

## Problem Set

### PROBLEM SET: Summarizing Valuation

#### Exercise 1.

A company named Magne Jernilden ASA is evaluating a move to a new location. The local community is offering a sweetener to encourage the move. The local community is offering Magne Jernilden ASA a 5 year, zero coupon, interest free loan of kr 5 million. Magne Jernilden ASA is paying 10% interest on its current debt.

What is the value to Magne Jernilden ASA of the offer made by the local community?

1. kr 0
2. kr 0,2 million
3. kr 0,5 million
4. kr 1,9 million
5. I choose not to answer.

#### Exercise 2.

*Omicron* [3]

You are given the following information about Omicron Industries (Market values in \$millions)

Assets		Liabilities		Cost of Capital	
Cash	0	Debt	200	Debt	6%
Other Assets	500	Equity	300	Equity	12%

Omicron's tax rate ( $\tau_c$ ) is 21%.

Omicron is considering a project with the following Free Cash Flows (Millions)

Year	0	1	2	3
Free Cash Flows	(\$100)	\$40	\$50	\$60

Assume that this new project is of average risk for Omicron and that the firm wants to hold constant its debt to equity ratio.

1. Find Omicron's weighted average cost of capital.
2. Find the NPV for Omicron's new project.
3. Find the debt capacity for Omicron's new project in year 0.

#### Exercise 3.

*Household products* [4]

Your firm is considering expanding its household products division. You identify Proctor & Gamble as a firm with comparable investments. Suppose PG's equity has a market capitalization of \$144 billion and a beta of 0.55. PG also has \$37 billion of AA rated debt outstanding, with an average yield of 3.1%. The current risk free interest rate is 3%. You have evaluated the current market risk premium to be 5%.

Your firm is an all-equity firm. What cost of capital should you use in evaluating the investment in the household products division?

#### Exercise 4.

##### *Divisional WACC usage [5]*

Explain how a firm might use a divisional WACC (a separate WACC for each division) approach to avoid overinvesting in divisions with more risky projects and underinvesting in divisions with less risky projects.

#### Exercise 5.

##### *Ratios [5]*

1. Parry Electronics is a regional electronics wholesaler and distributor which earned \$1,250,000 in EBITDA this year based on revenues of \$4,000,000. The enterprise values of publicly traded firms that operate in the same industry currently are valued at 5-6 times their current EBITDA. What is your estimate of the enterprise value of Parry Electronics?

If Parry is small relative to the size of the comparison firms with assets only one-tenth the size of the largest firm in the industry, how would this influence your valuation estimate? Explain.

2. In the tech sector, the price of an IPO is often stated as a multiple of its sales, which is then compared to the price/sales ratio of comparable firms. Why do you think that analysts use price/sales ratios in this setting rather than price/earnings ratios?

#### Exercise 6.

##### *Google [30]*

Google Inc. of Mountain View, California, operates the most popular and powerful search engine on the Web. The company went public using an unconventional Dutch auction method on August 19, 2004. The resulting IPO was the largest Internet IPO ever, raising \$1.67 billion and leaving the firm with 271,219,643 shares of common stock.

	Earthlink	Yahoo	eBay	Microsoft
Financial Information	ELNK	YHOO	EBAY	MSFT
2003 Shares Outstanding(thousands)	159 399	655 602	646 819	10 800 000
2003 Fiscal Close Stock Price	\$ 10.00	\$ 45.03	\$ 64.61	\$ 25.64
Market Capitalization(mill)	\$ 1 594	\$ 29 521	\$ 41 790	\$ 276 912
Short Term Debt (thousands)	\$ 900	\$ 0	\$ 2 800	\$ 0
Long Term Debt (thousands)	\$ 0	\$ 750 000	\$ 124 500	\$ 0
Cash & Equivalents (thousands)	\$ 349 740	\$ 713 539	\$ 1 381 513	\$ 6 438 000
Short Term Investments (thousands)	\$ 89 088	\$ 595 975	\$ 340 576	\$ 42 610 000
EBITDA (thousands)	\$ 218 100	\$ 455 300	\$ 818 200	\$ 14 656 000
Net Income (thousands)	\$ (62 200)	\$ 237 900	\$ 441 800	\$ 9 993 000
Calculated EPS	(0.39)	0.36	0.68	0.93

While Google commands a wide lead over its competitors in the search engine market, it is witnessing increased pressure from well-funded rival entities. Yahoo! Inc., with a market cap of approximately \$38.43 billion, is generally regarded as following a business model very similar to Google's.

