

## Chapter 12

12-1

- a. Reinvestment Rate =  $g/ROC = 5\%/10\% = 50\%$
- b. Firm Value =  $100 (1.05)(1-.5)/(.10-.05) = \$1050.00$
- c. Value of Firm =  $100/.10 = \$1,000.00$

If you allow for the lag between reinvestment and expected growth, the expected operating income next year will be 105 (because you reinvested last year to generate this growth). In this case,

$$\text{Value of firm} = 105/.10 = 1050$$

The value of the firm is insensitive to the growth rate because  $ROC = \text{Cost of capital}$

12-2

- a. Reinvestment Rate =  $5/15 = 33.3\%$
- b. Value of Firm =  $100 (1.05)(1-.3333)/(.10-.05) = \$1,400.00$

12-3

$$\text{Expected Growth rate next year} = \text{Reinvestment rate} * \text{ROC} = 0.5 * .01 = 5\%$$

$$\text{Expected FCFF next year} = 100 (1.05) (1-.5) = \$52.20$$

12-4

Since you have the cost of capital, you need to back into the operating income (EBIT)

$$\text{Net Income}/(1-t) = \text{EBT}$$

$$\text{EBIT} = \text{EBT} + \text{Interest Expense}$$

$$\text{Earnings before interest and taxes} = 50/.4 + 100 = \$225; \text{ tax rate of } 40\%.$$

$$\text{Net Cap Ex} = 200 - 100 = \$100.00$$

$$\text{FCFF} = 225 (1-.4) - 100 = \$ 35$$

$$\text{Value of Firm} = 35 (1.04)/(.11 - .04) = \$ 520 \text{ million}$$

12-5

$$\text{Unlevered beta of other networking software firms with cash} = 1.20$$

$$\text{Unlevered beta corrected for cash} = 1.20/(1-.10) = 1.33$$

$$\text{Levered Beta for Netsoft's operating assets} = 1.33 (1 + (1-.4) (15/85)) = 1.47$$

$$\text{Cost of Equity for Netsoft} = 6\% + 1.47 (5.5\%) = 14.09\%$$

$$\text{Cost of Capital for Netsoft} = 14.09\% (.85) + 10\% (1-.4) (.15) = 12.88\%$$

$$\text{After-tax Operating Income} = 200 (1-.40) = 120$$

$$\text{Reinvestment rate} = g/ \text{ROC} = 4/10 = 40\%$$

$$\text{Value of Operating Assets} = 120 * 1.04 * (1-.40)/(.1288-.04) = \$1,093.24$$

$$\text{Value of Cash} = \$250.00$$

$$\text{Value of Firm} = \$1,343.24$$

To get to the value of equity, you would need to subtract out debt from firm value.

12-6

$$\text{a. FCFF next year} = 5 (1.20) - (4 - 2) (1.20) - (12 - 10) = \$1.60$$

| Year | EBIT(1-t) | Cap Ex  | Depreciation | WC       | Chg in WC | FCFF     | PV      |
|------|-----------|---------|--------------|----------|-----------|----------|---------|
| 1    | \$ 6.00   | \$ 4.80 | \$ 2.40      | \$ 12.00 | \$ 2.00   | \$ 1.60  | \$ 1.43 |
| 2    | \$7.20    | \$ 5.76 | \$ 2.88      | \$ 14.40 | \$ 2.40   | \$ 1.92  | \$ 1.53 |
| 3    | \$8.64    | \$ 6.91 | \$ 3.46      | \$ 17.28 | \$ 2.88   | \$ 2.30  | \$ 1.64 |
| 4    | \$10.37   | \$ 8.29 | \$ 4.15      | \$ 20.74 | \$ 3.46   | \$ 2.76  | \$ 1.76 |
| 5    | \$12.44   | \$ 9.95 | \$ 4.98      | \$ 24.88 | \$ 4.15   | \$ 3.32  | \$ 1.88 |
| 6    | \$13.06   | \$ 6.53 | \$ 5.23      | \$ 26.13 | \$ 1.24   | \$ 10.51 |         |

c. Terminal value =  $10.51 / (.10 - .05) = \$ 210.26$

d. Value of Operating Assets = PV of cash flows over next 5 years + PV of terminal value =  $(1.43 + 1.53 + 1.64 + 1.76 + 1.88) + 210.26 / (1.12^5) = \$127.55$

