CORPORATE VALUATION

A Guide for Analysts, Managers, and Investors

CFM-MHE Professional Series in Finance

Honorary Consulting Editor: Dr Prasanna Chandra

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McGraw Hill Education (India) Private Limited

Published by McGraw Hill Education (India) Private Limited,
P-24, Green Park Extension, New Delhi 110 016.

Corporate Valuation: A Guide for Analysts, Managers, and Investors

Print Edition
ISBN (13): 978-93-329-0291-6
ISBN (10): 93-329-0291-7

E-Book Edition
ISBN (13): 978-93-329-0292-3
ISBN (10): 93-329-0292-5

Managing Director: *Kaushik Bellani*
Publishing Manager—Professional: *Mitadru Basu*
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DGM—Sales and Business Development—Professional: *S Girish*
Asst Product Manager—BGR: *Priyanka Goel*
General Manager—Production: *Rajender P Ghansela*
Manager—Production: *Reji Kumar*

Typeset at Text-o-Graphics, B-1/56, Aravali Apartment, Sector-34, Noida 201 301, and printed at

Cover Printer:

Cover Designer: Mukul Khattar

To
My family and friends

Preface

Valuation is the central theme is finance. If you are a financial analyst, you have to regularly value IPOs, acquisition proposals, and divestment candidates. If you are a manager, you have to assess the impact of your decisions on firm value. If you are an investor, you have to compare market price with value to decide whether you should buy or hold or sell a security.

This book discusses the techniques of valuation and the considerations that you have to bear in mind in valuing different types of companies. It seeks to provide a bridge between the world of 'academic finance' and the 'what do we today' world of appraisers, managers, investors, regulators, and lawyers who are involved in valuing real companies.

Target Audience

This book is aimed at two distinct audiences:

- Finance practitioners, senior managers, and investors who are involved in valuation
- MBA students and professional accountants who are pursuing specialised courses in corporate valuation, such as the ones offered by the Institute of Chartered Accountants of India and the Institute of Cost and Works Accountants of India.

Structure of the Book

The book is organised into twelve chapters:

- Chapter 1 provides an overview of corporate valuation.
- Chapter 2 discusses at length the enterprises DCF model, which is the most popular DCF model in practice.
- Chapter 3 explains how the cost of capital is computed.
- Chapter 4 explores other DCF models like the free cash flow to equity model, adjusted present value model, and economic profit model.
- Chapter 5 focuses on the relative valuation approach which is widely used in practice.

- Chapter 6 covers other approaches to valuation like the book value approach, stock and debt approach, and the strategic approach.
- Chapter 7 explains how real options may be valued.
- Chapter 8 provides a synoptic view of advanced issues in valuation.
- Chapter 9 discusses the valuation of intangibles.
- Chapter 10 presents a few case studies of real life valuations.
- Chapter 11 dwells on how the valuation report may be written.
- Chapter 12 discusses some approaches to value enhancement.

Ancillary Materials

To enhance the utility of the book for students and instructors, the following ancillary materials are available.

- **Spreadsheet Templates:** Mr. Venugopal Unni developed the spreadsheet templates in Excel. They correlate with various concepts in the text and are meant to help students work through financial problems. These spreadsheet templates may be downloaded from http://highered.mcgraw-hill.com:80/sites/9332902917
- **Additional Problems:** A number of additional problems have been given for students who want to practice more. These may be downloaded from http://highered.mcgraw-hill.com:80/sites/9332902917
- **Solutions Manual and Powerpoint Presentation:** A solution manual accounting solutions to the end of the chapter problems and cases and powerpoint presentations of all chapters are hosted on the web site of McGraw Hill. This can be accessed by the instructors who adopt the book. They may contact McGraw Hill for assistance in accessing the solutions, manual and powerpoint.

I earnestly solicit feedback from the readers to help me in improving the quality of this book in future.

Prasanna Chandra

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Acknowledgements

This book is an outgrowth of my lecture notes of a course on 'Valuation' that I taught at IIM Bangalore and a series of seminars that I offered to various corporate audiences. I am indebted to my students and participants of executive seminars of providing the stimulus for writing this book.

I would like to express my gratitude to the pioneers in the field of valuation who have shaped my understanding through their rich and varied contributions. I have benefited from my interactions with a number of academics and practitioners and from the help provided by Venugopal Unni and Pushpalatha—I am thankful to all of them.

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Contents

CHAPTER 1

An Overview

If you are buying or selling a company, an operating division, an IPL franchise, a shopping mall, or an equity share, the question "What is its value?" is paramount, and for a sound reason. If the price is too high relative to value, the buyer will get a poor return; by the same token, if the price is too low relative to value, the seller will leave plenty of money on the table.

Valuing a business is neither easy nor exact. Several methods have been developed to help you in this difficult task. This book will discuss the more important ones. Before we get started, remember two caveats. First, the true value of a business cannot be established with certainty. It is impossible to forecast accurately the future cash flows that the business would generate and estimate precisely the discount rate applicable to the future cash flows. There is an inescapable element of uncertainty in valuation.

Second, a business is not worth the same to different parties. Different prospective buyers are likely to assign different values to the same company, depending on how the company fits into their scheme of things. One may argue that just the way beauty lies in the eyes of the beholder, value lies in the pocket of the buyer.

The primary objective of management should be to maximise shareholder value. Owners of corporate securities will hold management responsible if they fail to enhance shareholder value. Since value maximisation is the central theme in financial management all managers must understand what determines value and how to measure it.

In the wake of economic liberalisation, companies are relying more on private equity and capital markets, mergers, acquisitions, and restructuring are becoming commonplace, strategic alliances are gaining popularity, public sector undertaking disinvestment is taking place, employee stock option plans are proliferating, and regulatory bodies are struggling with tariff determination. In general, corporate valuation is a critical issue in such decisions.

The purpose of corporate valuation is basically to estimate a fair market value of a company. So, at the outset, we must clarify what is meant by "fair market value" and what is meant by "a company". The most widely accepted definition of fair market value was laid down by the Internal Revenue Service of the U.S. It defined fair market value as "the price at which the property would change hands between a willing buyer and a willing seller when the former is not under any compulsion to buy and the latter is not under any compulsion to sell, both parties having reasonable knowledge of relevant facts." When the asset being appraised is "a company," the property the buyer and the seller are trading consists of the claims of all the investors of the company. This includes outstanding equity shares, preference shares, debentures, and loans.

This chapter provides an overview of corporate valuation. It is organized into nine sections:

- Context of valuation
- Approaches to valuation
- Features of the valuation process
- Corporate valuation in practice
- Information needed for valuation
- Refinements in valuation
- Judicial and regulatory overview of valuation
- Intrinsic value and stock market
- Importance of knowing the intrinsic value

1.1 CONTEXT OF VALUATION

Inter alia, corporate valuation is done in the following situations:

Raising Capital for a Nascent Venture Venture capital and private equity have become an important source of capital for newly set up firms. Venture capitalists and private equity investors generally participate in the equity of investee companies that they hold for few years before liquidating the same. Since new ventures are characterised by high risk, the venture capitalists and private equity investors value these businesses in such a way that their expected return is commensurate with the risk they incur.

Initial Public Offering After achieving a certain size and stability, most firms have a desire to access the public capital market. A very important issue in this context is: At what price should the initial public offering (IPO) be made? For this purpose the firm has to be valued properly.

Acquisitions Acquisitions occur in three broad ways: takeovers, mergers, and purchases of business divisions. In a takeover, one company (or investor) acquires a controlling stake in another company. For example, HINDALCO acquired a 54 percent stake in INDAL from its overseas parent, Alcan. Typically, the acquirer has to pay a premium over the prevailing market price and determining the quantum of premium is always a challenge.

A merger refers to a combination of two or more companies into one company. It may involve absorption or consolidation. Mergers in India, called amalgamations in legal parlance, are usually of absorption variety. The acquiring company (also referred to as the amalgamated or the merged company) acquires the assets and liabilities of the acquired company (also referred to as the amalgamating company or merging company).

Typically, the shareholders of the amalgamating company get shares of the amalgamated company in exchange for their shares in the amalgamating company. For example, when TOMCO was amalgamated with Hindustan Lever Limited, shareholders of TOMCO were given shares of Hindustan Lever Limited in the ratio of 2:15.This means that 2 shares of Hindustan Lever Limited were given in exchange for 15 shares of TOMCO. Obviously, the exchange ratio, perhaps the most critical element in a merger exercise, depends on the valuation of the combining companies.

A company may purchase a division or plant of another company. Typically, the acquiring company takes over the assets and liabilities of the concerned division and pays cash compensation. Haspiro, for example, acquired the injectables division of Orchid Chemicals for a consideration of $400 million. Clearly, such a transaction hinges on valuation being acceptable to both the parties.

In mergers, the focus is on comparative valuation of the merging companies. Hence, the valuation needs to be fair from the point of view of the shareholders of the transferor and transferee companies. According to clause 24(h) of the Listing Agreement, the listed as well as the unlisted companies getting merged are required to obtain a 'Fairness Opinion' on the valuation of assets/equity shares from an independent SEBI registered merchant banker.

Divestitures A divestiture involves the sale of a division or plant or unit of one company to another. It is the mirror image of a purchase of a division or plant or unit. Hence, such a transaction depends on valuation being acceptable to both the parties.

PSU Disinvestment The government of India has announced that in all public sector undertakings (PSUs), the government stake in shareholding will be brought down to 90 percent. Most probably, further dilutions will occur in many PSUs. In all such exercises, a valuation has to be done for the stake to be offloaded.

Employee Stock Option Plans In determining the exercise price for employee stock options, the valuation of the company, when the company is unlisted, has to be done.

Portfolio Management The role of valuation in portfolio management depends on the investment philosophy of the investor. Valuation matters a great deal to an active investor who subscribes to fundamental analysis, but is not much significance to a passive investor or an investor who relies on technical analysis.

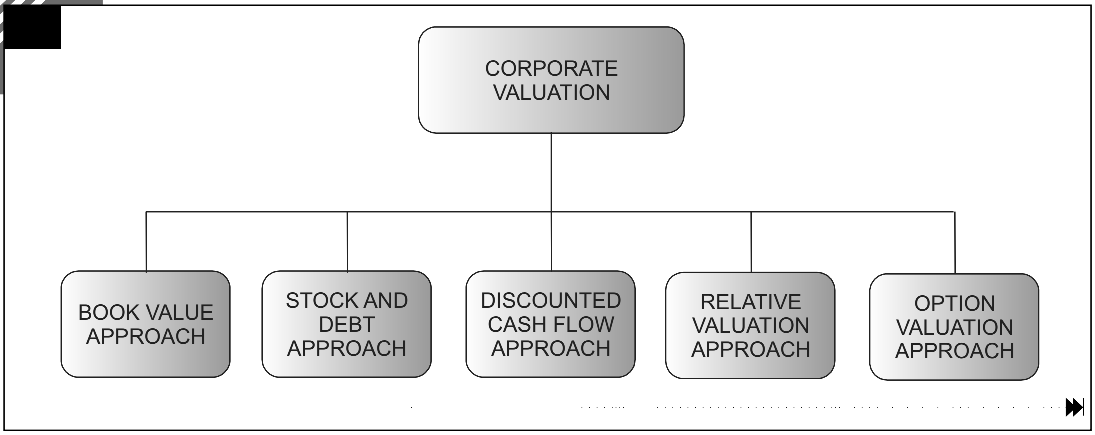
1.2 APPROACHES TO VALUATION

As shown in Exhibit 1.1 there are five broad approaches to appraising the value of a company:

- Book value approach
- Stock and debt approach

- Discounted cash flow approach
- Relative valuation approach
- Option valuation approach

Exhibit 1.1 ***Approaches to Corporate Valuation***



Book Value Approach

The simplest approach to valuing a company is to rely on the information found on its balance sheet. For example, if the book value of assets (fixed assets, investments, and net current assets), which by definition equals the book value of investor claims (equity, preference, and debt), is 500 million, we say that the value of the company (also called the enterprise value) is 500 million.

In practice, book value figures are adjusted to reflect replacement value or liquidation value or fair value. Often, even with these adjustments we find that the book value of the company is much less than the market value of the company (the sum of the market value of investor claims on the company). The discrepancy arises because the conventional balance sheet does not reflect valuable intangible assets of the firm such as brand equity, technical and managerial knowhow, relationships with vendors, and so on. Obviously, the divergence between book value and market value is more in intangible-intensive sectors such as information technology and pharmaceuticals, and less in tangible-intensive sectors such as real estate and banking.

Stock and Debt Approach

When the securities of a firm are publicly traded its value can be obtained by merely adding the market value of all its outstanding securities. This simple approach is called the **stock and debt approach** by property tax appraisers. It is also referred to as the market approach.

Take the case of Horizon Limited as an example of stock and debt approach. On March 31, 20X1, the firm had 1.5 billion outstanding shares. At the closing price of 20 on that day, Horizon's equity had a market value of 30 billion. On March 31, 20X1 the firm also had outstanding debt with a market value of 21 billion. Adding the market value of the equity to the market value of debt gives a total firm value of 51 billion for Horizon as on March 31, 20X1.

The stock and debt approach assumes market efficiency. An efficient market is one in which the market price of a security is an unbiased estimate of its intrinsic value. Note that market efficiency does not imply that the market price equals intrinsic value at every point in time. All that it says is that the errors in the market prices are unbiased. This means that the price can deviate from the intrinsic value but the deviations are random and uncorrelated with any observable variable.

Discounted Cash Flow Approach

Valuing a firm using the discounted cash flow (DCF) approach is conceptually similar to valuing a capital project using the present value method. The DCF approach involves forecasting future cash flows (for all time to come) and discounting the same to the present point of time, using a cost of capital that reflects, inter alia, the firm's capital structure and business risk. The notion of DCF or intrinsic value has been expressed well by Warren Buffett: "Intrinsic value is an all important concept that offers the only logical approach to evaluating the relative attractiveness of investments and businesses. Intrinsic value can be defined simply: It is the discounted value of the cash that can be taken out of a business during its remaining life." Although informationally intensive this approach has gained in popularity from the early 1990s.

There are several models of DCF valuation: enterprise DCF model, equity DCF model, adjusted present value model, and economic profit model. The **enterprise DCF model**, the most important DCF valuation model, involves forecasting the free cash flow to the firm (FCFF) and discounting the same at the weighted average cost of capital (WACC). The FCFF represents the cash flow available for distribution to all investors after meeting the capital expenditure and net working capital needs of the firm.

The **equity DCF model** focuses on the valuation of the firm's equity. There are two variants of the equity DCF model: the dividend discount model and the free cash flow to equity model. The dividend discount model involves forecasting the future dividends and discounting the same at the cost of equity. The free cash flow to equity model involves forecasting the free cash flow to equity (FCFE) and discounting the same at the cost of equity. FCFE is the cash flow available for distribution to equity shareholders after the firm has met its obligation toward other investors (debtholders and preference shareholders) and provided for its capital expenditure and net working capital needs.

The **adjusted present value model** defines enterprise value as the sum of two components:

$$\text{Enterprise value} = \begin{pmatrix}\text{Value of the unlevered} \\ \text{equity free cash flow}\end{pmatrix} + \begin{pmatrix}\text{Value of the financing} \\ \text{side effects}\end{pmatrix}$$

The unlevered equity free cash flow is the same as the free cash flow to the firm. It is discounted at the cost of unlevered equity. The value of the financing side effects is equal to the present value of the interest tax shields plus the value of subsidised financing, if any. The borrowing rate of the firm is used for computing the present value.

The **economic profit model** defines the enterprise value as follows:

$$\text{Enterprise value} = \begin{pmatrix}\begin{matrix}\text{Current invested} \\ \text{capital}\end{matrix} & + & \begin{matrix}\text{Present value of the} \\ \text{future economic} \\ \text{profit stream}\end{matrix}\end{pmatrix}$$

The economic profit of a given period is the surplus left after making an appropriate charge for the capital invested in the business.

$$\text{Economic profit} = \begin{matrix}\text{Invested} \\ \text{capital}\end{matrix}\begin{pmatrix}\begin{matrix}\text{Return on invested} \\ \text{capital}\end{matrix} & - & \begin{matrix}\text{Weighted average} \\ \text{cost of capital}\end{matrix}\end{pmatrix}$$

Relative Valuation Approach

Common sense and economic logic tell us that similar assets should trade at similar prices. Based on this principle, one can value an asset by looking at the price at which a comparable asset has changed hands between a reasonably informed buyer and a reasonably informed seller.

Also referred to as the direct comparison approach or the multiples approach, this approach uses a simple valuation formula.

$$V_T = X_T \frac{V_C}{X_C} \tag{1.1}$$

where V_T is the appraised value of the target firm, X_T is the observed variable (such as profit before interest taxes and taxes) that supposedly drives value, V_C is the observed value of the comparable firm, and X_C is the observed variable for the comparable company.

There are broadly two kinds of multiples used in relative valuation:

Enterprise Multiples An enterprise multiple expresses the value of the company, enterprise value (EV), in relation to a statistic that applies to the whole company. The most common enterprise multiples are EV/EBITDA, EV/BV, and EV/S, where EBITDA stands for earnings before interest, taxes, depreciation, and amortisation, BV stands for book value, and S stands for sales.

Equity Multiples An equity multiple expresses the value of equity in relation to an equity statistic. The most common equity multiples are P/E, and P/BV where P is market price per share, E is earnings per share, and BV is book value per share.

Option Valuation Approach

An option is a special contract under which the option owner enjoys the right to buy or sell something without an obligation to do so. For example, you can buy a call option that gives the right to buy 100 shares of Reliance Industries Limited on or before 25/10/20X1 at an exercise price of say ₹1000. To buy this call option you have to pay an option premium.

What we described above is a financial option. The idea behind real options is similar. For example, a particular plot of land may be used for building apartments or a shopping complex. Further, the construction can be done now or in future. The developer would like to develop the property now or in future so that the present value of the difference between benefits and costs is maximised. While the best possible current use of land can be established easily, its best possible future use may not be known.

