discounted cash flow valuation, the value of an asset is the present value of the expected cash flows on the asset.

- **Philosophical Basis**: Every asset has an intrinsic value that can be estimated, based upon its characteristics in terms of cash flows, growth and risk.

- **Information Needed**: To use discounted cash flow valuation, you need
  - to estimate the <u>life of the asset</u>
  - to estimate the <u>cash flows</u> during the life of the asset
  - to estimate the <u>discount rate</u> to apply to these cash flows to get present value

- **Market Inefficiency**: Markets are assumed to make <u>mistakes</u> in pricing assets <u>across time</u>, and are assumed to correct themselves over time, as new information comes out about assets.

DCF Choices: Equity Valuation versus Firm Valuation

Firm Valuation: Value the entire business

Assets		Liabilities	
Existing Investments Generate cashflows today Includes long lived (fixed) and short-lived(working capital) assets	Assets in Place	Debt	Fixed Claim on cash flows Little or No role in management *Fixed Maturity* *Tax Deductible*
Expected Value that will be created by future investments	Growth Assets	Equity	Residual Claim on cash flows Significant Role in management *Perpetual Lives*

Equity valuation: Value just the equity claim in the business

DISCOUNTED CASHFLOW VALUATION

Cashflow to Firm
EBIT (1-t)
- (Cap Ex - Depr)
- Change in WC
= FCFF

Expected Growth
Reinvestment Rate
* Return on Capital

Firm is in stable growth:
Grows at constant rate
forever

Terminal Value= $FCFF_{n+1}/(r-g_n)$

Value of Operating Assets
+ Cash & Non-op Assets
= Value of Firm
- Value of Debt
= Value of Equity

$FCFF_1$ $FCFF_2$ $FCFF_3$ $FCFF_4$ $FCFF_5$ $FCFF_n$ ....

Forever

Discount at WACC= Cost of Equity (Equity/(Debt + Equity)) + Cost of Debt (Debt/(Debt+ Equity))

Cost of Equity

Cost of Debt
(Riskfree Rate
+ Default Spread) (1-t)

Weights
Based on Market Value

Riskfree Rate :
- No default risk
- No reinvestment risk
- In same currency and
in same terms (real or
nominal as cash flows

+

Beta
- Measures market risk

X

Risk Premium
- Premium for average
risk investment

| Type of Business | Operating Leverage | Financial Leverage | Base Equity Premium | Country Risk Premium |

KRKA: April 2010

Average reinvestment rate from 2007-09: 57.13%

Average ROC from 2007-09: 20.7%

Current Cashflow to Firm
EBIT(1-t) :   179.33
- Nt CpX   15.00
- Chg WC   68.00
= FCFF   96.33
Reinv Rate = (15+68)/179.33= 46.28%
Tax rate = 23.69%
Return on capital = 18.71%

Reinvestment Rate
57.13%

Expected Growth in EBIT (1-t)
.5713*.207=0.1183
11.83%

Return on Capital
20.7%

Stable Growth
g = 3%; Beta = 0.80
Country Premium= 0.6%
Tax rate = 21%
Cost of capital = 7.60%
ROC= 7.60%;
Reinvestment Rate=g/ROC
=3/7.6= 39.47%

Terminal Value$_5$= 202.4(.076-.03) = € 4400

Rs Cashflows

Op. Assets €	3578
+ Cash:	24
- Debt	165
- Minority Int	4
=Equity	3,397

Value/Share € 96.87

Year	1	2	3	4	5	
EBIT (1-t)	€ 200.54	€ 224.26	€ 250.79	€ 280.45	€ 313.62	€ 334.41
- Reinvestment	€ 114.57	€ 128.12	€ 143.28	€ 160.23	€ 179.18	€ 132.01
FCFF	€ 85.97	€ 96.14	€ 107.51	€ 120.22	€ 134.44	€ 202.40

Discount at $ Cost of Capital (WACC) = 7.26% (.933) + 3.24% (0.067) = 6.99%

Cost of Equity
7.40%

Cost of Debt
(3%+ 0.50%+0.60%)(1-.21)
= 3.24%

Weights
E = 93.3% D = 6.7%

On April 1, 2010
KRKA price = 65 Euros

Riskfree Rate:
Euro Riskfree Rate= 3%

+

Beta
0.65

X

Mature market premium
4.5%

+

Lambda
0.15

X

CRP for Slovenia
(0.9%)

Lambda
0.40

X

CRP for Central Europe
(3%)

Unlevered Beta for Sectors: 0.62

Firm's D/E Ratio:7.14%

Country Default Spread

X

Rel Equity Mkt Vol
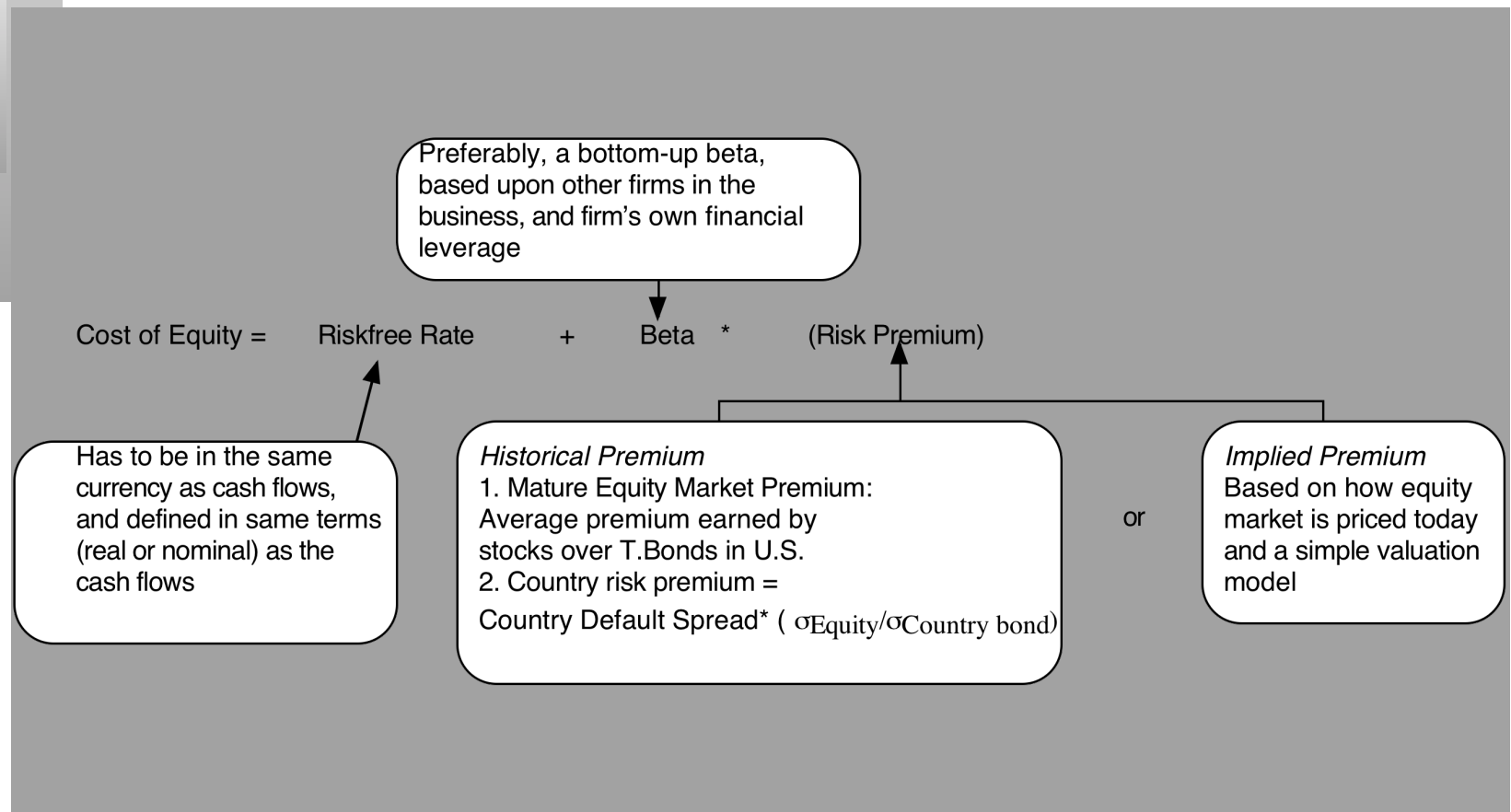
Adris Grupa: 4/2010

Current Cashflow to Firm
EBIT(1-t) :   614 HRK
- Nt CpX   337 HRK
- Chg WC   14 HRK
= FCFF   263 HRK
Reinv Rate = (337+14)/263= 57.17%
Tax rate = 20.67%
Return on capital = 11.35%

Reinvestment Rate
57.17%

Return on Capital
11.35%

Expected Growth from new inv.
.5717*1135 =0.0649
or 6.49%

Stable Growth
g = 4%; Beta = 0.80
Country Premium= 2%
Cost of capital = 9.69%
Tax rate = 20.00%
ROC=10%;
Reinvestment Rate=g/ROC
=4/10= 40%

Terminal Value$_5$= 529/(.0969-.04) =9296 HRK

Op. Assets 6,827	Year	1	2	3	4	5	
+ Cash: 30	EBIT (1-t)	HRK 654	HRK 696	HRK 741	HRK 789	HRK 841	881
- Debt 491	- Reinvestment	HRK 374	HRK 398	HRK 424	HRK 451	HRK 481	352
- Minority int 409	FCFF	HRK 280	HRK 298	HRK 318	HRK 338	HRK 360	529
=Equity 5,957							

Rs Cashflows

Value/Share 334 HRK

Discount at $ Cost of Capital (WACC) = 10.7% (.911) + 8.20% (0.089) = 10.48%

Cost of Equity 10.70%

Cost of Debt
(4.25%+ 4%+2%)(1-.20)
= 8.20%

Weights
E = 91.1% D = 8.9%

On April 1, 2010
AG Pfd price = 292 HRK
AG Common = 322 HRK

Riskfree Rate:
HRK Riskfree Rate=
4.25%

+

Beta
0.70

X

Mature market premium
4.5%

+

Lambda
0.68

X

CRP for Croatia
(3%)

Lambda
0.42

X

CRP for Central Europe
(3%)

Unlevered Beta for Sectors: 0.66

Firm's D/E Ratio: 9.72%

Country Default Spread
2%

X

Rel Equity Mkt Vol
1.50

Valuation: The Details

I. Estimating Discount Rates

Cost of Equity

Preferably, a bottom-up beta, based upon other firms in the business, and firm's own financial leverage

Cost of Equity =   Riskfree Rate   +   Beta   *   (Risk Premium)

Has to be in the same currency as cash flows, and defined in same terms (real or nominal) as the cash flows

Historical Premium
1. Mature Equity Market Premium: Average premium earned by stocks over T.Bonds in U.S.
2. Country risk premium =

Country Default Spread* ($\sigma_{Equity}/\sigma_{Country\ bond}$)

or

Implied Premium
Based on how equity market is priced today and a simple valuation model

A. The Riskfree 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

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

For a rate to be riskfree in valuation, it has to be long term, default free and currency matched (to the cash flows)

Estimating the Riskfree Rate in Croatian HKR… and US dollars..

■ Assume that you decide to value Adris Grupa in Croatian HKR. The Croatian government had 10-year HKR bonds outstanding, with a yield to maturity of 6.25% on April 1, 2010. In January 2010, the Croatian government's <u>local currency</u> sovereign rating of Baa3. The default spread (over a default free rate) for Baa3 rated country bonds in early 2010 was 2%.

■ The riskfree rate in Croatian HKR is

a) The yield to maturity on the 10-year bond (6.25%)

b) The yield to maturity on the 10-year bond + Default spread (6.25%+2% =8.25%)

c) The yield to maturity on the 10-year bond – Default spread (6.25%-2% = 4.25%)

d) None of the above

■ If you wanted to do you entire valuation in US dollars, what would you use as your riskfree rate?

■ How would your answer change if you were doing the analysis in Euros?

A Euro Riskfree Rate

Figure 4: Goverment Bond Rates in Euros
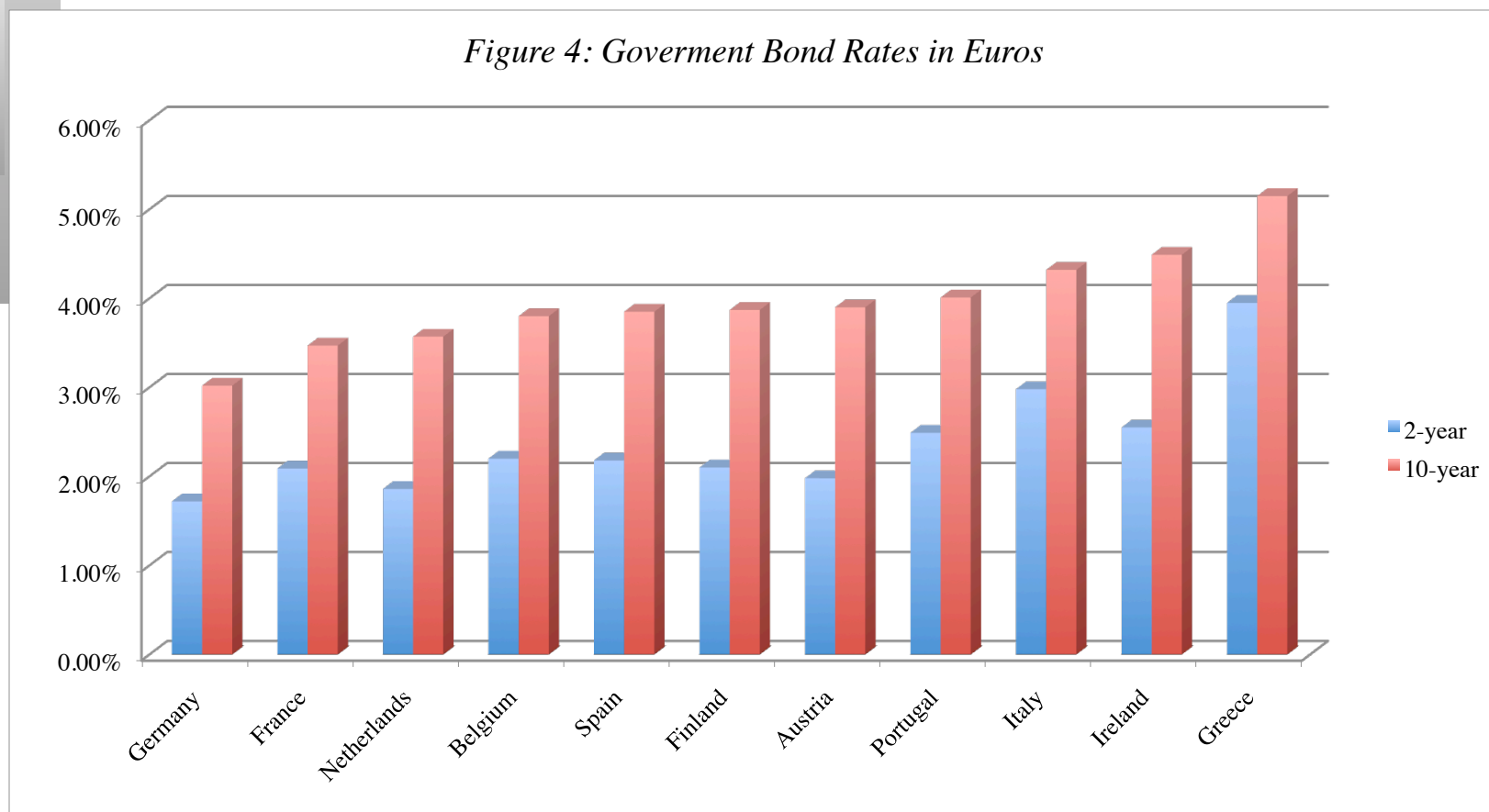
Why do riskfree rates vary?
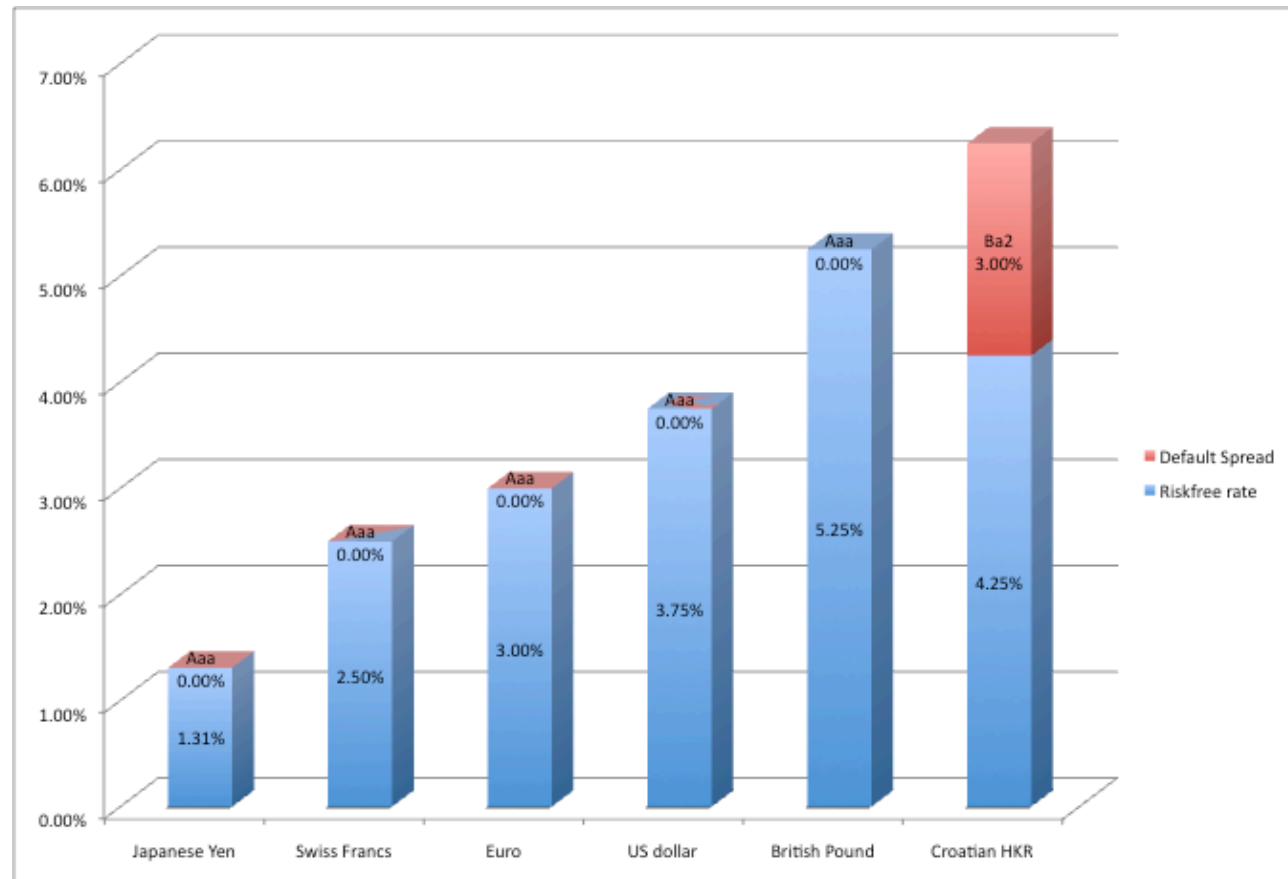
b. Equity Risk Premiums

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

■ Practitioners never seem to agree on the premium; 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
1928-2009	7.53%	6.03%	5.56%	4.29%
	(2.28%)	(2.40%)		
1960-2009	5.48%	3.78%	4.09%	2.74%
	(2.42%)	(2.71%)		
2000-2009	-1.59%	-5.47%	-3.68%	-7.22%
	(6.73%)	(9.22%)		

The perils of trusting the past…….