1. Use the data found in the Exhibit for the following companies as comparables in your analysis: Earthlink, Yahoo!, eBay and Microsoft. Compute the IPO value of Google shares using each of the comparable firms separately, and then use an average "multiple" of the comparable firms to do the analysis. Assume that Google's forecasted values at the time of the IPO are as follows: Net income is \$400 million, EBITDA is approximately \$800 million, cash and equivalents are \$430 million, and interest-bearing debt (total short-term and long-term) equals only \$10 million.
2. Which of the four comparable firms do you think is the best comparison firm for Google? Why?

### Exercise 7.

#### *Investments* [2]

Evaluate, by designing as price up, price down, no effect or impossible to tell, the effects of the following investment decisions on stock prices:

1. A stable company with no growth opportunities takes a project with a NPV of \$100 million.
2. A growth company (e.g., Microsoft) takes a project with an NPV of \$100 million
3. A company takes on a project with a NPV of negative \$100 million.
4. A company announces an acquisition of a target firm for \$500 million (the true value of the firm is only \$350 million.)
5. A company announces that it will be investing excess cash in treasury bonds.

### Exercise 8.

#### *PG* [3]

Prokter and Gramble (PG) has historically maintained a debt-equity ratio of approximately 0.20. Its current stock price is \$50 per share, with 2.5 billion shares outstanding. The firm enjoys very stable demand for its products, and consequently it has a low equity beta of 0.50 and can borrow at 4.20%, just 20 basis points over the risk free rate of 4%. The expected return on the market is 10%, and PG's tax rate is 35%.

- (a) This year, PG is expected to have free cash flows of \$6.0 billion. What constant expected growth rate of free cash flow is consistent with its current stock price?

### Exercise 9.

#### *Terminal Value* [4]

Terminal value refers to the valuation attached to the end of the planning period and that captures the value of all subsequent cash flows.

Estimate the value today for each of the following sets of future cash flow forecasts:

- (a) Claymore Mining Company anticipates that it will earn firm free cash flow (FCFs) of \$4 million per year for each of the next five years. Moreover, beginning in year 6, the firm will earn FCF of \$5 million per year for the indefinite future. If Claymore's cost of capital is 10%, what is the value of the firm's future cash flows?
- (b) Shameless Commerce Inc has no outstanding debt and is being evaluated as a possible acquisition. Shameless's FCFs for the next five years are projected to be \$1 million per year, and, beginning in year 6, the cash flows are expected to begin growing at the anticipated rate of inflation, which is currently 3% per annum. If the cost of capital for Shameless is 10%, what is your estimate of the present value of the FCFs?

### Exercise 10.

#### *MS* [3]

In early 2018, Microsoft Corporation had a market capitalization of \$716 billion, \$89 billion in debt, and \$133 billion in cash. If its estimated equity beta was 1.04, estimate the beta of Microsoft's underlying business enterprise.

### Exercise 11.

#### *Cash* [3]

Most firms, private and public, have assets on their books that can be considered to be non-operating assets. The first and most obvious example of such assets is cash and near-cash investments – investments in risk-less or very low-risk investments that most companies with large cash balances make.

1. Discuss how these type of holdings are treated in valuations.
2. Specifically, some of these holdings are in the form of marketable financial assets, such as corporate bonds. How does one treat holdings of corporate bonds in terms of valuation?

**Exercise 12.**

*Occidental Petroleum* [5]

Occidental Petroleum produces and markets crude oil. The following are selected numbers from the financial statements for 1992 and 1993 (in millions).

	1992	1993
Revenues	8,494.0	9,000.0
(less) Operating Expenses	(6,424.0)	(6,970.0)
(less) Depreciation	(872.0)	(860)
EBIT	1,198.0	1,170.0
(less) Interest Expenses	(510.0)	(515.0)
(less) Taxes	(362.0)	(420.0)
Net Income	326.0	235.0
Working Capital	(45.0)	(50.0)
Total Debt	5.4 billion	5.0 billion

The firm has capital expenditures of 950 million in 1992 and 1 billion in 1993. The working capital in 1991 was 190 million, and the total debt outstanding in 1991 was 5.75 billion. There were 305 million shares outstanding, trading at \$21 per share.

- (a) Estimate the cash flows to equity in 1992 and 1993.
- (b) Estimate the cash flows to the firm in 1992 and 1993.

