Valuation

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First Principles

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

Objective: Maximize the Value of the Firm

Discounted Cashflow Valuation: Basis for Approach

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

- where,
- n = Life of the asset
- CF_t = Cashflow in period t
- r = Discount rate reflecting the riskiness of the estimated cashflows

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 Equityt = Expected Cashflow to Equity in period t

ke = 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.

Firm Valuation

- 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.

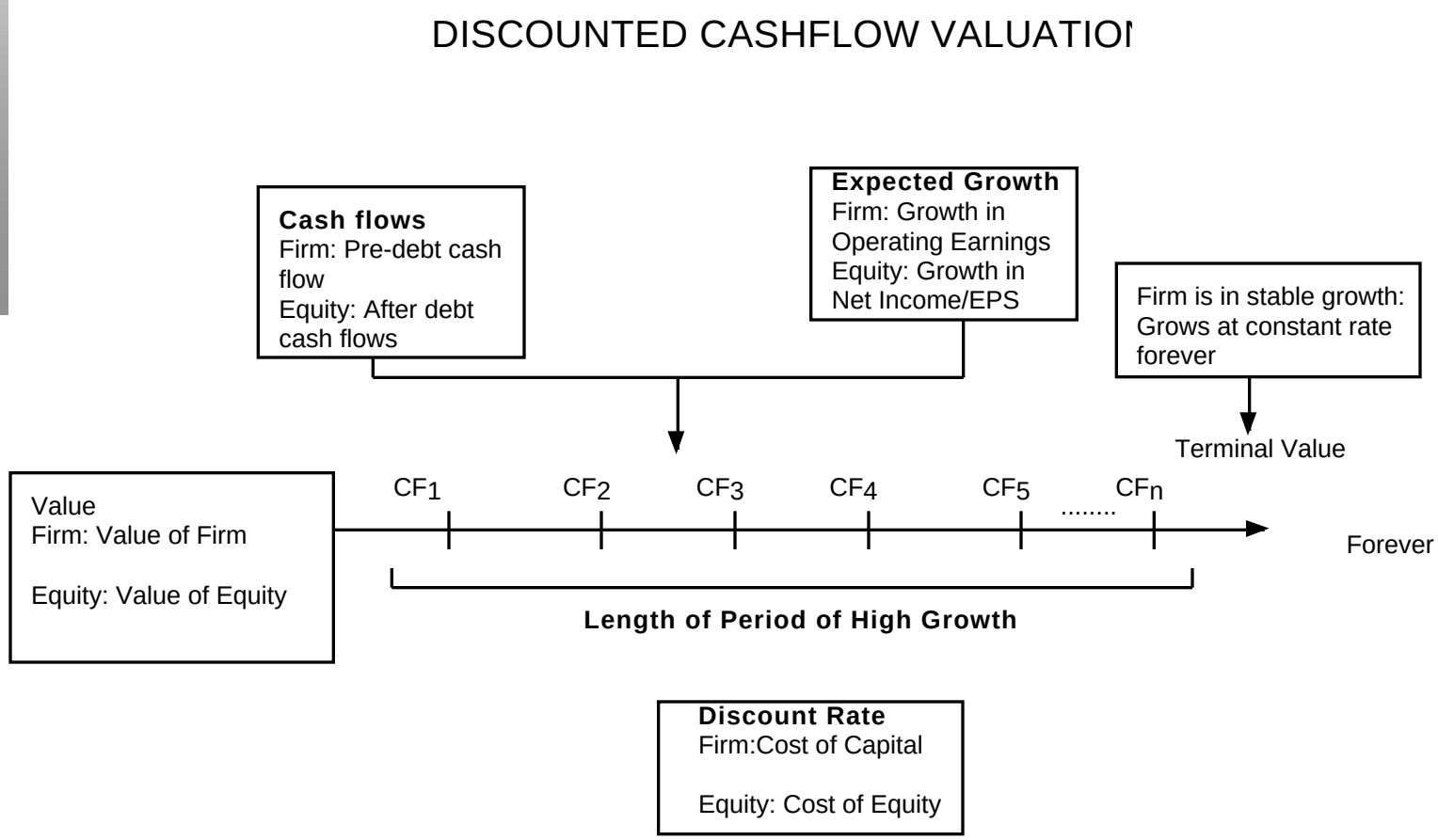
$$\text{Value of Firm} = \sum_{t=1}^{t=n} \frac{\text{CF to Firm}_t}{(1+\text{WACC})^t}$$

where,

CF to Firmt = Expected Cashflow to Firm in period t

WACC = Weighted Average Cost of Capital

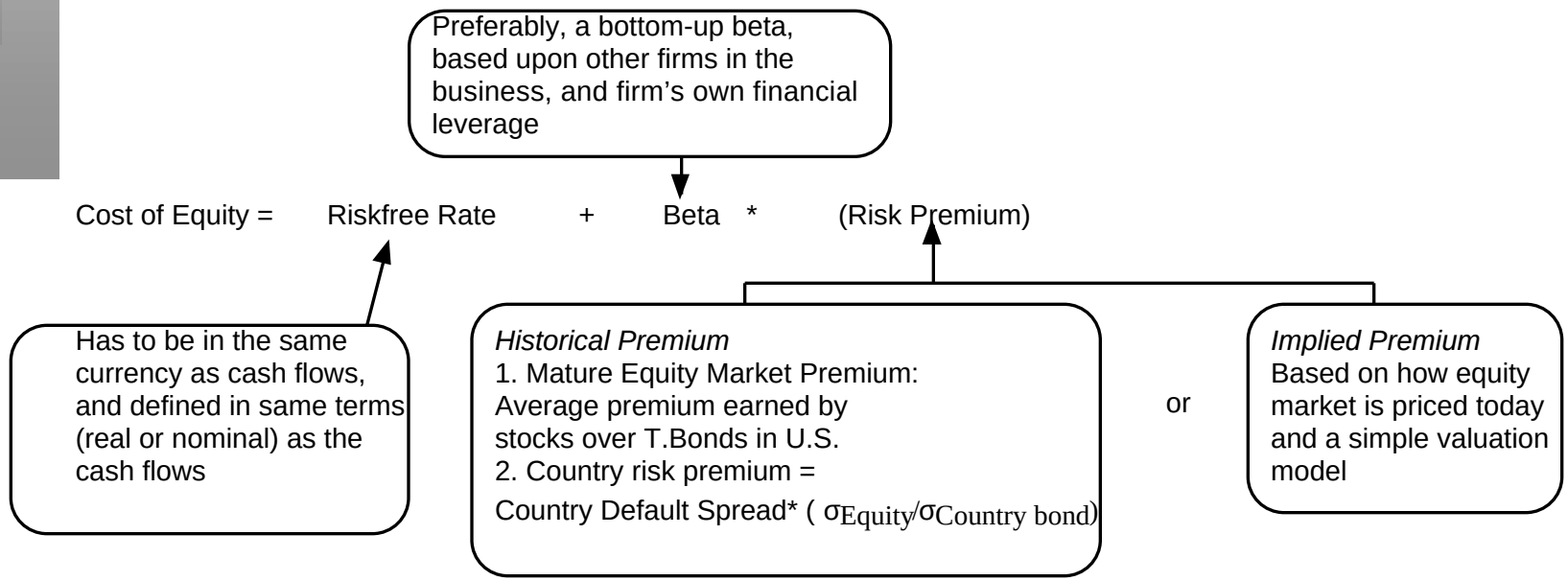
Generic DCF Valuation Model



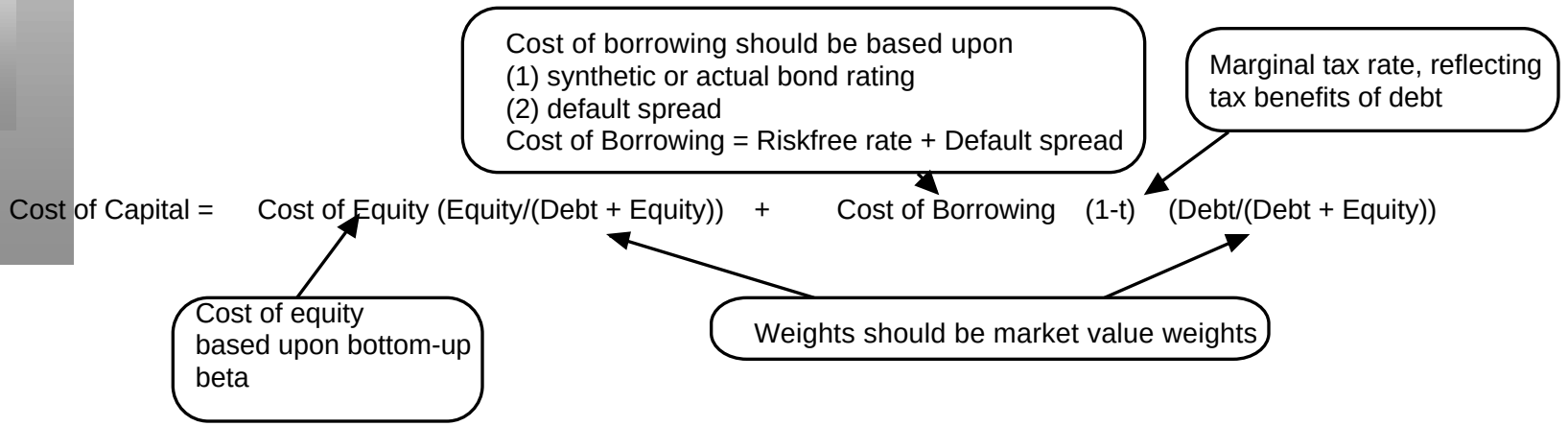
Estimating Inputs: I. Discount Rates

- **Critical ingredient** in discounted cashflow valuation. Errors in estimating the discount rate or mismatching cashflows and discount rates can lead to serious errors in valuation.
- At an intutive level, the discount rate used should be consistent with both the **riskiness** and the **type of cashflow** being discounted.
- The cost of equity is the rate at which we discount cash flows to equity (dividends or free cash flows to equity). The cost of capital is the rate at which we discount free cash flows to the firm.

