Valuation

Aswath Damodaran
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

\[
\text{Value} = \sum_{t=1}^{\text{n}} \frac{\text{CF}_t}{(1+r)^t}
\]

- where,
- \( n = \text{Life of the asset} \)
- \( \text{CF}_t = \text{Cashflow in period } t \)
- \( r = \text{Discount rate reflecting the riskiness of the estimated cashflows} \)
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,

- \(\text{CF to Equity}_t\) = 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.
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,
- \(\text{CF to Firm}_t\) = Expected Cashflow to Firm in period \(t\)
- \(\text{WACC}\) = Weighted Average Cost of Capital
**Generic DCF Valuation Model**

**DISCOUNTED CASHFLOW VALUATION**

- **Cash flows**
  - Firm: Pre-debt cash flow
  - Equity: After debt cash flows

- **Expected Growth**
  - Firm: Growth in Operating Earnings
  - Equity: Growth in Net Income/EPS

- **Value**
  - Firm: Value of Firm
  - Equity: Value of Equity

- **Discount Rate**
  - Firm: Cost of Capital
  - Equity: Cost of Equity

- **Terminal Value**
  - Firm is in stable growth: Grows at constant rate forever

- **Length of Period of High Growth**

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Aswath Damodaran
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 intuitive 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

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

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

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

Historical Premium
1. Mature Equity Market Premium:
   Average premium earned by stocks over T.Bonds in U.S.
2. Country risk premium = Country Default Spread* (σ_Equity/σ_Country bond)

Implied Premium
Based on how equity market is priced today and a simple valuation model
Estimating the Cost of Capital

Cost of Capital = Cost of Equity \left( \frac{\text{Equity}}{\text{Debt} + \text{Equity}} \right) + \text{Cost of Borrowing} \left( 1 - \frac{\text{Debt}}{\text{Debt} + \text{Equity}} \right)

Cost of Borrowing should be based upon:
1. synthetic or actual bond rating
2. default spread

Cost of Borrowing = \text{Riskfree rate} + \text{Default spread}

Marginal tax rate, reflecting tax benefits of debt

Weights should be market value weights

Cost of equity based upon bottom-up beta
## Costs of Equity, Debt and Capital

<table>
<thead>
<tr>
<th></th>
<th>Boeing</th>
<th>The Home Depot</th>
<th>InfoSoft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beta (Bottom-up)</td>
<td>1.01</td>
<td>0.87</td>
<td>1.49</td>
</tr>
<tr>
<td>Cost of Equity</td>
<td>10.58%</td>
<td>9.78%</td>
<td>13.19%</td>
</tr>
<tr>
<td>Equity/(Debt + Equity)</td>
<td>79.91%</td>
<td>95.45%</td>
<td>93.38%</td>
</tr>
<tr>
<td>Rating</td>
<td>AA</td>
<td>A+</td>
<td>A</td>
</tr>
<tr>
<td>After-tax Cost of Debt</td>
<td>3.58%</td>
<td>3.77%</td>
<td>3.48%</td>
</tr>
<tr>
<td>Debt/(Debt + Equity)</td>
<td>20.09%</td>
<td>4.55%</td>
<td>6.62%</td>
</tr>
<tr>
<td>Cost of Capital</td>
<td>9.17%</td>
<td>9.51%</td>
<td>12.55%</td>
</tr>
</tbody>
</table>
II. Estimating Cash Flows

Cash Flows

To Equity

*The Strict View*
- Dividends + Stock Buybacks

*The Broader View*
- Net Income
- Net Cap Ex (1-Debt Ratio)
- Chg WC (1 - Debt Ratio)
= Free Cashflow to Equity

To Firm

EBIT (1-t)
- (Cap Ex - Depreciation)
- Change in Working Capital
= Free Cashflow to Firm
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

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

<table>
<thead>
<tr>
<th></th>
<th>Boeing</th>
<th>Home Depot</th>
<th>InfoSoft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taxable Income</td>
<td>1397</td>
<td>2654</td>
<td>1685</td>
</tr>
<tr>
<td>Taxes</td>
<td>277</td>
<td>1040</td>
<td>707.7</td>
</tr>
<tr>
<td>Effective Tax Rate</td>
<td>19.83%</td>
<td>39.19%</td>
<td>42.00%</td>
</tr>
<tr>
<td>Average Effective Tax Rate:94-98</td>
<td>20.44%</td>
<td>38.78%</td>
<td>42%</td>
</tr>
<tr>
<td>Marginal tax rate</td>
<td>35%</td>
<td>35%</td>
<td>42%</td>
</tr>
</tbody>
</table>

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
  \[ \text{Adjusted Net Capital Expenditures} = \text{Net Capital Expenditures} + \text{Current year’s R&D expenses} - \text{Amortization of Research Asset} \]

- Acquisitions of other firms, since these are like capital expenditures. The adjusted cap ex will be
  \[ \text{Adjusted Net Cap Ex} = \text{Net Capital Expenditures} + \text{Acquisitions of other firms} - \text{Amortization of such acquisitions} \]

