Chapter 1: Financial Valuation Tools

Overview and objectives

Chapters 1 and 2 are primarily "tools" chapters: Chapter 1 reviews basic valuation techniques covered in most introductory finance courses and Chapter 2 serves the same purpose with respect to basic accounting techniques.

In our class discussion of this chapter we usually begin by describing the valuation process of any asset or firm as comprised of a detailed prediction of expected cash flows and an estimation of the price for which these cash flows can be sold. We then proceed to describe the determinants of the price for which various cash flows can be sold—the determinants of the appropriate discount rate.

Chapter structure

In the chapter we deal sequentially with each of the characteristics of cash flows that determine the price for which the cash flows can be sold: timing, risk, purchasing power, and liquidity.

Timing

We spend a short amount of time reviewing the discounting of certainty cash flows at the maturity-dependent risk-free rate. Since most students are probably familiar with the technical aspects of this issue, we dedicate most of the class discussion to the economic interpretation of discounting as a way to calculate how much a certain cash flow of a given timing can be sold for in the market. We also spend considerable time discussing the Gordon formula. (Later in the book we use the formula to estimate terminal values of projected financial performance, to estimate discount rates, and to estimate appropriate multiples.)

Risk

We emphasize the CAPM/APT intuition of risk measurement: Risk should be measured relative to the risk to which investors are already exposed. We use the CAPM framework to proxy for investors' existing risk by the variation in the return on the market portfolio. The discussion of practical ways to estimate risk-adjusted discount rates is deferred to Chapter 9.

Inflation and the purchasing power of money

The issue of changing purchasing power of money (i.e., inflation) is often confusing to students who tend to dismiss it as irrelevant. We emphasize that in valuations, which are based on projections of long or even infinite cash flows, the effect of even a low annual rate of inflation is material. We often use "The Super Project" case to illustrate the importance of correctly reflecting expected inflation in valuations. (In "The Super Project" case an annual inflation rate of 3% materially affects the value of a project expected to last 10 years.)

Liquidity

The effect of liquidity on asset values, an important element of the current academic research agenda in finance, is especially important for valuations of non-traded assets (such as the value of a privately held company). We approach the problem in two ways. First, we describe the practice of deducting from the value of a traded firm a discount of roughly one third of the value to estimate the value of the firm as a privately held one. Second, we propose that the discount can be estimated by the (present value of) cost of taking a privately held firm public.

Reflecting the current state of theory, neither approach suggests a measure of liquidity or a price per unit of liquidity. Liquidity is not explicitly treated again in the book, since we focus on estimating values of publicly traded firms, their projects, their divisions, or their securities. Yet both approaches to estimating liquidity discounts offer reference points ("practice" or "flotation costs") that can be used in actual negotiations over deal prices, which accompany deals in privately held firms.

Arbitrage and value additivity

We conclude the chapter by a short discussion of arbitrage and of the principle of value additivity, which are used later in the discussion of the effect of capital structure on discount rates (in Chapter 8) and in estimating the share of firm value to allocate to holders of convertible securities (in Chapter 12).

Cases that can be used with the chapter

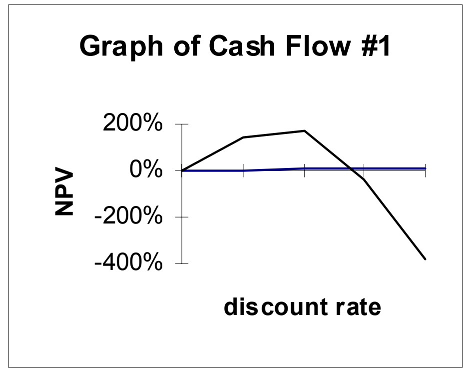
The suggested cases for this chapter illustrate the use of finance tools. Such cases include:

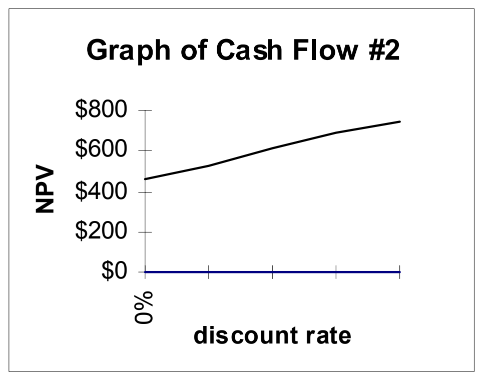
Harvard: Economy Shipping Co., The Super Project, MRC (A).
Bruner: Westfield Inc., Boggs Mineral Co.

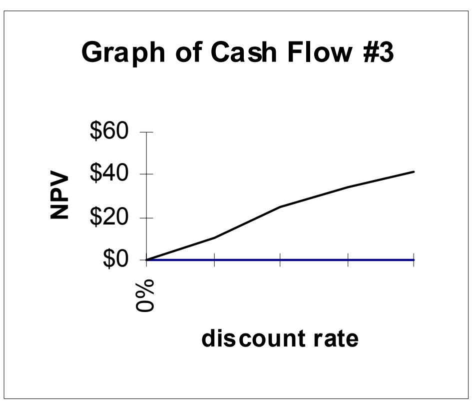
Solutions to End-of-Chapter Problems

Problem 1.1

Year-end	CF1	CF2	CF3
1	-100	1000	10
2	20	-20	20
3	40	-30	30
4	60	-40	40
5	80	-50	50
6	0	-60	-50
7	0	-70	-40
8	-100	-80	-30
9		-90	-20
10		-100	-10
discount rate			
0%	$0.00	$460.00	$0.00
2%	$1.45	$521.04	$9.97
6%	$1.71	$618.20	$24.78
10%	($0.36)	$690.60	$34.59
14%	($3.78)	$745.44	$40.96







By looking at the graph, we can see that CF1 has two IRRs. Using the Excel function **IRR(Cash Flows, 10%)** we find that the high IRR is 9.49%. Using the Excel function **IRR(Cash Flows, 0%)** we find that the low IRR is 0.0%. Thus, using two initial guesses for the IRR function we find the two IRRs of the cash flow.

Problem 1.2

Year-end	Dividend	growth
1958	1.00	
1959	1.15	15.00%
1960	1.30	13.04%
1961	1.40	7.69%
1962	1.60	14.29%
1963	1.80	12.50%
1964	2.00	11.11%
1965	2.00	0.00%
1966	2.10	5.00%
1967	2.20	4.76%

average growth rate	**9.27%**
cost of equity (Gordon model) = (1968 dividend)/(today's share price)+growth	
expected 1968 dividend	2.40
current share price	73.50
growth rate	9.27%
cost of equity	**12.54%**

Note: As discussed in Chapter 9, we have used the arithmetic average growth to estimate the cost of equity. We first calculate a year-by-year growth rate for the dividends; for example, the 1967 growth rate of 4.76% is calculated by:

$$4.76\% = \left(\frac{2.20}{2.10}\right) - 1$$

The *arithmetic average* of these continuous growth rates is the predicted dividend growth (assuming that the firm's dividend history is predictive of its future dividends--in view of the slowdown in dividend growth over the period, this is problematic). The Gordon model sets the cost of capital equal to:

$$cost\ of\ equity = r_e = \frac{D_{1968}}{P_{1967}} + g$$

$$= \frac{D_{1967} * (1 + g)}{P_{1967}} + g$$

$$= \frac{2.20 * (1 + 0.0927)}{73.50} + 0.0927 = 0.1255$$

Some students may want to use the *geometric growth rate*:

$$geometric\ growth\ rate = \left(\frac{2.20}{1.00}\right)^{1/9} - 1 = 9.16\%$$

For reasons discussed in Chapter 9, the arithmetic growth rate is preferable.

Problem 1.3

The expected year-end cash flow is:

$E(CF_1)$ = 80%*1,000,000+20%*0 = $800,000
RADR = 6% + 0.5*8% = 10%
$PV(CF_1)$ = $727,273

Problem 1.4

Value conditional on success = 600,000/(3%+5%) = $7,500,000
Expected value in one year = 80%*7,500,000 + 20%*0 = $6,000,000
Present value = 6,000,000/(1+8%) = $5,555,556

Problem 1.5

a. We can use the Gordon model on real growth rates. This means that we first have to adjust all of the dividends to 1994 prices. We can then use the Gordon formula:

$$real\ cost\ of\ equity = \frac{D_{1994} * (1 + real\ growth\ rate)}{P_{1994}} + real\ growth\ rate$$

This gives the following solution:

1994 stock price	30.00

year	Dividend paid	Year-end CPI	Dividend in 1994 prices	real growth
1989	1.30	120	1.43	
1990	1.35	122	1.46	2.14%
1991	1.40	126	1.47	0.41%
1992	1.50	129	1.53	4.65%
1993	1.60	133	1.59	3.46%
1994	1.65	132	1.65	3.91%

average growth	2.91%
expected 1995 dividend	1.70
real cost of equity	8.57%

b. Using the Fisher formula and the real cost of equity estimated in part (a) we get:

$$r^{nominal} = (1+8.57\%)*(1+4\%) - 1 = 0.1292 = 12.92\%$$

If, however (as the second part of problem 5.b asks), you assume that BCA's *nominal* dividend history can be used to infer its future nominal growth, then you get a different answer, given below. Most economists believe that this is *not* the correct way to do this—that the underlying processes in the economy are the real processes, and that inflation must be added to these processes (i.e., most economists would think that the correct nominal cost of capital is given in part 1 of 5.b, above).

However, here's the answer to this question:

1994 stock price	30.00

year	Dividend paid	nominal growth
1989	1.30	
1990	1.35	3.85%
1991	1.40	3.70%
1992	1.50	7.14%
1993	1.60	6.67%
1994	1.65	3.12%

average growth	4.90%
expected 1995 dividend	1.73
nominal cost of equity	10.67%

Problem 1.6

XYZ's dividends will grow at a rate of 20% for 5 years. After 5 years, the growth rate will be 8% forever. This means that the value of the share is given by:

$$P = \sum_{t=1}^{\infty} \frac{div_t}{(1+RADR)^t}$$

$$= \sum_{t=1}^{5} \frac{4*(1.2))^t}{(1+RADR)^t} + \sum_{t=6}^{\infty} \frac{4*(1.2))^5*(1.08)^{t-5}}{(1+RADR)^t}$$

The second term can be simplified by taking out $1/(1+RADR)^5$:

$$63 = \sum_{t=1}^{5} \frac{4*(1.2)^t}{(1+RADR)^t} + \frac{1}{(1+RADR)^5} \frac{4*(1.2))^5*(1.08)}{(RADR - 0.08)}$$

This is simply the discounted expected year 5 stock price (using the Gordon model, this is the discounted dividends from year 6 until 4). Since the stock price today is \$63, we need to solve:

$$63 = \sum_{t=1}^{5} \frac{4*(1.2)^t}{(1+RADR)^t} + \frac{1}{(1+RADR)^5} \sum_{t=1}^{\infty} \frac{4*(1.2))^5*(1.08)^t}{(1+RADR)^t}$$

This can be solved algebraically to yield RADR = 18.75%.

A **simpler way** to solve this problem is to use the **Goal Seek** feature of the spreadsheet:

current dividend	4	
short-term growth	20%	
long-term growth	8%	
current share price	63.00	
year 5 share value	100.02	<--year 5 dividend*(1.08)/(RADR-0.08)
RADR	18.75%	
discounted dividend+share price		
	$63.00	<--calculated by **Tools|Goal Seek**

year	dividend
1	4.80
2	5.76
3	6.91
4	8.29
5	9.95

CHAPTER 2: Using Financial Reporting Information

Overview and objectives

In this chapter, the second of the two "tools" chapters in the book, we discuss accounting principles and the relation between accounting statements and cash flows, primarily Free Cash Flows. The chapter has two objectives: to show students how to convert accounting statements to valuation-relevant cash flows and to review accounting principles and methods.

Chapter structure

We begin the chapter with a review of the two primary financial statements—the balance sheet and the income statement. Most students are familiar with these reports so our emphasis here is on the difference between the accrual-based income statement and cash flows, which are the basis for the economic valuation of an asset or a business.

We proceed to show how the balance sheet and the income statement can be converted to valuation-relevant cash flows. In particular, we show how to calculate, based on the income statement and the beginning and closing balance sheets, Free Cash Flows (FCFs) and their uses. We show cash flow calculations using the **direct method**, where individual accrual items are converted to cash basis, and the **indirect method**, where the net income is converted to cash basis.

The concept of FCFs is a key concept in valuation that is sometimes difficult for students to grasp: They often confuse the FCFs with the cash flows reported in the accounting cash flow statement. We emphasize the differences between the two cash flow measures:

- Accounting cash flows are calculated from the *shareholders' point of view*, while for valuation of assets and firms we want the cash flows that can be distributed to *all security holders*: stockholders, bondholders, preferred stockholders, convertible bondholders etc.

- Accounting cash flows are even incomplete with respect to the shareholders' point of view when there are *contingent payments*. For example, when the firm has convertible bonds only the interest portion of the cost of the convertible bond is recorded as an expense while the appreciation of the conversion option value is not.

- The FCFs are *operating* cash flows—cash flows generated by the main business of the firm that are only subject to *business* risk, while the accounting cash flows lump together *operating* and some *financial* cash flows (e.g., interest is included, principal redemption is not).

Since this concept is often unfamiliar to students, we illustrate the computation of FCFs using the financial statements of IBM. We later do the same thing with the Hacker Computers case.

We proceed with a review of accounting principles using the Hacker Computers case. The review is a rudimentary one. Hence, we typically do not teach the case in class; rather, we ask the students to review the material on their own. The focus of the review is on the economic interpretation of accounting figures and on the presentation of accounting records in the worksheet format. Moreover, to verify that the principles of working with accounting statements in worksheets and the interactions among the income statement, the balance sheet, and the cash flow statement are clear to the students, we ask the students to replicate some of the work-sheet examples in the text (and to do the end-of-chapter problem 2.1).

