

Valuation: Intrinsic, Relative and Contingent Claim Valuation

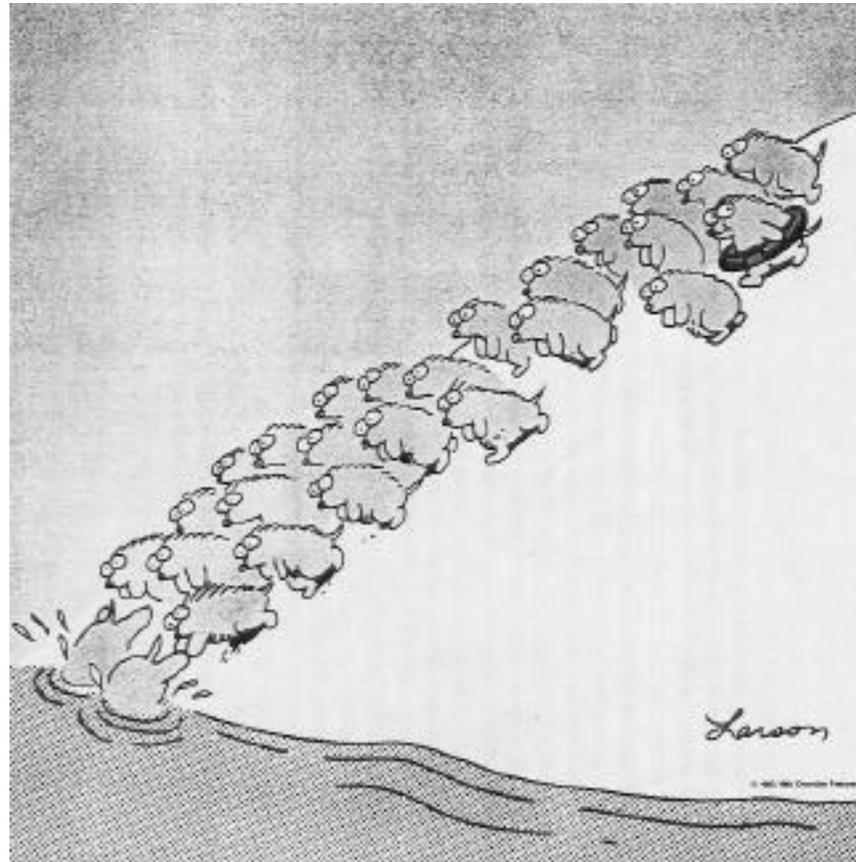
Aswath Damodaran

<http://www.stern.nyu.edu/~adamodar>

Some Initial Thoughts

" One hundred thousand lemmings cannot be wrong"

Graffiti



A philosophical basis for Valuation

- Many investors believe that the pursuit of 'true value' based upon financial fundamentals is a fruitless one in markets where prices often seem to have little to do with value.
- There have always been investors in financial markets who have argued that market prices are determined by the perceptions (and misperceptions) of buyers and sellers, and not by anything as prosaic as cashflows or earnings.
- Perceptions matter, but they cannot be all the matter.
- Asset prices cannot be justified by merely using the “bigger fool” theory.

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.

Approaches to Valuation

- **Discounted cashflow valuation**, relates the value of an asset to the present value of expected future cashflows on that asset.
- **Relative valuation**, estimates the value of an asset by looking at the pricing of 'comparable' assets relative to a common variable like earnings, cashflows, book value or sales.
- **Contingent claim valuation**, uses option pricing models to measure the value of assets that share option characteristics.

Basis for all valuation approaches

- The use of valuation models in investment decisions (i.e., in decisions on which assets are under valued and which are over valued) are based upon
 - a perception that markets are inefficient and make mistakes in assessing value
 - an assumption about how and when these inefficiencies will get corrected
- In an efficient market, the market price is the best estimate of value. The purpose of any valuation model is then the justification of this value.

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 life of the asset
 - to estimate the cash flows during the life of the asset
 - to estimate the discount rate to apply to these cash flows to get present value
- **Market Inefficiency:** Markets are assumed to make mistakes in pricing assets across time, and are assumed to correct themselves over time, as new information comes out about assets.

Discounted Cashflow Valuation: Basis for Approach

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

- where CF_t is the cash flow in period t , and r is the discount rate appropriate given the riskiness of the cash flow and t is the life of the asset.

Proposition 1: For an asset to have value, the expected cash flows have to be positive some time over the life of the asset.

Proposition 2: Assets that generate cash flows early in their life will be worth more than assets that generate cash flows later; the latter may however have greater growth and higher cash flows to compensate.

Valuing a Firm

- The value of the firm is obtained by discounting expected cashflows to the firm, i.e., the residual cashflows after meeting all operating expenses and taxes, but prior to debt payments, at the weighted average cost of capital, which is the cost of the different components of financing used by the firm, weighted by their market value proportions.

$$\text{Value of Firm} = \sum_{t=1}^{t=n} \frac{\text{CF to Firm}_t}{(1+WACC)^t}$$

where,

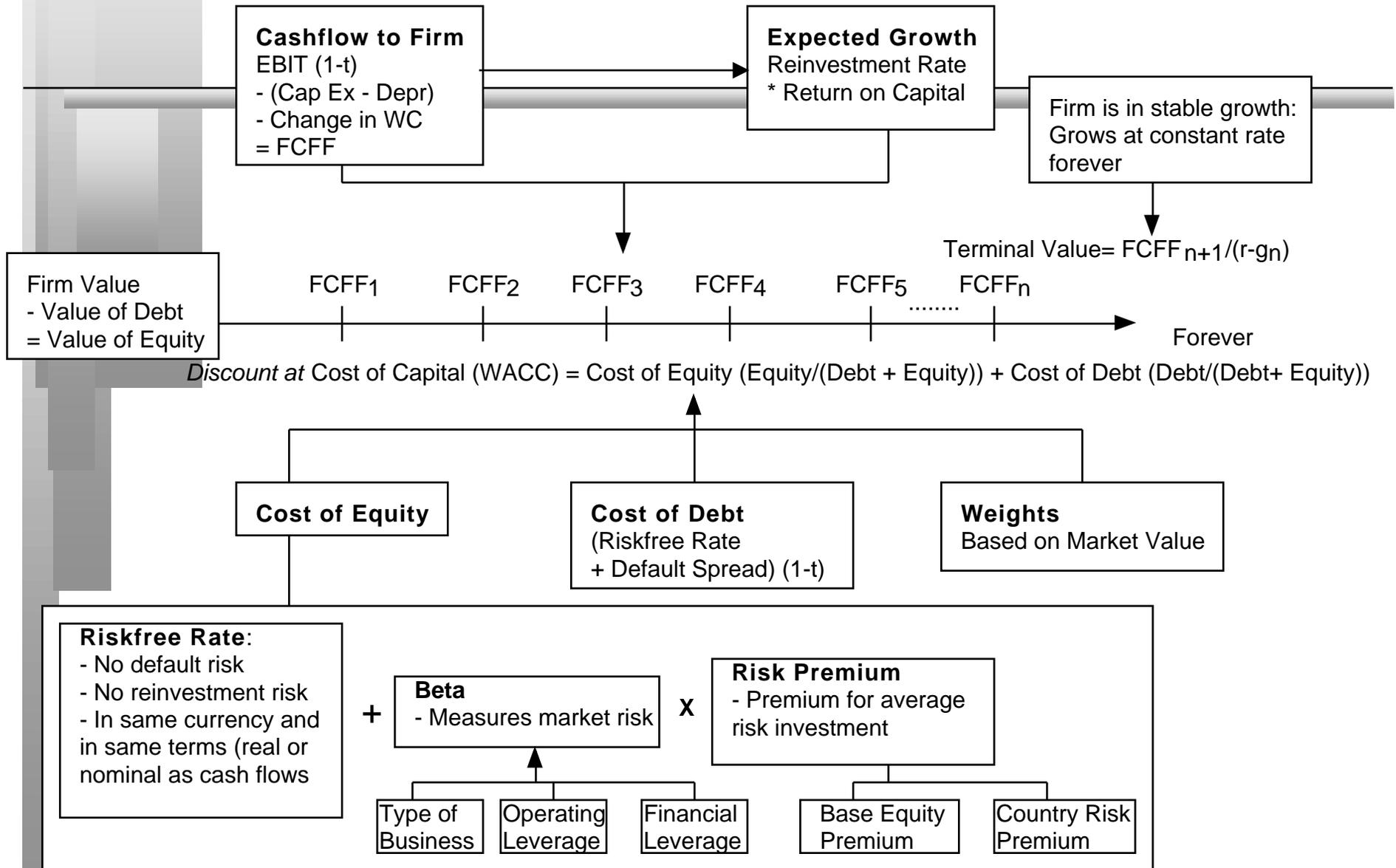
CF to Firm_t = Expected Cashflow to Firm in period t

WACC = Weighted Average Cost of Capital

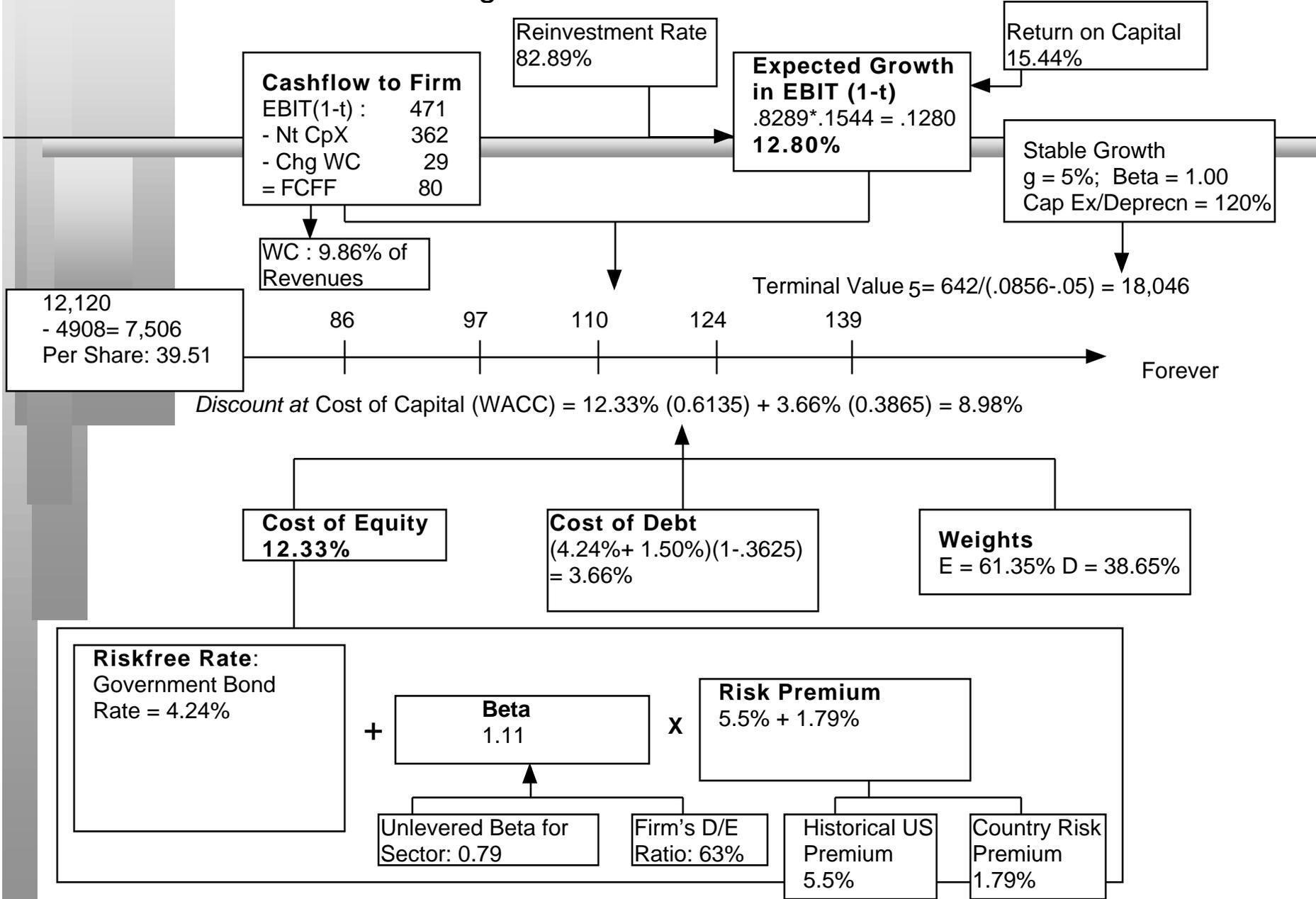
Discounted Cash Flow Valuation: The Steps