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

<table>
<thead>
<tr>
<th></th>
<th>Boeing</th>
<th>The Home Depot</th>
<th>InfoSoft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital Expenditures</td>
<td>$1,584</td>
<td>$2,059</td>
<td>$2,000</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>$1,895</td>
<td>$0</td>
<td>$4,000</td>
</tr>
<tr>
<td>Depreciation</td>
<td>$1,517</td>
<td>$373</td>
<td>$1,000</td>
</tr>
<tr>
<td>Amortization of R&amp;D</td>
<td>$1,382</td>
<td>$0</td>
<td>$2,367</td>
</tr>
<tr>
<td>Net Cap Ex w/o R&amp;D</td>
<td>$67</td>
<td>$1,686</td>
<td>$1,000</td>
</tr>
<tr>
<td>Net Cap Ex with R&amp;D</td>
<td>$580</td>
<td>$1,686</td>
<td>$2,633</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th></th>
<th>Boeing</th>
<th>The Home Depot</th>
<th>InfoSoft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues: 1998</td>
<td>$56,154</td>
<td>30219</td>
<td>20000</td>
</tr>
<tr>
<td>Non-cash WC: 1998</td>
<td>$1,360</td>
<td>2028</td>
<td>2000</td>
</tr>
<tr>
<td>Δ Working capital</td>
<td>$667</td>
<td>$190</td>
<td>$500</td>
</tr>
<tr>
<td>Non-cash WC as % of Revenues</td>
<td>2.42%</td>
<td>6.71%</td>
<td>10.00%</td>
</tr>
<tr>
<td>Average from 1994-1998</td>
<td>4.12%</td>
<td>7.08%</td>
<td>NA</td>
</tr>
<tr>
<td>Industry Average</td>
<td>18.95%</td>
<td>12.30%</td>
<td>18.00%</td>
</tr>
</tbody>
</table>
Estimate the FCFF for your firm in its most recent financial year:

In general, If using statement of cash flows

\[
\text{EBIT } (1-t) + \text{Depreciation}\]

\[
- \text{Capital Expenditures}\]

\[
- \text{Change in Non-cash WC}\]

\[
= \text{FCFF}\]

Estimate the dollar reinvestment at your firm:

\[
\text{Reinvestment } = \text{EBIT } (1-t) - \text{FCFF}\]
Choosing a Cash Flow to Discount

- When you cannot estimate the free cash flows 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

Net Income

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

Operating Income

- Reinvestment Rate = (Net Cap Ex + Chg in WC)/EBIT(1-t)
- Return on Capital = EBIT(1-t)/Book Value of Capital
Expected Growth in EPS

\[ g_{EPS} = \frac{\text{Retained Earnings}_{t-1}}{\text{NI}_{t-1}} \times \text{ROE} \]
\[ = \text{Retention Ratio} \times \text{ROE} \]
\[ = b \times \text{ROE} \]

- 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**
  \[ g_{EBIT} = \frac{\text{Net Capital Expenditures} + \text{Change in WC}}{\text{EBIT}(1-t)} \times \text{ROC} \]
  \[ = \text{Reinvestment Rate} \times \text{ROC} \]

- **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.
### Estimating Reinvestment Rate

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Net Cap Ex</td>
<td>$580</td>
<td>$1,686</td>
<td>$2,633</td>
</tr>
<tr>
<td>Change in Non-Cash WC</td>
<td>$667</td>
<td>$190</td>
<td>$500</td>
</tr>
<tr>
<td>Total Reinvestment</td>
<td>$1,247</td>
<td>$1,876</td>
<td>$3,133</td>
</tr>
<tr>
<td>EBIT (1-t)</td>
<td>$1,651</td>
<td>$1,830</td>
<td>$2,793</td>
</tr>
<tr>
<td>Reinvestment Rate</td>
<td>75.52%</td>
<td>102.53%</td>
<td>112.17%</td>
</tr>
<tr>
<td>Average : 1994-98</td>
<td>65.98%</td>
<td>131.85%</td>
<td>NA</td>
</tr>
<tr>
<td>Industry Average</td>
<td>55.48%</td>
<td>88.62%</td>
<td>73.12%</td>
</tr>
</tbody>
</table>
## Estimating Return on Capital

<table>
<thead>
<tr>
<th></th>
<th>Boeing</th>
<th>The Home Depot</th>
<th>InfoSoft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjusted EBIT (1-t)</td>
<td>$1,651</td>
<td>$1,830</td>
<td>$2,793</td>
</tr>
<tr>
<td>Adjusted BV of capital</td>
<td>$28,957</td>
<td>$11,173</td>
<td>$11,800</td>
</tr>
<tr>
<td>ROC</td>
<td>5.70%</td>
<td>16.38%</td>
<td>23.67%</td>
</tr>
<tr>
<td>Average ROC: 1994-1998</td>
<td>6.59%</td>
<td>15.12%</td>
<td>NA</td>
</tr>
<tr>
<td>Industry average ROC</td>
<td>15.07%</td>
<td>14.10%</td>
<td>17.20%</td>
</tr>
</tbody>
</table>
### Expected Growth Estimates