■ <u>Noisy estimates</u>: Even with long time periods of history, the risk premium that you derive will have substantial standard error. For instance, if you go back to 1928 (about 80 years of history) and you assume a standard deviation of 20% in annual stock returns, you arrive at a standard error of greater than 2%:

$$\text{Standard Error in Premium} = 20\%/\sqrt{80} = 2.26\%$$

■ <u>Survivorship Bias</u>: Using historical data from the U.S. equity markets over the twentieth century does create a sampling bias. After all, the US economy and equity markets were among the most successful of the global economies that you could have invested in early in the century.

These problems get exacerbated in markets like Croatia and Slovenia, where there is far less historical data and survivor bias is worse.

An Alternative: Watch what I pay, not what I say…

■ In January 2010, the S&P 500 was trading at 1115.10. You can back out the return that investors can expect to pay from the index and expected cash flows…

In 2010, the actual cash returned to stockholders was 40.38. That was down about 40% from 2008 levels.

Analysts expect earnings to grow 21% in 2010, resulting in a compounded annual growth rate of 7.2% over the next 5 years. We will assume that dividends & buybacks will keep pace.

After year 5, we will assume that earnings on the index will grow at 3.84%, the same rate as the entire economy (= riskfree rate).

43.29	46.40	49.74	53.32	57.16

January 1, 2010
S&P 500 is at 1115.10
Adjusted Dividends &
Buybacks for 2008 = 40.38

$$1115.10 = \frac{43.29}{(1+r)} + \frac{46.40}{(1+r)^2} + \frac{49.74}{(1+r)^3} + \frac{53.32}{(1+r)^4} + \frac{57.16}{(1+r)^5} + \frac{57.16(1.0384)}{(r-.0384)(1+r)^5}$$

Expected Return on Stocks (1/1/10) = 8.20%
T.Bond rate on 1/1/10 = 3.84 %
Equity Risk Premium = 8.20% - 3.84% = 4.36%

Implied Premiums in the US

Implied Premium for US Equity Market
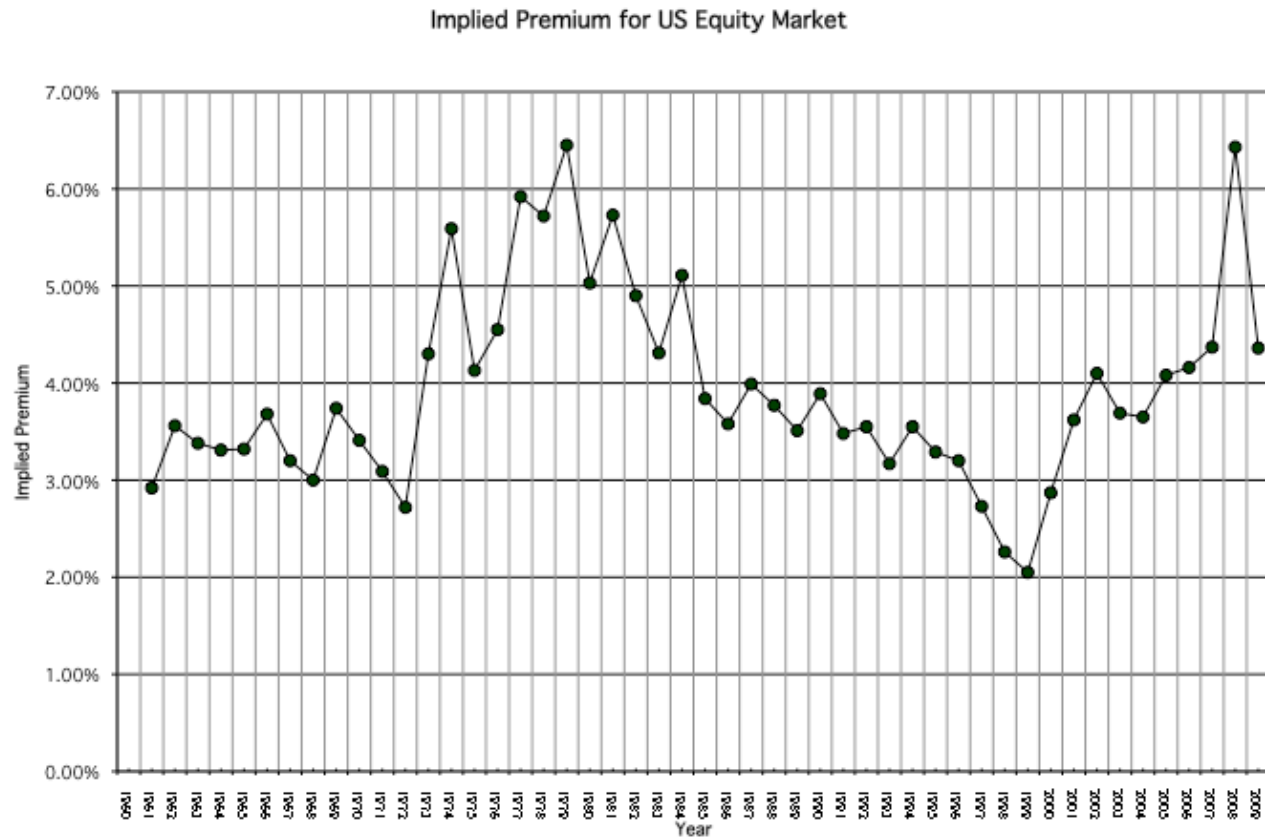
The Anatomy of a Crisis: Implied ERP from September 12, 2008 to January 1, 2009

Implied Equity Risk Premium - 9/12- 12/31/08

Average Implied ERP: 1960-2007 = 4.00%
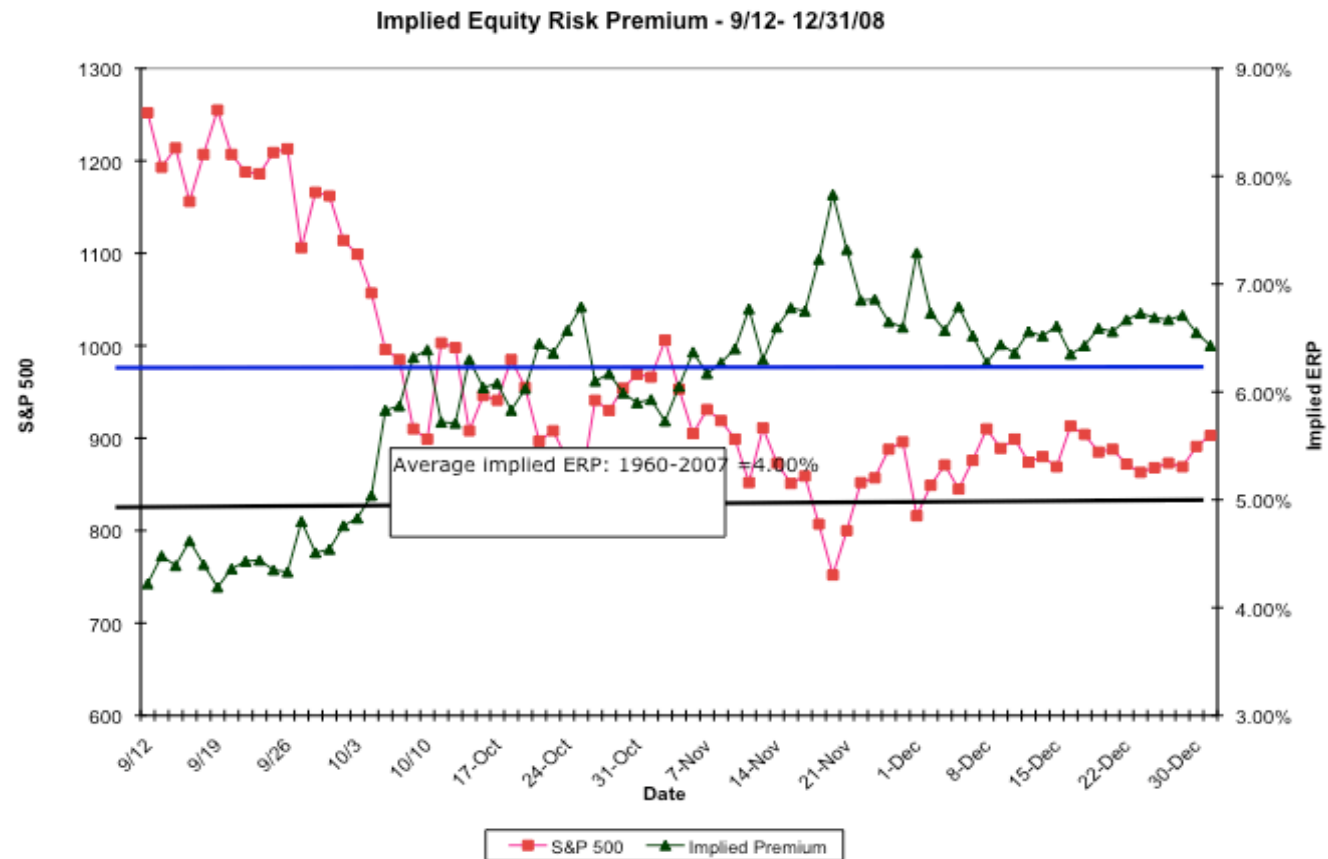
Implied Premium for Croatia & Slovenia: April 2010

	Slovenia	Croatia
Index used	LJSE Composite	Zagreb Crobex
Level	3892	2124
FCFE Yiled	3.45%	4.28%
Expected growth rate	12%	15%
Riskfree rate	3%	4.25%
IRR (Expected return)	8.22%	11.18%
ERP	5.22%	6.93%

A solution: Estimate a mature market premium with an added country risk premium

- Assume that the equity risk premium for the US and other mature equity markets is 4.5%. You could then add on an additional premium for investing in an emerging markets.

- Two ways of estimating the country risk premium:
  - *Default spread on Country Bond*: In this approach, the country equity risk premium is set equal to the default spread of the bond issued by the country.
    - Equity Risk Premium for Croatia = 4.5% + 2% = 6.5%
    - Equity Risk Premium for Slovenia = 4.5%+1.2% = 5.7%
  - *Adjusted for equity risk*: The country equity risk premium is based upon the volatility of the market in question relative to U.S market.

Country Risk Premiums
January 2010

Austria [1]	4.50%
Belgium [1]	4.95%
Cyprus [1]	5.63%
Denmark	4.50%
Finland [1]	4.50%
France [1]	4.50%
Germany [1]	4.50%
Greece [1]	6.08%
Iceland	7.50%
Ireland [1]	4.95%
Italy [1]	5.40%
Malta [1]	5.85%
Netherlands [1]	4.50%
Norway	4.50%
Portugal [1]	5.40%
Spain [1]	4.50%
Sweden	4.50%
Switzerland	4.50%
United Kingdom	4.50%

Albania	11.25%
Armenia	9.00%
Azerbaijan	8.25%
Belarus	11.25%
Bosnia and Herzegovina	12.75%
Bulgaria	7.50%
Croatia	7.50%
Czech Republic	5.85%
Estonia	5.85%
Hungary	6.90%
Kazakhstan	7.20%
Latvia	7.50%
Lithuania	6.90%
Moldova	15.75%
Montenegro	9.75%
Poland	6.08%
Romania	7.50%
Russia	6.90%
Slovakia	5.85%
Slovenia [1]	5.40%
Turkmenistan	12.75%
Ukraine	12.75%

Cambodia	12.75%
China	5.85%
Fiji Islands	11.25%
Hong Kong	5.40%
India	9.00%
Indonesia	9.00%
Japan	5.40%
Korea	6.08%
Macao	5.63%
Malaysia	6.30%
Mongolia	11.25%
Pakistan	14.25%
Papua New Guinea	11.25%
Philippines	9.75%
Singapore	4.50%
Taiwan	5.63%
Thailand	6.90%
Turkey	9.75%
Vietnam	9.75%

Canada	4.50%
Mexico	6.90%
United States of America	4.50%

Argentina	14.25%
Belize	14.25%
Bolivia	12.75%
Brazil	7.50%
Chile	5.85%
Colombia	7.50%
Costa Rica	8.25%
Ecuador	19.50%
El Salvador	19.50%
Guatemala	8.25%
Honduras	12.75%
Nicaragua	14.25%
Panama	8.25%
Paraguay	14.25%
Peru	7.50%
Uruguay	9.75%
Venezuela	11.25%

Botswana	6.08%
Egypt	8.25%
Mauritius	7.20%
Morocco	8.25%
South Africa	6.30%
Tunisia	7.20%

Bahrain	6.08%
Israel	5.85%
Jordan	7.50%
Kuwait	5.40%
Lebanon	12.75%
Oman	6.08%
Qatar	5.40%
Saudi Arabia	5.85%
United Arab Emirates	5.40%

Australia	4.50%
New Zealand	4.50%

From Country Risk Premiums to Corporate Risk premiums

- Approach 1: Assume that every company in the country is equally exposed to country risk. In this case,

    E(Return) = Riskfree Rate + Country ERP + Beta (US premium)

- Approach 2: Assume that a company's exposure to country risk is similar to its exposure to other market risk.

    E(Return) = Riskfree Rate + Beta (US premium + Country ERP)

- Approach 3: Treat country risk as a separate risk factor and allow firms to have different exposures to country risk (perhaps based upon the proportion of their revenues come from non-domestic sales)

    E(Return)=Riskfree Rate+ β (US premium) + λ (Country ERP)

    Country ERP: Additional country equity risk premium

Estimating Company Exposure to Country Risk

- Different companies should be exposed to different degrees to country risk. For instance, a Korean firm that generates the bulk of its revenues in Western Europe and the US should be less exposed to country risk than one that generates all its business within Korea.

- The factor "λ" measures the relative exposure of a firm to country risk. One simplistic solution would be to do the following:

  λ = % of revenues domestically$_{firm}$/ % of revenues domestically$_{avg\ firm}$

  Consider two firms – HyundaI Heavy Industries and Megastudy, both Korean companies. The former gets about 20% of its revenues in Korea and the latter gets 100%. The average Korean firm gets about 80% of its revenues in Korea:

  $\lambda_{Hyundai}$ = 20%/80% = 0.25

  $\lambda_{Megastudy}$ = 100%/80% = 1.25

- There are two implications
  - A company's risk exposure is determined by where it does business and not by where it is located
  - Firms might be able to actively manage their country risk exposures

Estimating lambda

	KRKA	Adris Grupa
% of revenues locally	10.67%	54%
% of revenues for average company	71.00%	80%
Lambda - local market	0.15	0.68
% of revenues developed markets	58.50%	10%
Lambda - developed markets	NA	NA
% of revenues other emerging markets	30.80%	29%
% of revenues for average company	77.00%	69%
Lambda- other emerging markets	0.4	0.42

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.

■ This beta has three problems:

- It has high standard error
- It reflects the firm's business mix over the period of the regression, not the current mix
- It reflects the firm's average financial leverage over the period rather than the current leverage.