In our review of accounting principles and techniques we emphasize:

- The difference between measuring performance using accrual earnings and using periodical cash flows to measure performance.
- Classifying events as operating or financial in nature to base the way we record the events rather than using the accounting classification of assets vs. liabilities.
- The interaction among the income statements, balance sheets, and cash flow statements.

We also use the chapter to introduce a convention we use throughout the book: We capitalize all items that refer to specific items in financial statements. For example "Sales" refers to the first line on the income statements whereas "sales" means simply the sales of the firm.

Cases that can be used with the chapter

We have found that the best case to accompany this chapter is a case based on the financial statements of an actual firm: We distribute to the students copies of the financial statements (or 10Ks) of a firm and ask them to:

- Put the income statements and balance sheets of the last three years in the worksheet format with each item linked to other items via the accounting relations (e.g., the year-end "Retained Earnings" in the balance sheet is the initial Retained Earnings plus the Retained Earnings from the year's income statement);
- Generate, via the accounting relations, cash flow statements using either the direct or indirect method;

- Verify that the cash flow statements "close the model": That when the bottom line of the cash flow statement feeds into the "Cash" item of the closing balance sheet, the balance sheet remains balanced. (This is often not achieved in the first attempt.)

- Compare the entries in the cash flow statement they generate to the cash flow statement and the notes to the financial statements prepared by the company and try to explain the differences.

The last part of the exercise often makes it abundantly clear that not all information is contained in the financial statements of firms and that sometimes the analyst must ask additional questions or guess what explains certain items in financial statements.

Cases that may illustrate accounting identities and their relations to cash flows are:

Harvard: Butler Lumber Co., Play Time Toy Co., Hampton Machine Tools
Bruner: De Laurentiis Entertainment Group, Columbia Mills Inc.,

We recommend that, besides dealing with the main issues of these cases, the students be asked to generate integrated income statements, balance sheets, and cash flow statements.

Solutions to End-of-Chapter Problems

Problem 2.1

Following the manner of presentation in the chapter, we reflect the transactions of Hacker International in the period in the spreadsheet format: We enter each item as a separate row in the spreadsheet and enter transactions as adjustments to these items, making sure that the adjustments to the assets and liabilities sides of the spreadsheet are always equal. We believe that this is the easiest way to get non-accounting students to develop intuition for the relation between accounting principles and pro-forma statements.

Note: Throughout the chapter we have not mentioned **journal entries**! Depending on your class level and sophistication, now is the time to do so.

	June 30	Sales[1]	Parts	Pay A/P	Old A/R	Expenses	Equipmt.[2]	Debt	Taxes[3]	Balance
Cash	324,000	2,750,722	-650,000	-115,000	223,000 -9,322 -8,000	-117,958	-82,000	-6,150 -36,000	-140,682	**2,132,610**
A/R	223,000	617,833			-223,000					**617,833**
Parts	45,900		1,322,880 -850,433 -253,451							**264,896**
Finished Goods	39,800		253,451							**293,251**
Property-cost	420,000									**420,000**
Property-deprn.	(1,000)						-4,500			**-5,500**
Equipment-cost	80,000						82,000			**162,000**
Equipment-deprn.	(75,000)						-4,100 -2,500			**-81,600**
Goodwill	250,678									**250,678**
TOTAL	**1,307,378**	**3,368,555**	**-177,553**	**-115,000**	**-17,322**	**-117,958**	**-11,100**	**-42,150**	**-140,682**	**4,054,168**
A/P	115,000		672,880	-115,000						**672,880**
Taxes Payable	140,682								935,997 -140,682	**935,997**
Def. Coll. Costs	8,000	21,624			-8,000					**21,624**
Advances	5,000									**5,000**
Note (to Cheng)	400,000							-20,000		**380,000**
Mortgage	106,000							-3,000		**103,000**
Stock	15,625									**15,625**
Paid Over Par	294,375									**294,375**
Retained Earnings	222,696	3,346,931	-850,433		-9,322	-117,958	-11,100	-19,150	-935,997	**1,625,667**
TOTAL	**1,307,378**	**3,368,555**	**-177,553**	**-115,000**	**-17,322**	**-117,958**	**-11,100**	**-42,150**	**-140,682**	**4,054,168**

[1] Sales of $3,468,322 are recorded as follows:
Cash: $2,850,489 less 3.5% collection costs = $2,750,722
Accounts Receivable: $617,833
Deferred Collection Costs: 3.5% of 617,833 = $21,624
Addition to Retained Earnings: $3,346,931

[2] Depreciation is the sum of quarterly charges on the new equipment ($4,100), store ($750), and Cheng's P&E ($6,250).

[3] Tax accounts are adjusted in accordance with the following P&L and the existing tax balances.

PROFIT AND LOSS	
Sales	3,468,322
COGS	850,433
Bad Debts	9,322
Collection Costs	121,391
Misc. Expenses.	117,958
Depreciation	11,100
Interest	19,150
Profit Before Tax	**2,338,426**
Taxes (@ 40%)	935,997
Profit After Tax	**1,402,429**

Note that amortization of goodwill is **not** an expense for tax purposes. Therefore, Hacker's taxable income is $2,338,426+$1,567=$2,339,993, taxed at the rate of 40%.

Based on the income statement and the beginning and closing balance sheets we can compute the **cash flow statement** for Hacker:

HACKER INTERNATIONAL CASH FLOW STATEMENT FOR 3rd QUARTER		
Profits after Tax	1,402,429	
Depreciation	10,075	
Change in Goodwill	1,567	
Change in Accounts Receivable		394,833
Change in Inventory		472,447
Change in Accounts payable		557,880
Changes in Taxes Payable		795,315
Changes in Collection Costs		13,624
Changes in Advances		(5,000)
Net change in NWC	(494,539)	
Add back After-tax Interest	11,490	
Cash flow from Operations	**1,920,100**	
Capital Expenditures: Equipment	82,000	
Free Cash Flow	**1,838,100**	

Note that the increase in current liabilities ($1,361,819) was actually larger than the increase in current assets ($867,280), so that cash was *supplied* to Hacker by the change in net working capital!

We can check the calculations by observing that the FCF less the financial flows of the period give the change in the cash account:

Free Cash Flow	1,838,100
Change in Long-Term Debt (mortgage and Cheng note)	(23,000)
After-tax Interest payment	(11,490)
Change in Cash	1,803,610

Problem 2.2

Since the two producers are equal in all respects except their machines, the only difference in their respective income statements is the depreciation charges that are included in the Cost of Goods Sold (COGS). If the cost of the machines appreciated at the rate of the overall change in the purchasing power of money—inflation, then NEW's depreciation charges (and COGS) would be higher than OLD's depreciation charges (and COGS). The higher COGS of NEW translate into lower earnings than OLD's earnings.

When there are no taxes, since depreciation is not a cash flow, the cash flows of the two firms will be the same. *When there are taxes*, the high depreciation charges of NEW lower its tax payments. Hence, the cash flows of NEW (both the Free Cash Flows and the stockholders' cash flows, which are *after-corporate-tax* cash flows) will be higher than the cash flows of OLD. Thus, when there are taxes, OLD will have higher earnings but lower cash flows.

Problem 2.3

To complete the balance sheet of the firm we first compute Total Assets for both years. We then use the addition to Retained Earnings reported in the income statement of year 1 to calculate the Retained Earnings of the end of year 0 ($163 - $63). Debt is then computed as the number that balances the balance sheet.

Year-end balance sheet

	Year	0	1
Assets			
Cash		100	90
Other Current Assets		150	153
Fixed assets			
At cost		1,000	1,150
Accumulated Deprec.		(300)	(415)
Total		**950**	**978**
Liabilities			
Non-debt Current Liabilities		70	75
Debt (short & long term)		380	340
Equity			
Stock		400	400
Retained Earnings		100	163
Total		**950**	**978**
Profit & Loss			
Sales		1,000	1,050
COGS (excluding depreciation)		(700)	(730)
Depreciation (annual expense)		(100)	(115)
Interest		(30)	(30)
Profit before Tax		170	175
Taxes (@ 40%)		(68)	(70)
Profit after Tax		102	105
Dividend		(40)	(42)
Retained Earnings		62	63
Cash Flow Statement			
Net Income			105
Add back after-tax interest			18
Depreciation			115
Change in non-cash NWC			2
Cash from Operation			**240**
Investment in Fixed Assets			(150)
Free Cash Flow			**90**
After-tax interest			(18)
Debt repayment			(40)
Dividend			(42)
Increase in Cash			**(10)**

To calculate the Free Cash Flows (FCF), we use the indirect method: We adjust the Net Income of year 1 for the after-tax interest included in the Net Income, the non-cash Depreciation charges, and for the changes in the non-cash working capital items. This gives the cash generated by the business. Deducting the period's investment in Fixed Assets, give the FCF. To check the calculations, we also include the *financial uses* of the FCF to derive the change in the Cash account as the residual.

Cash Flow Statement	
Net Income	105
Add back after-tax interest	18
Depreciation	115
Change in non-cash NWC	2
Cash from Operation	**240**
Investment in Fixed Assets	(150)
Free Cash Flow	**90**
After-tax interest	(18)
Debt repayment	(40)
Dividends	(42)
Increase in Cash	**(10)**

Chapter 3: Valuation: Processes and Principles

Overview and objectives

After reviewing (in Chapters 1 and 2) the basic valuation and accounting tools, we begin in this chapter the detailed discussion of valuation of assets, firms, and securities. As the first chapter in this detailed discussion, the purpose of this chapter is twofold:

- To present the general principles of valuation
- To illustrate a typical valuation with a very simple case—the "Motel Case."

We generally spend about 3 hours on teaching this chapter, with a substantial portion of the time devoted to the "Motel Case."[1]

Chapter structure

The valuation process

In this section we describe the valuation process in a sequential manner—beginning with an analysis of the environment and gradually focusing on the firm itself—where each step reflects our perception of the encompassing environment. This presentation of the thought process underlying valuations may erroneously cause students to think that all valuations are sequential. Hence, we emphasize in class presentations that the various steps of a valuation are typically done concurrently and are updated (when needed) in any order.

Sequential valuation vs. direct valuation

The objective of valuations is often to value the *equity* claims of the firm. The valuation process we present is section 2 of the chapter and follow in the remainder of the book is a process where we first value the *whole* firm. In the second stage of this process, this value is divided among the holders of the various securities the firm has issued, with equity being valued as the residual claim. The alternative, which is often used in practice, is to value equity directly by forecasting and discounting *equity* cash flows at the equity's cost of capital.

[1] Appended to this chapter of the Instructor's Manual is a short explanation of the use of data tables in spreadsheets. This is an invaluable technique for producing sensitivity and scenario analyses. The instructor may photocopy this appendix and hand it out to the class.

In this section we explain why, while the direct valuation of equity may give the same answer if properly applied, the sequential valuation of equity is simpler to implement. Moreover, when firms have issued continent claims, such as employee stock options, theory requires that the contingent claims and the equity be valued *conditional on the value of the whole firm*, which means that the sequential valuation process is the only feasible route to take. Hence, in class, we emphasize the counter-intuitive point that the sequential valuation process, which appears unnecessarily long, is actually the short (or even—in many cases—the only) way to value equity.

Some general valuation rules

In this section we present some fundamental valuation rules:

- *Value cash flow streams*—students often value firms by discounting earnings instead of cash flows. We use an example to illustrate the difference.

- *Deal consistently with inflation*—inflation is an issue that students often neglect to address (e.g., using nominal discount rates to value cash flow streams of constant purchasing power). In class we emphasize that in valuations accounting for the effects of inflation on cash flows and discount rates may be critical since the projection horizon is often long, meaning that even low inflation rates compound to significant effects.

- *Match the discount rate to the characteristics of the cash flows*—this is a general principle. We stress:

    Using WACC to discount Free Cash Flows and the cost of equity to discount equity cash flows

    Matching nominal discount rates to nominal cash flows and real discount rates to real cash flows

- *Accounting for the exact timing of cash flows*—We point out that operating cash flows occur *throughout* the year while most worksheet formulas assume that CFs occur *at year ends*. We show how to do mid-year discounting using worksheet formulas when the term structure of discount rates is flat.

- *Double-checking*—We emphasize in our class discussion that the process of valuation entails *estimating* values rather than *calculating* them. Thus, it is always advisable to estimate parameters (whenever possible) by more than one way.

The Country Motel—Case Study

One purpose of this case is to teach students how to do a simple cash flow projection. The big spreadsheet (Exhibit 3.1) may look daunting, but on examination it is readily understood. In the book and in class presentations we stress to students that the cash flows are that of the *equity owners* of the motel.

Another important aspect of this case is the use of pro forma profit and loss (P&L) statements. For many students this will be the first time they have encountered a pro forma. We use the opportunity to provide a general idea of pro formas and their use:

- A pro forma looks like an accounting statement. The difference is that an accounting statement relates to historical events, whereas a pro forma is a *prediction* of what the accounting statement will look like.

- The pro forma P&L in the case can be generated wholly from the cash flow table. Ask students:

  Which lines to ignore? (the lines relating to the Mortgage Principal payments).

  Does the pro forma P&L assume that the Motel operates on cash or on accrual basis? (Cash basis; Otherwise we have to exclude the collection of the preceding year's December billings, include this year's uncollected December billings, etc.. This is an opportunity to review *accrual* and *cash-based* accounting.)

  How to reconcile the pro forma P&L's Cash Flow to Equity with that generated from the cash flow spreadsheet? (Answer: reconcile the taxes).

- The forecast of FCFs can be based on the pro forma P&L: We have to adjust Net Profits for Depreciation (adding it back) and for Interest (by adding back the after-tax interest expense). Students often do not understand why interest is added back. We tell them:

  FCFs reflect *only business-related cash flows*. Since the Net Profit is computed *after deducting* $(1-t_c)$**interest*, which is a financial flow, this must be added back.