<table>
<thead>
<tr>
<th></th>
<th>Boeing</th>
<th>The Home Depot</th>
<th>InfoSoft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return on Capital</td>
<td>6.59%</td>
<td>16.38%</td>
<td>23.67%</td>
</tr>
<tr>
<td>Reinvestment Rate</td>
<td>65.98%</td>
<td>88.62%</td>
<td>112.17%</td>
</tr>
<tr>
<td>Expected Growth Rate</td>
<td>4.35%</td>
<td>14.51%</td>
<td>26.55%</td>
</tr>
</tbody>
</table>

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.

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

- 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:

\[
\text{Value} = \sum_{t=1}^{N} \frac{CF_t}{(1+r)^t} + \frac{\text{Terminal Value}}{(1+r)^N}
\]
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:
  \[ \text{Value} = \frac{\text{Expected Cash Flow Next Period}}{(r - g)} \]
  where,
  \[ r = \text{Discount rate (Cost of Equity or Cost of Capital)} \]
  \[ g = \text{Expected growth rate} \]
- 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.
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

<table>
<thead>
<tr>
<th></th>
<th>Boeing</th>
<th>The Home Depot</th>
<th>InfoSoft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firm Size/Market Size</td>
<td>Firm has the dominant market share of a slow-growing market</td>
<td>Firm has dominant market share of domestic market, but is entering new businesses and new markets (overseas)</td>
<td>Firm is a small firm in a market that is experiencing significant growth.</td>
</tr>
<tr>
<td>Current Excess Returns</td>
<td>Firm is earning less than its cost of capital, and has done so for last 5 years</td>
<td>Firm is earning substantially more than its cost of capital.</td>
<td>Firm is earning significant excess returns.</td>
</tr>
<tr>
<td>Competitive Advantages</td>
<td>Huge capital requirements and technological barriers to new entrants. Management record over the last few years has been poor.</td>
<td>Significant economies of scale are used to establish cost advantages over rivals. Has a management team that is focused on growth and efficiency.</td>
<td>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.</td>
</tr>
<tr>
<td>Length of High Growth period</td>
<td>10 years, entirely because of competitive advantages and barriers to entry.</td>
<td>10 years; it will be difficult for competitors to overcome the economies of scale.</td>
<td>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.</td>
</tr>
</tbody>
</table>
### Firm Characteristics as Growth Changes

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

<table>
<thead>
<tr>
<th></th>
<th>Boeing</th>
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<th></th>
<th>InfoSoft</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High Growth</td>
<td>Stable Growth</td>
<td>High Growth</td>
<td>Stable Growth</td>
<td>High Growth</td>
</tr>
<tr>
<td>Beta</td>
<td>1.014</td>
<td>1.0</td>
<td>0.869</td>
<td>0.869</td>
<td>1.489</td>
</tr>
<tr>
<td>Cost of Equity</td>
<td>10.58%</td>
<td>10.50%</td>
<td>9.78%</td>
<td>9.78%</td>
<td>13.19%</td>
</tr>
<tr>
<td>After-tax Cost of Debt</td>
<td>3.58%</td>
<td>3.58%</td>
<td>3.77%</td>
<td>3.58%</td>
<td>3.48%</td>
</tr>
<tr>
<td>Debt Ratio</td>
<td>20.09%</td>
<td>30.00%</td>
<td>4.55%</td>
<td>30.00%</td>
<td>6.62%</td>
</tr>
<tr>
<td>Cost of Capital</td>
<td>9.17%</td>
<td>8.42%</td>
<td>9.51%</td>
<td>7.92%</td>
<td>12.55%</td>
</tr>
</tbody>
</table>
Estimating Stable Period Net Cap Ex

\[ g_{\text{EBIT}} = \frac{(\text{Net Capital Expenditures} + \text{Change in WC})}{\text{EBIT}(1-t)} \times \text{ROC} \]

\[ = \text{Reinvestment Rate} \times \text{ROC} \]

Moving terms around,

Reinvestment Rate = \( g_{\text{EBIT}} \) / 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 = \( \frac{5}{8.42} = 59.36\% \)

