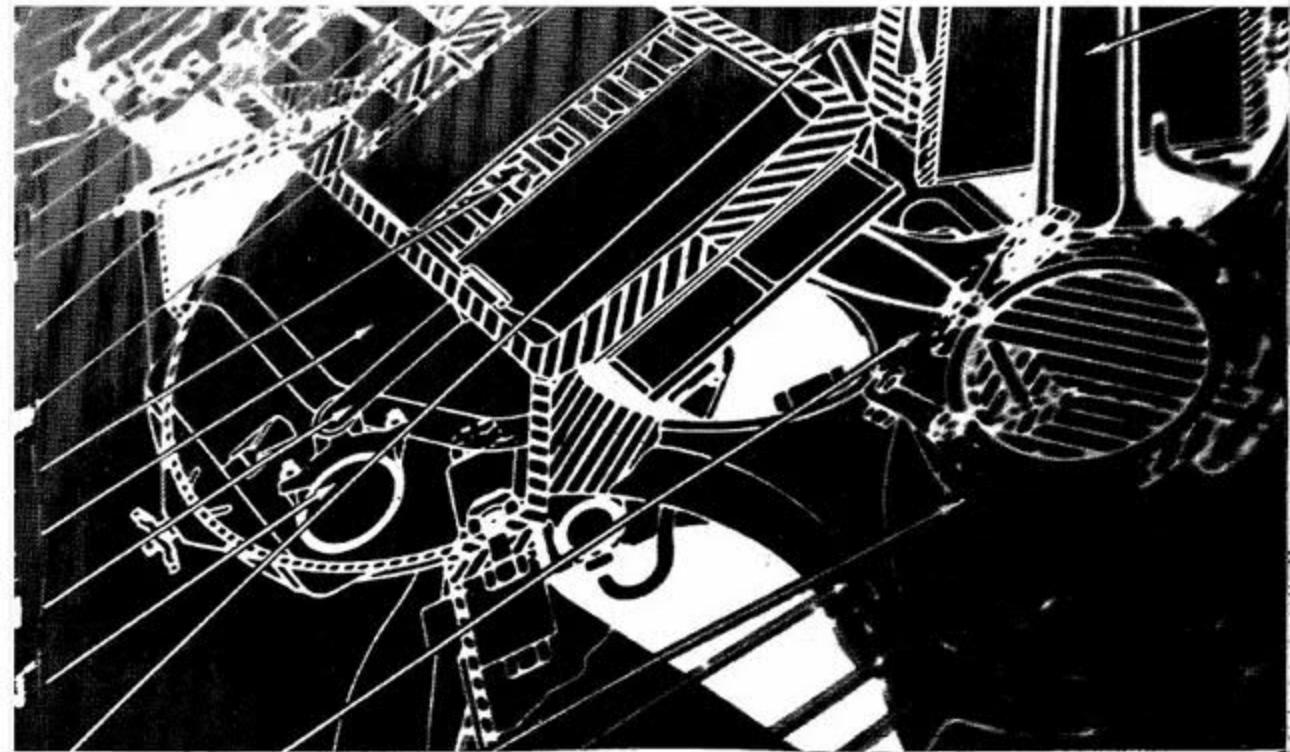


Dr. Peter Flynn

4th Qtr

2nd Qtr

Financial Management for **ENGINEERS**



Financial Management for ENGINEERS

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AUTHOR'S NOTE

Engineers often become managers: an estimated 33 to 50% of engineers will end up in a management role in their career.

Engineering education doesn't focus much on management, because engineering schools have so much technology that they must teach to ensure that graduates aren't a threat to society. Engineers work with expensive and powerful systems, and need a broad background in technology to understand how to get value from those systems without creating a hazard to society.

The result is that engineers who go into management are often stumbling about with poor background and inadequate skill sets. This was true of me. I was a supervisor after two years of work, and was running a company (a partially owned affiliate of a large publicly traded company) before I was 40. I couldn't read a balance sheet and had only a vague understanding of receivables. I would have done a better job if I had a better background in financial management.

Management involves a broad range of skills, from people management to technology to marketing, and always includes financial management skills. Engineers apply science to create commercial value, and as discussed in these notes commercial value is measured by money. These notes, and the course for which they were developed, focus on understanding financial concepts so that sound management decisions can be made. I hope that anyone who reads these notes won't be as ignorant as I was when I ran a company and couldn't understand its balance sheet.

These notes aren't designed to make you an accountant, and at times accounting precision is waived in favor of extracting the meaning of statements. They are meant to help anyone who moves into management, and will also help those who are managed understand what decisions are being taken, and why.

I dedicate these notes to my wife Jeanett, my sons Morris and Henry, and her daughters Chelsey and Ashley. I have had a wonderful time in many management roles, but none compared in pleasure to the roles of husband and father.

A JOKE FROM THE INTERNET

A man is flying in a hot air balloon and realises he is lost. He reduces height and spots a man down below. He lowers the balloon further and shouts "Excuse me, can you help me? I promised my friend I would meet him half an hour ago, but I don't know where I am".

The man replies "Yes, you are in a hot air balloon, hovering approximately 30 feet above this field. You are between 40 and 42 degrees North Latitude and between 58 and 60 degrees West longitude."

"You must be an engineer," says the balloonist. "I am" replies the man. "How did you know?" "Well", says the balloonist, "everything you have told me is technically correct, but I have no idea what to make of your information, and the fact is, I am still lost."

The man below says, "you must be a manager". "I am" replies the balloonist, "but how did you know?" "Well" says the man, "You don't know where you are, or where you are going. You made a promise which you have no idea how to keep and you expect me to solve your problem. The fact is you are in the exact position you were in before we met, but now it is somehow my fault."

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ENGINEERING, BUSINESS AND SOCIETY

1.1 WHY SHOULD ENGINEERS LEARN BUSINESS?

Engineering is typically an institutional enterprise (i.e. it is practiced in groups) trying to achieve commercial goals (i.e. making money is the object of most, but not all, engineering projects). There are two consequences of this:

- Because they work in groups and organizations, engineers will be “managed” by someone who typically will set or confirm goals and monitor progress. Technical companies are very frequently managed by engineers, who need to understand a range of management skills to serve in this role. Inevitably a significant percentage of engineers migrate into management tasks. How well you are managed will have an enormous impact on the quality of your life, and if you become a manager, how well you manage will strongly impact others.
- The work engineers do will most frequently be judged against commercial criteria, in which money is the measure of commercial value (money has limitations in measuring some values, but not commercial values, which is further discussed in Appendix 1.1). Even for projects that are not driven by an overall need to make money (examples: a weapons system or a bridge), concepts of budget, schedule and cost effectiveness arise within the project. We live within a world of values measured by money. Business (or organizational) success comes from the efforts of many, and engineering can only be practiced where it is part of overall business or organizational success. The history of engineering is full of elegant technical work that foundered because it could not be successfully applied by a business or organization.

Management is not “a better thing,” and not all will find happiness in management roles. Business activities are no better than or worse than technical activities. However, even for those with no interest in business or management, the act of being managed within an organizational or business context is made more bearable by knowledge of the issues and concerns of one’s manager and the overall needs of the organization or business. Hence, an elementary knowledge of business and management is part of a good career.

One or two survey courses are not intended to make an engineer an expert on business or management. Rather, the intent is to introduce the concepts and language of various elements of the manager’s skill set. Management is a “generalist” higher-level activity, and anyone who enters management needs to work with others, such as accountants/auditors, lawyers, technical specialists, etc. An overview of business and management will ideally make an engineer who goes into management more confident when dealing with others. Specialized areas of knowledge frequently develop a unique jargon that can deter understanding by others. Engineers who know the underlying issues of business and management

are far more likely to be able to cut through jargon and get the benefit of help from others. Hence the objective of this course is an engineer who understands some of the basic concepts of business and management, who recognizes that there is more to learn, and who has the confidence to deal knowledgeably with others.

1.2 BUSINESS, ENGINEERING AND SOCIETY

Business and a profession such as engineering operate within a given society, and ultimately are subordinate to social rule. At times, social values have significantly impacted commercial and professional issues.

Social values have modified the pattern and growth of business and the application of technology. In China, social forces led to the deferral of the industrial revolution when entrepreneurial values and behaviors came in conflict with social standards of harmony. In the United States, the concentration of business has been the subject of significant legislation. This led to "trust busting", for example the breakup of Rockefeller's Standard Oil and other major enterprises in the 1910's and 20's, and to a vigorous current debate over the potential breakup of Microsoft. Society as a whole or more typically various subsets have attempted less successfully to limit the application of technology (for example the Luddites smashed early weaving machines out of a fear of unemployment, medieval guilds went to great lengths to establish a monopoly on manufacture, and some unions resisted technological changes such as automated gear overheat detection as an alternative to the caboose).

Professions are a creation of society and exchange some restrictions on membership (e.g. the licensing of physicians) for a code of social conduct and an obligation to enforce standards of behavior (e.g. disciplinary hearings).

Labor law attacks the concept that the corporation/company is a "person" with equal power to any other real human person. The uneven power between persons is addressed in unionized settings by specific requirements about collective bargaining, including the application of majority rule on a unionized workforce, and in non-union settings by labor standards. Labor standards limit the ability of the individual to "bargain away" certain minimum standards; the limit is in place because of the perceived inequality in bargaining power between an individual and an employer.

Environmental issues are frequently a clear social tradeoff of the impact of higher prices on consumers with vastly different abilities to pay versus degradation of a common resource. Social wealth has historically had a significant correlation to the level of environmental standards, hence air and water pollution standards are far more stringent in Western Europe and North America than in India or China.

More subtle social issues are also impacted by business. Like other mammalian (and especially primate) social groups, humans are "ranking". How business deals with individuals creates powerful forces within a society in terms of status and rank. Much of the 20th century was driven by concepts of societal organization that on some level are a reflection of the impact of the inequalities in income and status that arose from the industrial revolution.

1.3 THE ROLE OF REGULATION

At a practical level, market capitalism restricted by specific regulation is the accepted framework for commercial activity in most industrialized countries. One theme of the past decade has been the reduc-

tion and streamlining of regulation to enable enterprises to operate more efficiently. However, this has not eliminated the need for regulation. One can think of regulation of business as addressing three concerns:

- Protecting businesses from the actions of other businesses.
- Protecting individuals from business actions.
- Protecting society from business actions.

Rockefeller and the Hudson's Bay had similar approaches to pricing: make very large profits in areas where one had a monopoly, and price below cost where one had competition. The result was a spiraling reduction of competitors, who went bankrupt. Extensive legislation exists in all industrialized countries (called combines legislation in Canada and fair trade or antitrust legislation in the US) to ensure that uneven pricing or other business practices are not employed to reduce competition.

As noted above, in the eyes of the law a huge corporation and an individual are each persons, but clearly of unequal power. At times of medium to high unemployment, the threat of job loss is overwhelming to most employees. Labor legislation such as rules governing the payment of overtime and the scheduling of work is intended to enshrine certain rights and practices in law so that individuals do not have to bargain on a one on one basis and face the threat of job loss. Similarly, safety legislation imposes a social standard on employers to ensure that risk of accident (which is never zero) passes a test of social acceptability.

Also as noted above, most manufacturing processes involve some use of common "sinks" such as the atmosphere, rivers or oceans, and landfills to reject heat and waste. Most would judge a pure "zero discharge" standard as unaffordable, and most would also judge that no restrictions on emissions leads to unacceptable environmental damage (for which there is ample historical evidence). Environmental regulations are the outcome of that tradeoff, and they represent the protection of society as a whole from the practices of business.

The efficiency and effectiveness of regulation is an ongoing issue that is of tremendous importance to society as a whole and to each of us as individuals. We can look back in recent history and see blatant examples of excessive regulation that led to gross inefficiencies, with all of society paying the cost. Airlines, trains, trucking, and electrical power generation are four areas where costs clearly dropped as the extent of regulation was reduced. On the other hand, under-regulation leads to abuses by the unscrupulous. Alberta has seen stunning examples of abuse of workers that critics associate with a failure to enforce labor standards. In the former Soviet block countries, environmental degradation was severe due to ineffective regulation, and has long lasting consequences in terms of nuclear contamination and birth defects. Engineers need to accept that the debate over how much regulation is the "right" level will take place throughout their career, and they can and should participate in this debate as part of their contribution to society.

1.4 WHAT IS THE SKILL SET OF A GOOD MANAGER?

Organizations are complex entities that can be likened to a living organism: many systems need to function properly at the same time to sustain health. For instance, in the human body, we think of the respiratory, circulatory, digestive, excretory, and nervous systems as examples of systems of organs and

processes that must function properly to sustain life. A serious disease in any of these systems can impair health and even life itself. In an organization, many systems also have to function as well: money has to flow into an organization and be spent on appropriate end uses, for example research, product development, manufacturing, and marketing to sustain the life of the organization. A "disease" in any of these systems can prove harmful or fatal. A manager is like a doctor, monitoring one or more of these functions and ensuring they are working properly, taking corrective action if needed. To do the "doctoring", a manager needs knowledge and skills. The kinds of skills various managers need include:

- Financial analysis: understand and apply concepts of financial statements and cash flow analysis. Understand the difference between income and cash flow, the role that non-cash expense items make to cash flow, and the role of tax on cash flow.
- Financial management: understand how money enters a company and the relationship between the risk that money is exposed to and the reward that is expected by the entity that advanced the money. Understand debt versus equity and the concept of the leverage of equity return.
- Operations management: understand directing an ongoing operating entity to make a profit and typically also grow. The focus is on continuous improvement and pushing responsibility downwards.
- Project management: understand directing a one-time effort to achieve a pre-defined level of quality within a targeted budget and schedule. The focus is on planning, tracking to plan, taking corrective action, hitting the schedule and budget numbers, and doing it right the first time.
- Marketing: understand the identification of needs and the targeting of prospective customers, plus an analysis of the "benefit in use" to a customer. Can design a promotion and sales program based on identified need. Understand the alternative channels to market: distributor, agent, direct sale, and the pricing implications of each. Understand fair trade practices and common violations of combines legislation.
- Sales: understand the rudiments of selling. Can discuss features and benefits, understand "overcoming the objections", and know what "asking for the order" or "closing" means.
- People management: understand management styles and variations in human personality, understand leadership issues of motivation, direction, and discipline, and understand supervisory issues of clear communication and active listening. Have some sense of the needs people bring to work. Be competent in a wide range of communications, including one on one, out to customers, suppliers, and key contacts, down to subordinates, up to superiors, and across to peers, and group communications that include a work team, an entire company, or an entire industry and its affected stakeholders. Can form and share a vision.
- Human Resources: understand the legal framework in which people work, the nature of deemed or actual employment contracts, the concept of severance, the role of unions, typical benefits issues (including typical pension issues).
- Company organization: understand the alternative forms of organizing a company, and when each form is most appropriate.
- Contracting: understand the role of the contract and the requirement to protect the interests of the company. Can acquire or license technology by contract and have some sense of deal structure.
- Developing, buying and selling technical know how: understand what is needed to protect intellectual property. Understand patents and licensing issues.

- Historical and social insight: business issues evolve in the context of history and competing forces within society, and people's reactions and actions today reflect their place in society as well as the history of an issue. Part of the skill set of senior management is understanding issues in the context of history (e.g. union labor relations) and society (e.g. the ongoing evolution of environmental controls).
- Strategic planning: what direction should a company take at the highest level. Some historical examples: should a pipeline company merge with a chemicals company so that the steady revenue of a regulated utility offsets the cyclical earnings in chemicals? Should a basic chemicals plus specialties business divest itself of the basic chemicals? Should a telephone provider buy a cable company or focus on offering cable type services through ADSL, in competition to the cable company?

Depending on the management assignment, not all of these are required. For example, Syncrude employees do not need sales skills, since marketing of the product is the responsibility of the owners. Usually only very senior management makes strategic decisions, in conjunction with a Board of Directors. In some larger companies, all decisions on sources of financing are made by a remote Treasury Department. However, the greater the familiarity with this overall skill set, the more enjoyable a career in engineering will be.

In ENGG 401 and 405, many of these will be touched on, albeit briefly in some cases. As noted above, the objective is not to make anyone an expert in these subjects, since far more training and/or experience would be required for that. As engineers move into management, they will need and can get further training (formal and informal) in each area. Part of the purpose of this course is to create a sense of pessimism about what the student has not mastered, that is more than offset by a sense of optimism about the ability to learn more over time in all areas of management.

APPENDIX 1.1: MONEY AS A MEASURE OF VALUE, AND SOCIETAL STANDARDS RE VALUES

Humans are constantly faced with questions of competing or conflicting values. At the individual level, we face these choices every day. Should I spend more to rent an apartment with a separate bedroom for me, or reduce the rent by sharing a bedroom? Should I buy an old car and face the prospect of higher maintenance charges, or buy a new car and have higher payments? Should I buy dinner out and have more time for studying, or take the time to eat in and save the money?

At an institutional level (for example a company), managers make many value choices. For example, should we produce nickel powder at a cost of x and a recovery of y , vs. nickel briquettes at a lower cost and higher recovery, but with a lower sale value (price)? Should we hire two more laborers or pay overtime? Should we buy a second machine or run a nightshift?

At a social level, we also face these choices every day. Should a wilderness area be drilled for gas, or are the area's features so unique that no development should be permitted? In a country with governmental health insurance, what is an appropriate waiting list for heart bypass surgery?

Money is a measure of commercial value, and as such it is an excellent guide to decisions that involve only commercial values. What is worth more, a pound of feathers or a pound of iron? This question is easily answered if the time frame is today, since one can look up the "market" price of feathers and iron and get a definitive answer. If the time frame is one or five or 25 years from now, the question is far

tougher to answer, since one must forecast the relative price of feathers and iron far into the future. This takes much more analysis and involves uncertainty, but money is still the measure that captures the commercial value (the value of money itself has a time component, as will be discussed in much greater detail later in the course).

The price of something (its commercial value) is usually set by a balance of supply and demand. There are many exceptions to this, for example services provided by a regulated utility which is granted a monopoly and a virtually set rate of return in exchange for cost based pricing, and in Canada services provided by a doctor. However, the vast majority of goods and services are allowed to fluctuate and respond to short term and long-term changes in supply and demand. Predicting future price is often the most important element in an investment decision.

At the individual and social level, we frequently find questions that cannot be measured by money because they involve values other than commercial values. What bank pays the highest interest on a \$500 GIC is easy to answer, but "should I save \$500 towards my retirement or go on a trip to the mountains with my spouse and children" cannot be answered by any reference to money. Similarly, the question of whether to save money and have a roommate, or spend more for a bedroom for yourself, cannot be answered by money alone. Clearly, the shared room is cheaper, but what is the value of privacy? Not all people will give the same answer to these value questions. Part of the joy of knowing others is understanding their values, which are in some way different from one's own.

Social questions such as the value of wilderness vs. jobs do not have a clear monetary measure. Some economists argue that one can assign an economic value to wilderness, in part by imputing the value from decisions that people make regarding the cost of accessing wilderness. This may have a theoretical grounding, but in a practical sense we don't even consider these monetary values when we consider these issues (usually in a political forum).

One clear function of society is to impose some non-monetary values on activities. Hence, society outlaws crime and defines a wide range of standards of behavior such as labor standards or environmental compliance. Money is not the only issue considered when standards are set. For example, when the length of the workweek or the number of paid holidays per year is considered, ideally both monetary and non-monetary factors are considered. Some business activists believe that an individual business should factor non-monetary values into its decisions (for example, don't trade with country X because of its human rights record, or redress historical imbalances in the work force unilaterally, or go beyond a required standard of environmental performance in some area). Businesses can normally assess commercial values very well, but can get very confused by a mix of commercial and societal values, since there is not a consistent mechanism to consider and resolve the societal values. (The major purpose of politics and government is to assign societal values and ensure that the important ones are met. Ideally this is done with informed public debate.)

A model of society assessing standards and setting the importance of non-commercial values is followed in most of the world. This frees business to maximize commercial value (measured by money) within the constraints of the standards. Some standards, once set, can be monetized, and this hybrid approach has worked very well in environmental issues. Thus, instead of forbidding any new emissions of SO₂ into an air basin, we give business the option of offsetting this by reducing emissions somewhere else in the basin by an amount equal to what is proposed to be added. This kind of offset program quickly leads to a "market" in emissions, which can be traded, and helps to ensure that the least expensive

clean up is done first, and the most expensive last. Note that the fundamental non-monetary value (that SO_i must be restricted to x level) still comes from society.

The model of society assessing standards and setting the importance of non-commercial values works best if all "persons" in a society can contribute to the discussion. Hence, the role of business is to make clear the cost of a new standard, since this will ultimately be built into the cost of a good or service and be borne by consumers. When business or interest groups either dominates the process or is excluded from the process of setting social standards, the quality of the standards is reduced.

As business has become increasingly globalized, i.e. as a given business operates in many countries, the problem of setting standards has become more difficult, since standard setting still largely occurs at a national level. (The emergence of the European Union is an exception to this, but one can think of the EU as a large "super-nation" that is not truly global.) From the perspective of society, a standard that is grossly out of line with a trading partner will raise costs and drive jobs out of the "high-standard" country. From the perspective of business, one can interfere with a balanced evaluation of an appropriate standard by threatening to pull work out of high standard countries. How this conflict will resolve itself is not yet clear. Historically, there have been times when business power has far exceeded the power of society to regulate it, but this normally balances out over time. Watching this drama unfold is one of the exciting elements of business at the turn of the century.

PROBLEMS

- 1.1 Read Building Wealth, by Lester C. Thurow, Atlantic Monthly, June 1999. You may also obtain a consolidated copy of this article for one time personal use, by e mail from the professor. In particular, comment briefly (one page or less) on the following:
 - What does Thurow think has created this most recent wave of creation of wealth, and what created the wave before it? Why would income distribution have a different trend in 1950 than in 1900 or 2006?
 - Thurow refers to *homo economicus*, and has some thoughts on why humans don't maximize current earnings. Reflect on those reasons.
- 1.2 Reflect on what you think your own happiness vs. income curve looks like, i.e. let the y-axis be "personal happiness" in the broadest human sense and the x-axis be income level. Speculate on what you think your curve will look like at age 25, 55, and 85 and plot these as well. Graph these curves (hand sketch is fine), and give one page or less of comments on your thoughts.
- 1.3 Comment on income level as a relative versus an absolute source of personal satisfaction, i.e., to what extent does a sense of personal satisfaction relate to the absolute level of income versus the relative level of income (how much a person makes compared to others). In forming your thoughts, reflect on your parents' generation and grandparents' generation absolute income levels (the absolute value of the income they received rather than its value relative to the income of others) and their relative happiness. Also comment on the statement that salary is a lousy motivator but an excellent demotivator. (One page or less).
- 1.4 Look at the list of management skills in chapter 1. Discuss, briefly, one situation from your summer or part time employment in which one of these skill sets was deficient, and describe the negative impact this had on the workplace you were in (1/2 to one page).
- 1.5 In section 1.3, three types of regulation of business were discussed:
 - Protecting businesses from the actions of other businesses.
 - Protecting individuals from business actions.
 - Protecting society from business actions.

Give an example of each type of regulation, say whether in your opinion this regulation is efficient and effective, and identify whether, in your opinion, society would benefit from a change.

- 1.6 Would you expect emission standards (for example from automobiles) to be more stringent (lower emissions) or less stringent (higher emissions) in India vs. Canada and the US. Say why, and relate your answer to the extent that your knowledge permits to the evolution of emission standards in North America over the last 100 years.
- 1.7 Take one issue in contemporary society today in which you see society as a whole struggling to define a value that is not purely commercial. (The example from the text was preservation of wilderness in a particular area of Alberta versus the development of additional hydrocarbon resources from under this area. As other examples, there are numerous environmental issues in Edmonton today, including locating an expanded power generation facility on the site of an existing facility in downtown Edmonton's river valley, and setting an appropriate level of SO₂ emissions for the Shell Scotford bitumen upgrader). For the issue you select, briefly say what the issue is, what the competing positions are (at least two, maybe more), who is advocating the various positions, and how society will eventually make a decision to resolve the conflict between various positions, i.e. who will make the decision, and how (1 page or less).
- 1.8 The US Justice Department recently prosecuted Microsoft for hindering competition. The Justice Department argued that Microsoft abused its large market share to, among other things, require customers to take "tied" deals, in which a requirement of obtaining Microsoft operating software at a competitive price was that Microsoft's Internet Explorer program be installed on the computer. The Justice Department furthered argued that this kind of practice, and the large market share that Microsoft holds in part due to such practices, is harmful to society. Microsoft argues that their large market share is the result of innovation and superior products, and that attempts to break up the company or limit its practices will harm innovation and hence society. Give your opinion on this (one to two paragraphs).

INTRODUCTION TO FINANCIAL STATEMENTS

2.1 OVERVIEW OF FINANCIAL STATEMENTS

Professions typically develop standard documentation that is crucial to the practice of the profession and so ubiquitous as to impact more than 90% of the group. For example, all doctors would know the form and purpose of a medical chart in a hospital. Within engineering, chemical engineers are virtually universally exposed to Process Flow Diagrams and Piping and Instrumentation Diagrams, electrical engineers would all be exposed to circuit diagrams, architects and civil structural engineers would all know plan and elevation drawings, and all engineers in construction would be exposed to critical path schedules. The standard documents of businesses are financial statements, and these are so important that anyone in a commercial environment should have a basic knowledge of them.

Financial statements are a form of scorekeeping, and are designed to answer some very important questions about commercial activity: "are we creating value?", "do we have enough resources to stay in business?", and "where does our money go?". These questions arise in family finance as well as business finance, and are relevant from a corner store to a multinational corporation. Just as in other fields of study, conventions and practices have evolved to help present data that contributes to insight. The key objective in learning about financial statements is to see how to extract useful information from the data.

2.2 BOOKKEEPING AND ACCOUNTING

As we discussed above, for almost all enterprises in which engineers are involved, money is an appropriate measure of value. For that reason, transactions that involve money are carefully recorded within almost all businesses. Bookkeepers note every transaction that takes place within a business. A non-exhaustive list of the types of transactions that are recorded would include:

- Product or service sales for cash
- Product or service sales to be invoiced and paid at a later date
- Asset sales (for example, selling used equipment that has been replaced)
- Purchase of raw materials (for cash or future payment)
- Purchase of services from third parties (e.g. legal help)
- Purchase of fixed assets (e.g. land, buildings, machines)
- Payment of salaries
- Payment of office expenses such as rent and utilities
- Payment of taxes
- Borrowing of money
- Repayment of borrowed money

- The investment of new funds (equity) into the business
- A dividend to investors
- The repurchase of shares in the company, i.e. the retirement of equity

Typically each transaction measurable by money is recorded first in a journal (a chronological listing of transactions). Within bookkeeping and accounting, there is a "double entry", since each transaction has two sides. For instance, if an asset is bought for cash, cash on hand goes down (a credit) and the value of assets goes up (a debit). There is a parallel between energy accounting (in ordinary thermodynamics, energy is neither created nor destroyed, hence it is a zero sum game) and financial accounting, in that each one uses a "balance" approach to see if energy gains and losses (or financial credits and debits) balance.

Journal entries are transferred to ledgers, which capture entries from the ledger into one of five categories:

- Revenue
- Expense
- Assets
- Liabilities
- Shareholders equity (capital)

Once transactions are entered into ledgers, they can be balanced and assembled into standard financial statements, which managers analyze to make appropriate decisions. Hence, the progression is from transaction to journal to ledger to financial statement to management analysis to decision making to implementation, and from bookkeeper to accountant to manager.

2.3 TIMING ISSUES AND MATERIALITY

Over time accounting has developed procedures that allow financial data to be highly usable in making management decisions. For example, careful steps are taken to ensure that revenues and expenses are recognized in the same time period.

Consider a business that makes large vessels, for example those used in high-pressure processes in the petrochemical industry. It can take months or even years to fabricate one such a vessel. Steel is purchased early in the manufacturing cycle and fittings such as nozzles and valves are purchased along the way. Direct labor charges are incurred over the course of the manufacturing of the vessel.

If all costs for the job were "expensed" at the same time, i.e. if the company did its accounts by showing expenses and revenues as they were realized, the company would show a loss over many months (since no revenue would be coming in while the vessel was being fabricated), and then would show an enormous profit in the month that payment for the vessel is received. It would be virtually impossible for management to determine how the company was really doing financially, since the months that losses were incurred might or might not be offset by the future sale.

To avoid this confusion, accounting has developed techniques to "postpone" expenses until the corresponding sale is booked. Thus, money spent on steel is held in an asset account (for example raw materials inventory or "work in progress", the name given to work on the shop floor). Direct labor charges

can also be accumulated in work in progress. If the vessel is not shipped as soon as it is made, it can be held in finished goods inventory. Then, at the point of actual transfer of the vessel from the manufacturer to the customer (the point of sale), the revenue for the sale is booked and the value in finished goods inventory (all of the accumulated costs of making the vessel) are converted from an asset (inventory) to an expense ("cost of goods sold", also known as COGS, which is discussed at some length in Chapter 3).

Similarly, when custody of the vessel changes hands the payment for the vessel is rarely done at the same time; most business terms are "net 30 days", meaning the customer is asked to pay 30 days after the invoice, which is usually issued on the day of sale or one day after. However, large companies often take up to 50 days to pay invoices because they process the paperwork so slowly. Even though the cash has not been received from the customer, the sale is "booked" and an offsetting asset is created: a receivable, which is money due from a customer.

These procedures help to line up revenue and expenses into the same time period, so that management can determine the key question: is the company creating value. The financial statements give insight into the business and allow informed management decisions. The accounting is complicated: the same steel will move through many accounts: raw materials inventory, work in progress, finished goods inventory, and ultimately COGS, and the same product will go from sale and receivable to cash. However, this complexity is more than offset by the insight that the information provides.

Another concept in accounting is materiality, which shows up in determining whether errors need correction. It is inevitable that mistakes will occur in accounting, given the thousands of transactions that are recorded daily. If the mistake is minor and correcting it is unlikely to add any insight into the business, it is judged to be "not material" and the correction is not made. Thus, a miscoded \$50 part on a \$1.2 million vessel will not be corrected if the books have been closed, i.e. completed. However, an error of \$50,000 would likely be corrected by a "post period adjustment". Companies often define standards for materiality.

2.4 FINANCIAL ANALYSIS AND FINANCIAL STATEMENTS

Accounting, like engineering, is a rigorous profession with many rules and standards developed over long periods of time. An engineer will not likely be a master of accounting, but the engineer can certainly be expected to understand financial information once it is at the level of a financial statement, and to be able to make informed decisions based on that information.

For business, there are four standard documents that are universal and apply from the smallest enterprise to huge multinational corporations:

- Income Statement: how much money (value) did we make in a given time period.
- Statement of Retained Earnings: of the money we have made since our business started, how much has been kept in the business vs. being paid out in dividends to the owners.
- Balance Sheet: how much do we have at a given point in time, and where did the money come from to acquire this.
- Statement of Cash Flow: what did we do with our cash.

The Income Statement is for a period of time, i.e. how much did we make in some period of time (e.g. a month, a quarter, or a year). The Statement of Retained Earnings records how much earned value

has stayed in a business since the start of the business, hence it is cumulative, but it also shows the most recent year, i.e. how much money was kept in the business in the last year. The Balance Sheet is at a point in time, since how much a business has (e.g. cash, inventory, assets) changes day by day, as customers buy goods and pay their bills, and the business buys raw materials or assets and pays its bills and payroll. The Statement of Cash Flow, like the Income Statement, is for a period of time: how much money flowed into and out of our business in some time period. The Statement of Cash Flow is usually prepared on the same basis as the Income Statement, i.e. monthly, quarterly, and/or annually.

To understand an existing business, you must understand historical versions of these documents. Reasons to understand a business are to manage it (hopefully for the better, be it growth, short-term profitability, or some other sensible goal) or to justify purchasing it. To start a business, especially if you want outside financing, you must project these statements forward (these are called *pro forma* statements).

The purpose of analyzing financial statements is to guide action. The actions can range from buying a stock to founding a company, but in all cases we pour over these statements so that our actions are appropriate and helpful.

2.5 OPERATIONAL VS. FINANCIAL MANAGEMENT

Financial statements let us observe and make judgments about two distinct elements of management: operational and financial.

To understand the difference between the two, consider two companies that make identical manufactured products. Company A has less wasted raw materials, uses less labor per unit, has less inventory, has more sales, has lower marketing costs, and has fewer units returned for warranty claims. Clearly, we would think that Company A was better at operating in the business than Company B is. If we were shareholders in Company B, we would want to ask management why Company A was so much better at using resources, assets and staff to make and sell goods. If we were shareholders in Company A, we would congratulate management on their operational skills: they can operate the physical elements of the business well, creating value in the process.

Now imagine that Company A has paid excessively high dividends over the years, depleting its cash reserves and increasing its debt to the point where one bad year will put it into bankruptcy (which occurs when a company can not service its interest and principal payments on its debt). Company B, although inferior from an operational point of view, has built up cash reserves, has a low debt level, and can ride out a bad year. We would think of the management of Company A as being financially reckless, while Company B's management has been quite conservative. If Company A goes into bankruptcy, the shareholders typically get nothing, and they would be quite right in criticizing the poor financial management skills.

Operational management is fairly easy to understand: how efficient is a company is using resources (materials, assets, and staff) to deliver a product or service that meets a customer's needs. Delivering more value while consuming fewer resources is what operational management is all about.

Financial management is less clear, but no less important. In a practical sense, all businesses use some combination of debt (other peoples' money) and equity (the owners' money) in order to operate. Financial management involves combining appropriate amounts of debt and equity, meeting obligations

to lenders and suppliers, and rewarding equity owners with a combination of growth and/or dividends, so that a company stays healthy and if needed it can attract more debt and equity in order to grow.

The key objective of financial analysis is to be able to make good judgments and decisions about operational and financial management issues.

PROBLEMS

- 2.1** Take the following list of accounts and for steps 1, 2, 3, 4, 5, and 7 and show an equal entry in two separate account, i.e. changes to two accounts that "balance". Step 6 will be discussed in class. Also answer the supplemental question in step 5. The accounts are: cash, accounts payable (money a company owes to its suppliers), inventory of raw materials, work in progress (the value of the goods that are on the shop floor being manufactured into a product), inventory of finished products, cost of goods sold, sales revenue, and accounts receivable (money due to be collected from a customer). Assume that the terms you buy materials and sell products on are standard commercial terms, i.e. you issue or receive a purchase order, which triggers an invoice, and the invoice is paid 30 days later.

Steps:

1. You order and receive \$1000 of steel from a supplier.
2. You pay the supplier (typically 30 days later).
3. You move the steel onto the shop floor and start fabrication.
4. You incur \$1000 of shop labor costs in making the product.
5. You finish fabrication of an item with a cost of \$2000, of which raw steel cost is \$1000 and shop floor labor is \$1000, and move it to finished product inventory. (What "book" value do you think the item would have sitting in finished product inventory, the cost incurred in making it (\$2000) or its likely sale price (\$2500)?)
6. You sell the material to a customer for \$2500.
7. The customer pays you (typically 30 days later).

- 2.2** Based on your experience of the home you grew up in and/or the home you have made, which of the concepts of financial statements do you think arise in a personal setting, i.e. how much time is spent determining and discussing the concepts? Comment briefly on your answers.

- Income Statement: how much money (value) do we make in a given time period?
- Statement of Retained Earnings: of the money we have made since we started, how much has been kept vs. being paid out?
- Balance Sheet: how much do we have at a given point in time, and where did the money come from to acquire this?
- Statement of Cash Flow: what did we do with our cash?

THE INCOME STATEMENT AND STATEMENT OF RETAINED EARNINGS

3.1 THE PURPOSE OF THE INCOME STATEMENT

The purpose of the income statement is to measure profitability of a business within a given time period. Profit (also known as gain or net income), measured by the accumulation of money, is simply a measure of the creation of value within a business. A business that is unprofitable in the long term does not create commercial value, and hence should not exist. As noted above, the test of profit must be restricted to commercial enterprises only, since we have many areas of life where value is not measurable by money.

3.2 THE TIME SCALE OF THE INCOME STATEMENT

For most businesses, the key time period for financial statements is monthly, with a quarterly and an annual roll up. For purposes of financing a new business or the purchase of an existing business, one would typically go to a lender or investor with a pro forma month by month projection for the first one or two years, and an annual forecast thereafter for up to five or ten years in total.

Income information usually does not have significant meaning in a very small time scale. "How much did our business make in the last year (or month)?" is a very relevant question. How much it made in the last 15 seconds is irrelevant, because the "noisiness" of income and the inability to match income and expense become overwhelming at the small time scale. This may sound obvious, but one sometimes sees a management demand forecasts of income over too small a time scale, which can lead to severely dysfunctional behavior in a business.

One example of this was a large metal and fertilizer producer that was weathering a period of low metal prices with a poorer stock performance than competitors. Management was concerned and not clear on how to deal with the issue. The notion arose that the company lacked good middle management, and that the test of good management was the ability to predict weekly income. The most likely source of this belief was that senior management was dealing with their frustration by looking at results on a week-by-week basis, and was seeing variability that it did not understand.

Metal sales for this company were by container load, and each container had a value of \$100,000 to \$1,000,000. All metal was pre-sold before shipment, and either covered by long term contract with companies that had excellent credit ratings or by an irrevocable letter of credit that said in essence "once custody passes from our hands to yours, your bank is irrevocably directed to pay us the full amount of the sale from funds pre-reserved for this purpose". Hence, the true sales risk was zero.

However, the point of custody transfer was when a dockside crane at a port first lifted the container. The metal remained in the producer's custody during the rail shipment to the port, and while on the dock. Although there was no risk to the ultimate sale, there was a great deal of risk that a container scheduled

to be loaded on a Friday might not actually get lifted until Monday, causing a large sale to shift from one week to the next. The ultimate impact of senior management's mistaken belief that a pro forma income statement was a crucial item on a week by week basis was to shift middle management's attention from the important work of selling metal at a high price to the unimportant work of understanding crane schedules in a remote port. The crane evaluation was unimportant because the sale was not at risk, simply the week it would be booked in. By picking too short a time period for an income statement, senior management had in effect diverted resources from useful to useless and defensive work.

3.3 THE FORM OF THE INCOME STATEMENT

There are many small variations in an income statement, but for this course we will use a common form:

	Gross Revenue (from sale of products or services)
Minus	Allowance for Bad Debt, Warranty, Returns and Adjustments
Gives	Net Revenue
Minus	Cost of Goods Sold
Gives	Contribution Margin (aka Gross Margin)
Minus	Sales, General and Administrative (aka Operating) Expense
Gives	Operating Income
Plus	Other Income
Gives	Net Income (aka Profit, or Loss if Negative)

3.3.1 A Comment on Tax

Companies, like individuals, pay income tax on net income. Taxes are based on consolidated income, i.e. they are calculated on a company-wide basis since in the eyes of the law the company is equivalent to a person. Income statements are frequently prepared by product line through the contribution margin, and by division within a company to the net income stage. This is understood to be net income before tax, and the calculation of tax is not performed until divisional data is rolled up into a company wide income statement.

In the balance of this chapter, net income is treated as before tax net income. Tax is discussed under depreciation, Section 3.4.3.1 below, and later in the course notes.

3.4 THE COMPONENTS OF THE INCOME STATEMENT

Some simple guidelines help make the assembly of an income statement consistent and hence more useful. One rule is to try to recognize revenue and its related expense in the same time period. If, for example, one has a major expense for materials for a sale that will not occur for many months into the future, one can apply accounting rules to "hold" this cost as an asset, either inventory or "work in progress" until the sale occurs, at which time the cost is transferred to an expense. Similarly, one might sell something to a customer who won't pay for 60 days. However, the sale is "booked" when title to the goods passes to the customer, and the revenue is recognized in the same period as the various expenses associated with the good or service that was sold. This approach prevents wild fluctuations in the numbers on an income statement.

Reflect on why this is important. Consider a business that fabricates large vessels, and makes perhaps 20 per year. If all expenses and revenues were booked in the period they were realized, then some months the business would have a huge loss (months in which it had bought the material for several vessels, but had sold none), and in some months the business would have a huge gain (a customer might pay for many vessels at once). In trying to make sense of the business, the manager would be looking at monthly income statements with wildly fluctuating levels of profit and loss. However, by applying simple accounting rules and recording the costs associated with the manufacture of a vessel in the same time period as the sale is "booked", one gets a consistent income statement that is a true picture of the business.

3.4.1 Revenue and Net Revenue

Revenue is typically sales. In some businesses, bad debt or warranty work is a significant portion of sales revenue. The **bad debt** is either not collectable or can only be collected at a steep discount (i.e. the business on average recovers only a fraction of the total value of the sale from "bad debt" customers). The **warranty** work is an obligation on the sellers' part to provide service during some initial period. The approach adopted in these notes is to deduct the likely bad debt or warranty load (based on history) directly from gross revenue, resulting in net sales revenue. This is in effect an allowance for bad debt and warranty. If the actual bad debt or warranty cost is different from the historical forecast, one can make an annual adjustment to the revenue. In practice, there is more than one way to treat bad debt or warranty in financial statements, so you can expect to see some variation, for example it may appear as an expense lower in the financial statement. The important thing to note, especially in businesses with low contribution margins, is that these costs can cause a significant reduction in operating income.

Adjustments for "allowances and returns" also show up as a deduction from gross revenue in some businesses. **Allowances and returns** is the name given to adjustments for wrong shipments and returned goods that for some reason can not be put back into inventory. The convention followed in these notes is to refer to "Allowance for Bad Debt and Warranty" as the only adjustment between gross and net revenue, but depending on the business, it may make sense to include "allowances and returns" or to exclude "bad debt and warranty". As will be noted often, consistency from year to year within a company is more important than consistency between different companies, since consistent practice lets management see emerging trends in financial performance.

3.4.2 Cost of Goods Sold and Contribution Margin

Cost of Goods Sold (COGS) is the direct cost of making or purchasing an item. In some cases, it is the materials input only, in other cases, it is the material plus the manufacturing labor. What is important is consistency, since the net revenue minus COGS is the **contribution margin**, which is extremely important in tracking and controlling a manufacturing business.

Many businesses have large COGS costs relative to final sale price. Think of a vessel manufacturer working in specialty alloy materials. The materials costs are a substantial part of the final cost of the item, and hence, in ratio to the price it will be a significant number. Tracking contribution margin in such a case is a means of determining the effectiveness of either a manufacturing group (including purchasing) in holding costs down, or of a sales group in keeping prices moving up in relation to increased costs.

In the example above of a high alloy material content, we know that the value of nickel, cobalt, molybdenum and chrome can vary widely, with significant shifts over short periods of time.

Note that some businesses have very low COGS values. These are businesses that add a large amount of value to simple raw materials. Also, consider a business with a single employee that offers a service. One would typically include the salary of the single employee in SG&A costs, discussed below. Hence, there is little or no COGS: perhaps some paper costs would go up as the volume of work increased, but this minimal expense item is again normally captured in SG&A. Hence, whether COGS and contribution margin are important measures of a business depends on the nature of the business. For manufacturing businesses, including assembly businesses such as compressor skid packaging, COGS is a crucial metric.

In a perfect world, COGS would be fully variable, i.e. it would vary in direct proportion to the level of sales. For example, if a vessel fabrication business sold two vessels it would buy twice as much alloy material and welding rod and perhaps hire twice as much labor. In the real world, few costs are purely variable. Even if you are assembling "widgets" into a product, you can sometimes get a volume discount as your purchase level increases, and you will likely find some "economies of scale" in production labor. Hence, the contribution margin will have some variability with level of sales. Nevertheless, the assumption that COGS is a measure of the variable cost of an incremental sale is a good assumption for small changes in sales volume, and therefore contribution margin measures what is left over from a sale to contribute to the fixed costs of a business. This is a very important concept that we will return to.

Contribution margin is also performed on a product-by-product basis within a business, and can be a powerful guide to where to focus company efforts. This will be illustrated in an assignment problem.

Contribution margin is calculated in dollar terms on an income statement, but it is most often cited as a percentage within a company, with the percentage being contribution margin over gross revenue. Hence, one might hear the phrase "our margin on unit x dropped by 1%", or "one of our key objectives for next year is to increase margin on product line y by 3%". Companies carefully look at year to year changes in margin.

3.4.2.1 Using Concepts of Contribution Margin

One may wonder why we go to all the effort to determine margin, and why we pay such attention to it. There are two key reasons for this.

First, margin is one good measure of the ability of a sales/marketing group to "take price", i.e. to continue to extract value from the customer for the goods that are sold. Falling margin usually means either that customers are not willing to continue to pay the same value relative to cost, or that a sales and marketing organization is going "soft" and has lost the will to extract price. In rare cases, it may be a warning that quality is dropping, if the loss of margin is associated with high returns or warranty claims, although one can also see this from the line item in the income statement associated with warranty and returns.