  The calculation of FCFs for the motel doesn't include two items usually found in FCF calculations:

  Investment in Fixed Assets—the assumption is that these are zero.

Changes in NWC—there are no) NWC accounts in the calculation of the FCF, because the Motel's financial statements are on cash basis.

Valuing the motel

The discussion in the text is largely self explanatory. Important points are:

- We have to distinguish between real and nominal cash flows: The operating flows from the motel are real. (because they are expected to adjust with inflation) while the depreciation tax shields are nominal (because they're based on historical numbers).

- We value the *whole motel* first and then find the value of the motel's equity (i.e., the value of the owners' investment) by subtracting out the value of the motel's mortgage. This is a simple example of the *sequential valuation* method.

Cases that can be used with the chapter

We have found that the best case to use with this chapter is to ask the students to replicate the pro forma and cash flow worksheets of the Motel case and the valuation illustrations. We then ask them to do several variations of the base case. (Some possible variations are included in the end-of-chapter review problems.) Other cases that can be done with the chapter are cases that illustrate simple DCF valuations:

Harvard: MRC (A), Interco
Bruner: Johnson's Nursery, Alfin Fragrances Inc

Solutions to End-of-Chapter Problems

Problem 3.1

To answer this question, we encourage students to build a spreadsheet. The first part of this spreadsheet looks like this:

	A	B
1	principal	300,000
2	interest rate (annual)	8%
3	maturity (years)	10
4	monthly payment	$3,639.83

The cell with the monthly payment contains the Excel formula: **= - PMT(B2/12,B3*12,B1)**.[2] We can now show students how to build a *loan table*:

	A	B	C	D	E
1 **2** **3**	**Period**	**Principal at the beginning of the period**	**Monthly mortgage payment**	**Interest portion**	**Principal portion**
4	1	300,000.00	3,639.83	2000.00	1,639.83
5	2	298,360.17	3,639.83	1989.07	1,650.76
6	3	296,709.41	3,639.83	1978.06	1,661.77
7	4	295,047.65	3,639.83	1966.98	1,672.84

The table shows the decomposition of the mortgage payments between interest and principal and the remaining principal at the beginning of each period. The answer to this question is contained in periods 13-24 of the above table. (An instructor wanting to make an important point about present values can show students that at the end of the 10 years, the remaining principal is in fact zero.

Problem 3.2

The spreadsheet which produces the cash flow and the pro-forma Profit and Loss is given in the disk accompanying this manual in the file PROB03.XLS, on the worksheet entitled "Problem

[2] The negative sign before **PMT** is necessary since otherwise Excel produces a negative number.

2.” The pro forma Profit & Loss statement appears starting at line 50. Varying the marginal cost per guest from $5 to $3 produces the following P&L:

PRO FORMA PROFIT AND LOSS

Total Cash Inflow	366,762
Expenses	
personnel	81,360
other expenses	100,298
mortgage interest	32,278
Taxes	
property taxes	30,000
hotel taxes	38,759
Depreciation	20,000
Total expenses	302,694
Profit before taxes	64,068
State tax (3.2%)	2,050
Federal tax (28%)	17,365
Profit after taxes	44,653
Add back depreciation	64,653
Less mortgage principal payments	4,881
cash flow to equity owners	59,771

Increasing all room costs by 10% produces the following P&L:

PRO FORMA PROFIT AND LOSS

Total Cash Inflow	403,438
Expenses	
personnel	81,360
other expenses	121,030
mortgage interest	32,278
Taxes	
property taxes	30,000
hotel taxes	42,085
Depreciation	20,000
Total expenses	326,752
Profit before taxes	76,686
State tax (3.2%)	2,454
Federal tax (28%)	20,785
Profit after taxes	53,447
Add back depreciation	73,447
Less mortgage principal payments	4,881
cash flow to equity owners	68,566

Problem 3.3

To answer this question, it is worthwhile teaching students how to use the **Data|Table** feature of spreadsheets. Instructors may reproduce the appendix to this chapter and distribute it to their classes. A data table varying the number of rooms gives:

	equity cash flow	free cash flow
rooms		
25	46,454	72,699
30	102,789	111,962
35	159,124	151,225
40	215,458	190,488
45	271,793	229,751
50	328,128	269,014
55	384,462	308,277
60	440,797	347,540

(This data table appears starting at row 101 of the worksheet labeled "Problem 2" in the file PROB03.XLS.)

Varying the number of rooms and using the worksheet labeled "Problem 3" in the file PROB03.XLS gives:

	equity cash flow	free cash flow	motel value	equity value
rooms				
25	46,454	72,699	367,868	72,243
30	102,789	111,962	532,477	236,852
35	159,124	151,225	697,086	401,461
40	215,458	190,488	861,695	566,070
45	271,793	229,751	1,026,304	730,679
50	328,128	269,014	1,190,913	895,288
55	384,462	308,277	1,355,522	1,059,897
60	440,797	347,540	1,520,131	1,224,506

Note that these calculations are based on the assumption that the amount of the mortgage is constant.

Problem 3.4

The answer is given on the worksheet entitled "Problem 4":

MOTEL CASH FLOWS ON A MONTHLY BASIS

assuming 2/3% monthly cost of negative bank balances and 0.6% monthly interest on positive bank balances

	percent	rate
double occupancy	60%	$55.00
single occupancy	40%	$45.00
occupancy rate (percent)	71%	
marginal cost per guest/night	$5.00	
rooms	25	
taxes	11%	
December taxes payable	5,500	

	January	February	March	April	May	June	July	August	September	October	November	December
days in month	31	28	31	30	31	30	31	31	30	31	30	31
initial cash balance	3,456	-5,752	3,805	-13,689	-5,459	6,789	18,151	11,543	23,797	35,261	26,756	38,238
Inflows												
billings	28,063	25,347	28,063	27,158	28,063	27,158	28,063	28,063	27,158	28,063	27,158	28,063
hotel taxes on billings	3,087	2,788	3,087	2,987	3,087	2,987	3,087	3,087	2,987	3,087	2,987	3,087
interest from bank	21	0	23	0	0	41	109	69	143	212	161	229
total inflows	31,170	28,135	31,172	30,145	31,150	30,186	31,259	31,219	30,288	31,361	30,305	31,379
Outflows												
personnel costs	6,780	6,780	6,780	6,780	6,780	6,780	6,780	6,780	6,780	6,780	6,780	6,780
hotel taxes	5,500	3,087	2,788	3,087	2,987	3,087	2,987	3,087	3,087	2,987	3,087	2,987
Federal taxes	2,500			2,500			2,500			2,500		
state taxes	500			500			500			500		
property tax			30,000									
marginal costs, guests	4,402	3,976	4,402	4,260	4,402	4,260	4,402	4,402	4,260	4,402	4,260	4,402
insurance	16,000						16,000					
utilities	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300
maintenance	300	300	300	300	300	300	300	300	300	18,300	300	300
total outflow, before mortgage	37,282	15,443	45,570	18,727	15,769	15,727	34,769	15,869	15,727	36,769	15,727	15,769
mortgage												
beginning principal	295,625	295,238	294,848	294,454	294,057	293,656	293,251	292,843	292,431	292,015	291,595	291,171
monthly payment	3,097	3,097	3,097	3,097	3,097	3,097	3,097	3,097	3,097	3,097	3,097	3,097
of which:												
interest	2,710	2,706	2,703	2,699	2,696	2,692	2,688	2,684	2,681	2,677	2,673	2,669
principal	387	390	394	397	401	405	408	412	416	420	424	427
interest to bank	0	38	0	91	36	0	0	0	0	0	0	0
total outflow	40,379	18,578	48,667	21,915	18,902	18,823	37,866	18,965	18,823	39,866	18,823	18,866
cash flow to owners	-9,208	9,557	-17,494	8,230	12,247	11,362	-6,607	12,253	11,464	-8,505	11,482	12,513
ending cash balance	-5,752	3,805	-13,689	-5,459	6,789	18,151	11,543	23,797	35,261	26,756	38,238	50,751
total cash flow	**47,295**											

Problem 3.5

To answer this question, we go back to the original spreadsheet, decreasing the personnel expenses by 12*(4000*1.08+300); see worksheet "Spreadsheet 3":

PRO FORMA PROFIT AND LOSS

Total Cash Inflow	366,762
Expenses	
personnel	25,920
other expenses	121,030
mortgage interest	32,278
Taxes	
property taxes	30,000
hotel taxes	38,759
Depreciation	20,000
Total expenses	267,986
Profit before taxes	98,776
State tax (3.2%)	3,161
Federal tax (28%)	26,772
Profit after taxes	68,843

Appendix: Data Table Commands[1]

A.1. Introduction

Data table commands are powerful commands that make it possible to do complex sensitivity analyses. In common with most other spreadsheets, Excel offers the opportunity to build a table in which one or two variables are changed. Excel is unusual in that its data tables are array functions, and thus change dynamically when related spreadsheet cells are changed. In this handout you will learn how to build both one-dimensional and two-dimensional Excel data tables.

A.2. An example

Consider a project which has an initial cost of $1,150, and seven subsequent cash flows. The cash flows in year 1-7 grow at rate *g*, so that the cash flow in year t is $CF_t = CF_1 * (1+g)^{t-1}$. Given a discount rate *r*, the net present value (NPV) of the project is

$$NPV = -1{,}150 + \sum_{t=1}^{7} \frac{CF_1 * (1+g)^{t-1}}{(1+r)^t}$$

The internal rate of return (IRR), *i*, is the rate at which the NPV equals zero:

$$-1{,}150 + \sum_{t=1}^{7} \frac{CF_1 * (1+g)^{t-1}}{(1+i)^t} = 0$$

These calculations are easily done in Excel:

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[1] This handout is taken from *Numerical Techniques in Finance* by Simon Benninga, published by MIT Press (2nd edition forthcoming, 1997). MIT Press has authorized instructors using *Corporate Finance: A Valuation Approach* by Simon Benninga and Oded Sarig to reproduce this handout for instructional use only.

	A	B	C	D	E	F	G	H	I
1	CF_1	234							
2	growth rate	10%							
3	discount rate	15%							
4									
5	year	0	1	2	3	4	5	6	7
6									
7	cash flow	-1150.00	234.00	257.40	283.14	311.45	342.60	376.86	414.55
8	NPV	101.46	= +B6+NPV(B3,C6:I6)						
9	IRR	17.60%	= IRR(B6:I6,0)						

Note the cell addresses for the growth rate, the discount rate, the NPV and the IRR. They will be needed below.

A.3. Setting up a data table

Suppose we want to know how the NPV and IRR are affected by a change in the growth rate. The command **Data|Table** allows us to do this simply. The first step is to set up the table's structure. In the example below, we put the formulas for the NPV and IRR on the top row and we put the variable we wish to vary (in this case the growth rate) in the first column. At this point the table looks like this:

	F	G	H	I	J
10			NPV	IRR	
11			101.46	17.60%	
12		0			
13	growth	5%			
14	rate	10%			
15		15%			
16					

The actual table (as opposed to the labels for the columns and the rows) is outlined in the dark border. The numbers directly under the labels "NPV" and "IRR" refer to the corresponding formulas in the previous picture. That is: If the cell B8 contains the calculation for the NPV, then the cell under the letters "NPV" contains the formula **=B8**. Similarly, if the cell B9 contains the original calculation for the IRR, then the cell under "IRR" in the table contains the formula **=B9**.

It is helpful to think of a Data Table spreadsheet as having two parts:

- A basic example.
- A table which does a sensitivity analysis on the basic example. In our example, the first row of the table contains references to calculations done in our basic

example. While there are other ways to do Data Tables, this structure is both typical and easy to understand.

Now do the following:

- Mark the table area (outlined in the dark border).

- Activate the command **Data|Table**. You will get a dialog box which asks you to indicate a **Row Input Cell** and/or a **Column Input Cell**. In this case, the variable we wish to change is in the left-hand column of our table, so we leave the Row Input Cell blank and indicate the cell B2 (this cell contains the growth rate in our basic example.) in the Column Input Cell box.

Here's the result:

	F	G	H	I	J
10			NPV	IRR	
11			101.46	17.60%	
12		0	-176.46	9.71%	
13	growth	5%	-47.82	13.67%	
14	rate	10%	101.46	17.60%	
15		15%	274.35	21.50%	
16					

A.4. Building a two-dimensional data table

We can extend the example above by adding columns, thus allowing us to vary *many* formulas while changing one parameter. We can also use the **Data|Table** command to vary *one* formula while changing *two* parameters.

Suppose, for example, that we want to calculate the NPV of the cash flows for different growth rates and different discount rates. We create a new table which looks like this:

	F	G	H	I	J	K
18			discount rate			
19		101.46	7%	10%	12%	
20	growth	0				
21	rate	5%				
22		10%				
23		15%				
24						

The upper left-hand corner of the table contains the formula **=B8** as a reference to the basic example.

We now use the **Data|Table** command again. This time we fill in both the **Row Input Cell** (indicating cell B3, the site of the discount rate in our basic example) and the **Column Input Cell** (indicating B2). Here's the result:

	F	G	H	I	J	K
18			discount rate			
19		101.46	7%	10%	12%	
20	growth	0	111.09	-10.79	-82.08	
21	rate	5%	297.62	150.74	65.13	
22		10%	515.79	339.09	236.44	
23		15%	770.34	558.25	435.41	
24						

A.5. An esthetic note: hiding the formula cells

Data tables tend to look a bit strange, because the formula being calculated shows up in the data table (in our examples: in the top row of the first data table, and in the left-hand top corner of the second data table). You can make your tables look nicer by *hiding* the formula cells. To do this, mark the offending cells and use the **Format Cells** command (or press the right mouse button and go to the **Number Format**). In the dialog box go to the box marked **Code** and insert a semicolon into the box. The cell contents will now be hidden. This gives the following result.

	F	G	H	I	J
10			NPV	IRR	
11					
12		0	-176.46	9.71%	
13	growth	5%	-47.82	13.67%	
14	rate	10%	101.46	17.60%	
15		15%	274.35	21.50%	
16					

A.6. Excel data tables are arrays!