The Cost of Equity: A Recap



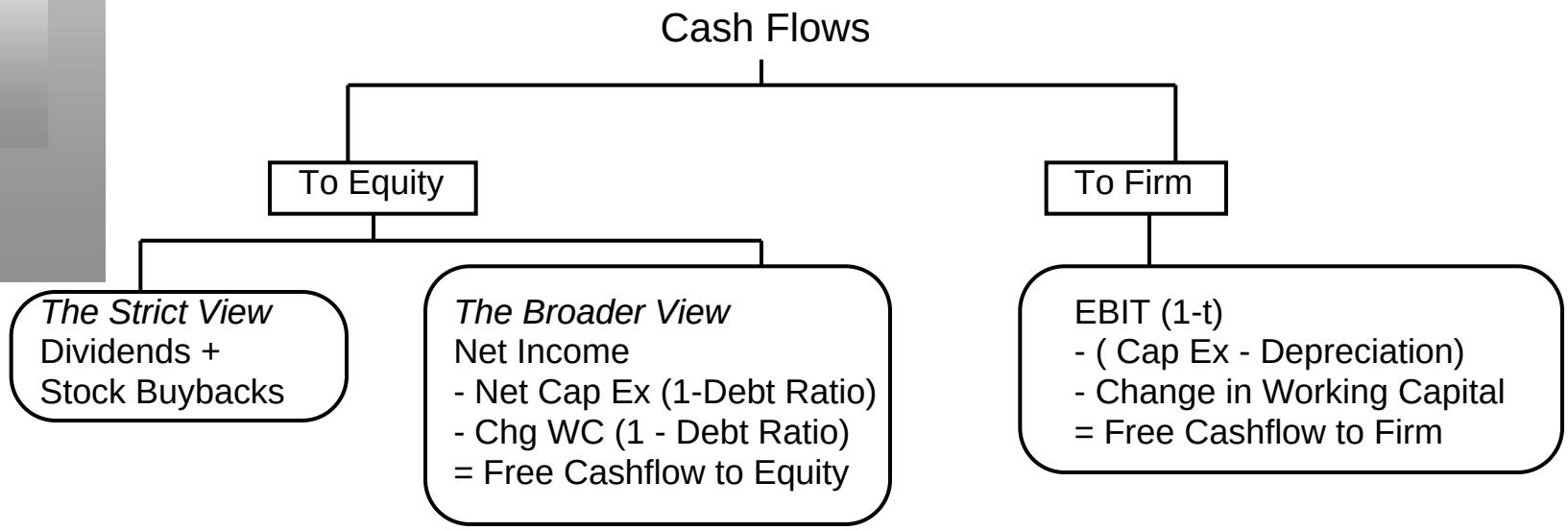
Estimating the Cost of Capital



Costs of Equity, Debt and Capital

	Boeing	*The Home Depot*	*InfoSoft*
Beta (Bottom-up)	1.01	0.87	1.49
Cost of Equity	10.58%	9.78%	13.19%
Equity/(Debt + Equity)	79.91%	95.45%	93.38%
Rating	AA	A+	A
After-tax Cost of Debt	3.58%	3.77%	3.48%
Debt/(Debt + Equity)	20.09%	4.55%	6.62%
Cost of Capital	9.17%	9.51%	12.55%

II. Estimating Cash Flows



Estimating Operating Income

- The first adjustment is for financing expenses that accountants treat as operating expenses. The most significant example is operating leases.
- The second adjustment is the treatment of some capital expenditures as operating expenses. Here, the most dramatic example is the treatment of research and development expenses.
- The third adjustment is to correct for the incidence of one-time or irregular income and expenses. Any expense (or income) that is truly a one-time expense (or income) should be removed from the operating income and should not be used in forecasting future operating income.

Operating Income Estimates

	Boeing	*Home Depot*	*InfoSoft*
Operating Income	$1,720	$2,661	$2,000
+ Special and One-time Charges	$0	$0	$0
+ Research and Development Expenses	$1,895	$0	$4,000
- Amortization of Research Asset	$1,382	$0	$2,367
+ Imputed Interest Expense on Operating Leases	$ 31	$ 154	$ -
= Adjusted Operating Income	$2,264	$2,815	$3,633

Estimating a Tax Rate

- The choice 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.

Tax Rate Estimates

	Boeing	*Home Depot*	*InfoSoft*
Taxable Income	1397	2654	1685
Taxes	277	1040	707.7
Effective Tax Rate	19.83%	39.19%	42.00%
Average Effective Tax Rate:94-98	20.44%	38.78%	42%
Marginal tax rate	35%	35%	42%

We will use the 35% tax rate to value Boeing and the Home Depot and 42% for InfoSoft.

Estimating Capital Expenditures

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

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

- Acquisitions of other firms, since these are like capital expenditures. The adjusted 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 normalized measure of acquisitions (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 other investment activities

Net Capital Expenditures: 1998

	Boeing	*The Home Depot*	*InfoSoft*
Capital Expenditures	$1,584	$2,059	$2,000
R&D	$1,895	$0	$4,000
Depreciation	$1,517	$373	$1,000
Amortization of R&D	$1,382	$0	$2,367
Net Cap Ex w/o R&D	$67	$1,686	$1,000
Net Cap Ex with R&D	$580	$1,686	$2,633

Estimating Net Working Capital Needs

- 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.

Net Working Capital Estimates

	Boeing	*The Home Depot*	*InfoSoft*
Revenues: 1998	$56,154	30219	20000
Non-cash WC: 1998	$1,360	2028	2000
Δ Working capital	$667	$190	$500
Non-cash WC as % of Revenues	2.42%	6.71%	10.00%
Average from 1994-1998	4.12%	7.08%	NA
Industry Average	*18.95%*	*12.30%*	*18.00%*

Application Test: Estimating your firm's FCFF

- Estimate the FCFF for your firm in its most recent financial year:

In general,	If using statement of cash flows
EBIT (1-t)	EBIT (1-t)
+ Depreciation	+ Depreciation
- Capital Expenditures	+ Capital Expenditures
- Change in Non-cash WC	+ Change in Non-cash WC
= FCFF	= FCFF

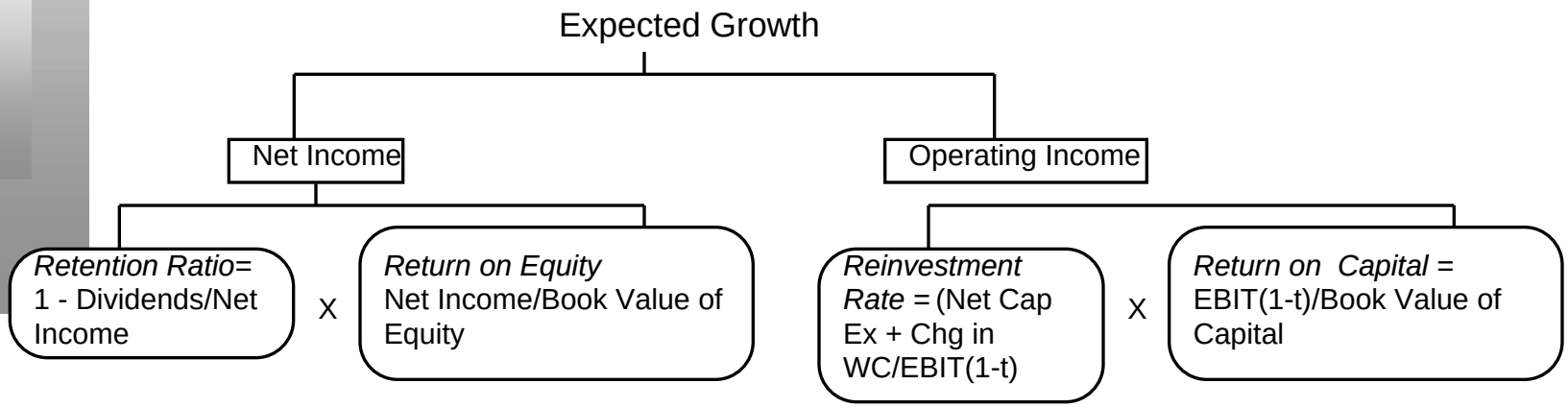
Estimate the dollar reinvestment at your firm:

Reinvestment = EBIT (1-t) - FCFF

Choosing a Cash Flow to Discount

- When you cannot estimate the free cash fllows to equity or the firm, the only cash flow that you can discount is dividends. For financial service firms, it is difficult to estimate free cash flows. For Deutsche Bank, we will be discounting dividends.
- If a firm's debt ratio is not expected to change over time, the free cash flows to equity can be discounted to yield the value of equity. For Aracruz, we will discount free cash flows to equity.
- If a firm's debt ratio might change over time, free cash flows to equity become cumbersome to estimate. Here, we would discount free cash flows to the firm. For Disney, we will discount the free cash flow to the firm.

III. Expected Growth



Expected Growth in EPS

g_{EPS} = Retained Earnings$_{t-1}$ / NI$_{t-1}$ * ROE
= Retention Ratio * ROE
= b * ROE

- Proposition 1: The expected growth rate in earnings for a company cannot exceed its return on equity in the long term.

Expected Growth in EBIT And Fundamentals

- Reinvestment Rate and Return on Capital

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

Estimating Reinvestment Rate

	Boeing	*The Home Depot*	*InfoSoft*
Net Cap Ex	$ 580	$ 1,686	$ 2,633
Change in Non-Cash WC	$ 667	$ 190	$ 500
Total Reinvestment	$ 1,247	$ 1,876	$ 3,133
EBIT (1-t)	$ 1,651	$ 1,830	$ 2,793
Reinvestment Rate	75.52%	102.53%	112.17%
Average : 1994-98	65.98%	131.85%	NA
Industry Average	55.48%	88.62%	73.12%

Estimating Return on Capital

	Boeing	*The Home Depot*	*InfoSoft*
Adjusted EBIT (1-t)	$ 1,651	$ 1,830	$ 2,793
Adjusted BV of capital	$ 28,957	$ 11,173	$ 11800
ROC	5.70%	16.38%	23.67%
Average ROC: 1994-1998	6.59%	15.12%	NA
Industry average ROC	15.07%	14.10%	17.20%

Expected Growth Estimates

	Boeing	*The Home Depot*	*InfoSoft*
Return on Capital	6.59%	16.38%	23.67%
Reinvestment Rate	65.98%	88.62%	112.17%
Expected Growth Rate	4.35%	14.51%	26.55%

Boeing: Used average return on capital and reinvestment rate over last 5 years

The Home Depot: Used current return on capital and Industry average reinvestment rate

InfoSoft: Used current return on capital and reinvestment rate

Application Test: Estimating Expected Growth

- Estimate the following:
  - The reinvestment rate for your firm
  - The after-tax return on capital
  - The expected growth in operating income, based upon these inputs

IV. 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:

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

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

- This "constant" growth rate is called a stable growth rate and cannot be higher than the growth rate of the economy in which the firm operates.
- While companies can maintain high growth rates for extended periods, they will all approach "stable growth" at some point in time.
- When they do approach stable growth, the valuation formula above can be used to estimate the "terminal value" of all cash flows beyond.

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 Length of High Growth Period

- 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.

Analyzing the Growth Period

	Boeing	*The Home Depot*	*InfoSoft*
Firm Size/Market Size	Firm has the dominant market share of a slow-growing market	Firm has dominant market share of domestic market, but is entering new businesses and new markets (overseas)	Firm is a small firm in a market that is experiencing significant growth.
Current Excess Returns	Firm is earning less than its cost of capital, and has done so for last 5 years	Firm is earning substantially more than its cost of capital.	Firm is earning significant excess returns.
Competitive Advantages	Huge capital requirements and technological barriers to new entrants. Management record over the last few years has been poor.	Significant economies of scale are used to establish cost advantages over rivals. Has a management team that is focused on growth and efficiency.	Has both a good product and good software engineers. Competitive advantage is likely to be limited, since employees can be hired away, and competitors are extremely aggressive.
Length of High Growth period	10 years, entirely because of competitive advantages and barriers to entry.	10 years; it will be difficult for competitors to overcome the economies of scale.	5 years. In spite of the firm's small size, the competitive nature of this market and the lack of barriers to competition make us conservative on our estimate.

Firm Characteristics as Growth Changes

Variable	High Growth Firms tend to	Stable Growth Firms tend to
Risk	be above-average risk	be average risk
Dividend Payout	pay little or no dividends	pay high dividends
Net Cap Ex	have high net cap ex	have low net cap ex
Return on Capital	earn high ROC (excess return)	earn ROC closer to WACC
Leverage	have little or no debt	higher leverage

Estimating Stable Growth Inputs

- Start with the fundamentals:
  - Profitability measures such as return on equity and capital, in stable growth, can be estimated by looking at
    - industry averages for these measure, in which case we assume that this firm in stable growth will look like the average firm in the industry
    - cost of equity and capital, in which case we assume that the firm will stop earning excess returns on its projects as a result of competition.
  - Leverage is a tougher call. While industry averages can be used here as well, it depends upon how entrenched current management is and whether they are stubborn about their policy on leverage (If they are, use current leverage; if they are not; use industry averages)
- Use the relationship between growth and fundamentals to estimate payout and net capital expenditures.