The standard DCF (discounted cash flow) valuation involves two steps, viz. estimation of expected future cash flows and discounting of these cash flows at an appropriate cost of capital. There are problems in applying this procedure to option valuation. While it is difficult (though possible) to estimate expected cash flows, it is impossible to determine the opportunity cost of capital because the risk of an option is virtually indeterminate as it changes every time the stock price varies.

To value a call option, we may set up a portfolio which imitates the call option in its payoff. The cost of such a portfolio, which is readily observed, must represent the value of the call option.

1.3 FEATURES OF THE VALUATION PROCESS

There are two diametrically opposite views of the valuation process. One view believes that valuation is a precise science, where there is no scope for human bias or error. The opposite view argues that valuation is an art and analysts have the freedom to produce whatever value number they want. The truth lies somewhere in the middle and so we must understand the following features of the valuation process: the bias in valuation, the uncertainty in valuation, and the complexity in valuation.

Bias in Valuation

We rarely value a company with a blank slate. Often, we have some prior views about the company before we begin to develop the inputs for our chosen model. Hence our conclusions tend to reflect our biases.

What are the sources of bias? There are several sources of bias. First, the companies that we choose to value are not chosen randomly. Rather they are companies about which we have read something good or bad or learnt from some experts that they are overvalued or undervalued. So, we already have a prior perception about the company that we are valuing. Second, the current market value of the company indirectly influences our valuation. We are hesitant to arrive at a value which is significantly different from the current market value. Third, institutional pressures prod equity analysts to issue buy not sell recommendations. So, they are likely to argue that firms are undervalued rather than overvalued.

How is bias manifested in value? There are different ways in which our bias manifests in value. First, we can be optimistic or pessimistic in defining the inputs (such as operating margin, return on investment capital, growth rate, and cost of capital) of valuation. Second, we may resort to *post-valuation tinkering*, by revising the assumptions after a valuation to get a value closer to a preconceived number. Third, we don't tinker with the estimated value but argue that the difference between what we consider to be the right value and the estimated value is due to qualitative factors such as strategic considerations and synergy.

What can be done to mitigate the effects of bias on valuation? Here are some suggestions:

1. *Avoid precommitments* Decision makers should not take a prior position on valuation. Let the analyst do his work without being pressured to conform to a predetermined position.
2. *Delink valuation from reward / punishment* A process where the reward or punishment depends on the outcome of valuation will induce a bias in valuation. So delink valuation from reward / punishment. For example, in acquisition valuation, separate the deal analysis from deal making.
3. *Diminish institutional pressures* Institutions interested in more objective equity valuation should shield their equity analysts who issue sell recommendations not only from annoyed clients but also from their own portfolio managers and sales executives.
4. *Increase self awareness* Self-awareness is a potent antidote to bias. The analyst should be aware of his/her biases and consciously tackle these biases while defining the valuation inputs.

Uncertainty in Valuation

In general, there is always an uncertainty associated with valuation, stemming from the following:

- *Estimation Uncertainty*: Even if the analyst uses reliable information, he has to translate raw information into inputs and use these inputs into valuation models. Mistakes can occur at either of these stages, leading to estimation error.
- *Firm-specific Uncertainty:* The analyst could go wrong in forecasting the firm's future. The performance of the firm could be much better or worse than expected.
- *Macroeconomic Uncertainty* Even if the firm's future performance is in line with expectations, macroeconomic environment may change unpredictably. The economy may do better or worse than expected and interest rates may go up or down – these macroeconomic factors will affect value.

How should the analyst respond to uncertainties? Here are some sensible responses.

- *Better Valuation Models* The analyst may build better valuation models that utilise fully the information that is available for valuation.
- *Valuation Ranges* Realising the uncertainty characterising valuation, the analyst may do simulation analysis or scenario analysis and come up with a valuation range, rather than a single value estimate.
- *Probabilistic Statements* The analyst may express his valuation in probabilistic terms to reflect the uncertainty he feels. For example, an analyst who comes up with a value of ₹50 for a stock that is trading at ₹40 may state that there is a 75 percent chance that the stock is undervalued rather than categorically stating that it is undervalued.

In the wake of uncertainty, some people despair of valuation. Paradoxically the payoff to valuation is the highest when there is greatest uncertainty about the numbers. Remember that the usefulness of a valuation depends on its relative precision not absolute precision. What really matters is how precise is your value estimate relative to the value estimates of others trying to value the same company.

Valuation Complexity

Over the past 25 years or so valuation models have become more and more complex as a result of two developments. First, computers and calculators have become far more powerful and affordable. Tasks which took days or weeks in the pre-computer era can now be done in seconds or minutes. Second, information is plentiful and accessible. You can download detailed data on thousands of companies very easily.

As models become more complex and information-intensive, there are certain problems and disadvantages:

- The analysts can suffer from information overload. Overwhelmed with vast quantities of conflicting information, they are likely to make poor input choices. The problem gets accentuated as analysts often face time constraints when valuing companies.
- As the model becomes very complex the analysts may not understand its inner workings: the model becomes a 'black box' for them. They just feed inputs and get the output. In effect they say "the model valued the company at 120 a share" rather than "we valued the company at 120."

Given the problems associated with complexity, the analysts would do well to follow the principle of parsimony in valuation. According to this principle we must try the simplest possible explanation for a phenomenon. When valuing an asset, we must use the simplest possible model. As Aswath Damodaran says: ".. if we can value an asset with three inputs we should not be using five. If we can value a company with three years of cash flow forecasts, forecasting 10 years of cash flows is asking for trouble."

1.4 CORPORATE VALUATION IN PRACTICE

Very broadly, the investment banking industry employs three basic valuation methods for enterprise valuation:

- Relative valuation
- Transaction multiples
- Discounted cash flow valuation

For pricing of initial public offering (IPOs), relative valuation, based of multiples of comparable companies, seems to be the preferred approach. Relative valuation makes sense in this situation because the company being valued will have publicly traded equity and investors can choose between the said company or any other 'peer' company that is publicly traded.

In mergers and acquisitions (M&A) analysis, the transactions multiple method (which is a kind of relative valuation method) is used along with the discounted cash flow (DCF) method. The logic for using transaction multiples is simple: both the buyer and the seller cannot ignore the multiples paid for similar transactions. Apart from using the transaction multiples, the buyer would also rely on DCF valuation that reflects its forecast of how the business would perform under its ownership.

While there may be slight variations in the DCF methods used by different investment banks, the typical approach is a hybrid approach wherein free cash flows during the planning period (usually a period of 5 to 10 years) are considered along with a terminal value which is estimated using a relative valuation method.

In M&A transactions involving a financial buyer (rather than a strategic buyer), such as a private equity firm like KKR or Blackstone, the DCF approach is used with a primary focus on internal rate of return (IRR). Financial buyers generally develop a cash flow forecast for a period of about 5 years, estimate a terminal value, and apply a discount rate (that reflects their required IRR) to establish the acquisition price.

Growing Consensus on Business Valuation Standards

Since the mid-1990s, there has been a growing consensus regarding business appraisal professional standards. Along with this, business valuation professional education has proliferated. Those who provide and use valuation services should be aware of these standards. Gone are the days when there were no generally accepted business valuation standards and almost anything could pass as a business valuation. Given the importance of business valuation, owners, investors, courts, government agencies, and others expect business valuation to conform to well defined standards.

Growing Emphasis on Cash Flows

Price WaterHouse Coopers commissioned an independent survey of 50 of the largest global investment managers and their approach to stock valuation. This survey confirmed that in assessing companies' economic value, large institutional investors are clearly moving from earnings-based return calculations to more sophisticated evaluation based on risk, growth, and cash flow returns on invested capital. Here are some typical comments:

- "We feel that when push comes to shove, it comes down to cash."
- "We think that the market is influenced by things that we don't tend to look at in the short run, but in the long run (it) is influenced by precisely what we look at—real cash-on-cash return on investments."
- "Cash is what you actually have. You can take your cash and you can reinvest in."
- "P/Es may have value as a rough proxy for expectations, but do a poor job of explaining the fundamental determinants of value. How much, how well and how long capital can be successfully redeployed in the business are considerations explicitly addressed in free cash flow model."

1.5 INFORMATION NEEDED FOR VALUATION

For valuing a company, you may require information relating to the following.

A. Industry and Competition
- Market size
- Market trends
- Market structure
- Characteristics of competitors
- Nature of competition

B. Operations
- Production capacities
- Products/services
- Cost structure
- Suppliers
- R&D
- Quality control

C. Marketing and Sales
- Customer base
- Marketing and sales organization

- Sales trends, domestic and international
- Pricing policies
- Advertising and promotion

D. **Human Resources**
- Employee strength
- Compensation policies

E. **Historical Financial Information**
- Historical income statements
- Historical balance sheets
- Historical statements of cash flow
- Notes to accounts (including significant accounting policies)
- Information on all exceptional and extraordinary items

F. **Financial Projections**
- Projected income statement for the next five years
- Projected balance sheet for the next five years
- Projected cash flows for the next five years
- Assumptions underlying financial projections

1.6 REFINEMENTS IN VALUATION

The disappointing outcomes of mergers and acquisitions of 1980s have led to refinement in company valuation. Thanks to the magic of Internet, now public filings are available online. Further, organizations like Factset and Ibbotson Associates provide a constant flow of data on M&A transactions and cost of capital statistics.

David Harding, a co-author of *Mastering the Merger* (Harvard Business School Publishing, 2004) said, "He knows much more about a target company today than he ever did 20 years ago. It's the difference between examining a patient with a stethoscope or with a CAT scan." Indeed, acquirers now have access to more comprehensive and reliable data for doing refined DCF analysis. In addition, they can conduct more rigorous due-diligence practices. As Robert Reilly, managing director of Chicago-based consultancy firm Willamette Management Associates, said, "You can now get every input you want for the capital asset pricing model (CAPM) for every industry and every time frame. Our ability to be more precise in the application of CAPM has improved a lot in the past 20 years." Further, newer methods such as the Fama-French three-factor model, capture additional factors like size and price-book ratio.

The improvement in DCF calculations has led to greater reliance of DCF models. For example, Colgate-Palmolive adopted the DCF approach for evaluating investments globally. As Robert Agate, former CFO of Colgate-Palmolive, said, "We used other approaches over the years, like sales growth and profitability trends. But when looking at high-and-low-inflation countries or different types of businesses, it was apparent that we needed a method that would provide a dollar-based common denominator for viewing the various transactions."

Better DCF forecasts have also made it possible to increase the complexity of M&A financing. Mezzanine financing, contingent convertible bonds, interest-only notes, and other structures have become possible mainly because better valuations enable lenders to assess risks properly. As Robert Reilly said, "If you have done a rigorous analysis, you are certain about the discount rate, and really know what the expected cash flow is going to be over the next 10 or 20 years, then you can convince the lender and the equity holder to buy these securities at a reasonable price." He added "On the other hand, in the 1980s you might have priced the deal simply on multiples. The lenders would have said, 'I'm not really confident about what the future will bring so. I'm not willing to purchase that kind of security.'"

If the valuation methodology has improved so much, why do companies overpay so often even now. One reason is the imprecision in estimating synergies. Another reason is that the numbers can be tweaked to justify the deal the CEO wants to do regardless of price. As Thomas Lys of Kellogg School of Management said, "Valuation is just an excuse. The moment it becomes clear that the CEO wants to do the deal no matter what, his investment banker and advisers are 'best advised to tell the emperor that his clothes are beautiful.'"

1.7 JUDICIAL REVIEW AND REGULATORY OVERSIGHT ON VALUATION

Valuation is understandably the most contentious issue in various corporate transactions such as mergers, takeovers, preferential allotments by listed companies, and so on. Hence it is subject to regulation and judicial review in various ways. Here is a synoptic view of such regulation and review.

- The pricing of preferential allotments by listed companies is subject to regulations of SEBI.
- To determine the fair value of shares to be transferred by a resident in India to a non-resident, the RBI has prescribed that the DCF method must be used and the valuation must be done by a chartered accountant or a SEBI-registered category 1 merchant banker.
- The pricing of open offers under the SEBI Takeover Code is subject to regulation.
- The valuation in a merger petition submitted to the court is a matter of judicial review.
- Minority shareholders, creditors, the central government, SEBI, or revenue authorities can challenge the proposed valuation in a court of competent jurisdiction for judicial review.

In general, the courts have maintained that valuation is a technical exercise to be done by experts and that courts will interfere only when it is seriously flawed or unfair. In

GL Sultania vs SEBI, the Supreme Court maintained: "If a valuer adopts the prescribed method or any other recognized method of valuation, the valuation cannot be assailed unless it is shown that the valuation is made on a fundamentally erroneous basis, or a patent mistake has been committed, or the valuer adopted a demonstrably wrong approach or a fundamental error going to the root of the matter." In Hindustan Lever Ltd vs Tata Oil Mills Co. Ltd, the Supreme Court maintained: "A court does not exercise an appellate jurisdiction. It exercises jurisdiction founded on fairness. It is not required to interfere only because the figure arrived at by the valuer was not as better as it would have been if another method would have been adopted." In judging the fairness of valuation, the courts ensure that established methods are used. The following are regarded as conventionally acceptable methods.

- For listed companies, the market price prevailing on the valuation date is considered highly relevant, especially for actively traded companies. For unlisted companies, the profitability and dividend track record are deemed important. Listed surrogates may be referred to if necessary.
- In cases relating to winding up, asset based valuation, using the break-up value, is largely applied.

1.8 INTRINSIC VALUE AND THE STOCK MARKET[1]

Given the roller-coaster ride of the stock market during the last two decades or so, people are wondering whether valuation theories can offer explanation for the dramatic swings in share prices. Some even argue that the stock market has a life of its own, divorced from the realities of profitability, growth, and risk. Are DCF valuations and market values decoupled? Do emotions reign supreme in the stock market?

We don't think so. For short periods, market values may diverge from fundamental values, but in the long run there is a remarkable convergence between the two. As Benjamin Graham insightfully remarked decades ago, "In the short run, the market is a voting machine, but in the long run it is a weighing machine."

Market Value Tracks Return on Invested Capital and Growth

Return on invested capital (ROIC) and growth are the major drivers of value in the capital market. Empirical evidence suggests that:

- The underlying performance of companies is reflected in the valuation levels of the market as a whole.
- Companies with higher ROIC and growth, as long as ROIC exceeds the cost of capital, command higher values in the stock market.

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1. Based on Tim Koller et al., *Valuation: Measuring and Managing the Value of Companies*, Fifth edition, John Wiley & Sons, 2010.

- Changes in investor expectation strongly influence TSR (total shareholder return) in the short-term (say less than three years). In the long-run (say 10 years and more), however, higher ROIC and growth lead to higher TSR.

Market Reflects Substance, Not Form

Many managers believe that the stock market is influenced by reported financial results. Hence they argue that a company must paint a picture of steady earnings growth and cover any deficiency by resorting to creative accounting. As a Wall Street Journal editorial put it: "A lot of executives apparently believe that if they figure out a way to boost reported earnings their stock price will go up even if the higher earnings do not represent an underlying economic change." Empirical evidence on market efficiency, however, strongly supports the view that the market is very intelligent in penetrating through the veil of accounting reports and seeing a company's underlying economic performance. Hence, efforts to artificially inflate reported earnings or creatively manage the bottom line are futile.

Since the market is driven by long-term economic fundamentals, managers should not be unduly concerned about how new accounting rules (relating to options, mergers, goodwill, foreign exchange, and so on) will affect their share prices, as these do not have any bearing on their underlying economics. Further, managers should not obsess about bonus issuance, stock splits, or listing in more developed markets, as these actions do not change the economic fundamentals of the business.

Emotions and Market Mispricing

Although the stock market is generally efficient, it is prone to commit mistakes, given the extraordinary difficulties in divining the future. Occasionally, the market displays high irrationality causing a substantial discrepancy between intrinsic value and market price. In market parlance it is called bubble time. Bubbles are often associated with the development of an exciting new technology or the emergence of a business opportunity. As Robert Shiller, Nobel laureate and author of the seminal work *Irrational Exuberance*, has noted, a bubble forms when there is a "positive feedback loop." A rise in the price of an asset encourages more and more people to buy it which in turn fuels further price rise and induces more and more people to join the bandwagon. The mechanism resembles a Ponzi mechanism, where more and more gullible (foolish) investors must be found to buy the assets from those who joined the game earlier. Eventually, however, the bubble bursts as one runs out of fools.

Just the way a price rise may encourage more people to buy, a price fall may induce more people to sell and this in turn may prod more and more people to sell, thereby triggering a sharp fall. Eventually, however, value-conscious investors step in and arrest the price fall.

There is a lot of substance in the argument of behavioralists, but empirical evidence, particularly for the U.S. and European stock markets, suggests that in the vast majority of cases, mis-pricings do not last very long. While market wide deviations are typically corrected in less than three years, company-specific deviations are corrected when barriers to trading are removed and market imperfections are sorted out.

A Model of the Market

There is a vast body of literature focused on investor behavior and market pricing. The general view is that market prices tend to gyrate around intrinsic value.

A simple yet insightful model assumes that two types of investors trade in the market viz., informed investors and noise traders. *Informed investors* estimate intrinsic value based on fundamental analysis. Of course, all informed investors have their own estimates based on the information they access and the analysis they do. Some may estimate the value at, say 100, others at 120, and still others at 140, thus resulting not in a single point but a range of 100 to 140 for the intrinsic value. Taking into account the margin of error and transaction costs, they will buy (sell) only when the stock price is less (more) than say 10 percent of their estimated intrinsic value. *Noise traders* hardly bother about intrinsic value. They trade on the basis of some news that may not really be material. For example, they may buy a stock when it rises by 5 percent or sell a stock when it falls by 5 percent. To understand what happens to the market price as a result of the interaction of intrinsic value investors and noise traders, let us say the price of the share is 70. Informed investors start buying shares because they assess the worth to be 100 to 140. Their actions push the share price up. When noise traders see the share price going up, they too start purchasing. This imparts further buoyancy to the share price and attracts more noise traders, as they don't want to be left behind. As the share price moves upward, the informed investors become less interested. At 90, the most pessimistic of them stop buying, and at 110, they begin to sell, convinced that the shares are overvalued. As the price goes up further, more informed investors curtail their purchases and begin to sell. Once the price crosses 150, all informed investors turn sellers. This exerts a downward pressure on price. On observing this, some noise traders also begin to sell, thereby reinforcing the downward pressure. As more and more noise traders become sellers, the downward momentum is accelerated. It, however, slows down as informed investors begin to buy and at 90, all informed investors turn buyers. Finally, the decline in downward momentum induces noise traders to buy as well and this stops the price decline.