This means that Excel data tables are dynamically linked to your initial example. When you change a parameter in the original example, the corresponding column or row of the data table changes. For example, if we change our discount rate in the basic example from 15% to 12%, here's what will happen in the data table pictured above:

	F	G	H	I	J
10			NPV	IRR	
11					
12		0	-82.08	9.71%	
13	growth	5%	65.13	13.67%	
14	rate	10%	236.44	17.60%	
15		15%	435.41	21.50%	
16					

Chapter 5: Analyzing the Firm's Environment

Overview and objectives

The purpose of Chapters 5 and 6 is to give the reader enough tools to build a sensible pro forma model of the firm. To this end the reader needs two types of tools:

- Tools which enable the prediction of the firm's sales. This is the subject of the current chapter. The general approach of this chapter is first to predict industry sales, and then to try to predict the firm's market share within the industry.

- Tools which enable the conversion of sales predictions to a full pro forma model of the firm. This is the subject of Chapter 6.

Chapter structure

The analysis of macroeconomic activity

This section discusses basic macroeconomic concepts which are central to the prediction of sales. Most students will have some acquaintance with the concepts of GNP and GDP, but many students will be relatively unfamiliar with Leading Economic Indicators and their connection to the prediction of future economic activity. In keeping with remarks made in earlier chapters, we stress the importance of understanding the difference between real and nominal growth of GNP and GDP.

The effect of macroeconomic conditions on industries

The central example of this section—the prediction of automobile sales in the U.S. and their relation to GDP—is worthy of some classroom attention. We stress to students:

- On the one hand, the prediction of sales derives from careful consideration of the relation between the sales of a specific industry and the relevant macroeconomic aggregates. On the other hand, a fair bit of "data mining" is often involved: We look for relations which work, often not knowing *ex ante* which of the many possible relations will best do the job.

- Students should be asked about the importance of R^2. The impression many students are left with in statistics courses is that an R^2 of less than 90% is indicative of little or no relevance. We like to stress that an R^2 of *more than 60-70%* is often totally implausible: It is highly unlikely that important economic variables contain such a small unmodeled/unexplained component![1]

Projecting long-run industry sales

We try to imbue our students with a healthy scepticism about their (or anyone else's!) ability to predict a firm's long-run sales in any but the crudest fashion. We know of no evidence that sophisticated econometric models are very useful in long-run sales prediction.

Students should understand that in most cases focusing on short-run prospects and using simple linear long-run projections is probably the best they can do. In some cases (our example of predicting car sales is a good example), some data mining may be helpful. They should also appreciate that the product life cycle concepts of marketing are useful qualitative tools in the prediction of sales.

Competition analysis and the projection of the firm's sales

Having predicted industry sales, we are left with the problem of predicting the sales of the specific firm being analyzed. One approach to this problem is to try to estimate markets share, which naturally embed individual sales projections within the larger industry picture. We propose a simple marketing model that assumes that the firm's market share is proportional to its share of the industry's marketing efforts. The model—while obviously no panacea for a firm's sales projections—is one approach an analyst may want to use to predict sales.

[1] In Chapter 7, when we try to build a model for the sales of J. M. Smucker, this point becomes even more important: It is extraordinarily simplistic to believe that anything more than 60% of Smucker's future sales should be predictable by the growth of households.

Solutions to End-of-Chapter Problems

Problem 5.1

The relation estimated in the chapter is:

$$Annual\ Car\ Sales = 6.76MM + 0.375 * GDPGrowth(\%)$$

a. Assuming the real growth rates given in the question:

year	real GNP growth	car sales (million)
1997	2%	7.51
1998	3%	7.89
1999	2%	7.51

b. The expected dollar sales of the industry are calculated in the following table:

year	Car sales (million)	Compounded inflation effect	Nominal car price	nominal sales ($ billion)	Constant dollar sales
1995	7.51	3.00%	15,450	116.03	119.51
1996	7.89	6.09%	15,914	125.48	125.48
1997	7.51	9.27%	16,391	123.10	119.51

c. Given that the share of foreign manufacturers will increase to 50%, domestic producers' share will fall from 60% to 50% and they will sell in 1997 five sixths of what they would sell otherwise. This means sales of (5/6) * 7.51 = 6.26 million cars.

Problem 5.2

a. To answer this question we need to figure the relative expected marking expenses of the four manufacturers. We do this by relating their current market shares to normalized marketing expenses and increasing these normalized expenses per the planned changes:

manufacturer	1997 market share	Normalized marketing expenses	Expected 1998 expenses	Expected 1998 shares
A	35%	35	42.00	37.00%
B	30%	30	33.00	29.07%
C	25%	25	27.50	24.23%
D	10%	10	11.00	9.69%
	100%	100	113.50	100.00%

b. If marketing expenses are the only determinant of market shares, relative market shares and relative marketing expenses are the same. We assume that the effect of a reduction in price is the same as an increase in marketing expenses, i.e., that a reduction in sales price in a competitive industry is tantamount to other spending on marketing efforts. We further assume that total industry sales will remain as they were in 1997—$600 million.

Even with these assumptions, this is a difficult problem to solve. The problem is that the sales of manufacturer A determine the level of its marketing expenses, which determine its market share, which determine its sales. That is, we have a circularity. We solve this circularity numerically using the following worksheet structure:

manu- facturer	1997 market share	1997 sales	1997 marketing expenses	1998 marketin g expenses	1998 market share	1998 sales
A	35%	210	10.50	15.89	44.90%	269.37
B	30%	180	9.00	9.00	25.43%	152.60
C	25%	150	7.50	7.50	21.19%	127.16
D	10%	60	3.00	3.00	8.48%	50.87
				35.39		600.00

Problem 5.3

To answer this question we need to interpolate the specific growth rates projected for the short run and the industry-wide growth rate projected for the long run. Thus, growth in the year 2000 is projected as the average of the last specific growth rate projected—1999's growth rate of 7%—and the long-run growth rate of 2%.

Year	Sales growth	Sales	Projection method
1996		240.0	**specific**
1997	12.0%	268.8	**annual**
1998	9.0%	293.0	
1999	7.0%	313.5	**projections**
2000	**4.5%**	327.6	**interpolation**
2001	2.0%	334.2	
2002	2.0%	340.8	**long-run**
2003	2.0%	347.7	**growth**
2004	2.0%	354.6	
2005	2.0%	361.7	**rate**

Chapter 6: Analyzing the Firm's Operations

Overview and objectives

The purpose of this chapter is to teach students to do a thorough analysis of the firm's mode of operations, primarily via a careful analysis of the financial statements of prior years. The result of such an analysis should be a set of relations, mostly expressed as financial ratios, that can be used to project the firm's pro forma financial statements. The ultimate objective is, of course, the conversion of sales projections, discussed in the preceding chapter, to consistent projections of the firm's free cash flows to be used in the valuation. Thus, we conclude the discussion of each element of ratio analysis with a discussion of how the predicted relations can be converted into a prediction of the corresponding financial statement items.

Chapter structure

Principles of ratio analysis

We begin with a discussion of the principles of any ratio analysis. We emphasize that the objective of ratio analysis is to generate **economically meaningful relations** that can be interpreted and projected. In particular, we emphasize that to predict reasonable ratios we should base our projections on a comparison to standards—ratios of prior years, average ratios of similar firms, and economic determinants of the ratios.

Analyzing Acme-Cleveland and its industry

Throughout the chapter we use the financial statements of Acme-Cleveland (AMT)—a machine tools firm—and its industry as a vehicle to illustrate ratio analysis. The data for this example is on the disk accompanying this manual, in the file CHAP06.XLS. Instructors may want to distribute this file to their students. In this section we present the firm and the comparable firms.

Analysis of the components of the income statement

This section covers cost ratios. We emphasize to students that, if possible, the allocated components of any cost item (e.g., depreciation charges) should be separated out before any relation (e.g., to COGS to Sales) is estimated. In some cases this may not be possible. For example, we prefer to break down costs between COGS and SG&A and to isolate the depreciation component in each; however, in many cases this is not possible from publicly available information.

We illustrate the use of non-ratio relations by regressing costs of sales to estimate separately the fixed and variable cost components. Students often ask whether we can reliably estimate regression relations with the little data we often have. We emphasize that estimating average ratios is effectively estimating a regression that forces the intercept to be zero, which means that estimating average ratios suffers from the same data limitations.

Tax expenses: Students should realize the difference between statutory, marginal, and average tax rates. When—in Chapter 8—we start to discuss capital structure theory, marginal tax rates are important; in financial statement analysis and pro forma modeling, average rates are important. Both of these differ from the statutory rates. The instructor may want to go back to the Motel Case of Chapter 3 to show how the firm's marginal tax rate can be calculated when statutory rates are known but the state and local taxes are deductible for Federal taxes.

Analysis of the components of working capital

Students find it difficult to believe how important working capital is to the firm.[1] Many more firms go bankrupt over a failure to provide for necessary financing of working capital than over the provision of initial Fixed Assets.

This section covers Accounts Receivable ratios, Current Liabilities ratios, average collection and payable periods, and Inventory days. The instructor should emphasize that the these ratios are not just formulas to be used blindly: Understanding the economic determinants of these ratios (e.g., credit terms, seasonality) is essential to reliably predicting future relation.

Analysis of capital investment requirements

Section 6.5 discusses the projection of the firm's capital investment requirements. There are several important points to be made here:

- To predict capital investment requirements according to capacity needs we need to determine whether capacity is better measured by "Fixed Assets At Cost" or by "Net Fixed Assets." This is equivalent to determining whether capacity deteriorates with age (roughly at the rate of depreciation) or not.

- Utilization of Fixed Assets is an important consideration. Under-utilization may mean that the firm can expand its Sales without needing new Fixed Assets. Ratio analysis often implicitly assumes that the rate of utilization is fixed.

Cases that can be used with the chapter

Harvard: Play Time Toy Co., Dynashears Inc., Science Technology Co. (1985)
Bruner: The Financial Detective, Atlantic Southeast Airlines

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[1] We often discuss this point when discussing the "Super Project" case where the required investment in the project's PP&E is $200K, but the investment in working capital is $269K.

Solutions to End-of-Chapter Problems

Problem 6.1

1991 Sales	120,000
Accounts receivable as of 12/31/91	3,000
Average collection period, 1991	9.13
Increase in Avg. Collection Period *(45 days/30 days)	13.69
Increase in Avg. Collection Period *2	27.375
Expected 1992 Sales	132,000
Expected 12/31/92 AR	9900

Problem 6.2

a. TSR's expected collection period for 1992 year-end is:

$$\frac{1992\ \ Sales/365}{1992\ \ Accounts\ \ Receivable} = \frac{688{,}818/365}{26{,}420} = 14\ \ days$$

b. We estimate TSR's COGS for 1992 on the basis of the ratio of COGS/Sales in 1989-1991:

	1989	1990	1991	1992(P)
COGS as % of Sales	70.00%	70.00%	70.00%	
Expected COGS		688,818 * 70% =		**482,173**

c. We first compute the missing numbers in the financial statements using the average ratios in the other years:

	1989	1990	1991	1992
Average collection period	14.00	14.00		14.00
Expected 1991 A/R			**24,463**	
COGS+SG&A-Depreciation		555,118	599,517	667,489
Average payable period		33.43	33.43	
Expected 1992 A/P				**61,135**

We then compute the respective FCFs:

	1990	**1990**	**1990**
Sales	590,550	637,794	688,818
-COGS	(413,385)	(446,446)	(482,173)
-SG&A	(124,016)	(133,937)	(144,652)
-Change in AR	(1,704)	1,811	1,957
+Change in AP	(3,828)	4,067	6,222
-Change in Prepaid Expenses	345	(367)	(396)
-Change in Inventory	10,960	(11,649)	(12,582)
+Depreciation	17,717	(866)	20,664
Free Cash Flow	**76,639**	**50,407**	**77,858**

Problem 6.3

The trick to answering this problem is to realize that the COGS includes both a **fixed** and a **variable** component. By examining the difference between Sales in 1991 and 1990 versus the difference in COGS for these two years, we come to the conclusion that the **marginal** *COGS* as a percentage of Sales is 70%:

$$\frac{1991\ COGS - 1990\ COGS}{1991\ Sales - 1990\ Sales} = \frac{14{,}000}{20{,}000} = 70\%$$

We can thus estimate that 1992 COGS will be $106,000 = $78,000 + 70%*($140,000-$100,000). This gives 1992 gross profits as $34,000.

Problem 6.4

1998 sales to corporate clients = $100,000 * 80% = $80,000
1998 sales to individuals = $100,000 - $80,000 = $20,000
1999 sales to corporate clients = $80,000 * (1 - 15%) * (1 + 25%) = $85,000
1999 total sales = $20,000 + $85,000 = $105,000

Problem 6.5

a. To estimate 1993 Accounts Receivable:

	1990	1991	1992	1993 (P)
Average collection period	60.00	60.00	60.00	**60.00**
Projected 1993 A/R				**164,907**

b. ABC's 1992 collection from clients was:

Sales	946,400
Previous year's A/R	149,589
End-1992 A/R	(155,573)
Collections	**1,251,562**

c. Since the major client pays in 90 days, end-of-year Accounts Receivable represent the last three months of sales to this client, or 25% of the annual sales made to this client. Since A/R are 16.438% of Sales, this means that this client accounts for 4*16.438% = 65.752% of Sales.

d. To calculate ABC's capital expenditures in 1991:

	1990	1991
PP&E, at Cost:	325,000	346,000
Add back: cost of assets disposed	0	10,000
	325,000	**356,000**
1991 capital expenditures		**31,000**

e. To calculate ABC's Accumulated Depreciation at the end of 1991:

Accumulated Depreciation, 1990	100,000
1991 Depreciation expenses	17,000
Accumulated depr. of disposed asset	(9,200)
Accumulated Depreciation, 1991	**107,800**

f. ABC's 1992 Free Cash Flow:

Net Profits	73,819
+ 1992 Depreciation	18,500
- Increase in A/R	(5,984)
- Increase in Inventory	(2,723)
+ Increase in A/P	3,500
- Increase in PP&E at cost	(21,840)
Free Cash Flow	**65,272**

Problem 6.6.

a. To calculate OVC's 1993 expected EBIT:

OVC's 1992 EBIT	100
1993 industry growth	20%
OVC's 1993 EBIT:	
Under the same market share	120
At half its 1992 market share	**60**

b. SFC's EBIT in 1993 will be smaller than OVC's:

- Like OVC, SFC expects its sales to decline by 40%;
- Unlike OVC, SFC expects its costs to decline by **less than 40%** since some of its costs are fixed.