Estimating Stable Period Cost of Capital

	Boeing		The Home Depot		InfoSoft	
	High Growth	Stable Growth	High Growth	Stable Growth	High Growth	Stable Growth
Beta	1.014	1	0.869	0.869	1.489	1.2
Cost of Equity	10.58%	10.50%	9.78%	9.78%	13.19%	11.60%
After-tax Cost of Debt	3.58%	3.58%	3.77%	3.58%	3.48%	3.48%
Debt Ratio	20.09%	30.00%	4.55%	30.00%	6.62%	6.62%
Cost of Capital	9.17%	8.42%	9.51%	7.92%	12.55%	11.06%

Estimating Stable Period Net Cap Ex

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

- Moving terms around,

Reinvestment Rate = g_{EBIT} / Return on Capital

- For instance, assume that Boeing in stable growth will
  - grow 5% and that
  - its return on capital in stable growth will be 8.42% (its cost of capital).

Reinvestment Rate for Boeing in Stable Growth = 5/8.42 = 59.36%

- In other words,
  - the net capital expenditures and working capital investment each year during the stable growth period will be 59.36% of after-tax operating income.

Stable Period Return on Capital and Reinvestment Rates

	Boeing		The Home Depot		InfoSoft	
	High Growth	Stable Growth	High Growth	Stable Growth	High Growth	Stable Growth
Return on Capital	6.59%	8.42%	16.38%	14.10%	23.67%	17.20%
Reinvestment Rate	65.98%	59.35%	88.62%	35.46%	112.17%	29.07%
Expected Growth Rate	4.35%	5.00%	14.51%	5.00%	26.55%	5.00%

Dealing with Cash and Marketable Securities

- The simplest and most direct way of dealing with cash and marketable securities is to keep it out of the valuation - the cash flows should be before interest income from cash and securities, and the discount rate should not be contaminated by the inclusion of cash. (Use betas of the operating assets alone to estimate the cost of equity).
- Once the firm has been valued, add back the value of cash and marketable securities.
  - If you have a particularly incompetent management, with a history of overpaying on acquisitions, markets may discount the value of this cash.

Cash and Marketable Securities: Estimates

	Boeing	*The Home Depot*	*InfoSoft*
Cash	$2,183	$62	$100
Marketable Securities	$279	$0	$400
Non-Operating Assets	$0	$0	$0
Excess of Pension Assets	$1,861	$0	$0
Cash and Non-Operating Assets	$4,323	$62	$500

Boeing has an overfunded pension plan. We considered only 50% of the overfunding, since the firm will have to pay a tax of 50% if it decides to withdraw the funds.

The Value of Cash

- Implicitly, we are assuming here that the market will value cash at face value. Assume now that you are buying a firm whose only asset is marketable securities worth $ 100 million. Can you ever consider a scenario where you would not be willing to pay $ 100 million for this firm?
  - Yes
  - No
- What is or are the scenario(s)?

Dealing with Holdings in Other firms

- Holdings in other firms can be categorized into
  - Minority passive holdings, in which case only the dividend from the holdings is shown in the balance sheet
  - Minority active holdings, in which case the share of equity income is shown in the income statements
  - Majority active holdings, in which case the financial statements are consolidated.

How to value holdings in other firms

Fin Statement	*Valuing*	*What to do…*
Not consolidated	Equity	Value equity in subsidiary and take share of holding.
Not consolidated	Firm	Value subsidiary as a firm and add portion of firm value. Add portion of debt in subsidiary to the debt in estimating equity value.
Consolidated	Firm	Strip operating income of subsidiary and value subsidiary separately. Add portion of this value to value of parent firm.

How some deal with subsidiaries...

- When financial statements are consolidated, some analysts value the firm with the consolidated operating income and then subtract minority interests from the firm value to arrive at the value of the equity in the firm. What is wrong with this approach?

Equity Value and Per Share Value: A Test

- Assume that you have done an equity valuation of Microsoft. The total value for equity is estimated to be $ 400 billion and there are 5 billion shares outstanding. What is the value per share?

An added fact

- In 1999, Microsoft had 500 million options outstanding, granted to employees over time. These options had an average exercise price of $ 20 (the current stock price is $ 80). Estimate the value per share.

Equity Value and Per Share Value

- The conventional way of getting from equity value to per share value is to divide the equity value by the number of shares outstanding. This approach assumes, however, that common stock is the only equity claim on the firm.
- In many firms, there are other equity claims as well including:
  - warrants, that are publicly traded
  - management and employee options, that have been granted, but do not trade
  - conversion options in convertible bonds
  - contingent value rights, that are also publicly traded.
- The value of these non-stock equity claims has to be subtracted from the value of equity before dividing by the number of shares outstanding.

Warrants

- A warrant is a security issued by a company that provides the holder with the right to buy a share of stock in the company at a fixed price during the life of the warrant.
- A warrant is therefore a long term call option on the equity of the firm and can be valued using option pricing models.
- Warrants and other equity options issued by the firm are claims on the equity of the firm and have to be treated as equity, which has relevance for:
  - estimating debt and equity for the leverage calculation
  - estimating per share value from total equity value

Convertible Bonds

- A convertible bond is a bond that can be converted into a pre-determined number of shares, at the option of the bond holder.
- While it generally does not pay to convert at the time of the bond issue, conversion becomes a more attractive option as stock prices increase.
- A convertible bond can be considered to be made up of two securities - a straight bond and a conversion option.
- Firms generally add conversions options to bonds to lower the interest rate paid on the bonds.

Factors in Using Option Pricing Models to Value Convertibles and Warrants

- Option pricing models can be used to value the conversion option with three caveats –
  - conversion options are long term, making the assumptions about constant variance and constant dividend yields much shakier,
  - conversion options result in stock dilution, and
  - conversion options are often exercised before expiration, making it dangerous to use European option pricing models.
- These problems can be partially alleviated by using a binomial option pricing model, allowing for shifts in variance and early exercise, and factoring in the dilution effect

Options Outstanding: Boeing

Exercise Price	*Number (in '000s)*	*Life*	*Black-Scholes Value/option*	*Total Value (in '000s)*
$ 16.35	4315	4.5	$ 17.71	$ 76,418.65
$ 23.32	8480	5	$ 14.23	$ 120,670.40
$ 38.44	1779	7.1	$ 10.75	$ 19,124.25
$ 41.25	4598	7.4	$ 10.34	$ 47,543.32
$ 53.37	9481	8.7	$ 9.12	$ 86,466.72
Total Value of Options Outstanding at Boeing =				$ 350,223.34

Options Outstanding: The Home Depot

- Average Exercise Price of Options Outstanding = $20.17
- Stock Price at time of analysis= $ 37.00
- Average Maturity of Options Outstanding = 7.6 years
- Number of Options Outstanding = 47.728 million
- Standard Deviation of The Home Depot stock = 30%
- Value of Options Outstanding = $2,021 million

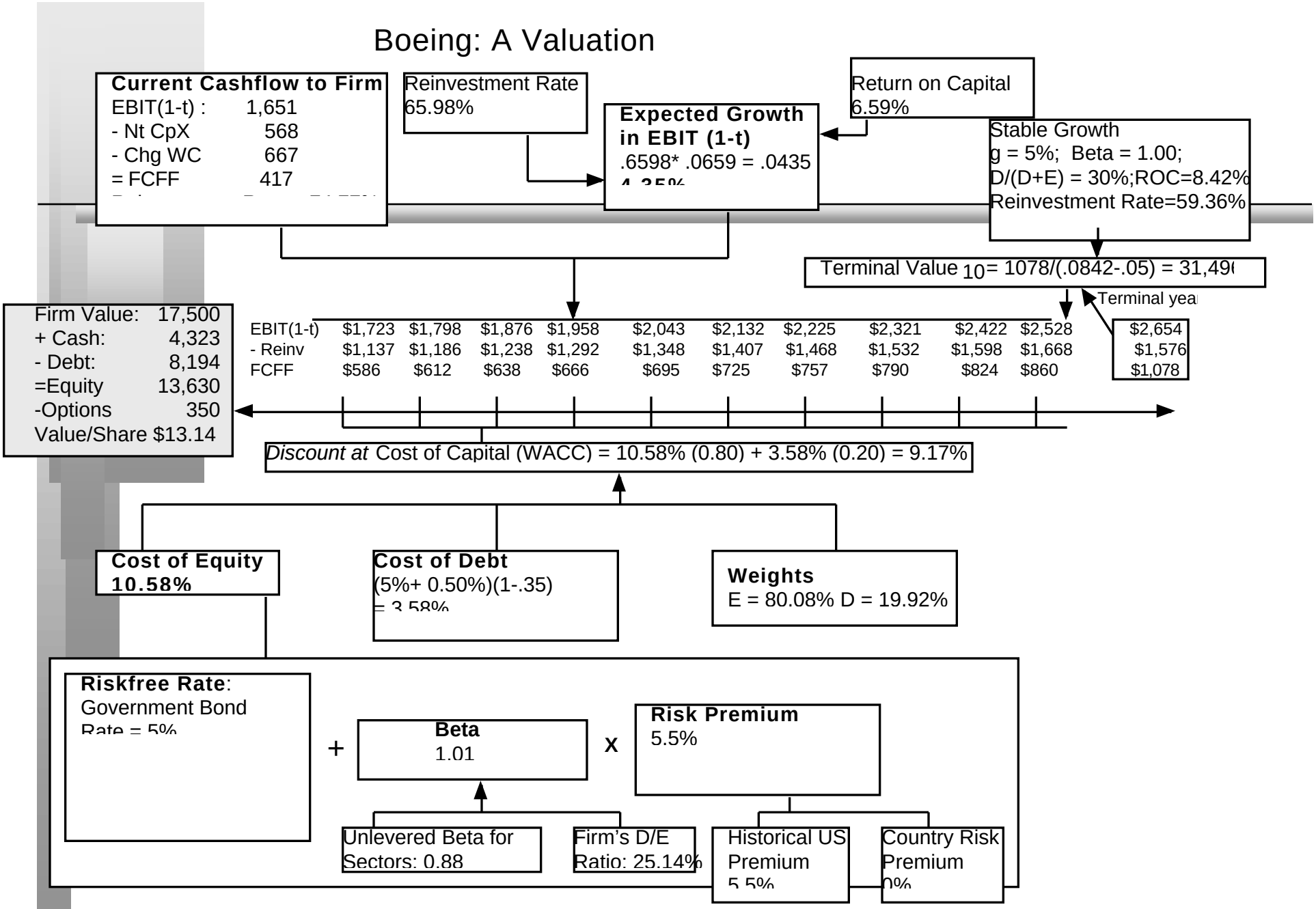
Steps in Getting to Value Per Share

- Step 1: Value the firm, using discounted cash flow or other valuation models.
- Step 2:Subtract out the value of the outstanding debt to arrive at the value of equity. Alternatively, skip step 1 and estimate the of equity directly.
- Step 3:Subtract out the market value (or estimated market value) of other equity claims:
  - Value of Warrants = Market Price per Warrant * Number of Warrants : Alternatively estimate the value using OPM
  - Value of Conversion Option = Market Value of Convertible Bonds - Value of Straight Debt Portion of Convertible Bonds
- Step 4:Divide the remaining value of equity by the number of shares outstanding to get value per share.