12-7

a. Value of Equity = Value of operating assets + cash and non-operating assets - debt =  $127.55 + 10 - 15 = \$122.55$

b. Value per share =  $122.55 / 5 = \$ 24.51$

c. Value of common stock = Value of Equity - Value of options =  $122.55 - 7 = \$115.55$   
Value per share =  $115.55 / 5 = \$23.11$

12-8

a. From the information given, we can work out the following information:

|              |          |
|--------------|----------|
| EBITDA       | 2483.125 |
| Depreciation | 960      |
| EBIT         | 1523.125 |
| Interest     | 320      |
| EBT          | 1203.125 |
| Taxes        | 433.125  |
| Net Income   | 770      |

$EBIT = 770 / (1 - .36) + 320 = 1523.125$

Hence Free Cash Flow to the Firm =  $EBIT(1 - \text{tax rate}) + \text{Depreciation} - \text{Capital Expenditures} - \text{Change in Working Capital} = 1523.125(1 - 0.36) + 960 - 1200 = \$734.8\text{m.}$

b. Reinvestment rate =  $(1200 - 960) / (1523.125(1 - .36)) = 24.62\%$

Return on Capital =  $1523.125(1 - 0.36) / (4000 + 5000) = 10.83\%$

Expected Growth Rate =  $(.2462)(.1083) = 2.67\%$

The cost of equity =  $7\% + 1.05(5.5\%) = 12.775\%$ ; the cost of debt after-tax =  $8\%(1 - 0.36) = 5.12\%$ ; the WACC =  $(4/16)(5.12) + (12/16)(12.775) = 10.86\%$ .

Value of firm (assuming perpetual growth) =  $734.8(1.0267) / (.10 + 43886 - .0267) = \$ 9211$  million

c. Value of Equity = Value of Firm - Debt value =  $\$9211 - \$3800 = \$ 6411$  million

Value of Equity per share =  $\$ 6411 \text{ million} / 200 = \$ 32.06$

12-9

a., b. From the information given, we can compute the following:

|                 | Most recent year | 1        | 2        | 3        | 4        | 5        | Terminal year |
|-----------------|------------------|----------|----------|----------|----------|----------|---------------|
| Revenues        | 13500            | 14782.50 | 16186.84 | 17724.59 | 19408.42 | 21252.22 | 22102.31      |
| EBITDA          | 1290             | 1412.55  | 1546.74  | 1693.68  | 1854.58  | 2030.77  | 2223.69       |
| Depreciation    | 400              | 438.00   | 479.61   | 525.17   | 575.06   | 629.70   | 689.52        |
| Cap. Exp        | 450              | 492.75   | 539.56   | 590.82   | 646.95   | 708.41   | 689.52        |
| Working Capital | 945              | 1034.78  | 1133.08  | 1240.72  | 1358.59  | 1487.66  | 1547.16       |
| FCFF            |                  | 440.21   | 482.02   | 527.82   | 577.96   | 632.87   | 861.00        |
| PV(FCFF)        |                  | 402.50   | 440.74   | 482.61   | 528.46   | 578.66   |               |

$$\text{FCFF} = (\text{EBITDA} - \text{Depreciation})(1-t) - (\text{Cap Ex} - \text{Depreciation}) - \text{Chg in WC}$$

The WACC now can be computed as 9.37%, using the cost of equity of 13.05% based on the current beta of 1.1.