- Estimate the **discount rate** or rates to use in the valuation
 - Discount rate can be either a cost of equity (if doing equity valuation) or a cost of capital (if valuing the firm)
 - Discount rate can be in nominal terms or real terms, depending upon whether the cash flows are nominal or real
 - Discount rate can vary across time.
- Estimate the **current earnings** and **cash flows** on the asset, to either equity investors (CF to Equity) or to all claimholders (CF to Firm)
- Estimate the **future earnings and cash flows** on the asset being valued, generally by estimating an expected growth rate in earnings.
- Estimate **when** the firm will reach “**stable growth**” and what characteristics (risk & cash flow) it will have when it does.
- Choose the **right DCF model** for this asset and value it.

DISCOUNTED CASHFLOW VALUATION



Portugal Telecom: A Valuator



I. Discount Rates: Cost of Equity

- Consider the standard approach to estimating cost of equity:

$$\text{Cost of Equity} = R_f + \text{Equity Beta} * (E(R_m) - R_f)$$

where,

R_f = Riskfree rate

$E(R_m)$ = Expected Return on the Market Index (Diversified Portfolio)

- In practice,
 - Short term government security rates are used as risk free rates
 - Historical risk premiums are used for the risk premium
 - Betas are estimated by regressing stock returns against market returns

Short term Governments are not riskfree

- 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
- Thus, the riskfree rates in valuation will depend upon when the cash flow is expected to occur and will vary across time
- A simpler approach is to match the duration of the analysis (generally long term) to the duration of the riskfree rate (also long term)
- In emerging markets, there are two problems:
 - The government might not be viewed as riskfree (Brazil, Indonesia)
 - There might be no market-based long term government rate (China)

Estimating a Riskfree Rate

- Estimate a range for the riskfree rate in local terms:
 - *Upper limit*: Obtain the rate at which the largest, safest firms in the country borrow at and use as the riskfree rate.
 - *Lower limit*: Use a local bank deposit rate as the riskfree rate
- Do the analysis in real terms (rather than nominal terms) using a real riskfree rate, which can be obtained in one of two ways –
 - from an inflation-indexed government bond, if one exists
 - set equal, approximately, to the long term real growth rate of the economy in which the valuation is being done.
- Do the analysis in another more stable currency, say US dollars.

A Simple Test

- You are valuing a Portuguese company in U.S. dollars and are attempting to estimate a riskfree rate to use in the analysis. The riskfree rate that you should use is
 - ❑ The interest rate on a Escudo denominated Portuguese Government bond
 - ❑ The interest rate on a US \$ denominated Portuguese Government bond
 - ❑ The interest rate on a US treasury bond

B. Everyone uses historical premiums, but..

- 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:

Historical period	Stocks - T.Bills		Stocks - T.Bonds	
	Arith	Geom	Arith	Geom
1926-1998	8.76%	6.95%	7.57%	5.91%
1962-1998	5.74%	4.63%	5.16%	4.46%
1981-1998	10.34%	9.72%	9.22%	8.02%

If you choose to use historical premiums....

- Go back as far as you can. A risk premium comes with a standard error. Given the annual standard deviation in stock prices is about 25%, the standard error in a historical premium estimated over 25 years is roughly:

$$\text{Standard Error in Premium} = 25\% / \sqrt{25} = 25\% / 5 = 5\%$$

- Be consistent in your use of the riskfree rate. Since we argued for long term bond rates, the premium should be the one over T.Bonds
- Use the geometric risk premium. It is closer to how investors think about risk premiums over long periods.
- Never use historical risk premiums estimated over short periods.
- For emerging markets, start with the base historical premium in the US and add a country spread, based upon the country rating and the relative equity market volatility.

Assessing Country Risk Using Currency Ratings: Western Europe

<i>Country</i>	<i>Rating</i>	<i>Default Spread</i>
Belgium	Aa1	75
Denmark	Aaa	0
France	Aaa	0
Germany	Aaa	0
Greece	A2	120
Ireland	Aaa	0
Italy	Aa3	90
Netherlands	Aaa	0
Norway	Aaa	0
Portugal	Aa2	85
United Kingdom	Aaa	0

Assessing Country Risk using Ratings: Eastern Europe

<i>Country</i>	<i>Rating</i>	<i>Default Spread (In bp)</i>
Bulgaria	B2	550
Croatia	Baa3	145
Czech Republic	Baa1	120
Hungary	Baa2	130
Russia	B3	650
Slovenia	A3	95

Using Country Ratings to Estimate Equity Spreads

- Country ratings measure default risk. While default risk premiums and equity risk premiums are highly correlated, one would expect equity spreads to be higher than debt spreads.
 - One way to adjust the country spread upwards is to use information from the US market. In the US, the equity risk premium has been roughly twice the default spread on junk bonds.
 - Another is to multiply the bond spread by the relative volatility of stock and bond prices in that market. For example,
 - Standard Deviation in PSI20 (Equity) = 17.78%
 - Standard Deviation in Portuguese long bond = 8.47%
 - Adjusted Equity Spread = 0.85% $(17.78/8.47) = 1.79\%$
- Ratings agencies make mistakes. They are often late in recognizing and building in risk.

Ratings Errors: Ratings for Asia

<i>Country</i>	<i>July 1997 Rating</i>	<i>January 1998 Ratings</i>
China	BBB+	BBB+
Indonesia	BBB	CCC+
India	BB+	BB+
Japan	AAA	AAA
South Korea	AA-	BB+
Malaysia	A+	A-
Pakistan	B+	B-
Philippines	BB+	BB+
Singapore	AAA	AAA
Taiwan	AA+	AA+
Thailand	A	BBB-

From Country Spreads to Risk premiums

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

$$E(\text{Return}) = \text{Riskfree Rate} + \text{Country Spread} + \text{Beta (US premium)}$$

Implicitly, this is what you are assuming when you use the local Government's dollar borrowing rate as your riskfree rate.

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

$$E(\text{Return}) = \text{Riskfree Rate} + \text{Beta (US premium + Country Spread)}$$

- 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)

$$E(\text{Return}) = \text{Riskfree Rate} + \text{Beta (US premium)} + \text{Beta (Country Spread)}$$

Estimating Exposure to Country Risk

- Different companies should be exposed to different degrees to country risk. For instance, a Portuguese firm that generates the bulk of its revenues in Western Europe should be less exposed to country risk in Portugal than one that generates all its business within Portugal.
- The factor “ ” measures the relative exposure of a firm to country risk. One simplistic solution would be to do the following:
 - = % of revenues domestically_{firm} / % of revenues domestically_{avg firm}For instance, if a firm gets 35% of its revenues domestically while the average firm in that market gets 70% of its revenues domestically
 - = 35% / 70 % = 0.5
- 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 E(Return) for Portugal Telecom

- Assume that the beta for Portugal Telecom is 1.11, and that the riskfree rate used is 4.24%. (Portuguese long bond rate)
- Approach 1: Assume that every company in the country is equally exposed to country risk. In this case,

$$E(\text{Return}) = 4.24\% + 1.79\% + 1.11 (5.5\%) = 12.135\%$$

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

$$E(\text{Return}) = 4.24\% + 1.11 (5.5\% + 1.79\%) = 12.33\%$$

- 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)

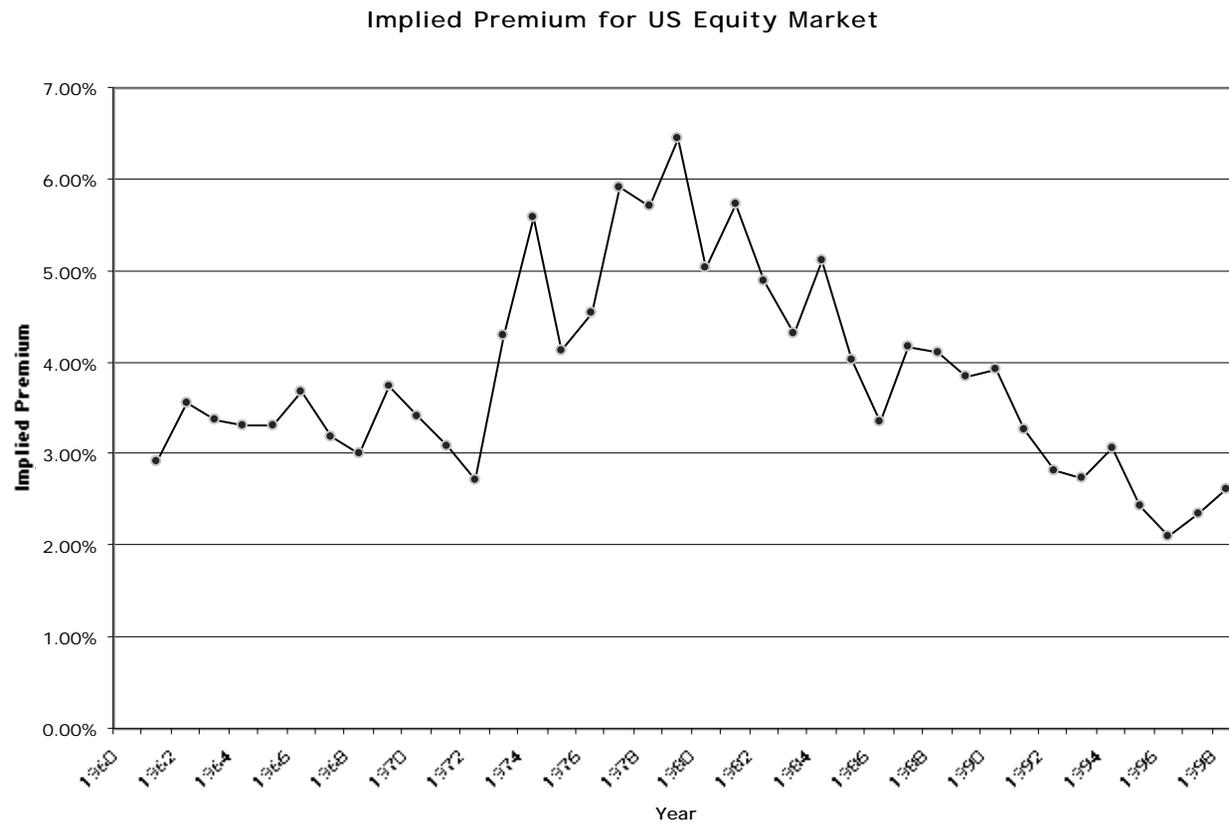
$$E(\text{Return}) = 4.24\% + 1.11 (5.5\%) + 1.252 (60\%) = 12.58\%$$

Portugal Telecom is more exposed to country risk than the typical Portuguese firm since much of its business is in the country.