Boeing: Valuation - Summary of Inputs

	High Growth Phase	Stable Growth Phase
Length	10 years	Forever after year 10
Growth Inputs		
- Reinvestment Rate	65.98%	59.36%
- Return on Capital	6.59%%	8.42%
- Expected Growth rate	4.35%	5.00%
Cost of Capital Inputs		
- Beta	1.01	1.00
- Cost of Debt	5.50%	5.50%
- Debt Ratio	19.92%	30.00%
- Cost of Capital	9.17%	8.42%
General Information		
- Tax Rate	35%	35%

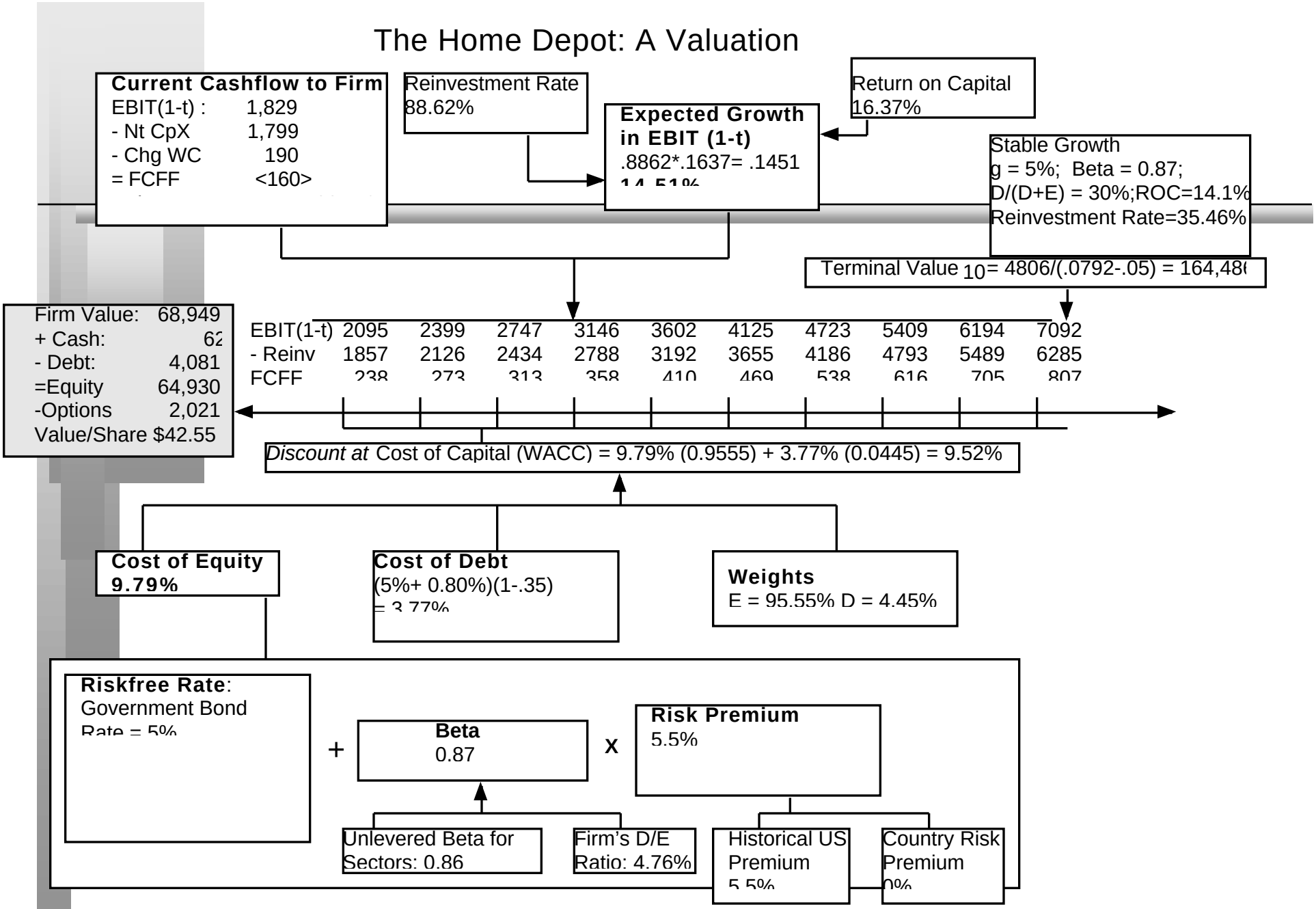
Boeing: A Valuation



The Home Depot: Valuation Inputs

	High Growth Phase	Stable Growth Phase
Length	10 years	Forever after year 10
Growth Inputs		
- Reinvestment Rate	88.62%	35.46%
- Return on Capital	16.37%	14.10%
- Expected Growth rate	14.51%	5.00%
Cost of Capital Inputs		
- Beta	0.87	0.87
- Cost of Debt	5.80%	5.50%
- Debt Ratio	4.55%	30.00%
- Cost of Capital	9.52%	7.92%
General Information		
- Tax Rate	35%	35%

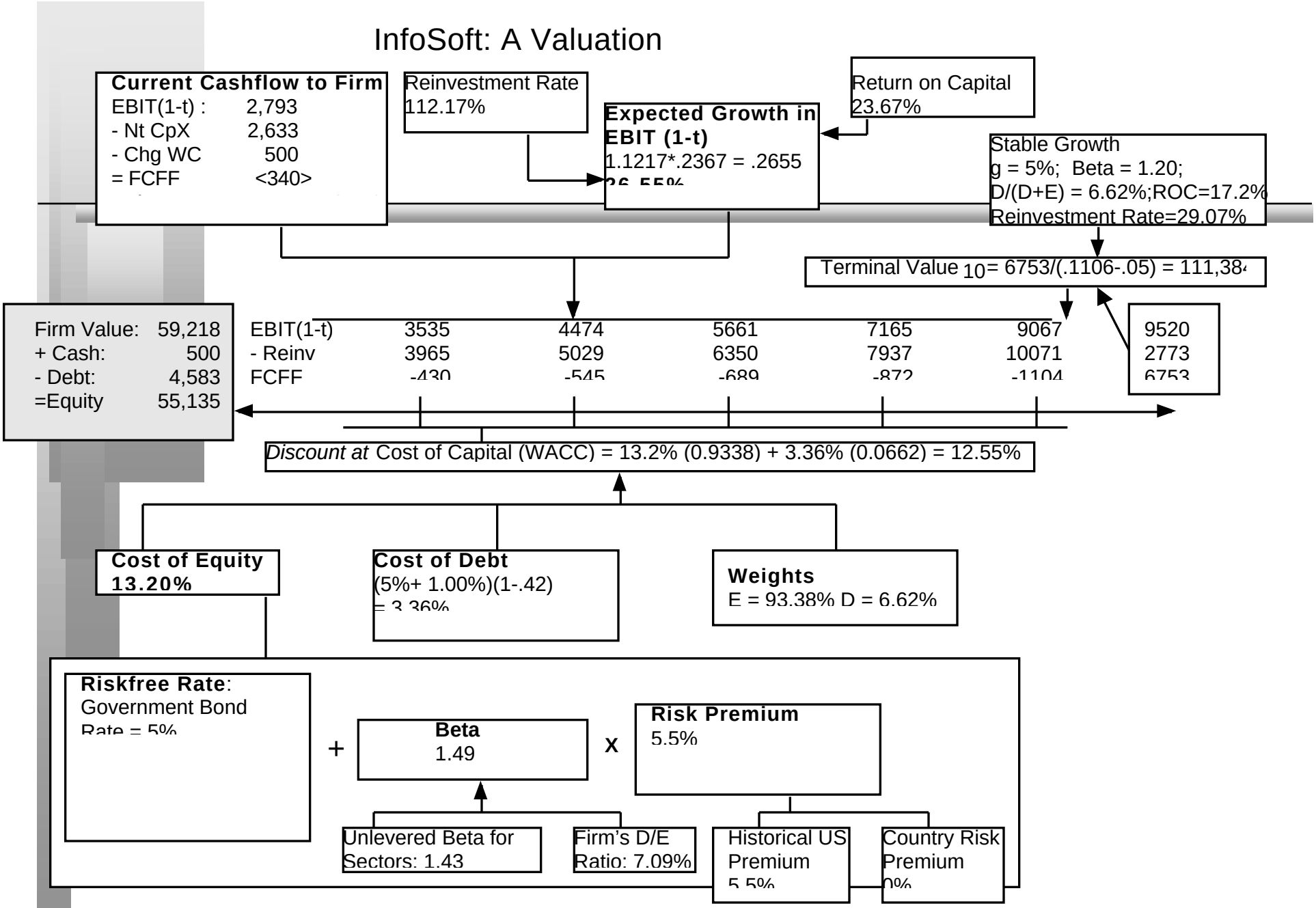
The Home Depot: A Valuation



InfoSoft: Valuation Estimates

	High Growth Phase	Stable Growth Phase
Length	5 years	Forever after year 5
Growth Inputs		
- Reinvestment Rate	112.17%	29.07%
- Return on Capital	23.67%	17.2%
- Expected Growth rate	26.55%	5.00%
Cost of Capital Inputs		
- Beta	1.49	1.20
- Cost of Debt	6.00%	6.00%
- Debt Ratio	6.62%	6.62%
- Cost of Capital	12.54%	11.05%
General Information		
- Tax Rate	42%	42%

InfoSoft: A Valuation



Relative Valuation

- In relative valuation, the value of an asset is derived from the pricing of 'comparable' assets, standardized using a common variable such as earnings, cashflows, book value or revenues. Examples include --
  - Price/Earnings (P/E) ratios
    - and variants (EBIT multiples, EBITDA multiples, Cash Flow multiples)
  - Price/Book (P/BV) ratios
    - and variants (Tobin's Q)
  - Price/Sales ratios

Equity Multiples: Determinants

- Gordon Growth Model: $P_0 = \frac{DPS_1}{r - g_n}$
- Dividing both sides by the earnings,

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

- Dividing both sides by the book value of equity,

$$\frac{P_0}{BV_0} = PBV = \frac{ROE * \text{Payout Ratio} * (1 + g_n)}{r - g_n}$$

- If the return on equity is written in terms of the retention ratio and the expected growth rate $\frac{P_0}{BV_0} = PBV = \frac{ROE - g_n}{r - g_n}$
- Dividing by the Sales per share,

$$\frac{P_0}{Sales_0} = PS = \frac{\text{Profit Margin} * \text{Payout Ratio} * (1 + g_n)}{r - g_n}$$

Firm Value Multiples

- The value of a firm in stable growth can be written as:

  Value of Firm =

- Dividing both sides by the expected free cash flow to the firm yields the Value/FCFF multiple for a stable growth firm:

- The value/EBITDA multiple, for instance, can be written as follows:

Determinants of Multiples

Multiple	*Determining Variables*
Price/Earnings Ratio	*Growth*, Payout, Risk
Price/Book Value Ratio	Growth, Payout, Risk, *ROE*
Price/Sales Ratio	Growth, Payout, Risk, *Net Margin*
Value/EBITDA	Growth, *Net Capital Expenditure needs*, Leverage, Risk
Value/Sales	Growth, Net Capital Expenditure needs, Leverage, Risk, *Operating Margin*
Value/Book Capital	Growth, Leverage, Risk and *ROC*

Companion variable is in italics.

Using Multiples based upon Comparables

- Simple Averages: The average multiple of comparable firms is used to value any firm. This works only if the firm is similar to the average firm in the sector.
- Adjusted Averages: Here, the average multiple is adjusted using one variable. For instance, the PE ratio may be divided by growth to arrive at a PEG ratio.
- Regression Estimates: Here, the multiple is regressed against one or more variables, and the regression is used to estimate the value any firm.