There is tremendous pressure in most companies to increase sales and hit budgeted sales targets, but this can lead to a "sales at any price" mindset in a sales force, in which discounting of price is seen as the primary mechanism to induce additional sales. Companies will sometimes counter this by tying commission for sales staff not to total sales, but to total contribution margin, i.e. a salesperson who made many sales at low price and a salesperson who made fewer sales at a higher price would get the same reward. With reflection, you can see that the fortunes of the company are tied to total margin contribution, not to total sales.

If margin is dropping, management should ask some probing questions to try to understand why:

- Is margin dropping because of an increase in costs, i.e. is the cost of goods sold going up? If so, why is this the case? Is there a legitimate increase in the cost structure of suppliers? For example, if the price of oil doubles, we can expect some costs to go up; goods that are delivered over long distances, for instance, will have higher shipping charges. If the price of a raw material goes up (for example, nickel), then the cost of stainless steel components will go up. However, suppliers want more net income, and sometimes the cost of raw materials goes up simply because the supplier is trying to extract more price. Management should know this, and decide how hard to "push back" by resisting the price increase with the current supplier and/or looking for alternate suppliers.
- If margin is dropping because costs are rising, why can't the increased cost be passed on to the customer through a price increase? The normal test of cost recovery is not a fixed dollar value of contribution margin, but a fixed percentage, meaning that we expect the contribution margin created in a company to stay proportional to the costs. If an increased cost can not be passed on to the customer, management should probe why this is the case. Does a competitor have a lower cost structure or a different supplier? Or, as sometimes occurs, is a sales force simply reluctant to push through the increase?
- If margin is dropping and costs are not rising, is the problem that a competitor is pushing down the price? If this is the case, then does the competitor have some advantage (better manufacturing equipment, lower raw material cost, cheaper labor rate), or is it just that the competitor wants more market share and is willing to earn less value (margin) to get that share? We will see when we discuss marketing that the long term pattern in a product life cycle is that margins start high when a product or service is novel, and erode over time as more and more companies try to supply the product or service based on lower cost. However management should be aware of such trends, because they affect the long term health of a product line and the company itself.

The second reason margin is so important is that it is used in pricing marginal sales. Imagine that you are selling a product in North America, say a gear box, and your factory is running at 80% capacity. Your product has a contribution margin of 24%, or a COGS of 76% (assuming warranty and bad debt is very low). You would like to have a wider customer base, and you want to try to break into Europe. What introductory price can you use to try to build up a customer base? Any discount less than the margin percentage still means that the incremental sale is contributing to the company. Thus, for example, if you discount your gear box 20% to try to get a new incremental customer in Europe, your company will still be further ahead (cash positive), because the cost of the incremental sale is 76% of the normal sale price, and the incremental revenue from the discounted sale is 80% of the normal sale price. The 4% difference is incremental cash that goes to cover the fixed costs of the company.

This exercise may seem trivial for one product, but imagine a company that has hundreds of products, each with a different margin, and a mandate to expand into a new market. The Vice President of Marketing might, for example, authorize his sales staff to discount up to half of the contribution margin on sales in the new territory, which would mean she would not have to review each individual pricing decision. The theory is that once the new customers try and like the new products, they will continue to buy the products at the normal price, returning the company's margin to historical level. We often label initial discounts as "temporary" to underline this concept to the new customer.

Pricing based on margin is a widespread practice when a company is trying to build new sales. However, it has some dangers that indicate one should take this approach with caution:

- Is there any extra cost associated with the marginal sale? For example, if a cost that is normally a part of SG&A increases due to a new sale, then pricing solely based on margin and COGS is not a true measure of the impact of the sale. In our gearbox example above, if two new shipping clerks need to be added to arrange special packaging for a sale to Europe, then a deeply discounted sale may not be cash positive to the company. Losing cash on a sale is rarely justified, and should require some higher level of authorization within a company!
- Is the sale truly marginal? Often we think that an overseas sale has no implications on our sales volume in a home market, but this is not always the case. If we sell many gearboxes to Europe, and they come back to North America in a finished product (say a hydraulic pump assembly) and back out sales from our customers that pay full price for our gearbox, then we don't have an incremental sale, but rather a lower margin sale displacing a higher margin one. At one time in the petrochemical industry deep discounting of Pacific Rim sales ended up damaging North American customers as cheap resin came back into the North American market both on resale and as manufactured product.
- Will our high paying customers learn that we are discounting to a less valued customer? Nothing frightens a marketing manager more than the thought that the discount given to get a new customer will become known to "long and faithful" customers, who will be indignant that they do not get "most favored" status. Treating discounts that are not related to volume of purchase as temporary and sticking to this is one way to minimize this risk.
- Is the sale a "dump"? At one time, it was a common practice for a company to have high margins from customers in its own country (with the market often protected by a tariff), and to sell at slightly above marginal cost in foreign markets. This practice became known as dumping, and both national legislation and international trade treaties (e.g. the WTO) have arisen to prohibit this practice. Discounts to build market share that become permanent (because the market being discounted is seen as distant) constitute dumping. The cost of defending a dumping action is prohibitive, and penalties are severe in that retroactive damages can be extracted.

Despite these cautions, analyzing pricing against margin and giving flexibility to discount based on margin, especially for new sales, are widespread practices.

Margin plays a key role in rigidly setting price in certain businesses. For instance, many warehouse distribution centers carry a varying line of products, and will simply "mark up" the product, selling it at a fixed multiple of the cost. Thus, if a distributor carries hundreds of products at a margin of 20% and is asked to carry a new product, he will price the product at cost times 1.25 (equivalent to cost divided by 1 minus margin). This kind of approach allows rapid pricing in response to customer enquiries, without senior management intervention. Similarly, skid packaging businesses often work to a fixed margin based on the component cost of a skid; they do this because the labor to assemble the skid can not be exactly estimated but usually runs a fixed percentage of the component cost. Thus, a company making compressor packages might have a rule of thumb that skids will sell for a fixed markup over the cost of components, and an engineer can price a new skid by pricing the components and applying the markup. This again helps in rapid response to bids and budgetary enquiries.

3.4.2.2 Margin in Public Annual Reports

Margin is an extremely sensitive business fact, and no company likes to reveal its true marginal (variable) costs. The simple reason for this is that a competitor then knows a pricing level that will cause the company to lose cash on every sale. The power of this is enormous: in history, the Hudson's Bay Company and Standard Oil, among others, exploited monopolies in some areas, extracting high price and margin, and "dumped" their products in areas where they had competition at less than the marginal cost of production of their competitors. The competitors ended up losing cash on every sale, and soon were sold or bankrupt. In some businesses where raw material price swings create a wide variation in COGS (for example, the manufacture of petrochemicals from ethane, propane, naphtha and gas oil feedstocks), exact knowledge of marginal cost would enable predatory pricing.

In publicly released documents, such as the annual financial statements of publicly traded companies, COGS is often not revealed, and variable and fixed costs (COGS and SG&A) are blended. In these documents, margin (sometimes called operating margin or contribution margin) is calculated based on all operating costs, not COGS. In addition, information by product line is very rarely given, and only at an aggregate level.

One major use of income statements is to assess changes in a business by product or product line through analysis of margin. Anyone who is buying a business with more than one product or service should insist on income statements that break down aggregated company data into COGS by product lines, and anyone selling a business with a good operating history will find it to their benefit to provide such information, since it conveys powerfully the strength and good future earning potential of the company.

3.4.3 Sales, General and Administrative Expense

The next element of the income statement is **Sales, General and Administrative (SG&A)** expense. As with other elements of the income statement, this can go by different names in other companies, for example **Operating Expense**. There is not always a common definition of what is in COGS and what is in SG&A; the important concept is consistency from year to year and product line to product line, since inconsistency for either of these factors can lead to wrong actions.

The items we think of as being in SG&A are the costs that are not related to the making of a product or the direct delivery of a service. For example, a company will have a President (or General Manager or Managing Director) regardless of the level of product manufacturing and sales that is achieved. This is a fixed cost of being in business. The same is true for telecom services; today, phone/fax/email is "table stakes", i.e. you cannot even start to be in business unless you have these items. A third example is business and property taxes and the fees to report to a provincial or federal regulator of companies, which a company must pay regardless of its profitability or its level of sales. A fourth example is accounting costs, since a business must keep books regardless of its sales level. These are the kinds of expenses that go into SG&A.

The cost of selling most often goes into SG&A, especially if a single Marketing and Sales group sells more than one product line. However, in some companies sales costs can be partitioned by product line because sales people are dedicated to a single line of the company's business. In these cases, particularly if sales costs are partially or highly variable (in that more sales cause higher selling costs on a near linear basis), the cost of selling is best included in COGS.

Again, in a perfect world SG&A costs would be "fixed", i.e. invariable. This is simply not true for major changes in revenue that have corresponding changes in the level of manufacturing (or service delivery) and sales. For example, if a company goes through a halving of its sales (as routinely occurs to many oil field service companies), then sales and administrative staff and expenses are usually "down-sized". Nevertheless, for small changes in revenue it is useful to think of SG&A as fully fixed, just as it is useful to think of COGS as fully variable. Typically, if you can achieve a small but significant increase in sales, for example 5 to 15%, you can support this change in sales level without an increase in SG&A. This is true if the number of customers does not increase, but the sales per customer increases, since there is then no increase in invoicing and accounting entries, simply bigger numbers per transaction.

3.4.3.1 Depreciation

Depreciation is one element of SG&A that requires special attention because it is key to understanding the difference between cash (or funds) flow and income as reported on the income statement, and is also crucial to understanding the difference between income as reported in a Financial Statement and income reported for purposes of tax.

If a person puts \$1 million in a bank in an interest bearing account, at the end of a time period she gets the original investment back plus the interest. If the same person puts the \$1 million into a business, they will want a return on their investment (which comes from profits), but they also want to be sure that their initial capital investment is recovered as well. Depreciation is best thought of as an accounting charge that insures that the value of assets that wear out is recovered by the business.

As will be discussed further when the balance sheet is reviewed, people put money into a business in order to acquire assets with which to run a business. Some assets are part of working capital, and by their nature they do not wear out. This concept is developed later. Some assets are fixed, i.e. they are tangible material things that a business uses. Examples are land, buildings, machinery, furniture, and computers. Consider this list: four of the five items wear out or become obsolete, but not on the same schedule. The fifth, land, does not wear out. So, if the business operated for 30 years, the computers it first purchased would have been obsolete many times over (at least six times based on the historical evolution of computer and systems technology), the furniture would have been replaced at least once and perhaps as much as three times, the machinery would likely have been replaced once, the buildings might just be coming to the end of their useful life, and the land would still have the same functionality that it had 30 years earlier.

Depreciation is a charge against revenue that recovers the cost of the original assets that are wearing out. It is usually treated by class. Thus, buildings would be lumped into one class, and might be depreciated over 20 or 30 years. Computers would be in another class, and might be depreciated over as little as 2 years.

The time period for depreciation depends on three factors: the durability of the item itself, the rate of change in the design of the item, and the nature of the business for which the item is being used. Thus, a computer and a pump can each operate 20 years in near continuous service with proper maintenance, and hence they have the same durability. However, the evolution of office systems in the last 20 years has ensured that computers are obsolete long before they wear out. We have discarded 286 personal computers not because they are broken down, but rather because they will not run the kinds of systems that we think we need to be efficient. Similarly, a pump in a petrochemical plant will likely last just as long as a pump in a petroleum refinery. However, we are more confident that there will be a market

10 years from now for refined petroleum products that the refinery can economically supply than we are that there will be a market for a specialty petrochemical. For this reason, one might depreciate the same pump faster if it is located in a petrochemical plant than in an oil refinery.

Note that depreciation is sometimes called amortization, as in the phrase "if we buy the new piece of equipment, we can amortize it over seven years". This is another example of the imprecision in financial statements.

3.4.3.2 Depreciation as a Non Cash Expense

When a company buys raw material, pays an employee, or buys telecom services or stationary, cash flows out of the business, if not right away then normally within 30 days when the invoice is paid or the employee's cheque clears the bank. These are cash expenses, and must be covered by cash that the business receives from revenue.

Depreciation is different in that there is no cash impact on the company in the time period that depreciation is assigned to the income statement. In effect, depreciation is a paper reduction of operating income that is designed to reflect past cash expenditures for assets that are wearing out, and for which the value cannot be recovered if the business is broken up and its assets sold. To state this another way, a portion of the money that a business generates is designated as equating to the value of fixed assets that are wearing out, and hence is not "value creation" as measured by net income. In a non-inflationary world that had no or very slow evolution of technology, one could also think that depreciation represented cash that was being saved to replace assets in kind in the future as they wear out, allowing the business to go on forever. However, there is no requirement to segregate depreciation into a separate account to buy assets in the future, and companies do not typically do this. As will be discussed later when balance sheets are discussed, if depreciation were not charged against income and deducted from the value of assets, then a company's financial statements would overstate both the value of the assets and the amount of operating income (value creation) the company generated.

Since depreciation is a charge that reflects past or future expenditures, but not current expenditures, no cash flows out of a business to cover this expense. The important concept that needs to be understood is that operating or net income measures the profitability of a business after including a recovery of past expenditures for assets that are wearing out, it does not measure cash (funds) flow. Operating or net income measures the creation of value, not the creation of cash. To say this another way, from a cash perspective, some of the revenue that comes into a company is attributed to depreciation rather than being named operating and net income, but that cash still sits within a company. If the cash that is attributed to depreciation were instead attributed to operating and net income, our income statement would overstate the true value created by the business. We would be fooling ourselves into thinking we were creating value when in fact what we were doing was using up an asset that we had purchased in the past without replacing it.

It is also important to recognize that cumulated depreciation is not a reserved pool of cash within a company. Management can use the cash that depreciation represents in many ways: it can be used to pay down short term or long term debt, it can be used to buy new assets, it can go towards a dividend to shareholders, or it can be left in the bank as cash. We have "recognized" cumulative depreciation by not calling this cash "income", but we have not "reserved" this cash. Management would strongly resist creating a reserve fund, because it restricts flexibility and requires that cash sit idle in a bank account until used at some time in the future for a single purpose (replacement of a given asset). Most management

teams can find better uses for cash than having it sit in an account, and a second consideration is that often technology changes and the asset that is wearing out is not replaced in kind.

Depreciation rates are driven by management judgment of the useful life of assets. One management team might think that its computers will be useful for four years, whereas another team would think that they would be obsolete in two years. One management team might think that a given petrochemical plant will be too inefficient to continue to be operated in five years, another might pick 10 years. These decisions affect the value of assets as stated in a company's books, and the value of net income that is reported. Because depreciation practices are affected by management judgment, they are normally discussed in a footnote to financial statements, i.e. one can find the assumed asset life by class in the footnotes.

The concepts of cash flow versus net or operating income and the impact of depreciation period on financial statements are crucial to proper financial analysis and will be returned to later.

3.4.3.3 Calculating Depreciation

The simplest and most commonly used means of calculating an annual or monthly depreciation charge is called "straight line depreciation". It is defined as

$$\text{Depreciation} = \frac{\text{Original cost minus expected salvage value}}{\text{Useful life}}$$

For example, imagine that all of the rolling equipment in a steel plant cost \$17 million and is to be depreciated over a 10 year period, and at the end of the ten years the equipment has no salvage value, meaning that its scrap value would equal the cost someone would charge to haul it away to a scrap yard. Then monthly depreciation is

$$\text{Depreciation (monthly)} = \frac{\$17,000,000 \text{ minus zero}}{120 \text{ months}} = \$141,666.67/\text{month}$$

Another means of calculating depreciation is discussed and illustrated in Appendix 3.1. Straight line depreciation is the most commonly used approach in business cases.

3.4.3.4 Early Retirement of Depreciating Assets

Accountants and Financial Managers are by nature conservative, in part because Auditors, who assess the financial statements of large publicly traded companies, are conservative. The purpose of auditing for publicly traded companies is to give the public a sense of comfort that the accounting procedures followed are prudent and that the reported net income and asset values for the company are "conservative but reasonable". Hence, it is not unusual that the true asset life exceeds the depreciation period.

However, a gross understatement of the depreciation period hurts a business. It appears to depress a company's earning power in the early life of an asset (because depreciation, which is an expense that reduces income, is very high compared to the true rate at which the equipment is wearing out). Earnings are then higher than appropriate later in the life of the equipment (because the equipment has been fully depreciated long before the equipment has reached the end of its useful life). Variability in operating income does not make a business easy to sell. So, the best test of depreciation period is "conservative but reasonable".

If an asset is sold for more than its remaining value (its original value minus the accumulated depreciation), then the extra cash received for this is taken into other income, with an entry or footnote such as "proceeds from the sale of equipment". As is discussed below, this income is not treated as operating income because the ordinary business of the company is to sell its products and services, not its equipment.

However, in some circumstances an asset is retired for a salvage value that is less than its remaining value (its original value minus the accumulated depreciation). In this case, a charge is made against income to bring the cumulative expense to the difference between the original purchase value and the salvage value. Thus, if an asset cost \$17,000,000, had an accumulated depreciation of \$12,000,000, and was retired and sold for \$2,000,000, a terminal expense of \$3,000,000 must be recognized. How this loss is treated is discussed in Section 3.6.2 Loss on Sale of Assets.

It is important to note that at the end of an asset's life, its net cost (original cost minus salvage value) is recovered as an expense and deducted from the revenue of the company net income. In that way, a person looking at income statements over a period of years knows that the reported income is what the business generated after it had recovered the cost of all assets that have a limited life.

3.5 OPERATING INCOME, CASH FLOW FROM OPERATIONS, AND THE CONCEPT OF BREAK EVEN

Net revenue minus COGS minus SG&A gives **operating income**, which is calculated before tax. This is not the total income of the company, but in terms of analyzing a business it is the most important income, since it is what income the business is producing from its normal activities. One component of other income, discussed below, is typically of an intermittent nature. Another component of "other income" can be interest on long term debt, which is often, but not always, put in "other income" as a negative entry (an expense). If operating income is calculated without the expense of interest on long-term debt, it can be thought of as the income of the ongoing business activity before charges for debt vs. equity financing, which is discussed further in Chapters 4, 6 and 9. If operating income is calculated with the expense of interest on long-term debt, it can be thought of as the "all in" income of the ongoing business activity.

Remember that a business generates more cash than operating or net income, the difference being depreciation. **Cash flow from operations** is the cash generated by normal business activities, and is operating income plus depreciation. Like operating income, cash flow from operations is calculated before tax.

As discussed above, the purpose of a commercial activity is to create value, and the measure of value in commercial activities is money. Thus, if a business has a positive operating income, it is creating value from its activities. If it has a negative value, it is not creating value and is not sustainable in the long run. As will be discussed later, if a business generates cash but does not have a positive operating income, it can stay in business for the short to medium term, but not the long term. How a business can show a negative operating income and have a positive cash flow is discussed in Appendix 3.2; this concept is very important for understanding financial statements and how businesses operate through lean times.

If you own a business, you are likely to want to sell it someday. One means of creating value in the eyes of a purchaser is to have a demonstrated long-term steady or steadily growing operating income. This is a sign that the business has a stable means of creating commercial value.

3.5.1 Break Even

Break even should be calculated on operating income if interest on long-term debt is expensed before the calculation of operating income, and should be calculated on net income if interest on long-term debt is put into "other income" (as a negative entry, i.e. an expense). The comments below assume that interest on long-term debt is expensed before the calculation of operating income, and hence refer to break even on operating income. The comments are equally relevant to net income if the other practice is followed.

"**Book**" **break even** is the point at which operating income becomes positive. If we think about contribution margin as being variable, i.e. depending on sales level, and SG&A as being fixed, i.e. independent of sales level, then break even occurs when the contribution margin matches the SG&A. Every sale after the break even point will drive operating income more positive.

One important concept is the difference between income from operations and cash flow from operations. Cash flow from operations is normally operating income plus the current year's depreciation. Remember that depreciation is a non-cash charge against earnings; it reflects the "recovery" of money that was spent in the past on assets that are wearing out. Because the money was spent in the past, the cash represented by depreciation is available to the business, even though it is not a part of operating income.

Cash break even is the point at which operating income plus depreciation (i.e cash flow from operations) becomes positive. The difference between cash and book break even is normally just depreciation, just as the difference between operating income and cash flow from operations is normally just depreciation.

Sometimes a business will create a book reserve for some future activity; for example, a mine might have a charge against its current earnings to provide for future reclamation of a mine site. Unless required by law, this reserve is not a separate cash account, it is simply a book "non cash" charge against earnings, in effect saying that "in order not to lead an investor into thinking that we are creating more value than we actually are doing, we must reduce our stated income to reflect money we will be required to spend in the future". Such book reserves are also non-cash charges against income, and in calculating cash flow from operations one would add back in the annual addition to a reserve, much as one adds back in annual depreciation charges. However, in the balance of this course the only pre-tax non-cash charge against earnings that will be considered is depreciation.

Note that cash break even means that the operations of a business excluding any change in assets (for example, an increase in inventory or the purchase of a long term asset) are generating cash; this is different from the overall business generating cash. If a business is slightly above cash break even but its customers are slow in paying their bills, then overall operations may be cash negative and the business may need some additional short term borrowing. If a business is slightly above cash break even but management buys a very expensive piece of equipment, the overall business will have a negative cash flow that might require more equity or long term borrowings. How to determine cash flow for a total company will be covered in Chapter 5 "The Statement of Cash Flow".

Even though the full analysis of cash flow in a business is more complicated, the simple test of cash break even is a quick check on the health of a business. In the vernacular of small businesses, break even is known as "**covering the nut**", and is a crucial target each month in any company. For the small business owner, the focus is more on cash break even: if the cash "nut is covered", then the owner does not have to dip into reserves to keep the business going. For businesses that are part of larger publicly traded companies, covering the "book" nut is more important. The large company is not going to run out of

cash in the aggregate, but the person managing a business unit that does not cover the book nut is going to attract the attention of someone in the head office!

All startup companies will be focused on forecasting the sales level that covers COGS and SG&A, and this will also be the major focus of whoever advances funding to the startup. Having a credible plan to reach break even is a key part of financing any startup; pricing strategy is part of that plan. High prices during startup recover more per sale but retards sales growth, whereas lower prices promote market size but postpone the point of cost recovery. Striking the right balance requires good judgment.

Simple graphical depictions of break even have been developed, but have limited value because they presume the concept that contribution margin is fully variable and operating costs are fully fixed. Their accuracy can be improved by building in refinements, but spreadsheet forecasts are equally effective in projecting break even, and more flexible.

3.6 OTHER INCOME

As noted above, **other income** has one or two components. One component is an unusual "one time" cost or revenue that is related to the business or revenue and expenses that are not related to the core business activities of a company. The other component is interest on long term debt, which is sometimes but not always put into "other income" as an expense.

First, consider an unrelated income item. Suppose a business started up with two parcels of land, and found that over the years it only needed one parcel and could sell the other at a far higher value than had been originally paid for the land. If the income from this sale were taken into sales revenue, it would create a serious distortion in the historical presentation of the company's results, in that there would be a one-year "blip" that came from a one-time activity.

Next, consider a "one time" income item related to the core business. Suppose a company makes a product, and decides that it does not want to sell this gadget into Africa because it is too costly to open up in Africa relative to the perceived total market size. However, an African firm learns of the gadget and approaches the company to buy a one time fully paid up license to make the item for resale only in Africa. This is a one-time "windfall" that is related to the company's business of making the product, but is not a direct consequence of the full manufacture and sale of the product.

If the license revenue were reported in Operating Income, it would create a one-year distortion in margin that would confuse the people managing the business, the investors, and any prospective buyer. Anyone tracking year over year performance would end up taking the "blip" out of the sales revenue in order to understand company performance.

Income from the sale of the land or the license is helpful to the business, and can be used for some valuable purpose such as paying a dividend to shareholders, retiring debt, or buying a new asset. The books would not balance if the income from the land or license sale did not show up somewhere. So, the solution in each case is to put this kind of revenue from a one time or non-normal activity into "Other Income". Other income would frequently be the subject of a footnote to annual financial statements, to explain the source of the revenue or expense.

3.6.1 Interest Expense as an "Other Income" Entry

Interest payable on long-term debt often shows up in "other income" as a negative entry, i.e. an expense. This is worth further comment. All businesses require some capital; even those with no fixed assets will

require some "working capital", as is discussed in Chapter 4. How the capital is sourced (debt vs. equity) is a business judgment on the part of the owners. If the investment in a business comes in the form of equity, then the investors will eventually expect a return, which can be in the form of a dividend or through the increased value of a business which pays no dividends but "reinvests" its earnings in the business. If the investment comes in the form of debt, then interest payments must be made on the debt. The underlying "earning power" of the commercial activities being conducted by the business can be thought of as being independent of the source of financing. Thus, for example, the customer buying shoes at price "x" from a store is indifferent to whether the store is financed by equity or debt.

If we put long-term interest charges into "other income", then the operating income represents the earning power of the commercial activity independent of the source of financing. In a sense, the operating income can be thought of as what is available from the commercial activity to reward the investors, through interest or dividends. If the purpose of analyzing the income statement is to compare relative performance of shoe stores, for instance, then it helps to treat interest on long term debt as "other income", since we can better compare the efficiency of a store to other stores when we separate out the financing costs from the operating costs. EBIT, Earnings Before Interest and Taxes, is a common measure of the value of a business, and its value is that it is looking at the raw earning power of a business before company specific elements such as financing costs and tax treatment are factored into net income.

As with so many other aspects of financial statements, interest costs do not always appear in "other income", and a person analyzing financial statements must read the statements and the notes to see where various cost elements are appearing.

3.6.2 Loss on Sale of Assets and Writedowns

A gain or loss on sale of assets, which occurs when the salvage value of an asset is greater or less than the remaining undepreciated book value, is reflected as an entry to the income statement. One can think of this entry as a one time correction to past depreciation. Typically this is entered into other income as "gain on sale of assets" or "loss on sale of assets", although the words "on disposal of assets" or "on liquidation of assets" may also show up.

Note that on occasion assets will be "written down", which means that their book value is being reduced by a decision of management. One frequent reason for doing this is that a change in business has occurred so that in the judgment of management the assets don't continue to retain value. For example, suppose you are in the trucking business and you buy land for a lay down yard in a remote area to help service a shipping contract to a mine site. Three years later, the mine closes and you believe it will not reopen. You find that you cannot sell the land. In this case, you would write the asset down to zero, since it will have no ongoing value to your business. Another example is if the research and development costs for a product are far greater than, in hindsight, the sale of the product can justify, the proper action is a writedown of the R&D costs. Another frequent reason for a writedown is stale or obsolete inventory. As a company's product line evolves, it is normal that some raw materials and finished goods inventory becomes unusable; frequently, the only practical disposition of this material is as scrap. The correct procedure is to take a writedown representing the value of the inventory that is no longer usable. It is particularly important when buying a company to determine the quality of the inventory, and to ensure that if a writedown is necessary it is taken prior to purchase. A writedown is entered as a loss in "other income", the same as a loss on sale of assets.

If a gain or loss on sale of an asset is small compared to a company's net income, the difference is not material. If, however, there is a major gain or loss at time of sale/salvage of an asset, this means that the operating income reported in prior years has been misstated. If, for example, there is a large loss on the sale of an asset, then in hindsight the depreciation for the asset should have been higher than was actually claimed. Because depreciation was too low in past years, the unrecovered cost for the asset that "wore out" has to be claimed in a one time entry.

Technically, the loss is from operations, but to report it in the year the asset is retired distorts that year relative to previous years. So, the better solution is an entry in "other income". However, the caution here is to a person using financial statements to critically evaluate the worth of a business. Consistent or even one time significant entries in "other income" for loss on disposal of assets means that operating income should be adjusted in any pro forma projection of future results. Operating income has been overstated in the past if a company is consistently showing extraordinary losses due to sale of assets or writedown of assets.

3.7 NET INCOME AND NET CASH FLOW: PRE-TAX, TAX, AND AFTER TAX

Net Income (also called profit or net earnings) is the end point of all income statements; it is the sum, over a given time period, of the net gain or loss on all activities in the business. While this number is important in that it gets transferred to the Sources and Uses of Funds statement, managers of most ongoing businesses would be more focused on trends in operating income rather than net income, because extraordinary or one time items that show up in net income can distort the picture of what a business will do in the future.

Note that net income, earnings, and profit (or loss if negative) all mean the same thing: how much money did a business make or lose in a given time period? Again, this is important because it is a measure of commercial value creation.

Net income is normally calculated both pre and after tax; it is the after tax figure that gets transferred to other financial statements. However, net income before tax and special measures of value creation (**EBIT**, **earnings before interest and taxes**, and **EBITD**, **earnings before interest, depreciation and taxes**) are also sometimes shown in financial statements or calculated by analysts. EBIT and EBITD are discussed in Chapter 8 "Valuation, Sale, and Cyclical Patterns in Business".

Net cash flow from a business bears the same relationship to net income as cash flow from operations does to operating income. The difference is normally annual depreciation charges, although any other non-cash charges (for example, for a book reserve) would also be added back in determining net cash flow.

3.7.1 Depreciation for Tax Purposes and the Calculation of Tax

In a simple world, net income before tax would be taxable at a given rate, and the after tax income would be what was left after the tax payment. Life is not nearly so simple! In calculating tax, one starts with net revenue as per the income statement. Some minor adjustments are normally made to expenses, for example certain meal or entertainment expenses are not allowed as deductions from income for tax purposes. Depreciation is handled in a completely different matter for tax purposes.

Tax policy, set by governments, is meant to ensure revenue collection but is also designed to stimulate particular forms of economic activity. As noted above, there is a great deal of management judgment in determining an appropriate depreciation. Both to stimulate economic activity and to reduce avoidance of taxes, the Canadian Government has its own rules for depreciation. These rules outline how to deduct the cost of capital equipment from taxable income for purposes of calculating income tax, and are set out in the **Capital Cost Allowance (CCA)** that can be claimed each taxation year against income before tax is calculated. In effect, CCA is "depreciation for tax purposes".

CCA is calculated by class of equipment, i.e. all costs associated with a given equipment class have the same CCA rule applied to them. A declining balance method is used for most CCA classes, so that a given percentage is multiplied times the residual **Unclaimed Capital Cost allowance** (called UCC). With a declining balance, an asset is never fully depreciated for tax purposes. A full interpretive bulletin IT285R2 is available on Revenue Canada's web site. Details of calculating CCA are also discussed in Appendix 7.1.

As a general observation, CCA depreciation rates usually exceed accounting (book) depreciation rates, which helps to encourage investment. In effect, companies can defer taxes that would otherwise be payable when CCA is higher than book depreciation.

The following steps must be taken to calculate income after tax:

- Make any minor adjustments in operating expenses that are required by law (for instance, certain meal expenses are not deductible as expenses for tax purposes).
- Add depreciation back into operating income. This gives net taxable income plus depreciation, or net taxable cash flow from operations.
- Calculate the CCA for each class of Capital Costs as per the Revenue Canada Guideline.
- Deduct the CCA from the net cash flow from operations, giving taxable income.
- Calculate income tax payable based on taxable income and the applicable tax rates for small or large businesses.
- Deduct income tax from taxable income to get net income after tax.

Several points can be made about tax:

1. Depreciation for tax purposes is almost always faster than for "book" purposes. Since depreciation is an expense, this means that taxable income (in effect, net income for the purpose of calculating tax) is less than book net income.
2. Given the very conservative nature of accounting, companies in Canada track the difference between how much tax is actually paid, and how much tax would have been paid if taxes were due on book net income rather than taxable income. This amount is referred to as **deferred taxes**. Note that deferred taxes are not money that is actually due to the government, it is money that would have been due if the government did not have its own way of dealing with depreciation. It can be thought of as being due in the future, which is why it is labeled "deferred".
3. Incremental deferred taxes are shown in a company's annual income statement. Deferred taxes are like depreciation: they are a non cash charge against income, i.e. they reduce book income but the cash does not flow out of the company. In concept, one can think of deferred taxes as the taxable component of "extra or faster depreciation for tax purposes".

4. Cumulative deferred taxes, i.e. the sum of deferred taxes from the startup of a company, are shown on the balance sheet as a liability. This is discussed in the next chapter. Like depreciation, the cash represented by deferred taxes is available to management to pay dividends, buy assets, or pay down debt. It does not sit as cash in a special reserve fund; rather, it is money that has come into a company that is not labeled "income", in order to ensure that income is not overstated by ignoring future potential tax costs.
5. Why do we bother to show deferred taxes? Remember that accounting is conservative, and in the case where the depreciation for tax purposes is very much higher than it is for book purposes, a lot of income is sheltered from tax by the high initial deduction of CCA. A person trying to understand the future earning power of such a company might be warned that past earnings history will not continue if deferred taxes have been very high relative to net income. Thus, as an example some environmental projects in Canada at one point could be written off for tax purposes (i.e. the capital cost of the project could be charged as an expense for the purpose of calculating taxable income) at the rate of 25% in year one, 50% in year two, and 25% in year three. The equipment itself might warrant a ten or twenty year depreciation period for book purposes. However, such extreme examples are rare, and practically speaking deferred tax is normally small compared to gross revenue and net income, and does not warrant a lot of attention in financial analysis.
6. Tax calculations are always "rolled up" and calculated on a whole company basis. The taxes of wholly owned subsidiaries that are in a similar business can also be consolidated into a single tax return. However, if a company owns a partial interest (even if a majority interest) in a subsidiary or affiliated company, that sub or affiliate must file separate taxes. This is sometimes unfortunate in that a subsidiary may have a loss for tax purposes that could otherwise have been used to offset a gain in the parent business, reducing the overall taxes owing.
7. One consequence of the "whole company" approach to preparing tax returns is that within a company most divisional or product income statements are done on a pre-tax basis.
8. Despite the fact that pre-tax income is used in internal income statements, the marginal tax impact of a new investment must be considered in evaluating a new investment. This is discussed in Chapter 7, "Analyzing New Investment".
9. Tax returns for businesses, even small businesses, are almost always completed with professional help. Tax law and regulations are extremely complex, which is understandable given the huge impact that taxation matters have on both fiscal solvency of government and on economic activity by companies. Management should seek help from specialists in preparing tax forms and making decisions that affect tax (for example, assigning CCA classes to assets or deciding which CCA classes to draw down when taxable income is less than eligible CCA in a given year).

For the remainder of our analysis of financial statements, income tax effects will not be considered.

For the income statement, this is equivalent to treating it as an internal divisional pre-tax income statement for a larger company. The principals of working with financial statements are not affected by ignoring tax, which would otherwise add so much complexity that the key points of financial analysis would be lost in the details. In practice, when running a small business one relies on external help in dealing with tax matters, and when running a larger business an internal accounting group will calculate tax based on rolled up divisional income.

3.7.2 The Significance of Net Income and Net Cash Flow

Net income is the measure of the creation of value by an overall business. If a company has a negative net income indefinitely, it is not creating enough value to recover the value of the assets that are used in the business. As the assets wear out, there will likely not be enough money in the business to replace them. Net cash flow from a business is a much more urgent test of a company's performance, and is a crucial test of a company's short term viability. Managers of businesses that are losing cash very quickly ask the question "why are we in this business", and why should we keep selling a good or service if we can not recover the cash cost of that sale?"

In economic downturns, it is not unusual for companies in cyclical industries to have negative net income but positive cash flow. These businesses can survive a period of under-recovery of depreciation, because they expect the cycle to turn and a period of high net income to occur. However, it is highly unusual for a company to operate with negative cash flow from operations other than during a startup period.

3.8 THE STATEMENT OF RETAINED EARNINGS

What is the fate of net income? Each year, the owners of the business have two choices: they can pay the money out of the business to themselves, or they can leave it in the business. If the money is left in the business, it has the name "**retained earnings**", and the purpose of the Statement of Retained Earnings is to record that this value has been retained in the business. The balance sheet will record cumulative retained earnings as a one source of money for the business.

The Statement of Retained Earnings is quite simple, as this example shows:

Sampleco	
Statement of Retained Earnings for the Year Ended This Year (\$000)	
Retained Earnings, December 31, Last Year	2,341
Net Income for This Year	389
Less: Dividends paid, This Year	125
Retained Earnings, December 31, This Year	2,605

The Statement of Retained Earnings must include the cumulative retained earnings (which will show up on the balance sheet), and it must indicate the current year's net income and how much of that net income is used for dividend payments.

What determines the dividend in a company? Basically, the shareholders (advised by management and the Board of Directors if the company is large and publicly traded) look at the opportunities for company growth from retaining earnings in the business vs. the needs of the owners for a cash return on their equity investment. In practice, growth oriented companies will often pay no dividend, while it is usual for stable large utility companies to pay 65% of their earnings in dividends. A retired senior citizen trying to live on a stream of dividends will be drawn to utility type stocks, while a young person with a speculative approach to building wealth for a long-distant retirement would be relatively indifferent to dividends and much more focused on growth. In smaller companies, the needs of the owners sometimes

vary and this can pose problems for deciding between dividends and retaining earnings to finance future growth.

Note that for owner operated companies in Canada (those companies for which all owners play some role in the business), tax treatment favors taking money out of a company in a different manner. This is a special case and is discussed in Appendix 3.4 below.

Note also that retained earnings can be negative, and in fact frequently are for start up companies and for exploration companies. For example, imagine a start up company that will spend two years developing a software system. It has negligible revenue during these years, but certainly has expenses that are paid from the seed money (equity) put up by the owners of the business. In this case, for at least two years the business will have a negative net income, and the retained earnings will typically be relabeled "cumulative deficit", which can be thought of as negative retained earnings.

Retained earnings are real value that a company built up, but like depreciation they are not kept as a separate cash reserve, they are simply money that is generated in a company and used to buy assets or inventory or to pay down short term or long term debt. This is discussed further when the balance sheet is considered.

The Statement of Retained Earnings is so simple that it is often combined with the income statement or the balance sheet, but it is technically a separate financial statement.

APPENDIX 3.1 SUM OF THE YEARS' DIGITS CALCULATION OF DEPRECIATION VS. STRAIGHT LINE DEPRECIATION

In this course, only straight-line depreciation will be used in assignments and tests. This is the most widely used means of calculating depreciation. Standard financial texts discuss other methods, including the "sum of the years' digits" method. This method will be illustrated briefly to convey that alternative methods exist and can have an impact on financial statements.

In Sum of the Years' Digits (SOYD), one sums up the digits of the numbers of years over which the equipment is to be used (call this S). S for a one year depreciation period is one, for two years is three, for five years is 15, etc. If N is the number of years of depreciation remaining at the start of the period, then

$$\text{Depreciation (SOYD)} = \text{Original cost minus expected salvage value times } (N/S)$$

To illustrate the effect of this, consider a \$15,000,000 investment with no net salvage value being depreciated over five years. The following table shows the calculation of the depreciation of this asset by the SOYD method and compares it to straight-line depreciation.

Monthly depreciation for SOYD is simply 1/12th of the annual depreciation, i.e. one uses a straight-line interpolation of the annual "non-straight line" depreciation to determine the monthly value.

SOYD takes a higher depreciation in the early years of an asset, and less in the later years. If you consider a car purchase, it depreciates far more in the first hour of its use than in the last year of its use, in that once it becomes a "used" car its value is far less than the original in the resale market. While the SOYD approach has the elegance of weighting resale value, it puts a distortion into the smoothness of reported income. On balance, the straight-line method is more normally used, which partly reflects the fact that the vast majority of businesses keep their assets throughout their depreciation period.

Sum of the Years' Digits Vs. Straight Line Depreciation
Asset Value \$15,000,000, No Salvage Value, Five Year Depreciation Period

Year	N	S	N/S	Depreciation	(SOYD)	Depreciation	(Str. Line)
				\$	Cum. %	\$	cum. %
1	5	15	0.33	\$5,000,000	33%	\$3,000,000	20%
2	4	15	0.27	\$4,000,000	60%	\$3,000,000	40%
3	3	15	0.20	\$3,000,000	80%	\$3,000,000	60%
4	2	15	0.13	\$2,000,000	93%	\$3,000,000	80%
5	1	15	0.07	\$1,000,000	100%	\$3,000,000	100%
				\$15,000,000		\$15,000,000	

APPENDIX 3.2 NEGATIVE OPERATING INCOME WITH POSITIVE CASH FLOW

Businesses can have a negative operating income (also known as an operating loss or loss from operations) and a positive cash flow in two ways:

- The operating loss is less than the depreciation. Since depreciation is a non-cash expense, it will contribute to a loss but will not take cash out of a company. When a business has positive cash flow from depreciation being larger than the operating loss, it is a sign that the business can cover its ongoing costs of staying in business, but cannot generate enough revenue to replenish its fixed assets as they wear out. For the short term, this is not a serious problem, and this in fact occurs for many capital-intensive businesses (which have high depreciation) during cyclical downturns. For the long term, this is a very serious problem since it is a sign that a business is not creating enough value to be sustained into the distant future.
- There is a large component of other income that offsets an operating loss. As discussed above, other income measures the revenue from non-normal business activities, for example a gain on the sale of some assets or one time revenue from the sale of a technology license. If "other income" is all that holds a company from a negative cash flow, this is a very serious situation since by its nature "other income" tends to be one-time in nature, and the company may be facing a negative cash flow in its next financial period.

Tracing cash through a business is so important that it is the subject of another financial statement, the Sources and Uses of Funds, which is discussed in a later chapter.

APPENDIX 3.3 INTEREST VS. PRINCIPAL REPAYMENTS

When a person or company borrows money from a lender, they accept that they must make payments to the lender. There are two components to these payments: interest (the "rental" cost of the money) and principal repayment (giving back to the lender the original amount of the loan). Interest and principal payments are treated quite differently in financial statements and for tax purposes. Interest is an expense to the payer and is income to the lender; principal repayment is not treated as an expense to the borrower, and does not create income for the lender.

The concepts of debt and interest are discussed in greater detail in Chapters 6 (Appendix 6.1) and Chapter 7 (Section 7.1). However, in dealing with Income Statements and Balance Sheets, some basic concepts must be understood.

First, loans will have a payment due at a time period specified in the loan agreement. Most mortgages on residences have monthly payments, but many business loans have quarterly, semi-annual or annual payments.

Second, a loan repayment is a single sum of money but can be thought of as having a component designated as interest and a component designated as principal repayment. The loan agreement will specify a basis for the repayment of principal; almost all loans require that interest on the outstanding balance (i.e. remaining principal) be paid on an ongoing basis. Only in very rare cases will a lender allow interest to "compound" by not being paid up as due.

If all payments have been made on a loan as per the loan agreement, we refer to the loan as being "current". If a payment has been missed, we say the loan is "past due", "overdue", or "in arrears".

Third, principal can be repaid in a variety of ways. Three different methods of repayment of principal are shown in Table A3.3.1. Note that combinations of these methods can be used, for instance a

Table A3.3.1 Methods of Principal Repayment

Loan Type (Name)	Principal Repayment	Total Payment	Comments
1. Straight Line	Constant in each period	Declines over the life of the loan, since the principal payment is the same in each period and the interest payment decreases as the principal is repaid.	This type of loan is very common for long term loans to business that are secured by assets, since the remaining principal matches the depreciating value of the asset.
2. Mortgage or Levelized Payment	Low in the initial period and increasing over the life of the asset.	Constant in each period. This means that the sum of interest and principal is the same in each period. In the early stages of the loan, most of the payment is interest and principal repayment is low. In the late stages of the loan, interest is low and principal repayment is high.	This type of loan is very common for real property (land and buildings) since these tend to hold their market value and not depreciate in a straight line.
3. Balloon	Zero until the final period.	Total payment is a constant for every period (interest on the total principal) except the final period. The final payment is interest plus the total principal amount.	This type of loan is typical for bonds.

lender might specify no principal repayment for the first five years of a loan, then switch to straight line principal repayment in the next five years.

Interest is treated as an operating expense of a company, and shows up on the income statement. As noted above, interest can show up either in SG&A or as a negative entry in other income. Treating it as other income has the merit of distinguishing the financing cost of the business from the pure cost of operating the business independent of how it is financed. However, many companies put interest in SG&A because they reserve "Other Income" for non-recurring expenses. Hence, one finds both treatments.

Principal repayments are not treated as an operating cost, and do not show up on the income statement. They are an important entry on the Statement of Cash Flow, and they are reflected in the balance sheet. Principal payments are related to the financing of the business, not to the monthly, quarterly, and annual creation of value through the delivery of a good or a service. As will be clearer when the balance sheet is considered in Chapter 4, a company can raise equity (investment by owners) to pay down principal, or can use retained earnings (value created by the company and not paid out to owners as dividends) to pay down principal. Alternatively, it can increase borrowings if it needs money for growth. Hence, changes in the principal amount of debt do not show up on the income statement.