Implied Equity Premiums

- If we use a basic discounted cash flow model, we can estimate the implied risk premium from the current level of stock prices.
- For instance, if stock prices are determined by the simple Gordon Growth Model:
 - $\text{Value} = \text{Expected Dividends next year} / (\text{Required Returns on Stocks} - \text{Expected Growth Rate})$
 - Plugging in the current level of the index, the dividends on the index and expected growth rate will yield a “implied” expected return on stocks. Subtracting out the riskfree rate will yield the implied premium.
- The problems with this approach are:
 - the discounted cash flow model used to value the stock index has to be the right one.
 - the inputs on dividends and expected growth have to be correct
 - it implicitly assumes that the market is currently correctly valued

Implied Premiums in US Market



Implied Premium for Portuguese market: June 1, 1999

- Level of the Index = 9808
- Dividends on the Index = 2.03% of 9808 (Used weighted yield)
- Other parameters
 - Riskfree Rate = 4.24%
 - Expected Growth (in nominal dollar terms)
 - Next 5 years = 12% (Used expected growth rate in Earnings)
 - After year 5 = 5%
- Solving for the expected return:
 - Expected return on Equity = 7.93%
 - Implied Equity premium = 3.69%

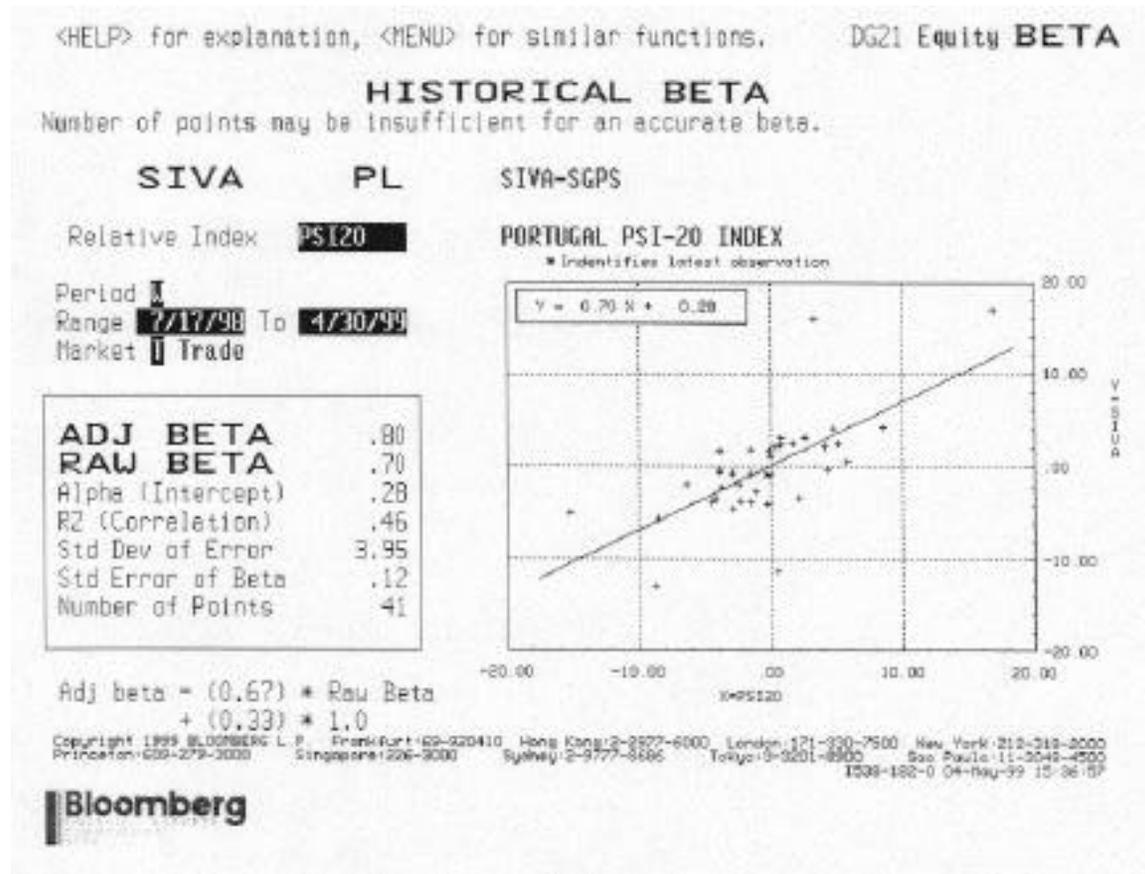
Estimating Beta

- The standard procedure for estimating betas is to regress stock returns (R_j) against market returns (R_m) -

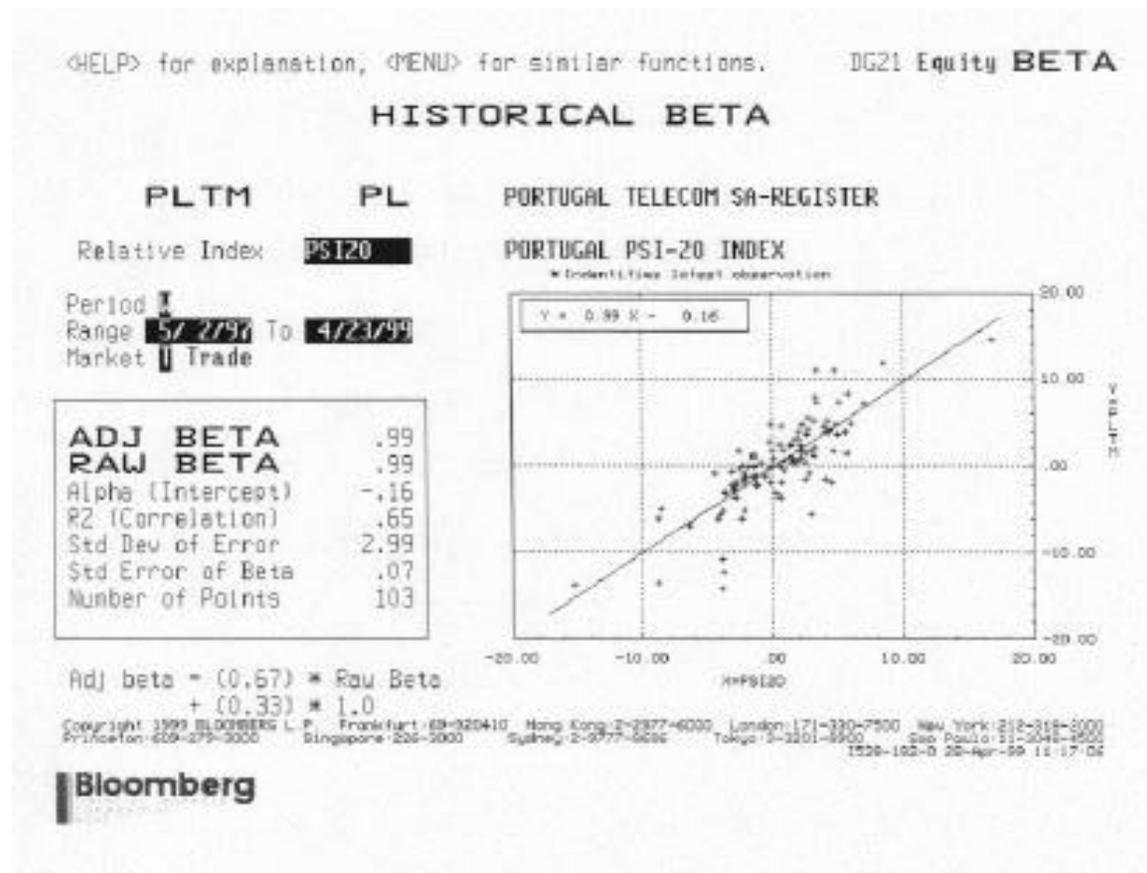
$$R_j = a + b R_m$$

- 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.

Beta Estimation: The Old Fashioned Way



The Index Effect



Determinants of Betas

- **Product or Service:** The beta value for a firm depends upon the sensitivity of the demand for its products and services and of its costs to macroeconomic factors that affect the overall market.
 - Cyclical companies have higher betas than non-cyclical firms
 - Firms which sell more discretionary products will have higher betas than firms that sell less discretionary products
- **Operating Leverage:** The greater the proportion of fixed costs in the cost structure of a business, the higher the beta will be of that business. This is because higher fixed costs increase your exposure to all risk, including market risk.
- **Financial Leverage:** The more debt a firm takes on, the higher the beta will be of the equity in that business. Debt creates a fixed cost, interest expenses, that increases exposure to market risk.

Equity Betas and Leverage

- The beta of equity alone can be written as a function of the unlevered beta and the debt-equity ratio

$$\beta_L = \beta_u (1 + ((1-t)D/E))$$

where

β_L = Levered or Equity Beta

β_u = Unlevered Beta

t = Corporate marginal tax rate

D = Market Value of Debt

E = Market Value of Equity

- While this beta is estimated on the assumption that debt carries no market risk (and has a beta of zero), you can have a modified version:

$$\beta_L = \beta_u (1 + ((1-t)D/E)) - \beta_{\text{debt}} (1-t) D/(D+E)$$

Solutions to the Regression Beta Problem

- Modify the regression beta by
 - changing the index used to estimate the beta
 - adjusting the regression beta estimate, by bringing in information about the fundamentals of the company
- Estimate the beta for the firm using
 - the standard deviation in stock prices instead of a regression against an index.
 - accounting earnings or revenues, which are less noisy than market prices.
- Estimate the beta for the firm from the bottom up without employing the regression technique. This will require
 - understanding the business mix of the firm
 - estimating the financial leverage of the firm
- Use an alternative measure of market risk that does not need a regression.

The Solution: Bottom-up Betas

■ The bottom up beta can be estimated by :

- Taking a weighted (by sales or operating income) average of the unlevered betas of the different businesses a firm is in.

$$\sum_{j=1}^k \beta_j \frac{\text{Operating Income}_j}{\text{Operating Income}_{\text{Firm}}}$$

(The unlevered beta of a business can be estimated by looking at other firms in the same business)

- Lever up using the firm's debt/equity ratio

$$\beta_{\text{levered}} = \beta_{\text{unlevered}} [1 + (1 - \text{tax rate}) (\text{Current Debt/Equity Ratio})]$$

■ The bottom up beta will give you a better estimate of the true beta when

- It has lower standard error ($SE_{\text{average}} = SE_{\text{firm}} / \sqrt{n}$ (n = number of firms))
- It reflects the firm's current business mix and financial leverage
- It can be estimated for divisions and private firms.

Portugal Telecom's Bottom-up Beta

Business	Unlevered Beta	D/E Ratio	Levered Beta	Riskfree Rate	Risk Premium	Cost of Equity
Telecom	0.79	63%	1.11	4.24%	7.29%	12.33%

Proportion of operating income from telecom = 100%

Unlevered Beta for Portugal Telecom = 0.79

Assume now that Portugal Telecom decides to go into the internet business, and that the unlevered beta for that business is 1.75. Assuming that 25% of Portugal Telecom's business looking forward will come from the internet, what will the firm's beta be?