PE Ratios and Growth Rates: Software Firms

Company Name	*PE*	*Expected Growth*	*PEG*
Spanlink Communications	51.00	50%	1.02
Expert Software	11.18	15%	0.75
Applied Microsystems	10.74	20%	0.54
Tripos	9.73	25%	0.39
MathSoft	14.14	30%	0.47
Comshare	6.06	10%	0.61
Eagle Point Software	46.57	5%	9.31
TSR	12.56	20%	0.63
Computer Outsourcing Services	16.04	40%	0.40
Data Research Associates	12.14	15%	0.81
Mecon	46.55	30%	1.55
Forsoft	16.86	25%	0.67
HIE	39.53	38%	1.04
CFI ProServices	13.54	22%	0.62
Adept Technology	23.96	19%	1.26
TechForce	23.15	15%	1.54
InVision Technologies	9.83	23%	0.43
American Software A	8.33	30%	0.28
Viasoft	9.05	17%	0.53
Micrografx	122.17	35%	3.49
Orcad	18.14	16%	1.13
MySoftware	153.00	30%	5.10
Integrated Measurement Systems	15.71	11%	1.43
Jetform	10.87	20%	0.54
Aladdin Knowledge Systems	9.53	18%	0.53
Average	***28.41***	***23%***	***1.40***

Valuing InfoSoft

- Using Simple Average

  Value of Equity

  = InfoSoft Net Earnings in 1998* Average PE ratio for sector

  = $977,300 * 28.41 = $27.765 million

- Using Average Adjusted for Growth
  - PEG Ratio = 1.40
  - Expected Growth Rate for InfoSoft= 27.03%
  - Value of Equity = $977,300 million * 1.40 * 27.03 = $ 37.056 million

Boeing: Price to Book Ratios for Aerospace/Defense Firms

Company	*PBV*	*ROE*	*Standarad Deviation in Stock Prices*
AAR Corp.	1.83	11.85%	61.19%
Orbital Sci Corp	2.32	3.28%	32.46%
CAE Inc.	3.66	25.41%	36.63%
Alliant Techsystems	3.93	25.57%	26.07%
Precision Castparts	1.77	14.46%	47.02%
Howmet Intl	6.00	27.10%	27.62%
Cordant Techn.	3.33	13.95%	27.15%
Litton Inds.	2.49	15.38%	35.62%
Sundstrand Corp.	7.17	33.03%	18.15%
Northrop Grumman	1.59	11.02%	37.59%
Raytheon Co. 'A'	0.65	10.51%	36.12%
Gen'l Dynamics	4.22	16.40%	19.48%
Bombardier Inc. 'B'	4.46	16.23%	22.16%
Lockheed Martin	2.83	19.29%	39.07%
Boeing	3.50	9.09%	34.32%
Average	3.32	16.84%	33.38%

PBV Regression

- Regressing price to book ratios against returns on equity and risk (standard deviation), we get

PBV = 3.54 + 12.69 ROE –6.97 Standard Deviation R^2 = 76.15%

(2.97) (3.35) (2.41)

- Using this regression, we get a predicted price to book value ratio for Boeing, based upon its return on equity of 9.09% and a standard deviation of 34.32%:

Predicted PBV_{Boeing} = 3.54 + 12.69 (.0909) –6.97 (.3432) = 2.27

- Boeing, which is trading at 3.50 times book value, looks over valued.

Is Boeing fairly valued?

- Based upon the PBV ratio, is Boeing under, over or correctly valued?
  - Under Valued
  - Over Valued
  - Correctly Valued
- Will this valuation give you a higher or lower valuation than the discounted cashflow valuation?
  - Higher
  - Lower

Relative Valuation Assumptions

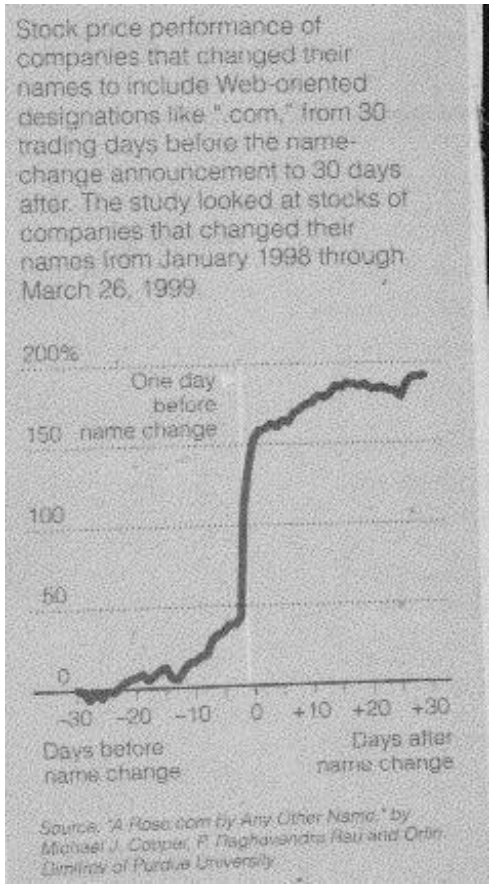
- Assume that you are reading an equity research report where a buy recommendation for a company is being based upon the fact that its PE ratio is lower than the average for the industry. Implicitly, what is the underlying assumption or assumptions being made by this analyst?
  - The sector itself is, on average, fairly priced
  - The earnings of the firms in the group are being measured consistently
  - The firms in the group are all of equivalent risk
  - The firms in the group are all at the same stage in the growth cycle
  - The firms in the group are of equivalent risk and have similar cash flow patterns
  - All of the above

Value Enhancement: Back to Basics

Aswath Damodaran

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

Price Enhancement versus Value Enhancement



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.
- Decisions that create new securities on the existing assets of the firm (without altering the financial mix) such as tracking stock cannot create value, though they might affect perceptions and hence the price.

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:

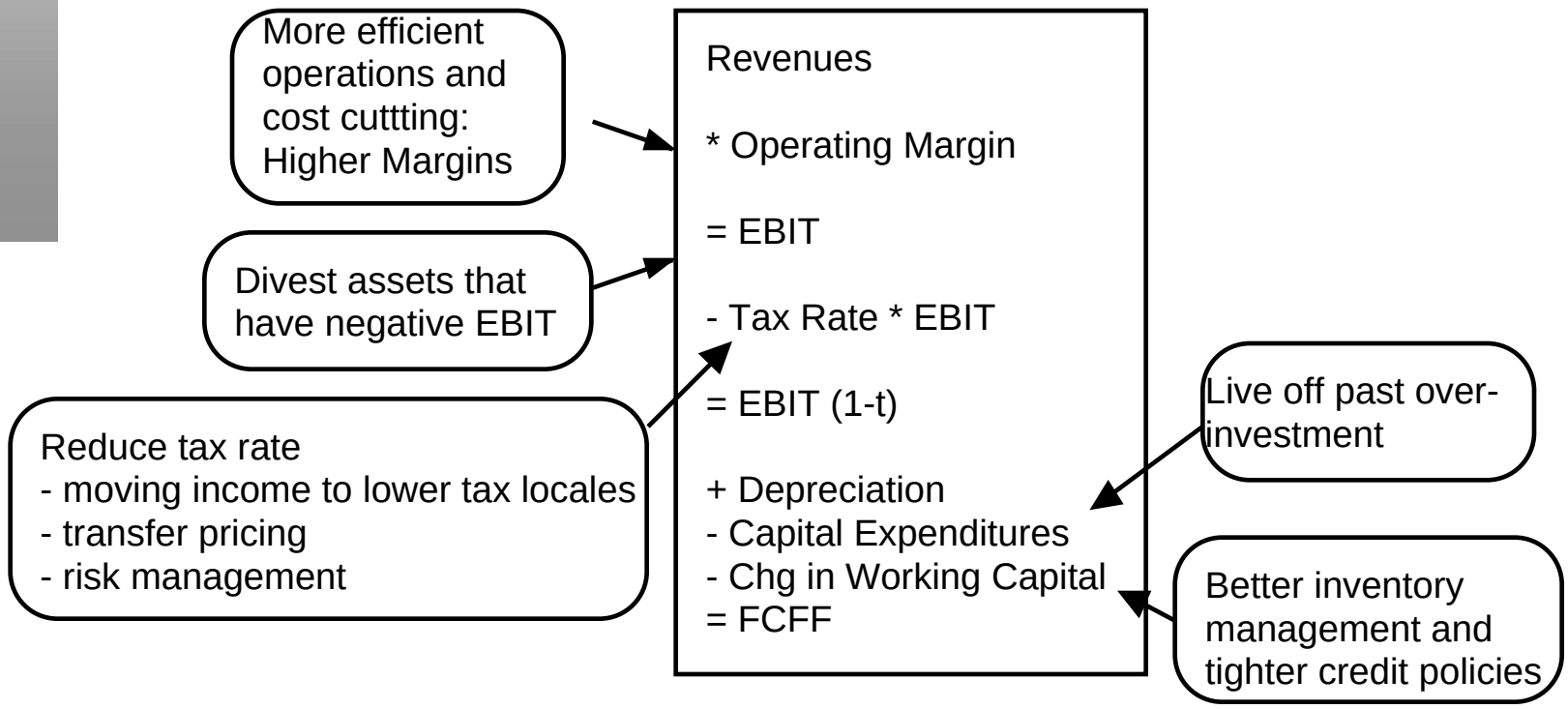
  EBIT (1-t)

  - (Capital Expenditures - Depreciation)

  - Change in Non-cash Working Capital

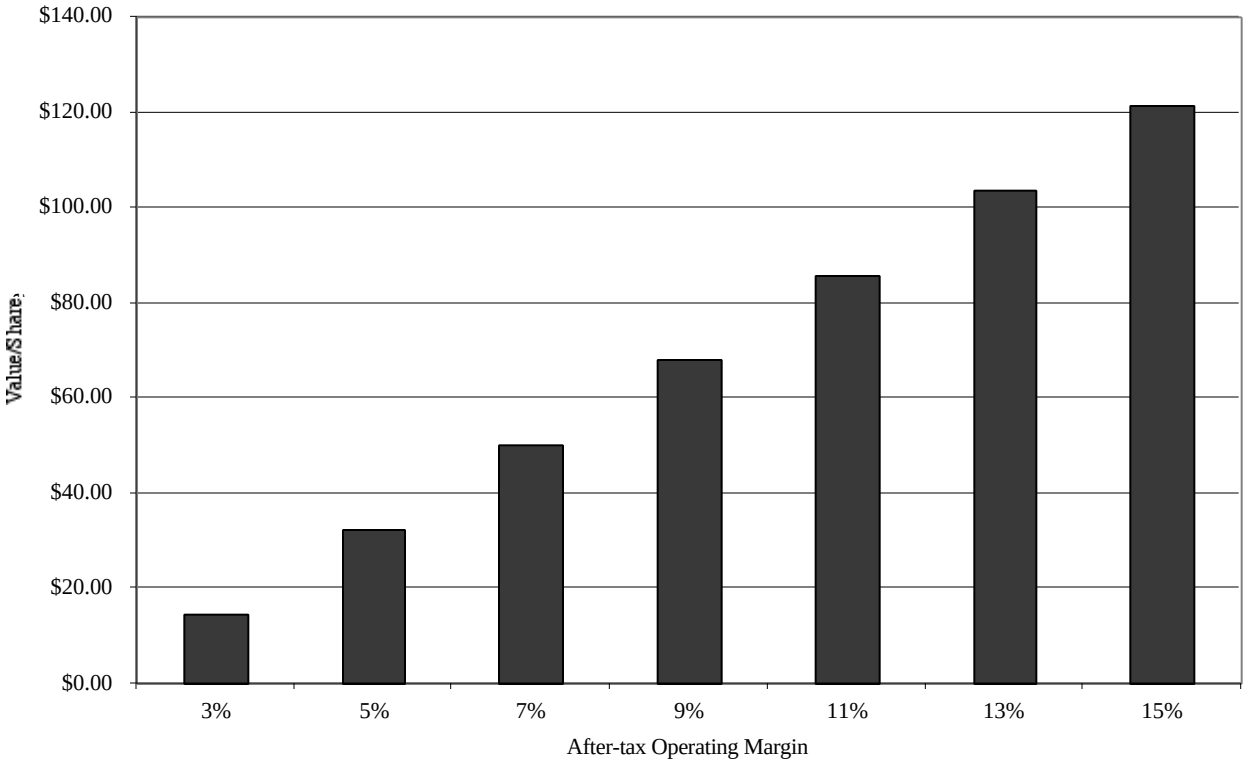
  = Free Cash Flow to Firm
- Proposition 2: A firm that can increase its current cash flows, without significantly impacting future growth or risk, will increase its value.