As noted in Table A3.3.1, much business long-term debt is secured by assets and is issued based on a fixed and constant schedule of the repayment of principal. For example, a company that borrows \$1 million to finance new equipment might arrange a ten-year repayment schedule in which ten annual principal repayments of \$100,000 are made in addition to interest on the unpaid principal. This is referred to as a straight line repayment of principal. If the company cannot meet its interest and principal repayment obligations, then the lender has the right to seize the assets and sell them to recover the outstanding portion of the debt. Because the assets are the security for the loan, the repayment schedule of principal should reflect the declining value of the assets, i.e. a bank that has a ten year repayment schedule has at least some notion that the assets can be sold for 90% of original value after one year, 50% of original value after five years, etc.

As noted in Table A3.3.1, most real estate debt is also secured by assets, but is subject to a different form of financing in which payments are "levelized", i.e. the combined payment of principal and interest is constant. As Table A3.3.2 below illustrates, principal retirement in the early years is low; most of the total payment in the early years goes to interest. Total interest payments over the course of the loan are higher, but the early year payments are lower. Why do lenders consider this for real estate? The simple reason is that the loss in resale value of real estate in the early years is normally quite low, so the security for the debt retains its value. Levelized payments are the basis of almost all home mortgages, and allow young couples to buy the largest possible home based on their current income. It is important to note that in the case of a levelized payment, the interest expense on the income statement varies each year.

What are the comparable values for a balloon repayment of \$1000? For years 1 through 19, the interest payment is \$80 per year, the principal repayment is zero, and the remaining balance is \$1000. For year 20, the interest payment is \$80, the principal repayment is \$1000, and the total payment is \$1080.

Note that in all cases of loan repayment, the remaining balance at the end of the loan period is zero, i.e. the principal amount is fully returned to the lender.

Table A3.3.2 Comparison of Fixed Principal (Straight Line) Repayment vs. Levelized Payment**Basis:**

- \$1000 of debt.
- Interest rate 8% per year compounded annually.
- One payment per year.
- 20 year term.

year	Straight Line				Level			
	interest paid	principal paid	total payment	remaining balance	interest paid	principal paid	total payment	remaining balance
1	\$80.00	\$50.00	\$130.00	\$950.00	\$80.00	\$21.85	\$101.85	\$978.15
2	\$76.00	\$50.00	\$126.00	\$900.00	\$78.25	\$23.60	\$101.85	\$954.55
3	\$72.00	\$50.00	\$122.00	\$850.00	\$76.36	\$25.49	\$101.85	\$929.06
4	\$68.00	\$50.00	\$118.00	\$800.00	\$74.32	\$27.53	\$101.85	\$901.53
5	\$64.00	\$50.00	\$114.00	\$750.00	\$72.12	\$29.73	\$101.85	\$871.80
6	\$60.00	\$50.00	\$110.00	\$700.00	\$69.74	\$32.11	\$101.85	\$839.69
7	\$56.00	\$50.00	\$106.00	\$650.00	\$67.18	\$34.68	\$101.85	\$805.02
8	\$52.00	\$50.00	\$102.00	\$600.00	\$64.40	\$37.45	\$101.85	\$767.57
9	\$48.00	\$50.00	\$98.00	\$550.00	\$61.41	\$40.45	\$101.85	\$727.12
10	\$44.00	\$50.00	\$94.00	\$500.00	\$58.17	\$43.68	\$101.85	\$683.44
11	\$40.00	\$50.00	\$90.00	\$450.00	\$54.67	\$47.18	\$101.85	\$636.26
12	\$36.00	\$50.00	\$86.00	\$400.00	\$50.90	\$50.95	\$101.85	\$585.31
13	\$32.00	\$50.00	\$82.00	\$350.00	\$46.82	\$55.03	\$101.85	\$530.28
14	\$28.00	\$50.00	\$78.00	\$300.00	\$42.42	\$59.43	\$101.85	\$470.85
15	\$24.00	\$50.00	\$74.00	\$250.00	\$37.67	\$64.18	\$101.85	\$406.67
16	\$20.00	\$50.00	\$70.00	\$200.00	\$32.53	\$69.32	\$101.85	\$337.35
17	\$16.00	\$50.00	\$66.00	\$150.00	\$26.99	\$74.86	\$101.85	\$262.48
18	\$12.00	\$50.00	\$62.00	\$100.00	\$21.00	\$80.85	\$101.85	\$181.53
19	\$8.00	\$50.00	\$58.00	\$50.00	\$14.53	\$87.32	\$101.85	\$94.31
20	\$4.00	\$50.00	\$54.00	\$0.00	\$7.54	\$94.31	\$101.85	\$0.00

APPENDIX 3.4 TAKING MONEY OUT OF A CANADIAN OWNER OPERATED BUSINESS

If a company is operated by its owners, as many small companies are, then tax treatment makes it advantageous to "bonus out" money from the company rather than paying a dividend on shares. Even if the company is in the "small business" category with a 20% tax rate, the effective tax on a dividend would be 20% within the company and about 30% by the individual receiving the dividend, for a total net tax rate of about 50%. If the money is paid out as a bonus to the owner/managers, then the net tax rate, depending on the province, is 45 to 53%. Hence, where the owners all work for a business, the common practice is to take money out of a business through a bonus that is treated as salary. This increases SG&A and reduces net income, reducing the tax paid by the company.

PROBLEMS

3.1 Which of the following items would you classify in COGS:

1. Circuit boards that go into the manufactured item
2. Stationary
3. The pay of the receptionist in the sales office
4. The pay of the receptionist in the manufacturing plant
5. Miscellaneous screws and fittings
6. Telephone charges
7. Raw steel for structural members
8. The pay of a welder brought in on contract
9. The pay of a welder on salary
10. The pay of the floor sweeper in the manufacturing plant
11. The cost of contract cleaning in the manufacturing plant
12. The cost of the crew of a service vehicle
13. The maintenance charges of a service vehicle
14. The annual registration cost of a service vehicle
15. The cost of annual business permits
16. Welding consumables (i.e. welding rod)
17. The pay of the shipping department
18. Part or all of the company president's salary
19. Freight on inbound materials
20. Freight on outbound products (assuming FOB point is remote from the factory, i.e. the manufacturer pays the freight rather than the customer.)

3.2 Large rotating equipment (for example, 10,000 HP air blowers or gas compressors used in oil sands fluid coking operations) requires lubrication. Given the enormous capital cost of such equipment, the lubrication system must be highly instrumented, i.e. it must have equipment shutdown links in the event of low lube oil pressure, pump failure, etc. Typically, a separate skid containing the lube oil pump and holding tank is ordered separate from the compressor or air blower.

A small company (staff of 20) that manufactures such products as well as oil field gas compressor skids does not code its labor to specific projects, since labor moves around the shop floor from job to job and tracking what hours were spent on what skid proved to be too inaccurate to be of value. However, component parts are tracked and coded to each product skid. Over the last five years, margin based on COGS of component parts only has run at 32%, i.e. COGS (component parts) has run at 68%.

A pipeline company that is building a major expansion has requested a budgetary quote (in essence, an indication price that will be used by the pipeline company in preparing its investment analysis, and that may influence whether your company is asked to prepare a formal bid in the future). The requested quote is for one lube oil skid that is twice the capacity of any unit built before in your shop. The pipeline company indicates that they may require 20 such units (two each at each of 10 compressor stations along the new pipeline). An engineer in your company has priced components at \$356,000.

- What do you give as a budgetary quote?
- What reservations would you have about the accuracy of the quote? Is it at more risk of being too high or too low?
- Why? In answering this, can you think of questions you would ask the engineer?

- 3.3 Polymerco, a North American manufacturer of specialty polymers, has the following income statement (highly condensed):

(\$000)	This Year	Last Year
Gross Sales	\$25,421	\$24,224
Bad Debt	nil	nil
Net Sales	\$25,421	\$24,224
COGS	\$22,243	\$21,341
Contribution Margin	\$3,178	\$2,883
CM, %	12.5%	11.9%
SG&A	\$2,122	\$2,067
Operating Income	\$1,056	\$816
Other Income and Interest on LT Debt	-\$60	-\$50
Net Income	\$996	\$766

Current sales are to North American customers only. The president, somewhat of an "airhead", mentions to you in the hall one day that it would be nice if there were more offshore sales to diversify the company. You think about this for a while, and go meet with the president to make a recommendation. What is your recommendation:

- If Polymerco's production is running at 84% of capacity?
 - If Polymerco's production is running at 100% of capacity?
- 3.4 A friend of yours has been given a "Dean's holiday", and decides to start a hotshot business. (A hotshot business involves quick deliveries to operating facilities such as refineries or oil wells that have a high marginal cost of downtime.) His entire proposed customer base is within a narrow area (say the Fort Saskatchewan area), so trip length is consistent. He intends to sell the business after one year in order to return to school, and wants to keep monthly books in order to demonstrate to a potential purchaser the value of the business. He asks your opinion about what expense items he should consider to be within COGS. Consider the following three alternatives:
- He is the sole employee, and hence responsible for selling, administration and driving. He buys the pickup truck.
 - He buys the pickup truck but decides to look after the office and selling, and pays a friend on a "per trip" basis to do the driving.
 - He pays a friend a "per trip" fee to both supply the pickup truck and do the driving.
- What additional information would you want from your friend before giving advice if instead of a constant trip length there was a highly variable trip length (for example, some trips of 15 km and some of 1500 km)? Can you think of a kind of expense that could go into COGS that might create a timing problem within your friend's relevant time horizon?
- 3.5 Your aunt graduated from chemistry in the late 1960's, and started a small distribution company aimed at supplying chemicals and equipment to the University. Through the years, she has skillfully grown the business and also supplies other labs in the region, including most of the chemical plants and refineries east of the city.

She sees an opportunity to expand into supplying chemicals to the oil industry by buying a medium sized local distribution company, Distco. She has asked you to help.

As a start, you sit down with the accountant for Distco and ask how she has determined COGS in the past. The accountant tells you that every year there were changes in what went into COGS and what went into SG&A, because Distco's owners couldn't come up with a scheme that met their needs. She says, however, that she has the information by raw account and will recast the financial data in a way that makes sense to you. Since your aunt is away for two weeks, you decide to "give it your best shot".

Distco is 25 years old and has three warehouses, one in Edmonton, one in Weyburn Saskatchewan, and one in Grand Prairie. Permanent staffing is two people per warehouse, one to take orders and arrange shipping and one to package up orders. Extra help is brought in on a temporary basis if needed for busy times. In addition, the head office

has a president, a receptionist/secretary, two bookkeepers, and a two person sales team that focuses on oil company head offices.

Classify the following accounts into COGS, SG&A, or asset:

Warehouse staff salaries	_____
Annual Christmas party	_____
Temporary staff salaries	_____
Purchase cost of chemicals and supplies	_____
Shipping costs from supplier to warehouse	_____
Shipping costs from warehouse to customer	_____
Phone costs	_____
Travel for sales staff	_____
Head office staff salaries	_____
Cost of benefits for permanent staff	_____
Cost of storage racks	_____
Utility bills	_____
New computer hardware and software to support integrated order, inventory, sale and invoice system	_____
Membership in Chamber of Commerce	_____
Warehouse and office rental charges	_____
Snow removal and grounds upkeep costs	_____

- 3.6 After the accountant takes your advice in problem 3.5, she returns with the following five year income statement for Distco. What do you tell your aunt about the business? Why? In answering this problem, be sure to look not only at aggregate net income from the business (which is slightly higher over the five year period) but at the margin.

Distco Summary Income Statement

(\$000)	Year 1	Year 2	Year 3	Year 4	Year 5
Gross Sales	\$4,662	\$5,126	\$6,229	\$6,641	\$6,978
Bad Debt	nil	nil	nil	nil	nil
Net Sales	\$4,662	\$5,126	\$6,229	\$6,641	\$6,978
COGS	\$3,846	\$4,260	\$5,388	\$5,857	\$6,183
Contribution Margin	\$816	\$866	\$841	\$784	\$795
SG&A	\$420	\$434	\$447	\$423	\$424
Operating Income	\$396	\$432	\$394	\$361	\$371
Other Income and Interest on LT Debt	-\$60	-\$50	-\$40	-\$30	-\$20
Net Income	\$336	\$382	\$354	\$331	\$351

- 3.7 What do you think creates the value in a distribution business? Think of what someone else would need to enter the business. What would you try to do to preserve value if you and your aunt decided to proceed to buy Distco?
- 3.8 You are the new Marketing VP for Watermetco, a company that sells two items: meters manufactured by a major supplier (an OEM, or Original Equipment Manufacturer), and meter servicing and calibration. Note that these business lines are fairly independent, i.e. you service all kinds of meters, not just the ones that you sell, and you sell meters to customers who do their own service. Hence, the two lines of business are not linked, i.e., you do not need to sell a meter to get the service work for the meter.

Your customers are water utilities. These utilities could buy the meters direct from the manufacturer, but they place orders through you for convenience. You have the summary shown in the following table for the current performance of the US region from your financial contact within the company. The president of the company tells you that as part of the overall strategy of the company, you are to ensure an expansion of activity in the existing US region, with the goal of generating more net income. As a result, you are going to hire a sales leader. Based on the attached financial statement, what do you tell the new sales person to emphasize? Why (one or two thoughtful paragraphs)? In preparing your answer, include the following: what is the approximate cost of the extra staff person (the sales leader) in terms of salary and likely level of expense? What percentage increase in meter sales, and what percentage increase in meter service, would be necessary to recover the cost of this extra staff person?

Watermetco Financial Forecast
US Regional Office

	<u>Meter Sales</u>	<u>Meter Service</u>	<u>Total</u>
Revenue			
Product Sales	\$2,100,000		\$2,100,000
Service Sales		\$672,000	\$672,000
Parts Sales for Service		\$39,000	\$39,000
Subtotal	\$2,100,000	\$711,000	\$2,811,000
(Percent of total)	74.7%	25.3%	100%
Direct Costs			
Cost of Materials	\$1,942,000	\$36,500	\$1,978,500
Direct Salaries & Fringe per Product (includes sales costs)	\$71,800	\$213,600	\$285,400
WCB & other Direct Employee Costs	\$700	\$1,100	\$1,800
Government Sealing Fees		\$2,800	\$2,800
Freight		\$18,600	\$18,600
Direct Sales Costs (travel, etc.)	\$10,000	\$3,400	\$13,400
Small Tools and Supplies		\$9,500	\$9,500
Subtotal	\$2,024,500	\$285,500	\$2,310,000
Contribution Margin	\$75,500	\$425,500	\$501,000
CM, %	3.6%	59.8%	17.8%
General and Admin Costs			
Travel & Accommodation			\$62,000
Advertising & Promotions			\$65,000
Vehicle Lease			\$6,000

Business & Property Tax	\$20,700
Legal & Professional Fees	\$12,000
Office Wages and Salaries	\$96,000
Office Fringe Benefits	\$11,900
Lawn, Snow, Cleaning and Security	\$6,700
Utilities	\$13,000
Printing & Stationary	\$7,000
Subscriptions	\$1,200
Telephone	\$12,800
Subtotal	\$314,300
Net Income	\$186,700

- 3.9 You are the president of a medium sized manufacturing company and you face the following situations. With which one or two of your staff do you first discuss the issue, and what questions do you try to get answered (one or two sentences per case)?

- Margin is falling and bad debt is rising, nearly dollar for dollar.
- Margin is falling, bad debt is rising but only at a fraction of the margin loss. Unit sales are rising.
- Margin is falling, sales are falling, and bad debt is rising.
- Margin is falling and warranty claims are rising, nearly dollar for dollar.
- Margin is falling and COGS is increasing, nearly dollar for dollar.

- 3.10 The table shows the income statement (highly compressed!) of a company. What is its cash flow from operations in the past year, and its net cash flow from operations (i.e. all items shown on the income statement) in the past year?

In the next year, sales, contribution margin, and SG&A expenses each hold steady. There is no extraordinary income or expense in the company that is not related to the core business (i.e. other income is zero for the next year). However, an existing piece of equipment that had an original cost of \$14,000,000 (no salvage value was assumed at the time the original depreciation schedule was created) and an accumulated depreciation of \$10,000,000 is retired for a salvage value of \$4,000,000. A new piece of equipment is bought and installed early in the next year for \$21,000,000. Management determines to use the same depreciation period of 7 years for the new piece of equipment that it had used for the old piece of equipment. (Remember, we use only straight-line depreciation.)

- How long was the old piece of equipment in service? Is an extraordinary adjustment required at the time of its retirement?
- Complete the income statement for the next year. Assume that the depreciation for all items other than the new piece of equipment is unchanged.
- What is the cash flow from operations in the next year?
- What is the net cash flow from all items shown on the income statement for the next year?
- Just given the data for the two years, was the company sound in buying the piece of equipment? Why (one or two sentences)?
- If the salvage value of the old piece of equipment was \$1,000,000 instead of \$4,000,000, assume that you show the impact of the unrecovered depreciation on the old piece of equipment in Other Income. What is the value of Other Income next year in this case? Does cash flow from operations change?

	Past Year	Next Year
Revenue	\$18,232,000	\$18,232,000
Allowance for Bad Debt	\$182,000	\$182,000
Net Revenue	\$18,050,000	\$18,050,000

Cost of Goods Sold	\$12,179,000	\$12,179,000
Contribution Margin	\$5,871,000	\$5,871,000
Contribution Margin, %	32.2%	32.2%
Sales, General, and Administrative Expense:		
All Items except Depreciation	\$2,796,000	\$2,796,000
Depreciation	\$2,430,000	
Operating Income	\$645,000	
Other Income	\$400,000	\$0
Net Income	\$1,045,000	

Operating Cash Flow**Net Cash Flow**

- 3.11 Your aunt was suffering from "empty nest" syndrome, and decided that she needed some activity to fill the gap in her life. She opened a video rental outlet that specializes in classic films. Most of her stock is reissued DVD's, and she does not change her stock each year (she does not carry current "hits"). She is not skilled in financial matters, and asks you to help her understand her business. She hands you a shoebox full of her receipts and notes, from which you withdraw the follow information:

Staff wages, January thru June	\$24,782
Cash register and computer purchase	\$9,587
Cash receipts for the 3 month period Jan-Mar	\$24,478
Store fixtures (shelving and counter)	\$16,000
Cash receipts for the 3 month period Oct - Dec	\$51,266
WCB and Vacation Payments for the year	\$496
Purchase of video stock, used videos	\$39,000
Advertising (neighborhood drop of flyer)	\$266
Cash receipts for the 3 month period Apr - June	\$36,221
Promotion (support a neighborhood hockey team)	\$400
Office supplies (pens, paper, etc.)	\$396
General Manager (Aunt's) Monthly Pay	\$3,000
Building rental, annual charge (includes snow removal)	\$38,000
Cash receipts for the 3 month period Jul-Sept	\$42,875
Membership, South Side Business Association	\$400
Subscription, Video World Magazine	\$120
Staff Christmas party	\$475
Telephone, annual bill	\$692
Building cleaning service, annual charge	\$5,600
Natural gas, annual charge	\$3,678
Sold table and six chairs left in store by previous occupant	\$500
Advertising (ad in community paper)	\$400
Software for title and cash management	\$650
Annual business tax	\$425
Staff wages, July thru December	\$26,822
Purchase of video stock, new releases	\$52,000
Annual fee for payroll preparation	\$480
Electricity and water, annual bill	\$1,896
Advertising (neighborhood drop of flyer)	\$298

Is your Aunt's business creating value? Is your Aunt's business generating cash? Should your Aunt be in this business? Some hints in doing this exercise:

- Is there Cost of Sales in a video rental business? If no, then ignore the variable cost component.
- Distinguish between assets and expenses. Remember that asset purchases do not go on an income statement, only depreciation.
- Make any reasonable assumption on depreciation by asset class, but be prepared to justify it. Do you think the depreciation period should be set by the life of the assets or the life of the overall business?
- Simplify the income statement by grouping some expenses, e.g. lump all advertising and promotional costs into one category.
- In addition to the income statement, think about cash flow from the business and the trend line of sales.

3.12 As a test of your conceptual knowledge of depreciation, answer the following questions:

1. In your own words (one or two sentences), what is the purpose of putting depreciation into an income statement?
2. If an asset has a depreciation period of 12 years, an original value of \$13.45 million, and an estimate salvage value of \$250,000, what is its accumulated depreciation (straight line) at the end of the fifth year?
3. An asset has an original purchase value of \$12 million, a depreciation period of 6 years, and an estimated salvage value of zero. What is the entry into "other income" if, after four years of operating the piece of equipment, it is sold for a salvage value of \$6 million? If the salvage value is \$4 million? If the salvage value is \$2 million? If the salvage value is zero?
4. Assume an asset has an original value of \$5 million, a depreciation period of five years, and no salvage value. If it is sold after three years for \$1 million, then there is \$1 million in non-depreciated value that must be reflected in the income statement as "other income": true or false? If true, is the entry in other income a negative number (a loss) or a positive number (a gain)? In hindsight, was the operating income for the business understated or overstated for the three-year period in which the piece of equipment was operated?

3.13 Look at the five-year history portrayed in the income statements in the following table. The company, Oilpatchco, is a stand-alone oil patch firm that is 75% owned by a large publicly traded company. The company has three business lines, a pump product, a "sucker rod" product, and a service division that services the company's products. You can assume that for the five-year period that activity in the oil patch has been steady or growing slightly. The pump product is a new design that is displacing other styles of pumps in specialized applications. Oilpatchco assembles pump components, so the labor content is low compared to the material. Oilpatchco manufactures sucker rod from raw steel, with capital-intensive equipment. Service is in the field to operating wells, and is offered through a fleet of vehicles.

This small business has a Vice President (or General Manager) of Marketing (which includes sales), of Finance & Admin, of Manufacturing (which includes research and new product development), and of Service. The VP of Marketing is responsible for the pump business, the VP of Manufacturing is responsible for the rod business line, and the VP of Service is responsible for the service business line.

Speculate thoughtfully on the following questions, and provide *succinct answers supported by a table of key numbers or ratios you have extracted from the income statements*:

- Does the business have a problem? If yes, what is the problem?
- If it has a problem, what do you think are possible causes of the problem? (You may give more than one answer if you like). Is one possible cause more likely than others?
- Assume you work for the large publicly traded company. If you agreed to a transfer to become the manager (i.e. President) of this business, what would you tell your boss (presumably an executive in the parent company who serves as chairman of Oilpatchco) that you would focus on in the first six months?
- With which direct report(s) would you spend the most time in the first month? Why?
- Provide a marked up income statement (i.e. Oilpatchco's income statement with any supplemental calculations you have done to help in your analysis of the business).

Some hints on doing this problem are:

- If the income statement has units sold as well as revenue, you can (and should) look at price per unit. If a product line is changing rapidly, this may not have meaning, but it can be a measure of price history for a stable product line.

- In analyzing a business over many years, always look at price history and annual growth rate for sales (units and \$), and calculate the bad debt/warranty cost, COGS, and contribution margin as a percentage of sales, preferably by product line. Give these careful consideration in assessing the business.
- You are to think of yourself as a business manager whose job security depends on your ability to analyze this business and identify any problems you see. What is asked for here is critical judgment.

Oilpatchco Income Statements All figures are \$'000)					
	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>Year 5</u>
<u>Revenue:</u>					
Pumps					
Units Sold	421	466	558	679	779
Revenue	\$2,515	\$2,759	\$3,175	\$3,782	\$4,300
Warranty and Bad Debt	\$35.2	\$42.8	\$59.7	\$75.3	\$103.2
Net Revenue	\$2,480	\$2,716	\$3,115	\$3,707	\$4,197
Cost of Goods Sold	\$1,811	\$2,066	\$2,469	\$3,023	\$3,499
Contribution Margin	\$669	\$650	\$646	\$684	\$698
Rod					
Km Sold	312.0	327.6	334.2	357.5	379.0
Revenue	\$7,017	\$7,662	\$8,116	\$8,926	\$9,802
Warranty and Bad Debt	\$63.2	\$65.9	\$66.6	\$63.4	\$62.7
Net Revenue	\$6,954	\$7,597	\$8,050	\$8,862	\$9,739
Cost of Goods Sold	\$3,298	\$3,563	\$3,717	\$4,034	\$4,342
Contribution Margin	\$3,656	\$4,034	\$4,332	\$4,828	\$5,397
Service					
Revenue	\$4,272	\$4,656	\$5,255	\$5,511	\$5,853
Warranty and Bad Debt	\$51.3	\$51.2	\$47.3	\$44.1	\$41.0
Net Revenue	\$4,221	\$4,605	\$5,207	\$5,467	\$5,812
Cost of Goods Sold	\$1,837	\$1,979	\$2,207	\$2,287	\$2,400
Contribution Margin	\$2,384	\$2,626	\$3,000	\$3,180	\$3,412
Total Gross Revenue	\$13,804	\$15,078	\$16,546	\$18,219	\$19,955
Total Warranty and Bad Debt	\$149.6	\$159.9	\$173.5	\$182.7	\$206.9
Total Net Revenue	\$13,655	\$14,918	\$16,372	\$18,036	\$19,748
Total Cost of Goods Sold	\$6,946	\$7,608	\$8,393	\$9,344	\$10,240
Total Contribution Margin	\$6,709	\$7,310	\$7,979	\$8,692	\$9,507
SG&A Expense					
All expenses less depreciation	\$2,457	\$2,555	\$2,657	\$2,764	\$2,874
Depreciation	\$3,125	\$3,301	\$3,456	\$3,701	\$3,812
Total SG&A	\$5,582	\$5,856	\$6,113	\$6,464	\$6,687
Operating Income	\$1,126	\$1,454	\$1,866	\$2,227	\$2,821

- 3.14** An abbreviated income statement for Startupco is attached (in \$000). Assuming SG&A excluding depreciation is fixed, i.e. it does not increase with sales, what is the break even sales level at which Startupco "covers the nut". Assuming SG&A excluding depreciation increases at 30% of sales, i.e. each \$1 increase in sales increases SG&A excluding depreciation by \$0.30 above its current level, what is the break even sales level at which Startupco "covers the nut"? Assume in each case that depreciation is fully fixed and COGS is fully variable.

Sales	\$1231	100%
Less Allowance for Bad Debt/Warranty	18	1.5%
Net Revenue	1213	98.5%
Cost of Goods Sold	486	-
Contribution Margin	727	59.1%
SG&A,excluding depreciation	1109	-
Depreciation	420	-
Operating Income	-802	-65.2%
Other Income	0	-
Net Income	-802	-65.2%

Note: answer each of the two cases for each of the two "nuts", book and cash.

THE BALANCE SHEET

4.1 THE PURPOSE OF THE BALANCE SHEET

The balance sheet shows at a given point in time, what assets a business has and where the money came from to acquire those assets. Information in the balance sheet is organized in a manner that makes it easy to extract very helpful information.

There is a simple equation that governs balance sheets:

$$\text{Assets} = \text{Liabilities} + \text{Shareholders Equity (Capital)}$$

This can be thought of as a simple “conservation” equation. Money that goes into an enterprise is:

- Someone else's money (a **liability**, which in a broad sense is debt (money legally owed to others)).
- The shareholders' direct investment (share capital) and the earnings made by the business and left in the business (retained earnings). The combination of share capital and retained earnings is called **equity or shareholders' equity**.

Cash from liabilities and equity is used to acquire **assets** which the enterprise uses to create value. Note that some assets are material things (e.g. a machine), and some may be non-material (for example, a patent or rights to use a technology, or receivables (money your customers owe you for goods you have shipped but they have not yet issued a cheque for)).

As material assets wear out (depreciate) or become useless (are written off), they create a reduction in income. (Remember that depreciation and writedowns show up on the income statement, and they reduce net income.) Appropriate entries remove this value from the balance sheet, so that at any point in time there is agreement between the remaining value of assets and the entries on the income statement. This is discussed further below.

4.2 THE FORM AND COMPONENTS OF THE BALANCE SHEET

A typical balance sheet is shown below. The left side shows assets, the right side shows liabilities and shareholders' equity. Assets and liabilities are shown in decreasing order of liquidity, meaning that at the top of the sheet the most available assets and the most pressing liabilities are listed, and at the bottom of the sheet the assets most difficult to convert to cash and the liabilities that extend the furthest into the future are listed. A company has no legal obligation to return equity to its shareholders, so shareholders' equity is below even the most long-term liability.

As with income statements, there are some differences in terminology and practice between various companies. The important standard is consistency from period to period.

The distinction between current and long term is typically a one-year test. For example, inventory is turned into product in less than a year, and receivables and payables turn over many times in a year.

Typical Balance Sheet Format:

<u>Assets</u>	<u>Liabilities</u>
<u>Current Assets:</u>	<u>Current Liabilities:</u>
Cash	Short Term Credit Line
Receivables	Accounts Payable
Short Term Investments	Accrued Expenses
Inventory	Taxes Payable
Prepaid Expenses	Current Portion of Long Term Debt
<u>Fixed Assets:</u>	<u>Long Term Debt:</u>
Land, Buildings and Equipment at Cost	Repayable Grants
Less Accumulated Depreciation	Long Term Debt
Long Term Investments	<u>Shareholders/Owners Equity:</u>
Goodwill and Intangible Assets	Capital Shares
 	Retained Earnings
Total Assets	Total Liabilities and Equity

4.3 ASSETS**4.3.1 Current Assets**

Current assets are crucial to short term lenders because of their potential to be turned into cash. The most liquid asset is **cash** itself, although it is normally a minor fraction of a company's assets. **Receivables** are the money coming in, typically from customers for goods already shipped. These can be counted on to generate cash quickly, and are the second most liquid asset a company has. **Short-term investments** rank ahead of **inventory** because in theory one could borrow on them, whereas inventory cannot always be sold for cash when a company is in distress. Finally, most companies have some **prepaid expenses**. An example is an insurance bill that is paid in April for a full year's period. At the end of April, 1/12th of the bill would be expensed and 11/12th would be carried in prepaid expenses. For minor non-material annual payments this need not be done, but for more major expenses this approach allows month-to-month tracking of margin. Unless the 11/12th's is carried as an asset, it would have to be fully expensed to get the books to balance.

It is worth pausing to reflect on receivables and inventory. Each of these is typically related to sales, and will increase as sales grow. Receivables are typically measured in days, i.e. the total amount of money owed as receivables is divided by monthly sales, and the resulting fraction is multiplied times 30. This number is a measure of the average time that a business is taking to collect money from customers after a sale is "booked", and it is typically 30 to 60 days for most businesses. Large companies are usually very reliable payers (the bad debt allowance or expense is low), but are slow to process an invoice because the paper related to the sale must be circulated within the large company. Small companies are usually less

reliable but quicker payers. Since customers will not be quicker to pay a large invoice than a small invoice, as sales or sales per customer grow, the receivables measured in days is often unchanged, meaning the receivables measured in dollars is increasing.

Similarly, inventory is often measured as days of sales. As sales grow, it is usual to expect more inventory to be on hand to ensure that manufacturing is not delayed. One note should be made here about conventions in relating receivables, inventory, and payables (discussed below under current liabilities) to days. Receivables and inventory are related to days by dividing by sales, i.e. the total dollar value of receivables or inventory is equated to days of sales. Some inventory in a company is raw materials, some is finished products, so that when we say inventory is "thirty days", we mean it is worth the same amount of money as thirty days of sales. If most of the inventory is carried as raw materials and these are a small fraction of the total value of a sale, then in fact "thirty days" of inventory might support many months of production. The equivalent days convention is a useful way of measuring trends in inventory, but it does not relate to the number of production days that can be supported from inventory. Payables follows a different convention, as discussed below.

Cash is often a small number or zero because a business puts all its spare cash into paying back short-term debt. It is normal for a business to arrange a short-term credit line with a bank, and then "float" on this line, i.e. the amount of short-term debt varies day by day as cheques are deposited or cashed.

4.3.2 Fixed Assets

A company's "hard" assets are called **fixed assets**. Examples are land, buildings, machinery and vehicles. Some of these assets depreciate, but land does not, as discussed above. It is normal to show the full original purchase price of fixed assets, and then to show accumulated depreciation as a reduction. Accumulated depreciation in this case would include all writedowns and losses from "other income" as well as depreciation that was included in SG&A.

4.3.3 Long Term Investments

Sometimes companies will have long-term financial investments like a bond. This might be common in some industries like financial services, but is very rare in manufacturing and technology companies, and is not considered further in this course.

4.3.4 Goodwill and Intangible Assets

If a company buys another company for more than its "book" value, the surplus is considered by accounting rules to be "**goodwill**", which is not treated as a hard asset. This is a very conservative approach that ensures that the value of fixed assets will never exceed their original cost. Other intangible assets would include trademarks, patents, or a franchise fee. These are of value, but they are not a "fixed" asset, i.e. an object. Goodwill and intangible assets can be depreciated over time just like a fixed asset if they have a limited life. In this case, the balance sheet would show original purchase price and accumulated depreciation, the same as for fixed assets.

4.3.5 Total Assets

The sum of current and fixed assets is total assets, and this will always exactly equal total liabilities and equity. One aspect of assets is worth noting. Often people who are starting up a business think of the equity requirements as coming from hard assets, such as land, buildings and equipment. In fact, one finds that a significant part of the assets of some businesses is tied up in receivables and inventory, which are not hard assets but simply the natural consequence of a business cycle. Both increase with sales, and the fact of business is that when sales grow, money flows out of a firm for inventory and wages earlier than it flows in from receivables. This creates a need for money in a firm to acquire the "assets" of receivables and inventory. As discussed later, a shortage of what is known as "working capital", defined as the difference between current assets and current liabilities, has caused the downfall of companies when their sales suddenly increased. On the other hand, companies will sometimes put on a concerted effort to reduce inventory in order to free up cash that the business needs for some other purpose.

4.4 LIABILITIES

4.4.1 Current Liabilities

Current liabilities can be thought of as obligations that are due in less than one year. A **short-term credit line** can usually be called at any time (i.e., it is a "demand" loan), and in any event will turn over many times in a year. A short-term lender almost always puts conditions (also known as covenants) on the credit line, which are conditions that the business must meet in order to maintain the credit line. Understanding why these covenants exist, and knowing how to predict whether they will be met in the future as a business goes through periods of growth or decline, is a key part of financial analysis.

Short-term debt is usually not "secured" in the same way that long-term debt is, in that it doesn't attach to specific assets, but rather is a general charge against a business. There are many examples of a business going from health to bankruptcy quite quickly, so a short-term lender will usually want monthly statements to ensure that the covenants are being met if there is significant short-term debt. A typical covenant requires that a business maintain positive **working capital** (defined as current assets minus current liabilities), since if a business gets in trouble the short term lender will hope to be repaid from current assets (since the fixed assets are usually pledged as security for long term debt, and hence can not be seized by the short term lender). Typical covenants on working capital require either a set ratio (current assets divided by current liabilities) or a certain dollar level (current assets minus current liabilities) be exceeded, or both.

Any business manager relying on a short-term credit line should be looking ahead to see if any covenant might be temporarily not met. A call to the banker and a discussion will give a far better signal than waiting for the banker to discover the problem himself, particularly if the problem is temporary or caused by growth in the business.

Payables are money owed to suppliers, and **accrued expenses** are usually wages owed to the workforce but not yet paid (payroll often runs two weeks or even a month behind the work, and this is an obligation that must be paid). **Taxes payable** are another form of accrued expenses, and sometimes these two categories would be lumped together.

Like receivables and inventory, payables are converted to an equivalent days measure, but by convention they are related to days of COGS, not sales. The formula is:

$$\text{Days payables} = (\text{Payables} (\$) / (\text{Monthly Sales} \times (1 - \text{Contribution Margin}))) \times 30$$

As with inventory and receivables, payables and accrued expenses will usually be related to sales level. If sales go up, the need for inventory (both raw materials and finished goods) almost always goes up. The purchase on credit of material from suppliers creates payables. In effect, a company's suppliers help to finance growth by providing short-term (typically 30 day) credit. On occasion, a startup company that has a chance of landing a major sale will approach its suppliers for longer terms on payables as a means of financing a single big sale, since the total time between buying raw materials and receiving money from the customer for the finished goods is longer than 30 days, and can be as long as 180 days depending on the nature of the business.

Many companies have some form of long-term debt, which they use in addition to a short-term credit line in order to "lock in" an interest rate and payment schedule. However, the principal portion of long-term debt that is due in the next 12 months (known as the "**current portion of long term debt**") should be shown in the "current liabilities" area because it is due within a year, and a default on it would jeopardize the company. This approach makes ratio tests, discussed below, more accurate. However, not all financial statements follow this convention, evidence again of the variability that arises in the actual practice of developing financial information.

4.4.2 Long Term Liabilities

Money due for payment past one year goes into the long-term liabilities category. Sometimes there is only a single entry, **long-term debt**. In special cases, more information is provided as in the table above that distinguishes **repayable grants** from debt. Footnotes to a balance sheet will sometimes give details on the nature of the long-term debt.

Fixed assets typically secure long-term debt. This means that if the business defaults on its repayment of long-term debt, the lender will have the right to take over the assets and sell them to recover the loan. This means that these assets are "tied up" from the perspective of other lenders, since the long-term lender will have first claim on them. Long term debt can also have covenants attached to it that obligate a company to do certain things. One frequent example is that a long-term lender will obligate a business not to take out other long-term debt that ranks ahead of its debt. A second example is ensuring that the proceeds of the loan are used for the purpose intended. A third example is a restriction that says the owners cannot pay a dividend or bonus to themselves unless certain reserve requirements are met (since the lender will think, quite understandably, that the money the business makes should be used for the repayment of debt rather than for the enrichment of the owners!). For startup companies, limiting the impact of covenants on the flexibility of management to grow a business is one important consideration in securing debt.

The amount of debt relative to total assets is a critical financial management decision for a business, and is discussed further in Chapter 6. It is important to remember that either debt or equity, discussed below, can be used to bring money into a company. However, these two forms of financing are quite different in expectations and rights. Debt carries a fixed cost (return to the lender), called interest. If a com-

pany is highly successful, the lender doesn't share any of the extraordinary gain: he simply gets his principal and interest payments. The common shareholder is the beneficiary of extraordinary performance in a company. To say this a different way, Microsoft made an enormous return for its equity investors, and simply paid the agreed interest to its lenders.

Why, then, does a lender lend rather than invest? It is because debt has less risk than equity: it is paid out fully before the common shareholder gets any benefit. If a company needs all of its free cash to make its loan payments, it will certainly use it, since debt must be paid, whereas benefits to investors, for example dividends, are optional. The reason that debt must be paid is that it has the legal right to drive a company into receivership, in which a court appoints someone other than management to run a business, if debt is not paid. Normally receivership results in the shutdown of a company and the forced sale of assets; the proceeds of this forced sale go exclusively to lenders until all of their claims are met. The equity shareholder gets nothing until all lenders' claims are satisfied. We say therefore that debt has less return than equity, on average, but has less risk as well.

Are banks keen to lend money? The answer is "of course". Banks are in the business of renting money from sources (in the form of interest on deposits) and then re-renting that money out to entities that can use it, mainly companies. Any banker that doesn't lend money would soon lose her job. However, a banker that lends money to an entity that doesn't pay the interest charges is also in trouble. Whenever a loan is in default, say due to lack of payment of the interest charges, it must be declared as a non-performing loan, and banks that report high levels of non-performing loans watch their own share values drop. Lenders are highly conservative and focused on preserving capital; lending to entities that go bankrupt destroys capital. Hence, banks are keen to lend money to those who can repay.

4.5 SHAREHOLDERS'/OWNERS' EQUITY

4.5.1 Capital Shares

Capital shares are the money put into a business by the sale of shares in the company. (Note that in a partnership, there are no shares so the entry would be relabeled partners' equity but the impact is the same.) This is the original money that comes into the company. After the shares are issued, the shareholder may sell them to a third party at a price that is different than their original sale price by the issuing company. This has no direct impact on the company itself.

This is an important concept to reflect on, especially in understanding publicly traded companies (those whose shares trade on a stock exchange). Such companies issue shares at one or more times, bringing money into the company. (Sometimes new shares are issued in company A who then uses them to acquire company B, but even in this case an equivalent dollar value will be assigned to the issued shares.) Once the shares are issued, they are usually free to be traded, i.e. sold to others. Investors in such companies hope that the market value of the shares goes up, i.e. some buyer will value them more in the future. However, this does not put any more money into the hands of the issuing company, but rather into the hands of the shareholder who sells the shares.

Companies do care about their share value, but not because there is a direct effect on the financial health of the company. Management and the Board of Directors of a company have a legal and ethical duty to act in the best interests of the shareholders. One of the main criteria by which shareholders judge management is their ability to give a return on investment to shareholders, through both dividends and

increased share value. If a stock value plummets, there is often a call for a change in management of a company.

Sometimes there are different classes of common shares. Some family run businesses have attempted to retain effective control of a company even as they raise equity from investors, by issuing non-voting shares. In theory these shares are equal to voting common shares, but can't elect directors or vote on issues such as a takeover bid. Non-voting shares have come under a great deal of valid criticism.

There is another type of share, the preferred share, that is quite different from common shares. The nature of preferred shares is discussed in Appendix 6.2.

4.5.2 Retained Earnings, Shareholders' Equity and Market vs. Book Value

As noted in Section 3.8, when a company makes money (net income) it can use that money for a dividend, or it can retain some or all of it in the business. Retained earnings on the income statement is incremental, while on the balance sheet we record the cumulative retained earnings, i.e. the value of the money that a company has made and kept in the company since the company started. Capital shares record the money that shareholders injected into a business. Retained earnings record the earnings that shareholders left in a business. **Shareholders' equity, the amount of money that shareholders have in a business**, is the sum of these two. In a partnership, which has no shares, this value is called owners' equity.

The "book value" of shareholders equity is the direct original value of capital shares and retained earnings. One can imagine that if a business is steadily losing cash, that the market value of the shares in the company will be less than the original value, i.e. a prospective new investor will not be willing to pay as much for the shares as the original value plus retained earnings. One can also imagine that when a company has extraordinary success (for example, an exploratory oil well finds enormous reserves far higher than expected), the market value of the shares soars because the company is worth far more than the shareholders' equity (in essence, a large current market value has been created, in anticipation of future earnings). This concept of the difference between market and book value of shareholders' equity is discussed further in Chapter 6 "Ratio Analysis of Financial Statements".

4.5.3 Shareholder Debt vs. Shareholders' Equity

Large publicly traded companies issue shares to shareholders. From the shareholders' perspective, the ability to buy and sell these shares is key to the willingness to invest in large companies. Capital requirements of modern enterprise are enormous, and are met by a wide variety of investors. Individuals invest in companies in two ways, directly (by share purchase in their own name), and indirectly through participation in mutual funds or pension plans. People have differing needs for their investments, the biggest being that they need to get their money back when the purpose for which they are saving (e.g. retirement or a home purchase) crystallizes. It is the existence of a liquid, regulated and fair stock exchange system that makes people willing to invest in large companies.

A small company cannot afford to be publicly traded, in part because the reporting requirements for stock exchanges are too onerous and costly to be justifiable to a very small enterprise. These companies can sell shares to individual purchasers, but these shares are typically illiquid, meaning that they are hard to sell to a third party because there is not a public market in which to trade them, and there is not a body of public information about them.

Sometimes individual investors in a company choose to put their investment in the company in the form of debt rather than share equity. There are still shares in the company, but they may have a nominal value attached to them, even as low as \$1. The significant investment in the company is a loan from the shareholder. This kind of debt is called shareholder debt, and it typically ranks below all other debt, i.e. it is paid out last. Shareholder debt is shown as a liability, but lenders will typically treat it as if it were equity when doing various “ratio tests” on a business. Lenders will also usually put covenants in place that forbid a company from retiring shareholder debt unless certain tests are met. Hence, shareholder debt is a special form of financing a company that, in practice, is closer to shareholders’ equity than it is to third party long term financing.

4.6 BALANCE SHEET VS. INCOME STATEMENT

Several comments can be made about a balance sheet versus an income statement:

- The income statement measures a rate: how much income do I make in a given period of time. The balance sheet measures wealth: how much do I have at this moment, and how much do I owe at this moment.
- The income statement covers a period of time, and that period must be long enough to be meaningful. Typical periods for income statements are monthly, quarterly, and annually. Balance sheets are at a moment in time. It makes sense to do a balance sheet at the end of the period of time of an income statement. Hence, if an annual income statement covers a company’s fiscal year of November 1 to October 31, then a balance sheet would be attached stating the company’s assets and liabilities as of October 31.
- To understand a business, one needs both statements. If, for example, an income statement shows a significant book and cash loss, we know the business is losing money. However, if the balance sheet shows substantial cash reserves, then we can get a sense that the company can “weather the storm”, i.e. that it has time to improve its performance. Contrast that to a company losing the same amount of money that has minimal equity. It will run into trouble very quickly. Anyone trying to understand a company’s position must look at both the income statement and the balance sheet.
- If you are buying the assets of a company, then the balance sheet is of little interest, but the income statement is of high interest. The income statement will tell you how much value the current owner has created by using the assets. It is not of particular relevance whether the current owner financed the assets or bought them with equity, since you are not assuming those obligations when you buy the assets.
- If you are buying a company, then the balance sheet is of just as much importance as the income statement, because you are assuming the obligations of the company, i.e. the liabilities of the company become your liabilities once you own the company. The balance sheet tells you what you are getting when you buy a company.