A standard regression.. A beta for KKRA

<HELP> for explanation, <MENU> for similar functions.   EquityBETA

KRKG SV Equity   Relative Index SBITOP Index   Historical Beta
Data   Last Price   Range   03/21/08 - 03/12/10   Period Weekly   Local CCY
Linear   Beta +/-   Non-Parametric

Y=1.030X+0.395
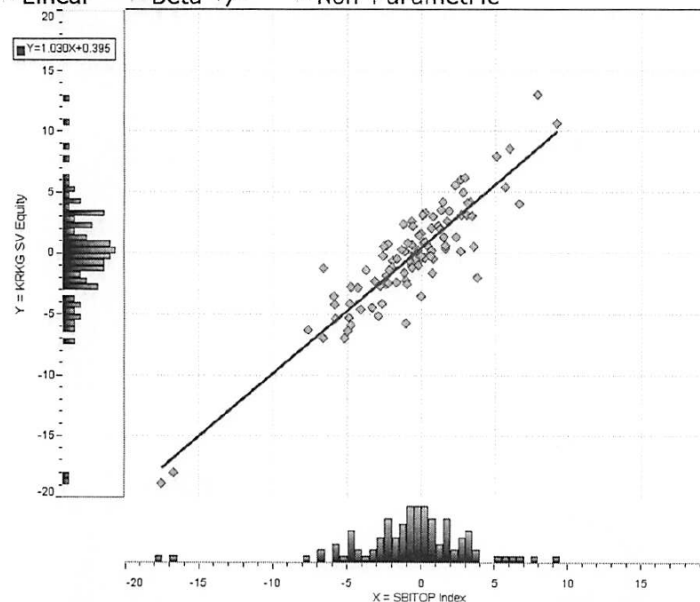
Y = KRKA
X = Slovenian Blue Chip Idx

Item	Value
Raw BETA	1.030
Adj BETA	1.020
ALPHA(Intercept)	0.395
R^2(Correlation^2)	0.818
Std Dev Of Error	1.892
Std Error Of ALPHA	0.189
Std Error Of BETA	0.048
Number Of Points	103

Y = KRKG SV Equity

X = SBITOP Index

* Last Observation

Australia 61 2 9777 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 2010 Bloomberg Finance L.P.
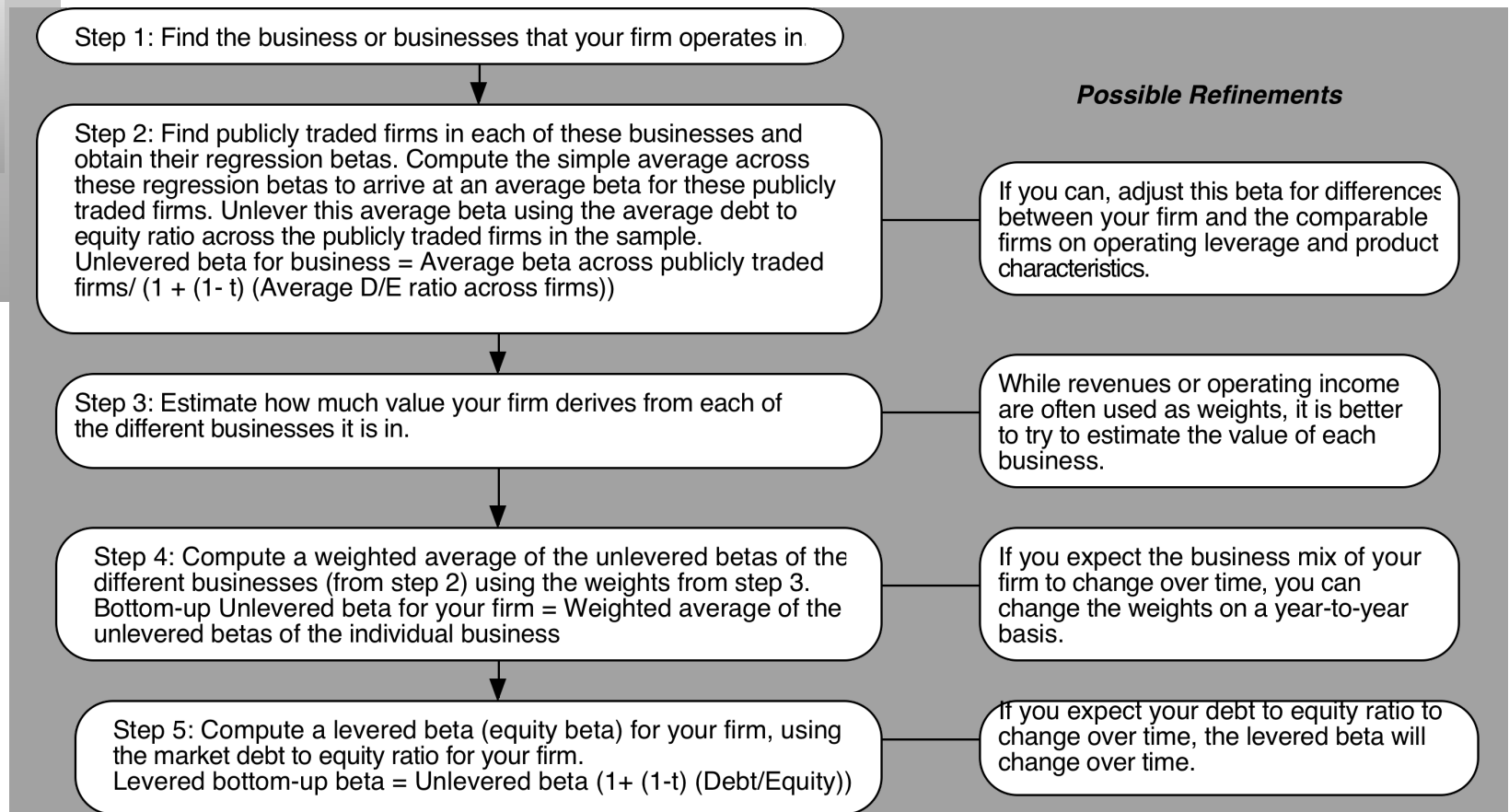   SN 636136 17-Mar-2010 15:21:51
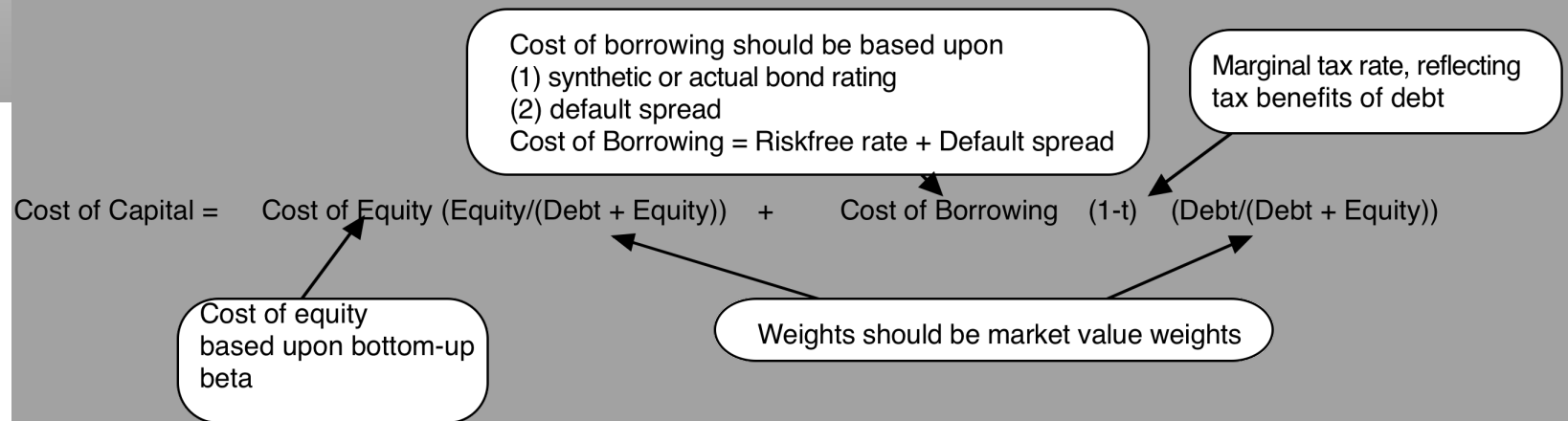
And Adris Grupa

Determinants of Betas

Beta of Equity

Beta of Firm

Nature of product or service offered by company:
Other things remaining equal, the more discretionary the product or service, the higher the beta.

Operating Leverage (Fixed Costs as percent of total costs):
Other things remaining equal the greater the proportion of the costs that are fixed, the higher the beta of the company.

Financial Leverage:
Other things remaining equal, the greater the proportion of capital that a firm raises from debt,the higher its equity beta will be

Implciations
Highly levered firms should have highe betas than firms with less debt.

Implications
1. Cyclical companies should have higher betas than non-cyclical companies.
2. Luxury goods firms should have higher betas than basic goods.
3. High priced goods/service firms should have higher betas than low prices goods/services firms.
4. Growth firms should have higher betas.

Implications
1. Firms with high infrastructure needs and rigid cost structures shoudl have higher betas than firms with flexible cost structures.
2. Smaller firms should have higher betas than larger firms.
3. Young firms should have

Aswath Damodaran

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.

Bottom Up Beta Estimates

	KRKA	Adris Grupa
Business	European pharma firms	Tourism & Tobacco
Unlevered Beta	0.62	0.65
D/E Ratio	7.18%	9.72%
Levered Beta	0.66	0.70

	Revenues	Estimated Weight	Unevered Beta
Tobacco	2297	82.21%	0.55
Tourism	497	17.79%	1.1
Adris Group	2794		0.65

From Cost of Equity to Cost of Capital

Cost of borrowing should be based upon
(1) synthetic or actual bond rating
(2) default spread
Cost of Borrowing = Riskfree rate + Default spread

Marginal tax rate, reflecting tax benefits of debt

Cost of Capital =   Cost of Equity (Equity/(Debt + Equity))   +   Cost of Borrowing   (1-t)   (Debt/(Debt + Equity))

Cost of equity based upon bottom-up beta

Weights should be market value weights

What is debt?

- 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.

Debt and Equity

	KRKA	Adris Grupa
Book value of equity	€ 156.00	HRK 6,167.80
Book value of debt	€ 920.00	HRK 95.90
Market value of equity	€ 2,306.23	HRK 5,045.00
Market value of debt	€ 165.57	HRK 490.57
Debt ratio - Book value	85.50%	1.53%
Debt ratio - Market value	6.70%	8.86%

Estimating the Cost of Debt

- If the firm has bonds outstanding, and the bonds are traded, the <u>yield to maturity</u> on a long-term, straight (no special features) bond can be used as the interest rate.

- If the firm is rated, use <u>the rating and a typical default spread</u> 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, <u>use the interest rate on the borrowing</u> or
  - estimate a synthetic rating for the company, and use the <u>synthetic rating</u> 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

■ The rating for a firm can be estimated using the financial characteristics of the firm. In its simplest form, the rating can be estimated from the interest coverage ratio

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

■ The interest coverage ratio can be linked to a debt rating, which in turn can provide an estimate of default spread and the cost of debt for a company.

Cost of debt = Riskfree Rate + Default spread for the company

■ In emerging markets, where governments themselves have default risk, the cost of debt for a company will include some or all of the default spread for the country.

Cost of debt = Riskfree Rate + Default spread for the country + Default spread for the company

Interest Coverage Ratios, Ratings and Default Spreads

If interest coverage ratio is			
greater than	≤ to	Rating is	Spread is
-100000	0.499999	D	15.00%
0.5	0.799999	C	12.00%
0.8	1.249999	CC	10.00%
1.25	1.499999	CCC	8.50%
1.5	1.999999	B-	5.50%
2	2.499999	B	5.25%
2.5	2.999999	B+	4.25%
3	3.499999	BB	4.00%
3.5	3.9999999	BB+	3.50%
4	4.499999	BBB	2.00%
4.5	5.999999	A-	1.50%
6	7.499999	A	1.25%
7.5	9.499999	A+	1.00%
9.5	12.499999	AA	0.75%
12.5	100000	AAA	0.50%

Estimating the cost of debt

	KRKA	Adris Grupa
EBIT	€ 235.00	HRK 774.00
Interest expenses	€ 10.50	HRK 238.00
Interest coverage ratio	22.38	3.25
Rating	AAA	BB
Company Default Spread	0.50%	4.00%
Country Default Spread	1.20%	2.00%
Riskfree Rate	3%	4.25%
Cost of debt - pre-tax	4.10%	10.25%
Marginal tax rate	21.00%	20.00%
Cost of debt - after-tax	3.24%	8.20%

Estimating Cost of Capital

	KRKA	Adris Grupa
Beta	0.65	0.70
Lambda	0.15	0.68
Lambda - other markets	0.40	0.42
Cost of equity	7.26%	10.70%
Synthetic rating	AAA	BB
Cost of debt	4.10%	10.25%
Cost of debt - after-tax	3.24%	8.20%
Debt Ratio	6.70%	8.86%
Cost of capital	6.99%	10.48%

II. Estimating Cashflows and Growth

Defining Cashflow

Cash flows can be measured to

All claimholders in the firm

EBIT (1- tax rate)
 - (Capital Expenditures - Depreciation)
- Change in non-cash working capital
= Free Cash Flow to Firm (FCFF)

Just Equity Investors

Net Income
- (Capital Expenditures - Depreciation)
- Change in non-cash Working Capital
- (Principal Repaid - New Debt Issues)
- Preferred Dividend

Dividends
+ Stock Buybacks
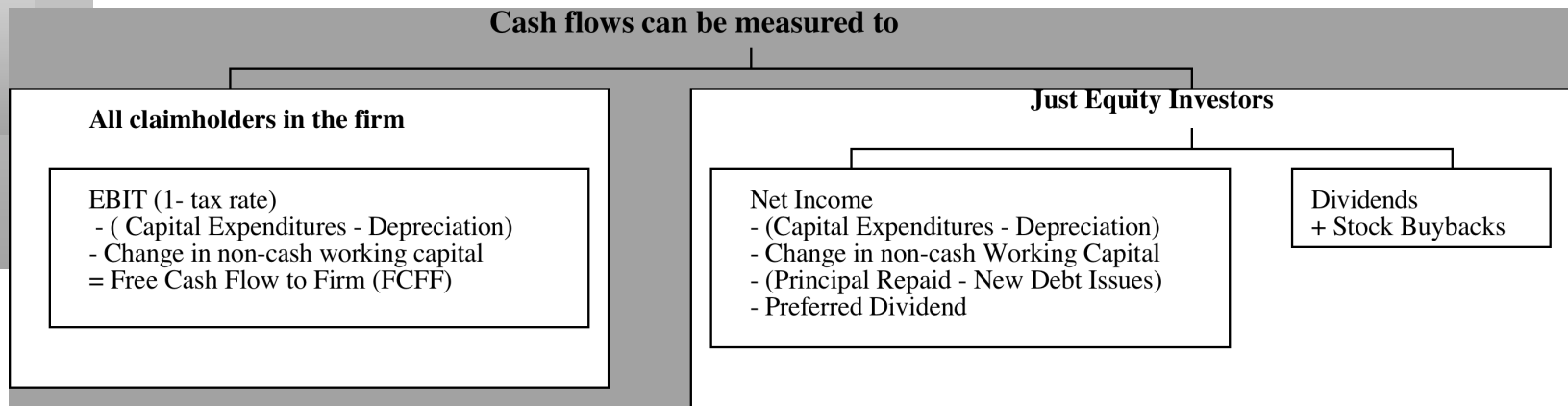
From Reported to Actual Earnings

Firm's history	Comparable Firms	Operating leases - Convert into debt - Adjust operating income	R&D Expenses - Convert into asset - Adjust operating income

Normalize Earnings

Cleanse operating items of
- Financial Expenses
- Capital Expenses
- Non-recurring expenses

Measuring Earnings

Update
- Trailing Earnings
- Unofficial numbers
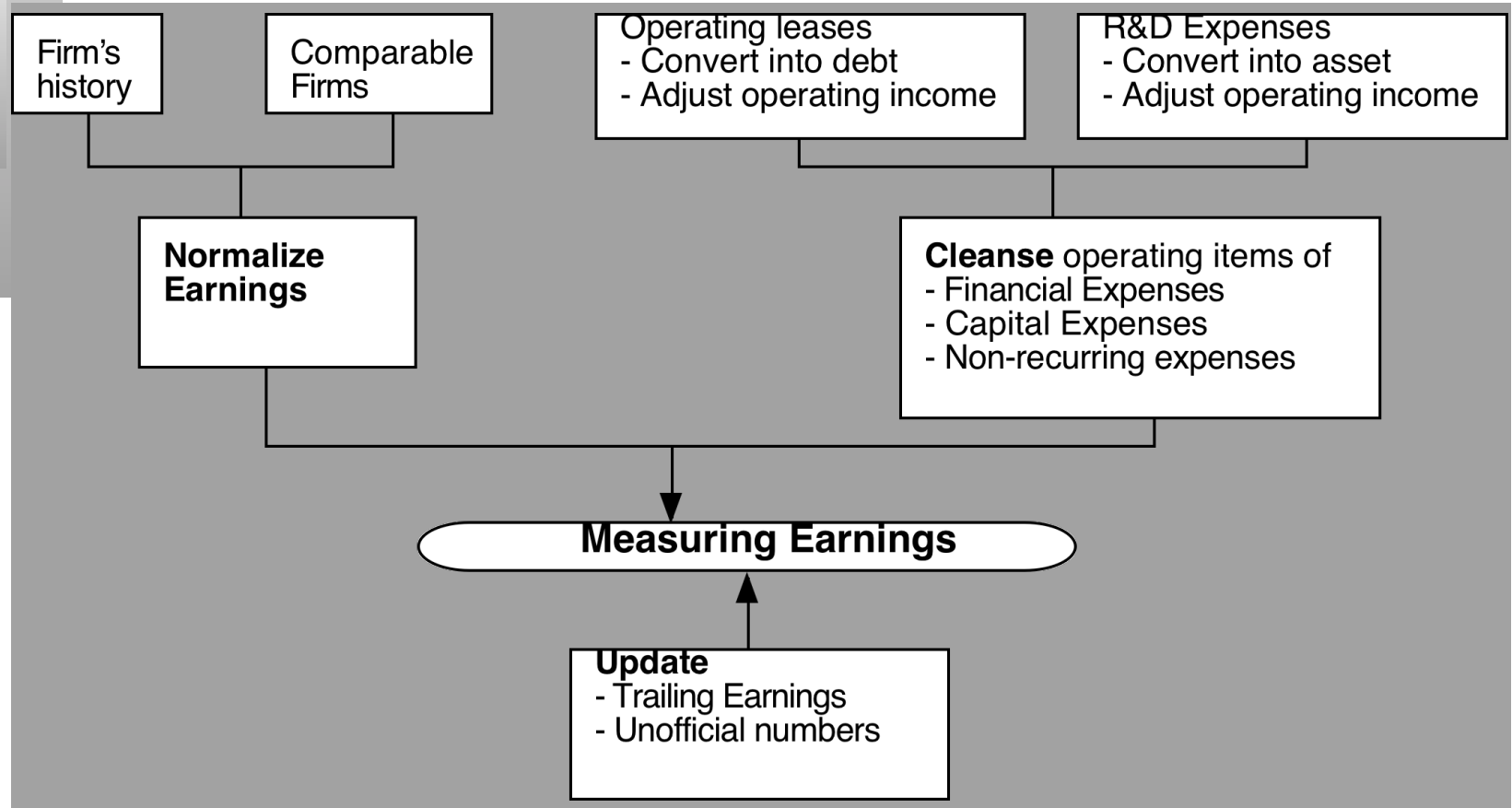
Dealing with Operating Lease Expenses

■ Operating Lease Expenses are treated as operating expenses in computing operating income. In reality, operating lease expenses should be treated as financing expenses, with the following adjustments to earnings and capital:

■ Debt Value of Operating Leases = Present value of Operating Lease Commitments at the pre-tax cost of debt

■ When you convert operating leases into debt, you also create an asset to counter it of exactly the same value.