Chapter 7: J. M. Smucker—Projecting Financial Performance

Overview and objectives

The primary aim of this chapter is to build a full-fledged pro forma model of a firm (in this case, J. M. Smucker, a large manufacturer of jellies and other food products). A secondary, but nonetheless very important aim, is to use the projected FCFs of Smucker to value the firm. Since we have not yet discussed either cost of capital models (Chapters 8 and 9) nor warrant valuation (Chapter 12) in detail, in the discussion of the valuation of Smucker's securities we make some assumptions which will only later be fully justified.

Chapter structure

Sales projection

We project *real* sales growth, not nominal sales growth, adding in expected future inflation to get future *projected nominal* sales. The instructor may wish to discuss with the class why this is different from simply extrapolating sales growth from past nominal sales growth (and to illustrate it with the average historical inflation rate vs. the current expected inflation). The point to emphasize is that economists believe that the underlying fundamental process is a real one, not nominal.

In a class discussion, we sometimes show that by directly regressing the *constant dollar* sales on the number of households, we get the following results:

Constant		(1,460,256)
Std Err of Y Est		6,380
R Squared		98.992%
No. of Observations		7
Degrees of Freedom		5
X Coefficient(s)	20.4344	
Std Err of Coef.	0.9221	

We discuss with students why these results (with their R^2 of 99%!) are unacceptable:

- The high R^2 is fundamentally unacceptable. If the sales of Smucker are 99% explicable by the number of households, what role is there for marketing? Unexpected events? Changes in tastes/incomes? It is inconceivable that the sales of any but the most uninteresting firm should be more than 60%-70% predictable by any parameter. Here we simply get the high R^2 by using a very small number of observations (that probably also fit the prescribed relation quite closely).

- The negative intercept often bothers students since it implies that with zero households, sales will be negative. However, if we view the regression as measuring a *locally linear relation*, the mere fact of a negative intercept derived from sales figures in the range of \$300 - \$500 million is not necessarily problematic.

- The *x* coefficient implies that an increase of one household increases Smucker sales by \$20.43 per annum. This is a large number, considering that not every household buys Smucker products. We often discuss what number we would expect from the students' own experience.

We also discuss with the students an alternative estimation procedure that focuses on *marginal* household/sales relation: Regressing the *change* in sales on the *change* in households. This produces the following results:

Constant		-0.0087
Std Err of Y Est		0.0226
R Squared		0.5865
No. of Observations		6
Degrees of Freedom		4
X Coefficient(s)	5.1284	
Std Err of Coef.	2.1530	

This implies that a 1% change in household growth produces a 5.13% change in sales. Assuming that household growth is 1.4%, the 7% short-term sales growth figure used is derived by *5.13*1.4% . 7%*.

Ratio analysis

In this section we perform a ratio analysis of Smucker. It might be noted by the instructor that the pro forma financials are *simpler* in structure than the historic financials. This is almost always the case: There are some items which are better lumped together (in our case, some of the working capital items are a good example). There are also items which we leave at their current balance sheet value (Other Assets, in this case—we do not know what this is). There are also items, such as Amounts Due from ESOP, which we ultimately eliminate from the pro forma (in this case we net such amounts out from the firm's equity). The specific procedure followed in this chapter is more fully discussed in Exhibit 7.11.

The calculation of the Fixed Asset ratios requires some class discussion. In the body of the chapter we have assumed straight-line depreciation for both reporting and tax purposes; the

Appendix to the chapter discusses how accelerated depreciation might be handled; this is a difficult case, and our standard advice to students (and colleagues!) is to ignore accelerated depreciation unless it is a large factor in the valuation. This produces a reasonable approximation when the firm is in a steady state and, at the very least, can serve as a starting point for more detailed modeling of depreciation.

Pro-forma projections

Section 7.4 puts together the ratio analysis into a pro-forma model similar to those discussed in Chapter 4. This is the place to tie some things together. For example, based on the analysis of how Smucker operates, we have decided that the *balance sheet plug* should be the Cash and Marketable Securities.

Exhibit 7.13 gives a cash flow analysis for the firm.

Terminal value projection

The terminal value (the largest number in the valuation, a very typical situation) can be calculated in a number of ways. If we want to do a terminal value calculation based on DCF, we must also know the appropriate discount rate. Thus, this section discusses both the CAPM RADR and the calculation of the terminal value. Note that we do only one terminal value projection, using the Gordon formula. In practice we would double-check this terminal value by using some other method—probably multiples.

At this point in the book we have not yet discussed the cost of capital. In Chapter 8 we show that the cost of equity using the CAPM should be calculated using a tax adjusted SML:

$$RADR = r_f\,(1-t_c) + \beta\left[E(r_M) - r_f\,(1-t_c)\right]$$

In the text we do not give a full explanation, instead, we write (without explaining the tax adjustments):

$$RADR = 3\% + 0.9\left[12\% - 3\%\right] = 11.1\%$$

Illustrative valuation

In Section 7.6, we value Smucker. Important points are:

- The use of midyear discounting (discussed previously in Chapters 3 and 4). This adds about 5% to the value over the standard end-of-year discounting, a point overlooked in many valuation courses.

- Valuation of Smucker debt at book value. In this case, the Debt is of minor importance. A full debt valuation must wait until Chapter 11.

- The simultaneous valuation of Smucker shares and warrants. We use a highly simplified option pricing model, which values the warrants at their intrinsic value; footnote 13 offers a slightly more sophisticated alternative. In Chapter 12 we return to the Smucker warrants, using the Black-Scholes formula to value them and using price data to calculate the stock price volatility.

Cases that can be used with the chapter

Harvard: Kennecott Copper Co. (in previous editions of the Harvard case book), E. I. du Pont de Nemours and Company, John Case Company

Bruner: ASA, Brown-Forman

Chapter 8: Capital Structure and the Cost of Capital

Overview and objectives

Chapter 8 is the first really "theoretical" chapter in *Corporate Finance: A Valuation Approach*. Up to this point all of the student's energies have been directed towards deriving an integrated modeling framework which can be used for the prediction (and sensitivity analysis) of Free Cash Flows.

When we teach Chapters 3-7, we stress from time to time that the basic valuation framework of the book is that

$$\textit{value of firm} = PV(\textit{future FCFs, discounted @ WACC}) + PV(\textit{financing effects})$$

We also stress that a justification of this approach is yet to come. Chapter 8's main purpose is to justify this valuation approach.

Capital structure is a thorny topic and the instructor may want to devote several classes to a thorough discussion. We have structured this chapter as follows:

- The chapter's main conclusions are in Section 8.1. Because capital structure can be so confusing to students, we put a compendium of the conclusions at the beginning of the chapter.
- Section 8.2 describes value additivity
- Sections 8.3 and 8.4 give a completely worked-out example of the standard textbook MM with corporate (but not personal) taxes. Some students might have seen this in an introductory course, but we have never found these sections superfluous!
- Section 8.5 gives three common solutions to the capital structure problem arising from the standard MM-with-corporate-taxes analysis. All of these solutions have insights to offer, but we stress that only the personal tax solution appears to be of the righ magnitude of effects and is numerically implementable.
- Section 8.6: Another textbook example. This example illustrates the implementation of the Miller model and shows how adding leverage, when $T > 0$, can increase the value of the firm (and the value of its residual claim—the equity).

Chapter structure

Basic insights—rules of thumb

This section summarizes the main results of the chapter.

The principle of additivity

Underlying the discussion of the effects of leverage on firm value is the assumption of value of additivity. We sometimes ask students when this assumption will *not* be true—what market frictions may allow violations of the principle to exist.

Capital structure: an initial simple example

Section 8.3 gives a simple example which embodies the principles of the M&M capital structure propositions (with only corporate taxes, no personal taxation). We stress in class that the example is completely general; instead of valuing the "machine + loan," we could also value a "firm + its debt." The result—that the value of the machine is enhanced (for this case) by the PV of the tax shields on the debt interest—is precisely the M&M result.

What can we conclude from the machine example?

This section gives 5 valuable lessons which derive from the M&M example in the previous section:

- The loan's value derives from the PV of the interest rates.
- When the loan is infinitely-lived, we get the usual introductory textbook formula that the value of the debt is t_cD.
- When the loan interest rate is different from the market interest rate, the value of the loan is *no longer* just the present value of its interest tax shields. The instructor might want to discuss why this is so; in particular how the value of a loan subsidy (when the loan rate is less than the market rate) can be calculated.
- Analyzing the machine plus loan together is tricky! It is worth discussing with students why the Total CF in Exhibit 8.1 is an *equity CF*. There is no direct method to evaluate this cash flow to see whether the total project (machine + loan) is worthwhile, although consideration of its two IRRs will lead to the conclusion that the project is probably worthwhile. A more general point to be made from this example is that it is much easier to value the machine and the loan separately.

- The last point is the traditional one made about M&M: When there are only corporate taxes and the firm's value increases with debt, the counter-factual prediction is that the optimal capital structure is 100% debt. This point is taken up in the next section.

Possible solutions to the optimal capital structure problem

This section presents 3 possible solutions. We stress to students that all of the solutions contain important descriptive elements of why firm value doesn't linearly increase with debt. However, only the third solution—the Miller equilibrium—is of the right magnitude of effects (and is the only numerically implementable solution). For many practical purposes, we can assume that *T . 0*. This is both close to the current tax rates and gives easy-to-use formulas. A good example is the CAPM formulation: When *T . 0*, the SML for equity returns becomes

$$RADR = rf_{debt} \cdot \left(1 - t_c\right) + \left\lfloor E(r_m) - \left(1 - t_c\right) \cdot rf_{debt} \right\rfloor$$

This has an easy intuitive explanation: We use the after-corporate-tax risk-free rate to benchmark expected returns. Note that this formula implies (correctly) that the *before-personal-tax* equity returns may be lower than *before-personal-tax* debt returns; this reflects the lower taxation on equity and will happen when the equity beta is very low.

Another textbook example

This textbook example takes the student through a step-by-step implementation of the results of Miller-type analysis. Two points are especially important:

- Two methods of discounting: The example can be used to justify the use of the WACC as a RADR for the firm's FCFs. The instructor should stress that discounting the FCFs by the WACC gives the total value of the firm (Equity plus Debt). As an alternative, we can use r_u to discount the FCFs to get the unlevered value of the firm, and then add the NPV of the leverage separately.

- The effect of a recapitalization on the value of the shares. Each share's value increases by the total debt tax shield divided by the initial number of shares.

Solutions to End-of-Chapter Problems

Problem 8.1

Since $t_c = 30\%$, $t_e = 10\%$, $t_d = 28\%$, we have:

a. Replacing $1 of equity with $1 of debt adds

$$T = 1 - \frac{(1-t_e)*(1-t_c)}{1-t_d} = 1 - \frac{0.7*0.9}{0.72} = 0.125$$

dollars to the value of the firm.

b. Since we are eliminating $1 of equity (to be replaced with $1 of debt), the value of the equity will *decline* by $1 less the increase due to the additional tax savings of $0.125, i.e., by $0.875.

c. The wealth of the firm's shareholders *increases* by $0.125: As the residual claimants of the firm they will fully reap the added tax benefit of the new capital structure.

Problem 8.2

In this problem $t_e = 10\%$ and $t_d = 19\%$. The firm expects to be profitable 4 out of 5 years; assuming that there are no tax loss carryovers, the expected corporate tax rate is $E(t_c) = 0.8*35\% + 0.2*0\% = 28\%$. Using this value gives:

$$T = 1 - \frac{(1-t_c)*(1-t_e)}{1-t_d} = 1 - \frac{(1-28\%)*(1-10\%)}{1-19\%} = 0.2$$

Note that if carry forwards were permissible, instead of using this expected corporate tax rate we would use the expected present value of the corporate tax rate (which would be closer to 34%). The corresponding T would also be higher in this case.

Problem 8.3

In Utopia Land there are no taxes, so that a change in ABC's capital structure will not affect the value of the firm and its WACC. The current WACC is:

$$current\ WACC = r_e(U) = r_f + \beta * market\ risk\ premium = 2\% + 0.5*8\% = 6\%$$

After the refinancing, the WACC formula gives:

$$WACC = 6\% = r_e(L) * \frac{E}{E+D} + r_d * \frac{D}{E+D}$$

r_d will reflect the debt's risk. If the new debt is risk free, r_d will equal 2% and we get

$$= r_e(L) \cdot 50\% + 2\% \cdot 50\%$$

$$\Rightarrow \quad r_e(L) = 10\%$$

If the debt is not risk free, its expected return will exceed 2% and, accordingly, the expected return of the shareholders will be lower. Thus, after the refinancing, r_e # 10%.