4.7 OPERATIONAL AND FINANCIAL MANAGEMENT OF A COMPANY

We return to a concept discussed earlier of financial vs. operational management of a company. It is intuitively obvious that to be successful in business, management must operate well, i.e. it must be efficient and effective in delivering a good or a service. The first test of this comes from the income statement: can

management provide a good or a service at a low enough direct cost (COGS) to create a large enough margin to more than cover the fixed costs (SG&A) of the business, creating a profit? But some concepts of operational effectiveness are contained in the balance sheet as well. Imagine two competitive companies delivering the same good or service and with the same level of sales (gross revenue), but one has twice the inventory and receivables that the other company has. Sloppy management requires more inventory, while good tight management strives for "just in time" approaches that reduce inventory. Sloppy management allows receivables to build up (in effect, lending money to customers, usually with no interest since customers often don't pay it even if it is entered on a subsequent invoice). Good tight management prompts customers to pay in a timely manner. Inventory and receivables are real costs to a business; they consume money. Good managers pay attention to such items. These concepts are developed further in Chapter 6 "Ratio Analysis of Financial Statements" and Chapter 9 "Using Financial Statements to Manage an Operating Company".

The other element of financial management that is evident from a balance sheet is how much of the firm's money has come from debt vs. equity. Firms with high debt (other people's money) relative to equity are more at risk if there is a downturn in business, since debt repayment is a legal obligation while dividends are not. A company can cut its dividend in hard times, but cannot cut its loan repayments. This concept is called leverage and is discussed in detail in Chapter 6.

PROBLEMS

- 4.1 What is the test to differentiate current from long term assets and liabilities? Some loans have what is called a "balloon payment", i.e. for the term of the loan interest only is paid, and at the end of the loan term the entire principal is repaid (the "balloon payment"). This kind of financing is rare, because it does not reflect the depreciation of assets, but it sometimes occurs if there is an excess of assets to secure the loan. Imagine that a company has a loan for \$25 million. What is the current liability of this loan in year one if it is a five year term with straight line repayment of principal? What is the current liability of this loan in year one if principal is recovered by a full balloon payment at the end of year five? What is the current liability of this loan in year one if it is a leveled (mortgage) type annual repayment with a 20 year term and 8% interest?
- 4.2 You are considering buying Exampleco, a manufacturing company. The president and CFO are traveling and won't be back for two weeks, and the financial statements cannot be released until then. However, you have talked to the daughter of the owner, and have written down the following comments. Try to do up a balance sheet for the company, making reasonable assumptions where necessary.
- "We started Exampleco two years ago with \$3.3 million that dad had inherited."
 - "Our sales have done well, and if we can keep them at last month's performance we would reach \$4.2 million a year. We hope to do even better than that."
 - "We bought four and half million dollars of equipment at an auction. It was used equipment but had been completely rebuilt, so dad decided on a ten year depreciation period."
 - "We just rent the space we are in."
 - "We never have any cash or notes in the bank. Dad set up a credit line and we float on that. The bank didn't want to give us long term financing until we were in operation for two years. We are trying to decide right now whether to take out some long term financing and really expand the business, or sell it to you and stay on as operators."
 - "At first our draw on our credit line was over 3 million, and the only way we could get it was to have a personal guarantee from my uncle. Lucky for us, the business has gone well and the draw from the bank has dropped over the two years we have been in business. Dad thinks we can get the requirement for a personal guarantee lifted."

- "When we set up the business, we decided to leave the depreciation in the business. We also decided to set up an objective for ourselves of leaving a quarter million dollars of net income per year in the company, and treating ourselves to a dividend on everything else. So far we have met our objective."
- "We play it safe on inventory. It is running 35 days of sales, which is a lot considering our materials cost is only 50% of sales. We could probably bring it down, but we have just been too busy filling orders."
- "We have been stringing our suppliers out 50 days. We have to talk to them every month to assure them we are doing ok, but it has worked so far. Because our sales grew to \$350k last month and we have stayed with the same suppliers, they haven't minded our slow pay."
- "Our prepaids are so small we ignore them. Our accountant said that they weren't material, and that we could just expense this stuff as we spent it."
- "We are current on taxes. Dad knew a guy that lost his business because of unpaid taxes, so he has insisted on a monthly payment to keep us current."
- "Our payroll is two weeks behind, but it isn't a big deal because our staff is only 22. Otherwise we are current on all our expenses."
- "Our customers are large companies, and they are sure slow to pay. Our receivables are running 55 days."
- "We are still getting by on the original equipment we bought."

Do you need the income statement to prepare the balance sheet in this case? Would you be able to make an intelligent decision about whether to buy the business without looking at the income statement? Why? (One sentence.)

What percentage of the total assets is tied up in inventory and receivables?

- 4.3 Take the following information on a company and say what the company has (its assets) and where the money came from to own those assets (its liabilities and equity) at the end of two years of operation (assume the principal repayment on debt has been made for year 2):

- The company has gross sales of \$48 million per year, and the pattern of sales is even, i.e. there is no cyclical pattern to sales.
- Customers are large firms with a typical large firm payment pattern.
- COGS for the business is 60% and is material only; all labor costs are in SG&A.
- Monthly payroll is \$200,000.
- There is enough raw material on hand to support one month of manufacturing, and two months of actual production of finished goods is in the warehouse. (Remember that finished goods in inventory are carried on the books at COGS, not expected sale price.)
- The company pays its suppliers 30 days after goods are received.
- The owners started the business with an initial capital injection of \$5.6 million 25 months ago.
- The company borrowed \$3 million of long term debt, with the principal repayable in 10 equal annual payments.
- The company bought \$8 million in assets at startup and picked a depreciation period of 10 years. No additional assets have been purchased.
- In the first two years of the business, the company had a cumulative net income of \$1,800,000, and paid dividends of \$300,000 (\$150,000 per year) to the owners.
- The business has a short term credit line that runs positive or negative based on the fluctuations of the business (just like a personal checking account).

Balance sheets help us do "what ifs" and think about the financial health of the business. Use the balance sheet to answer the following questions (this is easier if you have done the balance sheet as a spread sheet):

1. What assets does the business have? Which is larger, "current" assets or fixed?
2. How much short term debt does the business have?
3. How much working capital does the business have?
4. If the cumulative dividend over two years had been \$1,800,000 instead of \$300,000 (i.e. if all of the profits had been taken out of the business as dividends), what would the short term debt be? Would working capital still be positive?
5. If you cut the inventory in half by a vigorous program of "just in time" manufacturing and shipping, by how much would your bank borrowings drop? Would working capital change?

<u>Assets</u>		<u>Liabilities</u>	
<u>Current Assets:</u>		<u>Current Liabilities:</u>	
Cash	\$-	Short Term Credit Line	\$-
Receivables	\$-	Accounts Payable	\$-
Short Term Investments	\$-	Accrued Expenses	\$-
Inventory	\$-	Taxes Payable	\$-
Prepaid Expenses	\$-	Cur.Por. of L T Debt	\$-
	\$-		\$-
<u>Fixed Assets:</u>		<u>Long Term Debt:</u>	
Land, Bld.& Equip. @ Cost	\$-	Repayable Grants	\$-
Less Acc. Depreciation	\$-	Long Term Debt	\$-
	\$-		
Long Term Investments	\$-	<u>Shareholders Equity:</u>	
Goodwill	\$-	Capital Shares	\$-
		Retained Earnings	\$-
Total Assets	\$-	Total Liab. and Equity	\$-

4.4 Shown below is the balance sheet of Balanceco for End of Year last year.

Balanceco Balance Sheet	Last Year	\$ (000)	
<u>Assets</u>		<u>Liabilities</u>	
<u>Current Assets:</u>		<u>Current Liabilities:</u>	
Cash	\$15	Short Term Credit Line	\$96
Receivables	\$123	Accounts Payable	\$66
Short Term Investments	\$-	Accrued Expenses	\$16
Inventory	\$98	Taxes Payable	\$-
Prepaid Expenses	\$26	Cur.Por. of L T Debt	\$20
	\$262		\$198
<u>Fixed Assets:</u>		<u>Long Term Debt:</u>	
Land, Bld.& Equip. @ Cost	\$800	Repayable Grants	\$-
Less Acc. Depreciation	\$160	Long Term Debt	\$140
	\$640		
Long Term Investments	\$-	<u>Shareholders Equity:</u>	
Goodwill	\$-	Capital Shares	\$500
		Retained Earnings	\$64
Total Assets	\$902	Total Liab. and Equity	\$902

For this fiscal year, you have the following information:

- Inventory, receivables and payables are each up 35%, reflecting an improvement in sales.
- Net income for this year is \$142,000.

- Balanceco starts the year with three owners, one of whom wants to retire. The owners agree that the retiring owner will have his shares bought back by Balanceco for \$100,000. The two remaining shareholders each receive a dividend of \$50,000 in late this year. Other than leaving some retained earnings in the business this year, they don't inject any capital.
- A new piece of equipment is purchased for \$120,000, very this year. Its depreciation period is ten years (all depreciation is straight-line).
- Other than the extra depreciation on the new piece of equipment, depreciation on the balance of equipment is unchanged from last year at \$80,000 per year.
- Accrued wages are up 25% compared to last year's year-end, i.e. there are 25% more hours worked but unpaid at year-end.
- Cash in the bank and prepaid expenses are the same at year-end this year as in year-end last year.
- The long term financing is a loan of \$200k with a ten-year straight-line retirement. This year is the third year of this financing, i.e. at the end of last year two years of financing had been completed.

Complete Balanceco's balance sheet for this year. What fraction of Balanceco's assets is tied up in inventory and receivables this year?

Is Balanceco in good shape? If not, are the problems due to operational management or financial management? What could Balanceco have done differently?

STATEMENT OF CASH FLOW

5.1 THE ROLE OF CASH IN A BUSINESS

One early and crucial lesson taught to people taking first aid is to always check first if a victim is breathing, and if not, deal with that first. This lesson is taught because there have been instances where people have tended to bleeding wounds, only to find that the victim died from, say, a blocked air passage. Many things are essential to life, but in the short term, nothing is more important than breathing, in that an absence creates the most immediate life threatening "crisis".

Anyone running a business should think of cash as breath. Cash is meant here in the broader sense of access to funds by means of a positive bank account or access to a credit line. Another way of thinking of this is "if I write a cheque, will the bank cash it"? When a business loses access to funds, suppliers stop shipping, workers stop showing up at work, and inevitably a creditor will take steps to put the firm in receivership, at which point the owner(s) have legally lost the ability to operate the business. Normally a company that goes into receivership is broken up, meaning the assets are sold, often at a steep discount, to recover funds to pay off creditors.

There are cases where management of a business was so focused on a longer-term issue (e.g. bringing a new product to market, working with an existing customer, or attracting new investors) that they lost sight of the short-term cash position of the company, and the company went into bankruptcy. One purpose of funds flow analysis is to be able to predict the cash position of a company into the future. A good management team will always have a sense of their current and future cash position, to ensure that a short term need for cash does not ruin a business that would otherwise be healthy in the long term.

Eight minutes without breath is almost always fatal to a human, and two days without cash is almost always fatal to a business. Most businesses rely on a bank credit line (an account with a bank that can go positive or negative) to support their activities. Cash is flowing into and out of that account all the time as customer's cheques are deposited and suppliers cash the company's cheques. Cash or funds flow analysis is a critical business skill to ensure that the bank keeps the credit line open.

In Chapter 3 we saw a simple measure of cash break even: does a business generate cash from its normal operations, excluding considerations of assets. But in fact, companies do require assets: as sales grow, companies have higher receivables and inventory, and often need more fixed assets. Financing is often available from many sources: payables (in essence, borrowing from suppliers), bank debt (short or long term), equity injection through issuing shares, and retention of earnings. The financial statement that tracks all the funds flow into and out of a company and that predicts the position of the bank credit line is the "Statement of Cash Flow".

5.2 THE CONCEPT OF SOURCES AND USES OF FUNDS

Consider a business that is growing in sales. One inevitably finds in such a business that receivables increase, in that there are more customers or bigger invoices (or both), and so customers owe more money to the company. Similarly, inventory and payables go up: we have more materials in our warehouse, and we also owe our suppliers more money because our purchase orders issued to them are larger or more frequent.

An increased receivable requires funds: we have made a product, using materials and labor that we had to pay for, and our customers have not yet paid us. So, if our receivables grow, we would have needed funds to buy the materials and pay the labor for the products we shipped to our customers. An increased payable is in effect a source of funds: we have received materials and not yet paid for them. For instance, some of the value tied up in increased receivables (money our customers owe us) is offset by our payables (money we owe our suppliers).

We can use two successive balance sheets to track sources and uses of funds for a company. Since the balance sheet always "balances", in effect reflecting the cash or credit position of the company at year end, we will find that the sources of funds always balances the uses of funds in a company. Look at this example:

Growthco Balance Sheet \$(000)

	Last Year	This Year	Source	Use
Assets				
Current Assets:				
Cash	\$-	\$-		\$-
Receivables	\$642	\$877		\$235
Short Term Investments	\$-	\$-		\$-
Inventory	\$408	\$589		\$181
Prepaid Expenses	\$61	\$54	\$7	
	\$1,111	\$1,520		
Fixed Assets:				
Land, Bld.& Equip. @ Cost	\$4,500	\$6,200		\$1,700
Less Acc. Depreciation	\$900	\$1,520	\$620	
	\$3,600	\$4,680		
Long Term Investments	\$-	\$-		
Goodwill	\$-	\$-		
Total Assets	\$4,711	\$6,200		
Liabilities				
Current Liabilities:				
Short Term Credit Line	\$192	\$609	\$417	
Accounts Payable	\$292	\$387	\$95	
Accrued Expenses	\$44	\$67	\$23	
Taxes Payable	\$21	\$15		\$6
Cur.Por. of L T Debt	\$40	\$60	\$20	
	\$589	\$1,138		

Growthco Balance Sheet \$(000)

	<u>Last Year</u>	<u>This Year</u>	<u>Source</u>	<u>Use</u>
Long Term Debt:				
Repayable Grants	\$-	\$-		
Long Term Debt	\$340	\$480		\$140
Shareholders Equity:				
Capital Shares	\$3,300	\$4,000	\$700	
Retained Earnings	\$482	\$582	\$100	
Total Liab. and Equity	\$4,711	\$6,200		
Sources/Uses of Funds			\$2,122	\$2,122

This example is worth several comments:

- Growthco has no cash on hand, it "floats" on a short-term credit line it has negotiated with a bank. This is typical of many businesses.
- The company appears to be growing, since inventory, receivables and payables are all up. The company is generating net income, since retained earnings increase by \$100k over the year.
- Current assets increase by \$409k, largely due to the increase in inventory and receivables. This increase requires funds. Specifically, all current asset categories except prepaid expenses increase. The decrease in prepaid expenses has freed up some cash, but not much in this case.
- Growthco has clearly made some major fixed asset investment(s) in the past year to support its growth. Specifically, we can see from the balance sheet that \$1700 of new fixed asset investment occurred in the last 12 months, which is quite significant considering that in the previous history of the company only \$4500 of original investment had occurred.
- Growthco has a significant amount of depreciation this year, \$620k. *Depreciation is always a source of cash.* Remember from Chapter 3 that depreciation is a deemed expense, not a cash expense. Hence, depreciation can be thought of as money that has been taken into a company and which represents the recovery of past asset purchases. This money is available to the company to pay for future asset purchases (or for any other purpose).
- Growthco's current liabilities increase by \$549k. More money is owed to suppliers, and this is a source of funds; the company is, in essence, drawing on its credit with suppliers to help finance its growth. It is also increasing its short-term borrowings from the bank by \$417k. The small reduction in taxes payable is a user of funds (in that last year owed taxes were a form of "borrowing" from the government, and this year the "borrowing" is less).
- Growthco has increased its long-term debt. If one adds up the current portion (due within one year) and the long-term portion, the total net increase in long-term debt is \$160k. From last year's statement, we would guess that Growthco borrowed an additional \$200k of long-term debt this year and paid off \$40k of debt during the year, leading to a net increase of \$160k.
- Growthco has had a major increase in equity over the past year. It raised \$700k in new investment, and retained earnings of \$100k.

Note that funds flow (\$2122k) is not the same as an increase in asset value, which in the case of Growthco is \$1489k. If one reduces cash to buy inventory from one year to the next, the asset value of the company does not change, but there is a flow of funds from one account to another. The total amount of funds flow per year from account to account is not as significant as what the funds go to and where they come from.

To illustrate this, consider Growthco's increase in asset value. The net increase in fixed assets is \$1080k (\$4680 minus \$3600), and the increase in current assets is \$409k (\$1520 minus \$1111), for a total increase of \$1489k. Where does this money come from? Bank indebtedness goes up by \$577k, which is the sum of the increase in short term credit (\$417k) and long-term credit (\$140k plus \$20k (the current portion)). Equity goes up by \$800k, the sum of \$700k of new investment and \$100k of retained earnings. The balance of the increase in the asset value comes from changes in current liabilities, mainly payables, which is money that is owed to suppliers.

We can get a good feeling about the health of Growthco by seeing that they are financing their growth by a mixture of debt and equity, not just debt. If Growthco had borrowed all of the money it had required for its increase in asset value, we would have had an uneasy feeling that the company was "living on borrowed time", in that no person and no company can do all of their funding by borrowing from others. But, Growthco has healthy retained earnings and found someone during the year that believed enough in the company to invest an additional \$700k.

We can wonder why Growthco would have bought additional assets for \$1700k and only increased long term financing by a net of \$160k. It may be that Growthco found the covenants on a higher level of long term debt too onerous, it may be that the long term lender was unfamiliar with or uncomfortable with the new assets, it may be that Growthco has a further expansion in mind and will take out a more comprehensive long term financing package after that. In any event, a careful look at the sources and uses of funds has raised a question that a prospective investor in Growthco would raise with management before committing to an investment. This is the true power of financial analysis: it allows the owner, manager, buyer or seller of a business to focus their attention on critical details that affect the health of a business.

Critical to this analysis is the understanding that:

- An increase in an asset account year over year is a use of funds. Asset accounts represent real things, and it takes money to have real things.
- An increase in a liability account year over year is a source of funds. An increase in a liability is equivalent to saying that someone is lending us money. Sometimes this is clearly labeled debt, sometimes it is less evident (accrued expenses or taxes owing, for example), but these accounts represent what would be owed to others if the company went out of business.
- Depreciation is a source of funds. As noted above, depreciation represents funds that have come into a business and are being offset on the company's books against past asset purchases. Depreciation represents the declining value of assets that wear out and that, in theory, will need to be replaced someday. Once the money represented by depreciation is in the company, it can be used for any purpose, including the purchase of new assets and an increase in inventory and receivables (as occurred with Growthco). It should be noted that if depreciation is spent on other things, it is not available to be spent on replacement equipment. However, as long as depreciation is left in a company in some form (e.g. as working capital) rather than paid out of the company as a dividend, then one can usually borrow against the equity within the company to finance future equipment replacement.

5.3 STATEMENT OF CASH FLOW

From two successive years of balance sheets, one could construct the sources and uses table as we did above for Growthco. However, in practice a standard financial statement, the Statement of Cash Flow, has developed that incorporates all of the information from the "sources and uses" analysis plus some from the income statement (or statement of retained earnings), and displays it in a form that helps display a company's overall operation.

To start with, remember that working capital is the name given to current assets minus current liabilities. This is almost always positive, for reasons that will be discussed later. Working capital is one of the most critical numbers from the perspective of the short-term lender, and for many businesses, the short-term lender is the source of day-to-day cash (breath!). Working capital includes cash or a draw on a short-term credit line (which can be thought of as negative cash). Non-cash working capital means all items in current assets and liabilities except the cash or short-term credit line.

Growthco's income statement and statement of retained earnings for this year is:

Growthco Income Statement \$(000)

	<u>This Year</u>
Revenue	\$4,223
Allowance for Bad Debt	\$27
Net Revenue	\$4,196
Cost of Goods Sold	\$2,695
Contribution Margin	\$1,501
Contribution Margin, %	35.5%
Sales, General, and Administrative Expense:	
All Items except Depreciation	\$719
Depreciation	\$620
Operating Income	\$162
Other Income	-\$24
Net Income	\$138

Growthco Statement of Retained Earnings

Retained Earnings at Start of Year	\$482
Plus Net Income for This Year	\$138
Less Dividend Paid This Year	\$38
Retained Earnings at End of Year	\$582

We can use the income statement and balance sheet to prepare a standard form Statement of Cash Flow (SCF) as per the following table. The SCF rearranges information into the following broad categories:

- Operating activities: this starts with what the company made in the last year (net earnings) and adds back in depreciation (a non-cash charge against earnings) to get total funds generated by operations. In the same category, the use of funds for an increase in working capital other than cash (or the draw on the short term credit line) and the current portion of long-term debt is included. This value is determined by adding the year over year increase in current assets except cash, and subtracting the year over year increase in current liabilities except the short term borrowings and current portion of the long term debt. The logic for including "non cash working capital" is that as sales increase or decrease, non-cash working capital requirements (mainly receivables and inventory minus payables) go up or down. This is in effect driven by the change in the operating level of the company. Note:
 - Specific account by account information is not normally given in the SCF (e.g. a specific change in inventory, receivables, payables, accrued expenses and taxes payable), but a financial analyst who sees a significant change in non-cash working capital and wants to identify the source can easily extract this information from the balance sheet by using the approach shown in section 5.2.
 - Cash is excluded from this section because the whole purpose of the SCF is to solve the "balance" for cash (or negative cash, i.e. the draw on the credit line). It is this balance that tells us how much cash we have on hand (or how much of our credit line we have drawn).
 - The current portion of long-term debt is excluded from this portion because it is captured in the Financing Activities section of the SCF.
 - Positive operating income and depreciation are sources of funds, and hence are a positive entry in the SCF. An increase in non-cash working capital is a use of funds, and hence is a negative entry.

Growthco Statement of Cash Flow \$'000)

	<u>This</u> <u>Year</u>
<u>Operating Activities:</u>	
Net Earnings for the Year	\$138
Depreciation	\$620
Changes in Non-Cash Working Capital	-\$297
subtotal	<u>\$461</u>
<u>Investing Activities:</u>	
Additions to Fixed Assets	-\$1,700
Additions to Goodwill and Intangibles	\$-
subtotal	-\$1,700

Growthco Statement of Cash Flow \$(000)

	<u>This Year</u>
<u>Financing Activities:</u>	
Dividends	-\$38
Net New Long Term Borrowings	\$160
Net New Capital Shares	\$700
subtotal	<u>\$822</u>
Funds Flow	-\$417
Cash on hand, start of year	-\$192
Cash on hand, end of year	-\$609
Change in Cash Position	-\$417

- **Investing activities:** this section records the net effect of the purchase or sale of fixed assets or intangible assets (for example a patent, trademark, customer list or goodwill). Asset purchases are shown at cost, since any depreciation taken on them during the year is recorded in Operating Activities. Note that a net investment in new assets is a use of funds, and hence a negative entry in the SCF.
- **Financing activities:** this section captures dividends paid, changes in long term debt (it will sometimes show both payment of and additional creation of long-term debt, or it can simply net this out to a single number), and changes in share capital (common and preferred shares). Note:
 - Changes in short term borrowings are not included here, since again the purpose of the SCF is to “balance” the books by calculating the cash/short term credit position of the company. Since short-term borrowings can be called/repaid at any time, they are not viewed as a strategic financing of the business.
 - Retained earnings do not need to be included as a line item, since the SCF has net earnings as an addition to cash (in Operating Activities) and dividends as a reduction in cash (in Financing Activities), and the difference, retained earnings, is therefore built into the SCF.
 - The current portion of the long-term debt must be included in this section to accurately show all financing activity.
 - A dividend is a use of funds, and hence a negative entry in the SCF. Increases in equity or long-term debt are a source of funds, and hence a positive entry. In particular long-term debt changes will be positive or negative in the SCF depending on whether funds are flowing out of the company to repay debt, or into the company from an increase in debt level.

The power of the Statement of Change in Financial Position is that this single statement captures funds flow in a company and breaks it down by categories so that a person trying to understand a business can quickly see what is happening to the business. The other power of the analysis is that it shows the draw on the short-term credit line, which is key to the operation of any company. This is discussed further below in Section 9.2.11.

One minor note: if a company has cash and a short term credit line that it draws on, then the Statement of Cash Flow will give the net cash position (cash minus the draw on the credit line). Since cash can

normally be moved into the credit line at any time, one can think of these as two components of a single account. To put this another way, one can think of short term borrowings as "negative cash"; net cash position is the sum of positive cash ("cash") and negative cash ("short term borrowings").

PROBLEMS

- 5.1 In Problem 4.4, you prepared this year's balance sheet for Balanceco. Prepare a sources and uses analysis on the two year's balance sheets. Prepare a Statement of Cash Flow. Comment on the health of Balanceco (one paragraph or less). Note that for the SCF you need the income; you can find this in Problem 4.4.
- 5.2 Growthco, from Chapter 5, goes through another year of operation ("next year"). Prepare a Statement of Cash Flow for "next year" and comment on Growthco, comparing its performance "next year" to its performance "this year" drawn from Section 5.3 (one paragraph or less). Growthco's income statement and balance sheet for next year are shown below.

Growthco Income Statement \$(000)

	This Year	Next Year
Revenue	\$4,223	\$5,477
Allowance for Bad Debt	\$27	\$31
Net Revenue	\$4,196	\$5,446
Cost of Goods Sold	\$2,695	\$3,488
Contribution Margin	\$1,501	\$1,958
Contribution Margin, %	35.5%	35.7%
Sales, General, and Administrative Expense:		
All Items except Depreciation	\$719	\$815
Depreciation	\$620	\$620
Operating Income	\$162	\$523
Other Income	-\$24	-\$21
Net Income	\$138	\$502

Growthco Statement of Retained Earnings

Retained Earnings at Start of Year	\$482	\$582
Plus Net Income for This Year	\$138	\$502
Less Dividend Paid This Year	\$38	\$200
Retained Earnings at End of Year	\$582	\$884

Growthco Balance Sheet \$'000)

	This Year	Next Year
<u>Assets</u>		
<u>Current Assets:</u>		
Cash	\$-	\$-
Receivables	\$877	\$1,140
Short Term Investments	\$-	\$-
Inventory	\$589	\$754
Prepaid Expenses	<u>\$54</u>	<u>\$66</u>
	<u>\$1,520</u>	<u>\$1,960</u>
<u>Fixed Assets:</u>		
Land, Bld., & Equip. @ Cost	\$6,200	\$6,200
Less Acc. Depreciation	\$1,520	\$2,140
	<u>\$4,680</u>	<u>\$4,060</u>
Long Term Investments	\$-	\$-
Goodwill	\$-	\$-
Total Assets	\$6,200	\$6,020
<u>Liabilities</u>		
<u>Current Liabilities:</u>		
Short Term Credit Line	\$609	\$53
Accounts Payable	\$387	\$477
Accrued Expenses	\$67	\$93
Taxes Payable	\$15	\$33
Cur.Por. of L T Debt	<u>\$60</u>	<u>\$60</u>
	<u>\$1,138</u>	<u>\$716</u>
<u>Long Term Debt:</u>		
Repayable Grants	\$-	\$-
Long Term Debt	\$480	\$420
<u>Shareholders Equity:</u>		
Capital Shares	\$4,000	\$4,000
Retained Earnings	\$582	\$884
Total Liab. and Equity	\$6,200	\$6,020

Sources/Uses of Funds

RATIO ANALYSIS OF FINANCIAL STATEMENTS

6.1 WHY ARE FINANCIAL RATIOS USED?

It is sometimes necessary to do frequent financial comparisons of companies. Examples are:

- A banker's success depends on lending money to successful clients who will pay it back. If the banker does not lend, she has insufficient income and fails. If she lends to the wrong creditors, she has insufficient income and fails. She will compare a loan applicant to other companies as part of assessing the likelihood of repayment.
- An investment financial analyst's success depends on recommending "winning" stocks. He will compare companies to see which are likely to grow in value.
- A credit analyst makes a crucial decision in any company: "should we give normal commercial terms to customer x, shipping product and invoicing for payment at a later date". Again, companies are compared in making this assessment.

The purpose of financial ratios is to provide quick "tests" of various financial factors for companies. They are a fast screening technique. One would never buy a company without a rigorous year over year analysis of an income statement, balance sheet, and Statement of Cash Flow, but one does use ratio analysis for quick decisions on companies. A lender or a credit-checking agency will likely check some critical ratios every month, for instance, but will only go into more detailed analysis if there is a negative change in a ratio.

Different industries have historically had different ratio values, e.g. a capital intensive industry such as steel making will have different values on the same ratio than a "high turnover / low asset" business like a grocery chain. The biggest value of ratio tests is for year over year comparisons within a company and for the speed with which they allow company comparisons within an industry.

6.2 WHAT TYPES OF FINANCIAL RATIOS ARE USED?

Different authors have slightly different categories for ratios, but the tests themselves have become fairly standardized. There are five categories:

1. **Liquidity Ratios** that measure the likelihood that a business will stay solvent in the short term. A "liquid" asset is one that can be quickly and easily converted to cash (for example, an account receivable, which normally turns into cash within 30 days). An "illiquid" asset is one that is

difficult to turn into cash, for instance a highly specialized piece of equipment that has major installation costs. The two key tests are:

- Current Ratio
- Quick or Acid Test Ratio

2. Activity or Asset Management Ratios that measure how well management is using the assets it employs in the business. Management can use these ratios as an ongoing "report card". The key asset management ratios are:

- Inventory Turnover
- Average Collection Period (also called Days Sales Outstanding)
- Fixed Assets Turnover
- Total Assets Turnover

3. Leverage or Debt Management Ratios that measure how effective a company is likely to be in paying back its total debt. In particular, long term lenders and equity investors look to these ratios, the lenders to satisfy themselves that the company they are lending to can repay the long term debt, the investors to make sure the company has some, but not excessive, leverage. The key debt management tests are:

- Total Debt to Total Assets (Debt Ratio)
- Times Interest Earned
- Fixed Charge Coverage

4. Profitability Ratios that measure the profitability of the entire enterprise. The key profitability ratios are:

- Profit Margin on Sales
- Return on Total Assets
- Return on Equity

For completeness, two other ratios are mentioned here, although they do not derive from financial statements alone, but also from the market price of shares of a company:

5. Market Value Ratios that measure the stock price against earnings and "book" value of shareholder equity. The key market value ratios are:

- Price / Earnings (P/E) Ratio
- Market / Book Ratio

6.3 THE RATIOS AND WHAT THEY MEASURE

The financial ratios are illustrated by using Shell Canada's 2004 consolidated financial reports, drawn from www.shell.ca. All figures are millions of Canadian dollars except as noted. Shell is a Canadian integrated petroleum company.

6.3.1 Current Ratio

$$\text{Current Ratio} = \frac{\text{Current Assets}}{\text{Current Liabilities}} = \frac{\$2323}{\$2511} = 0.93$$

The current ratio (also called the working capital ratio) is of critical importance to a short-term lender because this lender does not have hard assets pledged as security and normally expects to be repaid by current assets only, i.e. the fixed assets are pledged against long-term debt and the short-term lender can't seize them if the firm goes bankrupt. A current ratio of less than one says that for every dollar of readily accessible ("liquid") assets, such as inventory and receivables, there is more than a dollar of debt owing to a creditor. This is viewed as a risk by a lender except in unusual circumstances. Short-term lenders will frequently have a covenant that requires the business owners to maintain or exceed a set current ratio or to have an absolute amount of working capital (current assets minus current liabilities). Shell has \$2323 - \$2511 = -\$188 million in working capital.

One of the key business skills discussed in the next chapter is the ability to forecast the cash position of a company and to do a "pro forma" income statement and balance sheet, so that the business manager knows what the liquidity of the company will be into the future. Firms that fail to do this can quickly get offside on debt, and in the extreme can go into receivership.

The normal view of a company is that working capital must always be positive, and hence the working capital ratio must be greater than one, otherwise there are insufficient funds available to the firm to finance short term obligations. Why, then, do Shell and many other large companies show a negative working capital? The answer is not that these firms are insolvent, but rather that they have a form of financing that they and their lenders view as "long term" but that accounting standards require be treated as above the line, i.e. short term. The kind of financing is typically a term loan created as a long term borrowing facility; however, under certain circumstances related to non-performance of certain covenants the loans can be called by the bank. Some years back accounting standards changed to treat this as short term debt based on the conservative standard that "it may be called under some circumstances, hence it must be treated as short term". Lenders complained that this accounting treatment interfered with the application of longstanding ratios, the working capital ratio and quick ratio being the main ones. Accounting responded: "change the covenants". The result is that one frequently finds large firms appear to show a negative working capital, when in fact they have sufficient funds to meet short term obligations.

How, then, do we make sense of the working capital test? It remains a reliable test when applied to small and medium companies, and is no longer a reliable measure for many large companies because of the blurring of the distinction between long and short term debt. For this course, we will treat the working capital and working capital ratio test as being valid for all of the small and medium sized cases we analyze in class and in assignments.

6.3.2 Quick Ratio or Acid Test

$$\text{Quick Ratio} = \frac{\text{Current Assets minus Inventories}}{\text{Current Liabilities}} = \frac{\$2323 - \$584}{\$2511} = 0.69$$

When a business fails, receivables can normally be collected. However, inventory is often sold at a steep discount. The Quick Ratio measures the extreme position: "if there is no value for the inventory, can the short term creditors be paid out from receivables?" This test is more critical for companies for whom inventory is specialized. A firm making one of a kind proprietary circuit boards would be an example of a specialized inventory. Shell, on the other hand, has an inventory that is easily sellable: crude oil, natural gas, and petroleum and chemical products would all have a ready market in the unlikely event that Shell

got into trouble. Hence, the quick ratio is not relevant in the specific case of Shell for two reasons: the blurring of long and short term debt, discussed above, and an inventory in which the lender has confidence of value.

6.3.3 Inventory Turnover

$$\text{Inventory Turnover} = \frac{\text{Sales}}{\text{Inventories}} = \frac{\$11228}{\$584} = 19.2$$

Inventory turnover is a rough measure of how many times inventory is restocked in a year. It will vary from industry to industry, but within an industry, higher is better, since this means less working capital is tied up in inventory. Frequently during business downturns inventory turnover drops; good management will make a conscious effort to reduce inventory at such times to free up cash for other purposes in the business.

Inventory turnover can be thought of as the inverse of "days inventory", adjusted to years; i.e., the inverse of the turnover is the "years" of inventory on hand, which, if multiplied by 365, will give the days of inventory on hand (where inventory is expressed in equivalent days of sales).

6.3.4 Days Sales Outstanding

$$\text{Days Sales Outstanding} = \frac{\text{Receivables}}{\text{Sales}/360} = \frac{\$1213}{\$11228/360} = 39 \text{ days}$$

Days Sales Outstanding (DSO) is also called Average Collection Period, and is a measure of how good a company is in getting its customers to pay. A "sad but true" fact of business is that many customers need to be prompted to pay promptly, and efforts to collect interest from good but slow paying customers are almost never successful. In the case of Shell, a 4-day reduction in DSO would generate \$121 million in cash or reduce short-term borrowings by \$121 million. Particularly in economic downturns, keeping a focus on receivables collection is a critical business management skill.

In calculating DSO, you can use 360 or 365 days; many financial calculations assume a 30 day month and the practice has crept into financial analysis of treating a year as 360 days in some calculations. The difference is not material.

6.3.5 Fixed Assets Turnover

$$\text{Fixed Asset Turnover} = \frac{\text{Sales}}{\text{Net Fixed Assets}} = \frac{\$11228}{\$8034} = 1.40$$

In theory fixed asset turnover measures the extent to which management is using the fixed assets (e.g. land, buildings and equipment), and within an industry can be used to compare two companies. This ratio is meaningless between industries, since for example a grocery chain will have huge turnover (low assets and high sales), whereas a highly capital intensive project will be the opposite. This ratio can also

have problems within an industry that an analyst should keep in mind. Accounting is conservative, and assets never have their value increased to reflect inflation; in essence, an asset is depreciated from its original cost, with no reflection of inflation. Hence, if one were to compare two companies, one with old assets and one with newer assets, there would be a depreciation and inflation impact that would distort this ratio. Fixed assets and total asset turnover ratios are therefore of limited value in inter-company company comparisons.

6.3.6 Total Assets Turnover

$$\text{Total Asset Turnover} = \frac{\text{Sales}}{\text{Total Assets}} = \frac{\$11228}{\$10906} = 1.03$$

The comments for fixed asset turnover apply to total asset turnover, except that the total assets of the company (including working capital and intangible assets) are included in the denominator.

6.3.7 Total Debt to Total Assets (Debt Ratio)

$$\text{Debt Ratio} = \frac{\text{Total Debt}}{\text{Total Assets}} = \frac{\$2511 + \$1}{\$10906} = 23.0\%$$

Debt ratio is a critical number for lenders and investors. Lenders have a strong focus on the security of a debt, i.e. its likelihood of repayment. To a lender, a high debt ratio increases the risk that the ongoing company will not service the debt, or that the debt cannot be recovered if the company fails. An investor would have the same concern if the debt ratio was very high: if the company can not meet its debt payment schedule, the lenders will push the firm into bankruptcy and there will be nothing left for the equity holders. However, investors often don't like a very low debt ratio, because their return is not "leveraged". This concept is crucial to understanding debt management strategies in large corporations, and is discussed in Appendix 6.1.

Debt ratio is sometimes called "debt to equity ratio". Technically, debt to equity is given by:

$$\text{Debt to Equity Ratio} = \frac{\text{Total Debt}}{\text{Total Equity}} = \frac{\text{Total Debt}}{\text{Total Assets} - \text{Total Debt}}$$

However, in practice one frequently finds the debt ratio (total debt / total assets) mistakenly labeled the "debt to equity ratio". When people refer to the "debt to equity ratio", they almost always use a number that means total debt to total assets. This is an important point to be resolved if unclear in a discussion.

One convention is very important to recognize in the debt ratio: for purposes of this ratio, all current liabilities are included in "debt", not just the money owed to short and long term lenders. In other words, for this ratio the "total debt" includes payables, accrued expenses, taxes payable, and any other current liability, plus long term debt. By this convention, a lender or investor can see how much of a company's assets are "owed" to others versus how much are financed by shareholder's equity.

6.3.8 Times Interest Earned

$$\text{Times Interest Earned} = \frac{\text{EBIT}}{\text{Interest Charges}} = \frac{\$1885}{\$26} = 72.5$$

Where EBIT is Earnings Before Interest and Taxes

Times interest earned is an important criterion for setting the interest rate on debt. This is often called bond rating, and there are specialized firms that assess the security (a measure of the likelihood that the debt will be repaid). These rank from the highest credit rating (Government of Canada, which in theory can always raise taxes to pay back debt) to "junk bonds" that are high risk and high interest rate. One of the key criteria bond rating agencies look at is "times interest earned". Times interest earned is more important to a lender than the debt ratio, because it measures the ability of the company to service the debt and keep the loan out of "non-performing" status. Some firms, such as regulated utilities selling essential commodities, can carry very high levels of debt relative to equity because their sales are stable and the regulator is committed to approving pricing levels that give a fair return to investors after all reasonable expenses are covered. We can imagine that a company with very low net income would have a hard time making debt repayments even if the debt ratio was low. Thus, to the bond rating agency or lender, times interest earned is the first test of credit worthiness.

Times interest earned looks at earnings with interest and income taxes added back in. Interest payments are added back in because they are earnings that are available to pay interest. The theory for adding taxes is that if a company becomes unprofitable its tax bill goes to zero (since taxes are calculated as a percentage of net earnings or profits), and the earnings that had been going to pay taxes can now be used to service debt. EBIT is an important concept in valuing companies, as discussed later.

Shell has very ample coverage of interest. This is a very good credit risk, and Shell's bonds would have a high grade (rating). Much lower interest coverage will satisfy a lender, and for stable utilities even a value of 2 will lead to a good credit rating.

6.3.9 Fixed Charge Coverage

$$\text{Fixed Charge Coverage} = \frac{\text{EBIT} + \text{Lease Payments}}{\text{Interest Charges} + \text{Lease Payments}}$$

As lease financing has become more popular, some analysts have switched from "times interest earned" to factoring in all fixed (non-avoidable) charges. Sometimes the before tax income required to fund a "sinking fund" is also included in the denominator. (A sinking fund is a reserve fund that holds cash with which to redeem the principle on bonds if the entire principle is due at the end of the life of the bond. Some analysts treat a sinking fund contribution requirement as being comparable to interest in terms of a "must pay" obligation associated with debt.)

Consolidated financial statements such as the Shell statement often don't have enough detail to complete the fixed charge coverage, because details on leasing payments are not included. More detailed information supplied to a bond-rating agency would certainly include this detail.

6.3.10 Profit Margin on Sales

$$\text{Profit Margin on Sales} = \frac{\text{Operating Income}}{\text{Sales}} = \frac{\$1628}{\$11228} = 14.4\%$$

It is important to note that different analysts define this ratio (always expressed as a percentage) differently. Some have the numerator as operating income before income tax and interest (to show the yield of the business before financing and tax related charges that distort inter-company comparisons). Others look at an after-tax and interest number, or define the numerator as "net income available to common shareholders". The important rule for financial analysis is "consistency is more important than uniformity".

Profit margin on sales provides some information year over year for a given company, but is a very powerful tool for comparing similar companies. For example, it leads to the kind of question: "why does a competitor very similar to us make so much more income per sale?" This can lead to a penetrating analysis of a company's efficiency.

6.3.11 Return on Total Assets

$$\text{Return on Total Assets} = \frac{\text{Operating Income}}{\text{Total Assets}} = \frac{\$1628}{\$10906} = 14.9\%$$

This is a measure of what a company earns on all of its assets, whether they are financed by debt or shareholder equity. This ratio, again always expressed as a percent, is a powerful tool for comparing between similar companies. Analysts sometimes look at net income rather than "income from operations". This test is also used within a company by comparing division-by-division operating income results (pre tax, interest and other income). This analysis asks a powerful question: how effectively do our various divisions use shareholders' capital? Again, understanding the differences between divisions yields valuable insight into a business.

6.3.12 Return on Equity

$$\text{Return on equity} = \frac{\text{Net Income}}{\text{Shareholder's Equity}} = \frac{\$1286}{\$6529} = 19.7\%$$

Return on equity is crucial to the shareholder. Anticipated year over year return on equity is a key driver of the share price, and one of management's major goals is maximizing the shareholders' value over the long term. Return on assets is independent of financing, but return on equity is strongly influenced by financing. Highly leveraged companies (those with a high debt ratio) can expect to have wider swings (more volatility) in their return on equity.

As with other ratios, some variation is possible. The formula above gives return on all equity (for example, common and preferred shares). Some analysts extract the cost of servicing the preferred shares from the numerator (i.e. they subtract the preferred share dividends from net income), and make the denominator the common share equity. This gives a return on common shares only.

6.3.13 Price/Earnings (P/E) Ratio

$$\text{P/E Ratio} = \frac{\text{Price per share}}{\text{Earnings per share}} = \frac{\text{Market Capitalization}}{\text{Net Income}}$$

Price Earnings Ratio is included here for completeness, but it is not a ratio that derives solely from the financial statements for a company. P/E ratio assesses the market value of a company against its reported earnings, and hence is tied to valuation. P/E ratios are crucial in assessing valuation.

P/E ratio is not the sole indicator of the value of a publicly traded stock, but it is important enough that it is usually reported daily in stock market quotations.

6.3.14 Market/Book Ratio

$$\text{Market/Book Ratio} = \frac{\text{Market price per share}}{\text{Book value of equity per share}}$$

Like P/E ratio, market to book ratio does not derive solely from the financial statements for a company. Market to book values assess the premium that a stock price has over the conservative valuation (depreciated assets with no adjustment for inflation) that accounting places on a company. It is discussed further when valuation is considered.

6.4 USING RATIO ANALYSIS

Industry average figures can be obtained from sources such as trade associations, financial or management consultants, or credit reporting agencies. Dun and Bradstreet, for instance, reports average figures for some ratios by industry type (e.g. Dun and Bradstreet, Key Business Ratios, published annually).

- Lenders and credit rating agencies use liquidity and debt management ratios as part of their normal working practice. For example, a bank that issues short term credit lines to businesses will lend to numerous small firms, and will request monthly statements from each. It will then complete a check on the ratios that tell it that the covenants of its lending are being satisfied. As a minimum, a short-term lender will check the current ratio and the amount of working capital in the business on a monthly basis. Long-term lenders use debt management, asset management and profitability ratios to convince themselves that a loan is likely to be repaid. A poorly run company that is highly leveraged and whose asset management and profitability ratios are poor compared to industry average is a far higher credit risk than a company with strong equity and good performance indicators. As noted above, ratio analysis is a component of rating debt, and for long-term borrowers a lower credit rating has a large cost.
- Financial analysts use debt management, asset management, profitability and market ratios in screening companies as an investment or acquisition target.
- Managers should use ratio analysis to screen their own performance, both year over year and against others in the industry. In particular, asset management and profitability ratios can be a powerful stimulus to a management team to do an honest and critical analysis of their management skills.