1.9 IMPORTANCE OF KNOWING INTRINSIC VALUE

Although valuations have been wrong from time to time, eventually they have returned to the level justified by economic fundamentals.

What are the implications of such behaviour for corporate managers? Paradoxically, such market deviations suggest that it is even more important for the managers of a company to understand and focus on the intrinsic value of its shares. This knowledge is helpful in taking advantage of any deviations, as and when they occur. For example, corporate managers can exploit such deviations by:

- Issuing additional share capital when the share price is too high relative to its intrinsic value.
- Buying back shares when the share price is significantly less than its intrinsic value.
- Paying for acquisitions with shares instead of cash when the share is overvalued.
- Divesting particular businesses when the trading multiples are higher than what can be justified by the fundamentals.

Consequences of Ignoring Value

Ignoring intrinsic value can have serious adverse consequences, as the following conspicuous examples suggest:

- The rise and fall of business conglomerates in the 1970s.
- Hostile takeovers in the US in the 1980s.
- The collapse of Japan's bubble economy in the 1990s.
- The Southeast Asian crisis in 1998.
- Internet bubble
- The economic crisis starting in 2007.
- The ambitious global leveraged acquisitions by Indian firms.

SUMMARY

- Since value maximisation is the central theme in financial management, all managers must understand what determines value and how value should be measured.
- The fair market value of a company is the price at which it would change hands between a willing buyer and a willing seller when the former is not under any compulsion to buy and latter is not under any compulsion to sell, both parties having reasonable knowledge of relevant facts.
- Inter alia, corporate valuation is done in the following situations: raising capital for a nascent venture from a venture capitalist or private equity investor, initial public offering, acquisitions (takeovers, mergers, and purchases of divisions), divestitures, PSU disinvestments, and employee stock options plans.
- There are five broad approaches to appraising the value of a company: book value approach, stock and debt approach, discounted cash flow approach, relative valuation approach, and option valuation approach.

- Valuation is often characterised by bias stemming from factors like perception about the company being valued, the current market value of the company, and institutional pressures.
- To mitigate the bias in valuation avoid precommitments, delink valuation from reward or punishment, diminish institutional pressures, and increase self-awareness.
- In general, there is always an uncertainty associated with valuation on account of estimation uncertainty, firm-specific uncertainty, and macroeconomic uncertainty.
- Very broadly, the investment banking industry employs three basic methodologies for enterprise valuation: relative valuation, transaction multiples, and discounted cash flow valuation.
- Since the mid-1990s, there has been a growing consensus regarding business appraisal professional standards.
- For valuing a company, information relating to the following is required: (a) Industry and competition, (b) Operations, (c) Marketing and sales, (d) Human resources, (e) Historical financial information, and (f) Financial projections.
- The disappointing outcomes of mergers and acquisitions of 1980s have led to refinement in company valuation.
- Valuation, understandably the most contentious issue in various corporate transactions, is subject to regulation and judicial review in various ways.
- For short periods, market values may diverge from fundamental values, but in the long run there is a remarkable convergence between the two.

Questions

1. Describe the situations in which corporate valuation is done.
2. Discuss briefly the five broad approaches used for valuing a company.
3. What are the sources of bias in valuation? How is bias manifested in value? What can be done to mitigate the effects of bias on valuation?
4. What are the sources of uncertainty in valuation? How should the analyst respond to uncertainties in valuation?
5. Describe briefly the three basic methods for enterprise valuation used by the investment banking industry.
6. Discuss the importance of knowing the intrinsic value.
7. What kinds of information is required for valuation?
8. Discuss the nature of judicial review and oversight on valuation.
9. Discuss the link between intrinsic value and market price.

CHAPTER 2

Enterprise DCF Model

Traditionally, the book value approach and the relative valuation approach were used more commonly. From the early 1990s, however, the discounted cash flow approach – in particular, the enterprise DCF model – has received greater attention, emphasis, and acceptance. This is mainly because of its conceptual superiority and its strong endorsement by leading consultancy organisations like McKinsey and Company.

This chapter discusses the McKinsey version of the enterprise DCF model. It draws heavily on the book *Valuation : Measuring and Managing the Value of Companies* authored by Tim Koller, Marc Goedhart, and David Wessels, and published by John Wiley & Sons.

Valuing a firm using the discounted cash flow approach is conceptually identical to valuing a capital project using the present value method. However, there are two important differences:

- While a capital project is deemed to have a finite life, a firm is considered as an entity that has an indefinite life. This means that when we value a capital project we define its economic life and impute a salvage value to the assets of the project at the end of its economic life; however, for a firm we don't define an economic life and impute a salvage value to its assets at the end of such a period.
- A capital project is typically valued as a 'one-off' investment. We do not ordinarily look at the follow on investments on the assumption that these will be evaluated separately as and when they crystallise. A firm, however, is viewed as a growing entity and for valuing a firm we take into account all the investments in fixed assets and net working capital that are expected to be made over time to sustain the growth of the firm.

To sum up, valuing a firm using the discounted cash flow approach calls for forecasting cash flows over an indefinite period of time for an entity that is expected to grow. This is indeed a daunting proposition. To tackle this task, in practice, the value of the firm is separated into two time periods:

$$\text{Value of the firm} = \text{Present value of cash flow during an explicit forecast period} + \text{Present value of cash flow after the explicit forecast period}$$

During the explicit forecast period – which is often a period of 5 to 15 years – the firm is expected to evolve rather rapidly and hence a great deal of effort is expended to forecast its cash flow on an annual basis. At the end of the explicit forecast period the firm is expected to reach a "steady state" and hence a simplified procedure is used to estimate its continuing value.

Thus, the discounted cash flow approach to valuing a firm involves the following steps:

1. Analysing historical performance
2. Estimating the cost of capital
3. Forecasting performance
4. Determining the continuing value
5. Calculating the firm value and interpreting the results.

These steps are discussed in detail in the sections that follow.

2.1 ANALYSING HISTORICAL PERFORMANCE

Understanding how a company has fared in the past provides a good foundation for forecasting its future. Hence, an analysis of historical performance is usually the first step in valuing a business. Since financial statements are not designed with valuation in mind, it is necessary to rework them to sharpen the focus on the company's economic performance. This calls for:

- Reorganising the financial statements to get a handle over economic performance, instead of accounting performance, in terms of net operating profit less adjusted taxes (NOPLAT) and free cash flow (FCF). It may be noted that NOPLAT, a term coined by McKinsey & Company, is more popularly referred to as NOPAT (net operating profit after tax).
- Getting a perspective on the drivers of FCF.
- Measuring and analysing the return on invested capital (ROIC) to assess the ability of the company to create value.
- Decomposing revenue growth into various components.
- Assessing the company's financial health and capital structure.

For discussing historical performance analysis, the profit and loss account and the balance sheet of Matrix Limited, given in Exhibit 2.1, will be used. This exhibit gives the financial statements for three years (1, 2, and 3) – the year that has just ended is year 3.

Exhibit 2.1 ***Financial Statements of Matrix Limited for the Preceding Three Years (Years 1-3)***

in million

Profit and Loss Account	*1*	*2*	*3*
Net sales	180	200	229
Income from marketable securities	-	-	3
Non-operating income	-	-	8
Total income	180	200	240
Cost of goods sold	100	105	125
Selling and general administration expenses	30	35	45
Depreciation	12	15	18
Interest expenses	12	15	16
Total costs and expenses	154	170	204
PBT	26	30	36
Taxes	8	9	12
PAT	18	21	24
Dividend	11	12	12
Retained earnings	7	9	12

Balance Sheet	*1*	*2*	*3*
Equity capital	60	90	90
Reserves & surplus	40	49	61
Debt	100	119	134
Total	200	258	285
Fixed assets	150	175	190
Investments	-	20	25
Net current assets	50	63	70
Total	200	258	285

Reorganising the Accounting Statements

Accounting statements emphasise profit after tax, return on assets, return on equity, cash flow from operations, and net change in cash and cash equivalents. These measures reflect the combined effect of operating items, non-operating items, and capital structure.

For a proper understanding of historical performance, we should separate operating performance from non-operating items and capital structure. To do this, the accounting statements must be reorganised to get a handle over the following: operating invested capital, NOPLAT, ROIC, net investment, and free cash flow.

Operating Invested Capital The capital provided by shareholders and lenders is invested in operating assets (operating invested capital) and non-operating assets. Operating invested capital consists of net fixed assets deployed in the operations of the firm plus the operating working capital (operating working assets minus non-interest bearing current liabilities). In practice, operating invested capital may be obtained as follows:

Total assets in the balance sheet
– Non-operating fixed assets like surplus land
– Excess cash and marketable securities[1]

If we assume that the investment figures of 20 and 25 in the balance sheet of Matrix Limited at the end of years 2 and 3 represent excess cash and marketable securities, the operating invested capital at the end of years 1, 2, and 3 for Matrix Limited is:

	1	2	3
Operating invested capital	200	238	260

NOPLAT NOPLAT stands for net operating profit less adjusted taxes. It is equal to:

$$\text{EBIT} - \text{Taxes on EBIT}$$

EBIT (earnings before interest and taxes) is the pre-tax operating income the firm would have earned if it had no debt. While calculating EBIT, the following are excluded: interest expenses, interest income, and non-operating income (or loss).

Taxes on EBIT represents the taxes the firm would pay if it had no debt, excess marketable securities, or non-operating income (or loss). Taxes on EBIT can be calculated by adjusting the income tax provision for the income tax attributable to interest expense, interest and dividend income from excess marketable securities, and non-operating income (or loss).

The calculation of NOPLAT for Matrix Limited is shown below, assuming a marginal tax rate of 40 percent.

[1] This represents cash and marketable securities in excess of the operational needs of the firm.

in million

		Year 1	*Year 2*	*Year 3*
	Profit before tax	26	30	36
+	Interest expense	12	15	16
–	Interest income	-	-	3
–	Non-operating income	-	-	8
=	EBIT	38	45	41
	Tax provision from income statement	8	9	12
+	Tax shield on interest expense	4.8	6	6.4
–	Tax on interest income	-	-	1.2
–	Tax on non-operating income			3.2
=	Taxes on EBIT	12.8	15	14.0
	NOPLAT	25.2	30	27.0

The Tax Factor To compute NOPLAT, you multiply EBIT by (1-*T*) where *T* is the estimated tax rate. What tax rate should you use? Two choices are available, viz, the effective tax rate and the marginal tax rate. The effective tax rate of a firm can be computed from its reported profit and loss statement as follows:

$$\text{Effective tax rate} = \frac{\text{Taxes due (also called current tax)}}{\text{Profit before tax}}$$

The marginal tax rate of a firm is the tax rate applicable on the last rupee of its income. It depends on the tax code. In India, for instance, the corporate tax rate on marginal income is 30 % for domestic companies and 40% for foreign companies.

The effective tax rate may differ from the marginal tax rate for the following reasons:

- Many firms follow different accounting standards for tax and for reporting purposes. For instance, firms typically use the straight line method of depreciation for reporting purposes but the written down value method for tax purposes. This causes a discrepancy between reported income and taxable income.
- Firms may enjoy tax reliefs and concessions. For instance, a company may be located in a Special Economic Zone and enjoy tax exemption for ten years. As a consequence, the reported taxable income (also called book profit) may be high but the taxable income may be nil. Thanks to Minimum Alternate Tax (MAT), firms have to pay a MAT of 18.5 percent on their book profit even though the taxable income may be nil. However, a firm that pays MAT is entitled to MAT credit that can be availed in future for the following 8 years to set off tax liability.

Which tax rate should you use? If the same tax rate has to be applied to EBIT every period, the marginal tax rate is a better choice because none of the two reasons noted above can sustain forever. If different tax rates can be applied to different periods, start with the effective tax rate for the current period and increase it linearly to the marginal tax rate over a reasonable time, say 5 to 10 years. However, it is critical that the tax rate used in perpetuity to compute the terminal value should be the marginal tax rate.

Implications of Net Operating Losses When a firm has unabsorbed losses that can be carried over time, you must change the tax rate over time. Since the firm will have zero tax rate till the losses are carried forward, use a zero value of T for computing NOPLAT as well as the post-tax cost of debt.

Return on Invested Capital Return on invested capital, ROIC, is defined as follows:

$$\text{ROIC} = \frac{\text{NOPLAT}}{\text{Invested capital}}$$

Invested capital is usually measured at the beginning of the year or as the average at the beginning and end of the year. While calculating ROIC, define the numerator and denominator consistently. If an asset is included in invested capital, income related to it should be included in NOPLAT to achieve consistency. The ROIC for Matrix Limited is calculated below:

	Year 2	*Year 3*
NOPLAT	30	27
Invested capital at the beginning of the year	200	238
ROIC	30/200 = 15%	27/238 = 11.3%

ROIC focuses on the true operating performance of the firm. It is a better measure compared to return on equity and return on assets. Return on equity reflects operating performance as well as financial structure and return on assets is internally inconsistent (numerator and denominator are not consistent).

Net Investment Net investment is the difference between gross investment and depreciation:

$$\text{Net investment} = \text{Gross investment} - \text{Depreciation}$$

Gross investment is the sum of incremental outlays on capital expenditures and net current assets. Depreciation refers to all non-cash charges.

Alternatively, net investment during the year can be calculated as follows:

$$\begin{pmatrix}\text{Net fixed assets at the end} & + & \text{Net current assets at the end} \\ \text{of the year} & & \text{of the year}\end{pmatrix}$$

$$-\begin{pmatrix}\text{Net fixed assets at the} & + & \text{Net current assets at the end} \\ \text{beginning of the year} & & \text{of the year}\end{pmatrix}$$

Calculated in this manner, the net investment for Matrix Limited is shown below:

		Year 2	*Year 3*
	Net fixed assets at the end of the year	175	190
+	Net current assets at the end of the year	63	70
–	Net fixed assets at the beginning of the year	150	175
–	Net current assets at the beginning of the year	50	63
		38	22

Free Cash Flow The **free cash flow** (FCF) is the post-tax cash flow generated from the operations of the firm after providing for investments in fixed assets and net current assets required for the operations of the firm. FCF can be expressed as:

FCF = NOPLAT – Net investment

FCF = (NOPLAT + Depreciation) – (Net investment + Depreciation)

FCF = Gross cash flow – Gross investment

Exhibit 2.2 shows the FCF calculation for Matrix Limited.

Exhibit 2.2 ***Matrix Limited Free Cash Flow***

	Year 1	*Year 2*	*Year 3*
NOPLAT	25.2	30.0	27.0
Depreciation	12	15	18
Gross cash flow	37.2	45	45
Increase/(decrease) in net current assets		13	7
Capital expenditure		40	33
Gross investment		53	40
Free cash flow		(8)	5

The **cash flow available to investors** (shareholders and lenders) is equal to free cash flow plus non-operating cash flow. We have discussed what free cash flow is. What is non-operating cash flow? Non-operating cash flow arises from non-operating items like sale of assets, restructuring, and settlement of disputes. Such items must, of course, be adjusted for taxes.

The cash flow available to investors can also be viewed as the **financing flow** which is derived as follows:

Financing flow	=	After-tax interest expense
	+	Cash dividend on equity and preference capital
	+	Redemption of debt
	–	New borrowings
	+	Redemption of preference shares
	+	Share buybacks
	–	Share issues
	+	Δ Excess marketable securities
	–	After tax income on excess marketable securities

The last two items in the above expression require some clarification. Excess marketable securities are regarded as negative debt. So, a change in excess marketable securities is treated as a financing flow. For the same reason, the post-tax income on excess marketable securities is regarded as a financing flow.

Exhibit 2.3 shows the calculation for the cash flow available to investors.

Exhibit 2.3 ***Matrix Limited—Cash Flow Available to Investors***

		Year 2	*Year 3*
	Free cash flow	(8)	5
+	Non-operating cash flow	–	4.8
=	Cash flow available to investors	(8)	9.8
	After-tax interest expense	9.0	9.6
+	Cash dividend on equity and preference capital	12	12
+	Redemption of debt		–
–	New borrowings	19	15
+	Share buybacks	–	–
–	Share issues	30	–
+	Δ Excess marketable securities	20	5
–	After-tax income on excess securities	–	1.8
=	Financing flow	(8)	9.8

Getting a Perspective on the Drivers of FCF

The FCF may be analysed in terms of its key drivers as follows:

$$\begin{aligned}
\text{FCF} &= \text{NOPLAT} - \text{Net Investment} \\
&= \text{NOPLAT}\left(1 - \frac{\text{Net Investment}}{\text{NOPLAT}}\right) \\
&= \text{Invested Capital}\left(\frac{\text{NOPLAT}}{\text{Invested Capital}}\right)\left(1 - \frac{\text{Net Investment}}{\text{NOPLAT}}\right) \\
&= \text{Invested Capital}\left(\frac{\text{NOPLAT}}{\text{Invested Capital}}\right)\left(1 - \frac{\text{Net Investment / Invested Capital}}{\text{NOPLAT / Invested Capital}}\right) \\
&= \text{Invested Capital} \times \text{ROIC}\left(1 - \frac{\text{Growth rate}}{\text{ROIC}}\right)
\end{aligned}$$

Thus, invested capital, ROIC, and growth rate are the basic drivers of FCF. The drivers of FCF for Matrix Limited for the years 2 and 3 are given below:

		Year 2	*Year 3*
• Invested capital (Beginning of the year)		200 million	238 million
• NOPLAT		30 million	27 million
• ROIC	$= \dfrac{\text{NOPLAT}}{\text{Invested capital}}$	15.0%	11.3%
• Net investment		38 million	22 million
• Growth rate	$= \dfrac{\text{Net investment}}{\text{Invested capital}}$	19.0%	9.2%
• FCF		-8 million	5 million

How Cash Flow Is Analysed by Rappaport

Alfred Rappaport[2], regarded by many as the father of shareholder value movement, developed his shareholder value approach in which he expresses cash flow (what others call free cash flow) as follows:

[(Sales in prior year) (1 + Sales growth rate) (Operating profit margin) (1 – Cash income tax rate)]

– [(Sales in prior year) (Sales growth rate) (Incremental fixed plus working capital investment rate)]

Note that the first term in the above expression is NOPLAT and the second term in the above expression is Net Investment.