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

<table>
<thead>
<tr>
<th></th>
<th>Boeing</th>
<th>The Home Depot</th>
<th>InfoSoft</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High Growth</td>
<td>Stable Growth</td>
<td>High Growth</td>
</tr>
<tr>
<td>Return on Capital</td>
<td>6.59%</td>
<td>8.42%</td>
<td>16.38%</td>
</tr>
<tr>
<td>Reinvestment Rate</td>
<td>65.98%</td>
<td>59.35%</td>
<td>88.62%</td>
</tr>
<tr>
<td>Expected Growth Rate</td>
<td>4.35%</td>
<td>5.00%</td>
<td>14.51%</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th></th>
<th>Boeing</th>
<th>The Home Depot</th>
<th>InfoSoft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash</td>
<td>$2,183</td>
<td>$62</td>
<td>$100</td>
</tr>
<tr>
<td>Marketable Securities</td>
<td>$279</td>
<td>$0</td>
<td>$400</td>
</tr>
<tr>
<td>Non-Operating Assets</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>Excess of Pension Assets</td>
<td>$1,861</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>Cash and Non-Operating Assets</td>
<td>$4,323</td>
<td>$62</td>
<td>$500</td>
</tr>
</tbody>
</table>

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.
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)?
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

<table>
<thead>
<tr>
<th>Fin Statement</th>
<th>Valuing</th>
<th>What to do…</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not consolidated</td>
<td>Equity</td>
<td>Value equity in subsidiary and take share of holding.</td>
</tr>
<tr>
<td>Not consolidated</td>
<td>Firm</td>
<td>Value subsidiary as a firm and add portion of firm value. Add portion of debt in subsidiary to the debt in estimating equity value.</td>
</tr>
<tr>
<td>Consolidated</td>
<td>Firm</td>
<td>Strip operating income of subsidiary and value subsidiary separately. Add portion of this value to value of parent firm.</td>
</tr>
</tbody>
</table>
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?
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.
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
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

<table>
<thead>
<tr>
<th>Exercise Price</th>
<th>Number (in ‘000s)</th>
<th>Life</th>
<th>Black-Scholes Value/option</th>
<th>Total Value (in ‘000s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$ 16.35</td>
<td>4315</td>
<td>4.5</td>
<td>$ 17.71</td>
<td>$ 76,418.65</td>
</tr>
<tr>
<td>$ 23.32</td>
<td>8480</td>
<td>5</td>
<td>$ 14.23</td>
<td>$ 120,670.40</td>
</tr>
<tr>
<td>$ 38.44</td>
<td>1779</td>
<td>7.1</td>
<td>$ 10.75</td>
<td>$ 19,124.25</td>
</tr>
<tr>
<td>$ 41.25</td>
<td>4598</td>
<td>7.4</td>
<td>$ 10.34</td>
<td>$ 47,543.32</td>
</tr>
<tr>
<td>$ 53.37</td>
<td>9481</td>
<td>8.7</td>
<td>$ 9.12</td>
<td>$ 86,466.72</td>
</tr>
</tbody>
</table>

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 value 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

<table>
<thead>
<tr>
<th></th>
<th>High Growth Phase</th>
<th>Stable Growth Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Length</strong></td>
<td>10 years</td>
<td>Forever after year 10</td>
</tr>
<tr>
<td><strong>Growth Inputs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Reinvestment Rate</td>
<td>65.98%</td>
<td>59.36%</td>
</tr>
<tr>
<td>- Return on Capital</td>
<td>6.59%</td>
<td>8.42%</td>
</tr>
<tr>
<td>- Expected Growth rate</td>
<td>4.35%</td>
<td>5.00%</td>
</tr>
<tr>
<td><strong>Cost of Capital Inputs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Beta</td>
<td>1.01</td>
<td>1.00</td>
</tr>
<tr>
<td>- Cost of Debt</td>
<td>5.50%</td>
<td>5.50%</td>
</tr>
<tr>
<td>- Debt Ratio</td>
<td>19.92%</td>
<td>30.00%</td>
</tr>
<tr>
<td>- Cost of Capital</td>
<td>9.17%</td>
<td>8.42%</td>
</tr>
<tr>
<td><strong>General Information</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Tax Rate</td>
<td>35%</td>
<td>35%</td>
</tr>
</tbody>
</table>
**Boeing: A Valuation**

**Current Cashflow to Firm**

<table>
<thead>
<tr>
<th>EBIT(1-t) : 1,651</th>
<th>Reinvestment Rate 65.98%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nt CpX 568</td>
<td></td>
</tr>
<tr>
<td>Chg WC 667</td>
<td></td>
</tr>
<tr>
<td>FCFF 417</td>
<td></td>
</tr>
</tbody>
</table>

**Expected Growth in EBIT (1-t)**

\[
\text{Expected Growth} = 0.6598 \times 0.0659 = 0.0435 \times 25\%
\]

**Return on Capital** 6.59%

**Stable Growth**

\[
g = 5\%; \ Beta = 1.00; \ D/(D+E) = 30%; \ ROC = 8.42\%
\]

**Reinvestment Rate** 59.36%

**Terminal Value**

\[
10 = \frac{1078}{0.0842 - 0.05} = 31,496
\]

**Cost of Equity** 10.58%

**Cost of Debt**

\[
5\% + 0.50\% \times (1 - 0.35) = 3.58\%
\]

**Weights**

\[
E = 80.08\% \ D = 19.92\%
\]