APPENDIX 6.1 DEBT AND THE CONCEPT OF LEVERAGE

Appendix 6.1.1 The Concept of Debt

In many (but not all) societies those individuals or institutions that have significant accumulated wealth look to at least preserve the value of their wealth against inflation and preferably increase their wealth. Exceptions to this tend to occur primarily in hunting and gathering societies, where giving away wealth can in some cultures be a means of increasing status, and among the religious and extraordinarily charitable, who give wealth away to support a social or religious cause. These cases are exceptional, and one can generalize that those with wealth look for opportunities to preserve and increase value.

Wealth often does not align with entrepreneurial values, i.e. those who have accumulated significant reserves of wealth in a society frequently do not have the drive and ambition to develop new products and services, and those with the drive to do so often do not have money to support their ideas. Direct investment would allow those with wealth to support new products and services, but this can leave the entrepreneur(s) who have developed the product or service without enough "upside" reward to give them the motivation to proceed. Debt is an alternate means of supporting products and services.

Debt normally is done by an agreement that includes specified terms for repayment, and an interest rate. Interest is the cost of money, and average interest rates change as money becomes scarcer or more abundant. Money can be thought of as a commodity with its own "supply / demand" pricing. Average interest rates vary, but interest on specific loans is different at any point in time depending on the risk of the loan, i.e. the potential that the business will not be able to repay the loan. For some investors, such as pension funds, loss of principal that occurs when a borrower defaults on a loan is a very serious issue. Bond rating agencies exist to provide an objective measure of risk, so that a lender such as a pension fund can have a mix of risk in their lending portfolio, and can get an interest rate appropriate to the risk.

Debt has the advantage for the borrower that it does not convey ownership of a business as long as it is repaid as per the agreed to schedule. Thus, if a business does exceptionally well, it is the holders of the common equity that will get the benefit. Unless specifically agreed otherwise, the lender who helped finance the company gets the same payment stream whether the underlying business does exceptionally well or is a moderate success. The "upside" potential of a business is sometimes called "blue sky", and the equity investors get the "blue sky" because their money is at higher risk.

Debt has lower risk than equity, and this is the advantage to the lender. If a company fails, the debt will be fully repaid before the shareholders of the company get any benefit. The debt "ranks" ahead of the equity. In large business failures it is normal for common shareholders to get nothing (e.g. Eaton's) or next to nothing (e.g. Philip Services). Lenders look to security to ensure they can be repaid. For instance, a bank that finances a car can repossess the car if the owner fails to make payments, a house is always "security" for the mortgage that is held on the house, and a short term lender to a company can have the receivables assigned to them, and can seize the inventory, in the event of default. In the event of default, lenders can push a company into receivership (when the court appoints a third party to administer the company, usually with the intent of winding up the company and repaying the lenders).

Debt also increases the volatility of the return on equity generated by a company. This effect is called leverage, and is an important concept in understanding finance.

Appendix 6.1.2 The Concept of Leverage

A lever is a device that multiplies the force or distance of a motion. Leverage in finance multiplies the upside and downside return on equity, because the equity takes a higher level of risk than debt. This concept is best illustrated with an example.

Consider three companies (Lodebtco, Medebtco, and Hidebtco) with an identical income from operations (before interest) and an identical asset base. Therefore, the return on assets based on operating income will be the same in each case. The only difference is in the liabilities and shareholders equity portion of the balance sheets. Lodebtco's bank debt is 10% of its assets, and its debt ratio (which includes all liabilities) is 18.2%. Medebtco's bank debt is 40% of its assets, and its debt ratio is 48.2%. Hidebtco's bank debt is 70% of its assets, and its debt ratio is 78.2 %. Lodebtco has relied on owner's equity, while Hidebtco has used other people's money (debt) to build the same business.

For simplicity, assume the interest rate on all debt is 10% (in the real world, Hidebtco might expect to pay a higher interest rate than Lodebtco, because of the higher risk of the debt). The attached tables show the income statements, balance sheets and key ratios, including the return on equity for a good year and a bad year.

Notice how much more volatile (subject to change) the net income and return on assets is for Hidebtco compared to Lodebtco, even though the base business operating income and return on assets (based on operating income) is identical (the only difference is financing). Although return on assets from operating income is the same for all three companies, the return on equity is far higher in a good year for Hidebtco. Investors in this company would see a high return for their smaller equity stake, a case of "less is more". But look at the bad year's performance: Hidebtco shows a loss, and shareholder's equity drops because retained earnings are negative, whereas the investor in Lodebtco or Medebtco continues to see a small but positive return on equity. The "bad year" is a 30% drop in sales; if this occurs year after year, Hidebtco will go out of business. Highly leveraged companies are vulnerable to business downturns, and one acquisition strategy is for low leverage companies to "pick off" highly leveraged competitors during economic downturns.

The reason return on equity is so volatile as debt increases is that all of the change in the income of the company "concentrates" on the equity, and as debt increases the equity portion is reduced. To say this another way, debt comes into the company at a fixed return (in this case, 10%), and the variation in real return is spread over a smaller amount of equity. In a good year, this is excellent for investors: a smaller initial investment gives a much higher return. In a bad year, however, the effect is reversed: the investor in Lodebtco has a modest return, but the investor in Hidebtco faces a loss because interest payments exceed operating income. This is not just "theoretical": business history is full of over-leveraged companies that start down a death spiral as debt costs exceed operating income. Recent examples of companies severely wounded or killed by excess debt include Fracmaster, Philip Services, and Probe Explorations. More examples exist of companies that used debt successfully to help expand their business, with a beneficial impact on equity investors.

Several points can thus be made about leverage:

- Leverage is measured by debt ratio. Averages vary industry by industry, but in many industries a "blue chip" company will strive to have more equity than debt, and in some cases will aim at twice as much equity as debt (equal to a debt ratio of 33%).

- Volatility (variability in company (and stock) performance) increases with increasing leverage.
- What creates the volatility is the different risk and return levels that exist between debt and equity. Debt has lower risk and lower return; lenders accept a lower return because debt has a higher claim (ranks higher) than equity when a company gets into trouble.
- Leverage helps equity investors in a good year and hurts them in a bad year. "Leverage up equals leverage down" is a saying that tries to match the opportunity and the peril of leverage. Risk adverse investors will likely avoid highly leveraged companies, but some investors like the risk and the higher performance that can be realized in good times.
- Lenders like the "right" amount of leverage. If all firms had no leverage there would be no lenders. If all firms were over-leveraged, defaults levels on debt would be at unacceptable levels.

Impact of Leverage in a Good Year

\$'(000)	Lodebtco	Medebtco	Hidebtco
<u>INCOME STATEMENT</u>			
Sales	\$10,000	\$10,000	\$10,000
COGS	\$5,000	\$5,000	\$5,000
Contribution Margin	\$5,000	\$5,000	\$5,000
Margin (%)	50%	50%	50%
SG&A	\$3,000	\$3,000	\$3,000
Operating Income	\$2,000	\$2,000	\$2,000
Interest Charges (10% of LT Debt)	\$97	\$388	\$679
Net Income From Operations	\$1,903	\$1,612	\$1,321

BALANCE SHEET (end of year)**Assets****Current Assets:**

Cash	\$100	\$100	\$100
Receivables	\$1,000	\$1,000	\$1,000
Inventory	\$500	\$500	\$500
Prepaid Expenses	\$100	\$100	\$100
	\$1,700	\$1,700	\$1,700

Fixed Assets:

Land, Bld.& Equip. @ Cost	\$10,000	\$10,000	\$10,000
Less Acc. Depreciation	-\$2,000	-\$2,000	-\$2,000
Goodwill	\$-	\$-	\$-
Total Assets	\$9,700	\$9,700	\$9,700

\$ (000)	<u>Lodebtco</u>	<u>Medebtco</u>	<u>Hidebtco</u>
<u>Liabilities:</u>			
Short Term Credit Line	\$-	\$-	\$-
Accounts Payable	\$500	\$500	\$500
Accrued Expenses	\$150	\$150	\$150
Taxes Payable	\$150	\$150	\$150
Cur.Por. of L T Debt	<u>\$97</u>	<u>\$388</u>	<u>\$679</u>
	<u>\$897</u>	<u>\$1,188</u>	<u>\$1,479</u>
Long Term Debt	\$873	\$3,492	\$6,111
<u>Shareholders Equity:</u>			
Capital Shares	\$6,930	\$4,020	\$1,110
Retained Earnings	\$1,000	\$1,000	\$1,000
Total Liab. and Equity	\$9,700	\$9,700	\$9,700

KEY RATIOS:

Current Ratio	1.90	1.43	1.15
Leverage (Bank Debt/Assets)	10.0%	40.0%	70.0%
Debt Ratio (Liabilities/Assets)	18.2%	48.2%	78.2%
Return on Assets (Oper. Inc.)	20.6%	20.6%	20.6%
Return on Equity (Net. Inc.)	24.0%	32.1%	62.6%

Impact of Leverage in a Bad Year**INCOME STATEMENT**

Sales	\$7,000	\$7,000	\$7,000
COGS	\$3,500	\$3,500	\$3,500
Contribution Margin	\$3,500	\$3,500	\$3,500
Margin (%)	50%	50%	50%
SG&A	\$3,000	\$3,000	\$3,000
Operating Income	\$500	\$500	\$500
Interest Charges (10% of LT Debt)	\$97	\$388	\$679
Net Income From Operations	\$403	\$112	-\$179

BALANCE SHEET (end of year)

\$ (000)	Lodebtco	Medebtco	Hidebtco
Assets			
Current Assets:			
Cash	\$100	\$100	\$100
Receivables	\$1,000	\$1,000	\$1,000
Inventory	\$500	\$500	\$500
Prepaid Expenses	\$100	\$100	\$100
	<u>\$1,700</u>	<u>\$1,700</u>	<u>\$1,700</u>
Fixed Assets:			
Land, Bld. & Equip. @ Cost	\$10,000	\$10,000	\$10,000
Less Acc. Depreciation	-\$2,000	-\$2,000	-\$2,000
Goodwill	\$-	\$-	\$-
Total Assets	\$9,700	\$9,700	\$9,700
Liabilities			
Current Liabilities:			
Short Term Credit Line	\$-	\$-	\$-
Accounts Payable	\$500	\$500	\$500
Accrued Expenses	\$150	\$150	\$150
Taxes Payable	\$150	\$150	\$150
Cur.Por. of L T Debt	\$97	\$388	\$679
	<u>\$897</u>	<u>\$1,188</u>	<u>\$1,479</u>
Long Term Debt	\$873	\$3,492	\$6,111
Shareholders Equity:			
Capital Shares	\$6,930	\$4,020	\$1,110
Retained Earnings	\$1,000	\$1,000	\$1,000
Total Liab. and Equity	\$9,700	\$9,700	\$9,700
KEY RATIOS:			
Current Ratio	1.90	1.43	1.15
Leverage (Bank Debt/Assets)	10.0%	40.0%	70.0%
Debt Ratio (Liabilities/Assets)	18.2%	48.2%	78.2%
Return on Assets (Oper. Inc.)	5.2%	5.2%	5.2%
Return on Equity (Net. Inc.)	5.1%	2.2%	-8.5%

APPENDIX 6.2 PREFERRED SHARES

Preferred shares are a hybrid financing device that has some of the features of debt and some of the features of equity.

Preferred shares are sold by a company with a prescribed dividend rate. This dividend is paid in preference to common shares, i.e. no dividend would be paid to common shareholders unless all dividends due to preferred shareholders had been paid. Hence, we can think of a preferred share as having a feature like debt: the return is a fixed and specified percentage. Technically, this return is paid as a dividend, so it comes from after tax dollars of a company (dividends are not an expense of a company for income tax purposes, while interest is). In Canada a dividend is taxed at a lower effective tax rate than interest income, so the dividend from a preferred share with a rate of 6% would give a greater after tax benefit than a bond paying 6% interest.

Preferred shares only get the specified dividend, and hence do not participate in any “upside” growth in the value of a company. In this they are like debt. From the perspective of the common shareholder, who is concerned to get a leveraged return from the profitability of a company, preferred shares do not reduce the leverage. Hence, the common shareholder views preferred shares as a form of debt when calculating leverage.

However, preferred shares lack some of the rights of debt. If a company board of directors decides it cannot pay the dividend due to preferred shareholders, the preferred shareholders cannot petition the company into bankruptcy to force the payment of the dividend or the repayment of the shares. They rank behind debt, i.e. all obligations to lenders are satisfied in preference to preferred shares, so the “preferred” status is only in relation to common shares. Since the primary concern of a lender is the security of repayment, they tend to see preferred shares as ranking behind and not representing a legally binding obligation on the company, and hence when calculating debt ratios treat preferred shares as equity.

Preferred shares thus have the remarkable feature of being seen as equity by lenders and debt by common shareholders.

Typical features of preferred shares are that they are redeemable, i.e. they can be repurchased at the option of the company (sometimes after a specified period of time), and they are cumulative, i.e. any dividend missed is still due, and must be paid in the future before any dividend is paid to common shareholders.

Why do companies issue preferred shares instead of debt? Typically, they are trying to maintain a good credit rating on their debt. Credit rating agencies such as Moody, Dominion Bond Rating Service (DBRS) or Standard and Poor, assign a rating to debt based on its risk. Each uses a different scale for defining the risk of bonds, but typically A is good and higher letters indicate lower quality of debt (more risk). Credit rating agencies do a careful job of assessing companies, and lenders rely on them in buying bonds. A lower credit rating means that a company will have to pay a higher interest rate for debt, since the market is less willing to purchase these bonds unless the higher interest rate offsets the higher risk. Credit rating agencies place a weight on both “times interest earned” and the debt ratio in assessing a rating. When a company gets close to a limit that it is comfortable with for a credit rating, it will issue preferred shares rather than debt if it needs to raise funds that it can repay (as opposed to common shares).

PROBLEMS

- 6.1 On October 19, 2000, a Government of Canada 30 year bond maturing in 2029 had a yield (interest rate) of 5.56%. What is the price earnings ratio for this bond?
- 6.2 On October 19, 2000 a Government of Alberta bond maturing on June 1 2004 had a yield of 5.84%. A Hydro Quebec bond with the same maturity guaranteed fully by the Government of Quebec had a yield of 5.95%. Can you think of two good reasons why these yields might be different? Note that when the Province of Quebec fully guarantees a bond the yield is identical between a Hydro Quebec bond and a Province of Quebec bond, i.e. the lender does not even give consideration to the power industry because the bond is guaranteed by the Province.

If each entity were to borrow \$1 billion, what is the per year incremental cost to the Government of Quebec (who owns Hydro Quebec) for the higher yield? If the total debt in Quebec is about \$75 billion (about \$12,000 per man, woman and child that lives in the province), what is the total cost to the Province of the higher yield relative to Alberta? Is it significant?

Can you imagine, after doing this problem, why governments treat bond rating agencies (who deliver opinions on the quality of bonds) with respect?

- 6.3 On December 5, 2005, Google shares had a price earnings ratio of 94.8 . Bank of Montreal shares had a price earnings ratio of 13.3. This is representative of history over the past several years, where consistently Google has had a price earnings ratio higher than Bank of Montreal. Speculate on what makes two blue chip profitable companies have such persistent differences in P/E ratio. What factor(s) other than earnings are investors taking into account in setting the market price for these two shares? (One to three sentences.) Note that in this question and in 6.4 there is no precise answer, you are speculating on why a market (the aggregate judgment of many people) places such a different value on earnings.
- 6.4 On October 19, 2000 a Government of Canada bond maturing in 2009 had a yield of 5.70%, a Bell Canada bond maturing in 2009 had a yield of 6.39%, and a Clearnet bond maturing in 2008 had a yield of 9.00%. Clearnet is a new telecommunications company that recently merged with Telus to form a Canadian based large wireless company. Why is the Government of Canada yield less than the Bell Canada yield? Why is the Bell Canada yield so much less than the Clearnet yield? What is the bond market saying about Clearnet? (One or two sentences per question.)

- 6.5 Sales are climbing in a company at a rate of 27% per year. If you managed this company, would you expect inventory to increase? Would you expect the ratio inventory turnover to increase? Would you expect receivables to increase? Would you expect Days Sales Outstanding to increase? Is the ratio more valuable than the absolute number as a management tool?
- 6.6 Three people set out to build essentially identical apartment buildings in essentially identical real estate markets, for the same cost of \$3.2 million. The three developers have the following characteristics:

- John is 45, married with three children between the ages of 8 and 14. 10 years ago, he went bankrupt, and lost title to his home and all assets. He has reestablished himself again, but promised himself that he would never again lose it all. He limits his mortgage financing (by the bank) to a maximum of 50% of project value.
- Helen is 24 and a recent graduate in civil engineering. Her uncle has decided to stake her in real estate development, i.e. give her equity. Helen thinks of herself as being a moderate risk taker, and has little bad experience with failure. After discussions with her uncle, she is prepared to bank finance 70% of the project.
- "The Donald" is 38 and determined to become very rich. He has been involved in a number of small business ventures, and now wants to get into property development to make it "big time" in a hurry. He has a strong ego and believes he can tolerate failure and bounce back again. He uses his "slick" and persuasive style to obtain 90% financing from the bank.

The projected (pro forma) highly abbreviated first year income statement for the apartment complex, used in discussions with the bank that is considering the mortgage, is shown in the attached table. For each of the three developers, complete the projections by calculating first year pro forma after tax net income and cash flow, and a "pro forma" first year return on equity based on cash flow after principal repayment (note that equity is what the developer puts up, i.e. it is the capital cost minus the mortgage financing). Does each developer have enough cash to make the principal repayment in year 1? For the pro forma case, approximately how many years would it take for each developer to recover his/her equity? Then develop a "downside case", where due to downturn in the local economy vacancy rate goes from 5% to 20%, and rental income per unit drops by 20%. For each of the three developers, calculate the same figures as for the pro forma case.

Does any developer have negative cash flow? What would the mortgage lender do if the developer did not have enough cash to make the mortgage payment?

(A developer would frequently focus on the first one to five years of a project rather than do a long term set of pro forma statements. He or she is mainly concerned with positive cash flow in the early years, i.e. can the development service its debt. The calculation of cash position would assume some short cuts, as is shown below. Thus, we ignore current assets and liabilities (including short term debt) and just look at the debt on the apartment building. This is pretty accurate for an apartment: inventory is negligible (some light bulbs and faucet washers) and receivables are usually zero since rent is paid in advance. Remember that interest is a taxable expense (but not principle repayments), hence you subtract interest cost from income before debt service before calculating tax. In this problem depreciation for tax and book purposes is the same (which is virtually never true in "real life"), so you can calculate the tax from the book income. Tax can not be negative (the government doesn't pay losers), so unless you had other positive income (in this problem assume you do not), a negative income from this apartment doesn't give you any tax benefit. Principal repayment occurs from after tax dollars; if you can't make the principal repayment, the lender seizes the apartment! Finally, return in this problem is cash return on equity: after you service the debt (principal plus interest), how much cash do you have left over, and what percentage is that of your equity. This is not identical to the return on equity ratio discussed in chapter six, but it is what a developer might focus on.)

Have fun with this problem, which illustrates both sides of leverage. Why are the returns so different for the three developers? Think about the position of the three developers in good times (when "The Donald" whizzes past you in a Porsche) and bad times (when you step over a homeless "The Donald" on your way to the Opera). When the "earning power" of the investment falls below the cost of money, i.e. the interest rate, can John sleep at night through the downturn? Will Helen go under in her first venture? In each case, assume a 20 year mortgage at 8% with an annual level payment of \$101.85 per \$1000 original loan, first year depreciation (book and tax) at 4%, and a tax rate of 40% on net income. Note that the cash expenses of running the apartment complex do not change significantly in the downside case.

For the "earning power" of the project use EBIT divided by assets. Think about what happens when the earning power of the project exceeds the cost of debt, and when it is lower than the cost of debt. This helps in understanding leverage.

Pro Forma Income Statement

(First Year)	John	Helen	"The Donald"
Number of Units	56		
Project Cost	\$3,200,000		
Capital Cost per Unit	\$57,143		
Annual Rent per Unit	\$11,200		
Income at Full Occupancy	\$627,200		
Less Vacancy Factor (5%)	\$31,360		
Adjusted Gross Income	\$595,840		
Cash Expenses	\$162,366		
Depreciation	\$128,000		
Income before debt service	\$305,474		
Cash flow before debt service	\$433,474		
"Earning Power of the Project"	9.5%		

(First Year)	<u>John</u>	<u>Helen</u>	<u>"The Donald"</u>
Leverage	50%		
Equity	\$1,600,000		
Debt	\$1,600,000		
Interest cost	\$128,000		
Pre Tax Net Income	\$177,474		
Tax	\$70,989		
After Tax Net Income	\$106,484		
Cash Flow Before Principal Repayment	\$234,484		
Principal Repayment	\$34,964		
Cash Flow After Principal Repayment	\$199,521		
Return on Equity	12.5%		

- 6.7 The text calculated many ratios for Shell, but did not calculate the market ratios because the stock price was not given. Go to a web site and find out the market price of Shell and the number of shares outstanding (the trading symbol for Shell is SHC). Determine the P/E ratio and try to find information on year over year growth in sales and profits and the stock price over the last year. Many web sites exist where you can find information on stocks, including the Toronto Stock Exchange, Yahoo Financial, the Globe and Mail, bank sites if you are a client, and the web sites of companies themselves. Visit the web site of Shell and open its most recent annual financial statement.

Now do the same for Imperial Oil.

Look at the information you have assembled on the two companies. If you had only this information and were to make a recommendation on one of these two companies to a person who had decided to add "Canadian Petroleum" to their investment portfolio, do you see enough of a difference between Imperial Oil and Shell to make a tentative choice?

ANALYZING NEW INVESTMENT

7.1 THE TIME VALUE OF MONEY

As discussed in Chapter 1, money is a measure of current commercial value. If we want an accurate assessment of the relative worth of a kilogram of nickel and a kilogram of gold, we can trust that the price, as long as it is set in a fair and liquid market that is visible and accessible to all, accurately reflects the commercial value.

Money has a time value, which is measured by **interest rate or return on investment**. (In the following discussion we will use interest rate and return on investment interchangeably, even though in a narrow sense interest rate is often reserved for debt and return on investment is often used for equity. At a general level, debt and equity are legally different but both are forms of investment. An additional term for interest rate is the discount rate, since it is the rate at which future dollars are discounted, a concept discussed below.) For example, a dollar that you are certain to receive ten years in the future is not worth as much today as a dollar that you are certain to receive one year in the future. The time value of money is the key factor in how we decide to invest in things: build new plants, start companies, buy stocks, or lend money. Engineering is crucially affected by decisions about whether to build new projects, and hence engineers need to understand the time value of money and its use in investment analysis.

7.1.1 The Time Value of Money from the Perspective of the Lender/Investor

People that lend money to others (or invest) give up some personal flexibility and security. They defer some other use of the money, for example a purchase or an investment in some other opportunity, and they face the risk that the person they lent the money to will not be able to repay them (or the company they invested in will fail to create value), or that inflation will reduce the purchasing power of the money they get back in the future. In practice, unless a person gets some benefit for lending/investing the money, they will choose the freedom, flexibility and security of keeping their money to themselves. Interest is the cost of borrowed money, and money is a commodity that has its own cycle of supply and demand.

Figure 7.1 shows the Bank of Canada interest rate (the rate at which the Bank of Canada, Canada's central government bank that controls the currency, lends money to private banks). The Bank of Canada rate is a key rate that is reflected in specific commercial rates such as commercial loans, mortgages, and consumer credit. Note that for 15 years after World War II (a period of unprecedented creation of real wealth in the Canadian and US economies) the interest rate was stable and low. By the late 1960's, but especially in the 1980's, interest rates were high and unstable. It cost a lot more to use "other people's money" in the 1980's than it did in the 1950's. Some of our manufacturing practices, like reduced inventory and "just in time" ordering, came to the fore during the period of extremely high interest rates as a means of reducing the interest cost associated with current assets. Equally as problematic as the high rate of interest is the high variability in it, since both providers and users of capital tend to adopt short term strategies to protect against the risk of further changes in interest rates. Long term investments are less likely in a climate of an unstable value of money.

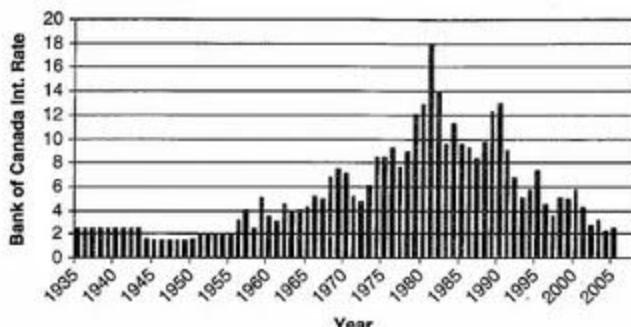


Figure 7.1: Variability of Interest Rate in Canada

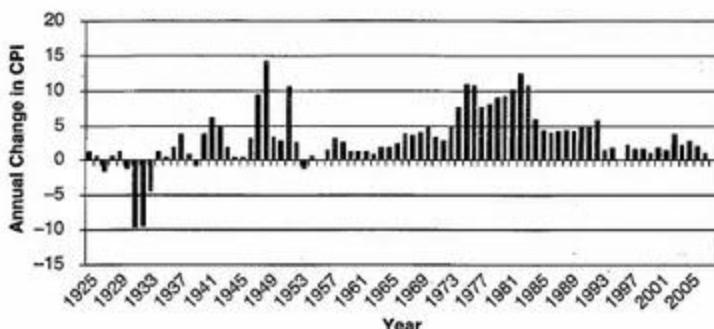
Source: Statistics Canada

Interest goes up and down as the competing forces between borrowers and lenders change. Similarly, the concept of “return on investment” is that an equity investment will bring a higher future value, and peoples’ expectations of an appropriate rate of return vary over time. This has been dramatically illustrated over the past two decades. Most recently, many governments in North America went from being net borrowers to net redeemers of debt, at the same time that the population of seniors and pre-senior “savers” increased. The result was an increase in the supply of money available to be lent and a reduction in the demand for such money, which has resulted in a sharp drop in the “cost of money”.

In trying to make sense of the cost of money, i.e. relative interest rates, one should think of the following factors, which affect lenders (debt) and investors (equity):

- **Inflation:** the purchasing power of money (its ability to be traded for real things, like a loaf of bread or a liter of gasoline) generally reduces over time. The reasons for this are complex and not the subject of this book. However, one can be sure that the interest rate must be higher than the perceived rate of inflation by some amount for any thinking person to become a lender. The difference between the nominal interest rate and the inflation rate is known as the “real” interest rate. If the real interest rate is negative, then a prudent lender would be better to buy something tangible (a commodity such as oil or nickel, or a home) and hold that real good as an investment. In North America, Europe and Japan, considerable focus is placed on limiting inflation; this concern arises from the experience of some countries that had very high rates of inflation, normally because of government mismanagement (instead of raising money by taxation, governments print additional money, a practice that always leads to high inflation). In such periods of high inflation lending decreases unless interest rates are also very high; there is normally a rush to convert the currency (whose value is deflating) into real goods or a more stable currency such as the US dollar. Germany went through this experience in the 1920’s, when inflation was so high that workers had to be paid mid day in order to be able to afford bread for dinner (since at its worst inflation was over 100% per day). Ecuador is a recent example of this phenomenon, and in essence the country has abandoned its own currency in favor of using the US dollar.

Figure 7.2 shows the inflation rate (year to year percentage change in the Canadian Consumer Price Index (CPI)) since 1925. It is clear that the aftermath of World War II caused sudden inflation; at least a

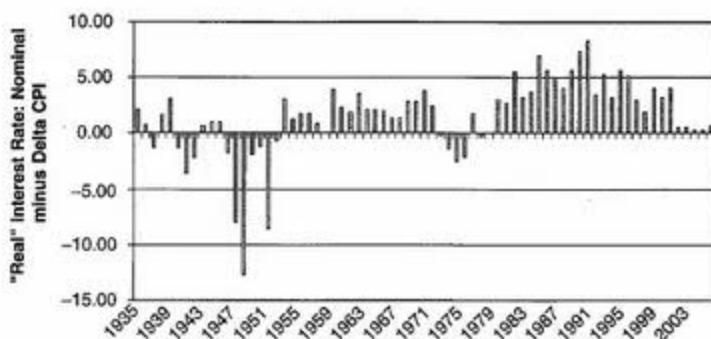
**Figure 7.2:** Canadian Inflation Rate Year over Year

(Source: Statistics Canada)

partial cause of this is the release of purchasing power when price controls and rationing were removed. A period of negative inflation (called deflation) occurred during the Great Depression in the early 1930's. It is also not surprising that at the time of high instability in interest rates in the 1970's and 1980's the inflation rate was both unstable and higher than average.

The "real" interest rate is the nominal interest rate minus inflation. As Figure 7.3 shows, this number is often between 2 and 5%, but in periods of high inflation or deflation it can deviate significantly from this, as it did in the early 1970's. Negative real interest means that a lender loses the value of their money even in a short term loan. Persistent periods of such instability harm investment because people naturally become reluctant to save and invest. For this reason, a major focus of current government fiscal policy is stability in inflation. Canada has had few periods of negative real interest, and they have been short in duration. Such periods are far more frequent in some third world countries that are subject to frequent political upheaval and manipulation of the currency. The absence of savings and investment in such countries is a major factor in limiting economic growth.

- **Supply and demand:** how much the interest rate exceeds the perceived inflation rate (i.e. the real interest rate) depends on the supply of and demand for money. When the post World War II "baby

**Figure 7.3:** "Real" Interest Rate: Bank of Canada Minus the Change in CPI

(Source: Statistics Canada)

"boom" was at the age of purchasing homes, demand for money and interest rates were high. Now that the baby boom is of an age where saving for retirement is critical, interest rates are low. Similarly, as noted above, when North American government spending exceeded taxation revenue and was financed by debt, demand for money and hence the interest rates were both high. Now that most governments are in a mode of net debt reduction, interest rates are low. Interest rates respond to many other factors, including perceptions of the relative value of currencies.

Figure 7.4 illustrates the demand side of this equation for one government, the Federal Government of Canada. Note the drop in new borrowing (negative in 1998) in very recent years after a long period of major borrowing. Relative to the Gross Domestic Product (GDP), the value of all the goods and services produced in Canada in a year, annual borrowing and total debt have been starting dropping. The same kind of change has occurred for most provincial governments in Canada.

- **Risk:** the largest factor in setting relative rates between investments is the perceived risk that the lender sees in the investment. "How likely am I to get my money back" is the key question. Government borrowers with the power to tax are normally seen as the lowest risk within a given geographical area, because the theory is that the legislative power to tax can ensure repayment. This theory is valid in settings like OECD countries and far less valid in regions of high turmoil like West Africa. Companies have different credit ratings for debt: intuitively we know that a large company producing a widely used product and backed by hard assets (for example, GM or Ford) is a lower risk than a startup Internet company with a good idea but no sales. Bond rating agencies like DBRS (Dominion Bond Rating Service) in Canada and Moody's or Standard and Poor in the United States specialize in assessing the ability of a government or company to repay debt, and they assign a debt rating that is virtually directly tied to the relative interest rate. Note that equity (e.g. a GM share) always has higher risk than debt (a GM bond), and the purchaser of the stock expects a higher return on the share price. The volatility of share prices is a reflection of the rapidly changing perception of the risk and level of anticipated returns on equity.

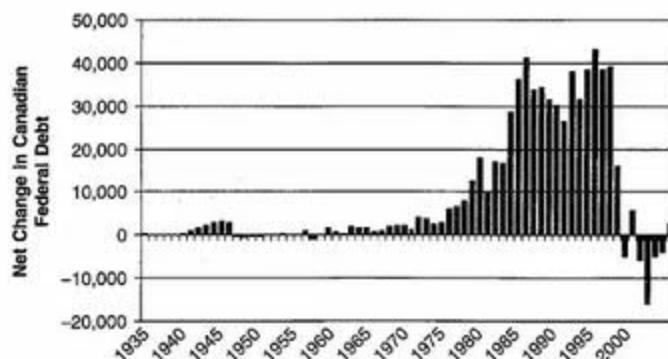


Figure 7.4: Net Change in Federal Debt in Canada

Source: Statistics Canada

- **Liquidity:** imagine two kinds of long term bonds, one of which can not be sold until the term is up and the other of which can be readily sold to someone else if the original lender has a sudden need for the money. The first bond is illiquid, and worth less in the eyes of the lender than the liquid bond. That means that a lender would need a higher rate of interest on the illiquid bond. The reason that developed countries place such an emphasis on fair and open markets for securities (stocks and bonds) is that it reduces the cost of money and promotes economic growth. Debt in government and corporate bonds and stocks in large and mid size companies are traded daily in regulated exchanges, and hence are highly liquid.

7.1.2 The Time Value of Money from the Perspective of the Borrower

Those who borrow money do so for one of two reasons. The first is that some personal expenditure is so important that the borrower would rather pay extra for it (in the form of interest) in order to have it early. The most common examples are home and vehicle purchases. If individuals saved until they could buy a home without borrowing, they would be old before they owned their own home. In North America, most individuals choose to pay more for a home that they own today, by borrowing and incurring interest costs, than wait to buy a home without borrowing and its attendant interest charges. The second reason people borrow money is to use it in some form that they believe will create commercial value. As long as the value that is created is higher than the interest cost, the borrower can create and keep excess value. This is the basis of business lending.

An investor is going to use money, either his/her own or borrowed funds, for some commercial purpose. The investor always has the option of lending the funds to others at the current interest rate. It is therefore incumbent on the investor, in their own best interest, to assess whether the contemplated investment is “worth it”, i.e. is it likely to return a stream of cash in the future that exceeds the cash that would be realized if the funds were invested at low risk in an interest bearing loan? Is the excess value large enough to warrant the risk that the investment may not work out? These questions are the heart of business growth and asset replacement decisions.

7.1.3 Defining the Time Value of Money

Imagine that you have \$1000 today, and you want to earn a return on this money. You decide that you need the money back in one year for some personal purpose, so you decide to lend it to the bank in a one year GIC (Guaranteed Investment Certificate) with an interest rate of 4%. Then, after one year the bank will return \$1040. You earn \$40 of interest income and get your \$1000 of principal back.

If instead you take out a two year GIC with an annual interest rate of 4%, then after two years you will get back \$1081.60. You get your \$1000 principal back, but in addition you get \$81.60 of interest. \$80 of this is the interest on the principal, and the other \$1.60 is the interest earned in the second year on the interest you made in the first year. (When both the principal and the prior periods' interest earns interest in the current period, we call this **compound interest**. There are cases where interest is not compounded, but this is fairly rare. For example, if one buys a bond and takes the interest payment on a yearly basis (known as “clipping coupons”, since bonds used to be issued with coupons attached that could be redeemed for interest), then interest is not compounded because it is paid out on a “pay as you go” basis.)

Now think of an example where you agree to pay a charity a donation of \$500 in three years. What is the present "value" of this pledge of future money? Suppose you decide to put money into a 3 year GIC that will be worth \$500 in three years. If you invest \$444.50 in such a GIC at 4% annual interest, it will be worth \$500 at the end of the three years. Given that you can earn interest at 4%, the future payment of \$500 is worth \$444.50 today.

These are examples of the fundamental principals of **compounding** (determining the future worth of a present amount of money) and **discounting** (determining the present value of a future amount of money). The interest rate is sometimes called the discount rate because a future sum (like the \$500 in the example in the previous paragraph) is worth less today by an amount determined by the interest rate.

The fundamental equations of discounting or compounding are:

- Future value of a current dollar (compounding) is given by:

$$F = P * (1+i)^n \quad (7.1)$$

Where: F = future value

P = present value

i = interest or discount rate per period

n = number of periods

Note that i , the interest or discount rate, means the return on money whether lent or invested, i.e. in this formula i means the time value of money.

- Present value of a future dollar (discounting) is given by:

$$P = F * (1/(1+i)^n) \quad (7.2)$$

7.1.4 The Value of the Interest / Discount / Return Rate

How do we know what value to use for i ? It depends on the inflation rate, the general supply of and demand for money, the risk and the liquidity of the investment, as discussed above, and also on what other investment alternatives we have. If we are giving money to a bank or a corporation in the form of debt or to purchase a publicly traded share, there is always a market value for the interest rate, which we can look up in a financial section of any paper. Our choice is to offer our capital at that rate, or decline to invest. If we are looking at investing some of our money as debt or equity in a small company whose shares and debentures do not trade on a market, then the situation is not so clear, and we make judgments without a clear "market" value.

What about a company making a decision to invest in a project? Practically speaking, most companies have a sense of a "hurdle rate of return", a return on investment below which they will not contemplate making an investment. "Does this meet the hurdle rate?" is a question asked of projects. (The hurdle rate is sometimes labeled the **Minimum Acceptable Rate of Return**, known by the acronym **MARR**.) Sophisticated companies will have more than one hurdle rate, depending on the nature of the risk. For example, imagine a power company that is looking at building unregulated generation. In one case, the output of the plant is 80% sold under a 25 year contract to a large "blue chip" industrial user; in a second

case, there is no prior contract for sale of power (this plant would be called a merchant generation plant). A sophisticated company will have a lower hurdle rate of return on the first case where the prior sale contract reduces risk. A fairly recent focus in financial analysis has been an emphasis on the **weighted average cost of capital (WACC)** which is the effective aggregated interest rate from the mix of debt, preferred shares, and equity that a given company (or a given project within a company) has. The targeted or hurdle return on equity is adjusted to the risk of the overall company or a given project. A new investment that is risk free has to do at least as well as the WACC, or it will be a drag on the overall company performance. To the extent that projects have increasing risk, the hurdle rate is the WACC plus the risk premium.

7.1.5 The Number of Periods

How do we know what number of periods to use? For interest calculations, this is set by the interest or "compounding" period. If a loan has interest "compounded annually", then it is calculated once per year. If the loan has interest compounded monthly, then it is calculated once per month. A five year loan with annual compounding has five periods, but with monthly compounding it has 60 periods. For investment calculations, an annual period is almost always used.

There is one convention in financing that is somewhat deceptive in nature. Lending institutions typically quote a nominal annual rate of interest but often have a more frequent compounding period. Hence, a bank that offers a loan at 9% annual interest compounded monthly is really offering a loan with a compounding period of one month and a monthly interest rate of 0.75%. The table below shows how interest would be compounded on such a loan in the first year, assuming no payment until year end. The real annual interest rate on such a loan is 9.38%. 9% can be thought of as a nominal interest rate, and 9.38% is the real or effective annual interest rate. Why do lenders compound more frequently than a year? Imagine you are lending \$100 billion per year; the impact of an additional 0.38% is \$380 million per year!

Table 7.1 Illustration of the True Cost of a 9% Nominal Interest Rate Compounded Monthly

Basis: Initial Loan Amount \$100
 Nominal Interest Rate 9%
 Compounding Period: Monthly
 No payments in the First 12 Months

Period	Interest	Balance
1	\$0.75	\$100.75
2	\$0.76	\$101.51
3	\$0.76	\$102.27
4	\$0.77	\$103.03
5	\$0.77	\$103.81
6	\$0.78	\$104.59
7	\$0.78	\$105.37
8	\$0.79	\$106.16
9	\$0.80	\$106.96
10	\$0.80	\$107.76
11	\$0.81	\$108.57
12	\$0.81	\$109.38

Table 7.2 Effective Interest Rate for Various Compounding Periods

Basis: Nominal Interest Rate 9%

Compounding Period	Effective Interest Rate
Annual	9.0000
Semi-annual	9.2025
Quarterly	9.3083
Monthly	9.3807
Daily	9.4162
Continual	9.4174

Why don't lenders more clearly disclose the effective annual interest rate? In the opinion of the author, it is simply a deceptive practice that crept into the lending industry when the cost of money was very high.

Imagine that one moves from compounding yearly to monthly to daily. Ultimately, at the end of this progression is **continuous compounding**, in which the compounding period is infinitesimal. This is a special case in which a step wise spreadsheet approach is not going to be applicable; the effective annual interest rate for continuous compounding is

$$i(\text{effective}) = e^{i(\text{nominal annual})} - 1 \quad (7.3)$$

The future value for continuous compounding is given by the equation

$$F(\text{at time } n) = P * e^{i^*n} \quad (7.4)$$

where F, P, i and n have the same meanings as in equations 7.1.

Table 7.2 shows the effective interest rate for various compounding periods assuming 9% nominal interest; increasing the compounding period past monthly achieves rapidly diminishing returns.

7.1.6 Other Comments on Present / Future Worth Calculations

For what time period do we set n equal to zero? This varies from company to company, the most common variants are:

- n equals zero in the year of the analysis, i.e. this year.
- n equals zero in the first year of capital spending, i.e. when the first project dollars are to be spent.
- n equals zero in the first year of operation of the project, i.e. when the plant or project starts up (in which case n has a negative value for the years in which the capital is being spent, i.e. capital is spent in year -1, -2, etc.).

When n equals zero defines the meaning of "present" in present value, and is arbitrary. If we make n equal to zero in some future year such as the year of plant startup, then when we talk about the "present value" of future money we mean present value measured in terms of the value of a dollar in that year in which n equals zero. Changing the year in which n equals zero has an impact on present value: as we push n equals zero out into the future, the "present" value of a given stream of cash increases. However, when

doing calculations of internal rate of return (IRR) discussed below, the results are independent of the choice of n equals zero, so the rate of return is an absolute measure of the earning power of a project. The important thing with choice of n equals zero is to be consistent with company practice so that all investments are compared consistently.

There is an implicit assumption in calculations that money is realized at the end of the period. For loans and bonds, this is in fact true. For analyzing investments, income is typically received over the course of the period rather than at the end of a period. For instance, imagine that you are looking at an incremental investment to add capacity to a refinery, and you model the cash flow received over 30 years. Implicit in the choice of an annual period and the application of equation 7.1 is that the cash flows to the company at the end of the year, when in fact it flows in over the course of the year. In practice, the impact of this is ignored since the error introduced is typically small compared to the accuracy of the assumptions that generate the cash flow forecasts.

Prior to the age of personal computers, it was common to develop elaborate tables of the present value of future dollars or the future value of present dollars, for various interest rates and compounding periods. Today, "solver" or "goal seek" features in spreadsheets allow anyone with access to such a program to do these calculations effortlessly. The further merit of developing a spreadsheet is that it is not uncommon for discussions of financial valuations to lead to "what if" questions. If a spreadsheet is set up cleverly, then a few keystrokes can lead to a change of interest rate, principal amount, etc. In these notes we refer to spreadsheets to solve compounding and discounting problems. It is important that the student know how to do this for a variety of problems.

7.2 WORKING WITH TIME ADJUSTED VALUES OF MONEY

There are a number of fairly standard problems that arise in financial analysis that can be readily solved with concepts of compounding and discounting.

7.2.1 Present Worth of a Future Stream of Dollars

What is the present value of a future stream of income, i.e. what amount of money would you accept today in place of a future stream of income? To do this, one must assume an interest rate. Consider first the example of a person who wins a lottery and has a choice of an upfront payment or ten equal annual payments of \$100,000. Let us assume that the person can invest the lump sum safely in a Government of Canada ten year bond at an interest rate of 6%. Thus, for this case the appropriate interest rate is 6%. If we apply equation 7.2 to calculate the present value of each future value, and sum the present values, we get the present value that equals all of the future payments. Table 7.3 shows this for a payment at the start of each year, and also for a payment at the end of each year. It is important to note that the present value technique is as valid for an uneven stream of numbers as it is for a constant stream.

The sum of the present value of each payment equals the total present value of the stream of payments. This means that if you are given \$780,169, you are equally well off as if you accept ten payments of \$100,000 at the start of each year. Delaying the payment by one year (from the start of the year to the end of the year) reduces the present value of the stream of payments by about \$54,000. Note that the present value of an immediate payment of \$100,000 (year one in the start of year case) is \$100,000 because you have immediate use of the payment, i.e. the payment is "present".