The approach followed by the Alcar Group, co-founded by Rappaport, focuses more on sales, sales growth rate, and operating profit margin, whereas the approach developed by McKinsey focuses more on invested capital, return on invested capital, and investment rate.

Developing the ROIC Tree

As ROIC is a key driver of free cash flow and valuation, it is useful to develop the ROIC tree which disaggregates ROIC into its key components. The starting point of the ROIC tree is:

$$\text{ROIC} = \frac{\text{NOPLAT}}{\text{Investment}}$$

Since NOPLAT is equal to EBIT (1-Cash tax rate), ROIC can be expressed as:

$$\text{ROIC} = \frac{\text{EBIT}}{\text{Invested capital}}(1 - \text{Cash tax rate})$$

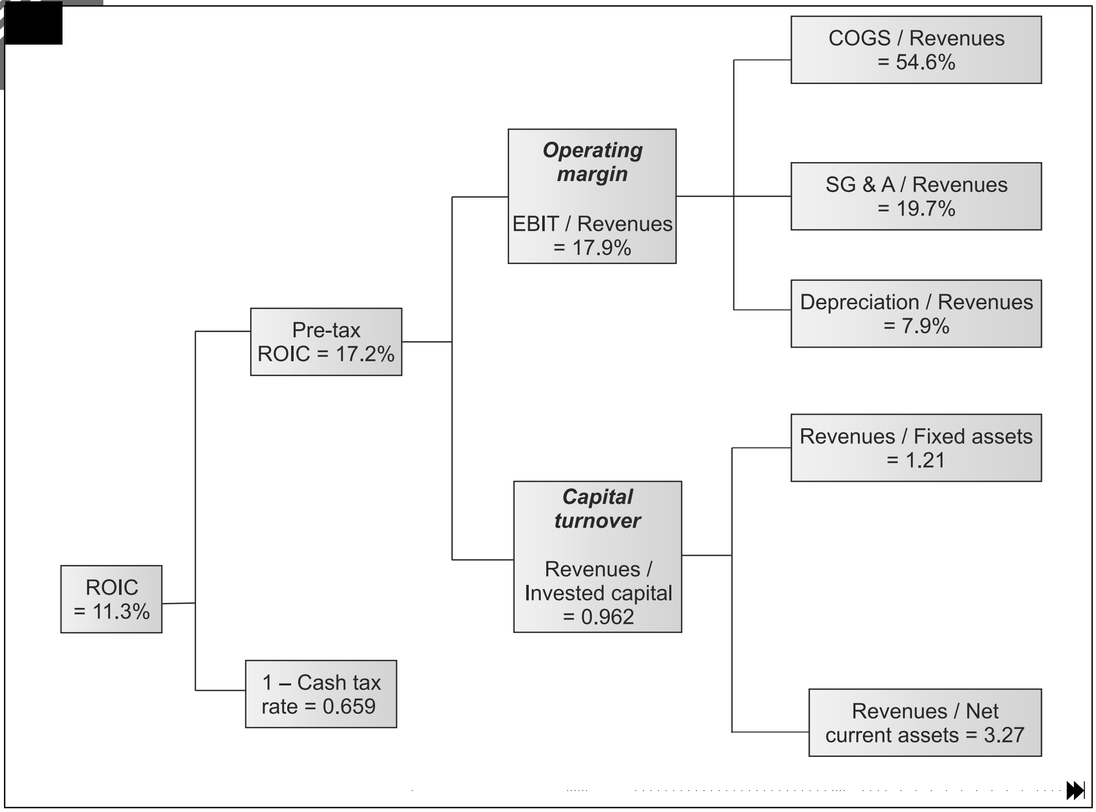
Pre-tax ROIC can be broken down into two components as follows:

$$\frac{\text{EBIT}}{\text{Invested capital}} = \underbrace{\frac{\text{EBIT}}{\text{Revenues}}}_{\text{Operating Margin}} \times \underbrace{\frac{\text{Revenues}}{\text{Invested capital}}}_{\text{Capital turnover}}$$

The first term, viz., the operating margin measures how effectively the firm converts revenues into profits and the second term, viz., the capital turnover reflects how effectively the company employs its invested capital. Each of these two components can be further disaggregated. Exhibit 2.4 shows the ROIC tree for Matrix Limited.

[2] Alfred Rappaport, *Creating Shareholder Value,* Free Press, New York, 1998.

Exhibit 2.4 ***Matrix Limited – ROIC Tree for Year 3***



Decomposing Revenue Growth

The value of a firm is driven by ROIC, WACC, and growth. Growth has been defined in terms of free cash flow. What drives the long term growth of free cash flow? Assuming stable profit margins and reinvestment rates, the long-term growth in free cash flow is determined by long-term growth in revenues. An analysis of historical revenue growth is helpful in assessing the future growth.

To begin with look at the year-to-year reported revenue growth for the past three to five years. Next, decompose the reported revenue growth into the following:

- Organic revenue growth
- Acquisitions and divestitures
- Currency effects
- Changes in accounting policies.

Organic revenue growth reflects the growth in revenue, when the impact of acquisitions and divestitures, currency factor, and changes in accounting policies is removed.

Acquisitions have a buoying effect on revenues and divestitures have a dampening effect on revenues. Changes in currency values have a bearing on the revenues of multinational companies. Finally, changes in accounting policies have an effect on earnings.

Assessing the Company's Financial Health and Capital Structure

Apart from looking at the primary drivers of value such as ROIC, growth, and free cash flow, you should also examine how the company has financed its operations. What is the capital structure of the firm? Is it sustainable? Does the company have enough financial flexibility to weather a downturn?

To assess the financial health and capital structure, you may examine interest coverage, leverage, and dividend payout ratio.

Interest Coverage Among the various measures of *interest coverage,* the most popular one is EBITDA (Earnings before interest, taxes, depreciation, and amortisation) to interest ratio. It measures the ability of the company to meet its short term financial commitments using current profits as well as depreciation amount meant for capital replacement. While a high EBITDA to interest ratio may suggest that the company is very well poised to meet its interest obligations, it does not say much about its ability to replace worn out equipments.

Leverage The effect of *leverage* can be understood better by considering the relationship between return on equity (ROE) and return on invested capital (ROIC).

$$\text{ROE} = \text{ROIC} + [\text{ROIC} - r\,(1 - t)]\ \text{D/E} \tag{2.1}$$[3]

where ROE is the return on equity, ROIC is the return on invested capital, $r(1 - t)$ is the after-tax cost of debt, and D/E is the debt-equity ratio.

According to this formula ROE is determined by ROIC, the spread between ROIC and post-tax cost of debt, and the debt-equity ratio. A higher debt-equity ratio has a positive impact on ROE when ROIC exceeds post-tax cost of debt, but a negative impact on ROE

[3] This equation is derived as follows:

$$
\begin{aligned}
\text{ROE} &= \text{PAT / E}\\
&= \frac{(\text{EBIT} - I)(1 - t)}{E}\\
&= \frac{(\text{EBIT})(1 - t) - I(1 - t)}{E}\\
&= \frac{\text{ROIC} \times (D + E) - r\,D(1 - t)}{E}\\
&= \text{ROIC} + [\text{ROIC} - r(1 - t)]D/E
\end{aligned}
$$

when ROIC is less than the post-tax cost of debt. Thus, an increase in the debt-equity magnifies the changes in ROE.

To assess a firm's financial leverage, look at its debt-equity ratio (in market value terms) over time and against its peers. How has the firm's debt-equity ratio changed over time? How does it compare with the industry average? Is the company taking a lot of financial risk?

Dividend Payout The *dividend payout ratio* of a company is simply the dividend (plus dividend distribution tax) paid by the company divided by the net profit accruing to equity shareholders, which is simply profit after tax less preference dividend. The dividend payout ratio of most of the companies ranges between 20 percent and 80 percent. The dividend payout ratio must be evaluated in relation of a company's reinvestment needs. Can the reinvestment needs of the company be met with internal accruals? To what extent will the company have to rely on external finance to meet its reinvestment needs? If the company's free cash flows exceed its dividend payments, will the company repay debt or create excess liquidity? In this case, is the company foregoing valuable tax benefits associated with debt, or building excess liquidity that earns a low return, or running the risk of squandering resources over uneconomic projects?

General Guidelines for Historical Analysis

It is not possible to provide a comprehensive checklist for historical financial performance analysis that is applicable across-the-board. Yet there are a few things that should generally be borne in mind:

- Consider a period of at least 5 years or more. A long time horizon helps you to know whether the company and industry have a tendency to revert to some mean level of performance and whether short-term trends are likely to endure.
- Disaggregate ROIC and revenue growth, the two principal value drivers, into their key components. As far as possible, link operating performance measures to these value drivers.
- If the performance has changed radically find out the cause(s). Is the change temporary or durable? Is it just an accounting effect?

Period of Analysis An important but difficult decision relates to the period over which the past performance is analysed. While there is no uniform rule for the selection of the period, the following guidelines may be borne in mind: (i) The period must be a period characterised by relative stability in the circumstances of the company. This ensures that changing circumstances do not vitiate the comparability of profits. (ii) The period must be sufficiently long to give confidence that earnings are maintainable but not so long that the past earnings figures become irrelevant in the present circumstances. (iii) If the business is subject to cyclicality, the period must cover at least one full business cycle.

2.2 ESTIMATING THE COST OF CAPITAL

Providers of capital (shareholders and lenders) want to be suitably compensated for investing funds in the firm. The cost of capital reflects what they expect. It is the discount rate used for converting the expected free cash flow into its present value. Hence, its definition must be consistent with that of the free cash flow. This means that the cost of capital should have the following features:

- It represents a weighted average of the costs of all sources of capital, as the free cash flow reflects the cash available to all providers of capital.
- It is calculated in post-tax terms because the free cash flow is expressed in post-tax terms.
- It is defined in nominal terms, since the free cash flow is stated in nominal terms.
- It is based on market value weights for each component of financing, as market values, not book values, represent the economic claims of various providers of capital.
- It reflects the risks borne by various providers of capital.

Formula

The formula that may be employed for estimating the weighted average cost of capital is:

$$\text{WACC} = r_E\,(S/V) + r_P\,(P/V) + r_D(1 - T)\,(B/V) \tag{2.2}$$

where WACC is the weighted average cost of capital, r_E is the cost of equity capital, S is the market value of equity, V is the market value of the firm, r_P is the cost of preference capital, P is the market value of preference capital, r_D is the pre-tax cost of debt, T is the marginal rate of tax applicable, and B is the market value of interest-bearing debt.

In the above formula r_D, the pre-tax cost of debt, is multiplied by the factor $(1 - T)$ because interest on debt is a tax-deductible payment.

Since preference and debt entail a fixed payment, which is pre-determined, it is fairly easy to estimate the cost of preference and the cost of debt. Estimating the cost of equity, however, is not easy, because when a firm raises equity it does not make any contractual commitment.

Currently, capital asset pricing model (CAPM) is widely used for estimating the cost of equity. This model is described in detail in the following chapter. In essence, the CAPM says:

$$\text{Cost of equity} = \text{Risk-free rate} + \text{Equity beta (Market risk premium)}$$

In this equation, equity beta represents the sensitivity of equity to general market movements and market risk premium is the difference between the expected return on the market portfolio and the risk-free rate.

Matrix's Weighted Average Cost of Capital

Matrix Limited has a target capital structure in which debt and equity have weights (in market value terms) of 2 and 3. The component costs of debt and equity are 12.67 percent and 18.27 percent. The marginal tax rate for Matrix is 40 percent. Given this information the, weighted average cost of capital is calculated as follows:

$$\text{WACC} = \frac{3}{5} \times 18.27 + \frac{2}{5} \times 12.67\,(1 - .4)$$
$$= 10.96 + 3.04 = 14 \text{ percent}$$

2.3 FORECASTING PERFORMANCE

After analysing historical performance, we move on to developing a set of financial forecasts, reflecting expected future performance of the company.

Since the future is unknowable, forecasting performance is at best an educated guesswork. It involves the following steps:

1. Determine the length of the explicit forecast period.
2. Develop a strategic perspective on the future performance.
3. Develop financial forecasts.

Determine the Length of the Explicit Forecast Period

Valuing a firm using the discounted cash flow approach calls for forecasting cash flows over an indefinite period of time for an entity that is expected to grow. This is indeed a daunting proposition. As mentioned earlier, to tackle this task, in practice, the value of the firm is separated into two time periods:

Value of the firm = Present value of cash flow during an explicit forecast period + Present value of cash flow after the explicit forecast period

During the explicit forecast period – which is often a period of 5 to 15 years – the firm is expected to evolve rather rapidly and hence a great deal of effort is expended to forecast its cash flow on an annual basis. At the end of the explicit forecast period the firm is expected to reach a "steady state" and hence a simplified procedure is used to estimate its continuing value.

The general guideline is that the explicit forecast period should be such that the company reaches a steady state at the end of this period. The steady state has the following characteristics:

- The company earns a fixed profit margin, achieves a constant turnover, and hence earns a constant return on invested capital.

- The re-investment rate (the proportion of cash flow invested annually) and the growth rate remain constant.
- The capital structure and the cost of capital remain constant.

The above assumptions imply that in the steady state the free cash flow will grow at a constant rate that can be discounted at a fixed discount rate. This means that the continuing value of the company at the end of the explicit forecast period can be estimated by using the growing free cash flow perpetuity method or the value driver method.

Determine a Strategic Perspective on Future Performance

The strategic perspective reflects a credible story about the company's future performance. One such story about a telecom software provider is given below for illustrative purposes:

> "The global telecom market is recovering. The company is well-positioned in those segments of the telecom market which are growing rapidly. The company has restructured its licensing arrangements with its customers and this is expected to augment its overall income from licensing. The combination of these factors is expected to generate a robust growth in revenues and improve the net profit margin over the next five years."

The story that you craft about the future prospects of the company provides the context for financial forecasting. So, develop the story on the basis of a thoughtful strategic analysis of the company and the industry to which it belongs. The ability of a company to earn superior returns depends on its sustainable competitive advantage which may come from cost leadership or product differentiation or both. Hence the story relating to the company's future performance must dwell on its potential competitive edge.

There are several analytical frameworks available in the extensive literature on strategy to help you in developing the story. Prominent among them are the industry structure analysis, customer segmentation analysis, value chain analysis, information rules, and disruptive technology. These frameworks are discussed in the appendix at the end of this chapter.

Problem with Detailed Scenarios The strategy story is typically in the form of a scenario. However, beware of a detailed scenario. As Tversky and Kahneman said, "As the amount of detail in a scenario increases, its probability can only decrease steadily, but its representativeness and hence its apparent likelihood may increase. The reliance on representativeness, we believe, is a primary reason for the unwarranted appeal of detailed scenarios and the illusory sense of insight that such constructions often provide." In a similar vein, Andrew Lo added, "While adding details in the form of a specific scenario to a risk-management simulation makes it more palpable and intuitive—in Tversky and Kahneman's terminology, more representative—it also decreases the probability of occurrence. Therefore, decisions based largely on scenario analysis may overestimate the likelihood of more relevant outcomes."

Importance of a Story

It is a well established psychological principle that much of the human thinking that leads to action is in the form of storytelling. In their study of how jurors reach decisions, psychologists Nancy Pennington and Reid Hastie found that jurors' reasoning tended to take the form of constructing a story, in which details gathered by them were woven in the form of a coherent narrative of the chain of events. As Robert Shiller put it: "In describing their verdict, they tended not to speak of quantities or probabilities, or of summing up the weight of the evidence, but rather merely to tell a story of the case, typically a chronology of events, and to remark how well their story fits together."

Develop Financial Forecasts

The DCF value of an enterprise depends on forecasted free cash flow and the latter is derived from the profit and loss account and balance sheet. So, the forecasting process may be broken up into the following steps:

1. Develop the sales forecast.
2. Forecast the profit and loss account.
3. Forecast the balance sheet: the assets side.
4. Forecast the balance sheet: the liabilities side.
5. Calculate ROIC and FCF.
6. Check for consistency and alignment.

Step 1: Develop the Sales Forecast At the core of any financial forecasting exercise lies the sales forecast. Sales to a company are like the GDP to a nation. Most of the variables in the profit and loss account and the balance sheet are linked to sales in some way or the other.

There are two ways of developing the sales forecast, viz., the top-down approach and the bottom-up approach. In the top down approach, the sales of the company are estimated by sizing up the total market, determining the market share the company would enjoy, and predicting the selling prices. In the bottom up approach, the projected sales to existing customers are added to the projected sales to new customers to get the forecasted sales of the company.

Irrespective of the approach followed, sales forecasting over long time horizons is inherently an uncertain and imprecise exercise. Unpredictable changes in the regulatory environment, technologies, corporate strategies, competitive conditions, consumer preferences, and currency movements determine the winners and losers in the marketplace. Hence, you have to periodically reevaluate the sales forecast. When you are unsure of your sales forecast, use multiple scenarios to reflect uncertainty.

Step 2: Forecast the Profit and Loss Account Based on the sales forecast, develop the forecasts for individual line items of the profit and loss account. Use the following three-step process for this:

(i) *Determine the economic driver of line items* Most line items like raw material cost, employee cost, power cost, and selling cost are linked directly to sales. Some line items like interest cost are related to the level of debt in the balance sheet.