Problem 8.4

a. Once the bond holders become shareholders, the firm will be all equity financed and the rate of return will be *r(U)*—the rate of return on the unlevered firm. Since there are no *taxes, r(U)* will equal the WACC of the firm when financed with 25% debt:

E/(E+D)	75%		
D/(E+D)	25%		
equity beta	2.0	==>equity return	19.00%
debt beta	0.4	==>debt return	6.20%
risk-free rate	3%		
market risk-premium	8%		
WACC	**15.80%**		

b. Now that there is 20% debt in the capital structure, the WACC will still be the same but the equity and debt returns will be different. Assuming that the new debt is risk free, the new cost of equity will be

$$r_e(L=20\%) = (15.8\% - 20\%*3\%) / 80\% = 19.00\%$$

Assuming that the new debt is as risky as it used to be, the new cost of equity will be

$$r_e(L=20\%) = (15.8\% - 20\%*6.2\%) / 80\% = 18.20\%$$

Since we don't know whether the new debt is less risky than it used to be (it cannot be **more** risky than it used to be), we have 18.20% # $r_e(L=20\%)$ # 19.00%.

c. Using these tax rates we calculate the net tax benefit of debt:

$$T = 1 - \frac{(1-20\%)\cdot(1-20\%)}{(1-36\%)} = 0 \ .$$

Since the net tax benefits of debt are zero, all answers to the previous problems remain the same.

Problem 8.5

To calculate the cost of equity, we use the standard WACC formula:

$$\text{WACC} = r_e(L) * E/V + (1-t_c) * r_d * D/V$$

6 $$r_e(L) = (\text{WACC} - (1-t_c) * r_d * D/V) * V/D = 15.00\%$$

Problem 8.6

a. Since the WACC = 8%, we use the WACC formula

$$\begin{aligned} WACC &= r_e * \frac{E}{E+D} + (1-t_c)\, r_d * \frac{D}{E+D} \\ &= r_e * 0.5 + (1-40\%) * 6\% * 0.5 = 8\% \end{aligned}$$

to solve for r_e, which gives $r_e = 12.40\%$.

b. To answer this question we use the debt and equity SMLs discussed in the Appendix:

$$\begin{aligned} RADR_{equity} &= rf_{debt}(1-t_c) + \beta_{equity}\left[E(r_m) - rf_{debt}(1-t_c)\right] \\ RADR_{debt} &= rf_{debt} + \beta_{debt}\left[E(r_m) - rf_{debt}(1-t_c)\right] \end{aligned}$$

Using $rf_{debt} = 5.5\%$, $E(r_m) = 10\%$, and $t_c = 40\%$, we get $\$_{equity} = 1.3582$ and $\$_{debt} = 0.0746$.

c. Assuming that the preferred is *safer* than the equity, the cost of the preferred is *lower* than the cost of equity. Since the costs of the preferred and of the common must *average* to the 12.4% computed above, the cost of the common is *higher* than the 12.40% cost of part **a**.

CHAPTER 9: ESTIMATING DISCOUNT RATES

Overview and objectives

The message of Chapter 8 is that the Miller model is an implementable version of a realistic capital structure model. In Chapter 9 we show the student how to estimate costs of capital. This implementation requires knowledge both of Miller and of various methods of estimating the cost the capital.

We find it important to emphasize to students that there are many methods of estimating the cost of capital, and that there are very few unambiguous, explicit answers. Ultimately the student will have to choose a "reasonable" cost of capital, based on a consensus view of the results of the various methods of estimation.

The three main methods covered in this chapter are:

- Using historic returns to estimate the cost of capital

- Using market prices to estimate discount rates. We illustrate two variants of using the Gordon dividend model:

  Estimating expected growth rates of dividends and using these rates to estimate the cost of equity from the stock price.

  Deriving the cost of equity from the P/E ratio (the derivation is based on the Gordon model).

- Using the CAPM to estimate the cost of capital

Here are the points we stress to students:

- Throughout we try end up with a **weighted average cost of capital** (WACC). This is because the book emphasizes the use of the WACC to discount the FCFs in order to arrive at the value of the whole firm.

- It is important to remember the distinction between **real** and **nominal** costs of capital. Our models often predict nominal cash flows and we thus need a nominal cost of capital as a discount rate. However, even in these cases we need to first derive the historic *real* returns, use them to predict future expected real returns, and then use future expected inflation to estimated a nominal cost of capital.

- Capital structure theory is important because it influences our calculation of the WACC. If we use the Miller model with T=0 as a starting point, then the WACC = r_u, the unlevered cost of capital. If we choose not to use T=0, then we have to calculate $r_e(L)$ and use Debt/Value and Equity/Value weights to calculate the WACC.

- Note the implicit assumption in the previous statement: In practice there is no getting away from the Miller model as a basis for cost of capital estimations. The question for the student (and the instructor) is whether T is close enough to zero to warrant using WACC . r_u.

Chapter structure

Using historic returns to estimate the cost of capital

Section 9.1 gives an example of using the past stock returns on Leggett & Platt (LEG) to estimate the expected returns. We first estimate the stock's nominal returns (using 10 years of data), then use CPI indices to turn these into real returns. We estimate the cost of equity by adding the stock risk premium to the current after-tax nominal risk-free rate, $(1-t_c)rf_{1992}$. The WACC can be estimated in a similar fashion, by first estimating the ex-post risk premium for the *whole* firm and adding this to the after-tax nominal risk-free rate; alternatively, we can estimate the WACC by simply averaging historic real WACCs and multiplying by 1 plus the expected inflation rate.

In discussing this section we lay considerable stress on three important aspects of cost of capital estimations:

- It is critical to differentiate between the real and the nominal historical returns. An often-made error is to average historic nominal returns and use this average as an estimate of future expected nominal returns. Because the historic nominal averages mix inflation and real returns, and because the underlying economic theory is that the *real* returns are the economic fundamentals, this is a mistake.

- There are many ways (all, in theory, correct) of estimating the cost of capital from historic market price data. Unfortunately, the implementational difficulties are such that we are likely to get different answers using different methods. One practical solution is to use a number of different methods and then find a "ballpark" answer. Another is to pick the one that is based on the most tenable assumptions.

- Finally, a bit of capital theory (Chapter 8) helps! If we believe that T . 0, then it follows that r_u . $WACC$. This means that the simple unlevering of the cost of equity should, for this important case, give the WACC.

Using market prices to estimate discount rates

This section (9.2) discusses two implementations of the Gordon dividend model to estimate the cost of equity. The first implementation is the standard one, in which we use dividend growth directly to estimate the cost of equity. The second implementation uses the firm's P/E ratio to estimate the cost of equity. Of course, in both implementations, we ultimately average the cost of equity with the cost of debt to arrive at an estimate for the WACC.

A second use for the P/E ratio method is to estimate the expected return on the market portfolio, $E(r_m)$. This is illustrated at the end of section 9.2. Most textbooks estimate $E(r_m)$ by using long-run historic averages; this is acceptable, provided it is properly done (i.e., by either using the long-run real average and then using current estimates of expected inflation to arrive at a nominal $E(r_m)$, or—alternatively—by using the average of the historic market risk-premium $E(r_m) - (1-t_c)rf$). The method illustrated here is an alternative which does not require using historic data.

Using models of risk/return trade-off to estimate the cost of capital

This section illustrates the use of the CAPM to estimate the cost of equity. We sometimes discuss with students the vagaries of commercial estimates of betas:

- Some providers use only price data to estimate beta, whereas others use total return data. The latter is theoretically preferable, though it requires the attribution of dividends (ex-post) to the price returns.

- Many providers use an adjustment to the "raw" beta which corrects for the statistically-found mean-reversion of betas. These adjustments (one well-known on-line service uses the formula $\$_{adjusted} = 2/3*\$_{raw} + 1/3*1$) are often arbitrary. We stress that ultimately high "raw" betas are likely to be overestimates (and low raw betas underestimates) of the true beta. In the context of corporate valuation, this means that sensitivity analysis is essential.

Unlevering betas to estimate the firm's cost of capital

To estimate the WACC using the CAPM, we must use the firm's asset beta. A separate section (9.4) discusses the estimation of this beta and illustrates using the data for the furniture industry. As might be expected, the industry's asset betas are closer together than the equity betas.

Cases that can be used with the chapter

Harvard: The Super Project, Communications Satellite Corporation, Marriott Corporation

Bruner: Blue Cross and Blue Shield of Virginia” Teletech Corporation, General Motors Corporation, 1988

Solutions to End-of chapter Problems

Problem 9.1

a. To estimate the real growth rate we need to convert the nominal (i.e., current dollar) dividend payments to constant-dollar dividends. Accordingly, we convert the nominal dividend history to dividends denominated in 1994 dollars. We then calculate the growth rates:

	nominal		real	dividend growth	
Year	dividend	CPI	dividend	nominal	real
1988	0.36	130	0.4154		
1989	0.42	132	0.4773	16.67%	14.90%
1990	0.50	136	0.5515	19.05%	15.55%
1991	0.55	140	0.5893	10.00%	6.86%
1992	0.65	145	0.6724	18.18%	14.11%
1993	0.73	149	0.7349	12.31%	9.29%
1994	0.82	150	0.8200	12.33%	11.58%
			average	**14.76%**	**12.05%**

Note: In the above table the growth rates have been calculated as:

$$\textit{dividend growth, year } t = \frac{\textit{dividend}_t}{\textit{dividend}_{t-1}} - 1$$

Some students may choose to calculate continuously compounded dividend growth rates:

$$\textit{dividend growth, year } t = \ln\left(\frac{\textit{dividend}_t}{\textit{dividend}_{t-1}}\right)$$

The continuously compounded growth rate is the correct way to compute growth when dividends are paid continuously throughout the year. Since in this question we assume year-end single payments, the former method of computing annual growth rates is the correct one.

b. We use the estimated real growth rate to estimate the real cost of capital:

$$r_{real} = \frac{Div_0 \cdot (1 + g_{real})}{P} + g_{real} = \frac{0.82 \cdot (1 + 12.05\%)}{50} + 12.05\% = 13.88\%$$

The nominal discount rate is computed as

$$r_{nominal} = (1 + r_{real}) \cdot (1 + i) - 1 = (1 + 13.88\%) \cdot (1 + 3\%) - 1 = 17.30\%$$

Note: Calculating the nominal discount rate using the Gordon formula and the *nominal growth rate* in the period 1988-1994 yields a lower discount rate because the average inflation rate in that period was 2.4% while the expected inflation rate is 3%.

c. Since the P/E is 20 and the stock price is \$50, the EPS was \$2.50 (= \$50/20). Hence, the payout ratio of the firm is \$0.82/\$2.50 = 32.8%. Using the relation

$$P/E = \frac{\rho \cdot (1+g)}{r-g}$$

$$\Rightarrow \quad r = \frac{\rho \cdot (1+g)}{P/E} + g$$

Using $\rho = 32.8\%$, $g_{real} = 12.05\%$, and $P/E = 20$, we get the same discount rates we got in part **a**.

Problem 9.2

To calculate the WACC we use market values of the three securities LBO has issued: equity, bond, bank loan. We assume that the value of the bank loan, which yields the prevailing market rate, is par—\$2,000,000. This means that the value of the firm is

Value of equity	\$6,000,00
Value of bonds	\$1,300,000
Value of floating rate debt	\$2,000,000
Value of LBO	\$9,300,000

b. If the term structure of interest rates is not flat, then the YTM of the **WACC, which is the sum of the risk free rate of interest and a risk premium, depends on the timing of the cash flow**. In other words, there is a different WACC to different maturities. Moreover, the YTMs of the bonds or of the floating rate debt are not indicative of the yields relevant for other maturities.

Problem 9.3

a. To calculate the real equity return, we have to adjust the dividend and stock price history for the change in the purchasing power of money. For example, the 1982 return of 15.33% is calculated as: [(7.33+0.20)*(90.9/96.5)]/6.15-1.

	stock price year end	dividend per share	CPI	real equity return
1981	6.15	0.19	90.9	
1982	7.33	0.20	96.5	15.33%
1983	8.45	0.24	99.6	14.86%
1984	9.35	0.32	103.9	9.70%
1985	11.00	0.35	107.6	17.22%
1986	15.60	0.39	109.7	42.58%
1987	18.35	0.40	113.7	15.96%
1988	16.25	0.46	118.4	-12.55%
1989	20.10	0.54	124.1	21.18%
1990	19.25	0.56	130.7	-6.42%
1991	22.35	0.59	136.3	14.27%
			average	**13.21%**

b. A similar inflation adjustment of the nominal WACC (calculated in the traditional manner) gives the real WACC.

c. If we assume that the historical **real** WACC is representative of XYZ's business risk, using the **expected** inflation rate of 6% (rather than the average inflation in 1981-1991 of 4.1%) we get that

	A	B	C	D	E	F	G	H	I	J	K
38					nominal	Value of	value of				
39		stock	dividend	CPI	equity	Debt	Equity		debt's	WACC	
40		price			return	($ million)	($ million)	% equity	interest	nominal	real
41	**1981**	6.15	0.19	90.9							
42	**1982**	7.33	0.20	96.5	22.44%	11.8	36.65	75.64%	14.0%	19.02%	12.11%
43	**1983**	8.45	0.24	99.6	18.55%	13.2	42.25	76.19%	11.0%	15.71%	12.11%
44	**1984**	9.35	0.32	103.9	14.44%	11.2	46.75	80.67%	10.0%	12.81%	8.14%
45	**1985**	11.00	0.35	107.6	21.39%	24.5	55.00	69.18%	8.0%	16.28%	12.28%
46	**1986**	15.60	0.39	109.7	45.36%	23.3	78.00	77.00%	7.2%	35.92%	33.32%
47	**1987**	18.35	0.40	113.7	20.19%	76.2	91.75	54.63%	6.9%	12.91%	8.94%
48	**1988**	16.25	0.46	118.4	-8.94%	70.6	81.25	53.51%	8.2%	-2.49%	-6.37%
49	**1989**	20.10	0.54	124.1	27.02%	69.1	100.50	59.26%	8.0%	17.96%	12.55%
50	**1990**	19.25	0.56	130.7	-1.44%	62.2	96.25	60.74%	9.0%	1.24%	-3.87%
51	**1991**	22.35	0.59	136.3	19.17%	55.0	111.75	67.02%	12.0%	15.22%	10.49%
52									average	**14.46%**	**9.97%**

the nominal WACC of XYZ is:

$$nominal\ \ WACC\ =\ (1 + real\ \ WACC) * (1 + expected\ \ inflation)$$

$$=\ 1.097 * 1.06\ -\ 1\ =\ 16.57\%$$

Problem 9.4

a. The market premium is

$$\pi_m\ \equiv\ E(r_m) - rf_{debt}(1 - t_c)\ =\ 15\% - 8\% * (1 - 35\%)\ =\ 9.8\%$$

Using the respective betas of the debt and the equity and the equations in the appendix of chapter 8 we get for equity:

$$r_e = rf_{debt} \cdot (1 - t_c) + \beta_{equity} \cdot \pi_m$$

$$= 8\% \cdot (1 - 35\%) + 1.3 * 9.8\% = \mathbf{17.94\%}$$

and for debt:

$$r_d = rf_{debt}\ + \beta_{debt} \cdot \pi_m$$

$$= 8\% + 0.2 * 9.8\% = \mathbf{9.96\%}$$

The resulting WACC is:

$$WACC = 60\%*17.94\% + 40\%*9.96\%*(1\text{-}35\%) = \mathbf{13.35\%}$$

b. The asset beta is the weighted average beta of the equity and the debt:

$$\beta_{asset} = 60\%*1.3 + 40\%*0.2*(1\text{-}35\%) = \mathbf{0.832}$$

Chapter 10: Valuation by Multiples

Overview and objectives

While multiples should not be the *primary* focus of a valuation, they should probably be used to *check* the results of a full-blown cash-flow-based valuation. Chapter 10 discusses how multiples can be used in valuation. It is important to stress to students that:

- Comparable firms have to be properly chosen. In particular, it is important to control for leverage (unless we use whole-firm multiples, as opposed to using stock price multiples).