**Riskfree Rate:**

Government Bond Rate = 5%

\[
\text{Risk Premium} = 5.5\%
\]

**Beta**

1.01

\[
\text{Unlevered Beta for Sectors: } 0.88
\]

**Firm's D/E Ratio:**

25.14%

**Historical US Premium:**

5.5%

**Country Risk Premium:**

0%

**Firm Value:**

17,500 + Cash: 4,323 - Debt: 8,194 = Equity 13,630 - Options 350

Value/Share $13.14

**Discount at Cost of Capital (WACC) = 10.58\% (0.80) + 3.58\% (0.20) = 9.17\%**
# The Home Depot: Valuation Inputs

<table>
<thead>
<tr>
<th></th>
<th>High Growth Phase</th>
<th>Stable Growth Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>10 years</td>
<td>Forever after year 10</td>
</tr>
<tr>
<td>Growth Inputs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Reinvestment Rate</td>
<td>88.62%</td>
<td>35.46%</td>
</tr>
<tr>
<td>- Return on Capital</td>
<td>16.37%</td>
<td>14.10%</td>
</tr>
<tr>
<td>- Expected Growth rate</td>
<td>14.51%</td>
<td>5.00%</td>
</tr>
<tr>
<td>Cost of Capital Inputs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Beta</td>
<td>0.87</td>
<td>0.87</td>
</tr>
<tr>
<td>- Cost of Debt</td>
<td>5.80%</td>
<td>5.50%</td>
</tr>
<tr>
<td>- Debt Ratio</td>
<td>4.55%</td>
<td>30.00%</td>
</tr>
<tr>
<td>- Cost of Capital</td>
<td>9.52%</td>
<td>7.92%</td>
</tr>
<tr>
<td>General Information</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Tax Rate</td>
<td>35%</td>
<td>35%</td>
</tr>
</tbody>
</table>
The Home Depot: A Valuation

Current Cashflow to Firm

<table>
<thead>
<tr>
<th>EBIT(1-t)</th>
<th>Nt CpX</th>
<th>Chg WC</th>
<th>FCFF</th>
<th>Reinvestment Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,829</td>
<td>1,799</td>
<td>190</td>
<td></td>
<td>88.62%</td>
</tr>
</tbody>
</table>

Expected Growth in EBIT (1-t)

\[0.8862 \times 0.1637 = 0.1451\]

Return on Capital 16.37%

Stable Growth

\[g = 5\%; \ Beta = 0.87; \ D/(D+E) = 30\%; \ ROC = 14.1\% \]

Reinvestment Rate = 35.46%

Terminal Value 10 = \[4806 / (0.0792 - 0.05) = 164,486\]

Cost of Equity 9.79%

Cost of Debt

\[(5\% + 0.80\%) \times (1 - 0.35) = 3.77\%\]

Weights

\[E = 95.55\%\; D = 4.45\%\]

Firm Value: 68,949

+ Cash: 62

- Debt: 4,081

= Equity 64,930

- Options 2,021

Value/Share $42.55

Discount at Cost of Capital (WACC) = 9.79\% \times 0.9555 + 3.77\% \times 0.0445 = 9.52\%

Riskfree Rate: Government Bond Rate = 5\%

Beta 0.87

Risk Premium 5.5\%

Unlevered Beta for Sectors: 0.86

Ratio: 4.76\%

Historical US Premium 5.5\%

Country Risk Premium 0\%

Aswath Damodaran
## InfoSoft: Valuation Estimates

<table>
<thead>
<tr>
<th></th>
<th>High Growth Phase</th>
<th>Stable Growth Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Length</strong></td>
<td>5 years</td>
<td>Forever after year 5</td>
</tr>
<tr>
<td><strong>Growth Inputs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Reinvestment Rate</td>
<td>112.17%</td>
<td>29.07%</td>
</tr>
<tr>
<td>- Return on Capital</td>
<td>23.67%</td>
<td>17.2%</td>
</tr>
<tr>
<td>- Expected Growth rate</td>
<td>26.55%</td>
<td>5.00%</td>
</tr>
<tr>
<td><strong>Cost of Capital Inputs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Beta</td>
<td>1.49</td>
<td>1.20</td>
</tr>
<tr>
<td>- Cost of Debt</td>
<td>6.00%</td>
<td>6.00%</td>
</tr>
<tr>
<td>- Debt Ratio</td>
<td>6.62%</td>
<td>6.62%</td>
</tr>
<tr>
<td>- Cost of Capital</td>
<td>12.54%</td>
<td>11.05%</td>
</tr>
<tr>
<td><strong>General Information</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Tax Rate</td>
<td>42%</td>
<td>42%</td>
</tr>
</tbody>
</table>
### Current Cashflow to Firm

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>EBIT(1-t)</td>
<td>2,793</td>
</tr>
<tr>
<td>- Net CapX</td>
<td>2,633</td>
</tr>
<tr>
<td>- Chg WC</td>
<td>500</td>
</tr>
<tr>
<td>= FCFF</td>
<td>&lt;340</td>
</tr>
</tbody>
</table>