(ii) *Estimate the forecast ratio* For each line item in the profit and loss account, calculate the historical value of the relevant ratio (such as raw material cost to sales ratio) and estimate the ratio applicable to future years.

(iii) *Multiply the forecast ratio by an estimate of its economic driver* As sales is the driver for most line items, most forecast ratios (such as COGS to sales) are multiplied by estimated sales.

Exhibit 2.7 presents typical forecast drivers and forecast ratios for the most common line items in the profit and loss account.

Exhibit 2.7 ***Forecast Drivers and Forecast Ratios***

Line Item	*Forecast Driver*	*Forecast Ratio*
• Cost of goods sold	Sales	COGS/ Sales
• Selling, general, and administration (S G & A)	Sales	SG&A / Sales
• Depreciation	Prior year's net fixed assets	Depreciation / net fixed assets
• Non-operating income	Appropriate non-operating assets	
• Interest expense	Prior year's total debt	Interest expense (t) / total debt ($t - 1$)
• Interest income	Prior year's excess cash	Interest income (t) / excess cash ($t - 1$)
• Tax	Earnings before tax	Average tax rate
• Dividend	None	Policy decision
• Retained earnings	None	Policy decision

The projected profit and loss account for Matrix Limited for five years – years 4 through 8 – representing the explicit forecast period are given in Exhibit 2.7.

Exhibit 2.8 ***Projected Profit and Loss Account for Matrix Limited for Five Years – Years 4 through 8 – The Explicit Forecast Period***

in million

Profit and Loss Account	*4*	*5*	*6*	*7*	*8*
• Net sales	270	320	360	400	440
• Income from excess marketable securities	3	2	-	-	-
• Non-operating income	-	-	-	-	-
• Total income	273	322	360	400	440
• Cost of goods sold	144	173	193	218	245
• Selling and general administration	47	59	67	70	77
• Depreciation	22	26	29	32	35
• Interest expense	18	20	21	23	25
• Total costs and expenses	231	278	310	343	382
• Profit before tax	42	44	50	57	58
• Tax provision	13	16	18	19	18
• Profit after tax	29	28	32	38	40
• Dividend	15	15	15	16	16
• Retained earnings	14	13	17	22	24

Step 3: Forecast the Balance Sheet: Assets Side You can forecast the line items in the balance sheet using the stock approach or the flow approach. For example, the stock approach forecasts end-of-year debtors as a function of sales and the flow approach forecasts the change in debtors as a function of the change in sales. The stock approach seems to be a better approach because the relationship between the balance sheet items and sales (or other volume measures) is more stable than that between balance sheet changes and changes in sales.

Exhibit 2.9 presents forecast drivers and forecast ratios for the most common line items on the assets side of the balance sheet. Note that the net current assets is: current assets, loans, and advances–current liabilities and provisions. So both the categories are covered.

Exhibit 2.9 ***Typical Forecast Drivers and Ratios for the Balance Sheet***

Line Item	*Typical Forecast Driver*	*Typical Forecast Ratio*
Net fixed assets	Sales	Net fixed assets / Sales
Investments	None	Growth in Investments
Inventories	Cost of goods sold (COGS)	Inventories / COGS
Debtors	Sales	Debtors / Sales
Loans and advances	None	Growth in loans and advances
Sundry creditors	Cost of goods sold	Sundry creditors / COGS
Advances from customers	None	Growth in advances from customers
Provision for dividend	None	Growth in dividend
Accrued employee benefits	None	Growth in accrued employee benefit

Step 4: Forecast the Balance Sheet: Liabilities Side The principal items on the liabilities side are paid up capital, reserves and surplus, and debt (secured loans and unsecured loans).

Use the following procedure to forecast the above items:

(i) Keep the paid up capital unchanged.

(ii) Estimate reserves and surplus using the principle of surplus accounting:

$$\begin{matrix}\text{Reserves and} \\ \text{surplus } (t+1)\end{matrix} = \begin{matrix}\text{Reserves} \\ \text{and surplus} \\ (t)\end{matrix} + \begin{matrix}\text{Profit} \\ \text{after tax} \\ (t+1)\end{matrix} - \begin{matrix}\text{Dividends} \\ (t+1)\end{matrix}$$

(iii) Forecast existing debt using contractual terms.

(iv) Compare the following:
A : Assets – Excess Cash
B : Paid up capital + Reserves and surplus + Debt

(v) If $A > B$, set excess cash equal to zero and plug the difference with new debt. If $B > A$, plug the difference with excess cash.

In the case of Matrix Limited the figures for year 4 are as follows:

$$A = \text{ Assets – Excess Cash} = 305 - 10 = 295 \text{ million}$$

B = Paid up capital + Reserves and surplus
+ Forecast existing debt using contractual terms
= 90 + 75 + 134 = 299 million

Since $B > A$, the excess cash will be 299 – 295 = 4 million. This means the excess cash (in the form of investments) will have to be reduced from 10 million to 4 million. However Matrix Limited would like to hold the entire investment of 10 million for one more year as there is an attractive terminal benefit. To accommodate this, it will increase the debt from 134 million to 140 million.

The forecast balance sheets for Matrix Limited for five years – years 4 through 8 – representing the explicit forecast period are given in Exhibit 2.10. It is expected that the investments (in marketable securities) will be liquidated in two installments: 15 at the end of year 4 and 10 at the end of year 5.

Exhibit 2.10 ***Projected Balance Sheet for Matrix Limited for Five Years – Years 4 through 8 – The Explicit Forecast Period***

in million

	4	*5*	*6*	*7*	*8*
• Equity capital	90	90	90	90	90
• Reserves & surplus	75	88	105	127	151
• Debt	140	150	161	177	192
Total	305	328	356	394	433
• Fixed assets	220	240	266	294	324
• Investments	10	–	–	–	–
• Net current assets	75	88	90	100	109
Total	305	328	356	394	433

Step 5: Calculate FCF and ROIC After completing the forecasts of profit and loss account and balance sheet, calculate FCF and ROIC for each forecast year. The FCF and ROIC for Matrix Limited for five years – years 4 through 8 – representing the explicit forecast period are given in Exhibit 2.11.

Exhibit 2.11 ***Free Cash Flow Forecast for Matrix Limited for Five Years – Years 4 through 8 – The Explicit Forecast Period***

in million

		4	5	6	7	8
1.	Profit before tax	42	44	50	57	58
2.	Interest expense	18	20	21	23	25
3.	Interest income	3	2	-	-	-
4.	Non-operating income	-	-	-	-	-
A.	EBIT: (1) + (2) – (3) – (4)	57	62	71	80	83
5.	Tax provision on income statement	13	16	18	19	18
6.	Tax shield on interest expense	7.2	8.0	8.4	9.2	10.0
7.	Tax on interest income	1.2	0.8	-	-	-
8.	Tax on non-operating income	-	-	-	-	-
B.	TAXES ON EBIT: (5) + (6) – (7) – (8)	19.0	23.2	26.4	28.2	28.0
C:	NOPLAT: (A) – (B)	38.0	38.8	44.6	51.8	55.0
D:	NET INVESTMENT	35.0	33.0	28.0	38.0	39.0
E:	FREE CASH FLOW: (C) – (D)	3.0	5.8	16.6	13.8	16.0
F:	ROIC = NOPLAT/INVESTED CAPITAL	$\frac{38}{295}$	$\frac{38.8}{328}$	$\frac{44.6}{356}$	$\frac{51.8}{394}$	$\frac{55.0}{433}$
	=	12.9%	11.8%	12.5%	13.1%	12.7%

Step 6: Check for Consistency and Alignment The final step in the forecasting exercise is to evaluate the forecast for consistency and alignment by asking the following questions.

- Is the projected revenue growth consistent with industry growth?
- Is the ROIC justified by the industry's competitive structure?
- What will be the impact of technological changes on risk and returns?
- Is the company capable of managing the proposed investments?
- Will the company be in a position to raise capital for its expansion needs?

Because ROIC and growth are the key drivers of value, let us look at how companies have performed on these parameters. Empirical evidence suggests that:

- Industry average ROICs and growth rates are related to economic fundamentals. For example, the pharmaceutical industry, thanks to patent protection, enjoys a higher ROIC whereas the automobile industry earns a lower ROIC because of its capital intensity.

- It is very difficult for a company to outperform its peers for an extended period of time because competition often catches up, sooner or later.

2.4 ESTIMATING THE CONTINUING VALUE

A variety of methods are available for estimating the continuing value. They may be classified into two broad categories: cash flow methods and non-cash flow methods.

Cash Flow Methods

The two commonly used cash flow methods are (a) growing free cash flow perpetuity method and (b) value driver method.

Growing Free Cash Flow Perpetuity Method This method assumes that the free cash flow would grow at a constant rate for ever after the explicit forecast period, *t*. Hence, the continuing value of such a stream can be established by applying the constant growth valuation model:

$$CV_t = \frac{\text{FCF}_{t+1}}{\text{WACC} - g} \tag{2.3}$$

where CV_t is the continuing value at the end of year *t*, FCF_{t+1} is the expected free cash flow for the first year after the explicit forecast period, WACC is the weighted average cost of capital, and g is the expected growth rate of free cash flow forever.

Value Driver Method This method too uses the growing free cash flow perpetuity formula but expresses it in terms of value drivers as follows:

$$CV_t = \frac{\text{NOPLAT}_{t+1}\left(1 - \frac{g}{\text{ROIC}}\right)}{\text{WACC} - g} \tag{2.4}$$

where CV_t is the continuing value at the end of year *t*, NOPLAT_{t+1} is the expected net operating profits less adjusted tax for the first year after the explicit forecast period, WACC is the weighted average cost of capital, g is the constant growth rate of NOPLAT after the explicit forecast period, and ROIC is the expected rate of return on net new invested capital.

The key value driver formula may be called the **Zen of Corporate Finance** because it reflects the value of a company in terms of its fundamental economic drivers viz., invested capital, ROIC, growth, and WACC. You can argue that this formula captures all there is to valuation. Everything else is a matter of detail.

The formulae given in Equations (2.3) and (2.4) produce the same result as they have the same denominator and the numerator in Equation (2.4) is just a different way of expressing the free cash flow (the numerator of Equation (2.3). Appendix 2B demonstrates the equality.

Considerations in Estimating the Continuing Value Parameters

Bear in mind the following technical considerations while estimating the continuing value parameters.

NOPLAT NOPLAT must be based on a normalised level of revenues and a margin and ROIC which are sustainable. The normalised level of revenues must be based on the mid-point of the business cycle and the average profit margin over the cycle.

ROIC The expected return on invested capital (ROIC) should reflect the expected competitive conditions. Since competition eventually eliminates supernormal returns, it makes sense to set ROIC equal to WACC. However, if a company has sustainable competitive advantages (on account of patents, brands, and so on), you may set ROIC equal to the ROIC the company is expected to earn toward the end of the explicit forecast period.

Growth Rate Very few companies can grow at a rate faster than the economy for prolonged periods. Perhaps the best estimate for growth rate would be the real long-term growth rate for the industry plus inflation.

WACC The weighted average cost of capital must reflect the underlying business risk and a sustainable capital structure.

Growth Rates

We have assumed certain growth rates. How can one get a handle on growth rates. Analysts often use the past growth rate in revenues and earnings as a proxy for the future growth rate. However, the historical growth rate of a company is not uniquely defined: it depends on the length of period over which growth is calculated, the measure of earnings (operating income, net income, earnings per share) considered, and the nature of average (arithmetic or geometric) used. Even worse, empirically the relationship between past and future growth rates is weak.

As an alternative, you can rely on the growth estimates provided by experts such as equity research analysts who track the firm or managers in the firm. While these experts have access to better information than most investors, they may lack objectivity. Managers tend to overestimate future growth and equity researchers have their own bias.

If the historical growth rate and expert estimates are not of much value, what is the way out? In the ultimate analysis, there are two sources of growth: improvement in the management of existing investments (efficiency growth) and new investments (new investment growth). Efficiency growth can be important for a poorly managed firm, but only for a short period. New investment growth depends on the reinvestment rate and the return on new investments. For example, if the reinvestment rate is 60 percent and the return on new investments is 15 percent, growth on account of new investments will be 9 percent (0.6 × 15).

Since the terminal value is highly sensitive to small changes in growth rate and discount rate, the scope for mis-estimation is high. So some sensible constraints must be imposed on its estimation. One, no firm can grow perpetually at a rate higher than the growth rate of the economy in which it operates. This means that the stable growth rate should not ordinarily exceed the risk-free rate employed in the valuation—the risk-free rate is a good proxy for the nominal growth rate in the economy. Two, as a firm achieves stable growth rate, its risk level should be similar that of the market (beta of one) and its debt ratio should conform to the industry norm. Three, the reinvestment rate of the firm must be sufficient to sustain the assumed growth rate. This means that:

$$\text{Reinvestment rate} = \frac{\text{Expected growth rate in NOPAT}}{\text{Return on invested capital}}$$

Sensitivity of Continuing Value to the Formula's Parameters

The continuing value is highly sensitive to the formula's parameters. Exhibit 2.12 shows how the continuing value, calculated with the help of the value driver formula, is affected by changes in ROIC and growth rate, assuming a base level NOPLAT of 1000 million and a WACC of 12 percent. For example, when the expected ROIC is 14 percent, a change in the growth rate from 6 percent to 10 percent increases the continuing value from about 9,524 million to about 14,286 million.

Exhibit 2.12 ***Impact of Changes in Continuing Value Assumptions***

		ROIC			
		12%	*14%*	*16%*	*18%*
Growth Rate	6%	8333	9524	10417	11111
	8%	8333	10714	12500	13889
	10%	8333	14286	18750	22222

Some Misconceptions about Continuing Value

There are three common misconceptions about continuing value.

- The length of the explicit forecast period has a bearing on value.
- Most of the value is created during the continuing value period.
- Competitive advantage period ends at the end of the explicit forecast period.

Length of the Explicit Forecast Period and Value Although the choice of the explicit forecast period is important, it has no bearing on company value. It merely affects the distribution of the value of the company between its two components, viz., the value of the cash flow during the explicit forecast period and the value of the cash flow after the explicit forecast period.

Explicit Forecast Period and Value The continuing value usually accounts for 50 percent to 125 percent of total value. These large percentages do not necessarily imply that the bulk of the value is created during the continuing value period. Often, continuing value is high because substantial investments in fixed assets and working capital made during the explicit forecast period generate higher cash flows in subsequent years.

Competitive Advantage Period An allied issue is the relationship between explicit forecast period and competitive advantage period.

Sometimes it is believed that the competitive advantage period is co-terminous with the explicit forecast period. This is not correct. The value driver formula assumes that the return on new invested capital after the explicit forecast period will just equal the weighted average cost of capital. However, it does not mean that the return on total invested capital (old and new) will equal the weighted average cost of capital. The capital invested prior to the continuing value period is expected to earn returns projected in the last year of the explicit forecast period. This means that the company's competitive advantage period does not end with the explicit forecast period.

Some Pitfalls in Estimating Continuing Value

Estimating a company's future performance is an inherently imprecise exercise. It is characterised by pitfalls like naive base-year extrapolation, naive conservatism, and purposeful conservatism.

Naive Base-Year Extrapolation Exhibit 2.13 illustrates the error of naive base-year extrapolation. From year 6 to year 7 (the last year of the explicit forecast period), the company's earnings and cash flow grow by 14 percent. The growth rate in the continuing value period (year 8 and beyond) is expected to be 10 percent per year. A naive forecast for year 8 (the continuing-value base year) simply increases every item from year 8 by 10 percent. This forecast is incorrect because the increase in working capital is much larger than warranted, given the expected increase in sales. When the sales growth slows down, the proportion of gross cash flow required for increasing the working capital declines substantially, as shown in the last column. Remember that the increase in working capital should be such that the year-end working capital is a constant percentage of sales.

Exhibit 2.13 ***Error of Naive Base Year Extrapolation***

			Year 8	
	Year 6	Year 7	Incorrect	Correct
Sales	1000	1140	1254	1254
Operating expenses	800	912	1003	1003
EBIT	200	228	251	251
Cash taxes	60	68	75	75
NOPLAT	140	160	176	176
Depreciation	40	46	50	50
Gross cash flow	100	114	126	126
Capital expenditure	50	57	63	63
Δ Working Capital	37	42	46	34
Gross investment	87	99	109	97
Free cash flow	13	15	17	29
Memo: year-end working capital	300	342	388	376
Working capital / sales (percent)	30	30	30.9	30
Increase in working capital / sales (percent)	3.7	3.7	3.7	2.7

Naïve Over-conservatism Analysts often assume that during the continuing-value period, the incremental return on capital will equal the cost of capital. Under this assumption, growth neither increases nor decreases value. Such an assumption relieves the analysts from estimating the growth rate. However, for some businesses like Coca Cola which earn superior returns on the strength of their brands, this assumption may be naively over-conservative.

Deliberate Over-conservatism Due to uncertainty characterising the continuing value, analysts sometimes tend to be deliberately over-conservative. Uncertainty, however, cuts both ways: actual results can be higher or lower than an unbiased estimate. Hence conservatism over compensates for uncertainty. Uncertainty should be modeled using scenarios and not adjusted through conservatism.

Non-Cash Flow Methods

In addition to cash flow methods, analysts use non-cash flow methods as well to estimate the continuing value. The three common non-cash flow methods are the multiples method, the replacement cost method, and the liquidation value method.

Multiples Method The multiples method assumes that the company will be worth some multiple of future earnings or book value or revenues during the continuing period. The commonly used multiples are enterprise value-to-EBITDA ratio, enterprise value-to-book value ratio, and enterprise value-to-sales ratio.

Enterprise Value-to-EBITDA Ratio A popular method for estimating the continuing value is the enterprise value-to-EBITDA ratio method. The expected EBITDA in the first year after the explicit forecast period is multiplied by a 'suitable' enterprise value-to-EBITDA ratio. The principal attraction of this method is that the enterprise value-to-EBITDA ratio is a commonly cited statistic and most executives and analysts feel comfortable with it.