- Valuation by multiples only works when: a) The firms being compared are similar (this is a catch-all word which can cover a multitude of sins ...), and b) When we have enough firms so that the vagaries of individual firms are "washed out."

- If we use whole-firm multiples, we are basically doing a sequential valuation: The multiple gives the value of the firm, from which must be subtracted the value of the firm's debt, its convertible securities, and warrants—if we ultimately want to value the firm's shares. The parallel with a DCF valuation is clear.

Chapter structure

Principles of valuation with multiples

Section 10.1 discusses the principles of valuation with multiples. Once said, most of the points are obvious. However, mistakes in choosing comparables, being objective about common bases for multiples, etc. are rife! We lay particular stress on the difference between equity and whole firm multiples. Since we are strong believers in the efficacy of sequential valuation techniques (i.e., valuing the whole firm, and only then valuing the component securities), we obviously prefer whole firm multiples.

Earnings multiple

Section 10.2 discusses the proper use of earnings multiples, the most commonly used of all multiples. Points stressed in the discussion of earnings multiples are:

- The difference between *leading* and *trailing* earnings multiples.
- Dealing with negative earnings--why firms with negative P/Es should not necessarily be excluded from our sample.
- Whole firm earnings multiples verses stock price/EPS multiples.

- Estimating growth using ROE and ROA.

The retail store industry

Section 10.3 illustrates the principles by doing a multiples valuation for Dayton Hudson. We present students with the necessary data to do such a valuation, showing how we eliminate firms from our sample. In the end we compare Dayton Hudson to 4 other firms in the industry. It is important to stress that moving from equity to whole firm multiples reduces the variation in the multiples (just as the variance of the asset betas is smaller than the variance of the equity betas).

Some other multiples

Section 10.4 discusses Sales multiples (again for the retail store industry) and Fixed Asset multiples (for the airline industry).

Cases that can be used with this chapter

Harvard: Gulf Oil Corporation, Interco, MRC
Bruner: Atlantic Southeast Airlines, Brown-Forman Corporation

Solutions to End-of-Chapter Problems

Problem 10.1

a. Inverting the P/E formula given in Chapter 10 (page 316):

$$r_e = \frac{b*(1+g)}{P_0/E_0} + g$$

Substituting $b = 30\%$, and $P_0/E_0 = 15$ gives $r_e = 12.2\%$.

b. By the formula given in the chapter:

$$P_0/E_0 = \frac{P_0}{EPS_0} = \frac{b\cdot(1+g)}{r_e - g}.$$

If the firm's cost of equity is 25%, its growth rate $g = 10\%$, and its dividend payout ratio $b=30\%$, then its P/E ratio will be $P_0/E_0 = 2.2$.

c. Given $r_e = 15\%$ and $g = 8\%$, ABC's $P/E = 4.63$.

d. P/E ratios have to be standardized for growth rates and risk (e.g., leverage). You cannot compare two P/E ratios for companies of different characteristics, even within the same industry.

Problem 10.2

a. Trailing earnings multiples are:

	LMN	QRS
Market value of equity	400,000	100,000
Net income	40,000	12,000
Trailing earnings multiples	**10.00**	**8.33**

b. Based on earnings multiples (from part **a**), QRS is a better investment opportunity. Whole-firm multiples, however, portray another picture: As a whole firm, LMN represents a better investment opportunity. Moreover, since the price of debt typically differs very little from its value, it is likely that the **equity** of LMN (as the residual claim) is probably also a better buy than the **equity** of QRS. The differences in the earnings multiples are probably reversed once the differential risk (induced by the differential leverage) is accounted for.

	LMN	QRS
Market value of debt	200,000	400,000
Market value of equity	400,000	100,000

Total firm value	**600,000**	**500,000**
Net income	40,000	12,000
After-tax interest expense	10,000	24,000
Total firm profitability	**50,000**	**36,000**
Whole firm multiples	**12.00**	**13.89**

c. QRSs Value/Sales ratio is \$500,000/\$200,000 = 2.5. If LMN had this ratio, it would be worth \$1,000,000 and its equity would be worth \$800,000.

CHAPTER 11: Valuing the Firm's Debt

Overview and objectives

This is the first chapter in which we discuss the division of the estimated value of the whole firm into separate values for the securities the firm has issued. We begin with the valuation of debt in this chapter, proceed with the valuation of convertible securities in Chapter 12, and discuss the direct valuation of equity (as an alternative to valuing equity as the residual claim) in Chapter 13. The objective of this chapter is to acquaint students with the tools of valuing fixed-income securities:

- Understand bond ratings: Students should understand not only the fundamentals of bond ratings; they should also be made to realize that a bond rating is not a continuously-determined measure of risk like a stock beta. This means that there will be a range of market-determined yields within a particular bond rating class.
- Valuing bonds by discounting promised payments at risk-adjusted yields to maturity: This should be contrasted with the usual procedure of valuing securities by discounting their expected cash flows at a risk-adjusted expected return.

Chapter structure

What is debt?

We begin the discussion of the valuation of debt securities by defining which securities are included in this category. Generally speaking, we call "debt" any security with a pre-determined upside potential. Thus, we exclude any convertible securities (which the term "fixed income securities" is often taken to include).

Approaches to bond valuation

Students who have never considered debt securities characteristics, valuation techniques, and trading might expect that debt securities be valued like any other asset: by discounting expected cash flows at a risk-adjusted expected return. Thus, at the outset we explain that fixed income securities are typically valued by discounting **promised payments** at a **risk-adjusted yield to maturity (RAYTM)**. We discuss the equivalence between how assets are usually valued and how fixed income securities are typically valued in the Appendix of the chapter.

Debt cash flows

In this section we discuss the difference between the cash flows **promised** to the bond holders and the cash flows they actually **expect to receive** and the determinants of the magnitude of this difference. Analogously, we define the yield to maturity (YTM) as the **promised** yield or the **maximal** return as opposed to the expected return. This is often a confusing point to students: They often argue that since the price of the bond reflects the possibility that bond holders will not be paid in full, the YTM also reflects this risk and is therefore the "expected return." Going through a simple example of calculating expected receipts under an assumed probability of default and then calculating both the expected return and the YTM often clarifies this point.

Bond rating

In this section we introduce bond ratings and discuss their use as broad categories of default risk.

Estimating appropriate rating

This and the next section are the most important sections for the purpose of valuing bonds. In this section we discuss how financial statement information, actual or predicted in pro formas, can be used to estimate the appropriate rating of a bond. We use the financial statements of Boeing to illustrate:

- The ratios used in such estimations
- Some adjustments needed to financial statement information before these ratios can be calculated
- The firm's ratios rarely fit neatly into the suggested ratios for a single bond rating.

We conclude this section with a discussion of how several ratios (which may indicate different appropriate ratings) may be integrated into a single rating or a single default risk score.

The use of the estimated appropriate rating is discussed in the next section.

Cases That Can Be Used with the Chapter

Cases that may illustrate bond valuation are:
Harvard: Southport Minerals, John Case Company
Bruner: Design Technologies, Inc., Johnstown Corporation, Merit Marine Corporation, Gifford Bunsen & Company

Solutions to End-of-Chapter Problems

Problem 11.1

a. The following spreadsheet extract shows the value of Mort Corp.'s bond:

		year	interest rate	Mort Corp's bond payment	Mort Corp's bond PV
Face value	1000	1	6.03%	80	75.45
coupon rate	8.00%	2	6.17%	80	70.97
bond value		3	6.31%	80	66.58
as riskless bond	**1067.30**	4	6.45%	80	62.29
		5	6.60%	80	58.13
		6	6.74%	80	54.10
		7	6.88%	80	50.22
		8	7.02%	80	46.50
		9	7.16%	80	42.93
		10	7.18%	1080	540.12

b. There is no analytic way to find the coupon rate which sets the bond value equal to par. However a spreadsheet's **Goal Seek** function can be used to find the correct coupon rate, as the following example illustrates:

			interest	Mort Corp's bond	
Face value	1000	year	rate	payment	PV
coupon rate	7.05%	1	6.03%	71	66.50
		2	6.17%	71	62.55
bond value		3	6.31%	71	58.68
as riskless bond	**1000.00**	4	6.45%	71	54.90
		5	6.60%	71	51.23
		6	6.74%	71	47.68
		7	6.88%	71	44.26
		8	7.02%	71	40.98
		9	7.16%	71	37.84
		10	7.18%	1071	535.37

c. According to Exhibit 11.3, the average yield spread of an **A-rated** bond is 1.16% over the government bond yield. A small revision of the above spreadsheet gives:

			interest	interest rate plus	Mort Corp's bond	
Face value	1000	year	rate	spread	payment	PV
coupon rate	8.00%	1	6.03%	7.19%	80	74.63
		2	6.17%	7.33%	80	69.44
bond value		3	6.31%	7.47%	80	64.45
as riskless bond	**987.13**	4	6.45%	7.61%	80	59.65
		5	6.60%	7.76%	80	55.07
yield spread	**1.16%**	6	6.74%	7.90%	80	50.71
		7	6.88%	8.04%	80	46.57
		8	7.02%	8.18%	80	42.65
		9	7.16%	8.32%	80	38.97
		10	7.18%	8.34%	1080	484.99
				bond value		987.13

Problem 11.2

The following spreadsheet extract (taken from the appropriate sheet of PROB11.XLS) gives the answer to the first question:

face value	$1,000	
coupon rate	12%	
default probability	10%	
payoff at default	70%	of par
price	$1,000	
expected year 1 CF	1078.0	
expected return	7.80%	

The answer to the second question is trivially 12% since the bond trades at par and has a coupon rate of 12% (which has a 70% chance of being actually paid).

Problem 11.3

The following table (taken from the worksheet PROB11.XLS) shows the calculation of the expected payments in years 1 and 2 and the corresponding expected return.

	CFs	probability	
year 1			
default	700	10%	
no default	120	90%	
expected cf			**178**
year 2			
1st year default	0	10%	
2nd year default	700	9%	
no default	1120	81%	
expected cf			**970.2**
year	**0**	**1**	**2**
Expected cash flows	-1000	178	970.2
IRR	**7.80%**		

Problem 11.4

Calculating the projected ratios from the model for years 1-5 gives:

Pre-tax return on total capital	14.5%	16.0%	17.1%	18.2%	19.3%
Operating Income to Sales	15.7%	15.9%	15.9%	15.9%	15.9%
Total Debt to Capitalization	26.2%	20.8%	15.4%	9.9%	4.4%
Pre-tax interest coverage	4.3	4.8	5.3	5.8	6.4

Compare this to the SP ratios:

SP ratios	AAA	AA	A	BBB	BB	B
Pre-tax return on total capital	24.2%	22.1%	17.1%	14.4%	12.8%	9.9%
Operating Income to Sales	21.2%	16.3%	13.5%	12.1%	13.1%	9.8%
Total Debt to Capitalization	19.5%	25.6%	35.0%	39.5%	53.7%	69.1%
Pre-tax interest coverage	13.5	9.0	5.3	3.7	2.4	1.3

Here are the ratings for XYZ based on individual projected ratios for years 1 and 5:

Ratio	Year 1	Year 5
Pre-tax return on total capital	BBB	A - AA
Operating Income to Sales	AA	AA
Total Debt to Capitalization	AA	AAA
Pre-tax interest coverage	BBB-A	A

On balance, we would give XYZ an “A” rating for the coming year, with the anticipation that this rating would improve to AA by year 5.

CHAPTER 12: The Valuation of Convertible Securities

Overview and objectives

After discussing in Chapter 11 how to value fixed income securities, the firm's most senior claims, in this chapter we discuss the division of the remaining value between the holders of the firm's convertible securities and the holders of the residual claims — the shareholders. At the end of the discussion of this chapter students should be able to modify the Black and Scholes (B&S) option pricing formula to value warrants and convertible bonds and to understand two key differences between options and convertible securities:

- Since the writer of the options embedded in convertible securities is the firm itself, the exercise of such an option may change the asset holdings of the firm.
- Since the exercise of the conversion option increases the number of shares outstanding, the exercise of such an option may dilute the claims of the existing shareholders.