Given the current beta and the current D/E ratio of 3200/3968, the unlevered beta = 0.74. After year 5, the stock beta changes to  $0.74(1+(1-0.4)0.5) = 0.964$  implying a cost of equity of 12.3% for 1999 and beyond. This in turn can be used to compute a WACC of 8.4%.

$$\text{Terminal value} = 861 / (.084 - .04) = \$19,568 \text{ million}$$

$$\text{PV of terminal value} = \$19,568 / 1.0937^5 = \$12,504 \text{ million}$$

$$\begin{aligned} \text{Value of firm} &= \text{Sum of PV between 1994 and 1998} + \text{PV of terminal value} \\ &= \$2,433 + \$12,504 = \$14,937 \text{ million} \end{aligned}$$

Subtracting out debt outstanding of \$3,200 million,

$$\text{Value of equity} = \$14,937 \text{ million} - \$3,200 = \$11,737 \text{ million}$$

$$\text{Value per share} = \$11,737 / 62 = \$189$$

The shares are grossly underpriced.

One reason may be that we are allowing the firm to grow forever at a 4% rate, without any reinvestment. If we assume a return on capital of 10%, for instance:

$$\text{Reinvestment rate after year 5} = g / \text{ROC} = 4 / 10 = 40\%$$

$$\text{FCFF in year 6} = \text{EBIT in year 6} (1 - \text{tax rate}) (1 - \text{Reinvestment rate}) = 1534 (1 - .4) (1 - .4) = \$552 \text{ million}$$

$$\text{Terminal value} = 552 / (.084 - .04) = \$13,806 \text{ million}$$

$$\text{Value today} = \$2,433 + \$13,806 / 1.0937^5 = \$11,255 \text{ million}$$

$$\text{Value per share} = (11255 - 3200) / 62 = \$129.93$$

Still undervalued but not by as much

12-10

a. The after tax cost of debt is  $7.5(1-0.4) = 4.5\%$ , while the cost of equity =  $7 + 1.15(0.55) = 13.325\%$ . Using a debt ratio of 20%, we find that the cost of capital for the health division =  $(.2)(4.5) + (0.8)13.325 = 11.56\%$

(Since the division has the same debt ratio as other companies in the business, we did not bother unlevering the industry average beta and relevering back at the same debt ratio.

b.

|              | ,Most recent year | 1       | 2       | 3       | 4       | 5       | Terminal year |
|--------------|-------------------|---------|---------|---------|---------|---------|---------------|
| Revenues     | 5285              | 5787.08 | 6336.85 | 6938.85 | 7598.04 | 8319.85 | 8652.65       |
| Depreciation | 350               | 364.00  | 378.56  | 393.70  | 409.45  | 425.83  | 442.86        |
| EBIT         | 560               | 593.60  | 629.22  | 666.97  | 706.99  | 749.41  | 779.38        |
| Cap. Exp     | 420               | 436.80  | 454.27  | 472.44  | 491.34  | 510.99  | 531.43        |
| FCFF         |                   | 283.36  | 301.82  | 321.44  | 342.30  | 364.48  | 379.06        |
| PV(FCFF)     |                   | 254.00  | 270.54  | 288.13  | 306.83  | 326.71  |               |

PV(FCFF for first 5 years) = 1446.22

Terminal value =  $379.06 / (.1156 - .04) = 5014.02$

PV of Terminal value =  $5014 / 1.1156^5 = 2901.61938$

Firm Value now = 4347.84

12-11

Unlevered Beta (using last 5 years) =  $0.9 / (1 + (1-.4)(.2)) = 0.80$

Unlevered Beta of Non-cash assets =  $0.80 / (1-.15) = 0.94$

Levered Beta for Non-cash assets =  $0.94 (1 + 0.6(.5)) = 1.222$

Cost of Equity for Non-cash Assets =  $6\% + 1.22(5.5\%) = 12.71\%$

Cost of Capital for Non-cash Assets =  $12.71\%(.667) + .07*.6*(.333) = 9.88\%$

Estimated FCFF next year from non-cash assets =  $(450-50)(1-.4)(1.05)-90 = 162$

Estimated Value of Non-cash Assets =  $162 / (.0988 - .05) = \$ 3,320$

Cash Balance = \$500

Estimated Value of the Firm = \$ 3,820

Less Value of Debt of \$800

= Value of Equity = \$3,020

12-12

First, solve for the cost of capital used by the analyst

$750 = 30 / (r - g)$

$g = 5\%$

$r = 9\%$

Cost of equity = 12%; Cost of debt = 6%

$12\% (1-X) + 6\% X = 9\%$

$X = 0.50$  : So book value weight for debt was 50%  
 Correct weights should be 75% equity, 25% debt  
 Cost of capital =  $12\%(.75) + 6\% (.25) = 0.105$   
 Corect firm value =  $30/ (.105-.05) = \$545.45$