Notwithstanding the practical appeal of the enterprise value-to-EBITDA ratio method, it suffers from serious limitations: (i) It assumes that EBITDA drives prices. EBITDA, however, is not a reliable bottom line for purposes of economic evaluation. (ii) There is an inherent inconsistency in combining cash flows during the explicit forecast period with EBITDA (an accounting number) for the post-forecast period. (iii) There is a practical problem as no reliable method is available for forecasting the enterprise value-to-EBITDA ratio.

Enterprise Value-to-Book Value Ratio According to this method, the continuing value of the company at the end of the explicit forecast period is assumed to be some multiple of its book value. The approach is conceptually analogous to the enterprise value-EBITDA ratio, and hence, suffers from the same problems. Further, the distortion in book value on account of inflation and arbitrary accounting policies may be high.

Enterprise Value-to-Sales Ratio Since sales is the ultimate driver of value, enterprise value-to-sales ratio is also used to estimate the continuing value. The advantage of this ratio is that sales, in comparison to EBITDA and book value, is not much influenced or distorted by accounting policies. The disadvantage of this ratio is that it is highly sensitive to factors like net profit margin, growth rate, and asset turnover.

Replacement Cost Method According to this method, the continuing value is equated with the expected replacement cost of the assets of the company.

This method suffers from two major limitations: (i) Only tangible assets can be replaced. The "organizational capital" (reputation of the company; brand image; relationships with suppliers, distributors, and customers; technical know-how; and so on) can only be valued with reference to the cash flows the firm generates in future, as it cannot be separated from the business as a going entity. Clearly, the replacement cost of tangible assets often grossly understates the value of the firm. (ii) It may simply be uneconomical for a firm to replace some of its assets. In such cases, their replacement cost exceeds their value to the business as a going concern.

Liquidation Value Method According to the liquidation value method, the continuing value of the firm at the end of the explicit forecast period is equal to the proceeds expected from the sale of the assets of the firm.

Liquidation value is often very different from the going concern value. The liquidation value of a profitable, growing company is much less than its going concern value. The liquidation value of a dying company may be greater than its going concern value. Such a company is better dead than alive. Do not use the liquidation value method unless you expect the company to be liquidated at the end of the explicit forecast period.

Continuing Value of Matrix Limited

Using the growing free cash flow perpetuity method and assuming a constant growth rate, the continuing value of Matrix Limited is:

$$\text{Continuing value}_8 = \frac{\text{FCF}_9}{\text{WACC} - g} = \frac{\text{FCF}_8\,(1+g)}{\text{WACC} - g}$$

$$= \frac{16(1.10)}{0.14 - 0.10} = 440 \text{ million}$$

2.5 CALCULATING AND INTERPRETING RESULTS

After developing financial projections and continuing value estimate, you are ready to move on to the final stage of the valuation exercise. This stage involves the following steps:

- Determine the value of operations
- Calculate the enterprise value and equity value
- Explore multiple scenarios
- Verify valuation results

Determine the Value of Operations

Based on free cash flow projections, the present value of operations may be calculated in three steps: (i) discount free cash flows, (ii) discount the continuing value, and (iii) determine the value of operations.

Discount Free Cash Flows In most valuations, a constant WACC is used for discounting future free cash flows. If WACC changes over time, you may use a time-varying discount rate to discount future free cash flows.[3]

A time-varying WACC may be considered if significant changes are expected in the capital structure of the firm or the cost of debt or tax rate. In such a case, the adjusted present value (APV) approach is a better alternative as it explicitly models the capital structure and debt-generated tax shields.

Discount the Continuing Value The continuing value is usually derived using a perpetuity-based approach. So, it is already expressed as a value at the end of the explicit forecast period. Hence, discount it for the number of years in the explicit forecast period. For example, if the explicit forecast period is 5 years, discount the continuing value by 5 years, not 6 years. Further, if WACC changes over the explicit forecast period follow the approach described above in discounting continuing value.[4]

Calculate the Value of Operations In the final step, add the present value of free cash flows in the explicit forecast period to the present value of continuing value to get the value of operations.

The value of operations for Matrix Limited is obtained as follows:

$$\text{PV(FCF)} = \frac{3.0}{(1.14)} + \frac{5.8}{(1.14)^2} + \frac{16.6}{(1.14)^3} + \frac{13.8}{(1.14)^4} + \frac{16.0}{(1.14)^5}$$

$$= 34.77 \text{ million}$$

$$\text{PV(CV)} = \frac{440}{(1.14)^5} = 228.52 \text{ million}$$

$$\begin{aligned}\text{Value of operations} &= 34.77 + 228.52 \\ &= 263.29 \text{ million}\end{aligned}$$

---

3. If WACC changes over time, the discount factor DF_T for the free cash flow in year T is defined as:

$$DF_T = \prod_{t=1}^{T}(1+WACC_t)$$

where $WACC_t$ is the cost of capital for year t

4. You are not done as yet because one more adjustment is required. Since cash flows occur throughout the year and not as a lumpsum at the end of the year, adjust the value of operations for midyear discounting. This simply means, increase the discounted value of operations at the WACC for six months. However, for the sake of simplicity, we have not carried out this adjustment in our calculations.

Calculate the Enterprise Value and Value of Equity

To the value of operations you have to add the value of non-operating assets to get the enterprise value. From the enterprise value, you have to deduct the value of non-equity claims to get the equity value. Thus:

Enterprise value = Value of operations + Value of non-operating Assets

Equity value = Enterprise value – Value of non-equity claims

The best approach for determining the value of non-operating assets and non-equity claims depends on how their value changes with the DCF value of operations.

Non-operating Assets Cash flows relating to non-operating assets like excess cash and marketable securities are not included in the free cash flows and therefore not reflected in the value of operations. So, the value of non-operating assets must be added to the value of operations.We discuss below the important non-operating assets and how they may be valued.

Excess Cash and Marketable Securities Non-operating assets that can be quickly converted into cash at a minimal cost may be called cash and marketable securities. Under U.S. GAAP (Generally Acceptable Acccounting Principles) and IFRS (International Financial Reporting Standards), these assets have to be reported at their fair market value. So, consider the most recent book values as a proxy for the market value.

Quoted Investments in Associate Companies These investments are made in companies which belong to the same business group. For example, Tata Power may hold shares of Tata Steel and vice versa. Since these holdings are usually small and there is an active market for them, they may be valued at the prevailing market price.

Quoted Investments in Subsidiary Companies Since these investments represent a controlling interest they may be valued at the prevailing market price plus a control premium of about 25 percent.

Unquoted Investments in Subsidiary Companies Do a DCF valuation of the subsidiary and value the parent's equity stake in it. If you do not have adequate information for doing DCF valuation, rely on relative valuation.

Excess Real Estate and Unutilised Assets It is difficult to identify these assets in an outside-in valuation. If you have information on these assets, rely on the most recent appraisal value.

Non-equity Claims The enterprise value is the value of operations plus the value of non operating assets. To get the value of equity, you have to deduct the value of non -equity claims from the enterprise value. Non-equity claims represent all financial claims other than those of current equity shareholders. They may be classified as follows:

- Debt
- Preference capital
- Hybrid claims
- Employee stock options

Debt Debt comes in various forms such as debentures, loans from financial institutions and banks, public deposits, and commercial paper. If the debt is in the form of a tradable instrument (debentures and commercial paper), use its market value. If the debt instrument is not traded (loans and public deposits), discount the promised interest and principal repayments at the current interest rate applicable to such an instrument to estimate its current value. If interest rates and default risk have not changed much since the debt issue, the book value of debt is a reasonable proxy for its current value.

Preference Capital Preference capital is akin to unsecured debt and preference dividends may be likened to interest payments as they are predetermined and payable under normal circumstances. If preference shares are traded, use the market value; if not, do a DCF valuation in which expected payments (dividends and principal redemption) are discounted at the cost of unsecured debt.

Hybrid Claims The most common hybrid claims are convertible debentures and convertible preference shares. Convertible debentures are debentures which can be exchanged, at the option of the holder , for equity shares at a predetermined conversion ratio. In essence, a convertible debenture is a package of a straight debenture plus a call option on equity. Since the conversion option often has a significant value, convertible debt has to be treated differently from regular debt.

The value of convertible debentures depends on the value of the firm. Hence, you cannot use the book value or the simple DCF value of debt cash flows to value convertible debentures. If convertible debentures are actively traded, you can use their market values; otherwise you may have to use option-based valuation.

Employee Stock Options If the cost of the stock options granted to the employees is fully captured in free cash flow projections, stock options should not be considered as a non-equity claim. If the cost of employee stock options is not fully reflected in free cash flow projections, the unreflected portion has to be valued and treated as a non-equity claim.

Enterprise Value and Equity Value of Matrix Limited

Assuming that the value of investments (the only non-operating assets) is 25 million (the balance sheet value) and the value on non-equity claims is 134 million (the balance sheet value), the enterprise value and equity value of Matrix Limited is:

Enterprise value	=	Value of operations	+	Value of investments
	=	263.29	+	25.0

	=	288.29 million		
Equity value	=	Enterprise value	–	Value of non-equity claims
	=	288.29	–	134
	=	154.29 million		

Value under Multiple Scenarios

Valuation is done to guide some management decision like acquiring a company, divesting a division, or adopting a strategic initiative. Hence the results of valuation must be analysed from the perspective of the decision at hand. As risk and uncertainty characterise most business decisions, you must think of scenarios and ranges of value, reflective of this uncertainty.

When you analyse the scenarios, critically examine your assumptions with respect to the following: broad economic conditions, competitive structure of the industry, internal capabilities of the company, and financing capabilities of the company.

While the decision based on any one scenario is fairly obvious, given its expected impact on shareholder value, interpreting multiple scenarios is far more complex. At a minimum, you should address the following questions:

- If the decision is positive, what can possibly go wrong to invalidate it? How likely is that to happen?
- If the decision is negative, what upside potential is being given up? What is the probability of the same?

Answering these questions can be illuminating. An examination of initial results may uncover unexpected questions that can perhaps be resolved by evaluating additional scenarios. This means that the valuation process tends to be inherently circular. Doing the valuation throws up questions and insights that lead to further scenarios and analyses.

Verify Valuation Results

After estimating the equity value, you should perform several tests to verify the results of valuation.

Is the Model Logically Correct? Your model must satisfy the following logical conditions:

- In the unadjusted financial statements, the balance sheet balances every year, net profit equals dividends plus retained earnings, and the sources of cash equal the use of cash.
- In the reorganised financial statements, invested capital plus non operating assets equal the financing sources.

Do the Valuation Results Correctly Reflect Value Driver Economics? Here are some of the checks to see whether the valuation results correctly reflect value driver economics:

- If the expected ROIC is greater than the WACC, the value of operations must be greater than the book value of invested capital.
- If the expected ROIC is close to the WACC, the value of the operations must be fairly insensitive to the rate of growth.
- If the expected ROIC is significantly higher than the WACC, the value of the operations must be highly sensitive to the rate of growth.

Are the Key Financial and Operating Ratios Consistent with Economic Logic? The patterns of key financial and operating ratios like capital turnover, profit margin, growth rate, and tax rate must be realistic and consistent with economic logic. Ensure that when you apply a continuing value formula the company achieves a steady state. If the company is still evolving, extend the explicit forecast period.

Are the Final Results Plausible? If the company is listed, compare your value estimate with the market value. If the market value is very different from your estimate, don't conclude that the market is wrong. Indeed, it makes sense to assume that the market is right, unless you have reason to believe that all relevant information is not incorporated in the market price due to factors such as small float or poor liquidity in the stock.

Compare the multiples of the company with its peers. Satisfy yourself that significant differences with peer companies can be explained in terms of value drivers and other relevant factors like business characteristics and strategy.

Suppose the intrinsic value estimated by you differs significantly from the prevailing market price. What can explain the divergence? There are three possible reasons: (a) The growth rate assumption is unrealistic. (b) The assessment of the firm's riskiness or the market risk premium is incorrect. (c) Your value assessment is right, but the market price is wrong. Even if your assessment is right and the market price wrong, you face the risk that market price may not converge (or deviate even more) to your value estimate in a reasonable period of time.

SUMMARY

- From the early 1990s the enterprise DCF model has received great attention, emphasis, and acceptance.
- Valuing a firm using the DCF approach is conceptually similar to valuing a capital project using the DCF approach. However, there are two important differences: (i) while a capital project is deemed to have a finite life, a firm is considered an entity that has an indefinite life; (ii) a capital project is typically valued as a 'one off' investment where as a firm is viewed as a growing entity requiring sustained additional investments in fixed assets and net working capital.
- The DCF approach to valuing a firm involves the following steps: (i) analysing historical performance, (ii) estimating the cost of capital, (iii) forecasting performance, (iv) determining the continuing value, and (v) calculating the firm value and interpreting the results.
- Analysing a company's historical performance calls for getting a handle over its NOPLAT and FCF, understanding the drivers of its FCF, measuring and analysing its ROIC, decomposing its revenue growth into various components, and assessing its financial health and capital structure.
- Providers of capital (shareholders and lenders) want to be suitably compensated for investing funds in the firm. The cost of capital reflects what they expect.
- Since the future is unknowable, forecasting performance is at best an educated guess work. It involves the following steps: (i) determine the length of the explicit forecast period, (ii) develop a strategic perspective on the future performance, and (iii) develop financial forecasts.
- Several methods are available for estimating the continuing value. They may be classified into two broad categories: cash flow methods and non-cash flow methods. The two commonly used cash flow methods are: growing free cash flow perpetuity method and value driver method. The three commonly used non-cash flow methods are: multiples method, replacement cost method, and liquidation value method.
- Calculating and interpreting results involves the following steps: (i) determine the value of operations, (ii) calculate equity value, (iii) explore multiple scenarios, and (iv) verify valuation results.

Questions

1. What are the important differences between valuing a company and valuing a project?
2. Define the following terms: operating invested capital, NOPLAT, ROIC, net investment, and free cash flow
3. What are the key drivers of FCF?
4. Delineate the ROIC tree. How would you assess a company's financial health and capital structure?
5. What are the features of cost of capital?
6. What are the characteristics of steady state?
7. List the steps involved in developing financial forecasts.
8. What are the typical forecast drivers and forecast ratios for the most common line items in the profit and loss account?
9. What are the typical forecast drivers and forecast ratios for the most common line items on the assets side of the balance sheet?
10. Discuss the cash flow methods available for estimating the continuing value.
11. What are the common misconceptions about continuing value? What are the common pitfalls in estimating continuing value?
12. Discuss the cash flows methods for estimating the continuing value.

SOLVED PROBLEMS

2.1 The profit and loss account and balance sheet of Zenith Corporation for two years (year 1, year 2) are given below:

Profit and Loss Account

	in million	
Year	*1*	*2*
Net sales	5600	6440
Income from marketable securities	140	210
Non-operating income	70	140
Total income	5810	6790
Cost of goods sold	3220	3780
Selling and administrative expenses	700	770

Depreciation	350	420
Interest expenses	336	392
Total costs and expenses	4606	5362
PBT	1204	1428
Tax provision	364	448
PAT	840	980
Dividend	420	560
Retained earnings	420	420
Balance Sheet		
Equity capital	2100	2100
Reserves and surplus	1680	2100
Debt	2520	2940
	6300	7140
Fixed assets	4200	4550
Investments	1260	1400
Net current assets	840	1190
	6300	7140

Assume a tax rate of 40 percent.

(i) What is the EBIT for year 2?

(ii) What is the tax on EBIT for year 2?

(iii) What is the NOPLAT for year 2?

(iv) What is the free cash flow to the firm (FCFF) for year 2?

(v) Give the break up of the financing flow for year

Solution

(i) EBIT for Zenith Corporation for year 2 is calculated below:

Profit before tax	1428
+ Interest expense	+ 392
– Interest income	– 210
– Non-operating income	– 140
	1470

(ii) Taxes on EBIT for year 2 is calculated below:

Tax provisio n from income statement	448
+ Tax shield on interest expense	+156.8

	– Tax on interest income	– 84
	– Tax on non-operating income	– 56
		464.8
(iii)	NOPLAT for year 2 is :	
	EBIT	1470
	– Tax on EBIT	464.8
		1005.2
(iv)	FCFF for year 2 is :	
	NOPLAT	1005.2
	– Net investment	– 700.0
	+ Non-operating cash flow	+ 84.0
		389.2
(v)	The break-up of the financing flow is as follows:	
	After-tax interest expense	235.2
	+ Cash dividend	+ 560
	– Net borrowing	– 420
	+ Δ Excess marketable securities	+ 140
	– After-tax income on excess marketable securities	– 126
		389.2

2.2 You are looking at the valuation of a stable firm, Networks Limited, done by an investment analyst. Based on an expected free cash flow of 54 million for the following year and an expected growth rate of 9 per cent, the analyst has estimated the value of the firm to be 1800 million. However, he committed a mistake of using the book values of debt and equity. You do not know the book value weights employed by him but you know that the firm has a cost of equity of 20 per cent and a post-tax cost of debt of 10 per cent. The market value of equity is thrice its book value, whereas the market value of its debt is nine-tenths of its book value. What is the correct value of the firm?