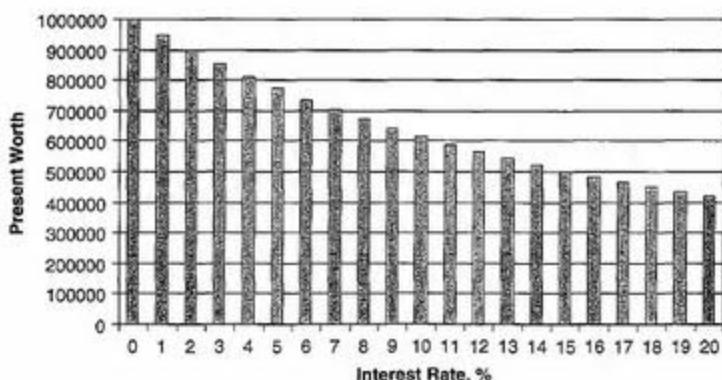
Table 7.3: Present Worth of a Stream of 10 Equal Annual Payments

Int. Rate 6%	Start of year present value	End of Year present value
year	payment	
1	\$100,000	\$100,000
2	\$100,000	\$94,340
3	\$100,000	\$89,000
4	\$100,000	\$83,962
5	\$100,000	\$79,209
6	\$100,000	\$74,726
7	\$100,000	\$70,496
8	\$100,000	\$66,506
9	\$100,000	\$62,741
10	\$100,000	\$59,190
		\$780,169
		\$736,009

It is important to think carefully about what is the right “discount” or interest rate to use in each case of compounding or discounting. In this case, a person has a secure prospect of a future stream of money, and the appropriate interest rate to choose when considering the alternative of an initial payment is the rate of interest for a secure alternate form of investment; hence the choice of 6%. The impact of the discount or interest rate on the present value for this example is shown in Figure 7.5. This curve is exponentially asymptotic to zero at infinite interest rate.

7.2.2 A Future Stream of Dollars that Amortizes an Initial Investment

How much do I have to pay in the future to “pay off” or **amortize** an initial amount? This is a standard question for mortgage lenders, for annuities (annual payments in exchange for an initial capital deposit), for those who lease equipment, and for those who want to determine a “**capital recovery**” charge. The capital

**Figure 7.5: Present Value of 10 Equal Payments of \$100,000 at the End of the Year**

recovery charge can be thought of as the leveled amount of money required in each period to ensure that a capital investment is recovered with a return equal to the value chosen for i . We have seen this kind of example before in the calculation of a mortgage payment in Appendix 3.3. One uses a "goal seek" or "solver" feature in a spread sheet, or trial and error, to ensure the balance is zero at the end of the period, that is, guess an initial payment and calculate interest for each period, deducting any excess payment from the principal balance. Then use a "solver" subroutine to force the principal balance to zero at the end of the specified number of period. Table 7.4 shows such a calculation for an initial sum of \$1000 with 25 annual periods at 10%.

This is a crucial calculation that arises in many areas of business and engineering, and it is important that every engineer be able to set up and solve such a problem. The use of a spread sheet, with the

Table 7.4: Annuity / Capital Recovery / Lease Payment / Mortgage Table

Basis:

Principal	\$1000
Interest	10%
Years	25
Compounding	Annual
Payment	\$110.17

Period	Payment	Interest Portion	-Principal Portion	End of Year Principal Balance
1	\$110.17	\$100.00	\$10.17	989.83
2	\$110.17	\$98.98	\$11.18	978.65
3	\$110.17	\$97.86	\$12.30	966.34
4	\$110.17	\$96.63	\$13.53	952.81
5	\$110.17	\$95.28	\$14.89	937.92
6	\$110.17	\$93.79	\$16.38	921.55
7	\$110.17	\$92.15	\$18.01	903.53
8	\$110.17	\$90.35	\$19.81	883.72
9	\$110.17	\$88.37	\$21.80	861.92
10	\$110.17	\$86.19	\$23.98	837.95
11	\$110.17	\$83.79	\$26.37	811.57
12	\$110.17	\$81.16	\$29.01	782.56
13	\$110.17	\$78.26	\$31.91	750.65
14	\$110.17	\$75.07	\$35.10	715.55
15	\$110.17	\$71.55	\$38.61	676.94
16	\$110.17	\$67.69	\$42.47	634.46
17	\$110.17	\$63.45	\$46.72	587.74
18	\$110.17	\$58.77	\$51.39	536.34
19	\$110.17	\$53.63	\$56.53	479.81
20	\$110.17	\$47.98	\$62.19	417.62
21	\$110.17	\$41.76	\$68.41	349.22
22	\$110.17	\$34.92	\$75.25	273.97
23	\$110.17	\$27.40	\$82.77	191.20
24	\$110.17	\$19.12	\$91.05	100.15
25	\$110.17	\$10.02	\$100.15	-0.00
Total	\$2,754.20	\$1,754.20		\$1,000.00

principal amounts and interest rate set up as single cell entries, means that "what if" cases can be run quite easily: what if the interest rate is a quarter point higher, or what if the principal amount changes? By dragging down the rows, one can extend the period of the loan, or go from annual compounding (25 periods at an interest rate of 10%) to monthly compounding (300 periods at an interest rate of 1/12^o of 10%).

Reflect on the values in the above table. First, consider it from the perspective of a person paying a mortgage. For every \$1000 borrowed at 10% for 25 years, the homeowner will pay \$2754, of which \$1754 is the interest on the loan. One can show that a shorter period or a one time "balloon payment" has an enormous reduction in interest paid, which is why prepayment provisions in mortgages are so important to borrowers.

Second, consider this from the perspective of a person who is weighing a capital vs. an operating cost. Examples of this kind of calculation arise constantly and are at the heart of many engineering evaluations. For example, should one specify a thicker conductor wire for a transmission line (at a higher capital cost) and reduce power losses due to resistance? Should one specify a larger pipe size on a pipeline to reduce pumping horsepower? The way one approaches such problems is develop an annual charge for a capital investment, in effect turning a capital cost into an annual operating cost. In the above example, the annual "value" of an investment of \$1000 with a life of 25 years and a discount rate of 10% is \$110.17. If 10% was an acceptable return on capital in a company, then the investment would be justified if the annual savings in operating costs were \$110.17 or higher. If the annual operating costs savings were less than that amount, then the capital expenditure should be rejected. With reflection, one can see that the specification of the target discount/interest/return rate is the critical issue in deciding the relative value of capital vs. operating costs. High target rates of return on capital investment discourage capital spending. Low rates of return encourage capital investment. For this reason, one strategy governments have sometimes employed in trying to encourage some investment seen as being socially desirable (e.g. housing for the poor or pollution control equipment) is to provide subsidized low interest loans. Note that a rapid writedown of the investment for tax purposes through high CCA rates has the same effect.

One can also think about the impact of governmental fiscal policy on a nation's economic health. Governmental decisions about borrowing and spending affect interest rates. In the early 1990's Canada was running large Federal and Provincial deficits at a time when the US had made serious efforts to curb spending in order to reduce annual deficits and reduce the overall level of debt. The net impact of this was a 4% higher interest rate in Canada than in the US. This had the effect of discouraging investment in Canada, because a given investment had to be more profitable to meet a hurdle rate of return compared to the US. When central banks want to reduce economic activity in order to control inflation, they raise interest rates for the same reason. Thus, the value of money has profound ripple effects on capital projects and the general level of economic activity in a nation.

Capital investments are one component of a society's economic wealth. The effective interest or hurdle rate of return on investment is the primary determinant of whether a given capital project makes sense. High or variable rates of inflation make investment decisions difficult, because investors don't know what an appropriate interest rate is. This is the reason that so much attention gets focused on inflation and interest rates. Since engineers to a large extent make their living from capital projects, they are highly affected by these issues.

7.2.3 Capital Recovery Factor

The emphasis in this course is on setting up spreadsheets to model present vs. future value calculations. Setting up these spreadsheets gives the engineer a tremendous advantage in studying sensitivities and in understanding results. However, one formula is often used as a shortcut, called the capital recovery factor or the annuity factor. This formula gives the same result as Table 7.4: what stream of money in the future equals a set amount of money today?

$$\text{CRF} = P * [(i * (1+i)^n) / ((1+i)^n - 1)]$$

where P is the present value in year zero of an initial sum of money, i is the interest rate, and n is the total number of periods.

The name “annuity” came from the practice of making an annual payment, however the formula works for any period, i.e. annual, monthly, weekly etc. If we set P at \$1000, i at 10% and n at 25 years we get an annual payment of \$110.17, the same result as Table 7.4.

7.3 EVALUATING INVESTMENTS

In theory, one could evaluate a new investment by looking out to the future and running a complete set of financial statements with and without the new investment. One could then look at the dividend stream and the residual worth of the company and decide if the new investment made sense. We don't do this for many reasons, in part because of the effort involved and the large number of projects that are screened in even a medium sized company every year. In practice, we evaluate investments on a straightforward analysis of the cash impact of the investment, i.e. the marginal (incremental) cash consequence of the investment is identified and analyzed.

Two conceptual approaches govern investment analysis:

- Discounting the value of cash streams by assigning an interest rate and assessing, in some form, the implicit earning power of the investment. **Discounted cash flow (DCF)** techniques include:
 - **Net present value (NPV)**, which determines the “extra” current value of an investment compared to a theoretical investment of the same amount of money at a prescribed interest rate.
 - **Internal rate of return (IRR)**, which is the effective interest rate at which the investment is exactly offset by the future incoming cash flows. The IRR is a direct measure of the effective earning power of the dollars being invested. This is also called the **return on equity (ROE)** or sometimes the **return on investment (ROI)**. Technically, the return on investment is the return provided by the total project (debt plus equity), and the return on equity is the return on the equity component only, which is “leveraged” by the debt. However, in practice the terms are often used carelessly and interchangeably, and one is cautioned to clarify what the speaker means by each term.
 - Payback period, which assesses the time required to get the original investment back from the future incoming cash flows.

IRR is the predominant method used to screen investments; NPV is often assessed in parallel, and is the method of choice for required investments that have no revenue (like a pollution abatement project).

Payback moderates our judgments based on IRR, in that a risky project that has a projected very high IRR and high payback may be less attractive than a lower IRR with a short payback, because future reality often deviates from current projections. This is discussed further below.

7.3.1 Cash Flow

The critical first step in any investment analysis is a calculation of the cash flows over the life of the project. This is always done on an incremental basis looking forward, i.e. we just look at the future cash flow differences associated with some project, not total cash flow for a company. Cash flow is normally done on an annual basis for major long term capital projects. Consider, for example, a major petrochemical project such as a new polypropylene plant. The planning, engineering and construction of such a project will typically take three to four years, during which time the cash flow is negative, i.e. the company uses cash to pay for permitting, engineering design, procurement, construction and startup of the project. Often during the startup year cash flow continues to be negative, because the plant takes a period of time to achieve operation at full capacity and also because the project must build inventory and receivables during the first year that will be "collected" in the last year of the project. Usually by the second and subsequent years of operation cash flow is positive. It is crucial that incremental tax effects be considered in any DCF analysis, since they have a major impact on cash flow; all DCF calculations should be done on an after tax basis. Determining the incremental tax impact of a project is addressed in Appendix 7.1.

Cash flows need to be incremental, i.e. only the extra costs associated with a new project should be considered. Imagine we are in a company that has one manufacturing plant and is considering building a second one. The company will not need a second president and vice president of finance in order to operate a second plant. In an accounting treatment, once the second plant is up and running the company might decide to charge half of the cost of the president and VP Finance to the second plant, but in an investment analysis this should not be done. The true marginal cost of the second plant is just the extra cash costs that the company will incur in building and operating it, and nothing else should be considered in the cash flow. In essence, this lets the economy of scale of the company be factored into the only decision the company now has: should the second plant be built?

Cash flows should be future oriented, i.e. they should ignore sunk costs. This is often a difficult concept to understand. Suppose that a project has gone over budget and instead of costing \$100 million the total cost will be \$150 million. If this is realized when the project has committed \$90 million, then the proper investment analysis is to look at whether it is worth \$60 million to complete the investment and operate the project. The project may have a poor return based on the \$150 million total cost, but the company's choice when the overrun is discovered is to spend an incremental \$60 million and complete the project, or walk away from the project. The \$90 million is a sunk cost, and should not show up in the cash flow analysis.

Cash flows should be developed in some detail, i.e. operating costs should be broken down as finely as possible, since inevitably when the senior levels of a company come to review a project many sensitivity cases are assessed, i.e. we look at a base case IRR and then look at the impact on the base case of a 10% overrun in capital cost or a 10% increase in feedstock or energy costs. The purpose of this sensitivity analysis is to see what risk factors most affect the return on investment. In some cases, a company can take steps to reduce some risks, for example feedstock or fuel can be purchased on a long term contract. In other cases, one must simply accept risks; no company, for example, has control over general

inflation and its impact on wages, or on governmental policies that can alter a project's economics sharply (for example, chlorinated fluorocarbons were banned when their impact on the ozone layer became fully understood).

How accurate are cash flow forecasts? The true answer is that they are a lot less accurate than the precision of subsequent analysis implies! It is not unusual to see DCF calculations that carry rates of return to two decimal places that are based on inputs that are at best educated guesses. There are many implicit assumptions in cash flow forecasts because they often go 30 or even 40 years into the future. Our knowledge of prices of key inputs (labor, energy (power and fuel), and feedstock are all examples) is at best hazy, and we usually end up assuming that these have some relationship to inflation. For example, it is not unusual to assume that wages will increase in the long term at 2% over inflation.

Consider energy projects in 1980: the conventional wisdom was that the real price of oil, then at \$40 US per barrel, would continue to rise over the next 35 years at a rate that was 2% greater than the assumed inflation rate. The dispute with this forecast was that it was too low; some oil companies, and some segments within government, argued that oil would increase at 3% real increase (i.e. 3% over inflation). What happened in reality is that the price of oil collapsed through several stages, and its value today is about half the real value that it had in 1980. The inaccuracy of the guess of future oil price simply overwhelmed any refinement in economic analysis. High attention should be paid to the accuracy of assumptions, especially the accuracy of price forecasts, into the future.

It is especially important that relative pricing be consistent within a cash flow forecast. For example, consider electrical power generation based on a combined cycle unit firing natural gas. Conventional wisdom today is that the price of gas and power are linked, in that natural gas will be the fuel that sets the effective level of price for power. To put this another way, power price in North America will be set at a level that will give a reasonable return (say 12%) on investment in a new combined cycle natural gas fired unit. If you accept this logic, then it would be inconsistent to develop a 30 year forecast that saw natural gas prices escalating at a different underlying rate than power prices.

Every input into a cash flow forecast should have a justification/explanation for its pattern of growth, and more than one person should review these to ensure as much internal consistency as possible in relative forecasts.

7.3.2 Net Present Value

Net present value takes a fixed interest or discount rate and calculates the net present value of the stream of cash flow. The normal means of referring to net present value is NPV(xx) where xx is the discount rate (in percent) used in the calculation. Thus, NPV(10) means the net present value of the investment if the cash flow stream is discounted at 10%. Calculating NPV is essentially the same procedure as the calculation of present value shown in Section 7.2.1 and Table 7.3 above. The discount or interest rate used in the calculation, however, is typically either a benchmark value (10%, 12%, or 15%) or a minimum hurdle rate of return (also known as MARR) for capital projects within a company.

What does NPV at MARR mean? In effect, it is the present "excess value" of a project over the minimum acceptable rate of return, expressed as current dollars. Thus, if a project has an NPV of \$12 million at the company's MARR, it means that if the company proceeds with the project and the future unfolds as per the forecast, the company will have received its MARR on the investment and have cre-

ated an additional amount of wealth (value) worth \$12 million in present dollars. In practice, IRR is used more often in evaluating cash generating investments.

For example, a power company building merchant generation plants may have the following hurdle rates of return:

Table 7.5 Sample Hurdle Rates of Return for an International Power Company

Type of Project	Minimum Hurdle Return on Investment
Merchant generation, North America, no contract	14%
Merchant generation, Europe / ANZ, no contract.	14.5%
Merchant generation, Latin America, no contract.	21%
Merchant generation, Africa, no contract.	Do not invest
More than 70% contracted (min 15 years) to customers with a "B high" credit rating or better, North America, Europe and ANZ.	12%
More than 70% contracted to customers (min 15 years) with a "B high" credit rating or better, Latin America.	17%
More than 70% contracted (min 15 years) to customers with a "B high" credit rating or better, Africa.	22%
100% contracted to customers with a "B high" credit rating or better, any geography.	Reduce hurdle rate by 0.5%
Customers are "A low" or better credit rating.	Reduce hurdle rate by 0.5%
Contract term 10 years instead of 15 years.	Increase hurdle rate by 0.75%
Full Guarantee by World Bank or Canadian Government Agency of Power Project in Africa for minimum of 12 years.	Reduce hurdle rate by 7%

Now imagine that you have a preordered combined cycle power generation unit that can go into a project in Egypt, Argentina, New Zealand, Ontario, or the state of Washington. One way to compare the alternatives is to prepare the cash flow projection for each of these projects (including all tax effects) and to discount them at the predefined hurdle rate of return. The result is the net present value at the hurdle rate; it would be in millions of dollars, and it represents the value over the minimum acceptable return that is available from the proposed investment. A negative NPV simply means that the project does not achieve the minimum hurdle rate of return.

Although IRR is more commonly considered by management in making this kind of decision, there is one type of investment that does not lend itself to calculating an IRR: investments required by law that have no incremental income. Consider, for example, a government order that requires that sulphur content in gasoline be reduced by a factor of ten (as is occurring in Canada today). Companies can meet this by a combination of additional hydrotreating, alternate feedstock purchase, and product blending with purchased low sulphur stocks. Cases can be developed that have vastly different patterns and levels of capital spending and operating costs. How do we pick between these alternatives when they are a mix of capital and operating costs with no net revenue? The answer is that, assuming that all alternatives are equal in quality and risk, we pick the alternative with the least negative NPV. The NPV will be negative

because there are capital and operating costs with no income, but the least negative NPV is the alternative that results in the lowest aggregated cost to the company.

In practice, of course, alternatives are not equal in quality and risk, and such factors play a major role in the choices management makes. Despite lots of proposed methodologies for quantifying risk, humans still trust the right hand side of their brain as the primary judgment mechanism for screening risk and choosing alternatives. Hence, NPV calculations contribute to the ultimate decision, but they do not make the ultimate decision.

Table 7.6 illustrates an NPV calculation for a Canadian based merchant power plant. Several observations can be made on this analysis:

- 14% was chosen the appropriate discount rate based on the information presented in Table 7.5; 14% is the minimum hurdle rate for a Canadian merchant generation plant. Note that the NPV (14) is \$4.5 million, meaning that the project has a positive present value of \$4.5 million even when discounted at 14%.
- Price and cost data builds in an inflation factor; it also builds in a real growth factor if one is warranted. In this case, wages have a real growth of 2% over inflation, and natural gas and electricity have a real growth of 1% over inflation. For a commodity such as natural gas, one can argue that a given period such as the next 15 years it will have a real increase in value, but recognize that for most commodities there is either no real growth in price or even a negative real growth in price. For example, over the last 200 years, the real cost of steel and wheat have dropped.
- In this case, the cost of maintenance has a real increase over inflation of 1/2%. This is a means of estimating the impact of an aging plant requiring more maintenance. Maintenance costs in reality are "lumpy", i.e. they are high in one year if a major problem is fixed, and low in others. It is usual just capture this impact by a steady cost forecast.
- Table 7.6 clearly illustrates that the early years of any project have far more weight in a DCF analysis than later years. Year 2's operation ($n = 4$) has a present worth of \$32 million, while Year 15 ($n = 17$) has a present worth of \$5 million. This is because of the compound discounting of future years' income: a dollar earned 15 years from today has a low value compared to a dollar in our hand today, especially at a high discount rate of 14%. Advancing the startup of the unit by three months will have a greater impact on NPV than extending the life of the plant by one year.
- The tax treatment in Table 7.6 is simplified in several ways, and needs further comment:
 - All capital is treated as a single CCA class with a 30% declining balance (available for some high efficiency power projects). In reality, life is not normally so simple, and one might have more than one CCA class (for example, buildings vs. equipment) with different schedules for claiming. One normally develops a spreadsheet to track this. As noted in the Appendix on tax, tax calculations involve a pooling of CCA and are normally done by a specialist in the firm (or a consulting accounting firm) and provided to the DCF analysis.
 - What does negative tax mean in years 1 and 2? It means that there is a negative entry for tax that can offset taxes payable from another part of the company. If this project were purely stand alone, then taxes could not be negative, since Federal and Provincial governments do not return money to companies that show losses! The effect of this is that companies with fully taxable income have more favorable economics on projects, especially those with a slow ramp up of income in the early years of the project, because the CCA claimed reduces taxes otherwise payable from other

operations of the company. For a startup company for whom this project is the only business venture, the CCA available is not all claimable against income in the early years because there is no other income.

- Note that the capital spending before startup does not lead to a CCA claim before startup, because until an asset is available for use the CCA cannot be claimed. Also note the half year rule (half CCA in first year).

7.3.3 Internal Rate of Return (IRR)

As noted above, the internal rate of return is the discount rate that causes the present value of the cash flow from a project to equal zero, i.e. it is the discount or interest rate that exactly matches the present value of expenditures (cash outflows) to returns (cash inflows). In effect, the IRR can be thought of as the earning power of the project. IRR can be calculated on a total investment basis (i.e. what is the total earning power of the investment in a project, independent of whether the financing is debt or equity), or it can be calculated on an equity basis (i.e. what is the total earning power of the equity portion of the investment in a project, after the cost of debt has been serviced). Return on Investment (ROI) is the name sometimes given to the former, and Return on Equity is the name sometimes given to the latter, although in practice use of these terms is imprecise.

Table 7.7 takes the same case as Table 7.6, but now instead of calculating the NPV at a given discount rate, the procedure is revised to calculate the interest/discount rate at which the NPV is zero. This is done by getting the “goal seek” or “solver” routine to set the NPV to zero based on varying the discount rate. (This is the reason that it is important to have the interest rate be a single cell in the calculation of present value and NPV.) For this case, the IRR is 14.4%; investing in this project gives the same financial benefit as investing on the same schedule in a financial instrument (e.g. a bond) with an interest rate of 14.4%. It is possible to have multiple values of interest rate for which the NPV of cash flow is zero, but practically this is a rare occurrence and can be ignored for most projects. Any project that starts with a negative cash flow and has a single sign change to a positive cash flow (which is true for most engineering projects) will have only one unique value of i that gives a zero NPV. See Park et al. (1995) Section 6.2.2 (page 313) for a more thorough treatment of multiple interest values when there is more than one sign change in a cash flow, and be aware that in this case one can possibly get more than one value of IRR by using goal seek type solver routines in a spread sheet. In these rare cases, NPV is the more reliable guide to an investment decision: e.g., is NPV positive at MARR?

7.3.3.1 IRR for Incremental Investment

Opportunities to spend more incremental dollars in a project occur often, and can be analyzed on an incremental basis. IRR is the most common form of analyzing such opportunities, although NPV analysis can also be used. For example, consider an oil sands project based on coking of bitumen in the Ft. McMurray area. An alternate case is developed based on pipelining diluted bitumen to the Edmonton area and hydrocracking it at high conversion levels (conversion is the measure of the production of light liquid hydrocarbons from heavy long chain “tar” molecules). Clearly, the capital cost of the hydrocracking alternative is higher, since one must build a larger pipeline for diluted bitumen vs. synthetic crude oil, since a return pipeline must also be built to carry diluent back to the Ft. McMurray area, and since hydrocracking is a more expensive upgrading technology. Is the extra investment in the hydrocracking case worth it?

One of the best ways to analyze this kind of question is to develop a full forecast of after tax cash flow for each of the two cases, and then subtract the coking cash flow from the hydrocracker cash flow. This gives the incremental cash flow between the two projects. This cash flow will have a unique NPV at any given discount rate, and will also have an IRR, i.e. there will be a discount rate at which the NPV is zero. In effect, this is the return on the extra investment in the hydrocracking case vs. the coking case.

Table 7.8 illustrates this effect. The overall rate of return on the coking case is 12.5%, and the overall rate of return on the hydrocracking case is 13.4%. Since 13.4% is higher than 12.5%, we know that the extra investment in hydrocracking improves the overall economics of the project, and in fact the return on just the extra (incremental) investment between the two cases is 26.0%. In other words, the return on the extra capital is more than twice the return on the overall coking project!

Would it be automatic that a company looking at Table 7.8 would choose the hydrocracking case over the coking case? No! Two factors would have to be considered: the relative technology risk between the two cases, and the availability of capital. First, coking is a well proven technology, while hydrocracking of bitumen at high conversions is not demonstrated. Low conversion hydrocracking is demonstrated, and a company might convince itself that the incremental risk of moving from low conversion to high conversion is acceptable, but it would have to be carefully considered. Second, what if the company simply could not raise the extra capital at a price it found acceptable? It might choose to be in the oil sands business, but reject the more attractive return on hydrocracking because it only had the capital for the coking project. In general, risk and capital availability have to be taken into account in all investment analysis.

Some other comments on Table 7.8:

- As with earlier cash flows, we see that a large sum of money a long distance in the future has a very low present value. Consider, for example, the coking case. Almost \$1.4 billion of revenue in year 33 has a present value of \$32 million because of compound discounting. Extending the project life has little impact on return because the impact of compound discounting is so high. For the coking case, an extra ten years of project life changes the IRR by 0.06%, which is not significant enough to change an investment decision from “no go” to “go” or vice versa.
- The cash flow from the coking and hydrocracking cases increases by 2% per year in years 8 and beyond. This is typical of a DCF analysis: how are we to accurately pick an oil price so far into the future? Normally, we make some global assumption like a steady 2% increase in the commodity price. We can test the impact of this assumption by sensitivity analysis.
- This kind of incremental modeling is how a great number of individual project decisions are made, for instance the amount of tankage an oil sands project requires would be decided based on an analysis of the incremental cash flow as tankage increases.

Imagine that one has a large pool of capital and a minimum hurdle rate, or MARR, for that capital, so that any project over a given minimum will be chosen. Further, imagine that five different projects have been developed, with different cash flows. One can use the least expensive capital case that has an acceptable return (over the hurdle rate) as a base case, and look at another projects in comparison to that project. (If there are more than two alternatives, one does this in a stepwise fashion, as described below.) If the marginal IRR on the incremental investment is above the hurdle rate, it would make sense to proceed with the incremental expenditure *even if the overall return is lower than the base case*, because the incremental capital has a return over the hurdle rate even if this return is lower than the base case.

Table 7.8: Incremental IRR for Hydrocracking vs. Coking Oil Sands Project

Year	Case 1:Coking		Case 2:Hydrocracking		Incremental	
	Cash Flow	PV	Cash Flow	PV	Cash Flow	PV
1	-322	-322	-344	-344	-22.0	-22.0
2	-2,324	-2,066	-2,499	-2,205	-175.0	-138.9
3	-2,122	-1,678	-2,188	-1,703	-66.0	-41.6
4	-565	-397	-570	-391	-5.0	-2.5
5	201	126	250	151	49.0	19.5
6	512	285	614	328	102.0	32.2
7	822	406	939	443	117.0	29.3
8	838	368	958	398	119.3	23.7
9	855	334	977	358	121.7	19.2
10	872	303	996	322	124.2	15.5
11	890	275	1,016	290	126.6	12.6
12	908	249	1,037	261	129.2	10.2
13	926	226	1,057	235	131.8	8.3
14	944	205	1,079	211	134.4	6.7
15	963	186	1,100	190	137.1	5.4
16	982	169	1,122	171	139.8	4.4
17	1,002	153	1,145	154	142.6	3.5
18	1,022	139	1,168	139	145.5	2.9
19	1,042	126	1,191	125	148.4	2.3
20	1,063	114	1,215	112	151.4	1.9
21	1,085	103	1,239	101	154.4	1.5
22	1,106	94	1,264	91	157.5	1.2
23	1,128	85	1,289	82	160.6	1.0
24	1,151	77	1,315	74	163.8	0.8
25	1,174	70	1,341	66	167.1	0.7
26	1,197	64	1,368	60	170.4	0.5
27	1,221	58	1,395	54	173.9	0.4
28	1,246	52	1,423	48	177.3	0.3
29	1,271	47	1,452	43	180.9	0.3
30	1,296	43	1,481	39	184.5	0.2
31	1,322	39	1,510	35	188.2	0.2
32	1,349	35	1,541	32	192.0	0.1
33	1,376	32	1,571	28	195.8	0.1
	NPV	0	NPV	0	NPV	0
	@IRR	12.5%	@IRR	13.4%	@IRR	26.0%

Companies that have a surplus of cash and a desire for investment opportunities would take this approach of investing in any incremental capital that gives an incremental return over the MARR. Companies that have a shortage of funds for capital projects might well pass up a large incremental investment that lowers the return of the base case. In practice, not all companies define a MARR, and a great deal of non-quantified executive judgment goes into decisions on large capital investments. The incremental approach is more often used for relatively small investment decisions such as tankage or a process selection within a refinery. There are many such decisions in designing a plant, and the senior executive is not involved in every decision.

For more than two projects, start with the lowest capital cost, Case A, and second lowest cost, Case B, and compare these projects incrementally. If B is the appropriate investment, for the reasons discussed above, it becomes the new "base case", and we compare Case C, the third lowest capital cost, to the base case. We proceed in this stepwise fashion until all cases are tested incrementally.

7.3.3.2 When IRR Is Not Used In Investment Decisions

IRR is the most common criteria by which investment decisions are made, but it is not universally applied. There are at least five circumstances in which IRR is not the prime factor in screening investments:

- When there is no income from the investment (e.g. a mandated environmental project), NPV is used to pick the least expensive alternative.
- When an investment is for base business preservation (e.g. replacing a valve during a startup or replacing a vehicle that is essential to continuing a large business, NPV is used to pick the least expensive alternative.
- When two projects have a nearly identical return, use payback to identify the project that more quickly returns the investment.
- When a project has an extremely uncertain future and typically a very short life (e.g. a nightclub or software), use payback, since cash flow forecasts long into the future are too uncertain to be relied upon. Short paybacks mean low risk of loss of capital.
- When projects are of a strategic nature or have a vastly different scale, strategic factors are used to screen alternatives in addition to return.

The use of NPV is discussed above, and the use of payback and the role of strategic issues are discussed further below.

7.3.4 Payback Period

Payback period is the length of time that it takes to "get back" one's investment. It is normally measured from the startup of the project (first production), not when construction starts. In the 1950's this was often the only way of judging investments: the shorter the payback, the better the investment. DCF analysis replaced payback as a far more sophisticated analysis of the earning power of an investment.

Payback calculations are done in two forms: payback based on cash flow dollars, and discounted payback based on discounted dollars. Projects will have a longer discounted payback period than a payback period; the idea of discounted payback period is that it weights for the time value of money, or if a discount rate based on interest on borrowed money is used, then it weights for the cost of the money used in the project. While the theoretical grounding for discounted payback may be more sophisticated, in practice actual payback period is used far more frequently.

In the coking case in Table 7.8, payback occurs at about 7.5 years after startup of the project. (Startup is assumed to occur late in year 4.) This is a relatively long payback period, and reflects the capital intensity of the oil sands. If one assumes an interest cost of 8%, then the discounted payback is 12 years after startup. Again, this is a long payback period, and would discourage many investors. Payback for the hydrocracking case is about 6.8 years after startup.

What gives us the confidence to accept a long payback period? Consider two investments, one in a machine that makes hula-hoops and one in an oil sands project. We are far more certain of the market demand for oil 12 years in the future than we are in the demand for hula-hoops. Any novelty item, and more broadly any item that can go out of fashion, would warrant a shorter payback period. Nightclubs, for instance, tend to be "hot" for a period of time, but what is "hot" shifts unexpectedly. A prudent investor would want a much shorter payback period for renovations to a nightclub than for an oil sands project.

We use payback period in different ways:

- When looking at two different projects that have comparable return but a different profile, payback will highlight the impact of the profile. For instance, consider Table 7.9, which shows two projects with a 2 year construction period and a 20 year life which have an identical IRR. Although the return is identical, the cash flow profile is not. The project labeled "late" has a longer payback period of 9.5 years (and a higher ultimate cash flow) than the project labeled "early". The payback period illustrates this clearly. If "early" and "late" were equally strategic and acceptable projects, then clearly early would be the preferred choice because one has the investment back sooner. If the market shifts, or an environmental regulation eliminates the product, at least the initial money has been

**Table 7.9 The Effect of Cash Flow Profile on Payback
for Two Projects with Identical IRR**

Year	Case 1: Cash Flow	Early PV	Case 2: Cash Flow	Late PV
1	-212	-212	-212	-212
2	-461	-407.0	-461	-407.0
3	90	70.2	12	9.4
4	92	63.2	15	10.3
5	94	56.9	20	12.2
6	96	51.3	30	16.1
7	97	46.2	50	23.7
8	99	41.6	70	29.3
9	101	37.4	100	36.9
10	103	33.7	120	39.1
11	105	30.4	150	43.2
12	108	27.4	228	58.0
13	110	24.6	232	52.2
14	112	22.2	237	47.0
15	114	20.0	242	42.3
16	116	18.0	247	38.1
17	119	16.2	252	34.3
18	121	14.6	257	30.9
19	124	13.1	262	27.9
20	126	11.8	267	25.1
21	129	10.7	272	22.6
22	131	9.6	278	20.4
	NPV	0.0	NPV	0.0
	@ IRR	13.3%	@ IRR	13.3%
	Payback	7	Payback	9.5

recovered. Notice the convention here that unless otherwise specified, payback is calculated from startup of the project, not from first construction.

- For some projects, doing a cash flow forecast far out into the future involves so much uncertainty that we do not trust the numbers, and rely exclusively on payback to become comfortable with the investment. The nightclub investment is an example of this: who would trust any forecast of revenue from a nightclub ten years into the future? Similarly, investments in software are frequently based solely on payback period.

7.4 PRACTICAL ISSUES IN INVESTMENT ANALYSIS

In industry an enormous amount of time is spent in analyzing and discussing investment opportunities. This is at the heart of engineering, since our profession designs, builds and operates capital facilities that create wealth. Companies that lose the heart to invest start to wither; those that invest in bad projects wither. Only companies that renew themselves through prudent investment in good projects survive in the long run.

7.4.1 A Strategic Vision

Ultimately, companies have some strategic vision that shapes their investment decisions. In theory, one could invest in anything that has a projected high rate of return. In practice, companies are very careful and very strategic in diversifying.

In the 1970's, the conglomerate company that was in a wide variety of businesses was briefly popular, but the appeal of this kind of company soon faded. First, the synergy from vastly different businesses was near zero: what help was it to a polypropylene business that your parent company also owned a car rental and leasing business? Second, the difficulty of finding management that could understand widely different businesses was very high. In practice, familiarity with an industry is an enormous asset to a manager, and the manager of a conglomerate could not be familiar with all of the disparate pieces of the company. Finally, the stock market never knew what to make of a conglomerate, and the stock price often was less than the value of the individual parts of the business. For example, two companies in North America tried the logic of having a pipeline business (regulated, stable and dividend oriented) and a chemical business (highly cyclical and capital gains oriented). The stock market valued each of the companies as either a pipeline business (thereby ignoring and not placing value on the chemical business) or vice versa. Each of these companies eventually was broken in two to help shareholders realize the full market value of their investment, i.e. higher aggregate value from holding shares in each of two companies vs. shares in one conglomerate.

Practically speaking, what does this mean? It means that a company that makes steel fabricated components will almost certainly evaluate an investment in equipment directly related to their current line of business, and may evaluate an investment in an extension of their business (for example, a plastics fabrication business or equipment). However, they are not likely to look at a completely unrelated business such as a retail garden center or a clothing manufacturing process, no matter how good the IRR appears. Managers in this situation don't trust their knowledge of the industry both to know future cash flows accurately, and to manage the business once acquired. Most investment decisions have an implicit strategic component that does not get reflected in the numbers in a DCF or payback analysis.

In an ideal world, the strategic thinking of senior management is visible, and employees can reflect on and grow from it. Often, however, strategic thinking is less visible (sometimes even to the strategizer), and an employee who is developing business opportunities through investment analysis can only learn it implicitly from the reaction of senior management to seemingly suitable investments.

7.4.2 What Technique Do We Use?

In larger corporations, most investment analysis will have six components:

- IRR.
- Sensitivities to IRR, for example the impact on IRR of capital and operating cost changes, price increases, or schedule delays.
- NPV at one or more discount rates.
- Payback.
- Risk factors and how they might be mitigated (for example, forward selling of product (such as electrical power) by long term contract).
- "Fit" with the company's strategic plan.

For small projects that are well within the capital spending limits of the company (for example, a \$2 million project in a company whose annual capital spending is \$200 million), then a simple IRR is the critical test. If the project has a high rate of return, it is likely to be done, and this is the key criteria for evaluating the project.

For very large projects, some other factors tend to get added to the mix. Some lower IRR projects may be approved if it is anticipated that they are part of the strategic future of the company *and that future synergies will arise from the initial project*. Thus, an oil company in Canada may conclude that if it is to remain in the oil business it must have an exposure to mineable oil sands, and that even if such a project shows a low return and long payback, that over the years additional investment opportunities (expansion or use of byproducts) will arise that will enhance the earning power of the base project.

As noted above, some projects are investments in revenue preservation. For example, if a plant is ordered to install pollution equipment or be shut down, then the investment is mandated and must be completed to preserve the revenue from the plant, which in most cases will be large. It is not meaningful to calculate an IRR in such a case, since all choices will appear to have a high IRR because they are capturing the value of all past investment in the plant. Instead, in this case we look at NPV and pick the project with the least negative NPV, i.e. the least cost when discounted to present value.

Plant startups present many cases where IRR calculations are misleading. Just before startup of a major facility such as a manufacturing plant, refinery or power plant, engineers and operators will go through "punch listing", in which a number of deficiencies are noted. For each of these individual deficiencies, the value of the entire production is often cited as the benefit, since the plant will not run unless the deficiency is corrected. Conventional investment analysis is meaningless in such circumstances, since no minor revamp will appear unattractive if the entire plant revenue is tied to it. However, this ultimately is an invalid test, and various other restraints (including an outright ban on revamps just prior to startup) are placed on last minute revamps to keep projects in control.

In rare cases, a company may face a mutually exclusive choice between two different investments of radically different scale. For instance, an industrial site may have only enough space left for one of two

projects, one of which is \$100 million with an IRR of 22% and the other of which is \$900 million with an IRR of 18%. If capital is not a constraint and the projects are truly mutually exclusive, then a company might pick the project with the lower return. Imagine that the weighted average cost of capital to the company is 13%. Then the large project with the lower return will create more NPV than the small project, and the company will be worth more if the larger project with the lower return is completed.

7.4.3 Accuracy of Cash Flow Forecasts and the Need for Judgment

The critical task in investment analysis is not the computation of NPV, IRR or payback, it is the assembly of a reasonable and consistent cash flow forecast. For large projects, it is normal to take cash flow forecasts out some 30 years past plant startup, or up to 35 years in total. It is a real mark of optimism that we are willing to forecast for such a long time in the future. Consider someone evaluating an energy related project 35 years ago: electricity was a regulated "cost of service" commodity, oil prices had a long stable history, natural gas prices in North America were driven by regulation. In the intervening 35 years, the oil price has soared and plunged, natural gas prices have been deregulated and have had both up and down cycles, and electrical power is rapidly being deregulated. No thoughtful forecast 35 years ago could have captured these events.

By its very nature, discounting places a lower weight on future events than on near term events, so to the extent that our forecasts of cash flow lose accuracy with increasing time, we can take comfort in the fact that errors more than 15 years after startup are of much less concern than errors in the first five years after startup. Even in the near term cash flow forecasts include a great deal of judgmental information, and they need to be thought of as "best estimates". DCF analysis is not a substitute for critical thinking, but rather an aid or stimulus to it. Senior management needs to understand what creates the value in a project, and in particular what factors would place that value at risk. Understanding long term drivers of value is crucial in assessing investment decisions.

For example, consider the generation of electrical power from a "mine mouth" surface mining coal plant. For coal, fuel price is virtually fixed at the time of the initial project, since the plant is located next to a coal mine that is developed specifically for the project, using capital equipment (trucks and shovels) that will last the lifetime of the project. The only significant cost variable in the coal price is the cost of labor, and this is minor in the overall cost of coal. So, a company building such a plant is not going to face a precipitous rise in the cost of fuel. Might the project experience a precipitous drop in the sale price of power? This would only occur if the price of some other fuel dropped, e.g. if the price of natural gas drops sharply, then power plants using natural gas as a fuel might cut the price of power to a point where a coal fired plant was a poor investment. A second risk in today's environmental/political scene is that a carbon tax would be levied on the coal fired facility because of greenhouse gas emissions issues. These two concerns, the relative price of natural gas to coal and the potential for a politically imposed carbon tax, are the real heart of the economics of a coal fired generating unit. This is the kind of issue that the engineer who is proposing the development, and the senior management who is reviewing the investment, should focus on.

Cash flow forecasts are estimates of the future. Discounted cash flow analysis is capable of very precise manipulation of numbers, and the calculation of returns to any number of decimal places. It is important to remember that the limiting factor on accuracy is not the sophistication of analysis but rather the quality of assumptions that go into the cash flow forecast, and in particular the interrelationship that

is assumed between long term costs and prices. Intuition and judgment, ultimately exercised by senior management (and a board of directors for major projects) are important elements of investment analysis.

7.5 RISK AND THE CONCEPT OF MITIGATION

All ventures have risk in them, which is why they need a return on investment higher than interest on government bonds. When we do some project, there is a small chance that it will be a complete failure; examples are the Come-by-Chance refinery in Newfoundland, which failed due to a design flaw, a dry oil or gas well, and a product that is not accepted by the market. Risk in investments leads to three strategic approaches:

- Include a contingency allowance reflecting uncertainty.
- Require a return on investment to offset the risk taken.
- Reduce risk by mitigation, i.e. take steps to reduce the likelihood or impact of potential risk factors.

7.5.1 Contingency

Contingency is simply a design allowance for unexpected costs. It normally shows up in a capital cost forecast, although it may also be used in a forecast of operating costs. Normally, the level of contingency reflects the stage of the estimate, i.e. when a project has a rough estimate based on some gross factors, contingency is high, say 30%, but when every piece of major equipment in a capital project has been specified, then contingency might drop to 20%, and when a final estimate is completed based on a full work breakdown, then contingency might drop to 10% or less. Contingency can be thought of as a “blind” allowance for risk, in that we simply use experience to estimate an allowance for what we don’t know.

“Shocks” in estimates are very difficult for an organization to deal with. If a project is expected to cost \$125 million, then this expectation gets accepted throughout an organization, from a projects group that will build the project to an operations group that is responsible for its profitable operation to the finance group that must ensure that funds are available (from debt, retained earnings and new equity) to pay for the project. A sudden rise in a capital cost estimate is a disappointment that shakes confidence in a project and creates the fear of additional shocks in the future. Contingency can be thought of as a psychological “shock absorber” that retains support for a project as unknown costs emerge and are deducted from contingency.

Sometimes projects are analyzed through a technique called Monte Carlo simulation to try to build a quantified basis for contingency. The theory is that a large team will spend time identifying risk factors at a highly detailed level and building a quantified bottoms up estimate of the dollars at risk and the probability of deviation for each element of a project. For instance, in an oil sands project each major piece of equipment, once estimated, will have some potential for a cost overrun or under run, and the team can place a “guesstimate” on the probability of this. If one goes through every element of the project, such as equipment, installation labor, required infrastructure (such as civil work to drain the site), then a large number of individual probability distributions and associated impact magnitudes can be assembled. The simulation then runs numerous cases in which random numbers are used to develop possible aggregate outcomes. By running a large number of cases one can get a sense of the probability of the overall project having a cost overrun, and tie the contingency level at time of project authorization to this. In practice,

however, Monte Carlo simulations consume enormous staff time and hide the underlying subjective judgments (of individual probabilities and magnitudes of deviation) below a sophisticated analysis. It is not unusual for the results of such a simulation to be modified by management judgment because the initial results deviate so highly from past experience. In effect, old "rules of thumb" on contingency at an overall project level are often imposed onto the Monte Carlo analysis.

Quantification of an appropriate contingency level is an area of ongoing research; company specific models based on judgments of project complexity have been tested. Any engineer going into major capital project work can expect to see ongoing evolution in analysis of contingency.

7.5.2 Risk and Expected Return

We intuitively know that the greater the risk of failure, the greater the return on investment (IRR) we are going to expect from a project, as discussed above in Section 7.1.4. Think of a company that sells a variety of materials for concrete related products that is thinking about investing \$10 million to make a fine silica dust that has an application in a particular kind of cement that is exposed to high temperatures. The existing sales force can add the product to their portfolio and the customers for the new product already buy other products from the company. Clearly, the risk of this project is less than another project that involves a totally new untested product in a new line of business. Whether the guidelines are explicit or not, almost all companies will have a higher hurdle rate of return for a risky project and a lower return for an extension to a base business. We can think of a higher return rate as a method of mitigating the impact of higher risk: if I invest in ten risky projects and three fail, the higher return I receive on the remaining seven projects compensates for the failure. This kind of logic guides "venture capital" firms that specialize in financing startups and early growth in companies.