Ways of Increasing Cash Flows from Assets in Place



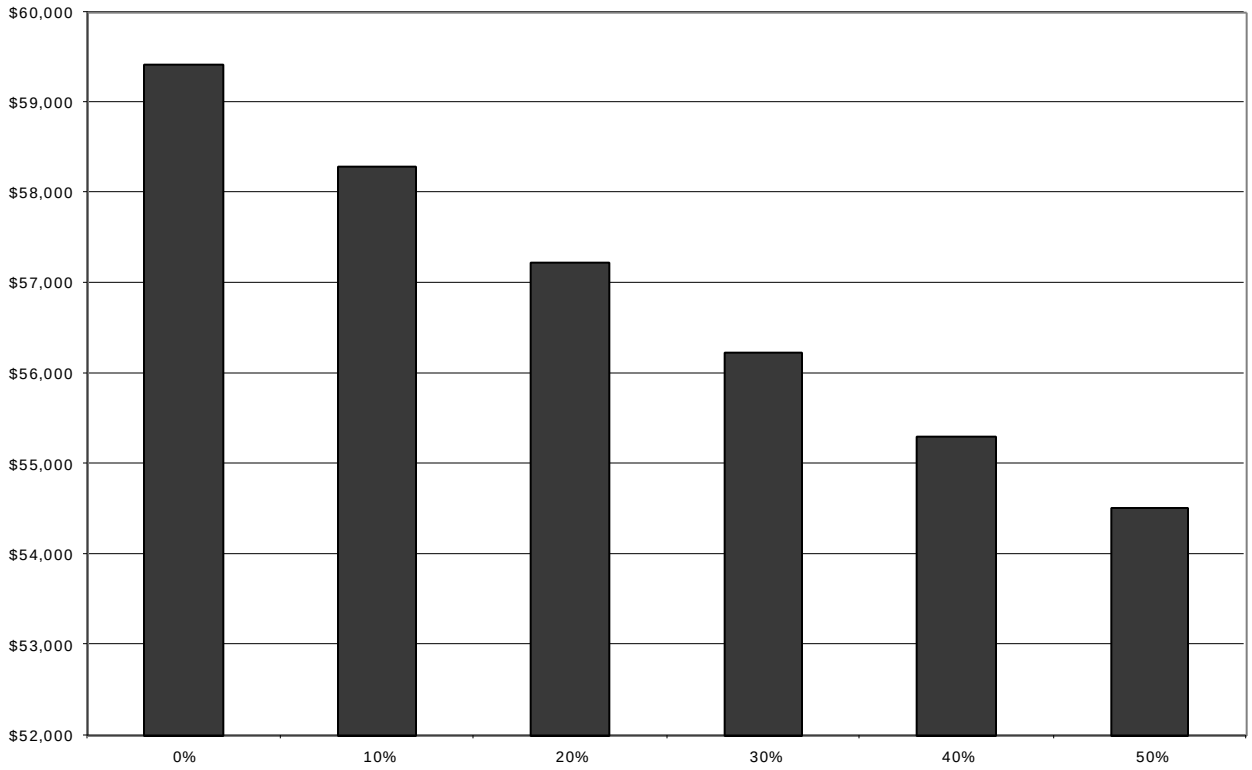
Operating Margin and Value Per Share: Boeing

Figure 25.2: Boeing: Operating Margin Effect on Value



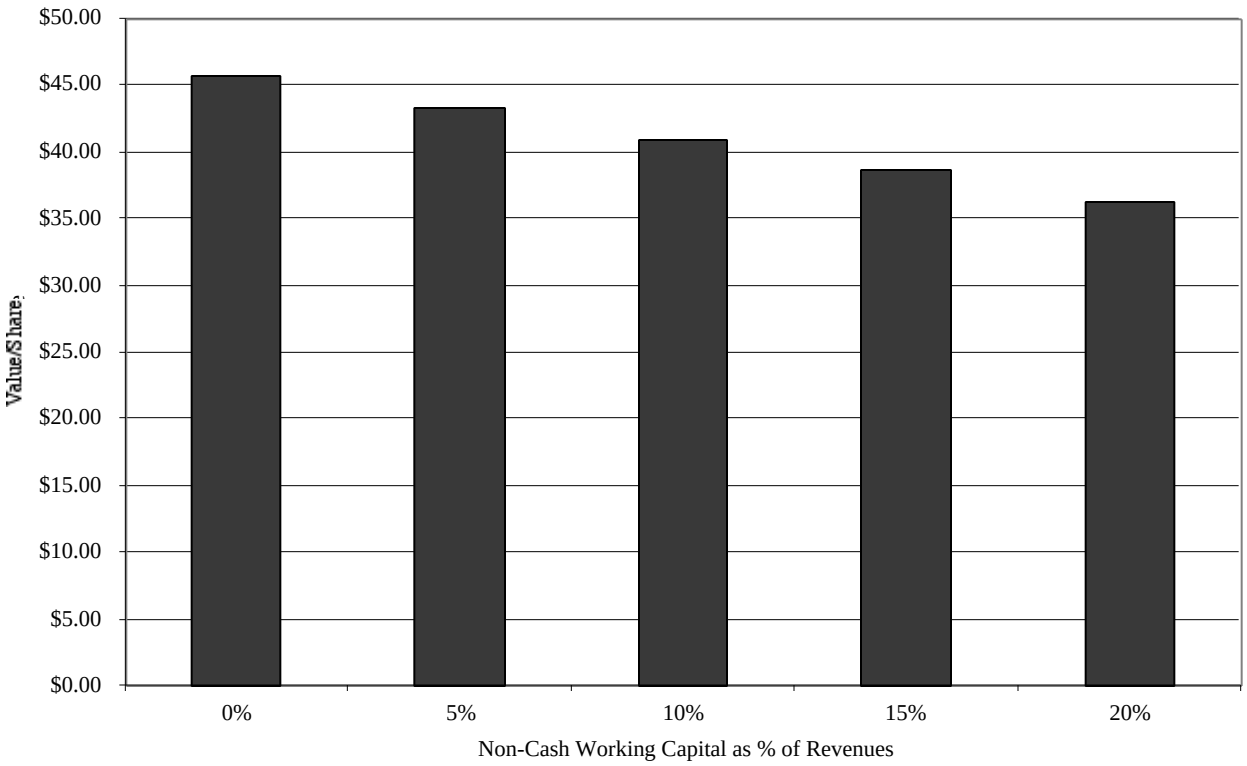
Tax Rate and Value: InfoSoft

Figure 25.3: Tax Rate and InfoSoft Value



Working Capital and Value: The Home Depot

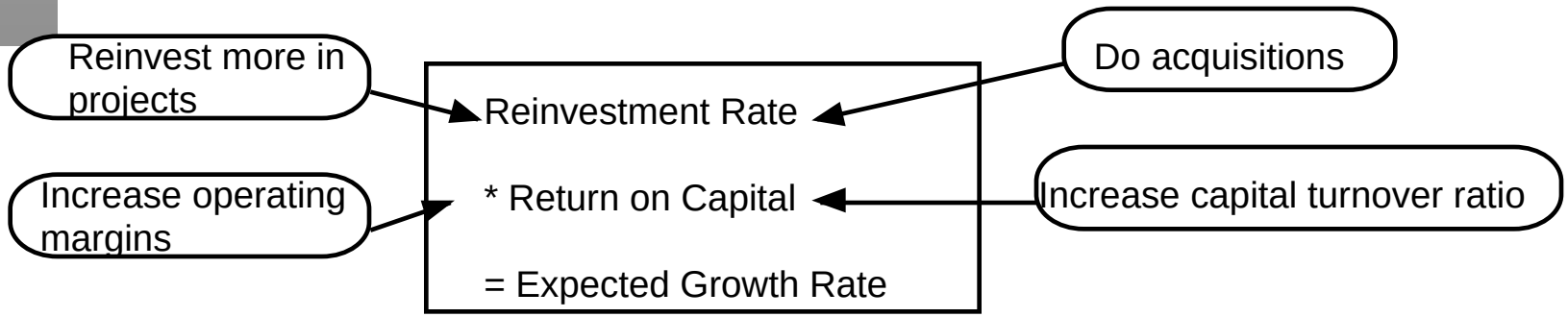
Figure 25.5: The Home Depot: Working Capital and Value/Share



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

Value Enhancement through Growth

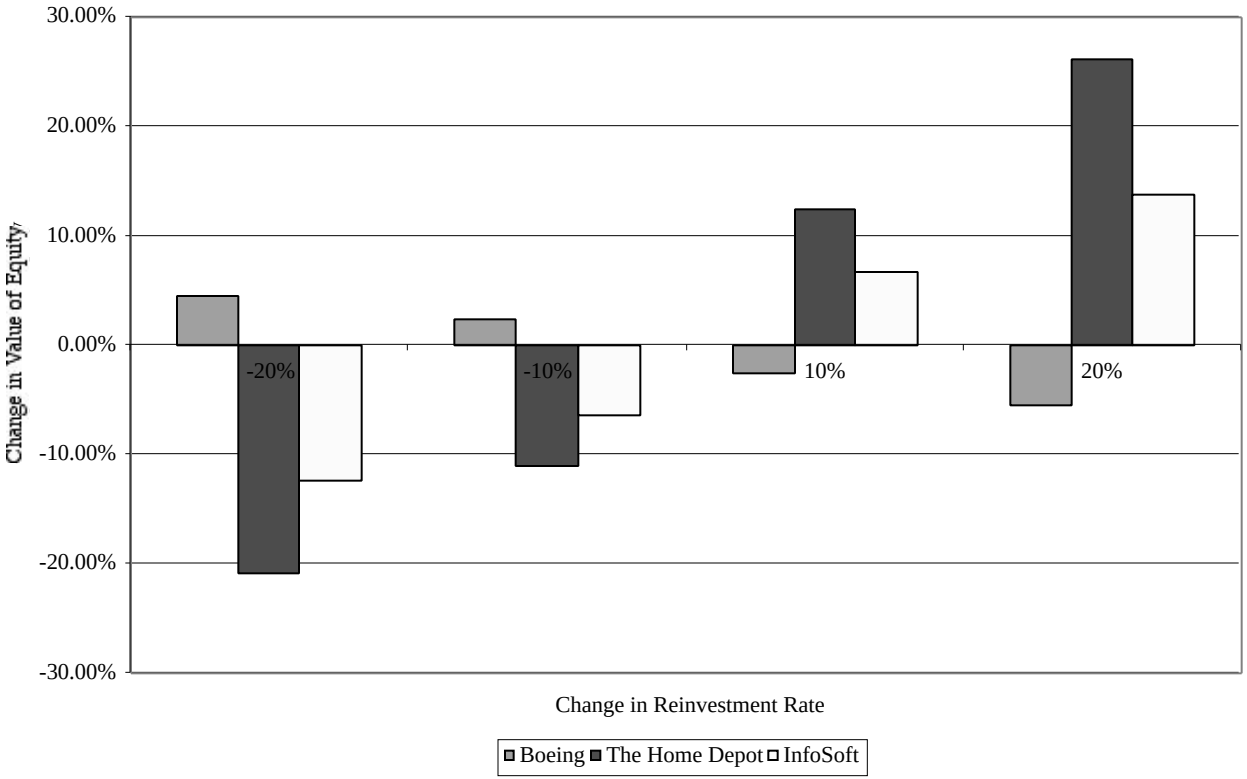


Reviewing the Valuation Inputs

	Boeing	*The Home Depot*	*InfoSoft*
Cost of Capital	9.17%	9.51%	12.55%
Return on Capital	6.59%	16.38%	23.67%
Reinvestment Rate	65.98%	88.62%	112.17%
Expected Growth Rate	5.72%	14.51%	27.03%
Value Per Share	$13.14	$42.55	$55.15

Changing the Reinvestment Rate

Figure 25.6: Effect of Changes in the Reinvestment Rate on the Value of Ec



Reinvestment Rate and Value

- Increasing the reinvestment rate increases value per share at The Home Depot and InfoSoft, but reduces it at Boeing. Why?