**Exercise 13.**

*Morgan Indus* [5]

Consider an investment opportunity available to Morgan Industries (Morgan), a hypothetical firm. The firm can make an investment in equipment to produce a new product line. The equipment will last for three years. At that time, Morgan can decide whether to continue, change, or end the product line. Thus the decision horizon is three years. The investment will be assumed to occur at the end of the current year, with sales beginning next year. The investment will be fully depreciated over the three years, even though Morgan believes the equipment will have some economic value (salvage value) at the end of the decision horizon. The specific assumed values for this investment are summarized in Table 1.

Table 1. Morgan's new product line investment summary.

Initial investment	180,000
Salvage value	20,000
Fixed annual cash operating expenses	55,000
Revenue in the first year	400,000
Cash variable expenses (% of revenue)	70%
Working capital needs (% of revenue)	10%
Growth rate of sales	15%
Tax rate	25%

1. Calculate the Free Cash Flow for this investment

**Exercise 14.**

A corporation's Annual Report contains the following information:

Sales: 2,000,000 kr.

Variable costs: 850,000 kr.

Overhead costs: 395,000 kr.

Depreciation: 248,000 kr.

Corporate tax rate: 34%

Calculate the corporation's after-tax cash flows

1. 582,620 kr.
2. 724,620 kr.
3. 755,000 kr.
4. 977,620 kr.
5. I choose not to answer.

**Exercise 15.**

*Savile* [5]

Savile Investors is evaluating the purchase of an apartment complex which will require a total outlay of \$4,000,000. Ninety percent of the outlay will be financed by a 5-year loan at 12% that requires annual interest payments. The principal will be paid off in five equal increments beginning at time  $t = 1$ . The net after-tax operating cash flows are estimated to be \$900,000 in the first year and \$1,100,000 in each of the next 4 years. Savile estimates it needs a 20% return on the investment. Its tax rate is 40%.

Using flow-to-equity (FTE), should Savile make the investment?

**Exercise 16.**

*Company Value* [4]

You are valuing a company using the WACC approach and have estimated that the free cash flows from the firm (FCFF) in the next years will be €36.7, €42.6, €45.1, €46.3 and €46.6 million, respectively. Beginning in year 6, you expect the cash flows to decrease at a rate of 3% per year for the indefinite future. You estimate that the appropriate WACC to use in discounting these cash flows is 10%. What is the value of the company?

**Exercise 17.**

*Santa Fe Pacific* [8]

Santa Fe Pacific, a major rail operator with diversified operations, had earnings before interest, taxes and depreciation, of \$637 million in 1993, with depreciation amounting to \$235 million (offset by capital expenditure of an equivalent amount). The firm is in steady state and expected to grow 6% a year in perpetuity. Santa Fe Pacific had a beta of 1.25 in 1993 and debt outstanding of \$1.34 billion. The stock price was \$18.25 at the end of 1993, and there were 183.1 million shares outstanding. The expected ratings and the cost of debt at different levels of debt for Santa Fe are shown in the following table. The treasury bond rate is 7%, and the firm faced a tax rate of 40%.

$\frac{D}{D+E}$	Rating	Cost of Debt (pre-tax)
0%	AAA	6.23%
10%	AAA	6.23%
20%	A+	6.93%
30%	A-	7.43%
40%	BB	8.43%
50%	B+	8.93%
60%	B-	10.93%
70%	CCC	11.93%
80%	CCC	11.93%
90%	CC	13.43%

The earnings before interest and taxes are expected to grow 3% a year in perpetuity, with capital expenditures offset by depreciation. (The tax rate is 40% and the treasury bond rate is 7%.)

1. Estimate the cost of capital (WACC) at the current debt ratio.
2. Estimate the cost of capital (WACC) at a debt ratio of 50%.
3. Estimate the value of the firm at the above two debt ratios.

### Exercise 18.

#### Repurchases. [2]

In recent years firms has been engaging in stock repurchases, ie. that the firm buys back its own shares. Should one account for such practices in a firm valuation? If we should, where would one modify the typical firm valuation analysis?

### Exercise 19.

#### True/False [5]

For each of the following statements, state whether it is true or false. If you say it is false, also indicate *why* it is false, in one or two sentences.