7.5.3 Identifying and Mitigating Specific Risk Elements

Qualitative assessment of specific risk elements and analysis of specific steps to mitigate risk help a project sponsor to think through elements of risk, and help a company identify means of reducing risk. One key concept is that risk is the product of probability and consequence, i.e. we intuitively (and sometimes quantitatively) identify risk by both its likelihood and the magnitude of its consequence. While in theory we could use the numerical product of consequence and probability to quantify risk, this is not the normal means of evaluation, partly because estimates of probability are almost always based on a rough judgment and vary from person to person. Risk is most often assessed by intuitive processes.

One major supplier of technology and engineering services to international customers uses a checklist as part of its project evaluation process. For each of the following categories, the person proposing the project assesses whether the risk category applies, whether it is high, medium or low, and what mitigative measures have been taken or are proposed to reduce the risk. Note that this risk check list is applicable to an engineering contractor bidding on a job.

As noted, this list is specific to an engineering and construction company. Risk for an operating company (for example, a chemical company that is building a new petrochemical plant) is more extensive because the company must operate the facility for many years in order to realize the return on investment. Table 7.11 shows some additional operational risks.

Table 7.10: Risk Factors for an International EPC Contractor

Risk	Description	Examples of Mitigative Measures
1. Political	<ul style="list-style-type: none"> Break in political relationships or disruption of economic relationships due to political events in client or major partner or subcontractor's country; includes war, civil ware, general civil disruptions. 	<ul style="list-style-type: none"> Get a development agency such as CIDA or World Bank to guarantee. Progress payments ahead of work.
2. Bankruptcy	<ul style="list-style-type: none"> Client goes into bankruptcy or experiences severe deterioration in ability to pay. Client fails to complete their portion of scope (e.g. civil infrastructure). Bank or funding agency fails to pay. Major supplier or subcontractor goes bankrupt during construction. 	<ul style="list-style-type: none"> Guarantee by third party (e.g. government) that is more credit worthy than the client. Completion bonds for all major suppliers and subcontractors.
3. Project Cancellation	<ul style="list-style-type: none"> Project is stopped part way through construction. 	<ul style="list-style-type: none"> Guarantee by third party.
4. Delayed Start	<ul style="list-style-type: none"> Due to Non-approval or legal or regulatory challenges. 	<ul style="list-style-type: none"> Limit EPC effort to a prescribed level prior to receipt of all approvals. Make the national government of the client's country a guarantor in the event of a change in regulation.
5. Foreign Exchange	<ul style="list-style-type: none"> Non-convertibility of local currency or a wide fluctuation in exchange rate. Severe inflation in country of the currency of the contract. 	<ul style="list-style-type: none"> Hedge foreign currency by buying forward in the futures market at time of contract execution.
6. Foreign Taxes	<ul style="list-style-type: none"> Change in foreign tax regime, e.g. imposition of a tax on payments. 	<ul style="list-style-type: none"> Make the national government of the client's country a guarantor in the event of a change in taxation.
7. Enforceability of Contract	<ul style="list-style-type: none"> Possible unenforceability of contract in foreign jurisdiction. Unfair / biased dispute resolution, e.g. biased arbitration. 	<ul style="list-style-type: none"> Make a known code of law the applicable law of the contract (e.g. Canada, US or EEC). Designate an international known arbitrator. Make the national government of the client's country a guarantor in the event of a legal judgment by a court in the country of the contractor.
8. Natural Disaster	<ul style="list-style-type: none"> Flood, earthquake, storm, etc. 	<ul style="list-style-type: none"> Insurance against specified perils.
9. Loss During Transport	<ul style="list-style-type: none"> e.g. severe damage to equipment during shipping or loss of ship. 	<ul style="list-style-type: none"> Insurance against specified perils.
10. Strikes / Lock-outs / Labor Disruptions	<ul style="list-style-type: none"> Unexpected disruption in labor supply. 	<ul style="list-style-type: none"> "No strike/no lockout" contract with unions for the duration of the project. Binding arbitration procedure.
11. Major Technical Flaw	<ul style="list-style-type: none"> Major design error or construction procedure that can not be executed. 	<ul style="list-style-type: none"> Formalized internal or third party review of technical scope. Periodic "constructability" reviews.
12. Intellectual Property Infringement	<ul style="list-style-type: none"> Scope of project includes technology that is patented or copyrighted by others. 	<ul style="list-style-type: none"> Formalized internal or third party review of ownership of technology. Require all third party suppliers of technology to indemnify the project in the event of an intellectual property claim.

Table 7.11 Additional Risk Factors for Operating Companies

Risk	Description	Examples of Mitigative Measures
1. Rise in Price of Feedstock/Raw Materials/Utilities	<ul style="list-style-type: none"> Sudden unanticipated price drop that affects plant economics, e.g. power, fuel, feedstock, materials. 	<ul style="list-style-type: none"> Long term supply contracts. Hedging by purchase of futures at time of project approval. "Reopener" or escalation clauses in all sales agreements that enables price adjustment in the event of an unanticipated cost change. Long term product sale contracts.
2. Fall in Price of Product.	<ul style="list-style-type: none"> Sudden unanticipated price drop, e.g. due to subsidized offshore supplier or oversupply. 	
3. Change in Regulations During Operating Life of Plant	<ul style="list-style-type: none"> Standards are tightened (e.g. environmental). 	<ul style="list-style-type: none"> Assess likelihood that any regulatory change will apply to all suppliers (and hence be built into everyone's cost base), or whether some suppliers (e.g. offshore) will be exempt. Develop effective individual or industry based presence that can lobby. Assess full life-cycle impact of all byproducts/waste and identify site reclamation plan at time of initial project approval.
4. Change In Taxation Regime During Operating Life of Plant	<ul style="list-style-type: none"> Taxes are increased in the jurisdiction of the operating plant, or decreased in the jurisdiction of competitors. 	<ul style="list-style-type: none"> Assess likelihood that any taxation change will apply to all suppliers (and hence be built into everyone's cost base), or whether some suppliers (e.g. offshore) will be exempt. Develop effective individual or industry based presence that can lobby.

Mitigating risk is normally not free, and some judgment is involved in how much expense is warranted. Normally senior management makes such decisions, and often reviews them with a Board of Directors or a subcommittee of the Board. Engineers who propose and champion projects should do a full risk assessment and recommend mitigative measures, but they should also expect considerable discussion and modification of their proposals as a project goes through various stages of approval.

APPENDIX 7.1 TAX CONSEQUENCES OF CAPITAL INVESTMENT

Canadian tax is highly complex (the basic guidelines for completing the 1999 Business T2 form run 96 pages), and the calculation of tax for all but the most simple companies usually involves professional advisors. In addition, Canadian business tax is likely to undergo significant changes over the next five to ten years to better conform to practices around the world. Failure to consider other countries' tax policy in designing Canada's corporate taxation system runs the risk of driving companies from Canada, and a consensus is emerging that a redesign of the corporate tax system in Canada is required.

Because the corporate tax system is complex and subject to change, treatment here will be brief and is intended to illustrate the general principals of how tax considerations factor into investment analysis. Anyone doing investment analysis in a company should normally seek help in understanding the current tax position of the company and the incremental tax impact of a new investment. Key questions would include:

- Does the company have net taxable income prior to the new investment?
- Does the company have unclaimed capital cost (UCC) from its prior investments that might "shield" income from a new investment from taxes?

Canada Customs and Revenue Agency (CCRA) has put most tax forms and publications on the web. Helpful references include:

- General menu: <http://www.ccra-adrc.gc.ca/menu-e.html>
- Business menu: <http://www.ccra-adrc.gc.ca/tax/business/menu-e.html>
- Corporate income tax: <http://www.cra-arc.gc.ca/E/pub/tg/t4012/t4012-e.html>
- Corporate T2 tax return form: <http://www.cra-arc.gc.ca/E/pbg/tf/t2/README.html>
- 2004 Guide to completing the T2 form (note that Schedule 8 of this document, page 57, gives guidelines on calculating CCA): <http://www.cra-arc.gc.ca/E/pub/tg/t4012/t4012-02-e.html>

A7.1.1 Taxable Income

The fundamental concept of taxation for companies is similar to taxation for individuals: one takes revenue minus allowed cash expenses (cash income) minus non-cash charges (mainly depreciation) to calculate net income, on which a percentage is levied for taxes. There are two key differences between the treatment of income on financial statements and the treatment of income on tax statements:

- Some expenses in business, mainly a portion of meal and entertainment expenses, are recognized by accounting but not for taxation purposes. In effect, these expenses have to be added back into net income to get net income for tax purposes. For purposes of investment analysis, this effect is so small as to be non-material, and can be ignored.
- As noted in section 3.7.1, depreciation for tax purposes follows a different set of rules than depreciation for accounting purposes. Depreciation for tax purposes is called Capital Cost Allowance (CCA). The CCA from the new investment must be calculated.

A7.1.2 CCA

Capital cost allowance (depreciation for tax purposes in Canada) is calculated by class, usually on a declining balance basis. Figure 7A-1 from the CCRA 2004 Guide to completing the T2 form shows the main classes of CCA that affect investment in Canada. Figure 7A-2 shows Schedule 8 of the T2 form, which is used for calculating CCA.

Two rules affect claiming CCA:

- The available for use rule says that CCA may not be claimed until an asset is available for use, which is defined as when the asset is used to generate income or make a product or service. (One exception to this rule is discussed below.)
- The half year rule says that in the first year of usage of an asset only half the calculated CCA may be claimed. This rule reflects the fact that on average investments are available for use for half of the taxation year in which they are commissioned.

An example best illustrates how to work with CCA. Consider a company that is going to spend \$600,000 on new processing equipment to go in an existing building, and that will invest \$60,000 on new office furniture and \$70,000 on new vehicles to support the staff it will add because of the new project. What is the *incremental* CCA because of the investment?

To calculate the incremental CCA, one must first determine the class of each of the assets:

- The \$600,000 in new manufacturing assets is Class 43, with a declining balance CCA of 30%.
- The \$60,000 in furniture is Class 8, with a declining balance CCA of 20%.
- The \$70,000 in new vehicles is Class 10, with a declining balance CCA of 30%.

Table 7A-1 shows the incremental CCA that is available from just this one investment for the first six years. Note that because of the declining balance concept, incremental CCA is highest in the early years

Table 7A-1 Calculation of CCA

Year	CCA Class	Percent	Unclaimed Capital Cost St. of Yr.	Annual CCA Claimable	Half Year Rule	Maximum CCA Claimable	Remaining Unclaimed Capital Cost
1	8	20%	\$60,000	\$12,000	Yes	\$6,000	\$54,000
	10	30%	\$70,000	\$21,000	Yes	\$10,500	\$59,500
	43	30%	\$600,000	\$180,000	Yes	\$90,000	\$510,000
2			\$730,000			\$106,500	\$623,500
	8	20%	\$54,000	\$10,800	No	\$10,800	\$43,200
	10	30%	\$59,500	\$17,850	No	\$17,850	\$41,650
3	43	30%	\$510,000	\$153,000	No	\$153,000	\$357,000
						\$181,650	\$441,850
	8	20%	\$43,200	\$8,640	No	\$8,640	\$34,560
4	10	30%	\$41,650	\$12,495	No	\$12,495	\$29,155
	43	30%	\$357,000	\$107,100	No	\$107,100	\$249,900
						\$128,235	\$313,615
5	8	20%	\$34,560	\$6,912	No	\$6,912	\$27,648
	10	30%	\$29,155	\$8,747	No	\$8,747	\$20,409
	43	30%	\$249,900	\$74,970	No	\$74,970	\$174,930
6						\$90,629	\$222,987
	8	20%	\$27,648	\$5,530	No	\$5,530	\$22,118
	10	30%	\$20,409	\$6,123	No	\$6,123	\$14,286
7	43	30%	\$174,930	\$52,479	No	\$52,479	\$122,451
						\$64,131	\$158,855
	8	20%	\$22,118	\$4,424	No	\$4,424	\$17,695
8	10	30%	\$14,286	\$4,286	No	\$4,286	\$10,000
	43	30%	\$122,451	\$36,735	No	\$36,735	\$85,716
9						\$45,445	\$113,411

and drops thereafter. At the end of year six, the remaining UCC (Unclaimed Capital Cost), i.e. the amount of the initial \$730,000 of investment that has not been depreciated (written off) for tax purposes is \$113,400, or about 15%.

The exception to the "available for use" rule is when a project is declared a "long term project" for tax purposes (for example a major oil sands project that may take five years to design, build and commission). The owner can apply to have Revenue Canada treat the project as a long-term project, which allows some CCA to be claimed as early as the third year of the project against other taxable income of the company. Tax treatment in such cases is very complex, but such large projects always have sophisticated tax help available in preparing an investment analysis.

CCA rates and classes

The following is a partial list and description of the most common capital cost allowance (CCA) classes. You will find a complete list in Schedule II of the *Income Tax Regulations*.

SOURCE: http://www.cra-arc.gc.ca/E/pub/tg/t4012/t4012-05-e.html#P1389_124653

Class #	Description	CCA rate
1	Most buildings made of brick, stone, or cement acquired after 1987, including their component parts such as electric wiring, lighting fixtures, plumbing, heating and cooling equipment, elevators, and escalators	4%
3	Most buildings made of brick, stone, or cement acquired before 1988, including their component parts as listed in class 1 above	5%
6	Buildings made of frame, log, stucco on frame, galvanized iron, or corrugated metal that are used in the business of farming or fishing, or that have no footings below ground; fences and most greenhouses	10%
7	Canoes, boats, and most other vessels, including their furniture, fittings, or equipment	15%
8	Property that is not included in any other class such as furniture, calculators and cash registers (that do not record multiple sales taxes), photocopy and fax machines, printers, display fixtures, refrigeration equipment, machinery, tools costing \$200 or more, and outdoor advertising billboards and greenhouses with rigid frames and plastic covers	20%
9	Aircraft, including furniture, fittings, or equipment attached, and their spare parts	25%
10	Automobiles (except taxis and others used for lease or rent), vans, wagons, trucks, buses, tractors, trailers, drive in theatres, general purpose electronic data processing equipment (e.g., personal computers) and systems software, and timber cutting and removing equipment	30%
10.1	Passenger vehicles costing more than \$30,000 if acquired after 2000	30%
12	Chinaware, cutlery, linen, uniforms, dies, jigs, moulds or lasts, computer software (except systems software), cutting or shaping parts of a machine, certain property used for earning rental income such as apparel or costumes, and videotape cassettes; property costing less than \$200 such as kitchen utensils, tools, and medical or certain dental equipment	100%
13	Property that is leasehold interest (the maximum CCA rate depends on the type of the leasehold and the terms of the lease)	N/A

Class #	Description	CCA rate
14	Patents, franchises, concessions, and licences for a limited period; the CCA is limited to whichever is less: the capital cost of the property spread out over the life of the property; on the undepreciated capital cost of the property at the end of the taxation year Class 14 also includes patents, and licences to use patents for a limited period, that you elect not to include in class 44	N/A
16	Automobiles for lease or rent, taxicabs, and coin operated video games or pinball machines; certain tractors and large trucks acquired after December 6, 1991, that are used to haul freight and that weigh more than 11,788 kilograms	40%
17	Roads, sidewalks, parking lot or storage areas, telephone, telegraph, or non electronic data communication switching equipment	8%
38	Most power operated movable equipment acquired after 1987 used for moving, excavating, placing, or compacting earth, rock, concrete, or asphalt	30%
39	Machinery and equipment acquired after 1987 that is used in Canada primarily to manufacture and process goods for sale or lease	25%
43	Manufacturing and processing machinery and equipment acquired after February 25, 1992, described in class 39 above	30%
44	Patents and licences to use patents for a limited or unlimited period that the corporation acquired after April 26, 1993. However, you can elect not to include such property in class 44 by attaching a letter to the return for the year the corporation acquired the property. In the letter, indicate the property you do not want to include in class 44	25%
45	Computer equipment that is general-purpose electronic data processing equipment and system software included in paragraph f of class 10 acquired after March 22, 2004	45%
46	Data network infrastructure equipment that supports advanced telecommunication applications, acquired after March 22, 2004. It includes assets such as switches, multiplexers, routers, hubs, modems and domain name servers that are used to control, transfer, modulate and direct data, but does not include office equipment such as telephones, cell phones or fax machines, or property such as wires, cables or structures	30%

CCA Form source:

<http://www.cra-arc.gc.ca/E/pbg/tf/t2sch8/t2sch8-99e.pdf>

A7.1.3 Tax Rates

As noted above, tax rates are subject to change, so when analyzing an investment check for the most recent rates. All rate information discussed below is valid as of July 2000, and is drawn from Ernst and Young's rate card.

Rates for taxation of business income depend on which of four categories a business fits into:

- Canadian Manufacturer and Processor eligible for the small business deduction (SBD) on the first \$200,000 of taxable income.
- Canadian Manufacturer and Processor either not eligible for the small business deduction or eligible but with income over \$200,000.

Table 7A-2 Corporate Income Tax Rates in Canada, July 2000 (Source Ernst & Young)

INCOME ALLOCATED TO	MANUFACTURING AND PROCESSING INCOME		OTHER INCOME	
	ELIGIBLE FOR SBD	EXCESS	ELIGIBLE FOR SBD	EXCESS
NFLD.	18.12%	27.12%	18.12%	43.12%
P.E.I.	20.62	29.62	20.62	45.12
N.S.	18.12	38.12	18.12	45.12
N.B.	17.62	39.12	17.62	46.12
QUE.	22.13	31.13	22.13	38.13
ONT.	20.45	34.95	20.45	43.95
MAN.	20.12	39.12	20.12	46.12
SASK.	21.12	39.12	21.12	46.12
ALTA.	19.12	36.62	19.12	44.62
B.C.	18.24	38.62	18.24	45.62
N.W.T.	18.12	36.12	18.12	43.12
NUNAVUT	18.12	36.12	18.12	43.12
YUKON	15.62	24.6	19.12	44.12
NON-RESIDENT	N/A	N/A	N/A	39.12

- Other company eligible for the small business deduction on the first \$200,000 of taxable income.
- Other company not eligible for the small business deduction or eligible but with income over \$200,000.

Table 7A-2 shows the corporate income tax rates for each of the provinces for the four categories of companies. Note that when a company is eligible for the SBD, it applies only to the first \$200,000 of taxable income. The test for the small business deduction is that one must be a Canadian controlled private corporation with capital less than \$15 million. The SBD is reduced if capital is between \$10 million and \$15 million. The test for the Manufacturing and Processing Income rate is that the company must derive at least 10% of its gross income from manufacturing or processing goods in Canada.

There are many exceptions and provisions that further complicate corporate tax, especially for new companies, but the values in Table 7A-2 can be used for investment analysis.

A7.1.4 Tax Payable and After-Tax Cash Flow

For investment analysis, we are concerned with incremental effects: what is the incremental after tax cash income that I would have if I made an investment? The incremental after tax income is the incremental pre tax income less the incremental tax. How much tax is payable? This depends on the tax position of the company prior to the investment and how much income the investment generates. One can always do a rigorous calculation of taxes payable by the overall company with and without the investment, and this is the proper course of action to follow if the taxes payable are uncertain. However, in most cases one can shorten this process.

There are two questions to ask:

1. Does the income generated by the incremental investment prior to the deduction of CCA exceed the incremental CCA in all years?
2. Is the company, prior to the investment, fully taxable at its highest marginal rate?

The most common for the purchase of new equipment by a large company (and hence the most common case encountered by engineers doing investment analysis) is yes to both of these questions. In this case, the incremental tax payable is simply the marginal rate of taxation of the company times the net taxable income after deduction of CCA. Thus, one calculates incremental pre tax cash flow from the investment, deducts incremental CCA on a year by year basis, calculates and subtracts the tax payable at the marginal rate on a year by year basis, and does a DCF analysis on the resulting after tax cash flow.

For the case of the investment of \$600,000 in Class 43 assets, with an additional \$130,000 investment in furniture (Class 8) and vehicles (Class 10) as described above, assume that the company making this investment is Alberta based and publicly traded (hence no SBD) and fully taxable at the Manufacturing and Processing rate (36.62%) prior to the investment and that the investment yields an incremental pre tax cash income of \$190,000 per year. Table 7A-3 shows the calculation of after tax cash flow for this case, using the CCA calculations from Table 7A-1.

What if the company's available CCA shield is greater than its taxable income both before and after the investment, i.e. it has no reportable tax income because its existing available CCA is greater than its existing cash income? Then the incremental income from the new investment will not incur tax until the excess CCA available is used up. This needs to be reflected in the cash flow, and in this case one should build up a taxes payable table with and without the investment, to document the incremental effect.

What if the project does not have enough income in its early years to soak up the available incremental CCA (which often happens when a new plant is being used to slowly build up a market)? Then the available CCA from the incremental investment can be used to reduce taxes from the existing income of the company. This needs to be reflected in the cash flow, and in this case one should build up a taxes payable table with and without the investment, to document the incremental effect.

In assessing the tax effects of incremental investment, engineers working in a large company will usually get help from a finance group and engineers working in smaller companies will normally get help from an accounting firm that does the company's books and tax returns. For preliminary assessment of investment, it is conservative to assume that the incremental income after deduction of CCA is fully tax-

Table 7A-3 Calculation of After-Tax Cash Flow

Year	Pre-Tax		Taxable Income	Tax Payable	After-tax Cash Flow
	Cash Income	CCA Available			
1	\$190,000	\$106,500	\$83,500	\$30,578	\$159,422
2	\$190,000	\$181,650	\$8,350	\$3,058	\$186,942
3	\$190,000	\$128,235	\$61,765	\$22,618	\$167,382
4	\$190,000	\$90,629	\$99,372	\$36,390	\$153,610
5	\$190,000	\$64,131	\$125,869	\$46,093	\$143,907
6	\$190,000	\$45,445	\$144,555	\$52,936	\$137,064

able, but in reality one can often obtain DCF values that are even higher by applying otherwise unused CCA towards existing company income.

A7.1.5 Other Tax Factors

A7.1.5.1 Investment Tax Credit

Certain investments will trigger an investment tax credit, which is in effect a reduction of a company's taxes payable in the year in which an investment is made. Governments use investment tax credits as a means of stimulating investment. For example, in Canada one can earn an investment tax credit for investment in certain science and research type activities, and for investment in economically depressed regions of the country.

One can make the interesting psychological and political observation that a dollar of tax revenue not collected by a government is far less difficult to justify than a dollar of revenue collected and then rebated by a grant program. Tax credits can be thought of as a "negative tax".

Investment tax credits are subtracted from the capital cost of an item for purposes of calculating CCA. If you buy something for \$500,000 and get an investment tax credit from the Federal Government of \$150,000, then as far as the Government is concerned the value of the asset (the initial UCC) is \$350,000.

A7.1.5.2 Negative Taxable Income

Tax cannot be negative, i.e. a government does not send a company that is losing money a check for this year's taxes. However, tax losses can be carried forward for seven years, i.e. they can accumulate and be used to offset future income for up to seven years. They can also be rolled backward for three years, i.e. if a company had paid taxes in any of the previous three years and then loses money it is possible to recover some prior taxes paid. For incremental investment, one can carry a loss forward in the calculation of tax. For a roll back of previous paid taxes, one would need help in assessing the impact on cash flow.

A7.1.5.3 Tax Effects on Sale of an Asset

We noted in Chapters 3 and 4 that an asset is carried on a company's books at a book value, which is the original cost less depreciation. (In rare cases, the book value will be reduced by a writedown if the asset can no longer generate revenue.)

For tax purposes, there is an equivalent "tax book" value of an asset, which is the undepreciated capital cost (UCC). The adjusted cost base is usually just the original cost of the asset.

When an asset is sold, tax treatment is quite complex and depends on whether the asset is in a CCA class with other assets or not. In practice, the tax treatment of disposition at the end of a project has little impact on the IRR or NPV of the project because it occurs so far out in the future that its impact is discounted. Typically the error introduced by ignoring tax treatment of the disposition of Class 43 manufacturing assets can be safely neglected in a DCF analysis.

However, one can estimate tax impact, especially in a large company, by considering six tax situations, as shown in Table 7A-4. The important concepts are:

- When a non-depreciable asset is sold below its adjusted cost base (the original purchase value), a capital loss occurs. When a non-depreciable asset is sold above its adjusted cost base, a capital gain occurs. A non-depreciable asset sold at exactly its purchase cost creates neither a gain or loss for tax purposes.

- Capital losses can only be incurred from a non-depreciable asset, such as land, that is sold at a loss. Sale of a depreciable asset (such as a building or machine) at a loss does not trigger a capital loss.
- Capital losses can only be applied to offset capital gains; they cannot be used to offset taxable income.
- We distinguish two treatments for the sale of depreciable assets. One treatment occurs if there are other assets in the same CCA pool (this is the most common situation for ongoing companies). The other treatment occurs if the asset being sold is the final item in the CCA class, i.e. there are no remaining assets in the CCA class after the asset is sold.
- If there are other assets in the CCA pool:
 - The sale value of the asset up to the adjusted cost base (usually the purchase cost of the asset) is used to reduce the CCA pool.
 - Sale value above the adjusted cost base is treated as a capital gain.
- If there are no remaining assets in the CCA pool then Table 7A-4 does not apply. Instead:
 - Sale value below the remaining value in the CCA pool creates a terminal loss which can be deducted from taxable income for that year.
 - Sale value above the remaining value in the CCA pool up to the adjusted cost base of the asset is treated as income, i.e. the remaining value in the CCA pool is subtracted from the sale proceeds, and the balance up to the adjusted cost base of the asset is treated as taxable income.
 - If the asset is sold above its adjusted cost base, the portion of the sale value above the adjusted cost base is treated as a capital gain.

Table 7A-4 Tax Treatment of Sale of Assets Assuming a Large Fully Taxable Company With Ongoing Assets in the CCA Pool from Which the Asset is Being Sold

Case	Designation	Tax Treatment
Non-depreciable asset is sold below its adjusted cost base (ACB), which is the original purchase value.	The difference between sale value and ACB (original purchase value) is a capital loss.	Capital loss can be used to reduce capital gains from the sale of other assets. In effect, taxes are reduced by the marginal tax rate times 1/2 of the capital loss, but only if there are capital gains. Capital losses can be carried forward indefinitely and can be carried back for three years.
Non-depreciable asset is sold at its ACB.	Neither a gain or loss is created for tax calculations.	None.
Non-depreciable asset is sold above its ACB.	The difference between sale value and ACB is a capital gain.	
Depreciable asset is sold below its ACB (usually the original purchase cost).	There is no capital gain or loss on the sale.	The balance in the CCA pool is reduced by the sale proceeds.
Depreciable asset is sold at its ACB (usually the original purchase cost).	There is no capital gain or loss on the sale.	The balance in the CCA pool is reduced by the sale proceeds.
Depreciable asset is sold above its ACB (usually the original purchase cost).	There is a capital gain on the sale of the difference between the sale value and the ACB.	Capital gain is taxed at 1/2 of the marginal tax rate. The balance in the CCA pool is reduced by the ACB.

- Hence, capital gain for tax purposes is any portion of the sale value in excess of the original purchase price. Capital gains are treated separately from income for businesses, much as they are for individuals. Capital gains are taxed at 1/2 the rate of income. Capital gains were once taxed as income, then the tax rate was first reduced to 2/3 that of income, and now it is 1/2. Occasionally there are proposals to eliminate all tax on capital gains.

PROBLEMS

- 7.1** You and your "significant other" are contemplating the purchase of a home. Your combined family income is \$80,000 per year. You know that mortgage lenders use a rule of thumb that the limit on the size of a mortgage loan is that no more than 30% of a family's income should go to the payment of principal and interest (PI, also sometimes known as IP). What is the maximum purchase value of a home that you and your partner could purchase assuming that you have a 10% down payment through savings? Answer this question for four cases: 20-year amortization and 30-year amortization, and mortgage interest rates of 7 and 11%. To make this problem easier, assume one annual mortgage payment instead of 12 monthly payments per year.

It may help to review Appendix 3.3 of the notes in setting up this problem. Note that you know the payment and the interest rate, and are using a "goal seek" or "solver" subroutine to set the remaining balance to zero at the end of the loan term. Also, note that sometimes lenders apply the 30% rule to the total payment of principal, interest and property taxes (PIT, also sometimes known as IPT), since unpaid property taxes are a claim on the property that ranks ahead of the mortgage lender.

- 7.2** Your uncle, a farmer, wins a lottery and is offered a choice of a cash payout: either 10 annual payments of \$13,000, with the first installment paid immediately, or a lump sum payment of \$100,000. Your uncle is very conservative and would simply invest the money in a bank account or a conservative bond mutual fund (that would allow annual withdrawals) if he takes the lump sum payment. He wants to use the money over a ten-year period, but doesn't know if the stream of payments is a good or a bad deal. Your uncle asks for your advice.

What is the effective discount rate being offered? What do you recommend to your uncle if the entity offering the stream of payments is a provincially guaranteed lottery corporation? If it is a local charitable group? In one sentence, if your advice is different based on the guarantor of the payment, why? Assume that the "going rate" of a bond mutual fund is 6%, which is the current interest rate on provincial and government bonds that the fund invests in, and that the current interest rate for bank deposits is 3%.

Would your advice be different if the \$13,000 payment stream was paid at the end of each year? What is the effective discount rate in this case?

- 7.3 a)** You are contemplating the purchase of a company that has a \$600,000 "balloon payment" on debt due in four years. Interest on the original loan is calculated at 8.5%, and interest payments are current, i.e. all interest payments have been made. As part of your plan to purchase this company, you are contemplating paying off the debt early in order to take out a larger long term debt with longer repayment provisions, at the current long term interest rate for company borrowing of 7.5%. What payment would be a fair offer to repay the balloon payment, assuming that you are going to refinance the new long term debt from the same financial institution at current rates?
- b)** You are contemplating the purchase of a company that owes a lender 9 equal annual payments of \$100,000, with the first one due in one year's time. The company can not be sold without consent of this lender, and you are planning to meet the lender to discuss your plans to purchase and to seek consent. What is a fair offer to payout this debt? In answering your question, pick a value of i and justify it (one or two sentences).
- 7.4** A 10-year bond was issued two years ago with a face value of \$1000 and an annual coupon (interest payment) of 6%. Two years later higher inflation and a surge of borrowing in a strong economy has shifted the market interest rate for eight-year bonds to 9.2%. What is the market value of the bond? Assume that you are at the start of year three, i.e. the second interest payment was just made. Does the higher interest rate today vs. two years ago increase or decrease the face value of the bond?

Now repeat the same exercise for a 20-year bond, i.e. determine the market value of a 20-year \$1000 bond with a six percent annual interest rate two years after issue when the market rate of interest for 18-year bonds is 9.2%. Is the impact of changing interest on bond value greater or less for increasing term?

- 7.5 You own a small fabrication shop that has specialized in custom work for construction projects, i.e. you cut, bend and weld components to specifications of others. You are contemplating purchasing a CNC water jet cutter machine. This machine uses an ultrahigh pressure water stream with suspended fine grit to cold cut materials. It is especially useful in alloy work and in cutting of intricate patterns architectural materials such as marble, since in each of these applications the heat generated by other cutting techniques is harmful (changing the properties of the alloy and discoloring the architectural materials).

You have the following estimates for the machine; you consider the estimate of saleable hours to be rough:

• Installed cost	\$112,000
• Operating cost	\$31/hr (includes maintenance and power)
• Saleable machine hours	
• Year 1	800
• Year 2	1200
• Year 3+	1450
• Useful life of the machine	15 years

At the time you are contemplating this decision the going interest rate for long term debt to your company that would be secured by assets is 8.5%. You have not yet had discussions with your bank about financing, but your business has done well and has significant room on its bank credit line.

How would you price the machine, i.e. what charge out rate per hour would you propose for the machine? In answering this question, specify and justify a discount rate (one to two sentences). Since hours are increasing over the first two years, would it make sense to have an initial higher price followed by a lower price?

Ignore inflation in your analysis, i.e. do the analysis in present dollars and assume that minor inflationary costs (increase in operating costs) can be passed on to customers. Also ignore tax (i.e., the discount rate you specify is a pre-tax return). Note that this problem does not require the calculation of any interest payment owing to others, i.e., you would use the same approach to this problem regardless of whether you financed the purchase by equity (your own money), debt (other peoples' money), or a combination of the two. The interest rate quoted above is included simply to help you set an appropriate time value of money.

- 7.6 You are working up a detailed cash flow forecast for a large and complex capital investment that involves building a new electronics manufacturing facility.
- Your accounting department advises you that the project will be charged \$400,000 per year as an allocation of existing head office overheads. This is your project's share of the head office executive and finance department. Do you include this amount as a negative entry in your cash flow statement? Why?
 - The manufacturing is "super clean", and you know that once every two years the plant will be shut down for two months for a cleaning and an overhaul of the clean room support equipment. The cost of the overhaul is \$14 million. Your accounting department tells you that it will create a "reserve", i.e. a non-cash charge against income, of \$7 million per year to smooth the impact of this shutdown. What does your cash flow forecast show as shutdown expense: \$14 million every other year, or \$7 million per year? Why?
 - Your company pays an annual cash payment of \$6 million to a fund as a security that the site will be cleared and restored at the end of the life of the manufacturing plant. Your accounting department says that if the new manufacturing facility proceeds it must contribute \$1 million per year to this fund? Do you factor this into your cash flow forecast? Why?
 - Over the past two years your company has spent \$12 million in development costs on this project, including R&D, architectural fees, environmental studies and engineering. The capital cost of completing the project is \$78 million. Do you factor the \$12 million into the cash flow forecast you will use to determine an IRR?

- 7.7 A northern mining project producing a nickel/cobalt concentrate has a capital cost of \$5.242 million, consisting of the following assets by class. The project starts in November of last year, and the company's financial reporting period is January 1 to December 31.

- What is the maximum incremental Capital Cost Allowance arising from this investment that can be claimed over the next 10 years, with the financial year of 'last year' being year 1.
- In what year does the maximum CCA claim occur, and what percentage of the initial investment is it?
- After 10 years, what percentage of each asset class is not yet depreciated for tax purposes?
- After 10 years, what percentage of the overall assets are not yet depreciated for tax purposes.

In answering, remember the half-year rule. Note that this is a repetitive problem as illustrated in Table 7A-1; it can be made much easier by copying year two repeatedly!

Item	CCA Class	Amount
Building (cement)	1	\$821
Aircraft	9	\$1,209
Large Trucks	16	\$824
Parking Area	17	\$180
Process Machinery	43	\$2,208
		\$5,242

- 7.8 Prepare a ten-year after tax incremental cash flow (i.e. ten years of production after startup, or a total of 12 years of cash flow) and discounted cash flow forecast for the project of problem 7.7, given the following additional information:

- The company's minimum acceptable rate of return for northern mining projects is 14%.
- The project construction takes two years, with 50% of the capital cost spent in each of the two years.
- The design throughput of the plant is 1,200,000 tonnes of concentrate per year.
- The expected production buildup is 80% of design throughput in year 1, 85% in year 2, 90% in year 3, 95% in year 4, and 100% in year five and thereafter.
- The estimated sale value of the concentrate is \$6 per tonne FOB Winnipeg.
- The variable operating cost is \$3.24 per tonne which includes shipping to Winnipeg.
- The fixed operating cost is \$1,620,000 per year.
- The corporate tax rate is 40%.

Given that information:

- What is the NPV at 14% (the company's MARR)?
- What is the IRR?
- How much does the IRR increase if capital cost is reduced by 10%? (Note, do not adjust CCA. This makes the calculation approximate, but the purpose of the sensitivity is to get an indication of the impact, and you can get an indication without a great deal of rework by ignoring the tax impact.)
- How much does the IRR increase if the variable operating cost is reduced by 10%?
- How much does the IRR increase if the price per tonne of concentrate increases by 10%?
- How much does the IRR increase if the corporate tax rate drops to 25%?
- How much does the IRR increase if the production profile changes to 90% in year 1 and 100% in year 2 and after?

Note: in setting up this problem, it is very important that you carry the main variables as single cells, and then refer to these in your year-by-year calculations. This will allow you to do the sensitivities in less than two minutes per case. Your spread sheet should include capital cost, production (tonnes), gross revenue, variable operating cost, fixed operating cost, pre-tax net cash flow, CCA (from problem 7.7), tax, after tax cash flow, and discounted after tax cash flow. Make year 1 the first year of production, which means that the capital will be spent in years -1 and 0.

When you have calculated the sensitivities, give some thought to what you would focus on if you were the person responsible for this project. Would you recommend the project? With whom would you spend the most time or effort to improve the return from this project?

- 7.9 A) You work for a large manufacturing company that has a high cash flow from previous investments and is actively looking for opportunities to invest. The concern of the senior management is that the company will have its assets depreciate and may fail to reinvest to sustain income in the future. The company has directed that all investments in its business line above a MARR of 14% should be pursued.

You have developed two cases for investing in a new assembly line. The first case has a lower degree of automation and hence has lower capital cost and higher operating costs (due to higher operating labor costs). The second case has a higher degree of automation and hence has a higher capital cost and lower operating cost. You have carefully worked up the following detailed cash flow forecasts for the estimated 15 year life of the equipment.

Which case do you recommend? Why?

Year	Low		High	
	Automation		Automation	
	Case	Case	Case	Case
	Cash Flow		Cash Flow	
Year	FV, \$ M		FV, \$ M	
-1	\$9.1		\$16.2	
0	\$57.4		\$81.4	
1	\$14.8		\$20.2	
2	\$16.2		\$21.6	
3	\$17.5		\$22.9	
4	\$18.5		\$23.9	
5	\$18.5		\$23.9	
6	\$18.5		\$23.9	
7	\$18.5		\$23.9	
8	\$18.5		\$23.9	
9	\$18.5		\$23.9	
10	\$18.5		\$23.9	
11	\$18.5		\$23.9	
12	\$18.5		\$23.9	
13	\$18.5		\$23.9	
14	\$18.5		\$23.9	
15	\$18.5		\$23.9	

- B) Would your answer be any different if your company had many opportunities to invest and very limited funds for capital investments? Why?
- 7.10 Your company is looking at acquiring a deep oil well in a region near some existing producing wells. The well being considered is projected to have a flat production profile for its remaining 12 years of life. You have the following information:
- The acquisition cost of the well is \$1,000,000.
 - Royalties are 40% of gross production, i.e. the Province (which is the owner of the resource) requires that 40% of gross revenue be paid as a Royalty fee for the right to extract the oil.
 - Operating costs are estimated to be labor at \$40,000 per year, parts and supplies at \$60,000 per year, and electrical power at \$200,000 per year.
 - Your company assumes a general inflation rate of 2% per year, i.e. all ongoing expenses and revenues are inflated at 2% per year. If the purchase is treated as year zero (i.e. at the end of year zero), then the first year's expenses and revenue are as stated above, and in year two and beyond they are increased by 2% per year.

- Projected gross revenue is \$800,000 per year.
- The effective CCA rate is 24% declining balance and the effective tax rate is 20%.
- Your company's MARR is 15%.

For a base case, set up a cash flow forecast and calculate IRR, NPV at the MARR, and simple payback. Also calculate a discounted payback using the MARR as a discount factor. Do you recommend the investment?

A Vice President of Energy Supply in your company is concerned about power price. Specifically she believes that electrical power may experience a far higher escalation (inflation) rate than other factors due to the application of Greenhouse Gas Emission controls. She asks you to run a case in which all other factors stay the same as the base case except electrical power expense, which is escalated at 6% per year. For this sensitivity case, calculate IRR, NPV at the MARR, and simple payback. Also calculate a discounted payback using the MARR as a discount factor. Do you recommend the investment?

In your personal opinion, is the sensitivity case realistic (one to three sentences)?

Note: As with other factors in cash flow spreadsheets, it is not unusual for sensitivities to be run on different inflation assumptions. To make it easier to work with these sensitivities, enter the general inflation factor (2%) in a single cell, then refer to that cell in your inflationary calculations. Then, you can run a different inflationary assumption by changing a single cell, not rewriting numerous formulae in the spreadsheet.

VALUATION, SALE AND CYCLICAL PATTERNS IN BUSINESS

8.1 OVERVIEW OF VALUATION

Valuation is a subject complex enough to warrant its own course, and in these notes we only superficially address some issues that affect valuation.

At a general level, one can approach valuation from two fundamentally different concepts:

- What are the assets of the business (tangible and intangible) worth from the perspective of their purchase/replacement cost?
- What is the business worth from the perspective of its earning power?

These two approaches often lead to different answers. For example, in the extreme one could spend a great deal of money buying an ice manufacturing facility and installing it in Antarctica. The installed cost of the assets would be substantial, but the earning power of the assets is negligible.

As a general rule, it is the *long term* earning power of a business that is critical in setting value. Cyclical industries (such as most commodity industries) may have negative earnings for significant periods of time, but it is the belief that the price of the commodity will increase in the future, leading to positive earnings, that sustains value in a downturn. Publicly traded companies will at times trade below the replacement value of the assets they hold, or even below their book value (which should always be a conservative value), but this is not typical if the industry and company are each seen as going concerns.

High tech businesses often have negligible fixed asset values compared to their market capitalization, especially in the case of information-based business. Compare Microsoft and GM, for instance. GM uses \$37 billion of fixed assets to generate \$3 to \$6 billion per year in net income. Its market capitalization is about \$50 billion. Microsoft uses \$1.5 billion of fixed assets to generate \$3 to 5 billion in net income, and has a market capitalization of \$75 billion, reflecting in part its consistent *growth* in earnings. The information revolution has forced us to think of business value unrelated to fixed assets.

8.2 FUNDAMENTAL CONCEPTS OF VALUATION

8.2.1 Asset Versus Share Sale and Its Impact on Tax and Liability

The first fundamental "watershed" decision when buying or selling a business is what is for sale, the assets of the business or the business itself. In either case, one presumes that the overall business is changing hands and that the existing owners are getting out of the business. However, there is a significant tax impact depending on what alternative is chosen.

If assets are sold, then they are free of the previous company debt and can be refinanced by the new owners. (The sellers normally pay off any debt that had been secured by the assets being sold.) The assets

"regenerate" CCA at their fair market value. Thus, if assets are sold for a fair market value of \$5 million and they had been depreciated for tax purposes down to a remaining Unclaimed Capital Cost of \$1 million, the purchaser will be able to start claiming CCA from a value of \$5 million, not \$1 million. The seller will have "recaptured" CCA of \$4 million, which will be treated as income for purposes of tax calculation. Thus, sale of assets will normally give a purchaser relief on taxes and will give the seller taxable income.

If a company is sold, the purchaser assumes the tax position of the company as is. In the example above, the purchaser has \$1 million in remaining value for the asset, even though its fair market value is \$5 million. The purchaser has a new "adjusted cost base" for the shares, and the seller will have a capital gain on the shares of the company. Capital gains are normally taxed at a lower rate than income, so this is a benefit to a seller. Thus, sale of a company will normally give a seller relief on taxes and will give the purchaser more taxable income.

In companies, losses or expenses can be used to offset earnings, thereby reducing tax. The Revenue Canada rule for buying a company in entirety and "merging" it for tax purposes is that if a loss is being captured, the company being bought must be in a "like business" to the buyer. This stopped the practice of failed companies with tax losses being bought by any firm just to reduce the tax that would otherwise be paid. Capturing tax losses, however, is still a powerful reason for some company purchases. In such cases, the buyer often has no intention of using any of the assets of the company being purchased; the only "asset" of value is the tax loss.

If a company is bought, then the buyer assumes all of the historical liabilities of the company including debt. Thus, if a product made five years ago fails and causes severe damage, then it is the company that is sued, regardless of the change in ownership. It is common in the case of the sale of companies for the seller to "indemnify" the buyer against legal actions that arise from prior to the time of sale, but if the seller goes bankrupt, this indemnification is of no value.

These factors play a major role in determining value, and anyone buying or selling a business should get professional help from both an accounting and a legal firm to identify all of the options and sort out all of the issues that arise in a sale situation.

One final comment is that tax treatment is subject to a test of "fair market value", coupled with what is known as the "anti-avoidance rule". Any attempt to skew the value of a company or its assets at time of sale that creates a deferral or avoidance of taxation is subject to reversal. In practice, sale between parties that are truly "arm's length", i.e. not related, are rarely subject to review because the presumption is that their interests are competing rather than aligned. Sale between related parties (e.g. blood relatives or partners) is more likely to be reviewed.

8.2.2 EBIT and EBITD as Drivers of Value

Valuation of a business with a steady income is relatively straightforward: how much will the business earn in the future. This can be done based on a detailed projection of future cash flow, which in turn derives from the development of pro forma income statements and balance sheets. In practice, many small businesses with a reasonably long operating history are valued based on their earnings before interest and taxes (EBIT). EBIT measures the ability of a business to generate earnings before any financing or tax charges are levied on the business. This is particularly relevant if assets are going to be sold, since the financing will normally be quite different for the buyer of the assets than the seller. Hence, the interest payment is not of concern to the buyer, who will have a different interest expense depending on the type of financing put in place.