Valuing a Firm from Different Risk Perspectives

Firm is assumed to have a cash flow of 100 each year forever.

Investor Type		Cares about	Risk Measure	Cost of Equity	Firm Value
Private Business: Owner has all his wealth invested in the business	Project Risk	Total Risk	Standard Deviation	40%	$100/.4=250$
	Competitive Risk				
	Sector Risk				
	Int'l Risk				
	Market Risk				
Venture Capitalist: Has wealth invested in a number of companies in one sector		Risk added to sector portfolio	Beta relative to sector	25%	$100/.25=400$
	Sector Risk				
	Int'l Risk				
	Market Risk				
Publicly traded company with investors who are diversified domestically or IPO to investors who are domestically diversified		Risk added to domestic portfolio	Beta relative to local index	15%	$100/.15=667$
	Int'l Risk				
	Market Risk				
Publicly traded company with investors who are diversified globally or IPO to global investors		Risk added to global portfolio	Beta relative to global index	10%	$100/.10=1000$
	Market Risk				

IB. Cost of Debt

- If the firm has bonds outstanding, and the bonds are traded, the yield to maturity on a long-term, straight (no special features) bond can be used as the interest rate.
- If the firm is rated, use the rating and a typical default spread 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, use the interest rate on the borrowing or
 - estimate a synthetic rating for the company, and use the synthetic rating 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

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

- For Portugal Telecom, for instance

$$\text{Interest Coverage Ratio} = 739/254 = 2.91$$

- Based upon the relationship between interest coverage ratios and ratings, we would estimate a rating of BBB for Portugal Telecom.

- For Semapa,

$$\text{Interest Coverage Ratio} = 88.2/8.7 = 10.1$$

- Based upon the relationship between interest coverage ratios and ratings, we would estimate a rating of AAA for Semapa

Interest Coverage Ratios, Ratings and Default Spreads

If Interest Coverage Ratio is	Estimated Bond Rating	Default Spread
> 8.50	AAA	0.20%
6.50 - 8.50	AA	0.50%
5.50 - 6.50	A+	0.80%
4.25 - 5.50	A	1.00%
3.00 - 4.25	A-	1.25%
2.50 - 3.00	BBB	1.50%
2.00 - 2.50	BB	2.00%
1.75 - 2.00	B+	2.50%
1.50 - 1.75	B	3.25%
1.25 - 1.50	B-	4.25%
0.80 - 1.25	CCC	5.00%
0.65 - 0.80	CC	6.00%
0.20 - 0.65	C	7.50%
< 0.20	D	10.00%

IC. Weights for the Cost of Capital Computation

- The weights used to compute the cost of capital should be the market value weights for debt and equity.
- There is an element of circularity that is introduced into every valuation by doing this, since the values that we attach to the firm and equity at the end of the analysis are different from the values we gave them at the beginning.
- As a general rule, the debt that you should subtract from firm value to arrive at the value of equity should be the same debt that you used to compute the cost of capital.

Book Value versus Market Value Weights

- It is often argued that using book value weights is more conservative than using market value weights. Do you agree?
 - Yes
 - No
- It is also often argued that book values are more reliable than market values since they are not as volatile. Do you agree?
 - Yes
 - No

Estimating Cost of Capital: Portugal Telecom

■ Equity

- Cost of Equity = 4.24% + 1.11 (7.29%) = 12.33%
- Market Value of Equity = 41*190 = 7,790 Mil (61.35%)

■ Debt

- Cost of debt = 4.24% + 1.5% (default spread) = 5.74%
- Market Value of Debt = 4,908 Mil (38.65%)

■ Cost of Capital

$$\text{Cost of Capital} = 12.33\% (.6135) + 5.74\% (1 - .3625) (.3865) = 8.98\%$$

Portugal Telecom: Book Value Weights

- Portugal Telecom has a book value of equity of 2,195 million and a book value of debt of 4,908 million. Estimate the cost of capital using book value weights instead of market value weights.

- Is this more conservative?

II. Estimating Cash Flows to Firm

EBIT (1 - tax rate)
+ Depreciation
- Capital Spending
- Change in Working Capital
= Cash flow to the firm

What is the EBIT of a firm?

- The EBIT, measured right, should capture the true operating income from assets in place at the firm.
- Any expense that is not an operating expense or income that is not an operating income should not be used to compute EBIT. In other words, any financial expense (like interest expenses) or capital expenditure should not affect your operating income.
- Can you name
 - A financing expense that gets treated as an operating expense?
 - A capital expense that gets treated as an operating expense?

Operating Lease Expenses: Operating or Financing 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 = PV of Operating Lease Expenses at the pre-tax cost of debt
- 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...:

Capitalizing R&D Expenses: Bristol Myers

- R & D was assumed to have a 10-year life.

Year	R&D Expense	Unamortized portion	\$ Value
1998	1385.00	1.00	1385.00
1997	1276.00	0.90	1148.40
1996	1199.00	0.80	959.20
1995	1108.00	0.70	775.60
1994	1128.00	0.60	676.80
1993	1083.00	0.50	541.50
1992	983.00	0.40	393.20
1991	881.00	0.30	264.30
1990	789.00	0.20	157.80
1989	688.00	0.10	68.80

Value of research asset = \$ 6,371 million

Amortization of research asset in 1998 = \$ 637 million

Adjustment to Operating Income = \$ 1,385 million - \$ 637 million = \$ 748 million

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
 - ❑ None of the above
 - ❑ Any of the above, as long as you compute your after-tax cost of debt using the same tax rate

The Right Tax Rate to Use

- The choice really is between the effective and the marginal tax rate. In doing projections, it is far safer to use the marginal tax rate since the effective tax rate is really a reflection of the difference between the accounting and the tax books.
- By using the marginal tax rate, we tend to understate the after-tax operating income in the earlier years, but the after-tax tax operating income is more accurate in later years
- If you choose to use the effective tax rate, adjust the tax rate towards the marginal tax rate over time.
- The tax rate used to compute the after-tax cost of debt has to be the same tax rate that you use to compute the after-tax operating income.

A Tax Rate for a Money Losing Firm

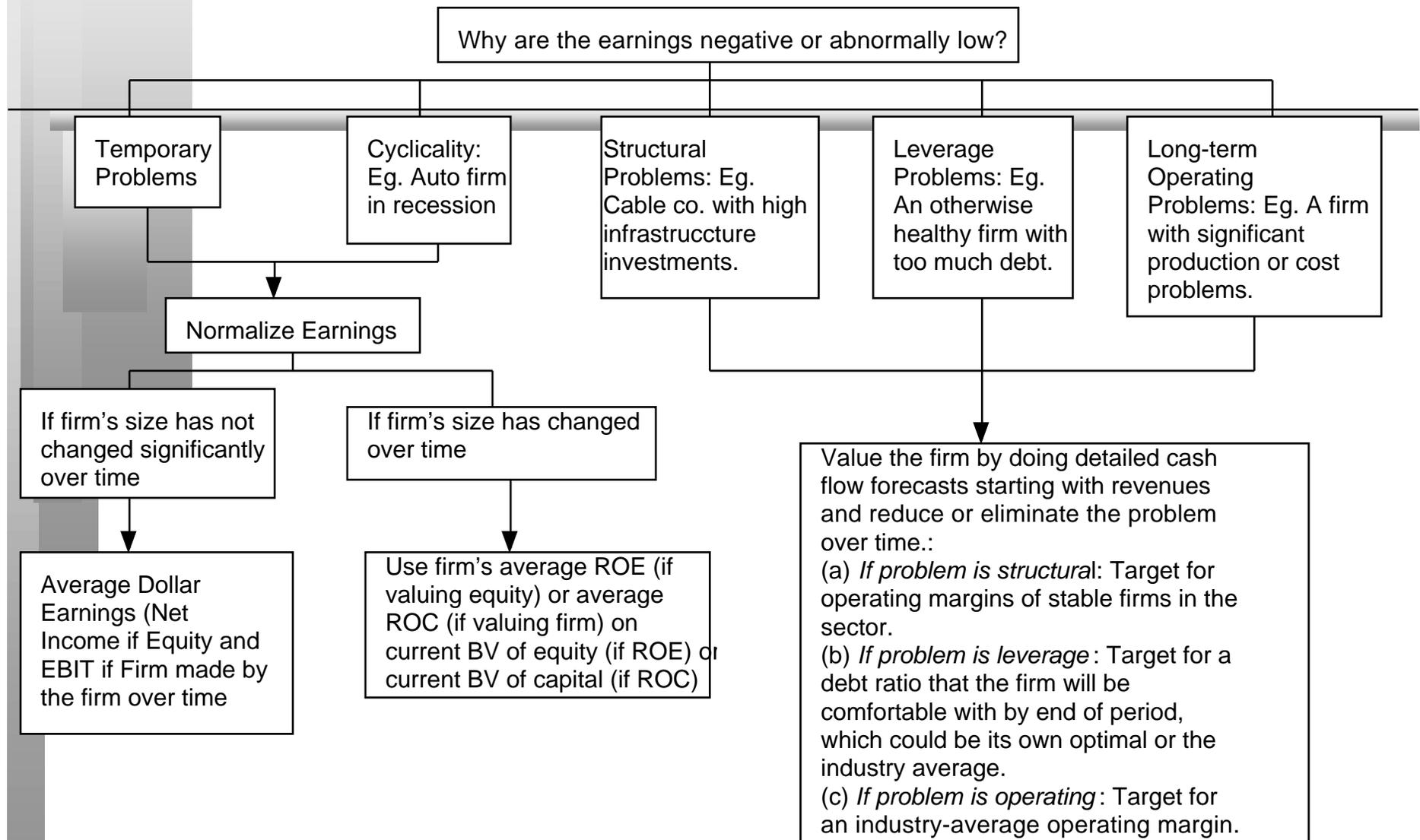
- Assume that you are trying to estimate the after-tax operating income for a firm with \$ 1 billion in net operating losses carried forward. This firm is expected to have operating income of \$ 500 million each year for the next 3 years, and the marginal tax rate on income for all firms that make money is 40%. Estimate the after-tax operating income each year for the next 3 years.

	Year 1	Year 2	Year 3
EBIT	500	500	500
Taxes			
EBIT (1-t)			
Tax rate			

Normalizing Earnings

- In most valuations, we begin with the current operating income and estimate expected growth. This practice works as long as
 - Current operating income is positive
 - Current operating income is normal. (In any given year, the operating income can be too low, if the firm has had a poor year, or too high, if it has had an explosively good year)
- If the current operating income is negative, it has to be normalized. How you normalize earnings will depend upon why the earnings are negative in the first place.

A Framework for Analyzing Companies with Negative or Abnormally Low Earnings



Net Capital Expenditures

- Net capital expenditures represent the difference between capital expenditures and depreciation. Depreciation is a cash inflow that pays for some or a lot (or sometimes all of) the capital expenditures.
- In general, the net capital expenditures will be a function of how fast a firm is growing or expecting to grow. High growth firms will have much higher net capital expenditures than low growth firms.
- Assumptions about net capital expenditures can therefore never be made independently of assumptions about growth in the future.