12-13

Adjusted pre-tax operating income = \$ 10 million - \$ 1.5 million = \$8.50 milliion  
 Adjusted after-tax operating income = \$ 8.5 million  $(1-.40) = \$5.10$   
 Firm Value =  $5.1(1.05)/(.09-.05) = \$133.88$   
 Illiquidity Discount =  $.30 - .04 (\ln(100)) = 11.58\%$   
 Firm Value after Illiquidity Discount =  $133.88 (1-.1158) = \$118.37$

This probably overstates value, since we used the cost of capital of publicly traded firms in the business. Since a private buyer will probably be undiversified, it would make more sense to use a total beta which would lead to a higher cost of capital and a lower value.

12-14

- a. Payout ratio =  $(1.06/2.40) = 44.17\%$   
 $g = 6\%$   
 $r = 7\% + 1.05 (5.5\%) = 12.775\%$   
 $PE = (.4417) (1.06)/(.12775-.06) = 6.91$
- b. The actual P/E ratio is 10.  
 $PE = (.4417) (1+g)/(.12775-g)$   
 Solving for g,  
 Implied Growth Rate = 8%

12-15

- a. The average P/E ratio = 13.2, while the median P/E ratio = 12.25, which is the average of the 7<sup>th</sup> ranking and 8<sup>th</sup> ranking firm's P/E ratios. The fact that the mean and the median are relatively close to each other means that there are no great extreme values. We can, therefore, interpret either number as a measure of of the market's valuation of earnings for a typical firm in the sector.
- b. This would be true if Thiokol's riskiness were equal or less than that of the industry, on average and its expected growth matched or beat the average for the sector. In Thiokol's case, the low PE can be attributed to low growth.
- c. Using the estimated PEG ratio, it would seem that Thiokol is overvalued, since the average PEG ratio works out to 1.53, while Thiokol's PEG ratio is 2.08. Using the PEG ratio however assumes that value is proportional to growth.
- d. As a first run, we regressed PE ratios against growth, payout and risk  
 $PE = -2.30 + 35.74 (\text{growth}) + 11.97 (\text{Beta}) + 2.90 (\text{Payout})$   
 The sample is small and the R-squared and t statistics are marginal. Payout, in particular, is statistically insignificant. We reran the regression with only growth and beta:  
 $PE = -1.55 + 34.68 (\text{Growth}) + 12.27 (\text{Beta})$   
 Using this regression, the third to last column gives us the estimated P/E ratios based on the payout ratio, risk and growth of each company. The second to last column, which

represents the difference between the actual P/E ratio and the estimated P/E ratio gives us an estimate of relative under- or over-valuation. Positive values imply overvaluation, while negative values imply undervaluation:

| <i>Company</i>    | <i>Actual P/E</i> | <i>Expected Growth</i> | <i>Beta</i> | <i>Payout</i> | <i>Estimated P/E ratio</i> | <i>Difference: Actual vs Estimate</i> | <i>Estimated PEG ratio</i> |
|-------------------|-------------------|------------------------|-------------|---------------|----------------------------|---------------------------------------|----------------------------|
| Thiokol           | 8.7               | 5.5                    | 0.95        | 15            | 12.00                      | -2.74                                 | 2.08                       |
| Northrop          | 9.5               | 9                      | 1.05        | 47            | 14.44                      | -5.32                                 | 1.65                       |
| Lockheed Corp.    | 10.2              | 9.5                    | 0.85        | 37            | 12.16                      | -2.11                                 | 1.30                       |
| United Industrial | 10.4              | 4.5                    | 0.7         | 50            | 8.59                       | 1.29                                  | 2.02                       |
| Martin Marietta   | 11                | 8                      | 0.85        | 22            | 11.64                      | -0.34                                 | 1.42                       |
| Grumman           | 11.4              | 10.5                   | 0.8         | 37            | 11.90                      | -0.67                                 | 1.15                       |
| Raytheon          | 12.1              | 9.5                    | 0.75        | 28            | 10.94                      | 1.25                                  | 1.14                       |
| Logicon           | 12.4              | 14                     | 0.85        | 11            | 13.72                      | -0.77                                 | 0.94                       |
| Loral Corporation | 13.3              | 16.5                   | 0.75        | 23            | 13.36                      | 0.09                                  | 0.80                       |
| Rockwell          | 13.9              | 11.5                   | 1           | 38            | 14.70                      | -0.95                                 | 1.29                       |
| General Dynamics  | 15.5              | 11.5                   | 1.25        | 40            | 17.76                      | -2.4                                  | 1.56                       |
| GM-Hughes         | 16.5              | 13                     | 0.85        | 41            | 13.38                      | 2.82                                  | 1.05                       |
| Boeing            | 17.3              | 3.5                    | 1.1         | 28            | 13.15                      | 4.4                                   | 3.69                       |
| McDonnell Doug.   | 22.6              | 13                     | 1.15        | 37            | 17.06                      | 5.45                                  | 1.32                       |
| Average           | 13.2              | 9.96                   | 0.92        | 32.43         | 13.20                      | 0.00                                  | 1.53                       |

In this case, the limitation of this approach is the small sample and the high error on the prediction. More generally, this approach assumes linear relationships between PE and each of the independent variables and no correlation between the independent variables.

12-16

a. The current payout ratio =  $2/4 = 0.5$ .

Cost of equity =  $.07 + .85 * .055 = .11675$

If we use the dividend discount model,

Value per share =  $2(1.05)/(.11675 - .05) = \$31.76$

The price/book value ratio =  $31.76/40 = 0.79$

You can also get to the same answer, using the

b. The actual share price is \$60. We can use this to solve for the value of g in the equation  $60 = 2(1+g)/(.11675-g)$ . Solving, we find  $g = 8\%$ . If  $g = 8\%$ , then we need a Return on Equity, such that  $.08 = .5(\text{Return on Equity})$ ; i.e. the required Return on Equity =  $16\%$ .

12-17

a. The average Price/Book Value ratio = 1.66. I wouldn't necessarily use this ratio to price the new issue because of the heterogeneity amongst these firms. In particular, the firms have very different payout ratios, growth rates and returns on equity.

b. I would try to control for differences in growth and risk.

| <i>Company</i>     | <i>PBV Ratio</i> | <i>ROE</i> | <i>Beta</i> | <i>Exp. Growth</i> |
|--------------------|------------------|------------|-------------|--------------------|
| Air & Water        | 1.13             | 4.72%      | 1.65        | 10.50%             |
| Allwaste           | 1.74             | 8.06%      | 1.1         | 18.50%             |
| Browning<br>Ferris | 2.52             | 12.61%     | 1.25        | 11.00%             |
| Chemical<br>Waste  | 2.51             | 12.00%     | 1.15        | 2.50%              |
| Groundwater        | 1.04             | 4.50%      | 1           | 3.00%              |
| Intr'l Tech.       | 0.99             | 4.78%      | 1.1         | 11.00%             |
| Ionics             | 1.55             | 7.10%      | 1           | 14.50%             |
| Laidlaw            | 1.08             | 6.84%      | 1.15        | 8.50%              |
| OHM                | 2.83             | 10.62%     | 1.15        | 9.50%              |
| Rollins            | 1.40             | 1.37%      | 1.3         | 1.00%              |
| Safety-Kleen       | 1.51             | 8.65%      | 1.15        | 6.50%              |
| Average            | 1.66             | 7.39%      | 1.18        | 8.77%              |

I would expect the IPO to trade at a much higher multiple of price to book than the sector since it has a substantially higher ROE ( $3.50/20 = 17.5\%$ ) and growth rate (25%) than the sector.