What "multiple" of EBIT a business is worth depends on the interest rates at the time of sale and on the perception of the likelihood of growth in EBIT. For small business, values from three to seven times EBIT are quite common. Special circumstances can drive this number higher.

The low end of EBIT multiples reflects businesses with low barriers to entry. "Barrier to entry" is a measure of the difficulty for a new entrant to come into the same business; it often reflects capital intensity, or the amount of fixed or total assets required per dollar of sales. At one extreme, a personal service offered in the home (such as housecleaning) has no real barrier to entry; any person wishing to clean houses can put up a sign in a grocery store and enter the business. At the other extreme, entering the new car manufacturing and sale business has huge barriers to entry: not just the capital intensive manufacturing facilities, but also the sales dealership network and new car financing program would have to be recreated by a new entrant.

Using EBIT as the driver of value has an implicit assumption in it, namely that depreciation will more or less match the ongoing need for investment. Remember from investment analysis that investment decisions are made on the basis of discounted cash flow, not income. EBIT is a measure of pre tax cash flow for a business where reinvestment matches depreciation. In special circumstances a buyer may be able to convince himself that no significant new asset purchases will be required for a long period of time. An example of this is the sale of a business during a cyclical downturn, when there is a high surplus of capital equipment. In this case, buyers will sometimes value a business on multiples of EBITD, earnings before interest, taxes and depreciation. This is equivalent to pre tax cash flow for a business that does not require reinvestment in new assets.

8.2.3 Replacement Value of Assets as an Alternative to Earnings Multiples

There are two circumstances where earnings tests fail. The first is a startup company that has the prospect for growth in sales but has not yet reached break even. The second is a company in a cyclical industry that is in a downturn and that has depressed earnings or even a loss. Such downturns are common in the resources industries.

A buyer in such a circumstance will frequently look at the replacement value of the assets as the driver of value. It is important to recognize that replacement value is used in the broadest sense, not just to buy the equivalent equipment to the company being sold, but also to build up knowledgeable staff and "intangible" benefits such as know how, customer lists, etc. Particularly for start up technology projects that are not truly capable of being protected by a patent, cost and time to develop a competing product are costs that a buyer weighs against the purchase price of a company.

Replacement value of assets in effect measures the barrier to entry: if I wanted to enter this business and not buy your company, how much would it cost?

8.3 OTHER CONSIDERATIONS IN THE VALUATION, SALE OR PURCHASE OF A BUSINESS

8.3.1 Consistency and Quality of Records

Nothing better helps the seller of a good business than good financial records that allow year-by-year comparison, especially for the income statement. This comment would seem obvious, but in reality obscure and inconsistent financial records going back a short period of time (to the most recent legal reor-

ganization of the business) are often all that a buyer has to go on. The impact of this is overwhelmingly to depress the sale price of the business.

8.3.2 Management "Bonuses" and Other Small Company Issues

As discussed above in Appendix 4.1, owner/managers of small businesses in Canada get better tax treatment if they take money out of a company as a bonus (income) than if they allow the money to be taxed within the company and paid out as a dividend. Thus, it is normal to see a small owner-managed business with a very low ongoing EBIT and a high salary bill. What the owners who are selling such a business will often do is add back in *all* owner compensation to give an adjusted EBIT. What the buyer should do is assume that if she/he works full time at the business then a "normal" salary is warranted and a legitimate charge against earnings, so that the adjusted EBIT would remove "excess" owner/manager compensation. When money has been removed from a company as expense (for example, a condominium in a warm location that is charged to the business), a buyer will have to make careful judgments about the true historical earning power of a company.

To someone operating a company, there is a lesson here: when a business is being sold, a cluttered analysis of lots of dubious expenses as being legitimate "add backs" to EBIT is a tough sell. Clean books make clean sales, and good books make good sales. If an owner thinks she/he is going to sell a business within five years, then keeping consistent and fully appropriate books is a good strategy for maximizing value.

8.3.3 Strategic Versus Financial Purchase

Buyers of a business whose initial intent is to continue to operate the business as is, perhaps with a vision of expanding the business in the future, are "financial" buyers, motivated by the ability of the business to make money "as is". From a seller's perspective, it is ideal to find a "strategic" buyer, one who can find some synergy between the current business and other operations.

This is perhaps best illustrated by an example. An Alberta oil patch product and service company was sold some years back by a major multinational firm. Management led a leveraged buy out bid, backed by a combination of debt and venture capital plus management equity. The venture capital firm was inherently a financial buyer, not motivated by synergies with other operations but rather looking for the business to be profitable and give a return "as is". A second bidder was a large US firm with a product line that in some areas complemented the products and services of the business being sold. Specifically, the US bidder thought that products from the Canadian firm could go to market through its existing US distribution channels, and products from the US firm could go to the Canadian market through the business being sold. A substantial premium was paid by the strategic buyer relative to the bid made by management, because of the anticipated synergies.

From the perspective of a seller of a business, efforts to identify a strategic buyer will normally boost the sale price of a business.

8.3.4 The Acquisition of Publicly Traded Companies

Two comments need to be made about publicly traded companies, i.e. those whose shares are traded on a recognized regulated stock exchange.

For the purchase of a publicly traded company, shareholders normally expect a premium to the current market value of the shares, i.e. a premium to the value that the market places on the company. Since the value that the market places on the company is a "consensus" view of the financial value of the company, most takeover bids for publicly traded companies are inherently from a "strategic" purchaser.

When publicly traded companies purchase a business, they need to be well informed on the likely impact on their share price of the purchase. When one publicly traded company offers to buy another publicly traded company, it is not unusual in the very short term for the share price of the target company to rise and the share price of the offering company to drop. In the mid to long-term, issues of sales, sales growth, and earning per share become critical to share price impact. Evaluating these is normally done with the help of skilled advisors.

8.3.5 Breakup Value: A Special Case

Bankers are concerned with loan security (the certainty that the interest costs will be serviced and the principal recovered). Banks also lend to so many businesses that they are no strangers to business failure, where a business is not sustainable and a receiver is appointed to sell off the assets and return as much as possible to the creditors of the business. In such cases, experience says that the breakup value of a business rarely exceeds the book value of the assets, and more typically would be some percentage of the book value (ranges of 50 to 80% are typical, but lower recoveries are possible).

Many factors influence the extent of asset recovery on business failure. For example:

- Is the business failure part of a general decline in the industry, or is it due to factors unique to just one company? If there is a general decline, often competitors will not be interested in the inventory fixed assets because they are carrying surplus inventory and their own fixed assets are underutilized. The rapid decline in energy prices in the 1980's led to many business failures, for example in the drilling sector. At times, rig utilization rates were so low that there was negligible interest amongst survivors in bidding on rigs. In the extreme case, working rigs were sold at 4 cents per pound and immediately hauled to scrap yards!
- Is the customer base of high integrity? Sometimes businesses take the bankruptcy of a supplier as an excuse not to pay for the last orders that they received from the supplier. In general, to the extent that the customer base is numerous small customers vs. a few large customers, this is more likely to be a problem.

Breakup values are not a normal part of business valuation because most sellers of a business are concerned with receiving value for a "going concern", but it is an approach to valuation in special cases of distressed businesses.

8.4 SOME COMMENTS ON STOCK MARKETS AND STOCK AND BOND VALUES

8.4.1 Securities (Stock) Markets

Securities markets, commonly known as **Stock Exchanges** or **Stock Markets**, are a key part of the ability of companies to raise equity for capital projects. Over time, countries have recognized that if stock markets are regulated to be fair and visible, then ordinary small investors will feel comfortable in putting

their savings into the purchase of shares in companies. Small investors want many things: honesty, no unfair "insider trading" based on advance knowledge, clear disclosure of information, and liquidity (the ability to sell shares on short notice when they need the money for other purposes).

Stock markets have been increasingly regulated to ensure that fairness and visibility are maintained. There are strict disclosure rules for any **prospectus** (a document circulated to investors outlining a new investment opportunity). These rules are so strict that entrepreneurs need to be careful in raising money that they do not violate laws about disclosure. "**Full, plain and true**" is the test applied to any disclosure statement. Regulations came from a long history of the unscrupulous playing on the greed of the naïve (one famous saying is that there are only two emotions on Wall St: greed and fear). Once a company becomes publicly traded on a stock exchange (a privilege for which it must apply and obtain approval), then it must file periodic statements with the stock exchange that are also carefully regulated. Significant events must be reported to the exchange, which will occasionally issue a "cease trading" order so that all investors have time to absorb news before those closest to the news reap an unfair benefit. Thus, if one company makes an offer to acquire another publicly traded company, then it is usual that trading in both the acquiring company and the target will be halted until news of the proposed takeover is disseminated. When a stock price has a sudden unexplained movement, officials from the stock exchange will contact the management of the company to determine whether management has any idea why the change in price is occurring. If some big planned transaction has "leaked", then the stock market officials will order a halt in trading until the news is disseminated to all. Finally, there are strict rules about insider trading, and any shares bought or sold by senior officers and directors must be reported to the stock exchange, which makes this information public. Some stock market analysts pay careful attention to insider trading as an indicator of management's expectations about future share price.

8.4.2 Initial vs. Resale Values of Stocks and Bonds

People first learning to analyze financial statements sometimes get confused between the market value of a security (share or debenture) and its value on a financial statement. The first time a company issues a share or debenture, it has a nominal value, which is what the company receives for the security. Thus, a company might issue ten million shares at \$10 per share at startup. The company would show \$100 million in share capital on its financial statement. Now imagine that this company develops a software product that has enormous market acceptance and "takes off", or finds a major new oil pool. Someone who holds shares in this company finds that the market value of the shares (what someone is willing to buy the shares from the original purchaser for) is far higher than \$10 per share, because of the value created by the successful product or oil discovery. On the other hand, imagine that the company spends its original capital on products that are not accepted by the market, or on exploratory oil wells that are "dry holes". Then a smart purchaser will not be willing to pay as much as \$10 per share. In any event, this has no impact on the book value of the original share capital; the company still got the \$100 million, whether it spent it wisely or foolishly.

8.4.3 Valuation of Bonds

There is a difference between the face yield of a bond and the market yield of a bond. Imagine that the Government of Canada issues a 30 year bond for \$1000 at 6% interest. This means that Canada is committed to

pay \$60 in interest every year for 30 years, and then return the original \$1000 principal. Now imagine that two years later that long term interest rates, through a combination of government fiscal policy and the supply and demand for money, have risen to 8%. The bond is now worth less, i.e. a person who is going to receive a payment stream of \$60 per year and \$1000 in 28 years will not be willing to pay \$1000 if the general value of government debt is 8% instead of 6%.

How much would the bond be worth? The concepts of present value, outlined in Chapter 7, can be applied to determine the market value, as shown in Table 8.1. A purchaser of the bond in the climate of 8% interest rates would only pay \$779. Again, there is no impact on the Government of Canada: it has the

Table 8.1 Recalculation of the Value of a Bond

n	Original Bond Value		New Bond Value (after two years) interest 8%	
	payment	present value interest 6%	payment	present value
1	\$60.00	\$56.60	\$60.00	\$55.56
2	\$60.00	\$53.40	\$60.00	\$51.44
3	\$60.00	\$50.38	\$60.00	\$47.63
4	\$60.00	\$47.53	\$60.00	\$44.10
5	\$60.00	\$44.84	\$60.00	\$40.83
6	\$60.00	\$42.30	\$60.00	\$37.81
7	\$60.00	\$39.90	\$60.00	\$35.01
8	\$60.00	\$37.64	\$60.00	\$32.42
9	\$60.00	\$35.51	\$60.00	\$30.01
10	\$60.00	\$33.50	\$60.00	\$27.79
11	\$60.00	\$31.61	\$60.00	\$25.73
12	\$60.00	\$29.82	\$60.00	\$23.83
13	\$60.00	\$28.13	\$60.00	\$22.06
14	\$60.00	\$26.54	\$60.00	\$20.43
15	\$60.00	\$25.04	\$60.00	\$18.91
16	\$60.00	\$23.62	\$60.00	\$17.51
17	\$60.00	\$22.28	\$60.00	\$16.22
18	\$60.00	\$21.02	\$60.00	\$15.01
19	\$60.00	\$19.83	\$60.00	\$13.90
20	\$60.00	\$18.71	\$60.00	\$12.87
21	\$60.00	\$17.65	\$60.00	\$11.92
22	\$60.00	\$16.65	\$60.00	\$11.04
23	\$60.00	\$15.71	\$60.00	\$10.22
24	\$60.00	\$14.82	\$60.00	\$9.46
25	\$60.00	\$13.98	\$60.00	\$8.76
26	\$60.00	\$13.19	\$60.00	\$8.11
27	\$60.00	\$12.44	\$60.00	\$7.51
28	\$60.00	\$11.74	\$1,060.00	\$122.87
29	\$60.00	\$11.07		
30	\$1,060.00	\$184.56		
	NPV	\$1,000.00	NPV	\$778.98

original \$1000, and continues to pay \$60 per year and the principal repayment of \$1000 as per the original schedule. It is the holder of the bond who is affected by the change in interest rates.

With a little reflection you can see that in a period of rapid change in interest rates, those holding a bond can experience a large **capital gain or loss** (a change in the value of an asset, in this case the bond). When interest rates change rapidly, the value of investments change rapidly, especially those that pay regular interest or a steady dividend; that is the reason why interest rate changes are headline news on a business page, and sometimes on the front page.

Companies borrow billions of dollars of debt to finance their asset purchases, and governments also borrow billions of dollars to finance public works and sometimes social programs that are not paid for from current taxes. Every day the market value for corporate and government debt changes, reflecting the current market value of interest. However, there is a second factor that affects interest rates between borrowers: the market perception of ability to pay. As was discussed in Chapter 7, various bond rating agencies will assess the creditworthiness of a company or government. For companies, one key test is the income of the company and its ability to cover interest costs. For government, one key test is the ratio of total debt to annual gross domestic product (the value of what is produced in a country in a year) and to annual taxation revenues, plus the political stability of the country. Intuitively we know that lending money to Sierra Leone is a far far riskier undertaking than lending money to Canada or the US. More subtly, within Canada we know that the ability to pay of the "have" provinces that are on debt reduction strategies (e.g. Ontario and Alberta) is higher than those that continue to run annual deficits (e.g. British Columbia), that have weak economies (e.g. Newfoundland), or that have some political uncertainty (e.g. Quebec). Similarly for companies, we know that GM or Microsoft is less at risk of default on debt than a startup dot.com company. Hence, one can see interest rate differences between governments and companies.

8.4.4 Valuation of Stocks

Stock (equity) values, like bond values, vary widely. This is a subject of great complexity and fascination to enormous numbers of people, and one can spend a lifetime trying to understand and profit from understanding the stock market. Some high level issues will be mentioned here.

One key issue in evaluating stocks that is so important that it is cited in almost every stock listing is **price/earnings ratio**, which was discussed in Chapter 6. A bond that pays 6% interest has a price/earnings ratio of $1/i$, i.e. 16.67. If you own the bond, you will get the interest payment, i.e. the earnings are fully "liquid" and paid out to the holder of the bond. Now consider a stock, which is quite different. Shell, for example, as a company has (at time of writing) a price/earnings ratio of about 19, which means that for each share of Shell that costs \$37 (December 2005), the company has earnings in the last 12 months of \$1.95. It is theoretically possible that the Board of Directors of Shell could pay all earnings out to shareholders as a dividend. However, this is virtually never the case, since a Board is trying to finance some growth from retained earnings, as discussed above. Hence, the holder of the stock gets a **dividend yield** with Shell (as of the market price of December 2005) of 1.2%. This means that for a \$37 share of Shell the Board has declared a quarterly dividend of \$0.11, or \$0.44 per year. Thus even though the price/earnings ratio of the company is 19, the price/dividend ratio is 84. (Note that by convention people who discuss stocks will quote price earnings ratio (known as the p/e ratio) as a number and dividend yield as a percentage. Dividend/price ratio is not normally quoted.)

The other key factor in stock valuation is the potential for **capital gains**, or an increase in the value of the asset, in this case the stock. Growth rate and/or prospects for future growth (in revenue and net earnings) are the key issue. For a startup company, earnings are always negative; investors decide to invest based on future prospects, not current performance. Companies with strong prospects for growth will have high price/earnings ratios or even negative ratios. A metric that has emerged recently is the **PEG ratio (price/earnings/growth ratio)**. In this formula, price is in dollars, earnings are in dollars per year (normally the last 12 months, and growth rate is in percent annual growth in earnings, but not expressed as a fraction. Hence, a company with a price/earnings ratio of 100 (very high) but with a growth rate in earnings of 50% per year would have a PEG ratio of 2. The concept of PEG is new enough that it is not widely reported.

Pause for a moment and think about the merit of holding a Government of Canada 6% bond vs. the same value in Shell shares. The bonds yield more cash, but have no potential for growth in earnings, i.e. the bond will pay the same interest period after period. If the bond has a long term and interest rates change, its market value will change, as illustrated in Table 8.1. However, the value at maturity is unchanged. If the same amount of money is put into Shell shares, then there are higher earnings per share, but the shareholder gets less cash because most of the earnings are kept in the company. There is the potential for future growth from retained earnings, and also the risk of a turndown that will reduce the earnings (and hence increase the price/earnings ratio) of the shares. The bond might have more appeal to a 70 year old with a high need for secure cash from dwindling savings, while the Shell shares might have more appeal to a 55 year old who is seven years away from retirement. Meanwhile, a 29 year old with no children might want to "roll the dice" and invest in a dot.com startup that has not earnings and pays no dividend, but if successful might experience ten fold capital gains.

This kind of tradeoff (would I rather own a bond or Shell shares) takes place every day in the securities market, over tens of thousands of bonds and stocks. It is what makes the market: the relative desire to own things. Securities tend to be owned by companies, by rich individuals, and by ordinary individuals (who hold them in two forms, directly and indirectly through pension plans). The desire to own a stock or bond is what sets the price; hence, there is a great deal of psychology in the market, and investors often act as a herd. In March of 2000 "tech stocks" like dot.com companies were very hot, the NASDAQ index tied to technology shares was over 5000, and investors piled into each new **IPO (Initial Public Offering**, the first time shares in a company are issued to the public at large). Two months later the NASDAQ index was below 3400 and tech shares were comparatively out of favor. The only substantial change in this time period was in investor sentiment. Because stock valuation is the subjective judgment by a mass of humans (each responding to fear and greed) of objective criteria, stock valuation is an art, not a science.

Different styles in purchasing of securities emerge, reflecting both the needs of the investor and the tolerance for risk. To be clear, risk means the potential for a substantial loss on a stock. Some investors fret more over one stock that goes down than 10 that go up; this kind of investor should not purchase highly risky stocks. Other investors have the view that if three out of ten shares fail completely but two of the remaining seven have high gains, then the overall portfolio return is better than average. Seniors are sometimes "**fixed income**" investors, looking for a reliable dividend return or bond interest payments. A second investing style is **value investing**, where the fund manager looks for low price/earnings ratio companies (usually paying a steady dividend) that represent solid value. Often these companies will not have glamour and hype, but they tend to perform solidly and steadily over time. A third investment style

is **speculative**, with an emphasis on high capital gains and no focus on dividends. A fourth style, **growth oriented**, lies between value investing and speculative: the focus is on companies with growth prospects that are less risky than the "speculative" category. Dividends are normally not important to growth oriented investors.

Capital gains on stocks are normally taxed at a lower rate than dividends, to encourage economic growth through investment.

8.5 PRICING CYCLES AND THE CONCEPT OF THE TRAGEDY OF THE COMMONS

Many items, but especially commodities, show cycles in pricing, from low prices where most producers have book losses, to high peaks where returns on assets are quite high. Figure 8.1 shows such price swings for nickel, based on the price at year end (not the average price), in both dollars of the day and constant purchasing value dollars (i.e. adjusted for inflation). Figure 8.2 shows price swings for ammonia and urea based on average annual prices. In both cases, we see very high variability in a basic fundamental commodity. How do we make sense of this repeated pattern of price swings?

Input costs are one factor: the price of natural gas and oil, for instance, went through major swings during the period of Figures 8.1 and 8.2. But input costs alone do not account for the total fluctuation in

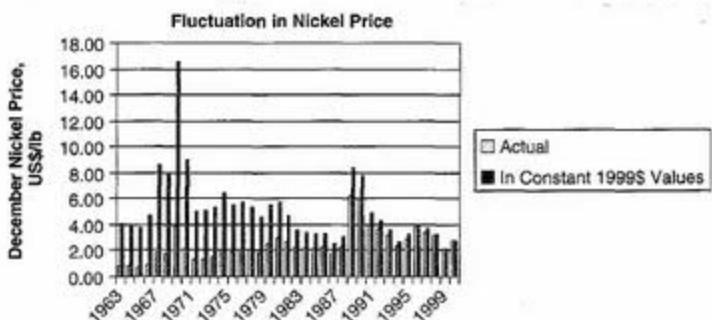


Figure 8.1 Fluctuation in Year End Nickel Price (Actual and Inflation Adjusted)

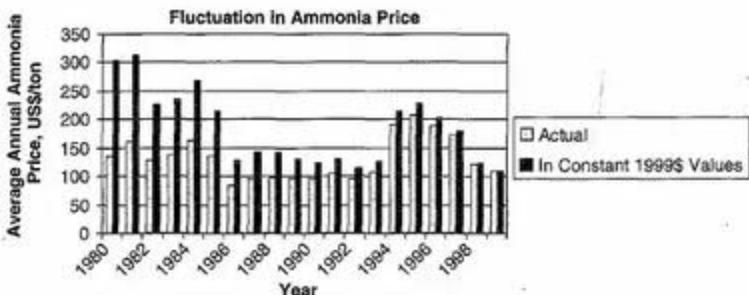


Figure 8.2 Fluctuation in North American Ammonia Price (Actual and Inflation Adjusted)

cost, since the nickel and ammonia industries went from periods of high profitability to book losses due to supply and demand. The "Tragedy of the Commons" is an anecdote first developed by an English mathematician in the 1800's and discussed at length by Garret Hardin (*The Tragedy of the Commons*, *Science*, v 162, p 1243-48 (1962)) that is often cited to explain both environmental degradation of common resources and persistent patterns of irregular investment.

Think of a common grazing area that has the capacity to support many sheep. If only one sheep grazes this common area and a second is added, meat production per year doubles. However, at some point additional sheep will lead to overgrazing, and the total meat production from the common will drop with each additional sheep because the common is overgrazed and the grass grows back at a less than optimal rate. Figure 8.3 illustrates such a common, and it is clear that the optimum number of sheep to be grazed on the common is 13. If you add a 14th sheep, then the total meat production stays the same but each sheep is thinner, i.e. 14 sheep produce the same total amount of meat as 13 sheep.

Now think about what would happen if nine independent farmers surrounded the common, each with one sheep. Each farmer would have the potential to add one sheep, doubling his flock. Each farmer would look at the incremental gain from going from nine to ten sheep, and see that by adding one sheep there is an incremental gain of over 100 kg of meat production per year. The result is that every farmer adds a sheep, thinking that just he will gain the 100 kg of meat production. What happens when this occurs? When each farmer adds a sheep, the commons has 18 in total, and the total meat production from 18 sheep is about 100 kg lower than it was when nine sheep grazed the common. Each farmer acted in self interest to add a sheep; the result is that each farmer is worse off.

The tragedy of the commons is used to illustrate two phenomena in business: the overuse of natural sinks (such as using a river for disposal of trace contaminants), and cyclical pricing in some industries.

The environmental issue is easy to see: each of 100 industries lining a river looks at the water flow in the river and thinks that their waste stream is so small compared to the river that the total level of contaminants will be well below acceptable levels if they dump into the river. However, when all 100 indus-

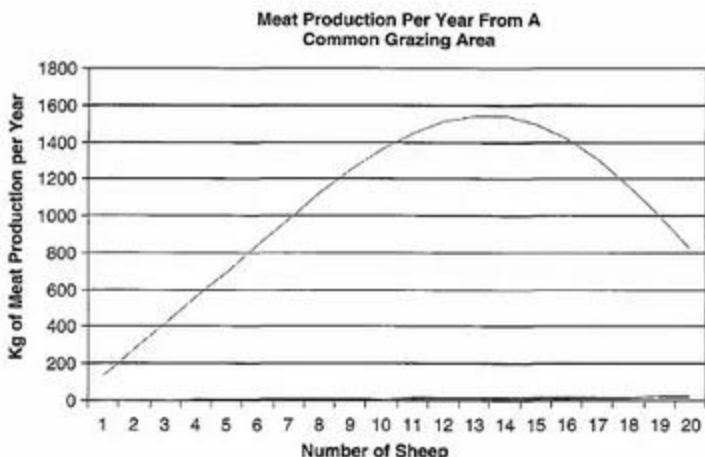


Figure 8.3 The Tragedy of the Commons

tries do this, the result is catastrophic: the river is polluted to a point where it can not be used for recreation or food production.

The same kind of issue arises for investment in commodity production. Typically commodities are produced in large "world scale" plants or mines. For example, no one builds a small fertilizer (ammonia/urea) plant since the economy of scale would mean that the plant would have a cost disadvantage compared to larger facilities. Similarly, mines that produce ores that must be chemically processed to the metal (for example, nickel production) are developed on large scale. This sets up the cyclic pattern: each of many producers watches the commodity price rise above the point where it provides a good return on investment. At that point, many or all producers commit to a world scale production facility because they want to retain their market share. When these start up they flood the market with the commodity and the price drops, often to the cash cost of production of the marginal producer (i.e. the point at which the highest cost producer still in business has a book loss but is at cash breakeven). Then, no one invests in additional capacity because the low product price means that the return on investment is below an acceptable level. Gradually increased world economic activity or the exhaustion of some facilities (e.g. a mine is depleted) brings the demand in line with supply, and the price rises back to the point where it justifies new investment, which starts the cycle all over again. The two key points in this cycle are the cash cost of the marginal producer (since companies don't run at a cash loss for long), which sets the low point in the cycle, and the cost at which new investment has an attractive return, which sets the decision point when companies commit to new investment. Since new facilities take time to build, it is normal for the price of a commodity to overshoot the price at which new investment is justified. During such price spikes producers can show startling profitability, but only until new capacity is developed.

The nine farmers could legally form a stock grazers' association and limit the number of sheep on the commons in some equitable manner. The reason this would be legal is that nine farmers (and 13 sheep) aren't big enough relative to the market to control the price of sheep. Commodity producers are sometimes tempted to try to smooth out price swings, because these are so disruptive to industry. (For example, consider the engineering industry that gears up to build many plants in a short time frame, then lays off staff during the price dips.) However, it is illegal in many jurisdictions for commodity producers to take steps to limit price swings; this constitutes price fixing. In essence, industrialized economies take the position that the inefficiency due to price swings does less damage to society than the inefficiency due to price control. OPEC, the Organization of Petroleum Exporting Countries, clearly does limit production to reduce price swings, so the view that price fixing is the greater harm is not universally held.

All industries show price swings, due to changes in supply capacity (number of plants producing the good) and demand (often influenced by the general level of economic activity). These swings are particularly severe in commodities because supply increments are large.

USING FINANCIAL STATEMENTS TO MANAGE AN OPERATING COMPANY

9.1 OVERVIEW

The purpose of assembling financial information is to guide action, and a good management team will look to financial statements and their analysis as the source of information for indications of what actions are needed.

There are several kinds of analysis that can be done on financial statements, some of which have been illustrated in the above notes:

- Horizontal analysis compares year over year performance, and in particular tracks percentage changes in revenue, operating, asset and liability accounts. This kind of analysis leads to questions such as "our sales increased by 20%, but our inventory increased by 35% - why?"
- Vertical analysis, also called common size analysis, reduces all elements on an income statement to a percentage of sales, and all items on a balance sheet to a percentage of total assets. This kind of analysis leads to questions such as "even though our sales are going up, our sales costs are increasing as a percentage of sales – why?"
- Ratio analysis looks at common values, as discussed extensively in Chapter 6. This kind of analysis leads to questions such as "why does it take us 52 days to get our customers money in the bank from the time we "book" a sale, when the industry average is 42 days?"

These kinds of questions are based on internal data, and are independent of market size. However, the other key questions management must know are related to the market: "what share of sales in our industry do we (and our competitors) make?" This in turn depends on the features, price and quality of the products or services our company sells.

Managing an ongoing business often comes down to asking the right questions, having the information and the persistence to answer them, deducing the right actions from the process of asking and answering questions, and implementing the actions. Sometimes the "right action" is so obvious once the questions are asked that the organization simply changes. Sometimes great persistence is needed not only to answer the questions, but also to determine and implement the right action. This is the art of management.

Most experienced managers have a knowledge base that she/he will pass on to the next generation of managers. Any one person's list of management elements is incomplete, and the best way to learn the art of managing an operating company is to learn from many experienced managers, not just one. The following elements of management are based on financial statements only and don't address the numerous market, human and legal issues managers also face. They are also based on one manager's insights.

9.2 SPECIFIC FINANCIAL STATEMENT ELEMENTS IN MANAGING A COMPANY

9.2.1 Sales

Sales growth is virtually an axiomatic goal of business, but the more important issue is market share (the percentage of total sales of a given product or service that come from your company), not absolute sales level. In a competitive market, products and services are positioned based on features, price and quality, and despite earnest attempts to say that “we can have it all” (i.e. best quality *and* lowest price), there is in reality almost always a tradeoff. Luxury cars are better, cost more, and have a smaller share than standard models, and no amount of advertising hype will change this.

Given that a company’s product or service has been positioned at a particular market niche based on its features, its quality, and its price, a change in share is a powerful signal that something is changing in the market that will affect the company’s long-term position. This is usually more important than a short-term drop in sales that comes from an industry wide downturn. To illustrate this, there have been companies who have experienced a slow growth in sales who did not realize that their share was dropping in a rapidly expanding market because competitors were taking up incremental sales. Steady erosion of share lets competitors offer more attractive volume based pricing, and the share loss can start to grow exponentially.

A financial statement doesn’t convey any information on market share, and one of the key inputs to management’s financial analysis from outside its statements is a knowledge of total market size, so that share can be determined. This is often the reason companies join industry associations.

Analysis of share leads to tough questions about customer preferences and buying decisions, and the appropriateness of a company’s positioning of features, quality and price. This is the heart of marketing, not financial analysis.

9.2.2 Margin

Erosion of margin is not unusual as products mature. As competition increases and market growth slows, prices often drop and highly profitable products become less profitable. However, efforts to maintain margin are a key part of maintaining income from operations. Margin is easily tracked as long as costs are consistently allocated to COGS vs. SG&A.

In a mature product, changes in margin usually come because of a disconnect between suppliers’ and customers’ prices. If suppliers increase prices and a company does not extract a comparable price increase from its customers, it will watch its margin drop. More importantly, if a downturn in a market forces a company to drop its prices to maintain share, the first thing it should do is try to get its suppliers to support a portion of this price rollback by rolling their prices back. Suppliers are often surprisingly willing to do this if it is clear that the price rollback at the supply level is temporary and tied to the price rollback at the customer level. (Recently some companies have taken the same approach with labor cost inputs, asking workers to accept lower wages in cyclical downturns and committing to “catch-up pay” during upturns. This has played a role in the reopening of a mine in British Columbia.)

“Pass it on” is the key management tool in maintaining margin. Management that loses sight of this will sometimes defer price increases year over year, only to find that they must have a large increase in one year to get their company back on track. One of the key indicators looked at by buyers of a company is consistency in margin. Owners who are selling a company who say “we could have had a price

increase", or even worse "if you buy this business you can put through a price increase" are not likely to get maximum value for their company.

9.2.3 Sales, General & Administrative

Managing a business is a constant tension between too much and too little. In good times, when earnings abound in a company, the temptation to add the extra market analyst, buy the news service that has industry specific information, and hire extra "front office" staff is enormous; people who have been through bad times want relief, and want to share in the good times. When the momentum to add staff goes on and on, inefficiencies steadily build up as costs grow, and some economists believe that it is these cost inefficiencies that lead to downturns, when cost cutting begins anew.

In an ideal world SG&A would stay very flat, i.e. be a pure "fixed cost", and increased sales would contribute all margin directly to profitability. In the real world, SG&A increases as sales grow, but not linearly.

No "relief" in good times discourages staff, no discipline on SG&A costs in good times builds the foundation of the next downturn. Walking that tightrope is the art of management.

9.2.3.1 Depreciation

One component of SG&A warrants special attention: depreciation. Judgments about depreciation have no impact on the cash position of a company, but they do affect how its earning power and value is represented through its financial statements. Accounting by nature is conservative, and rapid depreciation of assets is often encouraged so that the books do not overstate the value of the business. However, rapid depreciation reduces reported income and EBIT (but not EBITD), and reduces the "book" value of a business relative to a slower writedown. When it comes time to sell a business, the lower EBIT and book value can be a factor in a lower valuation. At the other extreme, a very low depreciation rate means that assets that are scrapped are overvalued, and accounting will require a special writedown when the asset is replaced. Historical financial statements full of special writedowns will give the potential buyer of a business a queasy feeling, especially if the buyer wants management to stay with the business. Balancing these two different concerns is the art of management. Modern business changes so quickly, especially in anything related to telecommunications and information technology, that picking the right depreciation rate is more art than science.

9.2.4 Integrating Volume, Margin, Cost and Income

It is easy to talk about managing share (sales volume), margin (price), and cost to maintain or grow operating income as if these things existed in isolation. In reality, they are interconnected, and any action in one area has an impact in another. For instance:

- In order to hold share in a falling market, one can cut price, but this drops margin and operating income.
- One can increase promotion/advertising to hold share, but this increases cost and drops operating income.
- One can hold margin (price) and lose share to competitors, which again drops operating income.

One can imagine a triangle sitting on a bowl of jello, with margin (price), share (sales volume), and costs at the three points. Action in any of these areas is like depressing the point of the triangle, with uncertainty as to how the rest of the triangle will respond through the medium of the jello. The art of management is trying to find one's way around this triangle, often by trial and error, and always by learning from experience. Almost no business has enough empirical data to mathematically optimize this kind of judgment, which is why management is more often an art than a science.

9.2.5 Net Income

The primary difference between operating and net income is interest cost. Long-term interest costs are often not subject to change, but management action can have a significant impact on short-term interest cost because management of working capital can substantially reduce short-term debt. This is developed below when the components of working capital are discussed.

9.2.6 Receivables

The management of receivables is a major opportunity for reducing the cash requirements of a business, and is especially important when a business is sold. The best management practice is to "age" receivables, so that each month management knows what fraction of the receivables are less than 30 days old, between 30 and 60 days old, and over 60 days. Depending on the business, there will be a "days late" when the "flashing warning light" goes on: receivables over a certain age are often a sign that a customer is in trouble. It is sad but true that nagging succeeds in collecting money: "the squeaky wheel gets the grease" is how some customers pay their bills. Such customers envision the receivable as a form of borrowing money from you, and will do so as long as you don't object.

In cyclical industries, everyone gets scared in a downturn, and everyone wants to hold on to someone else's cash. Collecting in a downturn is important in order to distinguish bad debt from slow debt. If you know debt is bad, stop shipping more product to the customer. If you know the debt is good but slow, keep shipping, since you need the sales.

Large companies that buy from small companies are almost always reliable but slow payers. Large integrated oil companies, for example, usually take 55 to 60 days to pay, but the risk of non-payment is negligibly small. Financing these customers is a cost of business. "New age" businesses like Dell that are trying to forge Internet based alliances with suppliers have addressed this problem by quick pay systems that solve the suppliers needs and required less processing cost on the part of the payer. Over the next 20 years the problem of "slow but reliable" payments from large customers will likely disappear.

Incentives are sometimes offered for quick payment (e.g. "less 2% if payment is received within 10 days"). A business needs to be cautious here. Ideally, the discount will be a credit, so that the customer doesn't shift the price point, otherwise in hard times you will be under pressure to take the 2% off without the quick pay. Second, such discounts can reduce margin if they are too high; as interest rates have fallen, quick pay incentives have grown to exceed the value that they originally conveyed in a time of high interest.

9.2.7 Inventory

Inventory is simply a cash cost that a company must finance; inventory is money "tied up", and any steps to reduce it (except a writedown) free up cash that the business can use for other purposes.

The super high interest rates of the late 1970's had one wonderful byproduct: they forced companies to ask why they needed so much inventory on hand. The phrase "just in time" came from this era: instead of having assembly line A produce parts and stockpile an inventory to go into assembly line B, just connect up the two assembly lines and have A feed B directly ("just in time"). The old argument for the intermediate inventory between A and B was that the reliability of line B could then be "decoupled" from line A. One benefit of the "just in time" movement was a higher focus on reliability: suddenly, when line A stopped the whole plant stopped, and management, which had ignored the frequent stoppage of line A in the past, came down on the floor, discovered why line A stopped so frequently, and did something about it.

"Just in time", supported by sophisticated computer tracking systems, has advanced to a point where auto parts companies think of trucks on the road as their warehouse. In the "new age", companies share their order information with suppliers, so that an order for finished product from a company (for example, an order for a Dell computer) is automatically translated into an order for the components, so that Dell does not need to store a large inventory of parts to ensure it can make every computer in its line. There is an implicit change in this approach: volume ordering discounts of the past ("if you order a large quantity, I will give you a lower price") have shifted to reliable order discounts ("if you have an alliance with me and I can count on being a significant supplier, I will give you a lower price"). Part of what has allowed this transition is lower processing costs for invoices and payments as the information age has automated, and in some few cases "de-papered", the process of invoicing and paying bills.

Other innovative techniques have been adopted to reduce inventory. When a steady relationship has been set up between a supplier and a company, one sometimes finds that both have an inventory: the supplier to ensure that the "good customer" is always serviced, and the "good customer" because there is a volume discount on buying or some fear of a transportation disruption. One "win-win" strategy that has been adopted in such cases is to have the supplier own the inventory at the customer's site. A steel supplier, for example, will store steel that it still owns at its customer's site. The customer doesn't own the steel until it pulls it out of the yard onto the production floor. The steel supplier is free to remove the steel at any time should it need it, but in practice overall inventory is reduced and both parties win.

As products change, "stale" inventory inevitably builds up: supplies that are unusable or product that is unsellable. The proper step to take is to scrap this material and write down the difference between the book value of the material and the scrap value recovered. Managements sometime defer this step because it causes a drop in net income, but to fail to do so distorts the true value of useful inventory and makes year over year comparisons increasingly meaningless. "Taking the medicine in small doses" is a guideline management should remember in steadily writing down stale inventory.

Startup companies sometimes find that their biggest financial peril is the large order they had dreamed of receiving, because they don't have the funds to buy inventory and carry the receivable after the sale. One technique for bridging short-term problems like this is to ask key suppliers to participate in the financing of the sale by extending special terms on their supplies. For instance, imagine a product that takes 30 days to assemble and ship that is being sold to a large "slow pay" customer. If the company making the product can convince its suppliers to extend 90 day terms for this order (often justified by the prospect

of additional future sales), then the company can make and ship the product and collect its receivable before its payable becomes due, solving the short term problem. Many suppliers will support this if they believe that the request for special terms is "one time" or infrequent and associated with growth.

9.2.8 Prepaid Expenses

Prepaid expenses means that someone else holds your money. The only reason to do this is because you get a benefit from the prepayment. If your once per year insurance premium isn't at a discount, then insist on paying it monthly.

9.2.9 Payables and Accrued Expenses

Payables and accrued expenses are a form of borrowing money from your suppliers. For all the reasons that you want to collect your receivables promptly you want to pay your payables slowly. Rapid changes in payment approach may disrupt long-term supplier relationships, but management should be aware of payables as a "float" that they have some control over.

9.2.10 Fixed and Intangible Assets

Management decisions about assets, both tangible and intangible, are obviously key to the success of a business. Once bought, the only financial decision to make about assets is the rate at which to depreciate them. There are numerous non-financial decisions to make about utilization, optimal maintenance, etc., but these derive from manufacturing management, not financial management.

Goodwill is an asset, and it needs to be depreciated just like a tangible fixed asset. Goodwill arises when a company is purchased for more than book value; almost all purchases of companies are at higher than book value, because book value is meant to be a conservative valuation of a business. There is a "right" depreciation period for writing down goodwill. If one buys a company to get its product name, know how, assets, and customer lists, clearly these have real value a year later. On the other hand, it is unlikely that they will have significant residual value one hundred years later. As with so many other elements of financial management, judgment is required.

9.2.11 The Short Term Credit Line

No issue is more critical to the survival of a business than its cash/short term borrowing position. In good times, this is not a day-to-day problem, and management therefore sometimes comes to ignore this or put it to the bottom of its daily priorities. In good times, management properly focuses on the growth issues of a business: "what do customers want, how is our product performing, what are our competitors doing, how can we sell more, what new products should we be developing". In bad times, and in times of rapid growth, management needs to quickly move cash (and short term borrowings, which is simply negative cash) to the top of the list.

Banks take deposits from people who accept a low interest rate in exchange for high security. Bankers hate to have non-recovery on loans, because it violates the basis on which they got the funds and because their own personal performance is judged in part on this criterion. Bankers lend to many, and early in their

career learn to develop very thick skins. You may think that your business is revolutionary and visionary and just deserves a break, but to your banker it is one of a wide portfolio of loans for which being onside on covenants is very important, being current in repayment (i.e. not being in default) is very very important, and being secure (i.e. fully recoverable) is career shaping.

Bankers are also human, thoughtful, and very keen to maintain a long-term relationship with a good business. If a business is going to go briefly offside on a covenant, the most important thing a management can do is talk to their short-term lender in advance. A bank might, for instance, relax its covenants to support a first time sale to a large customer (just as a supplier might, as discussed above under inventory). The bank might want an assignment of the payment from the customer in such a case, especially if its relationship with the company is new.

Many small businesses cannot have this "in advance" discussion with their short-term lender because they don't have the discipline and skills to forecast their cash position. For a small business, the owner manager should master this skill and think of it as maintaining the "breath" of cash in the business. For a large business, the senior manager should insist that the chief financial officer, not just the treasurer, be fully aware of the cash position of the company, and should review this issue annually in good times and much more frequently in bad times. Fracmaster, Probe and Philip Services are testimony to how good companies can spiral downwards when cash issues get out of control.

One final note on cash/short term borrowing: most banks will look for a personal guarantee (usually unlimited) from a new small company or a new owner of an established small company. The banks' logic in this is that a small business can get offside very quickly, and can go into a working capital deficit position from which it cannot recover. This is the responsibility of the owner/manager, and hence the personal assets of the owner/manager should provide security for the loan. Any owner who thinks that the bank wouldn't really kick him/her out of their house and sell it and its contents to recover a defaulted loan does not understand bank culture. However, when a business gets established it is often possible to get the personal guarantees lifted or reduced. This may require a change in covenants for a period of time, for instance the owner/manager may have to agree to maintain a higher minimum level of working capital or accept a higher current ratio within the company in exchange for a lifting of the personal guarantee. This is a goal that many owners aim for, especially in middle age, so that a failure of their company does not consume all of their net personal wealth.

In closing, and to repeat, no skill is so critical to the day-to-day survival of a company as knowing the current and likely future cash position. Any owner/manager of a small company who is not comfortable with their skills in this area should get help in order to master this skill. Business managers should never forget that "cash is breath."

FINAL HOMEWORK ASSIGNMENT

(Optional, May Be Substituted for a Missed Homework Assignment)

In the spirit of continuous improvement, provide the instructor with comments on this course. For each of the areas the course covered (ENGG 401/ENG M 620: society and values, financial analysis, and investment analysis; ENGG 405: society and values, contracts, marketing, the anthropology and sociology of work, and human personality and management style), please comment on the following:

- Are there subject areas that were covered that you think should not be? Are there subject areas that were not covered that you think should be? Was the relative weighting of the subject areas appropriate?
- Were the assignments helpful? Appropriate in length? Appropriate in difficulty? Are there any specific assignments you think should be added, dropped, or modified?
- Were the text notes helpful? Right level of complexity? Were there any parts of the text that you found unintelligible, too simplistic, too wordy, too repetitive, or too easy?
- Were the lecture transparencies helpful? Was the level of content appropriate?
- Were the lectures helpful? Was the amount of class interaction appropriate? Are there changes in lecture style, format or content that you think would make a better course? Are there changes the lecturer could implement to make this a better course?
- (ENGG 401 only): The Canadian Engineering Accreditation Board requires that students be exposed to "engineering economics" also known as investment analysis. Do you think the course achieved this objective, and if so, how well did it do it?
- (ENGG 405 only): What is your opinion of the assignment to read one of the three books?
- (ENGG 405 only): The Canadian Engineering Accreditation Board requires that students be exposed to "the impact of technology on society". Do you think the course achieved this objective, and if so, how well did it do it?
- Are there any other comments you wish to add?

Negative feedback will not affect your grade negatively. You have the option not to identify yourself in your comments, and if you prefer, you can put your comments in a sealed envelope, which will not be opened until all grading is complete. Your candid comments are appreciated.