■ Adjusted Operating Earnings

Adjusted Operating Earnings = Operating Earnings + Operating Lease Expenses - Depreciation on Leased Asset

• As an approximation, this works:

Adjusted Operating Earnings = Operating Earnings + Pre-tax cost of Debt * PV of Operating Leases.

R&D Expenses: Operating or Capital Expenses

■ Accounting standards require us to consider R&D as an operating expense even though it is designed to generate future growth. It is more logical to treat it as capital expenditures.

■ To capitalize R&D,
- Specify an amortizable life for R&D (2 - 10 years)
- Collect past R&D expenses for as long as the amortizable life
- Sum up the unamortized R&D over the period. (Thus, if the amortizable life is 5 years, the research asset can be obtained by adding up 1/5th of the R&D expense from five years ago, 2/5th of the R&D expense from four years ago...:

What tax rate?

- The tax rate that you should use in computing the after-tax operating income should be
  - ❏ The effective tax rate in the financial statements (taxes paid/Taxable income)
  - ❏ The tax rate based upon taxes paid and EBIT (taxes paid/EBIT)
  - ❏ The marginal tax rate for the country in which the company operates
  - ❏ The weighted average marginal tax rate across the countries in which the company operates
  - ❏ None of the above
  - ❏ Any of the above, as long as you compute your after-tax cost of debt using the same tax rate

Capital expenditures should include

- <u>Research and development expenses</u>, once they have been re-categorized as capital expenses. The adjusted net cap ex will be

  Adjusted Net Capital Expenditures = Net Capital Expenditures + Current year's R&D expenses - Amortization of Research Asset

- <u>Acquisitions of other firms</u>, since these are like capital expenditures. The adjusted net cap ex will be

  Adjusted Net Cap Ex = Net Capital Expenditures + Acquisitions of other firms - Amortization of such acquisitions

  Two caveats:

  1. Most firms do not do acquisitions every year. Hence, a <u>normalized measure of acquisitions</u> (looking at an average over time) should be used

  2. The best place to find acquisitions is in the statement of cash flows, usually categorized under <u>other investment activities</u>

Working Capital Investments

- In accounting terms, the working capital is the difference between current assets (inventory, cash and accounts receivable) and current liabilities (accounts payables, short term debt and debt due within the next year)

- A cleaner definition of working capital from a cash flow perspective is the difference between <u>non-cash current assets</u> (inventory and accounts receivable) and <u>non-debt current liabilities</u> (accounts payable)

- Any investment in this measure of working capital ties up cash. Therefore, any increases (decreases) in working capital will reduce (increase) cash flows in that period.

- When forecasting future growth, it is important to forecast the effects of such growth on working capital needs, and building these effects into the cash flows.

Estimating FCFF

	KRKA	Adris Grupa
EBIT	€ 235.00	HRK 774.00
Effective tax rate	€ 0.24	HRK 0.21
EBIT (1-t)	*€ 179.33*	*HRK 614.00*
Net Cap Ex	€ 15.00	HRK 337.00
Chg in WC	€ 68.00	HRK 14.00
Reinvestment	*€ 83.00*	*HRK 351.00*
FCFF	€ 96.33	HRK 263.00
Reinvestment Rate - last year	46.28%	57.17%

Growth in Earnings

- **Look at the past**
  - The historical growth in earnings per share is usually a good starting point for growth estimation

- **Look at what others are estimating**
  - Analysts estimate growth in earnings per share for many firms. It is useful to know what their estimates are.

- **Look at fundamentals**
  - Ultimately, all growth in earnings can be traced to two fundamentals - how much the firm is investing in new projects, and what returns these projects are making for the firm.

The Determinants of Growth

Expected Growth

Net Income	Operating Income

Net Income:

Retention Ratio= 1 - Dividends/Net Income   X   *Return on Equity* Net Income/Book Value of Equity

Operating Income:

Reinvestment Rate = (Net Cap Ex + Chg in WC/EBIT(1-t)   X   *Return on Capital =* EBIT(1-t)/Book Value of Capital
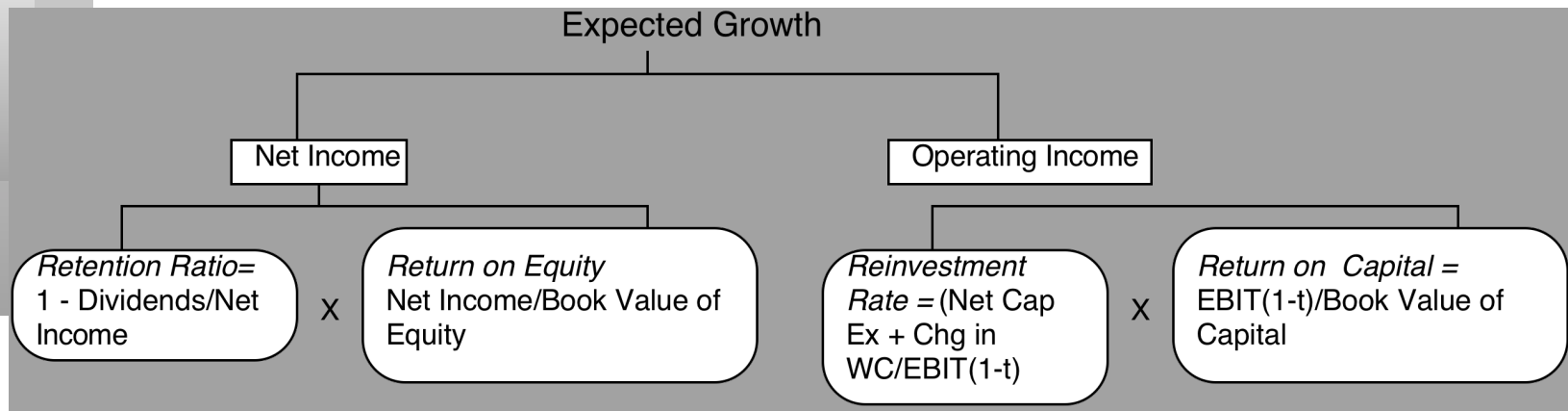
Measuring Return on Capital (Equity)

Adjust EBIT for
a. Extraordinary or one-time expenses or income
b. Operating leases and R&D
c. Cyclicality in earnings (Normalize)
d. Acquisition Debris (Goodwill amortization etc.)

Use a marginal tax rate to be safe. A high ROC created by paying low effective taxes is not sustainable

$$ROC = \frac{EBIT\ (\ 1-\ tax\ rate)}{Book\ Value\ of\ Equity + Book\ value\ of\ debt - Cash}$$

Adjust book equity for
1. Capitalized R&D
2. Acquisition Debris (Goodwill)

Adjust book value of debt for
a. Capitalized operating leases

Use end of prior year numbers or average over the year but be consistent in your application

Measuring Return on Capital

	KRKA	Adris Grupa
EBIT (1-t)	€ 179.33	HRK 614.00
BV of Debt	€ 184.00	HRK 539.20
BV of Equity	€ 783.00	HRK 5,738.00
Cash	€ 8.30	HRK 865.20
Invested Capital	€ 958.70	HRK 5,412.00
ROC	18.71%	11.35%
ROC - last 5 years	20.70%	10.17%

Measuring Reinvestment Rate and Expected Growth

	KRKA	Adris Grupa
Reinvestment Rate last year	46.28%	57.17%
Reinvestment Rate last 5 years	82.70%	79.55%
Reinvestment rate last 5 years - no acquisitions	57.13%	79.55%

	KRKA	Adris Grupa
ROC	20.70%	11.35%
Reinvestment Rate	57.13%	57.17%
Expected Growth rate	11.83%	6.49%

III. The Tail that wags the dog… Terminal Value

Getting Closure in Valuation

■ A publicly traded firm potentially has an infinite life. The value is therefore the present value of cash flows forever.

$$\text{Value} = \sum_{t=1}^{t=\infty} \frac{CF_t}{(1+r)^t}$$

■ Since we cannot estimate cash flows forever, we estimate cash flows for a "growth period" and then estimate a terminal value, to capture the value at the end of the period:

$$\text{Value} = \sum_{t=1}^{t=N} \frac{CF_t}{(1+r)^t} + \frac{\text{Terminal Value}}{(1+r)^N}$$

Ways of Estimating Terminal Value

Terminal Value

Liquidation Value	Multiple Approach	Stable Growth Model
Most useful when assets are separable and marketable	Easiest approach but makes the valuation a relative valuation	Technically soundest, but requires that you make judgments about when the firm will grow at a stable rate which it can sustain forever, and the excess returns (if any) that it will earn during the period.

Stable Growth and Terminal Value

■ When a firm's cash flows grow at a "constant" rate forever, the present value of those cash flows can be written as:

Value = Expected Cash Flow Next Period / (r - g)

where,

r = Discount rate (Cost of Equity or Cost of Capital)

g = Expected growth rate

■ While companies can maintain high growth rates for extended periods, they will all approach "stable growth" at some point in time. When they will do so will depend upon:

- How large they are relative to the market in which they operate
- Their competitive advantages

Four Rules for Terminal value

■ Respect the cap: The stable growth rate <u>cannot exceed the growth rate of the economy</u> but it can be set lower. One simple proxy for the nominal growth rate of the economy is the riskfree rate.

- Riskfree rate = Expected inflation + Expected Real Interest Rate
- Nominal growth rate in economy = Expected Inflation + Expected Real Growth

■ Stable period excess returns: Firms that generate returns on capital that vastly exceed their costs of capital should see these excess returns shrink in stable growth as competition enters and size works against them.

■ Reinvest to grow: Growth is never free and this is especially true in stable growth. To grow at a perpetual rate, firms have to reinvest and how much they reinvest will be a function of the return on capital:

Reinvestment Rate = Stable growth rate/ Stable ROC

■ Adjust risk and cost of capital: The cost of equity and capital in stable growth should be reflective of a mature firm in stable growth. In particular,

- Betas should move towards one
- Debt ratios should converge on long-term sustainable averages

1. How high can the stable growth rate be?

■ The stable growth rate <u>cannot exceed the growth rate of the economy</u> but it can be set lower.

  - If you assume that the economy is composed of high growth and stable growth firms, the growth rate of the latter will probably be lower than the growth rate of the economy.

  - The stable growth rate can be negative. The terminal value will be lower and you are assuming that your firm will disappear over time.

  - If you use nominal cashflows and discount rates, the growth rate should be nominal <u>in the currency</u> in which the valuation is denominated.

■ One simple proxy for the nominal growth rate of the economy is the riskfree rate.

  - Riskfree rate = Expected inflation + Expected Real Interest Rate
  - Nominal growth rate in economy = Expected Inflation + Expected Real Growth

2. When will the firm reach stable growth?

- **Size of the firm**
  - Success usually makes a firm larger. As firms <u>become larger</u>, it becomes much more difficult for them to maintain high growth rates
- **Current growth rate**
  - While past growth is not always a reliable indicator of future growth, there is a <u>correlation between current growth and future growth</u>. Thus, a firm growing at 30% currently probably has higher growth and a longer expected growth period than one growing 10% a year now.
- **Barriers to entry and differential advantages**
  - Ultimately, high growth comes from high project returns, which, in turn, comes from <u>barriers to entry</u> and <u>differential advantages</u>.
  - The question of how long growth will last and how high it will be can therefore be framed as a question about <u>what the barriers to entry are, how long they will stay up and how strong they will remain.</u>

3. What else should change in stable growth?

- In stable growth, firms should have the characteristics of other stable growth firms. In particular,
    - The risk of the firm, as measured by beta and ratings, should reflect that of a stable growth firm.
        - Beta should move towards one
        - The cost of debt should reflect the safety of stable firms (BBB or higher)
    - The debt ratio of the firm might increase to reflect the larger and more stable earnings of these firms.
        - The debt ratio of the firm might moved to the optimal or an industry average
        - If the managers of the firm are deeply averse to debt, this may never happen
    - The return on capital generated on investments should move to sustainable levels, relative to both the sector and the company's own cost of capital.

4. What excess returns will you generate in stable growth and why does it matter?

- Strange though this may seem, the terminal value is not as much a function of stable growth as it is a function of what you assume about excess returns in stable growth.

- The key connecting link is the reinvestment rate that you have in stable growth, which is a function of your return on capital:

  Reinvestment Rate = Stable growth rate/ Stable ROC

  The terminal value can be written in terms of ROC as follows:

  Terminal Value = $EBIT_{n+1}$ (1-t) (1 – g/ ROC)/ (Cost of capital – g)

- In the scenario where you assume that a firm earns a return on capital equal to its cost of capital in stable growth, the terminal value will not change as the growth rate changes.

- If you assume that your firm will earn positive (negative) excess returns in perpetuity, the terminal value will increase (decrease) as the stable growth rate increases.

Stable Growth Assumptions

		KRKA	Adris Grupa
Beta	High Growth	0.65	0.70
	Stable Growth	0.80	0.80
Lambda	High Growth	0.15	1.10
	Stable Growth	0.15	1.10
CRP	High Growth	0.90%	3.00%
	Stable Growth	0.60%	2.00%
Cost of equity	High Growth	7.26%	10.70%
	Stable Growth	7.89%	10.05%
Cost of capital	High Growth	6.99%	10.48%
	Stable Growth	7.60%	9.69%
Return on capital	High Growth	20.70%	11.35%
	Stable Growth	7.60%	10.00%
Reinvestment Rate	High Growth	57.13%	57.17%
	Stable Growth	39.47%	40.00%
Expected growth rate	High Growth	11.83%	6.49%
	Stable Growth	3.00%	4.00%

Terminal Value and Growth

Stable Growth Rate	KRKA		Adris Grupa	
	Reinvestment Rate	Value of firm	Reinvestment Rate	Value of firm
0%	0.00%	€ 4,400	0.00%	HRK 9,098
1%	13.16%	€ 4,400	10.00%	HRK 9,130
2%	26.31%	€ 4,400	20.00%	HRK 9,171
3%	39.47%	€ 4,400	30.00%	HRK 9,224
4%	52.62%	€ 4,400	40.00%	HRK 9,296
5%	65.78%	€ 4,400	50.00%	HRK 9,398

V. Tying up Loose Ends

For firm value to equity value per share

1. Value cash and other non-operating assets

■ When you discount operating cash flows at the cost of capital, you have valued only the operating assets (that contribute to the operating income) of the firm. Any assets whose earnings are not counted as part of operating income have not been valued yet. In particular, these would include:

- Cash and marketable securities: The income from these are not part of operating income. Hence, the current value of these assets has to be added to the value of the operating assets.

- Non-operating assets: If the firm own other assets that have value but do not contribute to operations, the value of these assets should also be included in the firm value.

■ The key, though, is to not double count an asset. Thus, an asset (say your office headquarters building) that has value but is used for operations should not be added on to the value of operating assets.

2. Dealing with Holdings in Other firms

■ Cross holdings in other firms can create problems because the accounting for these holdings can vary widely across countries, across companies and even within the same company, across different holdings. In particular, we care about

- How the income from these holdings is accounted for in the income statement
  - What is counted as income? (Operating income, Net income or just dividends)
  - Where is it shown? (Above or below the operating income line)
  - How much of the income is shown? (The share of the holding, 100%?)
- How is the value of the asset recorded on the balance sheet?
  - Is it recorded at original cost, updated book value or market value?
  - Is just the net value of the holding shown or are all of the assets and liabilities recorded?

How to value holdings in other firms.. In a perfect world..

■ In a perfect world, we would strip the parent company from its subsidiaries and value each one separately. The value of the combined firm will be
  - Value of parent company + Proportion of value of each subsidiary
■ To do this right, you will need
  - to be provided detailed information on each subsidiary to estimated cash flows and discount rates.
  - To have a manageable number of subsidiaries

Three compromise solutions…

- <u>The market value solution</u>: When the subsidiaries are publicly traded, you could use their traded market capitalizations to estimate the values of the cross holdings. You do risk carrying into your valuation any mistakes that the market may be making in valuation.

- <u>The relative value solution</u>: When there are too many cross holdings to value separately or when there is insufficient information provided on cross holdings, you can convert the book values of holdings that you have on the balance sheet (for both minority holdings and minority interests in majority holdings) by using the average price to book value ratio of the sector in which the subsidiaries operate.

- <u>The "take what I can get" solution</u>: Estimate the market value of those holdings that are publicly traded, the relative value of those holdings where there are publicly traded investments to obtain multiples from and book value for the rest.

3. Subtract out "debt"

■ If you have under funded pension fund or health care plans, you should consider the under funding at this stage in getting to the value of equity.

   • If you do so, you should not double count by also including a cash flow line item reflecting cash you would need to set aside to meet the unfunded obligation.

   • You should not be counting these items as debt in your cost of capital calculations….

■ If you have contingent liabilities - for example, a potential liability from a lawsuit that has not been decided - you should consider the expected value of these contingent liabilities

   • Value of contingent liability = Probability that the liability will occur * Expected value of liability

4. Value other claims on equity

■ In recent years, firms have turned to giving employees (and especially top managers) equity option packages as part of compensation. These options are usually
  - Long term
  - At-the-money when issued
  - On volatile stocks

■ Options outstanding
  - Step 1: List all options outstanding, with maturity, exercise price and vesting status.
  - Step 2: Value the options, taking into accoutning dilution, vesting and early exercise considerations
  - Step 3: Subtract from the value of equity and divide by the actual number of shares outstanding (not diluted or partially diluted).

Getting to per share value

	KRKA	Adris Grupa
Value of operating assets	€ 3,577.69	HRK 6,827.03
+ Cash	€ 14.20	HRK 29.50
+ Holdings in other companies	€ 9.70	HRK 0.00
Value of firm	€ 3,601.59	HRK 6,856.53
- Debt	€ 165.57	HRK 490.57
- Minority interests	€ 4.25	HRK 409.14
- Options	€ 0.00	HRK 5,956.82
Value of equity in stock	€ 3,431.77	HRK 5,956.82
Value per share	€ 96.87	HRK 334.15

Corporate Finance meets Value:
The secret to value enhancement

Price Enhancement versus Value Enhancement

Stock price performance of companies that changed their names to include Web-oriented designations like ".com," from 30 trading days before the name-change announcement to 30 days after. The study looked at stocks of companies that changed their names from January 1998 through March 26, 1999.