1. The Adjusted Present Value (APV) method discounts the Free Cash Flow to the firm at the (levered) equity cost of capital.
2. The Flow to Equity method discounts the Free Cash Flow to Equity at the (levered) equity cost of capital.
3. In theory, APV, FTE and WACC will all give the same present value, but in practice one will often find different present values.
4. Valuation is the estimation of the market value of an asset/firm. When one values a company, the valuation of its equity should equal the market value of shares outstanding.
5. For firms listed on stock exchanges one can estimate the beta risk of the company directly from historical stock returns for the stock.

### Exercise 20.

#### Short Answers [3]

Short answer questions

- (a) When we estimate the firm's cost of capital, we typically first estimate the equity cost of capital by finding a relevant beta. If a firm is traded on a stock exchange we use historical data on returns to estimate beta. What do we do if the firm's stock is not traded on an exchange?

- (b) How do we estimate the market value of a company's debt?
- (c) In doing comparables analysis, one have to select a set of comparable companies. What was the trade-off between a large versus a small number of comparable companies?
- (d) Firms do at times repurchase shares. How do such repurchases affect corporate valuations?
- (e) There are various beta adjustments proposed in the literature, such as the BARRA and Bloomberg adjustments. What underlying problem(s) are such methods meant to address?
- (f) A company's *hurdle* rate is the cost of capital used to value the company. What types of investments can be evaluated using the company's current hurdle rate?

**Exercise 21.**

*Roofing* [4]

You own a business that specializes in designing and producing roofs for houses in central Spain. Your annual costs include office rent of €14 400, salaries for four designing engineers of €240 000, design software costs of €12 000 and other overhead costs of €3000. An average roof in the region is priced at €3500. It costs €1200 in raw material, €1100 in labor and €100 in other expenses (for example, purchasing building permits.) The effective tax rate for your business last year was 20%.

- (a) What is the minimum number of roofs you need to sell to earn a profit?

**Exercise 22.**

*Liquidity* [2]

In some valuation settings one discusses a *liquidity premium*.

- (a) What motivation does one typically see for discussing liquidity?
- (a) For what types of companies is it most relevant to discuss liquidity?

## Solutions

### PROBLEM SET: Summarizing Valuation

#### Solution to Exercise 1.

Calculate present value of the offer.

$$\begin{array}{r} t \quad C_t \\ 0 \quad 5 \\ 5 \quad -5 \\ \hline \end{array}$$
$$NPV = 5 + -\frac{5}{(1+0.1)^5} = 1.89539$$

(d) is correct.

#### Solution to Exercise 2.

Omicron [3]

1. WACC

$$WACC = \frac{E}{D+E}r_E + \frac{D}{D+E}r_D(1-\tau_c)$$
$$wacc = (.12) + (.06)(1-.21) = .0910$$

2. NPV

$$NPV = -\$100M + \dots + = \$24.87M$$

3. Debt Capacity

$$\text{Value} = \text{Investment} + NPV = 100M + 24.87M = 124.87M$$

$$\text{Debt Capacity} = \frac{D}{D+E}\text{Value} = \$49.95 \text{ million}$$

#### Solution to Exercise 3.

Household products [4]

P&G: Equity cost of capital

$$r_E = 3\% + 0.55 \cdot 5\% = 5.75\%$$

P&G: Debt cost of capital (using the current average yield).

$$r_D = 3.1\%$$

Unlevered cost of capital for P&G:

$$r = r_E \frac{E}{D+E} + r_D \frac{D}{D+E}$$
$$= 0.0575 \frac{144}{144+37} + 0.031 \frac{37}{144+37} = 5.21\%$$

Since your firm is all-equity, this is the relevant cost of capital.

Note that an alternative way of estimating this is to work through the beta. Assuming the beta of the debt is zero, the unlevered beta is

$$\beta = 0.55 \frac{144}{144+37} + 0.0 \frac{37}{144+37} = 0.438$$

Plugging this into the CAPM gives a cost of capital of

$$r = r_f + \beta MRP = 0.03 + 0.438 \cdot 0.05 = 5.19\%$$

The difference between these two is due to the zero beta assumption, which is not quite consistent with the debt being AA rated, but it is still a valid way to generate an estimate.

#### Solution to Exercise 4.



### Divisional WACC usage [5]

This is about the general issue of company-wide costs of capital. They should be avoided, the cost of capital applied to any project should reflect that project's risk. A company-wide cost of capital should be used only for scale-increasing investments and similar investments with the same risk as the company.