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 non-cash current assets (inventory and accounts receivable) and non-debt current liabilities (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: Portugal Telecom

- EBIT (1998) = 739 million
- Tax rate used = 36.25% (Assumed Effective = Marginal)
- Capital spending (1998) = 974 million
- Depreciation (1998) = 612 million
- Non-cash Working capital Change (1998) = \$ 28.50 million
- Estimating FCFF (1998)
 - Current EBIT * (1 - tax rate) = 739 (1-.3625) = 471 million
 - (Capital Spending - Depreciation) = 362 million
 - Change in Working Capital = 29 million
 - Current FCFF = 80 million

IV. Estimating Growth

- When valuing firms, some people use analyst projections of earnings growth (over the next 5 years) that are widely available in Zacks, I/B/E/S or First Call in the US, and less so overseas. This practice is
 - Fine. Equity research analysts follow these stocks closely and should be pretty good at estimating growth
 - Shoddy. Analysts are not that good at projecting growth in earnings in the long term.
 - Wrong. Analysts do not project growth in operating earnings

Expected Growth in EBIT and Fundamentals

- Reinvestment Rate and Return on Capital

$$g_{\text{EBIT}} = (\text{Net Capital Expenditures} + \text{Change in WC}) / \text{EBIT}(1-t) * \text{ROC} = \text{Reinvestment Rate} * \text{ROC}$$

- Proposition 2: No firm can expect its operating income to grow over time without reinvesting some of the operating income in net capital expenditures and/or working capital.
- Proposition 3: The net capital expenditure needs of a firm, for a given growth rate, should be inversely proportional to the quality of its investments.

Expected Growth and Portugal Telecom

- Return on Capital = $\text{EBIT} (1 - \text{tax rate}) / (\text{BV of Debt} + \text{BV of Equity})$
 $= 471 / (1132 + 2020) = 15.44\%$
- Reinvestment Rate = $(\text{Cap Ex} - \text{Deprcn} + \text{Chg in WC}) / \text{EBIT} (1 - t)$
 $= (362 + 29) / 471 = 82.89\%$
- Expected Growth in Operating Income = $(.8289) (15.44\%) = 12.8\%$

Not all growth is equal: Disney versus Hansol Paper

■ Disney

- Reinvestment Rate = 50%
- Return on Capital = 18.69%
- Expected Growth in EBIT = $.5(18.69\%) = 9.35\%$

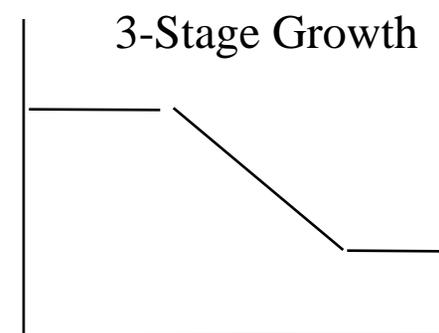
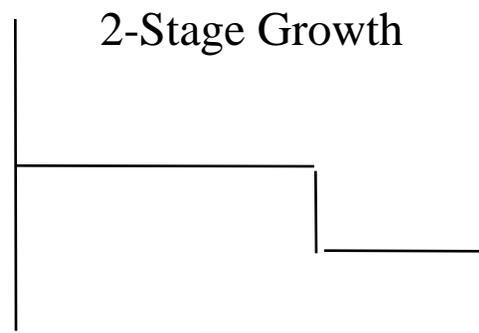
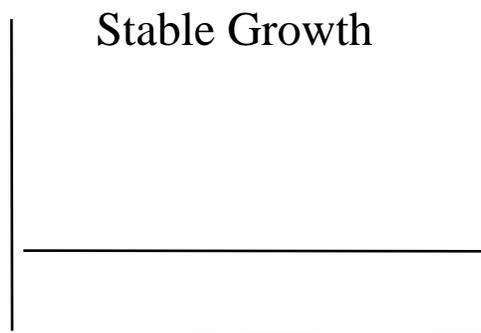
■ Hansol Paper

- Reinvestment Rate = $(105,000+1,000)/(109,569*.7) = 138.20\%$
- Return on Capital = 6.76%
- Expected Growth in EBIT = $6.76\% (1.382) = 9.35\%$

- ### ■ Both these firms have the same expected growth rate in operating income. Are they equivalent from a valuation standpoint?

V. Growth Patterns

- A key assumption in all discounted cash flow models is the period of high growth, and the pattern of growth during that period. In general, we can make one of three assumptions:
 - there is no high growth, in which case the firm is already in stable growth
 - there will be high growth for a period, at the end of which the growth rate will drop to the stable growth rate (2-stage)
 - there will be high growth for a period, at the end of which the growth rate will decline gradually to a stable growth rate(3-stage)



Determinants of Growth Patterns

- Size of the firm
 - Success usually makes a firm larger. As firms become larger, 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 correlation between current growth and future growth. 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 barriers to entry and differential advantages.
 - The question of how long growth will last and how high it will be can therefore be framed as a question about what the barriers to entry are, how long they will stay up and how strong they will remain.

An Alternative: Equity Valuation

- The value of equity is obtained by discounting expected cashflows to equity, i.e., the residual cashflows after meeting all expenses, tax obligations and interest and principal payments, at the cost of equity, i.e., the rate of return required by equity investors in the firm.

$$\text{Value of Equity} = \sum_{t=1}^{t=n} \frac{\text{CF to Equity}_t}{(1+k_e)^t}$$

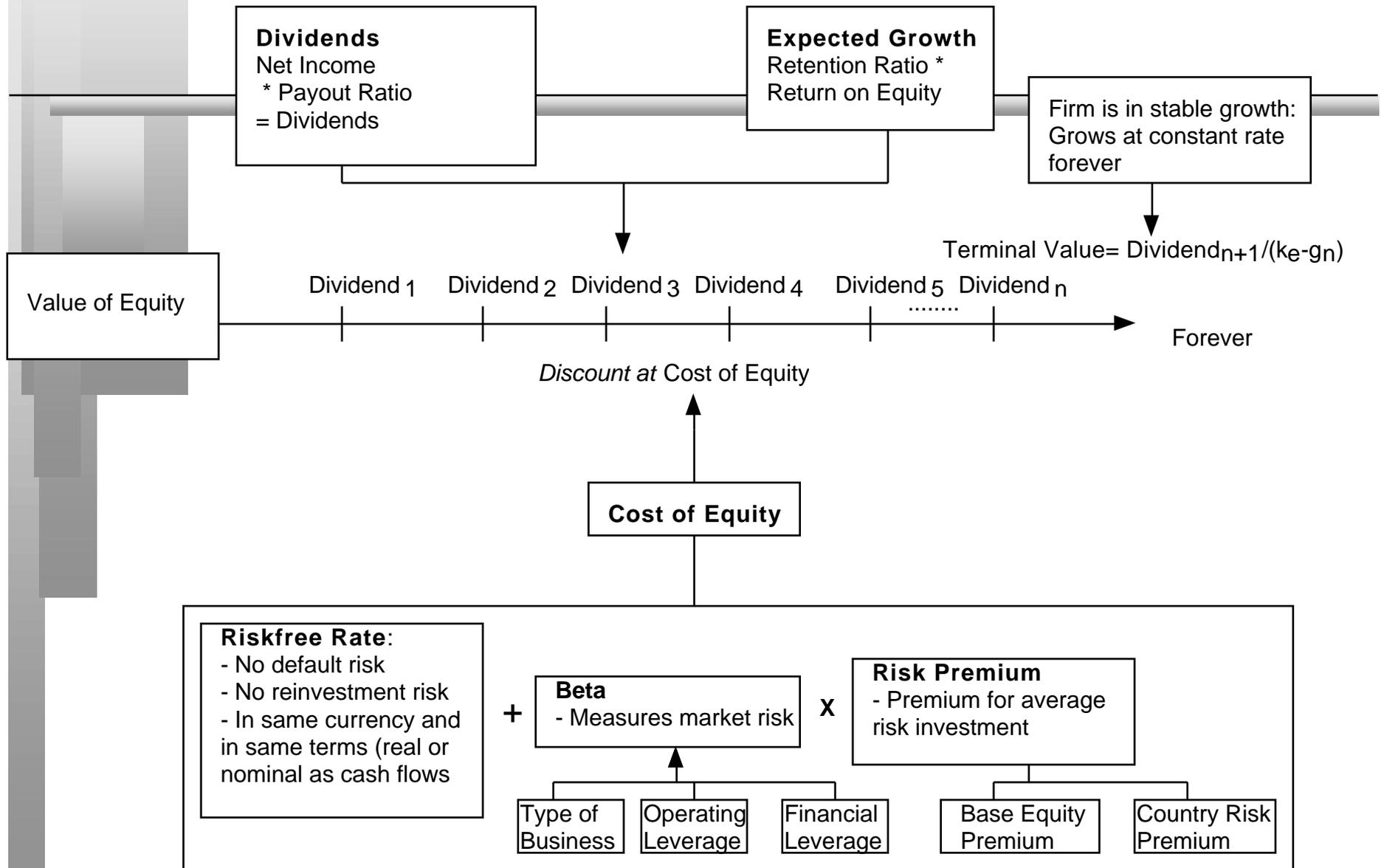
where,

CF to Equity_t = Expected Cashflow to Equity in period t

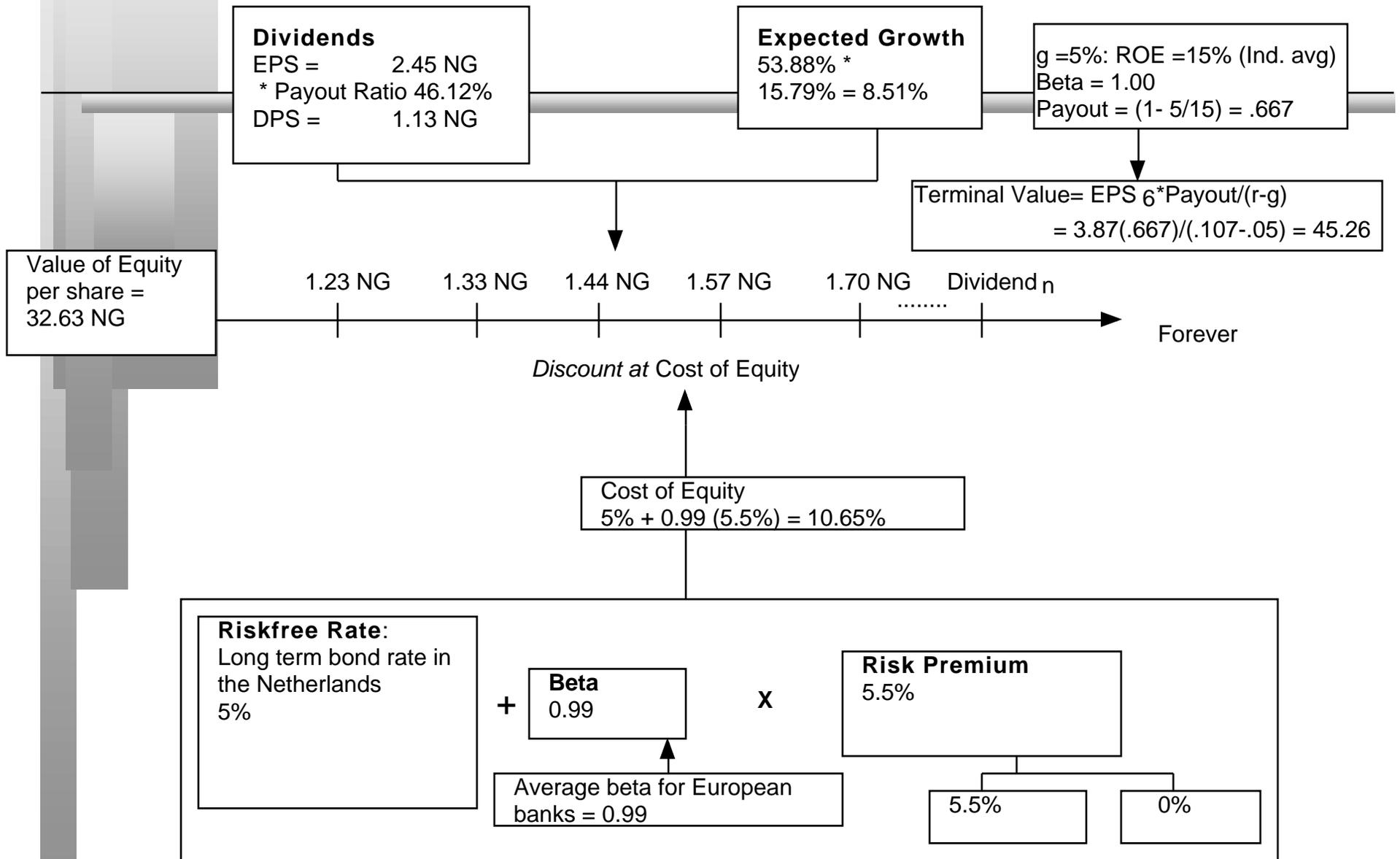
k_e = Cost of Equity

- The dividend discount model is a specialized case of equity valuation, and the value of a stock is the present value of expected future dividends.