12-18

- a. Cost of equity =  $.07 + 0.9(5.5\%) = .1195$  or 11.95%  
 Value per share =  $1.12(1.06)/(.1195-.06) = \$19.95$   
 Price to Sales ratio =  $\$19.95/\$122 = 0.1635$ .  
 Alternatively,  
 Net profit margin =  $2.45/122 = 0.02008$   
 Payout ratio =  $1.12/2.45 = 0.4571$   
 Price to Sales ratio = Net profit margin \* Payout ratio \*  $(1+g)/(Cost\ of\ equity - g)$   
 $= 0.02008 * 0.4571 * (1.06)/(.1195-.06) = 0.1635$

b. Actual price = \$34

Price to sales ratio =  $34/122 = 0.2786$

Holding the dividend payout and cost of equity constant, we solve for the net profit margin:

$$0.2786 = \text{Net profit margin} * 0.4571 * 1.06 / (.1195 - .06)$$

$$\text{Net profit margin} = 3.42\%$$

12-19

To assess whether Walgreen's should trade at a higher price to sales ratio than the rest of the sector, we assess the three possible explanations: that Walgreen's has higher expected growth than other firms in the sector, that Walgreen's has lower risk than other firms in the sector and that Walgreen's has higher net profit margins than other firms in the sector.

Looking at the data:

| <i>Company</i>  | <i>P/S Ratio</i> | <i>Profit Margin</i> | <i>Payout</i> | <i>Expected Growth</i> | <i>Beta</i> |
|-----------------|------------------|----------------------|---------------|------------------------|-------------|
| Arbor Drugs     | 0.42             | 3.40%                | 18%           | 14.00%                 | 1.05        |
| Big B           | 0.3              | 1.90%                | 14%           | 23.50%                 | 0.70        |
| Drug Emporium   | 0.1              | 0.60%                | 0%            | 27.50%                 | 0.90        |
| Fay's           | 0.15             | 1.30%                | 37%           | 11.50%                 | 0.90        |
| Genovese        | 0.18             | 1.70%                | 26%           | 10.50%                 | 0.80        |
| Longs Drug      | 0.3              | 2.00%                | 46%           | 6.00%                  | 0.90        |
| Perry Drugs     | 0.12             | 1.30%                | 0%            | 12.50%                 | 1.10        |
| Rite-Aid        | 0.33             | 3.20%                | 37%           | 10.50%                 | 0.90        |
| Average         | 0.2375           | 1.93%                | 22%           | 14.50%                 | 0.91        |
| <i>Walgreen</i> | <i>0.6</i>       | <i>2.70%</i>         | <i>31%</i>    | <i>13.50%</i>          | <i>1.15</i> |

- Growth: One reason might be that the market expects higher growth in the future for the firm; . However, Walgreen's expected growth rate of 13.5% is less than the average of the firms, which is 14.5.
- Risk: If Walgreen's were substantially less risky than other firms in the sector, we might be able to justify its higher price to sales ratio. However, Walgreen's has a higher beta than the sector average.
- Net profit margin: A higher margin should translate into a higher price to sales ratio. It is only this dimension that Walgreen's looks better than the sector.

In summary, we would be inclined to conclude that the margin difference is not large enough to account for the higher price to sales ratio for Walgreens. It seems over valued relative to the sector.

12-20

Expected growth rate = 5%

Return on capital = 15%

Reinvestment rate =  $g/ROC = 5/15 = 33.33\%$

EBIT = EBITDA – Depreciation = 550-150 = 400

EBIT(1-t) = (EBITDA – Depreciation) (1- tax rate) = (550-150) (1-.4) = 240

FCFF = EBIT (1-t) (1- Reinvestment Rate) = 240 (1-.3333) = 160

Value of firm =  $FCFF (1+g) / (Cost\ of\ capital - g)$   
 $= 160(1.05) / (.09 - .05) = \$4,200\ million$

Value/FCFF = 4200/160 = 26.25

Value/EBIT = 4200/400 = 10.5

Value/ EBITDA = 4200/550 = 7.64