If only one discount rate is used the projects in the riskier division are overvalued and the project in the less risky division are undervalued. This means that the firm will end up overinvesting in risky projects and underinvesting in less risky problems. This was an issue for a large PC manufacturer whose printer business was booming in a market that was less risky than its PC business. Without holding the less risky printer business to a lower cost of capital standard the firm would have underinvested in a very lucrative business.

### Solution to Exercise 5.

#### Ratios [5]

1. The information can be used to put a range of

$$[1, 25 \times 5, 1, 25 \times 6] \text{ mill} = [6.25, 7.5] \text{ mill}$$

on the estimated value.

The source of difference relative to the comparison source is firm size/listing. Depending on how one adjust. One possibility is to add a small firm premium to the cost of capital, making it likely that Parry will have a higher cost of capital, and thus a lower EBITDA multiple.

Alternatively, one will adjust a value downward directly to account for size.

Of course, we should also consider differences in the firm's growth opportunities.

2. The problem is that many of these firms do not have positive earnings, so sales is the best valuation metric that can be used.

It should be noted that sales multiples are not particularly informative in most cases, and are only used when there are not good alternatives.

### Solution to Exercise 6.

#### Google [30]

1. Estimating the IPO price

					Average
Price to Earnings	(25.63)	124.09	94.59	27.71	55.19
Enterprise Value (mill)	\$1 245	\$29 558	\$40 536	\$270 474	
EBITDA multiple	5.71	64.92	49.54	18.45	34.66
EBITDA	\$ 800 000 000				
Cash	\$ 430 000 000				
Debt	\$ 10 000 000				
Net income	\$ 400 000 000				
Shares	271 219 643				
EPS	\$ 1.47				
IPO proceeds	\$ 1 670 000 000				

	Earthlink	Yahoo	eBay	Microsoft	Average
Imputed IPO price per share from PE ratio	(\$38)	\$183.01	\$139.51	\$40.87	\$81.40
Impute EV from EBITDA multiples (mill)	\$4 567	\$51 936	\$39 635	\$14 763	\$27 725
Owner's equity (mill)	\$4 987	\$52 356	\$40 055	\$15 183	\$28 145
Impute IPO price per share	\$18.39	\$193.04	\$147.68	\$55.98	\$103.77

2. Best comparison?

Yahoo seems to be the closest in terms of leverage, and it is. And fairly close in terms of EBITDA, NI. Microsoft and Earthlink have little debt. Microsoft seems to be much bigger in size. e-Bay has huge amounts of debt. It does not seem comparable. The choice is between Earthlink and Yahoo. Yahoo may be the best. Its debt is comparable to Google, its EBITDA and NI are closer to Google, and it has a similar businesses.

### Solution to Exercise 7.

Investments [2]

1. Price up
2. Both Impossible to tell and price up are reasonable answers.  
The Impossible to tell answer is the most correct, as this positive NPV project may already have been part of the growth opportunities. Some of the value that you pay for growth includes a premium for future positive NPV projects.
3. Price down.
4. Price down. This is the equivalent of taking a negative NPV project.
5. No effect. Investing in T Bonds is a zero NPV decision. They are assumed to be fairly priced.

### Solution to Exercise 8.

PG [3]

The growth rate  $g$  is calculated from

$$V = \text{Firm Value} = \frac{FCFF_1}{r - g}$$

where  $FCFF_1$  are the free cash flows to the firm,  $r$  the WACC and  $g$  the growth rate.

Current value of equity:  $E = 50 \times 2.5 \text{ billion} = 125 \text{ billion}$ .

Given a debt/equity ratio of 0.2

$$\frac{D}{E} = 0.2 = \frac{D}{125} = 0.2$$

$$D = 0.2 \times 125 = 25$$

$$V = 25 + 125 = 150$$

$$r_E = 0.04 + 0.5(0.10 - 0.04) = 7\%$$

$$r_D = 0.042$$

$$WACC = \frac{25}{25 + 125} 0.042 \cdot (1 - 0.35) + \frac{125}{150} 0.07 \approx 0.0629$$

There is an ambiguity in the way the FCF "this year" is specified. Since it is "expected", most reasonable to set 6 as  $FCF_1$

$$150 = \frac{6}{0.0629 - g}$$

$$\frac{6}{150} = 0.0629 - g$$

$$g = 0.0629 - 0.0375 = 0.0258 = 2.58\%$$

Alternatively, one can assume that 6 is the current year's FCF ( $FCF_0$ ), in which case you would calculate  $FCF_1 = FCF_0(1 + g)$ .

$$150 = \frac{6(1 + g)}{0.0629 - g}$$

$$g = \frac{150 \times WACC - 6}{150 + 6} = 2.2\%$$

Either of those are possible answers.