Solution

$$1800 = \frac{54}{r - 0.09} \qquad \Rightarrow \quad r = 0.12 \text{ or } 12\%$$

$$0.12 = x \times 0.20 + (1 - x) \times 0.10 \Rightarrow \quad x = 0.20$$

x is the weight assigned to equity is 0.20

So $\qquad D/E = 0.8/0.2 = 4$

Since the market value of equity is thrice its book value and the market value of debt is nine-tenths of its book value, the market value weights of equity and debt are

$$0.2 \times 3 \text{ and } 0.8 \times 0.9$$

That is 0.6 and 0.72

Hence the WACC is

$$\frac{0.6}{1.32} \times 0.20 + \frac{0.72}{1.32} \times 0.10 = 0.1454 \text{ or } 14.54\ \%$$

Hence the value of the firm is:

$$\frac{54}{.1454 - .09} = 974.7 \text{ million}$$

Problems

2.1 The profit and loss account and balance sheet of Hitech Limited for three years (year 1, year 2, and year 3) are given below:

Profit and Loss Account

in million

	1	*2*	*3*
Net sales	350	400	460
Income from marketable securities	-	10	15
Non-operating income	-	5	10
Total income	350	415	485
Cost of goods sold	200	230	270
Selling and general administration expenses	45	50	55
Depreciation	20	25	30
Interest expenses	20	24	28
Total costs and expenses	285	329	383
PBT	65	86	102
Tax provision	20	26	32
PAT	45	60	70
Dividend	20	30	40
Retained earnings	25	30	30

Balance Sheet			
	1	*2*	*3*
Equity capital	130	150	150
Reserves and surplus	90	120	150
Debt	150	180	210
Total	370	450	510
Fixed assets	250	300	325
Investments	60	90	100
Net current assets	60	60	85
Total	370	450	510

The tax rate for Hitech Limited is 40 percent. During year 2 the firm made a rights issue of 20 million at par.

(a) Calculate the following for years 2 and 3

(i) EBIT

(ii) Taxes on EBIT

(iii) NOPLAT

(iv) Net investment

(v) Operating free cash flow

(vi) Non operating cash flow

(vii) Free cash flow to the firm

(b) Give the break-up of the financing flow for years 2 and 3.

(c) Calculate the following key drivers of FCF for years 2 and 3.

(i) Invested capital

(ii) ROIC

(iii) Growth rate

MINICASE

Fifteen years ago, Manish Kothari set up a company called Manish Detergents to make detergent powder. After few years of teething problems the company established itself as a low cost producer of good quality detergent powder branded as Manna. For the last decade Manish Detergents has grown profitably. The profit and loss account for year 0 (the year that just ended) and the balance sheet at the end of year 0 for Manish Detergents are given below.

Financials of Manish Detergents

Profit and Loss Account		Balance Sheet	
in million			
		Sources of Funds	
• Revenues	900	Shareholders' funds	500
• PBDIT	209	Loan funds	200
• Depreciation	45		700
• PBIT	164		
• Interest	24		
• PBT	140	*Application of Funds*	
• Tax	49	Net fixed assets	450
• PAT	91	Net current assets	250
			700

The paid up capital of Manish Detergents is 100 million divided into 10 million shares of 10 each. All the shares are presently held by Manish Kothari, who is planning to take the company public by selling 4 million of his existing shares. The purpose of the issue is to enable Manish Kothari to liquefy a portion of his equity. Once the equity of Manish Detergents is listed it will help the company in raising capital from the market as and when required in the future.

Manish Kothari called Ajay Kapoor, vice president of Indus Capital, a merchant banking firm, to help him in estimating the worth of his shares.

Ajay Kapoor asked Manish Kothari to spell out his plans for the next 5 to 10 years, develop the forecast for financial performance and investment requirements, and indicate his target debt-equity ratio.

Manish Detergents is currently operating mainly in western India but it has definite plans to set up a unit in Hyderabad in the next two years to serve the southern market. This will require substantial investment in factory, godowns, and current assets. Since this investment will take some time to start yielding results, Manish expects a short-term dip in profits. However, once the southern venture takes off Manish is confident that profits will improve.

Taking into account the above, Manish Kothari has developed forecasts of operating profit and investment requirements which are given in Exhibit 1. Beyond year 6 he expects that Manish Detergents will grow at a steady state of 10 percent and this will apply to its free cash flow as well.

Exhibit 1 ***Financial Forecasts***

Part A : Forecasted Operating Profit

	1	2	3	4	5	6
Revenues	950	1000	1200	1450	1660	1770
PBDIT	195	200	210	305	330	374
Depreciation	55	85	80	83	85	87
PBIT	140	115	130	222	245	287

Part B: Forecasted Investments

	1	2	3	4	5	6
Gross investments in fixed assets	100	250	85	100	105	120
Investments in net current assets	10	15	70	70	70	54
Total	110	265	155	170	175	174

Manish Kothari is happy with the present debt-equity ratio of 0.4:1.0 and plans to keep it that way. Ajay Kapoor has come up with the following estimates:

- Tax rate : 35 percent
- Pre-tax cost of debt for Manish Detergents : 12 percent
- Cost of equity : 16.48 percent

Required:

1. Calculate the DCF value of the firm
2. Calculate the value of the equity, assuming that the market value of debt is the same as its book value.

APPENDIX 2A

STRATEGY ANALYSIS

The key drivers of value are growth, ROIC, and risk. So you have to develop a point of view on how the company is likely to perform on these key value drivers. This calls for evaluating the company's strategic position, taking into account the industry characteristics and the company's capabilities.

Strategy analysis seeks to explore the economics of a firm and identify its profit drivers so that the subsequent financial analysis reflects business realities.

The profit potential of a firm is influenced by the industry or industries in which it participates (industry choice), by the strategy it follows to compete in its chosen industry or industries (competitive strategy), and by the way in which it exploits synergies across its business portfolio (corporate strategy).

Hence, strategy analysis involves industry analysis, competitive strategy analysis, and corporate strategy analysis. This appendix discusses these aspects of strategy analysis. In addition it explores some ideas and concepts to help you in developing a strategic perspective on the company being valued.

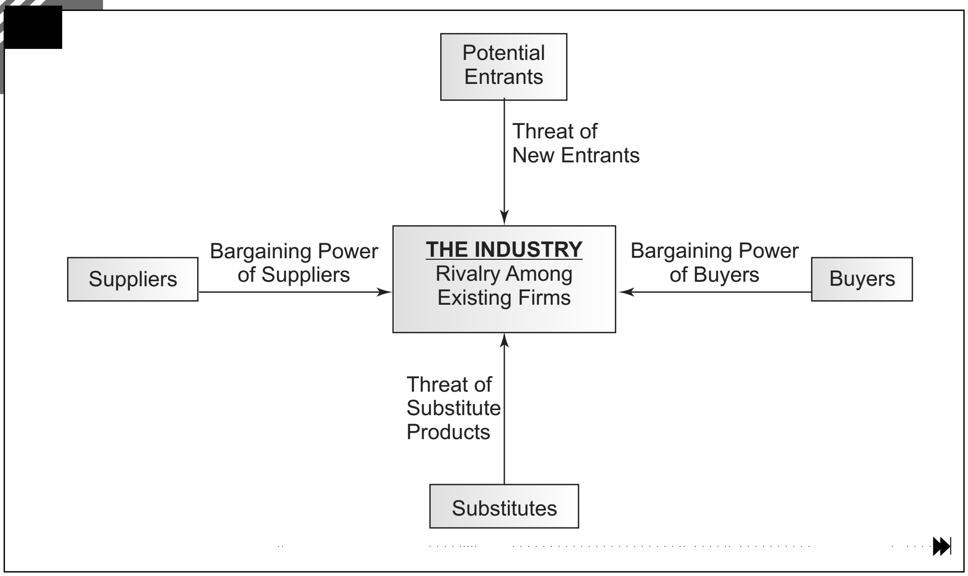
1. INDUSTRY ANALYSIS

In analysing a firm's profit potential, the analyst typically begins with an assessment of the profit potential of each of the industries in which the firm is present because of the differences in the profit potential of various industries.

As Michael Michael Porter[5] has argued the profit potential of an industry depends on the combined strength of the following five basic competitive forces:

- Threat of new entrants
- Rivalry among existing firms
- Pressure from substitute products
- Bargaining power of buyers
- Bargaining power of sellers

Exhibit 2A.1 ***Forces Driving Industry Competition***



5. Michael E. Porter, *Competitive Strategy: Techniques for Analysing Industries and Competitors*, The Free press, 1980.

Threat of New Entrants

New entrants add capacity, inflate costs, push prices down, and reduce profitability. Hence, if an industry faces the threat of new entrants, its profit potential would be limited. The threat from new entrants is low if the entry barriers confer an advantage on existing firms and deter new entrants. Entry barriers are high when:

- The new entrants have to invest substantial resources to enter the industry.
- Economies of scale are enjoyed by the industry.
- Existing firms control the distribution channels, benefit from product differentiation in the form of brand image and customer loyalty, and enjoy some kind of proprietary experience curve.
- Switching costs—these are essentially one-time costs of switching from the products of one supplier to another—are high.
- The government policy limits or even prevents new entrants.

Rivalry between Existing Firms

Firms in an industry compete on the basis of price, quality, promotion, service, warranties, and so on. Generally, a firm's attempts to improve its competitive position provoke retaliatory action from others. If the rivalry between the firms in an industry is strong, competitive moves and countermoves dampen the average profitability of the industry. The intensity of rivalry in an industry tends to be high when:

- The number of competitors in the industry is large.
- At least a few firms are relatively balanced and capable of engaging in a sustained competitive battle.
- The industry growth is sluggish, prodding firms to strive for a higher market share.
- The level of fixed costs is high, generating strong pressure for all firms to achieve a higher capacity utilisation level.
- There is chronic over capacity in the industry.
- The industry's product is regarded as a commodity or near-commodity, stimulating strong price and service competition.
- The industry confronts high exit barriers.

Pressure from Substitute Products

In a way, all firms in an industry face competition from industries producing substitute products. Performing the same function as the product of industry, substitute products may limit the profit potential of the industry by imposing a ceiling on the prices that can be charged by the firms in the industry. The threat from substitute products is high when:

- The price-performance tradeoff offered by the substitute products is attractive.

- The switching costs for prospective buyers are minimal.
- The substitute products are being produced by industries earning superior profits.

Bargaining Power of Buyers

Buyers are a competitive force. They can bargain for price cut, ask for superior quality and better service, and induce rivalry among competitors. If they are powerful, they can depress the profitability of the supplier industry. The bargaining power of a buyer group is high when:

- Its purchases are large relative to the sales of the seller.
- Its switching costs are low.
- It poses a strong threat of backward integration.

Bargaining Power of Suppliers

Suppliers, like buyers, can exert a competitive force in an industry as they can raise prices, lower quality, and curtail the range of free services they provide. Powerful suppliers can hurt the profitability of the buyer industry. Suppliers have strong bargaining power when:

- A few suppliers dominate and the supplier group is more concentrated than the buyer group.
- There are hardly any viable substitutes for the products supplied.
- The switching costs for the buyers are high.
- Suppliers do present a real threat of forward integration.

Application of Industry Analysis: The Personal Computer Industry

For all practical purposes, the personal computer industry began in 1981 when IBM introduced its PC with Intel's microprocessor and Microsoft's DOS operating system. Since then the PC industry has grown spectacularly. However, it has been characterised by low profitability, in general. What can explain this?

The following factors have contributed to low profitability.

1. There is intense rivalry among existing players and there are few barriers to entry as virtually all components required to make a computer can be outsourced.
2. The bargaining power of suppliers is high. For example, Intel dominates the microprocessor production and Microsoft controls the operating system market.
3. Corporate buyers, who account for a substantial portion of the market, are highly price sensitive and enjoy bargaining power.
4. It is fairly easy to switch from one brand of personal computers to another as most of the computers use Intel microprocessors and Microsoft window operating systems.

5. As the products offered by different firms are virtually identical, the room for product differentiation is very limited.

To sum up, the intense rivalry among existing players, ease of entry, strong bargaining power of suppliers and buyers, low switching costs, and limited room for product differentiation depressed the average profitability of the personal computer industry. No wonder, IBM sold its personal computer business to Lenovo of China.

2. COMPETITIVE STRATEGY

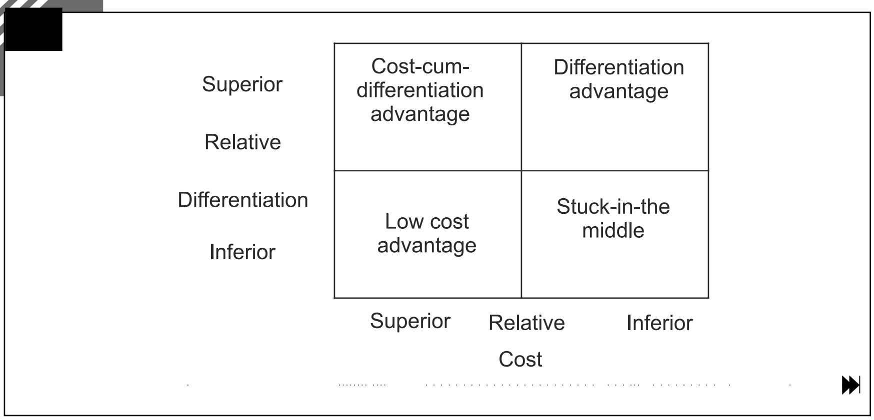
Among the various frameworks of strategy formulation, the one developed by Michael E. Porter in his seminal work *Competitive Strategy* has been perhaps the most influential in shaping management practice. Michael Porter argues that the firm can explore two generic ways of gaining sustainable competitive advantage viz., cost leadership and product differentiation.

Cost leadership can be attained by exploiting economies of scale, exercising tight cost control, minimizing costs in area like R&D and advertising, and deriving advantage from cumulative learning. Firms which follow this strategy include Bajaj Auto in two wheelers, Mittal in steel, WalMart in discount retailing, and Reliance Industries in petrochemicals.

Product differentiation involves creating a product that is perceived by customers are distinctive or even unique so that they can be expected to pay a higher price. Firms which have excelled in this strategy include Mercedes in automobiles, Rolex in wristwatches, Mont Blanc in pens, and Raymond in textiles.

Exhibit 2A.2 depicts the competitive position of the firm based on its relative cost and differentiation positions. The most attractive position of course is the cost-cum-differentiation advantage position.

Exhibit 2A.2 ***Competitive Position of the Firm***



Gaining Competitive Advantage

By choosing an appropriate strategy, a firm does not necessarily gain competitive advantage. To do so the firm must develop the required core competencies (the key economic assets of the firm) and structure its value chain (the set of activities required to convert inputs into outputs) appropriately. As Palepu et al. say: "The uniqueness of a firm's core competencies and its value chain and the extent to which it is difficult for competitors to imitate them determines the sustainability of a firm's competitive advantage."

To assess whether a firm is likely to gain competitive advantage, the analyst should examine the following:

- The key success factors and risks associated with the firm's chosen competitive strategy.
- The resources and capabilities, current and potential, of the firm to deal with the key success factors and risks.
- The compatibility between the competitive strategy chosen by the firm and the manner in which it has structured its activities (R&D, design, manufacturing, marketing and distribution, and support).
- The sustainability of the firm's competitive advantage.
- The potential changes in the industry structure and the adaptability of the firm to address these changes.

3. CORPORATE STRATEGY ANALYSIS

When you analyse a multi-business firm, you have to evaluate not only the profit potential of individual businesses but also the economic implications (positive as well as negative) of managing different businesses under one corporate canopy. For example, General Electric has succeeded immensely in creating significant value by managing a highly diversified set of businesses ranging from light bulbs to aircraft engine, whereas Sears has not succeeded in managing retailing with financial services.

Corporate Sources of Value Creation

What factors influence a firm's ability to create value through a broad scope? The optimal scope depends on how the costs of performing activities inside the firm compare with the costs of using the market mechanism. Transaction cost economics suggests that a diversified firm is more efficient if coordination among independent, focused firms costs more on account of market transaction costs.

Transaction costs inside a firm may be less compared to market based transactions for the following reasons: (a) Communication costs inside a firm are lower because it is easier to protect confidentiality and assume credibility. (b) The corporate office can reduce the costs of enforcing agreements between the various units of the firm. (c) Valuable nondivisible assets (brand names, distribution channels, and so on) and nontradable assets (systems, processes, and so on) can be shared by the various units of the firm.

However, there are some forces that increase transaction costs inside the firm. Top management may not have the capability and expertise to manage diverse businesses. Such managerial inadequacy diminishes the possibility of realising the economies of scope, even when such a potential exists. This problem can perhaps be addressed by setting up a decentralised organisational structure, hiring specialist managers who are empowered, and incentivising them properly. But decentralisation almost invariably diminishes goal congruence among managers of various subunits which makes it difficult to realise economies of scope.

Thus, whether a multibusiness firm is more valuable compared to a collection of focused firms finally depends on the context. The analyst should examine the following factors to assess whether a firm's corporate strategy has the potential to create value.

- Imperfections in the product, labour, or financial markets in the business in which the firm operates.
- Existence of special resources such as brand name, proprietary knowledge, scarce distribution channels, and organisational processes that potentially create economies of scope.
- The degree of fit between the company's specialised resources and its portfolio of businesses.
- The allocation of decision rights between the corporate office and business units and its effect on the potential economies of scope.
- The system of performance measurement and incentive compensation and its effect on agency costs.

4. SOME CONCEPTS AND FRAMEWORKS

There is an extensive literature on strategy with numerous frameworks, models, and concepts that illuminate various aspects of strategy. This section selectively looks at the following concepts and ideas: customer segmentation analysis, value chain analysis, information rules, disruptive technology, fitness landscape and competitive strategy.

Customer Segmentation Analysis

Customer segmentation analysis helps in (a) estimating the potential market share by identifying why customers prefer one company's products over others and (b) determining the profitability of each type of customer, considering their needs and cost to serve.

Customer segmentation analysis is done from the perspective of the customer and the producer. When you do it from the perspective of the customer, you ask: Why customers prefer one product over another? This throws light on why competitive market share differs across customer groups and suggests opportunities for segment differentiation.