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.
- The length of the high growth period is a direct function of the competitive advantages that a firm brings into the process. Creating new competitive advantage or augmenting existing ones can create value.

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.

Illustration: Valuing a brand name: Coca Cola

	Coca Cola	Generic Cola Company
AT Operating Margin	**18.56%**	**7.50%**
Sales/BV of Capital	1.67	1.67
ROC	31.02%	12.53%
Reinvestment Rate	65.00% (19.35%)	65.00% (47.90%)
Expected Growth	20.16%	8.15%
Length	10 years	10 yea
Cost of Equity	12.33%	12.33%
E/(D+E)	97.65%	97.65%
AT Cost of Debt	4.16%	4.16%
D/(D+E)	2.35%	2.35%
Cost of Capital	12.13%	12.13%
Value	**$115**	**$13**

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

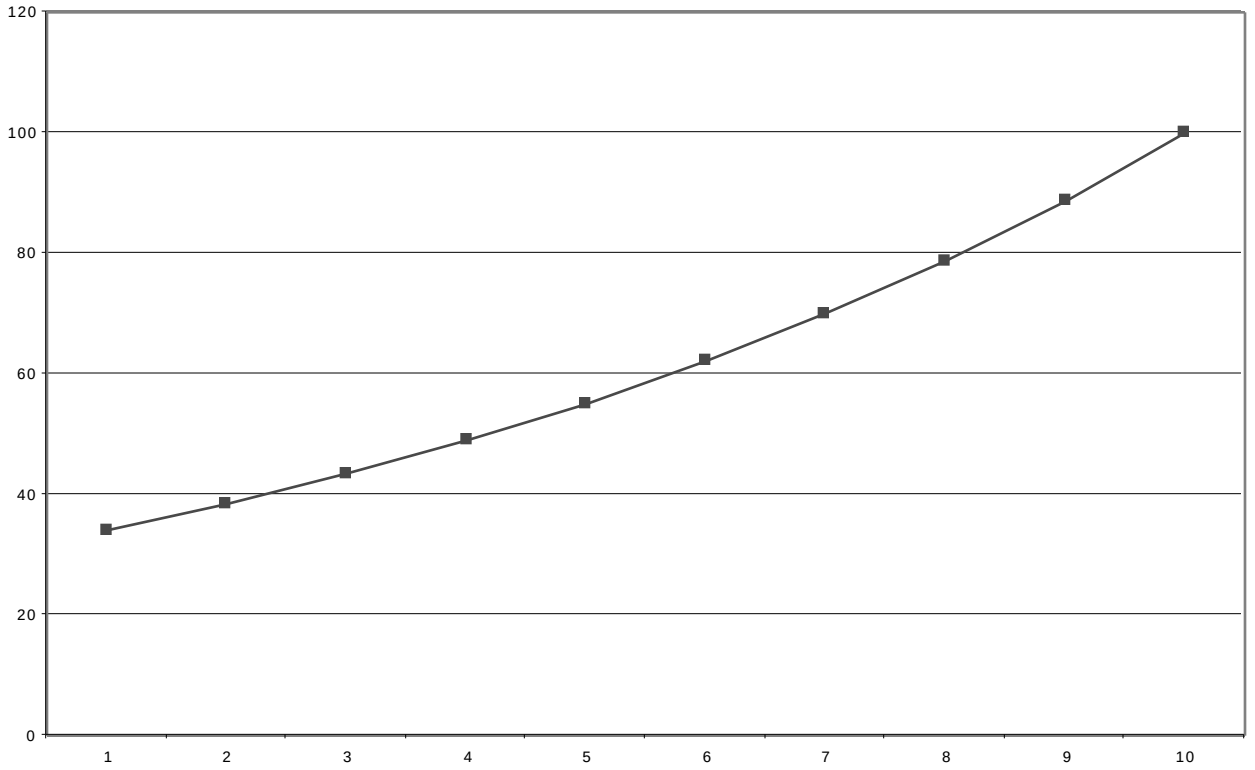
- Another potential barrier to entry is the cost associated with switching from one firm's products to another.
- The greater the switching costs, the more difficult it is for competitors to come in and compete away excess returns.
- Firms that devise ways to increase the cost of switching from their 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.
  - Owning or having the rights to extract a natural resource which is in restricted supply (The undeveloped reserves of an oil or mining company, for instance)
- 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.

Growth Period and Value: InfoSoft

Figure 25.7: Value of InfoSoft and Expected Growth Period



Gauging Barriers to Entry

- Which of the following barriers to entry are most likely to work for the firm that you are analyzing?
  - Brand Name
  - Patents and Legal Protection
  - Switching Costs
  - Cost Advantages

Value Creation 4: Reduce Cost of Capital

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

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

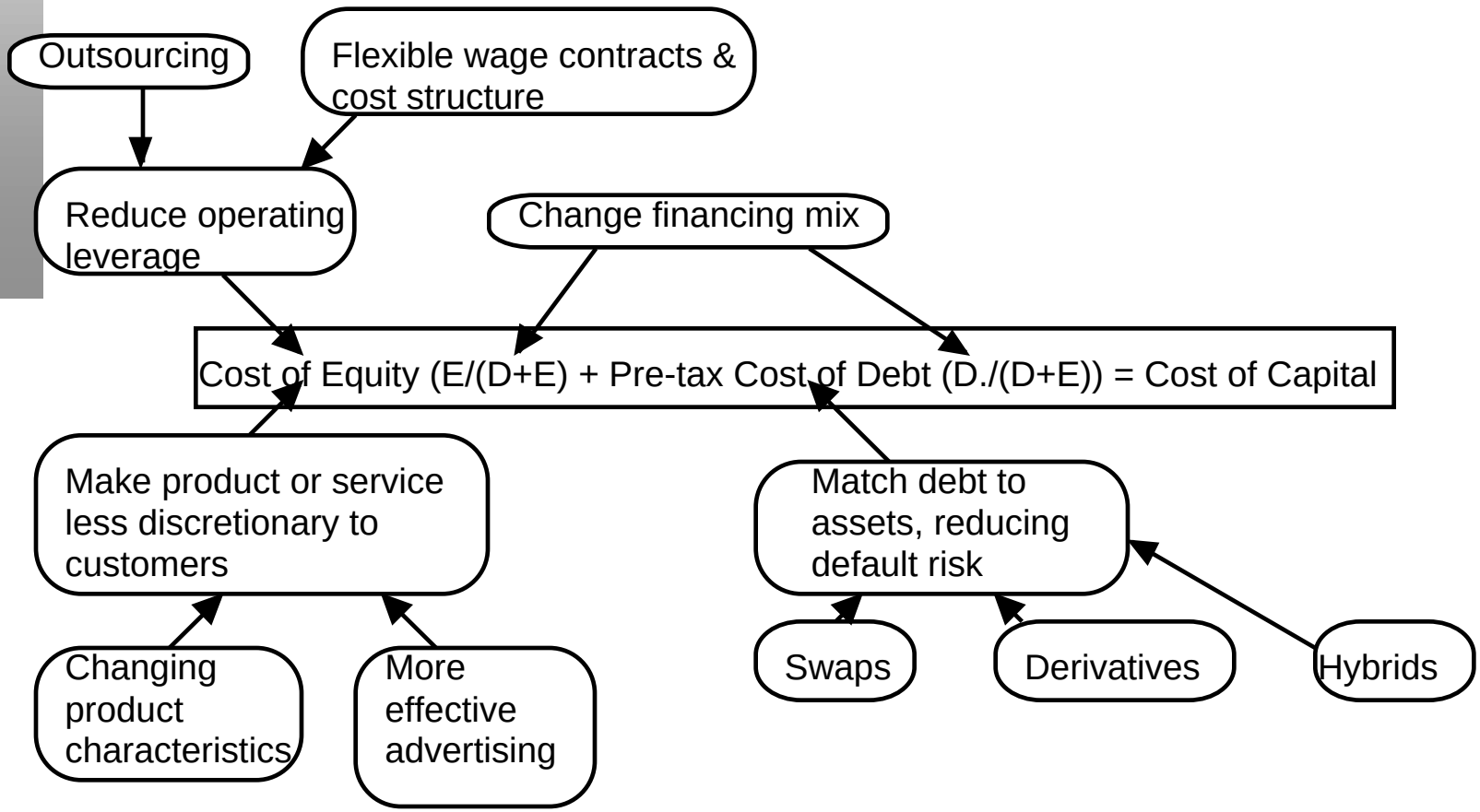
Where,

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.

Reducing Cost of Capital



Actual versus Optimal Debt Ratios

	Current		*Optimal*	
	Debt Ratio	*Cost of Capital*	*Debt Ratio*	*Cost of Capital*
Boeing	20.09%	9.17%	30%	9.16%
The Home Depot	4.55%	9.51%	20%	9.23%
InfoSoft	6.55%	12.55%	20%	12.28%