### Solution to Exercise 9.

Terminal Value [4]

Calculate the terminal values at the end first, and then take present values.

1. Terminal value at year 5 (millions):

$$TV = \frac{5}{0.10} = 50$$

Present value

$$PV(TV) = \frac{50}{(1 + 0.1)^5} = 31.05$$

2. Terminal value at year 5 (millions):

$$TV = \frac{1 + 0.03}{0.10 - 0.03} = 14.71$$

Present value

$$PV(TV) = \frac{14.71}{(1 + 0.1)^5} = 9.1$$

### Solution to Exercise 10.

*MS* [3]

Microsoft has net debt  $(89 - 133) = -44$  billion. Therefore, Microsoft's enterprise value is  $(716 - 44) = \$672$  billion, which is the total value of its underlying business on a debt-free basis and excluding cash. Assuming Microsoft's debt and cash investments are both risk-free, we can estimate the beta of this enterprise value as

$$\beta_U = \frac{E}{E + D}\beta_E + \frac{D}{D + E}\beta_D = \frac{716}{716 - 44}1.04 + \frac{-44}{716 - 44}0 = 1.11$$

Note that in this case, Microsoft's equity is *less* risky than its underlying business activities due to its cash holdings.

### Solution to Exercise 11.

*Cash* [3]

1. Here one have to distinguish between the cash that is part of working capital and that which is not.

The typical terminology is operating vs non-operating (excess) cash.

One first determine a company's need for operating cash. Methods for doing so include:

- (a) Rule of thumb (well known: 2% of revenues)
- (b) Industry average
- (c) Cross-sectional regression

Once one have estimated the split between operating and non-operating cash, one will then take the non-operating cash out of the valuation of future cash flows, and just add it to the value of the firm one estimates from discounting cash flows from future operations.

2. If the holdings are marketable securities, one will need to figure out the value to the firm.

Possibilities

- (a) Use the current market value of the marketable securities and add this value to the value of the firm.
- (b) Estimate the current market value of the securities, as in the previous, but then subtract any capital gains taxes the realization of the securities would entail. This is particularly pertinent when one values the firm on a liquidation basis.
- (c) Value the firm that has issued the bonds, and use that to estimate the bond values. This may be particularly useful for firms that have few, but large, holdings in other publicly traded firms.

### Solution to Exercise 12.

*Occidental Petroleum* [5]

The solution includes answers to the additional subquestions:

- (c) Assuming that revenues and all expenses (including depreciation and capital expenditures) increase 4%, and that working capital remains unchanged in 1994, estimate the projected cash flows to equity and the firm in 1994. (The firm is assumed to be at its optimal financial leverage.)
- (d) How would your answer to (c) change if the firm planned to reduce its debt ratio in 1994 by financing 100% of its capital expenditures (net of depreciation) with new equity issues?

	1991	1992	1993	1994	1994 (no debt)
Revenues		8,494	9,000	9,360	9,360
– Operating Expenses		6,424	6,970	7,249	7,249
– Depreciation		872	860	894	894
EBIT		1,198	1,170	1,217	1,217
– Interest Expenses		510	515	536	536
– Taxes		362	420	437	437
Net Income		326	235	244	244
Depreciation		872	860	894	894
– Capital Expenditures		950	1,000	1,040	1,040
– $\Delta$ Working Capital		(235)	(5)	(0)	(0)
+ Net Debt Issues		(350)	(400)	63	0
FCFE		133	(300)	162	103
+ Interest Expenses(1-t)		268	330	343	343
– Net Debt Issues		(350)	(400)	63	0
FCFF		751	430	442	442
Working Capital	190	(45)	(50)	(50)	(50)
Total Debt	5,750	5,400	5,000		
Debt Ratio				43.84%	
Tax Rate		52.62%	64.12%	64.12%	64.12%

(Note, there is an error in the FCF calculations in the above table, fix before using.)

### Solution to Exercise 13.

*Morgan Indus* [5]

The FCF is estimated below using two alternative methods

Table 2. Analysis of operating cash flow by parts.