EQUITY VALUATION WITH DIVIDENDS



VALUING ABN AMRC



Dividends and Cash Flows to Equity

- In the strictest sense, the only cash flow that an investor will receive from an equity investment in a publicly traded firm is the dividend that will be paid on the stock.
- Actual dividends, however, are set by the managers of the firm and may be much lower than the potential dividends (that could have been paid out)
 - managers are conservative and try to smooth out dividends
 - managers like to hold on to cash to meet unforeseen future contingencies and investment opportunities
- When actual dividends are less than potential dividends, using a model that focuses only on dividends will under state the true value of the equity in a firm.

Measuring Potential Dividends

- Some analysts assume that the earnings of a firm represent its potential dividends. This cannot be true for several reasons:
 - Earnings are not cash flows, since there are both non-cash revenues and expenses in the earnings calculation
 - Even if earnings were cash flows, a firm that paid its earnings out as dividends would not be investing in new assets and thus could not grow
 - Valuation models, where earnings are discounted back to the present, will overestimate the value of the equity in the firm
- The potential dividends of a firm are the cash flows left over after the firm has made any “investments” it needs to make to create future growth and net debt repayments (debt repayments - new debt issues)
 - The common categorization of capital expenditures into discretionary and non-discretionary loses its basis when there is future growth built into the valuation.

Estimating Cash Flows: FCFE

- Cash flows to Equity for a Levered Firm

Net Income

+ Depreciation & Amortization

= Cash flows from Operations to Equity Investors

- Preferred Dividends

- Capital Expenditures

- Working Capital Needs (Changes in Non-cash Working Capital)

- Principal Repayments

+ Proceeds from New Debt Issues

= Free Cash flow to Equity

Estimating FCFE when Leverage is Stable

Net Income

- (1 - τ_c) (Capital Expenditures - Depreciation)

- (1 - τ_c) Working Capital Needs

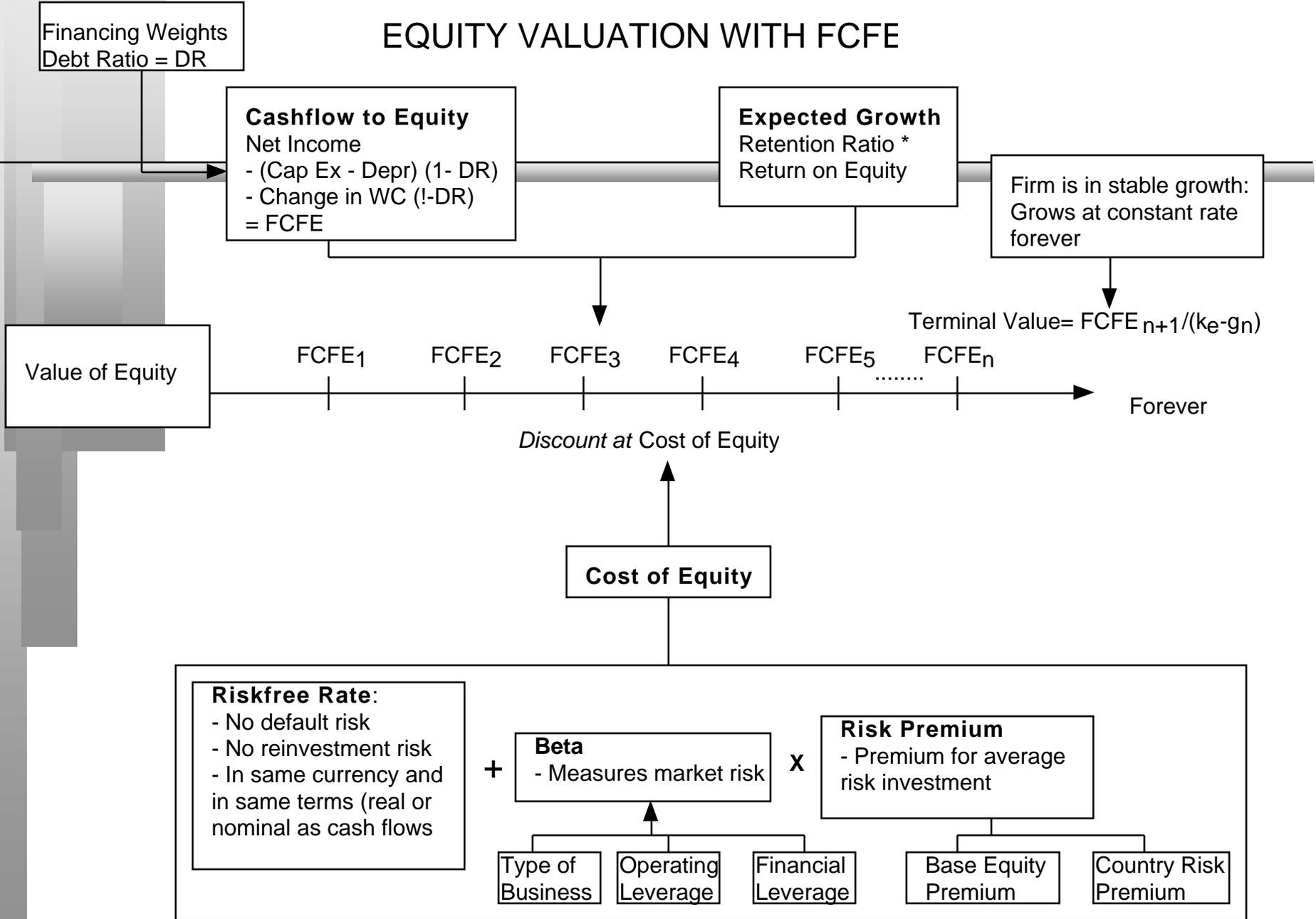
= Free Cash flow to Equity

= Debt/Capital Ratio

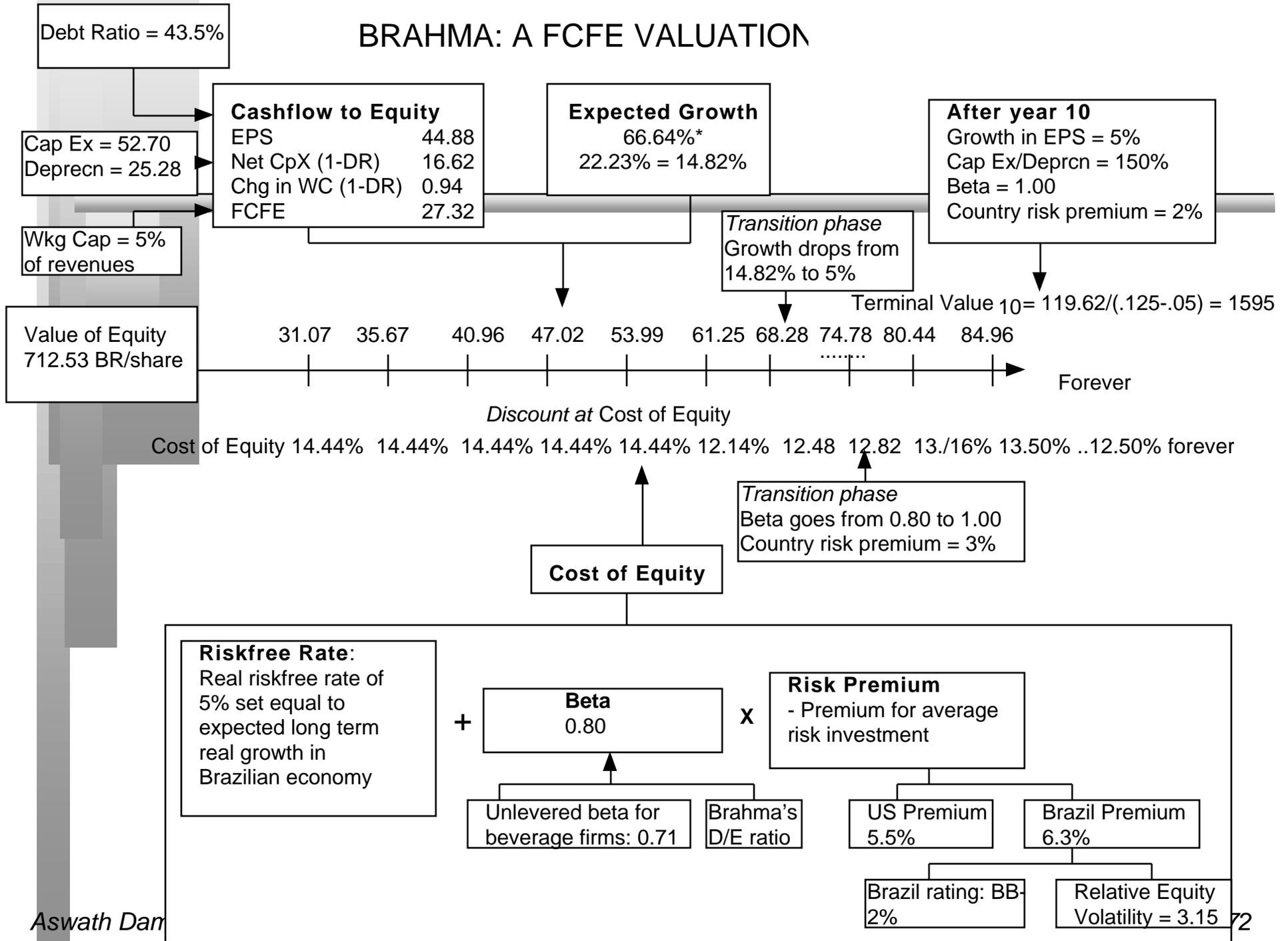
For this firm,

- Proceeds from new debt issues = Principal Repayments + d (Capital Expenditures - Depreciation + Working Capital Needs)