Source: "A Rose.com by Any Other Name," by Michael J. Cooper, P. Raghavendra Rau and Orlin Dimitrov of Purdue University.

NAME THAT STOCK

New Markets, New Names
In the bull market, adding dot-com to a company name made a stock soar. Lately those zippy new monikers are disappearing.

New Name, Higher Price
But the stocks still get a bounce when dot-com goes away. Chart shows returns in the days before and after the name change.

Sources: Thomson Datastream; P. Raghavendra Rau, Michael J. Cooper, Igor Osobov, Purdue Univ.; Ajay Khorana, Virginia Univ.; Ajay Patel, Wake Forest Univ.

Value-Neutral Actions

- **■** <u>Stock splits and stock dividends</u> change the number of units of equity in a firm, but cannot affect firm value since they do not affect cash flows, growth or risk.

- **■** <u>Accounting decisions</u> that affect reported earnings but not cash flows should have no effect on value.
  - • <u>Changing inventory valuation methods</u> from FIFO to LIFO or vice versa in financial reports but not for tax purposes
  - • <u>Changing the depreciation method</u> used in financial reports (but not the tax books) from accelerated to straight line depreciation
  - • <u>Major non-cash restructuring charges</u> that reduce reported earnings but are not tax deductible
  - • <u>Using pooling instead of purchase</u> in acquisitions cannot change the value of a target firm.

- **■** Decisions that create new securities on the existing assets of the firm (without altering the financial mix) such as <u>tracking stock</u>.

The Paths to Value Creation.. Back to the determinants of value..

Are you investing optimally for future growth?

How well do you manage your existing investments/assets?

Growth from new investments
Growth created by making new investments; function of amount and quality of investments

Efficiency Growth
Growth generated by using existing assets better

Is there scope for more efficient utilization of exsting assets?

Cashflows from existing assets
Cashflows before debt payments, but after taxes and reinvestment to maintain exising assets

Expected Growth during high growth period

Stable growth firm, with no or very limited excess returns

Are you building on your competitive advantages?

Length of the high growth period
Since value creating growth requires excess returns, this is a function of
- Magnitude of competitive advantages
- Sustainability of competitive advantages

Are you using the right amount and kind of debt for your firm?

Cost of capital to apply to discounting cashflows
Determined by
- Operating risk of the company
- Default risk of the company
- Mix of debt and equity used in financing

Value Creation 1: Increase Cash Flows from Assets in Place

More efficient operations and cost cuttting: Higher Margins

Divest assets that have negative EBIT

Reduce tax rate
- moving income to lower tax locales
- transfer pricing
- risk management

Revenues

* Operating Margin

= EBIT

- Tax Rate * EBIT

= EBIT (1-t)

+ Depreciation
- Capital Expenditures
- Chg in Working Capital
= FCFF

Live off past over-investment

Better inventory management and tighter credit policies

Value Creation 2: Increase Expected Growth

■ Keeping all else constant, increasing the expected growth in earnings will increase the value of a firm.