**Reinvestment Rate**: 112.17%

**Expected Growth in EBIT (1-t)**

\[ 1.1217 \times 0.2367 = 0.2655 \]

**Stable Growth**

\[ g = 5\%; \ Beta = 1.20; \ D/(D+E) = 6.62\%; \ ROC = 17.2\% \]

**Reinvestment Rate**: 29.07%

**Terminal Value**

\[ 6753 / (0.1106 - 0.05) = 111,384 \]

**Cost of Equity**: 13.20%

**Cost of Debt**: (5% + 1.00%)(1 - 0.42) = 3.36%

**Weights**

\[ E = 93.38\% \; D = 6.62\% \]

**Riskfree Rate**

Government Bond Rate = 5%

\[ \text{Beta} \times \text{Risk Premium} \]

\[ 1.49 \times 5.5\% \]

**Unlevered Beta for Sectors**: 1.43

**Firm's D/E Ratio**: 7.09%

**Historical US Premium**: 5.5%

**Country Risk Premium**: 0%
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,
  \[ \frac{P_0}{EPS_0} = \frac{DPS_1}{EPS_0(1 - \frac{g_n}{r})} = PE = \frac{\text{Payout Ratio} \times (1 + g_n)}{r - g_n} \]

- Dividing both sides by the book value of equity,
  \[ \frac{P_0}{BV_0} = \frac{DPS_1}{BV_0(1 - \frac{g_n}{r})} = \frac{\text{ROE} \times \text{Payout Ratio} \times (1 + g_n)}{r - g_n} \]

- If the return on equity is written in terms of the retention ratio and the expected growth rate
  \[ \frac{P_0}{BV_0} = \frac{DPS_1}{BV_0(1 - \frac{g_n}{r})} = \frac{\text{ROE} - g_n}{r - g_n} \]

- Dividing by the Sales per share,
  \[ \frac{P_0}{Sales_0} = \frac{DPS_1}{Sales_0(1 - \frac{g_n}{r})} = \frac{\text{Profit Margin} \times \text{Payout Ratio} \times (1 + g_n)}{r - g_n} \]
Firm Value Multiples

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

  \[
  \text{Value of Firm} = \n  \]

- 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

<table>
<thead>
<tr>
<th>Multiple</th>
<th>Determining Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price/Earnings Ratio</td>
<td>Growth, Payout, Risk</td>
</tr>
<tr>
<td>Price/Book Value Ratio</td>
<td>Growth, Payout, Risk, ROE</td>
</tr>
<tr>
<td>Price/Sales Ratio</td>
<td>Growth, Payout, Risk, Net Margin</td>
</tr>
<tr>
<td>Value/EBITDA</td>
<td>Growth, Net Capital Expenditure needs,</td>
</tr>
<tr>
<td></td>
<td>Leverage, Risk</td>
</tr>
<tr>
<td>Value/Sales</td>
<td>Growth, Net Capital Expenditure needs,</td>
</tr>
<tr>
<td></td>
<td>Leverage, Risk, Operating Margin</td>
</tr>
<tr>
<td>Value/Book Capital</td>
<td>Growth, Leverage, Risk and ROC</td>
</tr>
</tbody>
</table>

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

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

- **Using Simple Average**
  - Value of Equity
    - $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

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

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

\[ PBV = 3.54 + 12.69 \text{ ROE} - 6.97 \text{ Standard Deviation} \quad R^2 = 76.15\% \]

(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%:

\[ \text{Predicted PBV}_{\text{Boeing}} = 3.54 + 12.69 (.0909) - 6.97 (.3432) = 2.27 \]

- 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

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

Source: "A Rose, or Any Other Name," by Michael J. Cusumano, P. Kaplanski, Rau, and Otten, Department of Purdue University.
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:
  
  \[
  \text{EBIT (1-t)} - (\text{Capital Expenditures - Depreciation}) - \text{Change in Non-cash Working Capital} = \text{Free Cash Flow to Firm}
  \]

- 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

Revenues
* Operating Margin
  = EBIT
- Tax Rate * EBIT
  = EBIT (1-t)
+ Depreciation
- Capital Expenditures
- Chg in Working Capital
  = FCFF

More efficient operations and cost cutting: Higher Margins
Divest assets that have negative EBIT
Reduce tax rate
  - moving income to lower tax locales
  - transfer pricing
  - risk management

Live off past over-investment
Better inventory management and tighter credit policies
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
Figure 25.5: The Home Depot: Working Capital and Value/Share

Non-Cash Working Capital as % of Revenues

- 0%
- 5%
- 10%
- 15%
- 20%
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