EQUITY VALUATION WITH FCFE



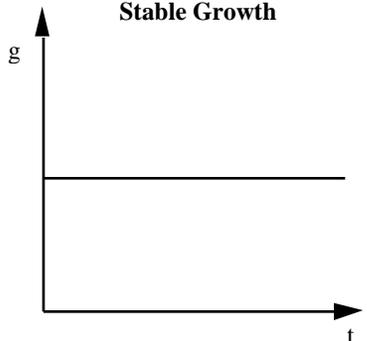
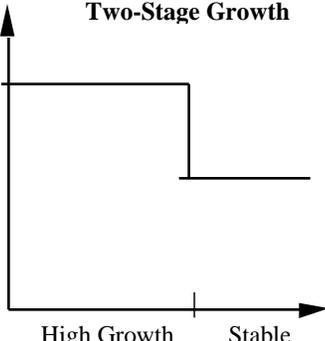
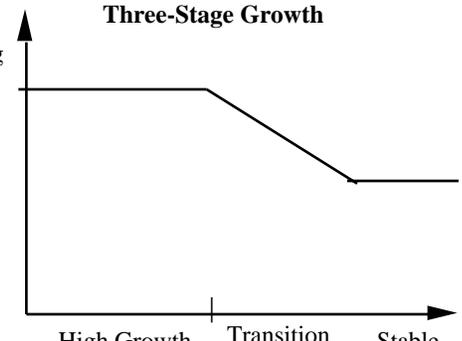
BRAHMA: A FCFE VALUATION

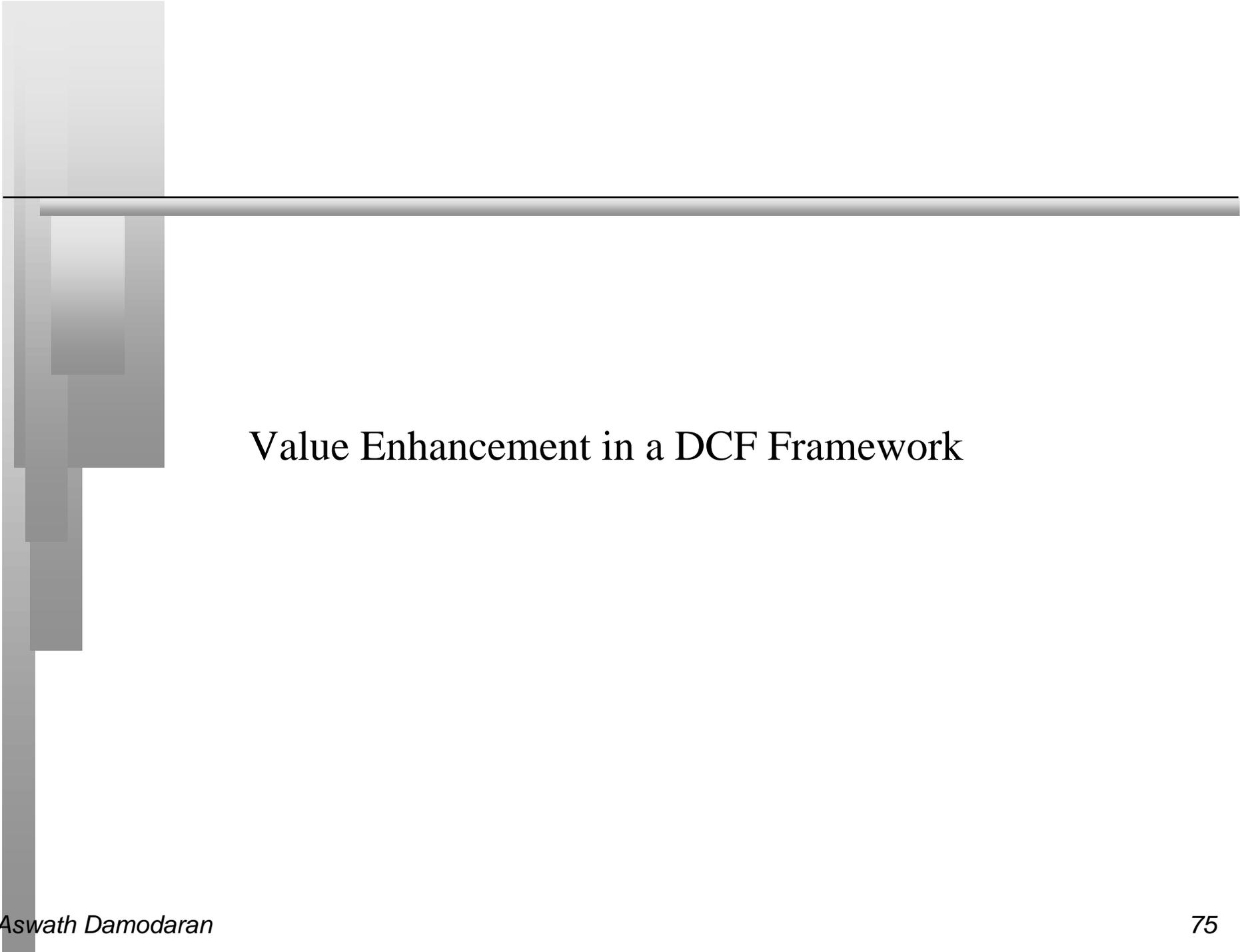


Equity versus Firm Valuation Models

- Use Equity Valuation
 - (a) for firms which have stable leverage, whether high or not, and
 - (b) if equity (stock) is being valued
- Use Firm Valuation
 - (a) for firms which have leverage which is too high or too low, and expect to change the leverage over time, because debt payments and issues do not have to be factored in the cash flows and the discount rate (cost of capital) does not change dramatically over time.
 - (b) for firms for which you have partial information on leverage (eg: interest expenses are missing..)
 - (c) in all other cases, where you are more interested in valuing the firm than the equity. (Value Consulting?)

The Choices in DCF Valuation

Choose a			
Cash Flow	<p style="text-align: center;"><i>Dividends</i></p> <p>Expected Dividends to Stockholders</p>	<p style="text-align: center;"><i>Cashflows to Equity</i></p> <p>Net Income - (1-) (Capital Exp. - Deprec'n) - (1-) Change in Work. Capital = Free Cash flow to Equity (FCFE) [= Debt Ratio]</p>	<p style="text-align: center;"><i>Cashflows to Firm</i></p> <p>EBIT (1- tax rate) - (Capital Exp. - Deprec'n) - Change in Work. Capital = Free Cash flow to Firm (FCFF)</p>
& A Discount Rate	<p style="text-align: center;"><i>Cost of Equity</i></p> <ul style="list-style-type: none"> <i>Basis:</i> The riskier the investment, the greater is the cost of equity. <i>Models:</i> CAPM: Riskfree Rate + Beta (Risk Premium) APM: Riskfree Rate + Beta_j (Risk Premium)_j: <i>n factors</i> 		<p style="text-align: center;"><i>Cost of Capital</i></p> <p>WACC = $k_e (E / (D+E))$ + $k_d (D / (D+E))$ k_d = Current Borrowing Rate (1-t) E,D: Mkt Val of Equity and Debt</p>
& a growth pattern	<p style="text-align: center;">Stable Growth</p> 	<p style="text-align: center;">Two-Stage Growth</p> 	<p style="text-align: center;">Three-Stage Growth</p> 



Value Enhancement in a DCF Framework

The Paths to Value Creation

- Using the DCF framework, there are four basic ways in which the value of a firm can be enhanced:
 - The cash flows from existing assets to the firm can be increased, by either
 - increasing after-tax earnings from assets in place or
 - reducing reinvestment needs (net capital expenditures or working capital)
 - The expected growth rate in these cash flows can be increased by either
 - Increasing the rate of reinvestment in the firm
 - Improving the return on capital on those reinvestments
 - The length of the high growth period can be extended to allow for more years of high growth.
 - The cost of capital can be reduced by
 - Reducing the operating risk in investments/assets
 - Changing the financial mix
 - Changing the financing composition

A Basic Proposition

- For an action to affect the value of the firm, it has to
 - Affect current cash flows (or)
 - Affect future growth (or)
 - Affect the length of the high growth period (or)
 - Affect the discount rate (cost of capital)
- **Proposition 1: Actions that do not affect current cash flows, future growth, the length of the high growth period or the discount rate cannot affect value.**

Value-Neutral Actions

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

Issue 1: In-Process R&D

- In acquisitions of firms with R&D, firms have increasingly taken advantage of a provision that allows them to write off in-process R&D immediately. This reduces the amount that gets charged as goodwill and amortized in future periods; this, in turn, increases reported earnings in future periods. None of this has any tax implications.
 - A study that looked at high-tech firms found that they paid larger premiums for firms when they could qualify for this provision.
 - When FASB announced that it was looking at banning this procedure, high-tech firms argued that doing so would make it harder to justify acquisitions.
- Does qualifying or not qualifying for this provision affect value?

Value Creation 1: Increase Cash Flows from Assets in Place

- The assets in place for a firm reflect investments that have been made historically by the firm. To the extent that these investments were poorly made and/or poorly managed, it is possible that value can be increased by increasing the after-tax cash flows generated by these assets.
- The cash flows discounted in valuation are after taxes and reinvestment needs have been met:
 - EBIT (1-t)
 - (Capital Expenditures - Depreciation)
 - Change in Non-cash Working Capital
 - = Free Cash Flow to Firm
- Proposition 2: A firm that can increase its current cash flows, without significantly impacting future growth or risk, will increase its value.

1.1.: Poor Investments: Should you divest?

- Every firm has at least a few investments in place that are poor investments, earning less than the cost of capital or even losing money.
- At first sight, it may seem that terminating or divesting these investments would increase value. That is not necessarily true, however, because that implicitly assumes that you get at least your capital back when you terminate a project.
- In reality, there are three values that we need to consider:
 - **Continuing Value:** This is the present value of the expected cash flows from continuing the investment through the end of its life.
 - **Salvage or Liquidation Value:** This is the net cash flow that the firm will receive if it terminated the project today.
 - **Divestiture Value:** This is the price that will be paid by the highest bidder for this investment.

Issue 2: To liquidate or not to liquidate

- Assume that you have a division in your firm in which you have invested \$ 1 billion in capital (book value today). The division is earning \$ 80 million in after-tax operating income on an annual basis, and expects to earn this amount each year forever. If your cost of capital were 12.5%, would your value increase from liquidating this division?

A Divestiture Decision Matrix

- Whether to continue, terminate or divest an investment will depend upon which of the three values - continuing, liquidation or divestiture - is the greatest.
- If the continuing value is the greatest, there can be no value created by terminating or liquidating this investment.
- If the liquidation or divestiture value is greater than the continuing value, the firm value will increase by the difference between the two values:
 - If liquidation is optimal: Liquidation Value - Continuing Value
 - If divestiture is optimal: Divestiture Value - Continuing Value

1.2: More Efficient Operations

- The operating income for a firm can be written as
Revenues
* Operating Margin
= EBIT
- The operating margin for a firm is a function of how efficiently it operates to produce the products and services that it sells. If a firm can reduce its costs, while generating similar revenues, it will increase its operating income and value.

Issue 3: Operating Margins and R&D

- Assume that analysts focus on the traditional operating margin. An easy way to post higher earnings and margins is by cutting back on R&D expenses. Is this value creating?

Cost Cutting: The First Leg

- Cost cutting and layoffs comprise the first leg of value enhancement for most firms. Since they occur quickly and are tangible, the effect on earnings (and value) is immediate.
- Not all cost cutting is value enhancing. If firms cut expenditures which are designed to create future growth (research and training expenses, for instance), they might report higher operating income but their value might drop.

1.3: The Tax Burden

- The value of a firm is the present value of its after-tax cash flows. Thus, any action that can reduce the tax burden on a firm over time, for a given operating income, will increase value.
- The tax rate of a firm can be reduced over time by doing any or all of the following:
 - Moving income from high-tax locales to low-tax or no-tax locales
 - Acquiring or Obtaining net operating loss carry forwards that can be used to shield future income
 - Using risk management to reduce the average tax rate paid over time on income
 - The marginal tax rate on income tends to rise, in most regimes, as income increases.
 - By using risk management to smooth income over time, firms can make their income more stable and reduce their exposure to the highest marginal tax rates.
 - By doing so, they can increase their value.