	Year 0	Year 1	Year 2	Year 3	
Annual Cash Flow After Tax					
Cash revenues		400,000	460,000	529,000	
Cash variable expenses		280,000	322,000	370,300	
Cash fixed expenses		55,000	55,000	55,000	
Annual cash profit		65,000	83,000	103,700	
Tax on annual cash profit		16,250	20,750	25,925	
		48,750	62,250	77,775	A
Investments Cash Flow					
Investment	(180,000)				
Recovery of investment				15,000	
Change in NWC		(40,000)	(6,000)	(6,900)	
Recovery of NWC				52,900	
	(180,000)	(40,000)	(6,000)	61,000	B
Depreciation Tax Shield		60,000	60,000	60,000	
Tax shield (depreciation $\times$ tax rate)		15,000	15,000	15,000	C
Cash flow [A + B + C]		23,750	71,250	153,775	
NWC		40,000	46,000	52,900	

Table 3. Salvage value schedule.

Salvage value	20,000
Book value	0
Gain or loss	20,000
Tax on gain or loss	5,000
Salvage value	20,000
Tax	5,000
Net cash flow from salvage value	15,000

Table 4. Free cash flow calculation.

	Year 0	Year 1	Year 2	Year 3	
Cash revenues		400,000	460,000	529,000	
Cash variable expenses		280,000	322,000	370,300	
Cash fixed expenses		55,000	55,000	55,000	
Depreciation		60,000	60,000	60,000	
EBIT		5,000	23,000	43,700	
Tax on EBIT		1,250	5,750	10,925	
NOPAT		3,750	17,250	32,775	A
plus: Depreciation		60,000	60,000	60,000	B
less: Capital expenditures	180,000				C
plus: Residual value				15,000	D
less: Change in NWC		40,000	6,000	6,900	E
plus: Recovery of NWC				52,900	F
Free cash flow $[A + B - C + D - E + F]$	(180,000)	23,750	71,250	153,775	

(This example is from an article by Marc Lipson).

**Solution to Exercise 14.**

**Solution to Exercise 15.**

*Savile* [5]

The borrowing will be 90% of the purchase price of \$4,000,000, which is 3.6 mill. At 12% interest, the interest charge is \$432,000 the first year. Thereafter it declines as the firm pays back the principal. The principal payment will be \$3,600,000/5 per year which is 720,000 per year. Finally, because 90% of the initial investment will be borrowed, the initial cash outlay to equity investors is only \$400,000.

The cash flows to the owners are as follows

	0	1	2	3	4	5
Operating Cash Flows		900,000	1,100,000	1,100,000	1,100,000	1,100,000
Initial Investment	-400,000					
Borrowing 3,600,000						
Principal Repayment		-720,000	-720,000	-720,000	-720,000	-720,000
Interest at 12% (lagged)		-432,000	-345,000	-259,000	-172,000	-86,400
Tax benefit of interest		172,000	138,240	103,680	69,120	34,560
Cash flow to stockholders	-400,000	-79,200	172,640	224,480	276,320	328,160

$$FTE = -400,000 + \frac{-79,200}{1.20} + \dots$$

$$FTE = 48,932$$

Based on the positive flows-to-equity, the investment in the apartment complex should be made.

**Solution to Exercise 16.**

*Company Value* [4]

$t$	$C_t$
0	0
1	36.7
2	42.6
3	45.1
4	46.3
5	46.6

$$NPV = \frac{36.7}{(1+0.1)^1} + \frac{42.6}{(1+0.1)^2} + \frac{45.1}{(1+0.1)^3} + \frac{46.3}{(1+0.1)^4} + \frac{46.6}{(1+0.1)^5} = 163.013$$

The present value of the cash flows expected over the next five years is €163.01 mill.

The terminal value is

$$TV_5 = \frac{FCFF_5(1+g)}{WACC-g} = 347.71 \text{ mill}$$

The present value of the terminal value is 215.9 mill.

If there are no non-operating assets, the value of the firm is

$$V = 378.9 \text{ mill}$$

### Solution to Exercise 17.

*Santa Fe Pacific* [8]

It is here necessary to make an assumption about the equity market risk premium. This was in the nineties, so a 5.5% risk premium was a typical number. Below are calculations using that assumptions.

Cost of equity  $7\% + 1.25 \times 5.5\% = 13.88\%$ .

Current Debt Ratio  $1340/(1340 + 18.25 \times 183.1) = 28.63\%$ .

After-tax Cost of Debt  $7.43\%(1 - 0.4) = 4.46\%$ .