Chapter structure

A short review of option theory

We begin with a short review of the option pricing theory. Many students will have seen the B&S formula before getting to this chapter so this section may be skimmed or skipped altogether. We review the basics at an intuitive level: payoffs upon expiration, binomial pricing, and the B&S formula. Since students might have seen different versions of the formula we give both the version with the continuously compounded risk free rate and with the annually compounded risk free rate. We also give a simple example of calculating the formula's value in a spreadsheet format. Finally, we discuss the impact of dividend payment on option values and on optimal exercise policies.

Warrant valuation

In this section we discuss the pricing of warrants. Here and throughout the discussion of convertible security pricing we look at **aggregate values**—the aggregate value of the underlying asset and the aggregate exercise price. We have found that aggregate analysis allows for the most intuitive presentation of the adjustments of the B&S formula for the effects of cash infusion and dilution. We present a simple warrant valuation example with the associated worksheet structure that implements it. Finally, we discuss some shortfalls of the B&S formula as applied to warrant valuation.

Valuing Smucker's warrants and stock

In this section we return to the warrants issued by Smucker (i.e., Smucker's warrants) that we have simply presented in Chapter 7. Using these warrants, we can illustrate the valuation of warrants using the limited information that often is reported in notes to financial statements about such warrants. We illustrate the estimation of return volatility. Lastly, we derive the value of Smucker's stock as the residual.

We use the Smucker example to illustrate an important point that is often difficult for students to grasp at first pass: Students often wonder why the money paid by the warrant holders to the firm does not appear as part of the firm value. That is, they often fail to see that the money is actually taken into account as a reduction in the **effective exercise price**, which we illustrate under the assumption that the warrants are sure to be exercised.

Convertible bond valuation

In this section we discuss the valuation of convertible bonds. We remind the students how to value the bond portion using the tools of Chapter 12, and how to adjust the B&S formula to value the conversion option. Again, the discussion is in aggregate terms—aggregate exercise price (i.e., the total face value of the convertibles) and aggregate value of the underlying asset.

An illustration of a convertible bond valuation

In this section we illustrate the method of valuing convertible bonds by valuing the convertible bonds of Home Depot. Our starting point is the assumption that we agree with the market's assessment of the **total value to be shared**. This value is the value of the firm after the exclusion of the present value of the expected payments on straight bonds and dividend payments, which are exclusively paid to the bond holders and to the shareholders, respectively. Thus, we only concern ourselves in this example with the appropriate division of this value between the convertible bond holders and the shareholders.

Cases that can be used with the chapter

We have found that students often prefer the valuation of actual derivative securities to the analysis of a case that illustrates such valuation. Consequently, we often accompany this chapter with a valuation of a traded convertible bond along the principles of the example of section 12.5: Assuming we agree with the market's assessment of the **total value to be shared**, we ask the students to divide this value between the holders of the convertible and the holders of the stock. This requires estimating the value of the straight bond part, the value of the exclusive cash flows (interest and dividends) until the bond's maturity, estimating the volatility of the return on the shared value, etc.

Cases that may illustrate convertible valuation and convertibles issuance:

Harvard: MCI Corporation
Bruner: Johnstown Corporation, Chrysler's Warrants: September 1983, Flowers Industries, Inc.

Solutions to End-of-Chapter Problems

Problem 12.1

The following table is an extract of the worksheet (which is included in file PROB12.XLS) that implements the B&S formula with this problem's parameters.

S	55			
X	60			
riskfree--continuously compounded	7.696%		annual riskfree	8%
T	0.2521		Current date	21-Aug-96
sigma	40.00%		Expiration date	21-Nov-96
d_1	-0.2363			
d_2	-0.4371			
N(d_1)	0.40661	<== Hedge ratio (HR)		
N(d_2)	0.33102			
Call price	2.884			
Put price	6.731			

If the stock price rises by $1, the call price will rise to $3.308 or $0.424 above the original value of $2.884. Using the HR we would expect the value to rise by $0.40661 to $3.290.

Problem 12.2

Assuming the warrants are exercised, we can use the B&S formula adjusted for warrant valuation with $N(d_1) = N(d_2) = 1.0$ to value the warrants. Alternatively, since the valuation is as of the expiration day and the options are sure to be exercised, we can do the calculation from scratch. The following extract from the worksheet file PROB12.XLS gives the details of this solution method.

Value of firm prior to exercise	$1,000
Aggregate exercise price	$200
Value of firm after exercise	$1,200
Number of new shares	40
Number of existing shares	100
Number of shares after exercise	140
Alpha	28.57%
Aggregate warrant value after exercise	$342.86
Aggregate warrant value before exercise	$142.86
Per warrant value before exercise	$3.571

a. The total value of the warrants is $142.8, or $3.57 per warrant.

b. The value of the shares is the remaining value divided by the number of shares

Remaining value ($1,000 - $142.86)	$857.14
Per share value	$8.57

c. The price of the shares will not change upon the warrants exercise since the exercise is certain as of the day before the expiration.

Problem 12.3

Since the issuer's option to call the bond is valuable, the callable bond is worth less than the non-callable bond.

Problem 12.4

a. The increase in the value of the firm means two things for the convertible bond:

- An increase in the safety of the bond (i.e., an increase in the likelihood that the bond will be paid in full); and
- An increase in the value of the conversion option.

Hence, the value of the convertible bond of CVB will rise following the rise in the value of the assets of CVB.

b. The value of the bond of SB will rise by less than the value of the bond of CVB since SB's bond holders will not benefit from the rise in the value of the conversion option, which benefits the holders of CVB's convertible bonds. Since the total rise in the value of both firms is assumed identical, the value of the **equity** of SB will rise more than the value of the equity of CVB.

Chapter 13: Valuing Equity Cash Flows Directly

Overview and objectives

This chapter discusses the direct valuation of equity cash flows: Such a valuation is an alternative to the sequential valuation technique stressed in the rest of the book, and will—in principle—lead to the valuation of the firm's equity with no intermediate steps. We think that, ultimately, direct valuation of equity is more difficult than the sequential valuation.

We stress that the direct valuation of Equity is not a panacea: The direct valuation technique requires students to consider not only the firm's FCFs, but also to consider issues such as the firm's dividend policies and the effects of financing on the firm's cost of capital.

Structure of the chapter

What are equity cash flows?

The chapter starts with a discussion (Section 13.1) of the firm's equity cash flows. These are defined as the residuals from the FCF, after paying off holders of debt and convertible securities. The instructor should discuss what "Net Repayments of Debt Principal" means: If the firm rolls over its debt, it may have zero net Debt repayment. Note that throughout Chapter 13, we assume that the firm has only Debt and Equity; this *greatly* simplifies the discussion. If there were also convertible securities, the payments on these would be subtracted from the FCF in order to derive the Equity cash flow. (Some of the convertibles' cash flows may be contingent!)

Section 13.1 then discusses the M&M dividend irrelevance propositions. We feel that these propositions are most easily understood in the context of a pro forma analysis of the firm. This context, for example, makes it abundently clear that M&M refer to the liabilities side of the balance sheet while the assets side is not affected by the firm's dividend policy.

Equity cash flows: some examples

Students may intuitively think that the equity cash flow is really just another name for the firm's dividends. Section 13.2 gets at this issue by deriving the equity cash flow for some important special cases, using accounting identities. If, for example, in a particular year Debt is the balance sheet "plug," then the Equity Cash Flow is indeed just the dividend. If, on the other hand, in another year Equity is the plug, then the Equity Cash Flow = FCF - $(1-t_c)$*interest. These results are interesting in order to get some intuitions about Equity Cash Flows, but the instructor should stress that the best way of deriving the Equity Cash Flow is through *a complete pro forma model which incorporates all of the operating and financing assumptions about the firm*. Direct valuation of Equity Cash Flows is not a cheap lunch!

Valuing the equity cash-flow streams—two examples

Section 13.3 gives two fully worked-out examples of the valuation of Equity Cash Flows using pro formas. The examples differ in their financing assumptions, but they both assume that $T = 0$, so that there are no tax-motivated valuation effects of Debt. If this assumption is to be dropped, we prefer the following method:

- First, value the Equity directly by assuming $T = 0$. This allows us to value the Equity Cash Flows at r_u , the firm's unlevered cost of capital.
- Next, add to the derived Equity value from the previous step the present value of the interest tax shields, *PV(T*Interest Payments)*. Of course, if the Debt is constant, this simply becomes *T*Debt*.

Why not use a direct valuation?

Exhibit 13.7 compares the steps in a direct Equity valuation to the steps in a sequential valuation. Ultimately, we feel that the difficulties in a direct Equity valuation make a strong argument for the sequential alternative. This point is reinforced by problem 13.4 at the end of the chapter.

Cases to use with this chapter

Practically any valuation case can be used with this chapter.

Harvard: Kennecott Copper

Bruner: Brown-Forman, Atlantic Southeast Airlines

Solutions To End-of-Chapter Problems

Problem 13.1

The spreadsheet is on the disk accompanying this manual. We like to take students through the following thought process: Suppose, all other things being equal, we *increase* the target Debt/Equity ratio. Then:

- The cost of equity should increase, since the equity's risk is a function of the firm's leverage. Students often fail to note that this will be true even in a Miller equilibrium where leverage does not affect firm value.

- The growth rate of equity cash flows will be higher when the firm's leverage is higher (again, all other things being equal). This is true since less shareholder money is being used to finance the cash flows.

These intuitions can be confirmed by changing the parameters on the spreadsheet.

Problem 13.2

A spreadsheet to solve this problem is on the disk. The instructor should walk the students through the following thought process:

- When the growth rate of Sales increases, the firm needs more Fixed Assets. This causes an initial **decrease** in the Free Cash Flow. Since the Equity Cash Flow for the case of constant Debt equals the FCF less the after-tax interest payment (i.e., $(1-t_c)$*interest, see Section 13.1), this also means that the Equity Cash Flow decreases initially. An increase in the Sales growth rate should be viewed as a tradeoff between lower short-term cash flows and higher longer-term cash flows.
- When the Sales growth rate increases, the value of the Equity increases. This is not completely obvious, because of the tradeoff mentioned in the previous bullet.
- As long as the Sales growth is such that the firm's Debt/Equity ratio *decreases over time*, the cost of levered equity, $r_e(L)$, will decrease. This statement should be related to the cost of levered equity formula from Chapter 8:

$$r_e(L) = r(U) + \left[r(U)\cdot(1-T) - (1-t_c)\cdot r_d\right]\frac{D}{E}$$

Problem 13.3

When the firm sets a target Debt/Equity ratio, larger dividends mean more new equity issued. This means that the increased dividends *do not affect the Equity Cash Flows*, and hence do not affect the valuation of the equity. The instructor should point out that this is a direct consequence of the M&M dividend irrelevance proposition.

Problem 13.4

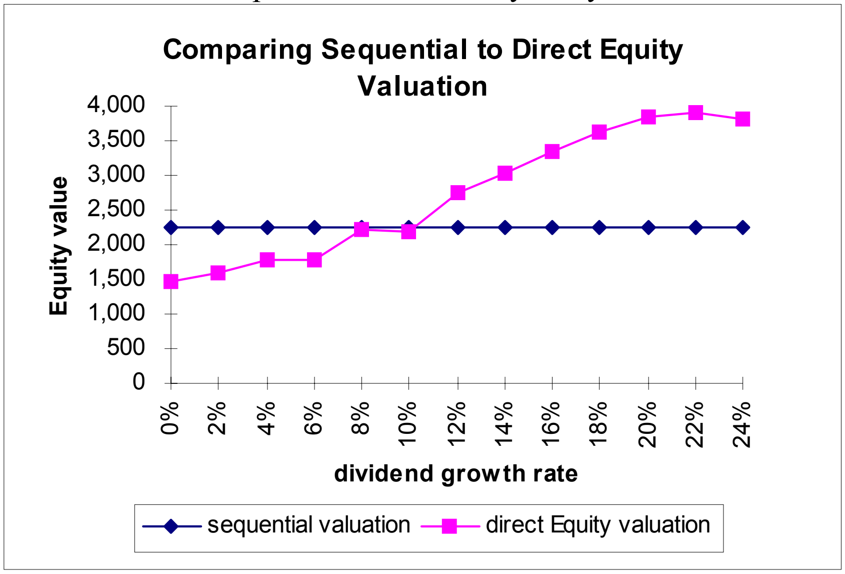
In this problem, increased dividends are financed by increasing the firm's Debt. This will have the following effects:

a. The Equity Cash Flow will increase when the dividend growth rate increases. This is a direct consequence of the relation derived in Section 13.1: When Debt is the "plug," we showed there that the Equity Cash Flow is the firm's dividend payment.

There is an important point to note. We estimate terminal values using the Gordon formula, which means that we discount an **infinite repetitions** of the **last projected equity cash flows**. Consequently, the repayment of debt in the last year is accounted for too heavily in figuring the terminal value—as if it would reoccur infinitely many times. This clearly cannot happen as the debt will be fully repaid at some point. Consequently, the value estimate of the equity in this way is too low.

b. Part b to this question gives the instructor a chance to point out why sequential valuations are better than the direct valuation of Equity. Using a sequential valuation, it is clear that when Debt is the plug and when $T = 0$ (this is the assumption in all of the examples in the chapter), then **an increase in the firm's future dividends should not affect the value of Equity**. Increasing the dividend will add Debt to the firm's capital structure, but this Debt brings with it *no incremental value*: Since $V_L = V_U + PV(future\ interest\ rate\ payments * T)$, it is clear that an increase in future Debt will not affect V_L.

If we used a sequential valuation of the Equity, this would be immediate (there is an illustration on the disk). However, the direct valuation of Equity requires a lot of compromises in the formulas (some of these are hinted at in footnote 7 of Chapter 13). The result is that we get quite different valuations for the Equity in this case when we vary the dividend growth rate. In the following figure we show some output from a sensitivity analysis:



The instructor should point out that the upshot of these differences in valuation is that we are better off using the *sequential* valuation, and not the direct valuation of Equity!