1.4: Reduce Net Capital Expenditures

- The net capital expenditures refers to the difference between capital expenditures and depreciation. The net capital expenditure is a cash outflow that reduces the free cash flow to the firm.
- Part of the net capital expenditure is designed to generate future growth, but part of it may to be maintain assets in place
- If a firm can reduce its net capital expenditures on assets in place, it will increase value.
- During short periods, the capital expenditures can even be lower than depreciation for assets in place, creating a cash inflow from net capital expenditures.

1.5: Reduce Working Capital Needs

- The non-cash working capital in a firm can be measured as follows:
 - Accounts Receivable
 - + Inventory
 - Accounts Payable
 - = Non-cash Working Capital
- Increases in non-cash working capital represent cash outflows, while decreases represent cash inflows.
- Reducing the non-cash working capital needs of a firm, while keeping growth and risk constant, will increase its value.

The Cash Flow Effects of Working Capital: Portugal Telecom

	<i>1997</i>	<i>1998</i>	<i>Telecom</i>
Inventory	59	55	
Accounts Receivable	325	765	
Accounts Payable	298	610	
Other Curr liab	12	107	
Non-cash WC	74	103	
% of Sales	6.70%	9.86%	6.57%

- What was the effect of working capital on cash flows in 1998?
- How much would cash flows have changed if PT's working capital needs matched the industry average?

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

2.1: Increase the Reinvestment Rate

- Holding all else constant, increasing the reinvestment rate will increase the expected growth in earnings of a firm. Increasing the reinvestment rate will, however, reduce the cash flows of the firms. The net effect will determine whether value increases or decreases.
- As a general rule,
 - Increasing the reinvestment rate when the ROC is less than the cost of capital will reduce the value of the firm
 - Increasing the reinvestment rate when the ROC is greater than the cost of capital will increase the value of the firm

2.2: Improve Quality of Investments

- If a firm can increase its return on capital on new projects, while holding the reinvestment rate constant, it will increase its firm value.
 - The firm's cost of capital still acts as a floor on the return on capital. If the return on capital is lower than the cost of capital, increasing the return on capital will reduce the amount of value destroyed but will not create value. The firm would be better off under those circumstances returning the cash to the owners of the business.
 - It is only when the return on capital exceeds the cost of capital, that the increase in value generated by the higher growth will more than offset the decrease in cash flows caused by reinvesting.
- This proposition might not hold, however, if the investments are in riskier projects, because the cost of capital will then increase.

2.3: Pricing Decisions, ROC and Expected Growth

- The return on capital on a project or firm can be written as:
ROC = EBIT (1-t)/ Sales * Sales/ Capital
= After-tax Operating Margin * Capital Turnover Ratio
- When firms increase prices for their products, they improve operating margins but reduce sales (and turnover ratios). The effects of the price/quantity decision can be captured in the return on capital. It provides a simple way of allowing firms to:
 - Choose between price leader and volume leader strategies
 - The strategy that maximizes value should be the better strategy
 - In analyzing these strategies, we should allow for a dynamic competitive environment where competitors react to the firm's pricing decisions.
 - Decide whether to change price policy in response to competitive pressure

2.4: The Role of Acquisitions and Divestitures

- An acquisition is just a large-scale project. All of the rules that apply to individual investments apply to acquisitions, as well. For an acquisition to create value, it has to
 - Generate a higher return on capital, after allowing for synergy and control factors, than the cost of capital.
 - Put another way, an acquisition will create value only if the present value of the cash flows on the acquired firm, inclusive of synergy and control benefits, exceeds the cost of the acquisitions
- A divestiture is the reverse of an acquisition, with a cash inflow now (from divesting the assets) followed by cash outflows (i.e., cash flows foregone on the divested asset) in the future. If the present value of the future cash outflows is less than the cash inflow today, the divestiture will increase value.
- A fair-price acquisition or divestiture is value neutral.

An Acquisition Choice

- Assume now that you have the opportunity to acquire a internet firm and that you compute the internal rate of return on this firm to 17.50%. PT has a cost of capital of 8.98%, but the cost of capital for firms in the high technology business is 20%. Is this a value enhancing acquisition?
- If it does not pass your financial test, can you make the argument that strategic considerations would lead you to override the financials and acquire the firm?

Value Creation 3: Increase Length of High Growth Period

- Every firm, at some point in the future, will become a stable growth firm, growing at a rate equal to or less than the economy in which it operates.
- The high growth period refers to the period over which a firm is able to sustain a growth rate greater than this “stable” growth rate.
- If a firm is able to increase the length of its high growth period, other things remaining equal, it will increase value.

High Growth and Barriers to Entry

- For firms to maintain high growth over a period, they have to earn excess returns. In a competitive market place, these excess returns should attract competitors who will erase these excess returns over time.
- Thus, for a firm to maintain high growth and excess returns over time, it has to create barriers to entry that allow it to maintain these excess returns.

3.1: The Brand Name Advantage

- Some firms are able to sustain above-normal returns and growth because they have well-recognized brand names that allow them to charge higher prices than their competitors and/or sell more than their competitors.
- Firms that are able to improve their brand name value over time can increase both their growth rate and the period over which they can expect to grow at rates above the stable growth rate, thus increasing value.

3.2: Patents and Legal Protection

- The most complete protection that a firm can have from competitive pressure is to own a patent, copyright or some other kind of legal protection allowing it to be the sole producer for an extended period.
- Note that patents only provide partial protection, since they cannot protect a firm against a competitive product that meets the same need but is not covered by the patent protection.
- Licenses and government-sanctioned monopolies also provide protection against competition. They may, however, come with restrictions on excess returns; utilities in the United States, for instance, are monopolies but are regulated when it comes to price increases and returns.

3.3: Switching Costs

- Another potential barrier to entry is the cost associated with switching from one firm's products to another.
- The greater the switching costs, the more difficult it is for competitors to come in and compete away excess returns.
- Firms that devise ways to increase the cost of switching from their products to competitors' products, while reducing the costs of switching from competitor products to their own will be able to increase their expected length of growth.

3.4: Cost Advantages

- There are a number of ways in which firms can establish a cost advantage over their competitors, and use this cost advantage as a barrier to entry:
 - In businesses, where scale can be used to reduce costs, economies of scale can give bigger firms advantages over smaller firms
 - Owning or having exclusive rights to a distribution system can provide firms with a cost advantage over its competitors.
- These cost advantages will show up in valuation in one of two ways:
 - The firm may charge the same price as its competitors, but have a much higher operating margin.
 - The firm may charge lower prices than its competitors and have a much higher capital turnover ratio.

Value Creation 4: Reduce Cost of Capital

- The cost of capital for a firm can be written as:

$$\text{Cost of Capital} = k_e (E/(D+E)) + k_d (D/(D+E))$$

Where,

k_e = Cost of Equity for the firm

k_d = Borrowing rate (1 - tax rate)

- The cost of equity reflects the rate of return that equity investors in the firm would demand to compensate for risk, while the borrowing rate reflects the current long-term rate at which the firm can borrow, given current interest rates and its own default risk.
- The cash flows generated over time are discounted back to the present at the cost of capital. Holding the cash flows constant, reducing the cost of capital will increase the value of the firm.

Estimating Cost of Capital: Portugal Telecom

■ Equity

- Cost of Equity = 4.24% + 1.11 (7.29%) = 12.33%
- Market Value of Equity = 41*190 = 7,790 Mil (61.35%)

■ Debt

- Cost of debt = 4.24% + 1.5% (default spread) = 5.74%
- Market Value of Debt = 4,908 Mil (38.65%)

■ Cost of Capital

Cost of Capital = 12.33% (.6135) + 5.74% (1- .3625) (.3865) = 8.98%

4.1: Reduce Operating Risk

- Both the cost of equity and cost of debt of a firm are affected by the operating risk of the business or businesses in which it operates. In the case of equity, only that portion of the operating risk that is not diversifiable will affect value.
- The operating risk of a firm is a direct function of the kinds of products or services it provides, and the degree to which these products or services are discretionary to the customer. The more discretionary they are, the greater the operating risk faced by the firm.
- Firms can reduce their operating risk by making their products and services less discretionary. Advertising clearly plays a role, but coming up with new uses for a product/service may be another.

4.2: Reduce Operating Leverage

- The operating leverage of a firm measures the proportion of its costs that are fixed. Other things remaining equal, the greater the proportion of the costs of a firm that are fixed, the higher its cost of capital will be.
- Reducing the proportion of the costs that are fixed will make firms much less risky and reduce their cost of capital. This can be accomplished in a number of different ways:
 - By using outside contractors for some services; if business does not measure up, the firm is not stuck with the costs of providing this service.
 - By tying expenses to revenues; in particular, with wage contracts tying wages paid to revenues made will reduce the proportion of the costs that are fixed.

4.3: Changing Financial Mix

- The third approach to reducing the cost of capital is to change the mix of debt and equity used to finance the firm.
- Debt is always cheaper than equity, partly because lenders bear less risk and partly because of the tax advantage associated with debt.
- Taking on debt increases the risk (and the cost) of both debt (by increasing the probability of bankruptcy) and equity (by making earnings to equity investors more volatile).
- The net effect will determine whether the cost of capital will increase or decrease if the firm takes on more debt.

Portugal Telecom: Optimal Debt Ratio

Debt Ratio	Beta	Cost of Equity	Bond Rating	Interest rate on debt	Tax Rate	Cost of Debt (after-tax)	WACC	Firm Value (G)
0%	0.79	10.01%	AAA	4.54%	36.25%	2.89%	10.01%	\$9,232
10%	0.85	10.42%	AAA	4.54%	36.25%	2.89%	9.67%	\$10,169
20%	0.92	10.93%	A	5.49%	36.25%	3.50%	9.45%	\$10,875
30%	1.01	11.59%	BBB	6.24%	36.25%	3.98%	9.31%	\$11,367
40%	1.13	12.47%	B	8.24%	36.25%	5.25%	9.58%	\$10,437
50%	1.30	13.69%	CCC	10.24%	36.25%	6.53%	10.11%	\$8,995
60%	1.62	16.08%	CC	11.74%	29.95%	8.22%	11.37%	\$6,712
70%	2.22	20.42%	C	13.24%	22.76%	10.23%	13.28%	\$4,745
80%	3.33	28.51%	C	13.24%	19.92%	10.60%	14.18%	\$4,139
90%	6.66	52.77%	C	13.24%	17.70%	10.90%	15.08%	\$3,654

4.4: Changing Financing Type

- The fundamental principle in designing the financing of a firm is to ensure that the cash flows on the debt should match as closely as possible the cash flows on the asset.
- By matching cash flows on debt to cash flows on the asset, a firm reduces its risk of default and increases its capacity to carry debt, which, in turn, reduces its cost of capital, and increases value.
- Firms which mismatch cash flows on debt and cash flows on assets by using
 - Short term debt to finance long term assets
 - Dollar debt to finance non-dollar assets
 - Floating rate debt to finance assets whose cash flows are negatively or not affected by inflationwill end up with higher default risk, higher costs of capital and lower firm value.

Financing Details: Portugal Telecom

- What would the cash flows on a project look like in terms of
 - Project life?:
 - Cash Flow Patterns?:
 - Growth?:
 - Currency?:
- Now what kind of debt would be best to finance such a project?