■ The expected growth in earnings of any firm is a function of two variables:
- The amount that the firm reinvests in assets and projects
- The quality of these investments

```
┌────────────────────┐          ┌─────────────────┐
│ Reinvest more in   │          │ Do acquisitions │
│ projects           │          └─────────────────┘
└────────────────────┘      ┌──────────────────────────┐
                            │  Reinvestment Rate        │
┌────────────────────┐      │                           │   ┌──────────────────────────────┐
│ Increase operating │      │  * Return on Capital      │   │ Increase capital turnover ratio │
│ margins            │      │                           │   └──────────────────────────────┘
└────────────────────┘      │  = Expected Growth Rate   │
                            └──────────────────────────┘
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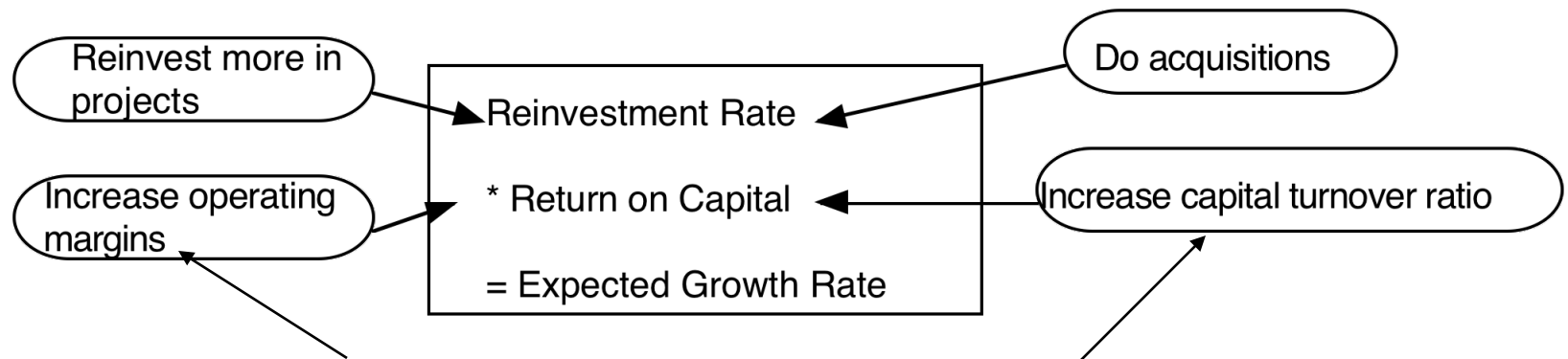
Price Leader versus Volume Leader Strategies
*Return on Capital = Operating Margin * Capital Turnover Ratio*

Value Creating Growth… Evaluating the Alternatives..

Modes of organic growth vary in value creation intensity—consumer goods industry

Aswath Damodaran

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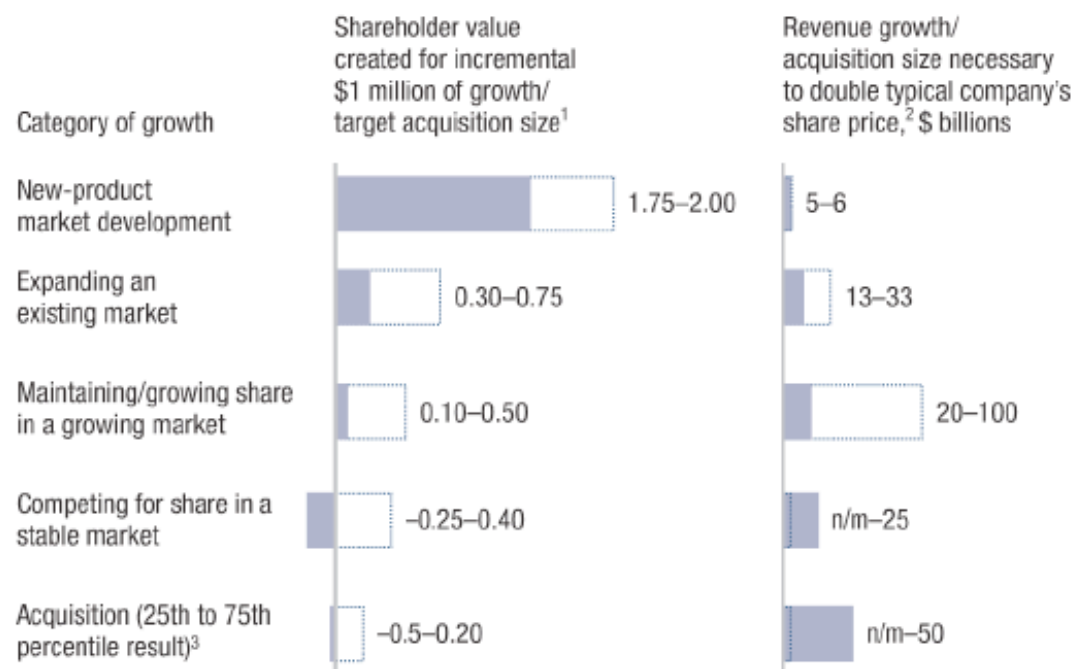
Seven reasons why acquisitions fail…

1. Risk Transference: Attributing acquiring company risk characteristics to the target firm. Just because you are a safe firm and operate in a secure market, does not mean that you can transfer these characteristics to a target firm.

2. Debt subsidies: Subsiding target firm stockholders for the strengths of the acquiring firm is providing them with a benefit they did not earn.

3. Auto-pilot Control: Adding 20% or some arbitrary number to the market price just because other people do it is a recipe for overpayment. Using silly rules such as EPS accretion just makes the problem worse.

4. Elusive Synergy: While there is much talk about synergy in mergers, it is seldom valued realistically or appropriately.

5. Its all relative: The use of transaction multiples (multiples paid by other acquirers in acquisitions) perpetuates over payment.

6. Verdict first, trial afterwards: Deciding you want to do an acquisition first and then looking for justification for the price paid does not make sense.

7. It's not my fault: Holding no one responsible for delivering results is a sure-fire way not to get results…

III. Building Competitive Advantages: Increase length of the growth period

Increase length of growth period

- Build on existing competitive advantages
- Find new competitive advantages
  - Brand name
  - Legal Protection
  - Switching Costs
  - Cost advantages
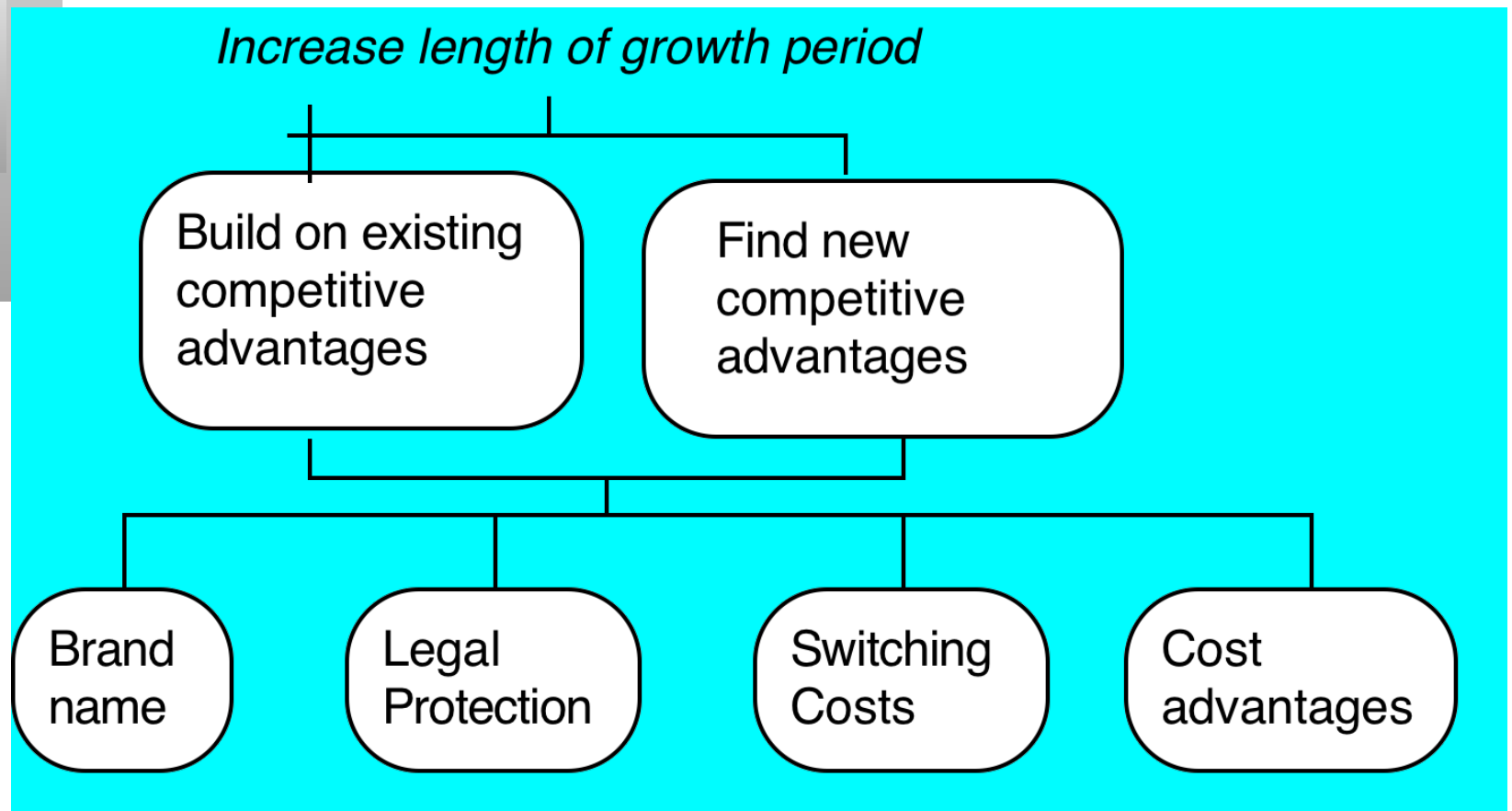
Value Creation 4: Reduce Cost of Capital

Outsourcing

Flexible wage contracts & cost structure

Reduce operating leverage

Change financing mix

Cost of Equity (E/(D+E) + Pre-tax Cost of Debt (D./(D+E)) = Cost of Capital

Make product or service less discretionary to customers

Match debt to assets, reducing default risk

Changing product characteristics

More effective advertising

Swaps

Derivatives

Hybrids
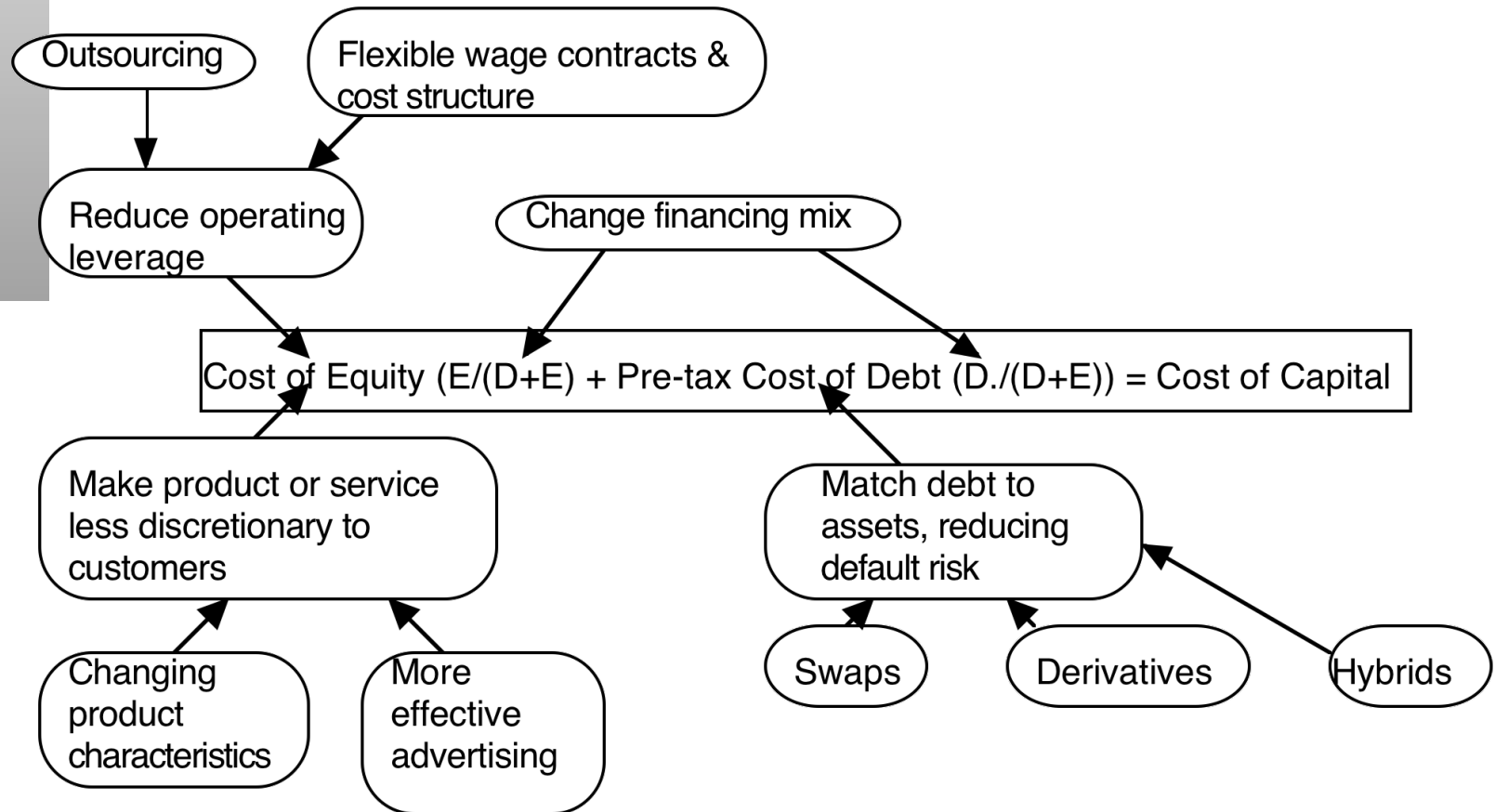
Optimal Financing Mix: KRKA

Debt Ratio	Beta	Cost of Equity	Bond Rating	Interest rate on debt	Tax Rate	Cost of Debt (after-tax)	WACC	Firm Value (G)
0%	0.61	7.04%	AAA	4.10%	21.00%	3.24%	7.04%	€ 2,459
10%	0.67	7.39%	AAA	4.10%	21.00%	3.24%	6.97%	€ 2,479
20%	0.74	7.83%	AA	4.35%	21.00%	3.44%	6.95%	€ 2,486
30%	0.82	8.40%	A	4.85%	21.00%	3.83%	7.03%	€ 2,460
40%	0.94	9.16%	BB	7.60%	21.00%	6.00%	7.90%	€ 2,203
50%	1.10	10.22%	B	8.85%	21.00%	6.99%	8.61%	€ 2,029
60%	1.34	11.82%	CC	13.60%	21.00%	10.74%	11.17%	€ 1,580
70%	1.75	14.47%	CC	13.60%	21.00%	10.74%	11.86%	€ 1,491
80%	2.59	20.03%	CC	13.60%	19.51%	10.95%	12.76%	€ 1,389
90%	5.31	37.86%	C	15.60%	15.12%	13.24%	15.70%	€ 1,137

As D/E ratio changes, the
Levered Beta = Unlevered Beta (1+ (1-t) (D/E))

Debt increases -> Interest
Expenses increase -> Interest
coverage ratio decreases ->
Ratings drop -> Cost of debt
increases

Optimal Financing Mix: Adris Grupa

Debt Ratio	Beta	Cost of Equity	Bond Rating	Interest rate on debt	Tax Rate	Cost of Debt (after-tax)	WACC	Firm Value (G)
0%	0.65	10.23%	AAA	6.75%	20.00%	5.40%	10.23%	HRK 5,771
10%	0.71	10.77%	AAA	6.75%	20.00%	5.40%	10.23%	HRK 5,776
20%	0.78	11.43%	AA	7.00%	20.00%	5.60%	10.27%	HRK 5,740
30%	0.87	12.29%	A	7.50%	20.00%	6.00%	10.40%	HRK 5,609
40%	1.00	13.43%	BB	10.25%	20.00%	8.20%	11.34%	HRK 4,837
50%	1.17	15.02%	B	11.50%	20.00%	9.20%	12.11%	HRK 4,337
60%	1.43	17.42%	B-	11.75%	20.00%	9.40%	12.61%	HRK 4,066
70%	1.86	21.41%	CC	16.25%	20.00%	13.00%	15.52%	HRK 2,954
80%	2.73	29.38%	CC	16.25%	20.00%	13.00%	16.28%	HRK 2,753
90%	5.38	53.80%	CC	16.25%	19.12%	13.14%	17.21%	HRK 2,539

If debt is cheaper than equity (and it is), why is there no benefit to borrowing money?

V. From fair value to fair price..

There is many a slip between the cup and the lip…

Are markets fair?

■ In an efficient market, the market price converges instantaneously on value. Thus, a firm that takes value increasing actions will see its stock price go up and a firm that is value destructive will be punished by the market.

■ In practice, there are three potential impediments to this process working smoothly:

- Investors may be irrational and/or short term.
- Markets may not trust the managers of the firm.
- Information about the actions may not get to markets or the message may be muddled.

I. The "right" investors

- Optimally, a firm that is focused on long term value would like to get investors who
  - Have long time horizons
  - Care about fundamentals
  - Do their research/homework
- While firms do not get to pick their investors, they can influence the composition by
  - Having a core of long term investors who may also be insiders in the firm
  - Choosing a dividend policy that attracts the right type of investors
  - What they focus on when they make decisions

II. Management Trust

■ Management trust is earned through a history of being focused on delivering value to investors. In other words, firms that have delivered solid returns to stockholders over time and taken good investments earn the trust of their stockholders, whereas firms that have delivered poor returns or over promised lose that trust.

■ When a firm loses the trust of its stockholders, it will not only find every action that it takes subjected to scrutiny and scrutiny but will come under intense pressure to return more of its cash to stockholders.

A Symbol of Distrust
How much cash is too much cash?

Market Value of $ 1 in cash:
Estimates obtained by regressing Enterprise Value against Cash Balances

Mature firms, Negative excess returns	All firms	High Growth firms, High Excess Returns
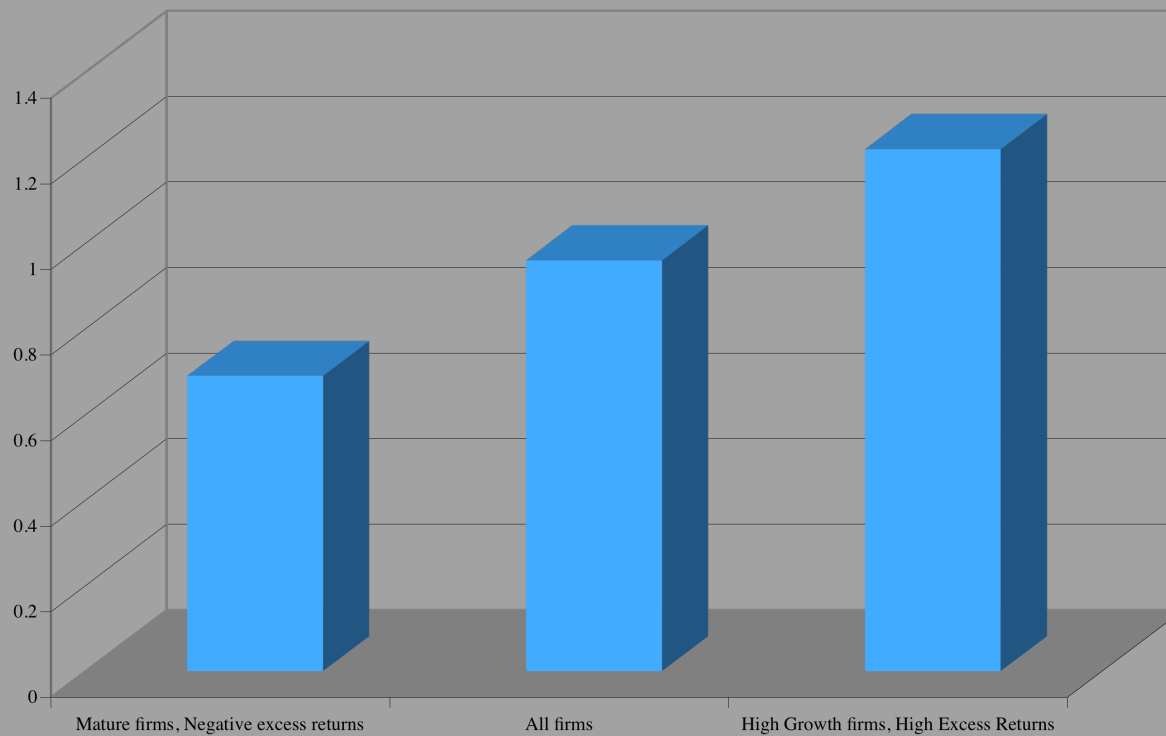
III. Information Gaps

■ For markets to react appropriately to actions taken by a firm, information about those actions has to be conveyed clearly and credibly to markets. In practice, information disclosure is hindered by

- An unwillingness to provide "key" details of actions, for fear of letting competitors in on secrets.
- A belief that investors are not intelligent or informed enough to use information appropriately.
- An inability to communicate effectively and directly.
- Complexity and confusion in the disclosure,

■ Managers will be better served trusting their investors to make the right judgments about actions and providing them with the information (positive and negative) to make these judgments.

Information Overload
A Discount for Complexity

	Company A	*Company B*
Operating Income	$ 1 billion	$ 1 billion
Tax rate	40%	40%
ROIC	10%	10%
Expected Growth	5%	5%
Cost of capital	8%	8%
Business Mix	Single Business	Multiple Businesses
Holdings	Simple	Complex
Accounting	Transparent	Opaque

■ *Which firm would you value more highly?*

Measuring Complexity: Volume of Data in Financial Statements

Company	Number of pages in last 10Q	Number of pages in last 10K
General Electric	65	410
Microsoft	63	218
Wal-mart	38	244
Exxon Mobil	86	332
Pfizer	171	460
Citigroup	252	1026
Intel	69	215
AIG	164	720
Johnson & Johnson	63	218
IBM	85	353

Measuring Complexity: A Complexity Score

Item	Factors	Follow-up Question	Answer	Weighting factor	Gerdau Score	GE Score
Operating Income	1. Multiple Businesses	Number of businesses (with more than 10% of revenues) =	1	2.00	2	30
	2. One-time income and expenses	Percent of operating income =	10%	10.00	1	0.8
	3. Income from unspecified sources	Percent of operating income =	0%	10.00	0	1.2
	4. Items in income statement that are volatile	Percent of operating income =	15%	5.00	0.75	1
Tax Rate	1. Income from multiple locales	Percent of revenues from non-domestic locales =	70%	3.00	2.1	1.8
	2. Different tax and reporting books	Yes or No	No	Yes=3	0	3
	3. Headquarters in tax havens	Yes or No	No	Yes=3	0	0
	4. Volatile effective tax rate	Yes or No	Yes	Yes=2	2	0
Capital Expenditures	1. Volatile capital expenditures	Yes or No	Yes	Yes=2	2	2
	2. Frequent and large acquisitions	Yes or No	Yes	Yes=4	4	4
	3. Stock payment for acquisitions and investments	Yes or No	No	Yes=4	0	4
Working capital	1. Unspecified current assets and current liabilities	Yes or No	No	Yes=3	0	0
	2. Volatile working capital items	Yes or No	Yes	Yes=2	2	2
Expected Growth rate	1. Off-balance sheet assets and liabilities (operating leases and R&D)	Yes or No	No	Yes=3	0	3
	2. Substantial stock buybacks	Yes or No	No	Yes=3	0	3
	3. Changing return on capital over time	Is your return on capital volatile?	Yes	Yes=5	5	5
	4. Unsustainably high return	Is your firm's ROC much higher than industry average?	No	Yes=5	0	0
Cost of capital	1. Multiple businesses	Number of businesses (more than 10% of revenues) =	1	1.00	1	20
	2. Operations in emerging markets	Percent of revenues=	50%	5.00	2.5	2.5
	3. Is the debt market traded?	Yes or No	No	No=2	2	0
	4. Does the company have a rating?	Yes or No	Yes	No=2	0	0
	5. Does the company have off-balance sheet debt?	Yes or No	No	Yes=5	0	5
No-operating assets	Minority holdings as percent of book assets	Minority holdings as percent of book assets	0%	20.00	0	0.8
Firm to Equity value	Consolidation of subsidiaries	Minority interest as percent of book value of equity	63%	20.00	12.6	1.2
Per share value	Shares with different voting rights	Does the firm have shares with different voting rights?	Yes	Yes = 10	10	0
	Equity options outstanding	Options outstanding as percent of shares	0%	10.00	0	0.25
		Complexity Score =			48.95	90.55