Reinvest more in projects

Increase operating margins

Do acquisitions

Reinvestment Rate

* Return on Capital

= Expected Growth Rate

Increase capital turnover ratio
## Reviewing the Valuation Inputs

<table>
<thead>
<tr>
<th></th>
<th>Boeing</th>
<th>The Home Depot</th>
<th>InfoSoft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of Capital</td>
<td>9.17%</td>
<td>9.51%</td>
<td>12.55%</td>
</tr>
<tr>
<td>Return on Capital</td>
<td>6.59%</td>
<td>16.38%</td>
<td>23.67%</td>
</tr>
<tr>
<td>Reinvestment Rate</td>
<td>65.98%</td>
<td>88.62%</td>
<td>112.17%</td>
</tr>
<tr>
<td>Expected Growth Rate</td>
<td>5.72%</td>
<td>14.51%</td>
<td>27.03%</td>
</tr>
<tr>
<td>Value Per Share</td>
<td>$13.14</td>
<td>$42.55</td>
<td>$55.15</td>
</tr>
</tbody>
</table>
Changing the Reinvestment Rate

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

Change in Reinvestment Rate

-30.00%
-20.00%
-10.00%
0.00%
10.00%
20.00%
30.00%

Change in Value of Equity

-30.00%
-20.00%
-10.00%
0.00%
10.00%
20.00%

-20%
-10%
10%
20%

Boeing ■ The Home Depot □ InfoSoft
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

<table>
<thead>
<tr>
<th></th>
<th>Coca Cola</th>
<th>Generic Cola Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT Operating Margin</td>
<td>18.56%</td>
<td>7.50%</td>
</tr>
<tr>
<td>Sales/BV of Capital</td>
<td>1.67</td>
<td>1.67</td>
</tr>
<tr>
<td>ROC</td>
<td>31.02%</td>
<td>12.53%</td>
</tr>
<tr>
<td>Reinvestment Rate</td>
<td>65.00% (19.35%)</td>
<td>65.00% (47.90%)</td>
</tr>
<tr>
<td>Expected Growth</td>
<td>20.16%</td>
<td>8.15%</td>
</tr>
<tr>
<td>Length</td>
<td>10 years</td>
<td>10 years</td>
</tr>
<tr>
<td>Cost of Equity</td>
<td>12.33%</td>
<td>12.33%</td>
</tr>
<tr>
<td>E/(D+E)</td>
<td>97.65%</td>
<td>97.65%</td>
</tr>
<tr>
<td>AT Cost of Debt</td>
<td>4.16%</td>
<td>4.16%</td>
</tr>
<tr>
<td>D/(D+E)</td>
<td>2.35%</td>
<td>2.35%</td>
</tr>
<tr>
<td>Cost of Capital</td>
<td>12.13%</td>
<td>12.13%</td>
</tr>
<tr>
<td><strong>Value</strong></td>
<td><strong>$115</strong></td>
<td><strong>$13</strong></td>
</tr>
</tbody>
</table>
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
The cost of capital for a firm can be written as:

\[
\text{Cost of Capital} = k_e \left( \frac{E}{D+E} \right) + k_d \left( \frac{D}{D+E} \right)
\]

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

\[
\text{Cost of Equity } \left( \frac{E}{D+E} \right) + \text{Pre-tax Cost of Debt } \left( \frac{D}{D+E} \right) = \text{Cost of Capital}
\]

- Change financing mix
- Make product or service less discretionary to customers
- Reduce operating leverage
- Match debt to assets, reducing default risk
- Outsourcing
- Flexible wage contracts & cost structure
- More effective advertising
- Changing product characteristics
- Swaps
- Derivatives
- Hybrids
# Actual versus Optimal Debt Ratios

<table>
<thead>
<tr>
<th>Company</th>
<th>Current Debt Ratio</th>
<th>Current Cost of Capital</th>
<th>Optimal Debt Ratio</th>
<th>Optimal Cost of Capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boeing</td>
<td>20.09%</td>
<td>9.17%</td>
<td>30%</td>
<td>9.16%</td>
</tr>
<tr>
<td>The Home Depot</td>
<td>4.55%</td>
<td>9.51%</td>
<td>20%</td>
<td>9.23%</td>
</tr>
<tr>
<td>InfoSoft</td>
<td>6.55%</td>
<td>12.55%</td>
<td>20%</td>
<td>12.28%</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th><strong>Assets in Place</strong></th>
<th><strong>Gimme’</strong></th>
<th><strong>Odds on.</strong></th>
<th><strong>Could work if..</strong></th>
</tr>
</thead>
</table>
|                     | 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**

**Current Cashflow to Firm**
- EBIT(1-t) : 2,123
- Nt CpX 1,039
- Chg WC 667
- FCFF 417

Reinvestment Rate = 80.38%

**Expected Growth in EBIT (1-t)**

\[
0.6598 \times 0.125 = 0.08
\]

8.25%

**Return on Capital**
12.50%

**Stable Growth**
- g = 5%; Beta = 1.00;
- D/(D+E) = 30%; ROC = 12.5%
- Reinvestment Rate = 40%

**Terminal Value**

\[
10 = 2,298(0.0842 - 0.05) = 67,148
\]