Cost of Capital  $13.88\%(0.7137) + 4.46\%(0.2863)$

Showing estimates for several debt levels

$\frac{D}{D+E}$	Cost of Debt	Beta	Cost of Equity	AT Cost of Debt	Cost of Capital	Firm Value
0%	6.23%	1.01	12.54%	3.74%	12.54%	2,604
10%	6.23%	1.07	12.91%	3.74%	11.99%	2,763
50%	8.93%	1.61	15.87%	5.36%	10.61%	3,265

Unlevered beta:  $1.25/(1 + 0.6 \times (1340/(183.1 \times 18.25))) = 1.01$ .

Levered beta at 10%  $D/(D + E) = 1.01(1 + 0.6(10/90)) = 1.07$ .

FCFF to Firm Next Year  $(637 - 235)(1 - 0.4)1.03 = 248.43$  million.

Note that there are two growths talked about. The relevant one is the growth in earnings, which is 3%.

Value of the Firm  $248.43/(WACC - 0.03)$ .

However, students are likely to make other assumptions about the risk premium. The "usual" assumption is a 5% market risk premium. Below shows some of the numbers calculated with different assumptions about the market risk premium

Current capital structure

$E[r_m]$	0.055	0.05
$\beta_e$	1.25	1.25
$R_E$	0.1388	0.1325
WACC	0.1109	0.1065
Firm Value	3069	3249

Calculation with 50% capital structure

$E[r_m]$	0.055	0.05
$\beta_E$	1.616	1.616
$R_E$	0.1589	0.1508
WACC	0.0945	0.0914
Firm Value	3849	4045

Common mistakes:

- Not updating the equity beta when changing capital structure.
- Thinking one can ignore the depreciation when calculating the tax. The information about depreciation equal to capital expenditures only applies to the *adding back* part.
- “Rounding” in the table for ratings. A debt weight of 28% still has an *A+* rating, it only switches to *A-* when the percentage goes *above* 30%. (Not that serious a mistake).

Worth extra points: Linking estimate of risk premium to time period. It was higher in the nineties than it is now.

### Solution to Exercise 18.

*Repurchases.* [2]

It may impact the analysis - it depends.

If for example we are doing valuation using a dividend discount model we would be understating dividends if we did not account for the repurchases.

It is also a question of how the firm is accounting for repurchases. If they are left on the balance sheet we may need to lower the asset value by the repurchases.

### Solution to Exercise 19.

*True/False* [5]

1. False, discount the FCF at the (unlevered) cost of equity, and then subtract tax effects.
2. True.
3. True, the three methods will give the same answer *if used correctly*, but in practice it is hard to get the three methods to agree 100%, due to slightly different implicit assumptions used in the calculations.
4. True
5. False, it is the beta of the *stock* one estimates, will then have to adjust for the debt/equity ratio.

### Solution to Exercise 20.

*Short Answers* [3]

1. Look at comparable companies/industries
2. If some of the debt is traded, use that. Otherwise go for book values.
3. Large sample: Statistical power, not influenced that much by outliers/special cases. However: Will often include firms only marginally similar to the one analyzing. Small sample: More likely to find “exact matches,” but more exposed to special things about firms in sample.
4. Share repurchases will reduce the number of shares outstanding, either actually (firm writes down the shares) or implicitly (firm keeps treasury stock). One need to be careful about calculations going from stocks to the firm. For example, need to make sure one do not double count when multiplying stock price times no shares outstanding to find current market value of the firm.
5. That company betas are estimated with an error, and that betas change over time.
6. Investments with the same aggregate risk as the corporation, such as scale expansions, maintenance, etc.

### Solution to Exercise 21.

*Roofing* [4]

Fixed Costs:  $14.4 + 240 + 12 + 3 = 269.4$

Variable Costs:  $1200 + 1100 + 100 = 2400$

Let  $X$  be break even of sales

$$0 = -269.4 + (3.5 - 2.4)X = -269.4 + 1.1X$$

$$X = \frac{269.4}{1.1} = 244.90 \approx 245$$

or need to sell 254 roofs before becoming profitable.

(No need to consider tax for this calculation, as you don't start paying tax until making a profit...)

### **Solution to Exercise 22.**

*Liquidity* [2]

When it is hard to find a buyer of an asset it is illiquid.

To rapidly sell it, may need to lower (discount) the price to attract buyers. This is termed a liquidity premium. In some sense it is really a liquidity *discount*, but if one adds a liquidity *premium* to the discount rate, the result is lowering values.

Anyway, this discussion of liquidity in valuation is typically for small, illiquid firms, often not traded on exchanges.