Aswath Damodaran

Relative Valuation

Aswath Damodaran

Relative valuation is pervasive…

- Most asset valuations are relative.
- Most equity valuations on Wall Street are relative valuations.
    - Almost 85% of equity research reports are based upon a multiple and comparables.
    - More than 50% of all acquisition valuations are based upon multiples
    - Rules of thumb based on multiples are not only common but are often the basis for final valuation judgments.
- While there are more discounted cashflow valuations in consulting and corporate finance, they are often relative valuations masquerading as discounted cash flow valuations.
    - The objective in many discounted cashflow valuations is to back into a number that has been obtained by using a multiple.
    - The terminal value in a significant number of discounted cashflow valuations is estimated using a multiple.

The Reasons for the allure…

"If you think I'm crazy, you should see the guy who lives across the hall"
Jerry Seinfeld talking about Kramer in a Seinfeld episode

" A little inaccuracy sometimes saves tons of explanation"

H.H. Munro

" If you are going to screw up, make sure that you have lots of company"

Ex-portfolio manager

The Four Steps to Deconstructing Multiples

- **Define the multiple**
  - In use, the same multiple can be defined in <u>different ways</u> by different users. When comparing and using multiples, estimated by someone else, it is critical that we <u>understand how the multiples have been estimated</u>
- **Describe the multiple**
  - Too many people who use a multiple have <u>no idea what its cross sectional distribution</u> is. If you do not know what the cross sectional distribution of a multiple is, it is difficult to look at a number and pass judgment on whether it is too high or low.
- **Analyze the multiple**
  - It is critical that we <u>understand the fundamentals</u> that drive each multiple, and the <u>nature of the relationship</u> between the multiple and each variable.
- **Apply the multiple**
  - Defining the <u>comparable universe</u> and <u>controlling for differences</u> is far more difficult in practice than it is in theory.

Definitional Tests

- Is the multiple consistently defined?
  - **Proposition 1: Both the value (the numerator) and the standardizing variable (the denominator) should be to the same claimholders in the firm. In other words, the value of equity should be divided by equity earnings or equity book value, and firm value should be divided by firm earnings or book value.**

- Is the multiple uniformly estimated?
  - The variables used in defining the multiple should be estimated uniformly across assets in the "comparable firm" list.
  - If earnings-based multiples are used, the accounting rules to measure earnings should be applied consistently across assets. The same rule applies with book-value based multiples.

Example 1: Price Earnings Ratio: Definition

PE = Market Price per Share / Earnings per Share

■ There are a number of variants on the basic PE ratio in use. They are based upon how the price and the earnings are defined.

■ Price: is usually the current price

        is sometimes the average price for the year

■ EPS: earnings per share in most recent financial year

        earnings per share in trailing 12 months (Trailing PE)

        forecasted earnings per share next year (Forward PE)

        forecasted earnings per share in future year

Example 2: Enterprise Value /EBITDA Multiple

■ The enterprise value to EBITDA multiple is obtained by netting cash out against debt to arrive at enterprise value and dividing by EBITDA.

$$\frac{\text{Enterprise Value}}{\text{EBITDA}} = \frac{\text{Market Value of Equity} + \text{Market Value of Debt} - \text{Cash}}{\text{Earnings before Interest, Taxes and Depreciation}}$$

■ Why do we net out cash from firm value?

■ What happens if a firm has cross holdings which are categorized as:

- Minority interests?
- Majority active interests?

Descriptive Tests

■ What is the <u>average and standard deviation</u> for this multiple, across the universe (market)?

■ What is the <u>median</u> for this multiple?

  • The median for this multiple is often a more reliable comparison point.

■ How <u>large are the outliers</u> to the distribution, and <u>how do we deal</u> with the outliers?

  • Throwing out the outliers may seem like an obvious solution, but if the outliers all lie on one side of the distribution (they usually are large positive numbers), this can lead to a biased estimate.

■ Are there cases where the multiple <u>cannot be estimated</u>? Will ignoring these cases lead to a <u>biased estimate</u> of the multiple?

■ How has this multiple <u>changed over time?</u>

Looking at the distribution of PE ratios…

PE Ratios - US in January 2009
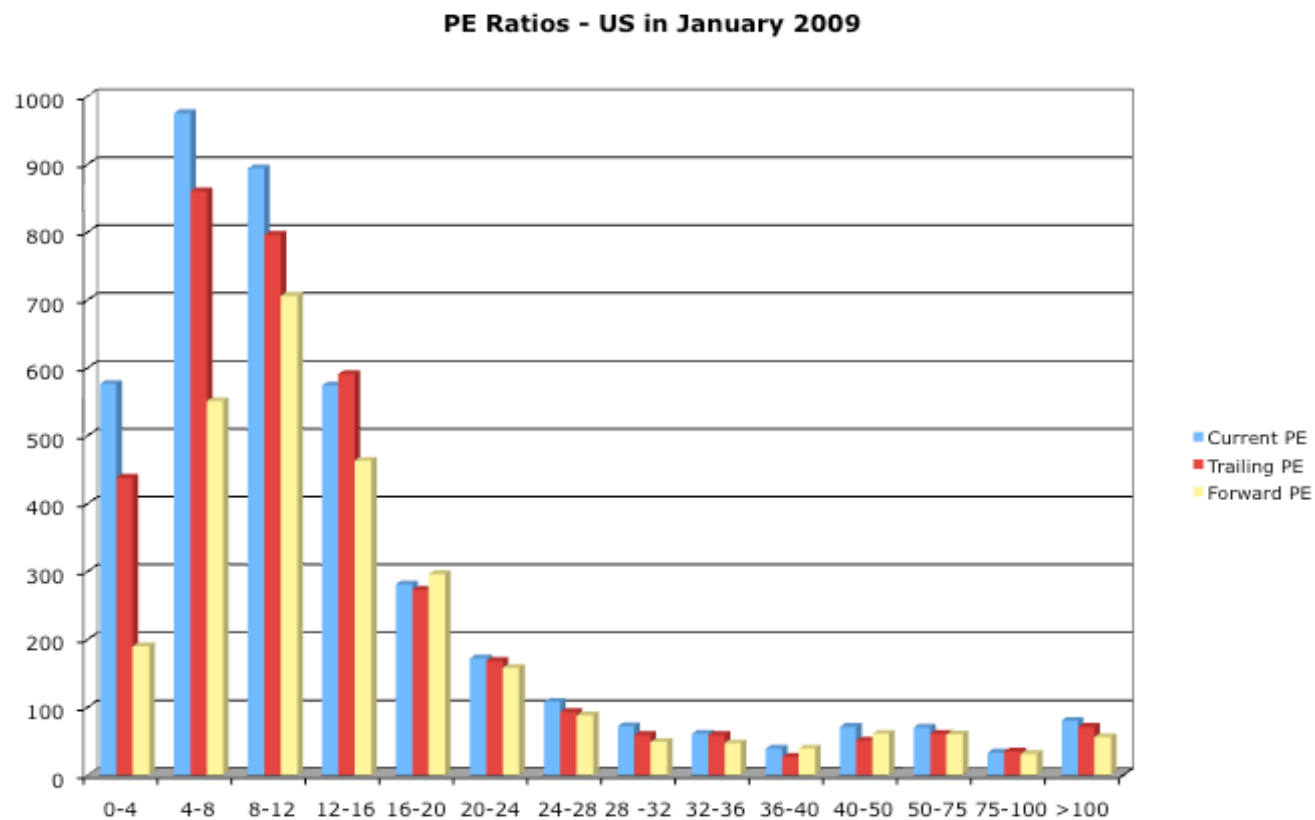
PE: Deciphering the Distribution

	Jan-09			Jan-08		
	Current PE	Trailing PE	Forward PE	Current PE	Trailing PE	Forward PE
Mean	18.91	17.48	20.04	45.02	32.44	32.21
Standard Error	0.98	0.91	0.87	4.64	1.96	1.47
Median	9.80	9.89	11.69	18.16	17.00	17.28
Standard Deviation	61.97	55.61	45.74	299.11	123.29	80.82
Kurtosis	668.30	1073.76	174.18	1618.20	1241.97	269.80
Skewness	21.06	27.18	11.66	35.41	30.30	14.23
Maximum	2442.83	2475.71	933.00	15126.20	5713.00	1912.33
Count	4010	3737	2795	4155	3944	3004
Sample size	6871	6871	6871	7155	7155	7155
Largest(400)	29.50	26.18	25.06			
Smallest(400)	3.00	2.76	5.74			

Comparing PE Ratios: US, Europe, Japan and Emerging Markets

PE ratios across markets

	Median PE
Japan	12.26
US	9.8
Europe	7.7
Emerging Mkts	7.5
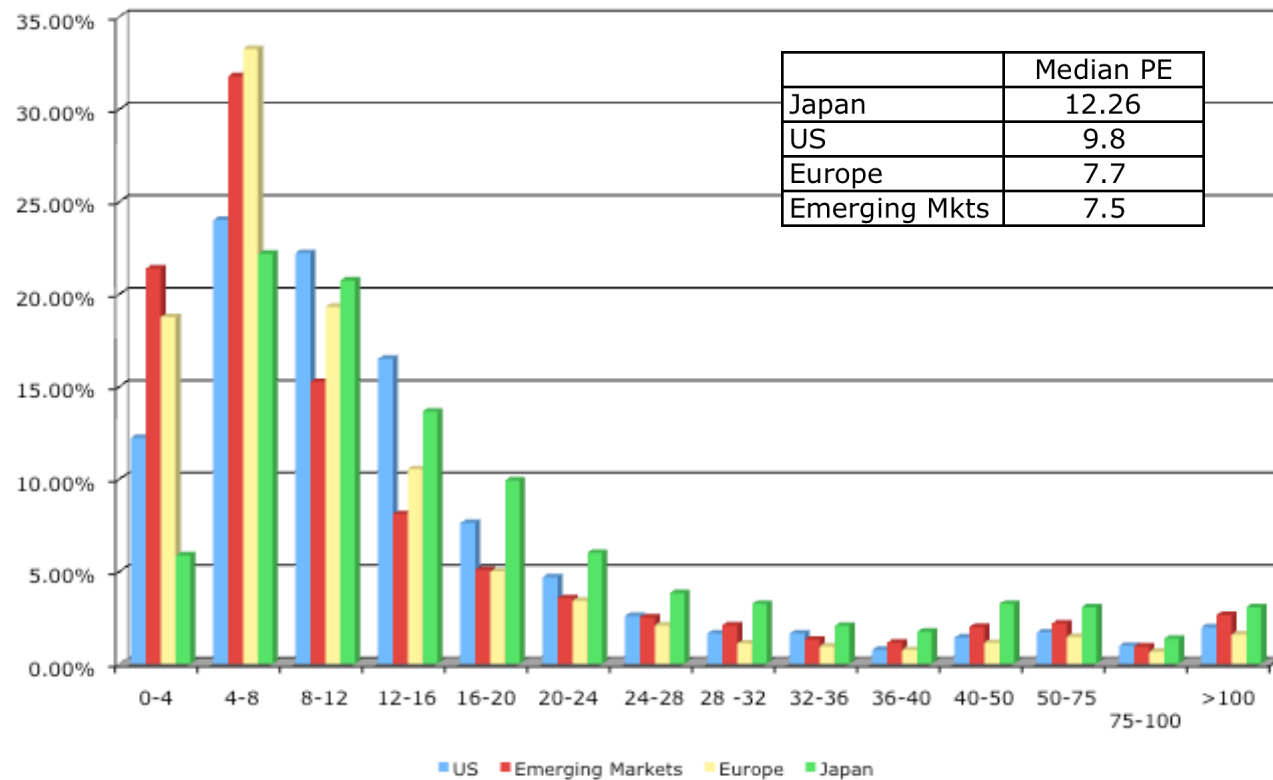
And isolating Eastern Europe

Aswath Damodaran
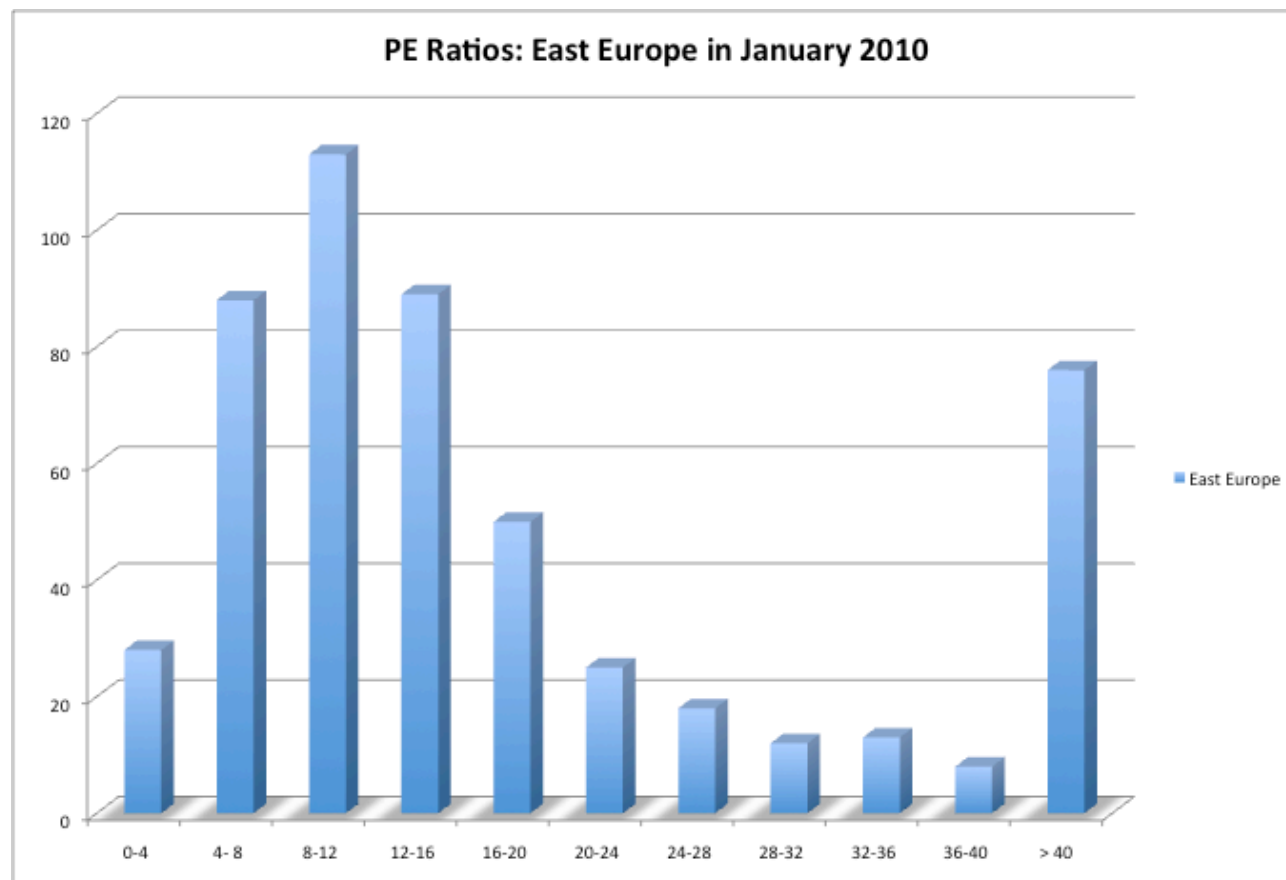
And 6 times EBITDA may not be cheap…

EV/EBITDA- Eastern Europe in January 2010
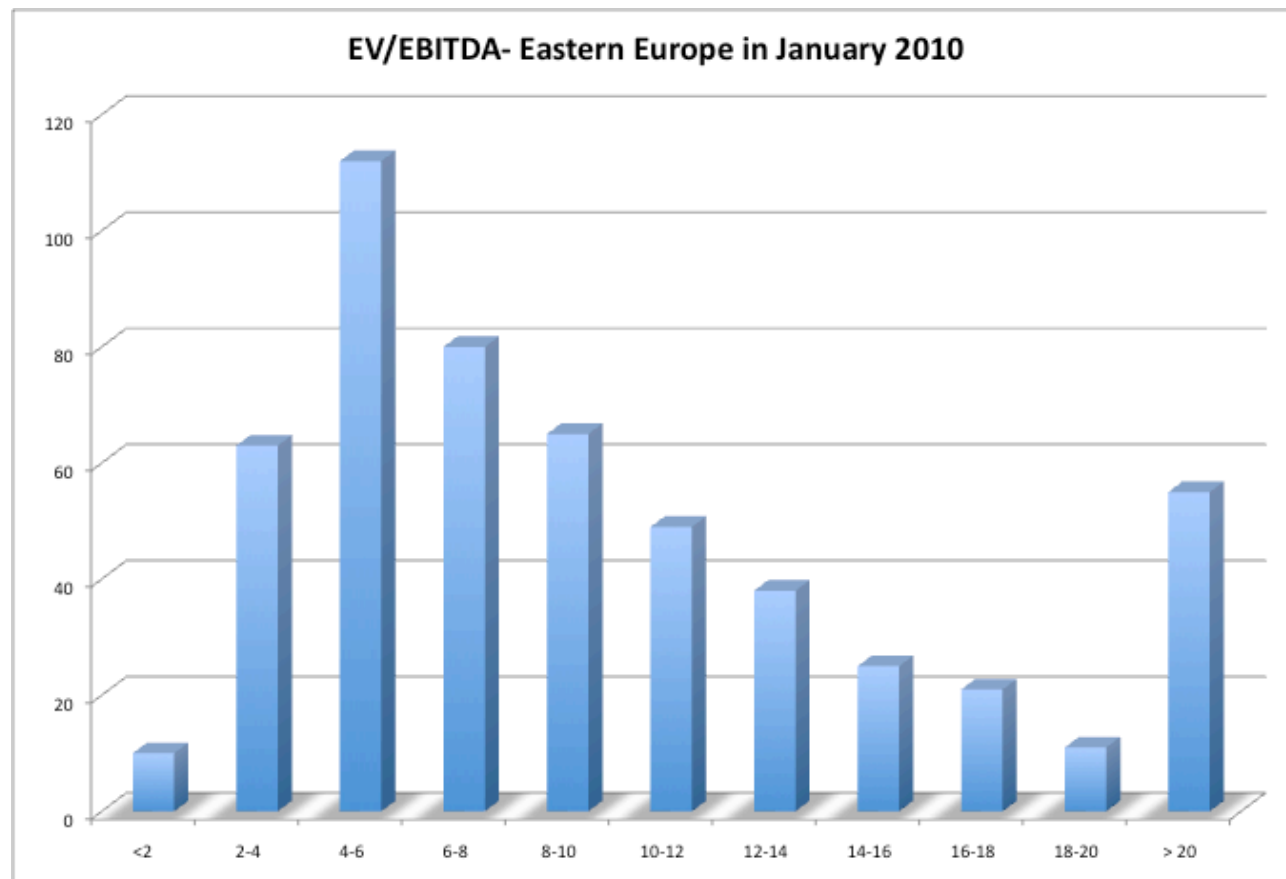
Analytical Tests

■ What are the <u>fundamentals</u> that determine and drive these multiples?

- Proposition 2: Embedded in every multiple are all of the variables that drive every discounted cash flow valuation - growth, risk and cash flow patterns.

- In fact, using a simple discounted cash flow model and basic algebra should yield the fundamentals that drive a multiple

■ How do <u>changes in these fundamentals</u> change the multiple?

- The relationship between a fundamental (like growth) and a multiple (such as PE) is seldom linear. For example, if firm A has twice the growth rate of firm B, it will generally not trade at twice its PE ratio

- **Proposition 3: It is impossible to properly compare firms on a multiple, if we do not know the nature of the relationship between fundamentals and the multiple.**

PE Ratio: Understanding the Fundamentals

■ To understand the fundamentals, start with a basic <u>equity</u> discounted cash flow model.

■ With the dividend discount model,

$$P_0 = \frac{DPS_1}{r - g_n}$$

■ Dividing both sides by the current earnings per share,

$$\frac{P_0}{EPS_0} = PE = \frac{Payout\ Ratio * (1 + g_n)}{r - g_n}$$

■ If this had been a FCFE Model,

$$P_0 = \frac{FCFE_1}{r - g_n}$$

$$\frac{P_0}{EPS_0} = PE = \frac{(FCFE/Earnings) * (1 + g_n)}{r - g_n}$$

The Determinants of Multiples…

Value of Stock = $DPS_1/(k_e - g)$

| PE=Payout Ratio $(1+g)/(r-g)$ | PEG=Payout ratio $(1+g)/g(r-g)$ | PBV=ROE (Payout ratio) $(1+g)/(r-g)$ | PS= Net Margin (Payout ratio) $(1+g)/(r-g)$ |

PE=f(g, payout, risk) PEG=f(g, payout, risk) PBV=f(ROE,payout, g, risk) PS=f(Net Mgn, payout, g, risk)

Equity Multiples

Firm Multiples

V/FCFF=f(g, WACC) V/EBIT(1-t)=f(g, RIR, WACC V/EBIT=f(g, RIR, WACC, t VS=f(Oper Mgn, RIR, g, WACC)

| Value/FCFF=$(1+g)/$ (WACC-g) | Value/EBIT(1-t) = $(1+g)$ (1- RIR)/(WACC-g) | Value/EBIT=$(1+g)$(1-RiR)/(1-t)(WACC-g) | VS= Oper Margin (1-RIR) $(1+g)/$(WACC-g) |

Value of Firm = $FCFF_1/(WACC - g)$

Application Tests

■ Given the firm that we are valuing, what is a "comparable" firm?

- While traditional analysis is built on the premise that firms in the same sector are comparable firms, valuation theory would suggest that a comparable firm is one which is similar to the one being analyzed in terms of fundamentals.

- **Proposition 4: There is no reason why a firm cannot be compared with another firm in a very different business, if the two firms have the same risk, growth and cash flow characteristics.**

■ Given the comparable firms, how do we adjust for differences across firms on the fundamentals?

- **Proposition 5: It is impossible to find an exactly identical firm to the one you are valuing.**

An Example: Comparing Multiples across a Sector: KRKA

Company Name	Current PE	Trailing PE	Forward PE	PBV	PS	EV/EBITDA	EV/ Invested Capital	EV/Sales	Return on Equity	Return on Capital (ROC or ROIC)	Net Profit Margin	Pre-tax Operating Margin
Sanitas AB			5.29	0.96	0.79	6.16	0.98	1.64	-3.58%	6.20%	-4.12%	13.41%
Deva Holding AS				1.60	2.39		1.46	2.87	-12.32%	-0.99%	-10.94%	-1.67%
EIS Eczacibasi Ilaç Sanayi ve Ticaret A.S.	19.62	19.62	4.58		1.75	124.82		1.75			8.93%	-0.69%
Genera d.d.				0.63	0.69	44.56	0.68	0.87			-21.93%	-3.70%
Pharmstandard Group	19.44	16.56	19.74	4.78	4.75	10.99	4.92	4.71	30.61%	41.49%	23.83%	36.77%
Veropharm Co. Ltd.	7.78	8.06	7.44	1.98	1.66	5.98	1.93	1.82	24.04%	27.47%	22.84%	27.26%
Antibiotice S.A.	26.65	26.65	15.36		1.30	4.33		1.30	7.49%	22.80%	4.87%	17.90%
AS Olainfarm		10.94	8.52	0.81	0.67	14.84	0.89	1.02	8.31%	8.50%	5.83%	8.31%
BioFarm SA												
Biovet JSC												
JSC Grindeks	4.13	11.41	4.92	0.72	0.60	3.96	0.77	0.81	7.00%	6.81%	5.81%	6.45%
KrKa dd Novo Mesto	14.20	13.79	13.00	2.48	2.33	7.69	2.34	2.51	21.28%	28.04%	16.12%	25.17%
Average	*15.30*	*15.29*	*10.51*	*1.86*	*1.79*	*27.14*	*1.86*	*1.96*	*12.34%*	*19.16%*	*6.15%*	*12.87%*
Median	*16.82*	*13.79*	*8.52*	*1.60*	*1.66*	*9.34*	*1.46*	*1.75*	*8.31%*	*22.80%*	*5.83%*	*8.31%*

PBV versus ROE – East European Pharmaceuticals

Dependent variable is: PBV

R squared = 48.3%

PBV = 1.16 +   9.13 ROE

    (1.33)   (2.57)

Evaluating KRKA, with its ROE of 21.28%:

Predicted PBV for KRKA = 1.16 + 9.13 (.2128) = 3.1028

Actual PBV for KRKA = 2.48

Stock is undervalued by about 20% (3.10/2.48)

Real Options: Fact and Fantasy

Aswath Damodaran

The Basis for Real Options

■ In the last few years, there are some who have argued that discounted cashflow valuations under valued some companies and that a real option premium should be tacked on to DCF valuations. To understanding its moorings, compare the two trees below:

A bad investment……………….. Becomes a good one..