**Cost of Equity**
13.85%

**Cost of Debt**

\[
(5\% + 0.50\%)(1 - 0.35) = 3.58\%
\]

**Weights**

\[
E = 80.08\% D = 19.92\%
\]

**Discount at Cost of Capital (WACC)**

\[
10.56\% (0.80) + 3.58\% (0.20) = 9.16\%
\]

**Firm Value:**

\[
33,254 + \text{Cash:} 4,323 - \text{Debt:} 8,194 = \text{Equity} 40,776 - \text{Options} 350
\]

Value/Share $28.73

**Boeing: Risk and Return**

- **Expected Growth in EBIT (1-t):**
  \[
  0.6598 \times 0.125 = 0.08
  \]
  8.25%

- **Return on Capital:**
  12.50%

- **Stable Growth:**
  - g = 5%; Beta = 1.00;
  - D/(D+E) = 30%; ROC = 12.5%
  - Reinvestment Rate = 40%

- **Terminal Value:**
  \[
  10 = 2,298(0.0842 - 0.05) = 67,148
  \]

- **Cost of Equity:**
  13.85%

- **Cost of Debt:**
  \[
  (5\% + 0.50\%)(1 - 0.35) = 3.58\%
  \]

- **Weights:**
  \[
  E = 80.08\% D = 19.92\%
  \]

- **Discount at Cost of Capital (WACC):**
  \[
  10.56\% (0.80) + 3.58\% (0.20) = 9.16\%
  \]

- **Firm Value:**
  \[
  33,254 + \text{Cash:} 4,323 - \text{Debt:} 8,194 = \text{Equity} 40,776 - \text{Options} 350
  \]
  Value/Share $28.73

**Riskfree Rate:**
- Government Bond Rate = 5%

**Beta:**
- 1.01

**Risk Premium:**
- 5.5%

**Unlevered Beta for Sectors:**
- 0.88

**Firm's D/E Ratio:**
- 25.14%

**Historical US Premium:**
- 5.5%

**Country Risk Premium:**
- 0%
The Home Depot: A Restructured Valuation

**Current Cashflow to Firm**
- EBIT(1-t) : 1,841
- Nt CpX : 1,813
- Chg WC : 190
= FCFF = <161>
Reinvestment Rate = 108.76%

**Expected Growth in EBIT (1-t)**
- 1.0876^*.1677 = .1824
- 18.24%

**Return on Capital**
- 16.77%

**Stable Growth**
- g = 5%; Beta = 0.87;
- D/(D+E) = 30%; ROC = 14.1%
- Reinvestment Rate = 35.46%

**Terminal Value**
- 10 = 6666/(.0792-.05) = 228,146

**Discount at Cost of Capital (WACC)**
- 10.39% (0.80) + 4.55% (0.20) = 9.23%

**Firm Value**
- 89,850 + Cash: 62 - Debt: 3,885 = Equity 86,027 - Options 2,021
Value/Share $56.81

**Cost of Equity**
- 10.39%

**Cost of Debt**
- (5%+ 2.00%)(1-.35) = 4.55%

**Weights**
- E = 80% D = 20%

**Riskfree Rate**
- Government Bond Rate = 5%

**Beta**
- 0.98

**Risk Premium**
- 5.5%

**Unlevered Beta for Sectors**
- 0.86

**Firm’s D/E Ratio**
- 25%

**Historical US Premium**
- 5.5%

**Country Risk Premium**
- 0%
InfoSoft: A Restructured Valuation

Current Cashflow to Firm

EBIT(1-t) : 2,793
- Nt CpX 2,633
- Chg WC 500
= FCFF <340>

Reinvestment Rate = 112.17%

Expected Growth in EBIT (1-t)
1.1217 * 23.67% = .2655

26.55%

Return on Capital
23.67%

Stable Growth

g = 5%; Beta = 1.20;
D/(D+E) = 20%; ROC = 17.2%
Reinvestment Rate = 29.07%

Terminal Value 10 = 21918/(.1035-.05) = 409453

Cost of Equity
14.02%

Cost of Debt

5% + 4.00%)(1-.42)
= 5.37%

Weights
E = 80% D = 20%

Riskfree Rate:
Government Bond Rate = 5%

Beta
1.64

Risk Premium
5.5%

Country Risk Premium
0%

InfoSoft: A Restructured Valuation

Firm Value: 121522
+ Cash: 500
- Debt: 4,583
= Equity 117439

EBIT(1-t) 3535 4474 5661 7165 9067 11474 14521 18376 23255 29429
- Reinv 3965 5018 6350 8047 10170 12871 16288 20613 26086 33011
FCFF -430 -544 -689 -872 -1103 -1397 -1767 -2237 -2831 -3582

Discount at Cost of Capital (WACC) = 14.02% (0.80) + 5.37% (0.20) = 12.29%
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