Changing Financing Type

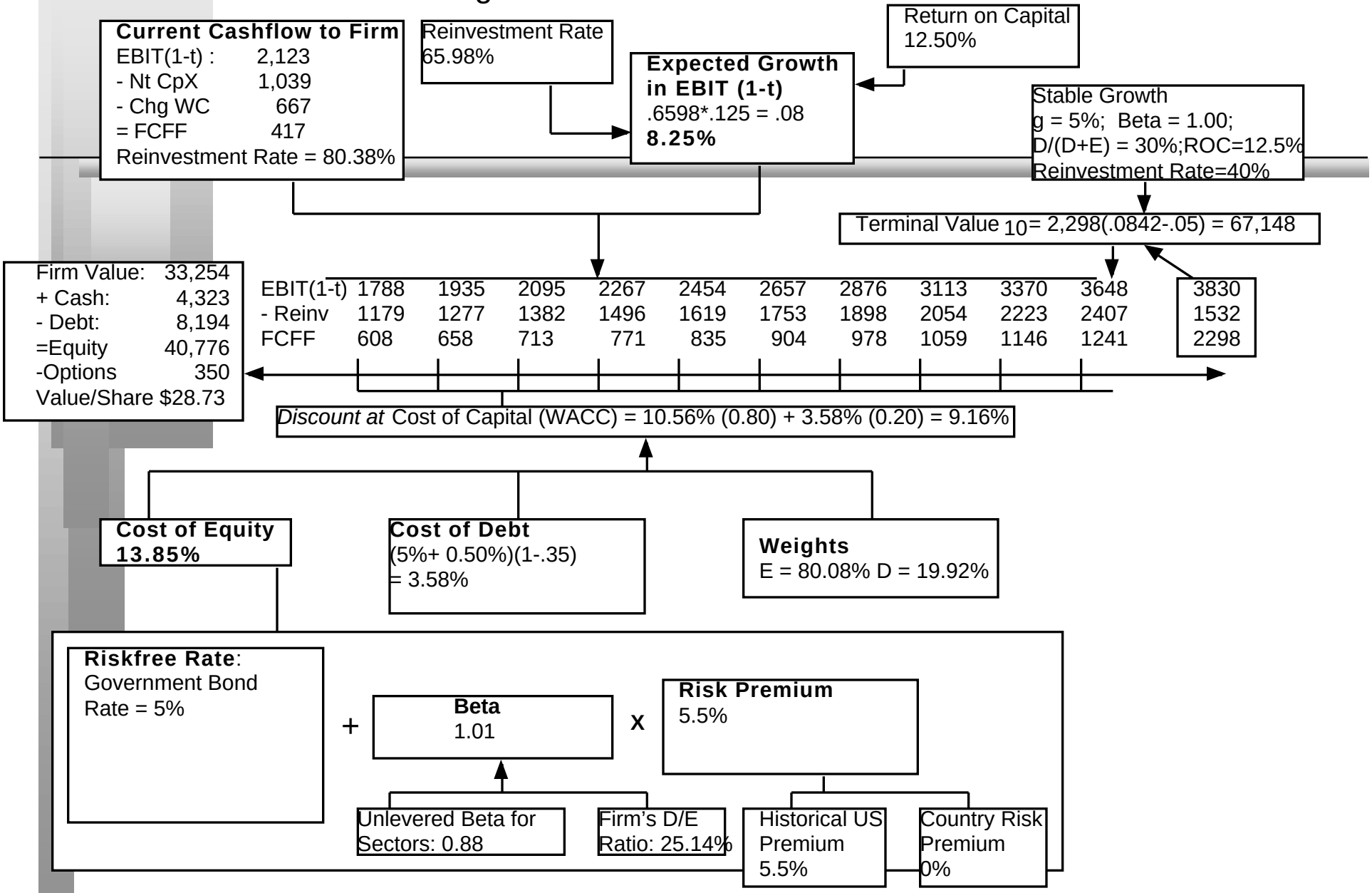
- The fundamental principle in designing the financing of a firm is to ensure that the cash flows on the debt should match as closely as possible the cash flows on the asset.
- By matching cash flows on debt to cash flows on the asset, a firm reduces its risk of default and increases its capacity to 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 inflation

  will end up with higher default risk, higher costs of capital and lower firm value.

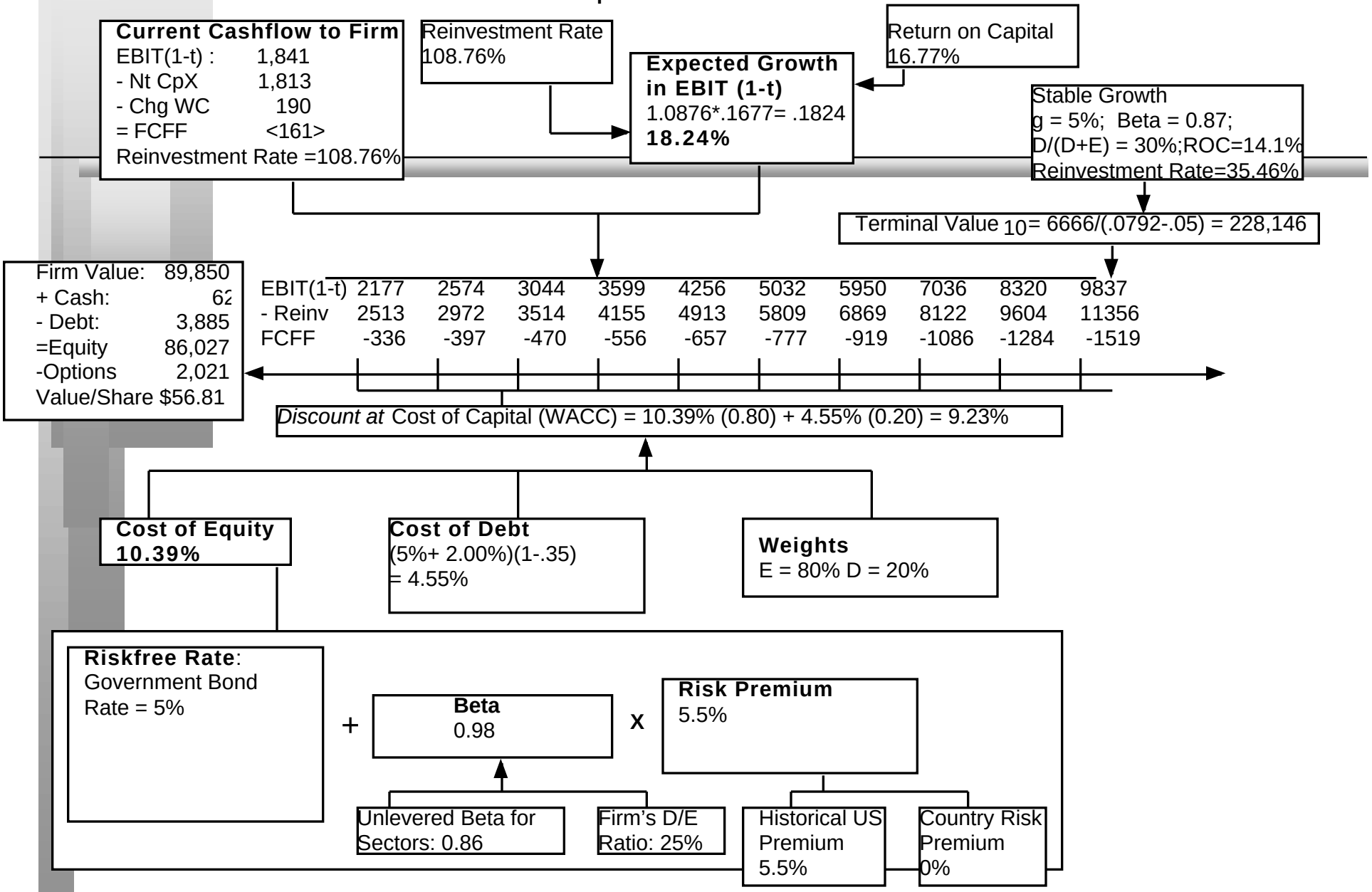
The Value Enhancement Chain

	Gimme'	*Odds on.*	*Could work if..*
Assets in Place	1. Divest assets/projects with Divestiture Value > Continuing Value 2. Terminate projects with Liquidation Value > Continuing Value 3. Eliminate operating expenses that generate no current revenues and no growth.	1. Reduce net working capital requirements, by reducing inventory and accounts receivable, or by increasing accounts payable. 2. Reduce capital maintenance expenditures on assets in place.	1. Change pricing strategy to maximize the product of profit margins and turnover ratio.
Expected Growth	Eliminate new capital expenditures that are expected to earn less than the cost of capital	Increase reinvestment rate or marginal return on capital or both in firm's existing businesses.	Increase reinvestment rate or marginal return on capital or both in new businesses.
Length of High Growth Period	If any of the firm's products or services can be patented and protected, do so	Use economies of scale or cost advantages to create higher return on capital.	1. Build up brand name 2. Increase the cost of switching from product and reduce cost of switching to it.
Cost of Financing	1. Use swaps and derivatives to match debt more closely to firm's assets 2. Recapitalize to move the firm towards its optimal debt ratio.	1. Change financing type and use innovative securities to reflect the types of assets being financed 2. Use the optimal financing mix to finance new investments. 3. Make cost structure more flexible to reduce operating leverage.	Reduce the operating risk of the firm, by making products less discretionary to customers.

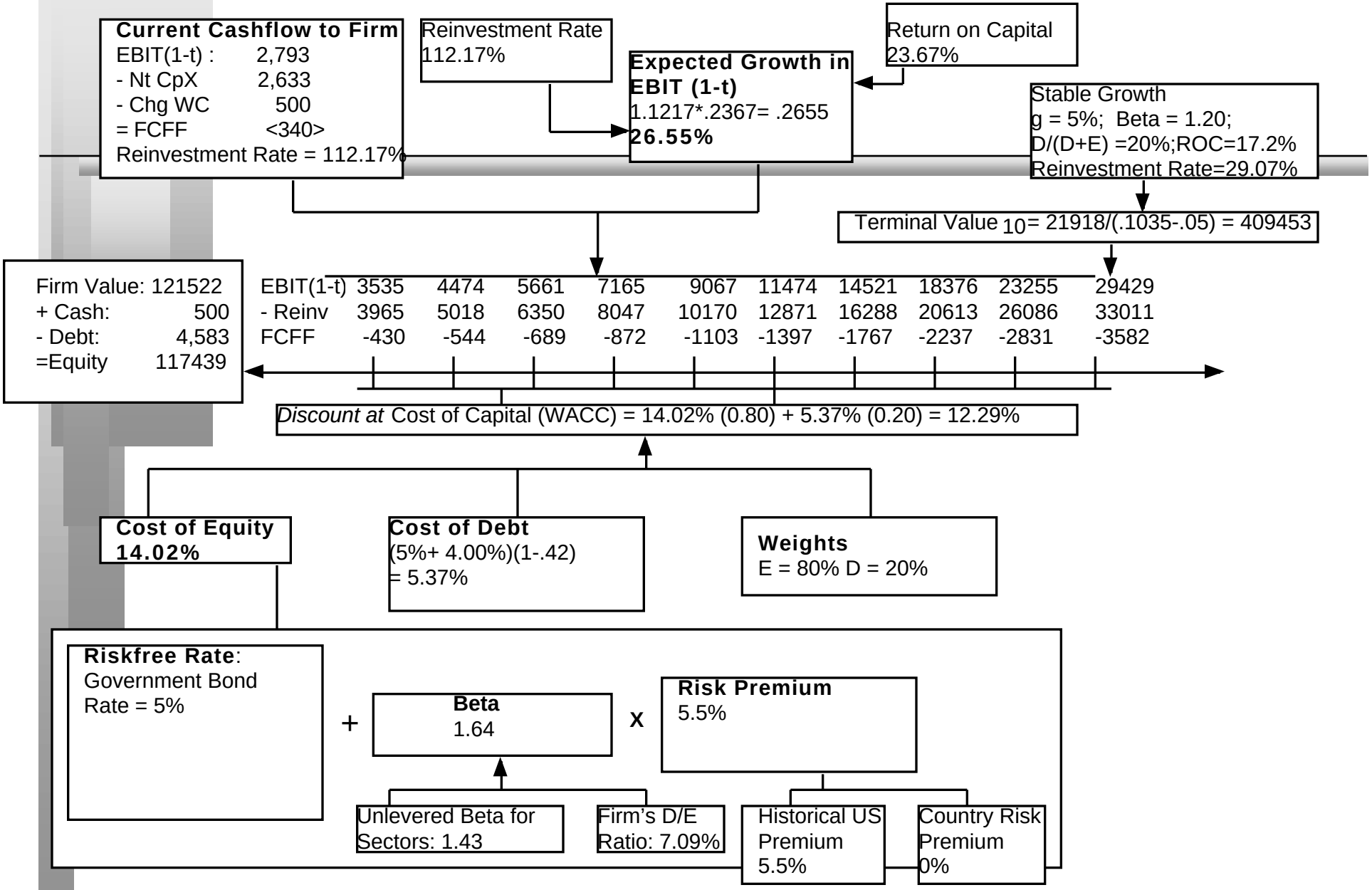
Boeing: A Restructured Valuation



The Home Depot: A Restructured Valuation



InfoSoft: A Restructured Valuation



First Principles

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

Objective: Maximize the Value of the Firm