```
            +100
    Success
    1/2

Today


    1/2
    Failure
            -120
```

```
                        2/3      +80

              +20
    1/3                1/3

Now                             -100

    2/3
         -20    STOP
```
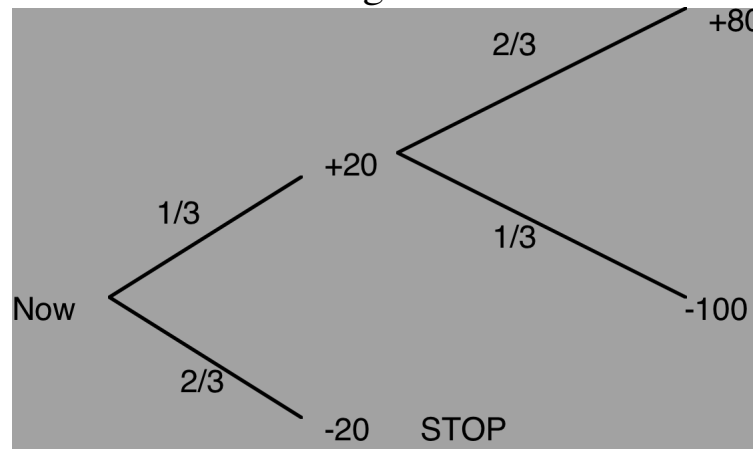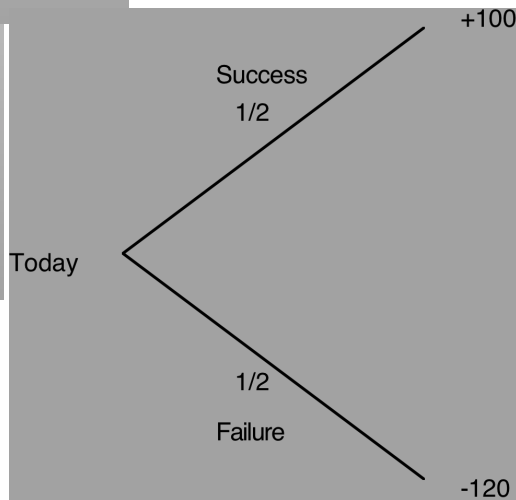
1. Learn at relatively low cost
2. Make better decisions based on learning

When is there an option embedded in an action?

■ An option provides the holder with the **right** to buy or sell a specified quantity of an underlying asset at a fixed price (called a strike price or an exercise price) at or before the expiration date of the option.

■ There has to be a <u>clearly defined underlying asset</u> whose value changes over time in unpredictable ways.

■ The <u>payoffs on this asset</u> (real option) have to be <u>contingent on an specified event</u> occurring within a finite period.

Example 1: Product Patent as an Option

PV of Cash Flows
from Project

Initial Investment in
Project

Present Value of Expected
Cash Flows on Product

Project's NPV turns
positive in this section

Project has negative
NPV in this section
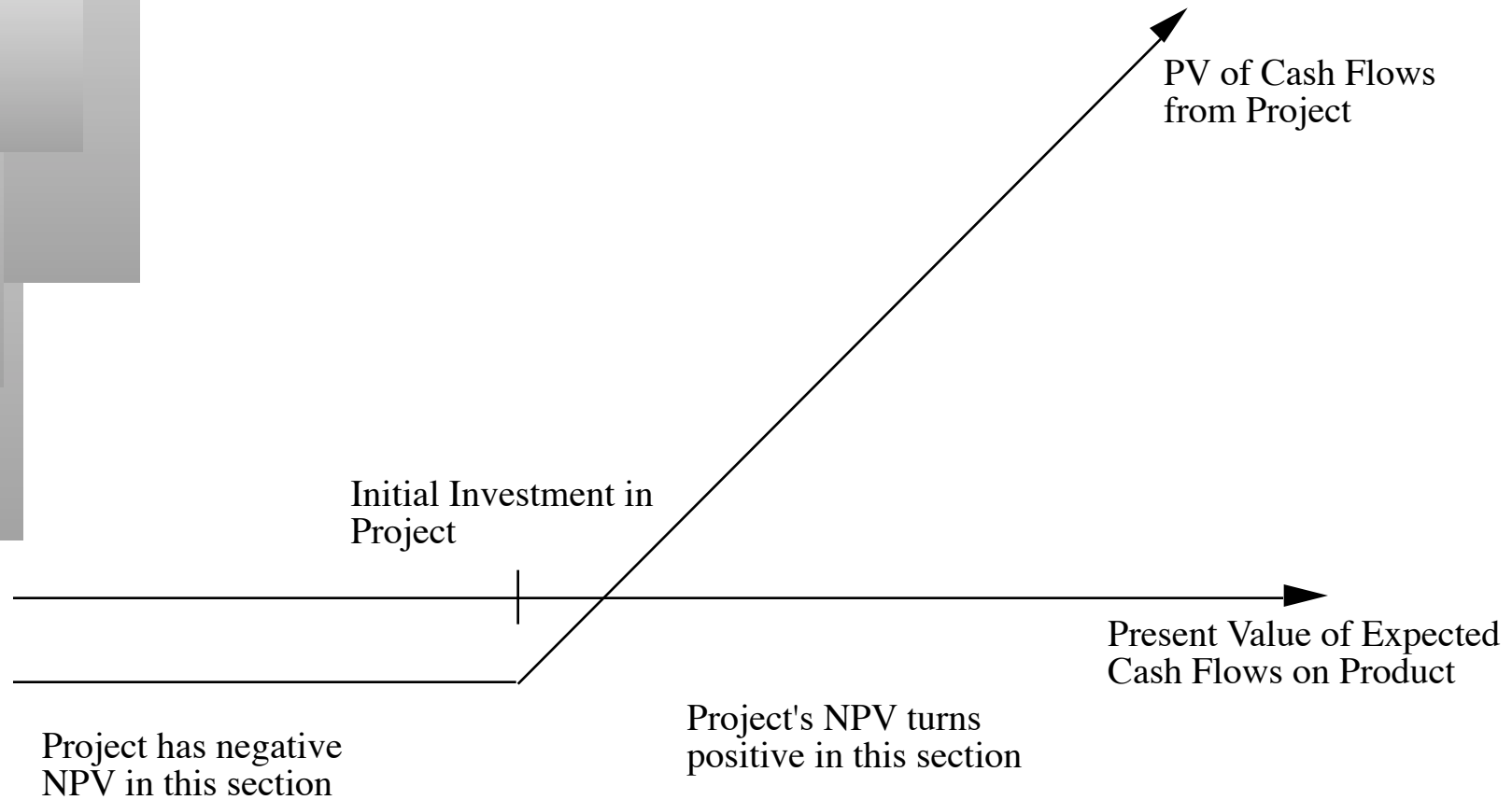
Example 2: Expansion of existing project as an option

PV of Cash Flows
from Expansion

Additional Investment
to Expand

Present Value of Expected
Cash Flows on Expansion

Firm will not expand in
this section

Expansion becomes
attractive in this section
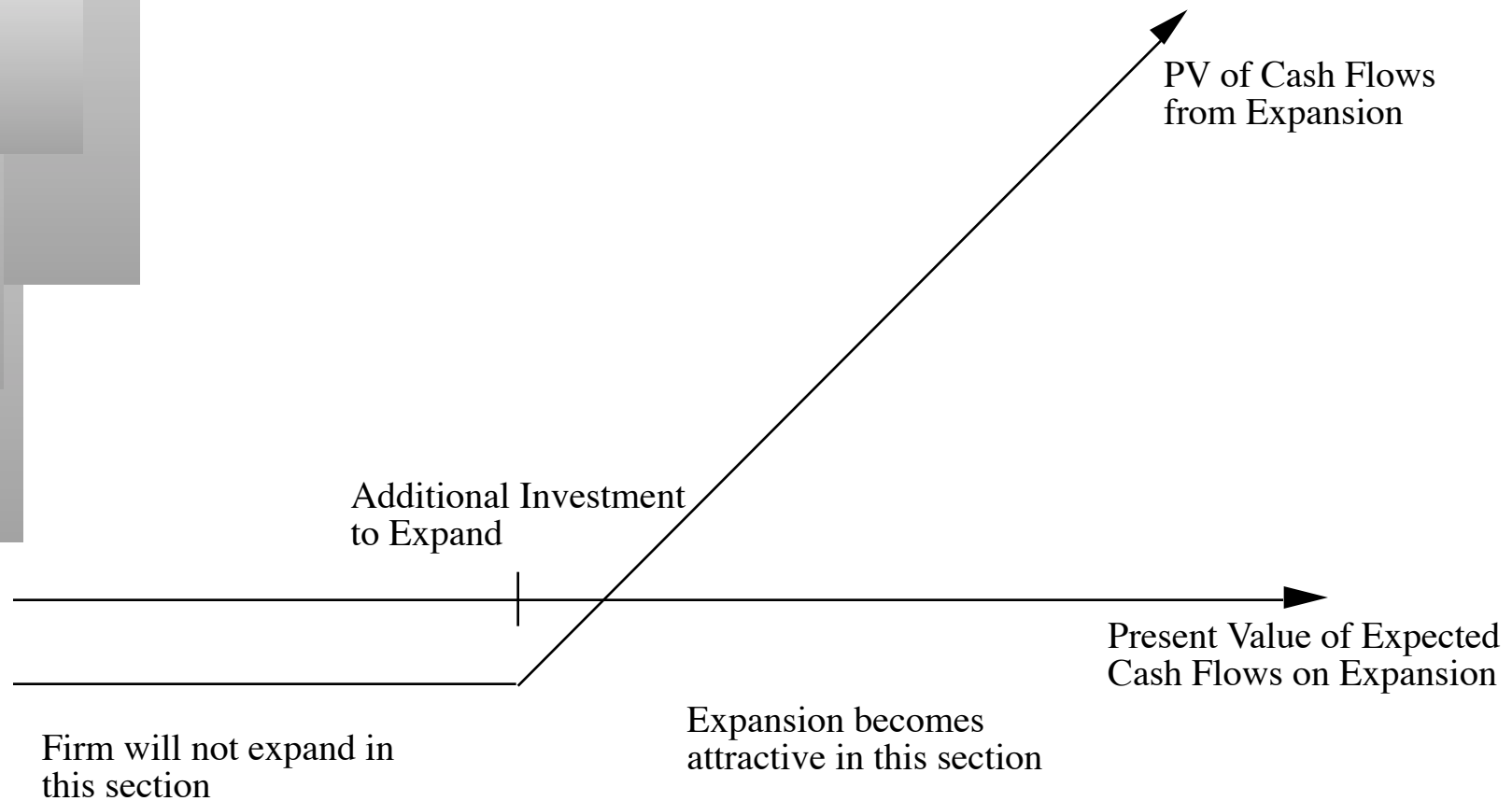
When does the option have significant economic value?

■ For an option to have significant economic value, there has to be a <u>restriction on competition in the event of the contingency</u>. In a perfectly competitive product market, no contingency, no matter how positive, will generate positive net present value.

■ At the limit, real options are <u>most valuable when you have exclusivity</u> - you and only you can take advantage of the contingency. They become less valuable as the barriers to competition become less steep.

Exclusivity: Putting Real Options to the Test

- Product Options: Patent on a drug
  - Patents restrict competitors from developing similar products
  - Patents do not restrict competitors from developing other products to treat the same disease.
- Growth Options: Expansion into a new product or market
  - Barriers may range from strong (exclusive licenses granted by the government - as in telecom businesses) to weaker (brand name, knowledge of the market) to weakest (first mover).

Determinants of option value

- **Variables Relating to Underlying Asset**
  - <u>Value of Underlying Asset</u>; as this value increases, the right to buy at a fixed price (calls) will become more valuable and the right to sell at a fixed price (puts) will become less valuable.
  - <u>Variance in that value</u>; as the variance increases, both calls and puts will become more valuable because all options have limited downside and depend upon price volatility for upside.
  - <u>Expected dividends on the asset</u>, which are likely to reduce the price appreciation component of the asset, reducing the value of calls and increasing the value of puts.
- **Variables Relating to Option**
  - <u>Strike Price of Options</u>; the right to buy (sell) at a fixed price becomes more (less) valuable at a lower price.
  - <u>Life of the Option</u>; both calls and puts benefit from a longer life.
- **Level of Interest Rates**; as rates increase, the right to buy (sell) at a fixed price in the future becomes more (less) valuable.

When can you use option pricing models to value real options?

■ The notion of a replicating portfolio that drives option pricing models makes them most suited for valuing real options where

- The underlying asset is traded - this yield not only observable prices and volatility as inputs to option pricing models but allows for the possibility of creating replicating portfolios
- An active marketplace exists for the option itself.
- The cost of exercising the option is known with some degree of certainty.

■ When option pricing models are used to value real assets, we have to accept the fact that

- The value estimates that emerge will be far more imprecise.
- The value can deviate much more dramatically from market price because of the difficulty of arbitrage.

Valuing a Product Patent as an option: Avonex

■ Biogen, a bio-technology firm, has a patent on Avonex, a drug to treat multiple sclerosis, for the next 17 years, and it plans to produce and sell the drug by itself. The key inputs on the drug are as follows:

PV of Cash Flows from Introducing the Drug Now = S = $ 3.422 billion

PV of Cost of Developing Drug for Commercial Use = K = $ 2.875 billion

Patent Life = t = 17 years   Riskless Rate = r = 6.7% (17-year T.Bond rate)

Variance in Expected Present Values = σ^2 = 0.224 (Industry average firm variance for bio-tech firms)

Expected Cost of Delay = y = 1/17 = 5.89%

d1 = 1.1362   N(d1) = 0.8720

d2 = -0.8512   N(d2) = 0.2076

Call Value= 3,422 exp$^{(-0.0589)(17)}$ (0.8720) - 2,875 (exp$^{(-0.067)(17)}$ (0.2076)= $ 907 million

One final example: Equity as a Liquidation Option

Net Payoff
on Equity

Face Value
of Debt
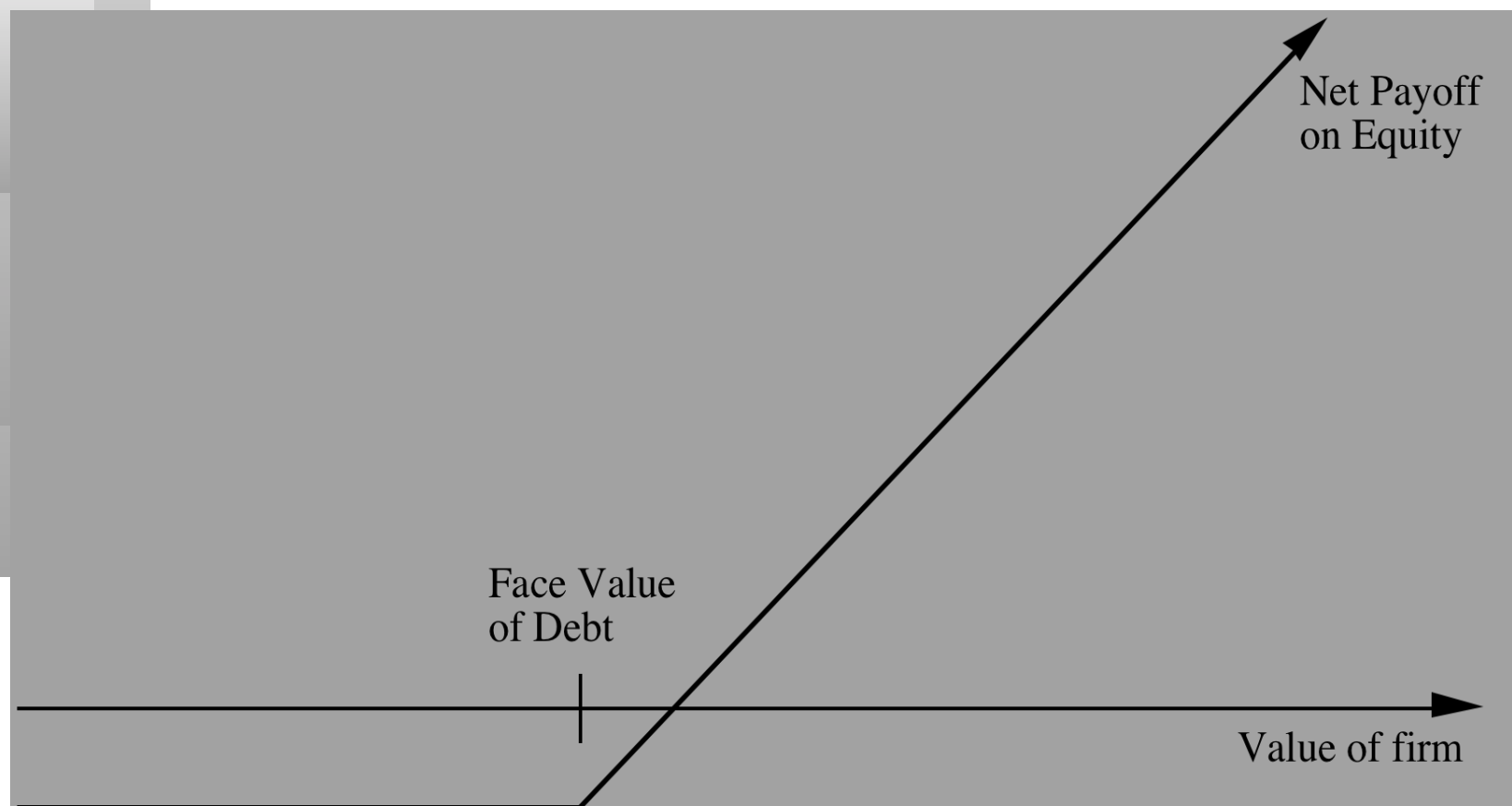
Value of firm

Application to valuation: A simple example

■ Assume that you have a firm whose assets are currently valued at $100 million and that the standard deviation in this asset value is 40%.

■ Further, assume that the face value of debt is $80 million (It is zero coupon debt with 10 years left to maturity).

■ If the ten-year treasury bond rate is 10%,

  • how much is the equity worth?
  • What should the interest rate on debt be?

Valuing Equity as a Call Option

- Inputs to option pricing model
  - Value of the underlying asset = S = Value of the firm = $ 100 million
  - Exercise price = K = Face Value of outstanding debt = $ 80 million
  - Life of the option = t = Life of zero-coupon debt = 10 years
  - Variance in the value of the underlying asset = σ^2 = Variance in firm value = 0.16
  - Riskless rate = r = Treasury bond rate corresponding to option life = 10%
- Based upon these inputs, the Black-Scholes model provides the following value for the call:
  - d1 = 1.5994   N(d1) = 0.9451
  - d2 = 0.3345   N(d2) = 0.6310
- Value of the call = 100 (0.9451) - 80 exp$^{(-0.10)(10)}$ (0.6310) = $75.94 million
- Value of the outstanding debt = $100 - $75.94 = $24.06 million
- Interest rate on debt = ($ 80 / $24.06)$^{1/10}$ -1 = 12.77%

The Effect of Catastrophic Drops in Value

■ Assume now that a catastrophe wipes out half the value of this firm (the value drops to $ 50 million), while the face value of the debt remains at $ 80 million. Consider the new inputs into the equity valuation:

- Value of the underlying asset = S = Value of the firm = $ 50 million
- Exercise price = K = Face Value of outstanding debt = $ 80 million
- Life of the option = t = Life of zero-coupon debt = 10 years
- Variance in the value of the underlying asset = σ^2 = Variance in firm value = 0.16
- Riskless rate = r = Treasury bond rate corresponding to option life = 10%

■ Based upon these inputs, the Black-Scholes model provides the following value for the call:

- d1 = 1.0515   N(d1) = 0.8534
- d2 = -0.2135   N(d2) = 0.4155
- Value of the call (Equity)= 50 (0.8534) - 80 exp$^{(-0.10)(10)}$ (0.4155) = $30.44 million
- Value of the debt= $50 - $30.44 = $19.56 million

Equity value persists ..

Value of Equity as Firm Value Changes

Back to Lemmings...

WHAT LEMMINGS BELIEVE