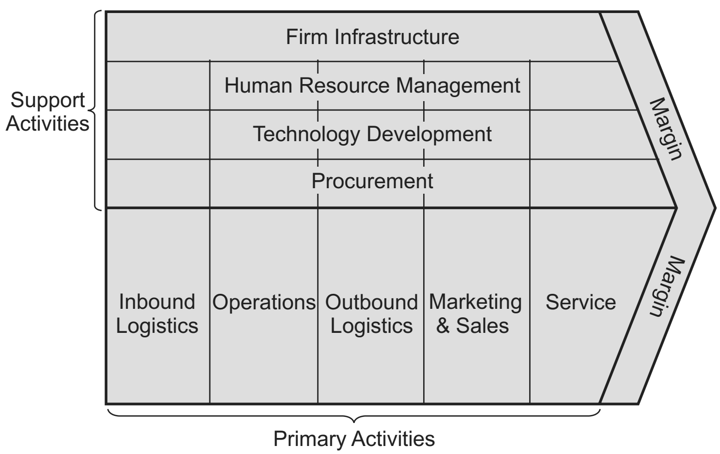
When you do it from a producer perspective, you ask: What are the different costs associated with serving different customers?

Customer segmentation analysis, from the customer and producer perspectives, helps in evaluating a company's ability to satisfy customers relative to competitors and identifying current or potential competitive advantage.

Value Chain Analysis

Since competitive advantage stems from a firm's ability to enhance customer value or reduce costs or do both, it should identify where it can do so. For this purpose, it is helpful to look at the value chain, the entire set of activities from raw material extraction to after sales service to customers. Exhibit 2A.3 depicts a typical value chain.

Exhibit 2A.3 ***Value Chain***



Michael Porter, a proponent of value chain analysis, argues that competitive advantage can be understood not by looking at the company as a whole but by analysing the discrete activities that a company performs to deliver its goods or services. Each activity in the value chain enhances or diminishes a company's ability to capture and sustain competitive advantage.

By disaggregating a company's activities, you can analyse its cost position and product differentiation in relation to its peers. By comparing value chains of companies within an industry, you can assess competitive advantage.

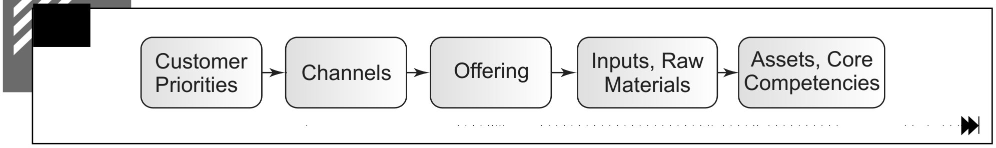
Value chain analysis is relevant for most businesses, but particularly useful for businesses engaged in two types of activities.

- **Vertically integrated activities** A vertically integrated business is engaged in all the activities required for converting raw materials into finished goods. Value chain analysis helps in identifying where the company is doing well, where the company needs to improve, and what the company can outsource profitably.

- **Activities susceptible to technological change** Technological changes can disintegrate value chains, permitting companies to specialise in a narrow set of activities.

Modern Value Chain Since the world is becoming more and more customer- centric, coporates have to be more responsive and flexible. So, Adrian Slywotzky and David Morrison suggest that value chain analysis should start with the customer. According to them, the "modern value chain", as shown in Exhibit 2A.4, comprises five activities viz., customer priorities, channels, offerings, inputs/ raw materials, and asset competencies.

Exhibit 2A.4 The Modern Value Chain



Source: From *The Profit Zone* by Adrian J. Slywotzky and David J. Morrison, copyright © 1997 by Mercer Management Consulting, Inc.

- **Customer Priorities** Companies must continually monitor the changes in their customers' needs and priorities and shift the emphasis of their activities accordingly.
- **Channels** To deliver its products or services to its customers, a company needs distribution channels. Technology is causing shifts in distribution channels. For example, the Internet has brought about major changes in distribution of financial services.
- **Offering** A company's product or service offering should satisfy customer priorities and flow through appropriate channels.
- **Inputs/raw materials** An important aspect of the value chain is the supply of raw materials, or inputs, required for the products or services. A strong and dependable relationship with suppliers can lead to a virtual value chain, which enables a company to focus on activities that maximise value.
- **Asset/core competency** The activities that a company chooses dictate its required assets (physical and intangible) and core competency. Nike, for example, focuses on product design and marketing and outsources its manufacturing. So it concentrates on designing products and marketing.

Information Rules: Information Economics

A shift is taking from reliance on physical capital to reliance on intellectual, or knowledge, capital. Economists Carl Shapiro and Hal Varian have articulated information rules which apply to knowledge-based companies. The characteristics of knowledge-based companies are different from those of physical-asset-based companies. The key characteristics of knowledge-based companies are as follows:

High initial but low incremental costs While physical, human, and financial assets are rival in nature – a specific deployment of a rival asset precludes its simultaneous use elsewhere – intangible assets are, in general, nonrival in nature. This means that they can be deployed simultaneously in multiple uses. For example, the aircrafts and crew of American Airlines can be used during a given time period only on limited routes whereas its famous reservations system, SABRE, a knowledge – intensive asset, can be used by any number of customers. Intangibles are non-rival mainly because they involve a large fixed (sunk) cost and negligible variable cost. The discovery of a drug or the development of a software programme often requires huge initial investment, but the cost of producing the pills or software diskettes is negligible. This means that intangibles are often characterised by increasing returns to scale.

Given the properties of non-rivalry and increasing returns, intangibles are scalable. This is manifested in the market dominance of many intangible-intensive firms. For example, Intel, Cisco, and American Online enjoy nearly three-fourths of the market in which they operate. Such market dominance is unknown in tangible-intensive sectors, where even the most efficient enterprises such as Exxon, General Electric, or Ford have less than one-fourth of the market share.

Network effects Telephones, first introduced in the U.S. in late 19th century, were not very useful initially. A person could just talk to a few others who had a telephone. But as more and more homes and offices joined the telephone network, the utility of telephones increased. This phenomenon is referred to as the network effect: the value of a product or service increases as more and more people use it.

Success with the network strategy depends on the ability of a company to lead the charge and establish a dominant position. When a company does so, there is very little space available for others. That is why the network effect strategy is also called the winner-take-all strategy. For example, eBay dominates the online auction industry. Buyers flock to eBay as it has the most sellers, and sellers list their items as it has the most buyers. This virtuous circle established eBay as the dominant online auction site. Likewise, Microsoft enjoys a dominant position with its Window operating system. As Richard Luecke put it: "Thus, since most PCs operated with Windows, most new software was developed for Windows machines. And because most software was Windows-based, more people bought PCs equipped with the Windows operating system. To date no one has broken this virtuous circle."

Lock-in Once customers become skillful in using a given product, they are reluctant to switch to a rival product, even if it performs better. This helps the company to "lock in" customers, who are predisposed to purchasing product upgrades which are very profitable to the company.

To exploit the above characteristics or advantages, knowledge-based companies rely on the following:

Giveaways If a company has a large user base, it can build a valuable network and lock-in customers. So, it makes sense to initially give away (or heavily discount) the products or services. A conspicuous example is Hotmail, a free e-mail service which was launched in 1996. Within six months of launch it had 1 million users. After eighteen months, it had 12 million users and, by the summer of 2000, it had over 45 million users. The detailed demographic profile provided by each user contributes to a valuable database attracting advertisers to its web site.

Link-and-leverage Economist W. Brian Arthur coined the term link-and-leverage for the transfer of a user base from one technology node to another. The evolution of Microsoft's products from operating systems, to applications, to Internet access is a conspicuous example.

Adaptation While mature physical businesses optimise or continually improve their processes to create value, knowledge companies, confronted with rapid product obsolescence, must seek new opportunities even if it means cannibalising their profitable current businesses.

Disruptive Technology: Innovation

Clay Christensen's model of disruptive technologies explains why dominant companies may fail to retain their position of leadership, although they have competent managers making sound decisions based on standard management principles: His framework is based on three premises:

1. Sustaining technologies are quite different from disruptive technologies. Sustaining technologies lead to product improvement within a well-defined value network-the "context within which a firm identifies and responds to customers' needs, solves problems, procures input, reacts to competitors, and strives for profit." By contrast, disruptive technologies provide a very different value proposition and products based on such technologies may, to begin with, appeal to only a few customers who value features such as low price or greater convenience. Since these technologies tend to generally underperform established products in the short term, leading companies tend to ignore them in early phases.
2. Technologies often move faster than the demands of the market. So, established companies generally provide customers more than what they need or more than what they are eventually willing to pay for. This permits the emergence of disruptive technologies. Although such technologies may underperform the present demands of users, they become performance-competitive in future.
3. Disruptive technologies tend to be ignored by established companies because disruptive products do not look financially attractive in the short-run.

A conspicuous example of disruptive technology in action is provided by Amazon.com. When Amazon.com came with its initial public offering (IPO) in 1997, leading book retailers like Barnes & Noble were improving their standard bookselling business model by setting up superstores that offered enhanced experience in terms of ambience, assortment, and service:

By contrast, Amazon.com offered a different experience which improved customer proposition along several dimensions, such as assortment, price, and convenience. Instead of competing with traditional booksellers at their own game, Amazon.com redefined the game by launching a new value network.

Fitness Landscape and Competitive Strategy

There are three broad types of competitive landscape: stable, coarse, roiling.

Stable Landscape Businesses in this landscape tend to be fairly predictable, with limited growth opportunities. It is easier to guess what they will look like in future. Examples: utilities, commodity producers, and consumer nondurables. Companies in such businesses produce superior economic returns during cyclical upswings and inferior economic returns during cyclical downswings.

Coarse Landscape This landscape is rougher than the stable landscape. Businesses in this landscape are in a flux, and subject to rapid change. Examples: retail, financial services, health care, and more established parts of technology.

In this landscape some firms perform much better than others, but there is a definite threat of being unseated by a disruptive technology.

Roiling Landscape This is the most unpredictable landscape, with constantly changing peaks and valleys. Firms in this environment face substantial uncertainty, experiment with different models, and come up with ever-changing product offerings. Examples: genomics industry, many software companies, fashion-related sectors, and most start-ups. Returns to firms in this group can be or can potentially be significantly high, but may be fleeting.

Eric Beinhocker suggests two broad strategies to improve fitness. He labels the first "small jumps" as it involves small incremental steps mostly in the form of process-improvement initiative aimed toward reaching a peak. He calls the other "long jumps" – these are discontinuous moves such as investments in nascent products and meaningful acquisitions in unrelated fields. Such moves may catapult a company to a higher peak or push it into a lower valley.

Michael Mauboussin argues, a shown below, that a company's competitive landscape largely defines the appropriate balance between short and long jumps.

Fitness Landscape	*Strategy*	*Financial Tool*	*Organisational Structure*
Stable	Short jumps	DCF	Centralised
Coarse	Fine blend between short and long jumps	DCF + strategic options	Loose centralisation
Roiling	Long jumps	Strategic options	Decentralised

APPENDIX 2B

EQUIVALENCE OF THE TWO FORMULAE

The two formulae for determining the continuing value are as follows:

$$\text{Free cash flow perpetuity formula: } \frac{\text{FCF}_{t+1}}{\text{WACC} - g} \tag{2B.1}$$

$$\text{Value driver formula: } \frac{\text{NOPLAT}_{t+1}\left(1 - \dfrac{g}{\text{ROIC}}\right)}{WACC - g} \tag{2B.2}$$

As the denominators are identical, to establish the equivalence of the two formulae, we have to prove that

$$\text{FCF} = \text{NOPLAT}\left(1 - \frac{g}{\text{ROIC}}\right) \tag{2B.3}$$

Let us start with the following definition of free cash flow (FCF):

$$\text{FCF} = \text{NOPLAT} - \text{INV} \tag{2B.4}$$

where INV is the net increase in invested capital.

If the return on existing capital employed remains constant, a firm's NOPLAT in year t is equal to its NOPLAT in year $t - 1$ plus the return earned on INV made in year $t - 1$.

$$\text{NOPLAT}_t = \text{NOPLAT}_{t-1} + \text{ROIC} \times \text{INV}_{t-1} \tag{2B.5}$$

Rearranging Eq. (2B.5) gives:

$$\text{NOPLAT}_t - \text{NOPLAT}_{t-1} = \text{ROIC} \times \text{INV}_{t-1} \tag{2B.6}$$

Dividing both sides of Eq. (2B.6) by NOPLAT_{t-1} gives:

$$\frac{\text{NOPLAT}_t - \text{NOPLAT}_{t-1}}{\text{NOPLAT}_{t-1}} = \frac{\text{ROIC} \times \text{INV}_{t-1}}{\text{NOPLAT}_{t-1}} \tag{2B.7}$$

As the left hand side of Eq. (2B.7) represents the growth (g) in NOPLAT, we get:

$$g = \text{ROIC} \times \frac{\text{INV}}{\text{NOPLAT}} \tag{2B.8}$$

Note that the time subscript has been dropped for the sake of simplicity.

This gives:

$$\text{INV} = \text{NOPLAT} \times \frac{g}{\text{ROIC}} \tag{2B.9}$$

$$\text{FCF} = \text{NOPLAT} - \text{NOPLAT} \times \left(\frac{g}{\text{ROIC}}\right) \tag{2B.10}$$

$$\text{FCF} = \text{NOPLAT}\left(1 - \frac{g}{\text{ROIC}}\right) \tag{2B.11}$$

g/ROIC may be referred to as the net investment rate. It reflects the ratio of net new investment to NOPLAT.

A simple example shows that the two methods produce identical continuing value estimates, given the same assumptions.

The cash flow projections for a firm are as follows:

	Year 1	*Year 2*	*Year 3*	*Year 4*	*Year 5*
NOPLAT	100	108	117	126	136
Net investment	50	54	59	63	68
Free cash flow	50	54	58	63	68

NOPLAT and the free cash flow grow at a rate of 8 percent. The rate of return on net investment is 16 percent. The weighted average cost of capital is assumed to be 12 percent. The continuing value according to the growing free cash flow perpetuity formula is:

$$\text{Continuing value} = \frac{50}{12\% - 8\%} = 1{,}250$$

The continuing value according to the value driver formula is

$$\text{Continuing value} = \frac{100\left(1 - \frac{8\%}{16\%}\right)}{12\% - 8\%} = 1{,}250$$

APPENDIX 2C

ENTERPRISE DCF VALUATION: 2-STAGE AND 3-STAGE GROWTH MODELS

In our chapter 2 discussions we worked with detailed year-by-year forecasts which permitted any kind of variation in any item from year to year. When such detailed forecasts are not available, we may have to rely on simplified versions of the DCF approach. This section discusses two simplified versions of the DCF approach:

- Two-stage growth model
- Three-stage growth model

Two Stage Growth Model

The two stage growth model allows for two stages of growth—an initial period of higher growth followed by a stable (but lower) growth forever.

$$\begin{array}{c}\text{Value of}\\ \text{the firm}\end{array} = \begin{array}{c}\text{Present value of the}\\ \text{FCF during the high}\\ \text{growth phase}\end{array} + \begin{array}{c}\text{Present value of}\\ \text{terminal value}\end{array}$$

Note that in simplified versions of the DCF approach, it is generally assumed that the free cash flow (FCF) is equal to the cash flow to the investors. In other words, it is assumed that non-operating cash flows are nil.

To illustrate the two stage-growth model, let us consider an example. Exotica Corporation is expected to grow at a higher rate for five years; thereafter the growth rate will fall and stabilise at a lower level. The following information is available:

Base Year (Year 0) Information

- Revenues = 4000 million
- EBIT (12.5% of revenues) = 500 million
- Capital expenditure = 300 million
- Depreciation = 200 million
- Net working capital as a percentage of revenues = 30 percent
- Corporate tax rate (for all time) = 40 percent
- Paid up equity capital (10 par) = 300 million
- Market value of debt = 1250 million

Inputs for the High Growth Rate

- Length of the high growth phase = 5 years

- Growth rate in revenues, depreciation, EBIT and capital expenditure = 10 percent
- Net working capital as a percentage of revenues = 30 percent
- Cost of debt = 15 percent (pre-tax)
- Debt-equity ratio = 1 : 1
- Risk free rate = 13 percent
- Market risk premium = 6 percent
- Equity beta = 1.333

Inputs for the Stable Growth Period

- Expected growth rate in revenues and EBIT = 6 percent
- Capital expenditures are offset by depreciation
- Net working capital as a percentage of revenues = 30 percent
- Cost of debt = 15 percent (pre-tax)
- Debt-equity ratio = 2 : 3
- Risk free rate = 12 percent
- Market risk premium = 7 percent
- Equity beta = 1.0

Given the above information, the forecasted FCF during the high growth period are calculated in Exhibit 2C.1

Exhibit 2C.1 ***Forecasted FCF: Exotica Corporation***

in million

	1	*2*	*3*	*4*	*5*	*Terminal year*
1. Revenues	4400	4840	5324	5856.4	6442.0	6828.6
2. EBIT	550	605	665.6	732.1	805.1	853.4
3. EBIT (1 – *t*)	330	363	399.3	439.2	483.2	512.1
4. Cap exp-Depreciation	110	121	133.1	146.4	161.1	-
5. Δ Net working capital	120	132	145.2	159.7	175.7	116.0
6. FCF (3-4-5)	100	110	121	133.1	146.4	396.1

The cost of equity (r_E), using the capital asset pricing model, and the weighted average cost of capital (WACC) during the high growth period and stable growth period are calculated below:

	r_E = *Risk free rate + Equity beta (Market risk premium)*	*WACC* = $w_E r_E + w_D r_D (1 - t)$
High growth period	13% + 1.333 (6%) = 21%	0.5(21%) + 0.5(15%)(0.6) = 15%
Stable growth period	12% + 1.0(7%)= 19%	0.6(19%) + 0.4 (15%)(0.6) = 15%

The present value of the FCF during the explicit forecast period is:

$$= \frac{100}{(1.15)} + \frac{110}{(1.15)^2} + \frac{121}{(1.15)^3} + \frac{133.1}{(1.15)^4} + \frac{146.4}{(1.15)^5} = 398.58 \text{ million}$$

The present value of the terminal value is:

$$= \frac{396.1}{0.15 - 0.06} \times \frac{1}{(1.15)^5} = 2188.13 \text{ million}$$

The value of the firm is:

$$= 398.58 + 2188.13 = 2586.71 \text{ million}$$

Three Stage Growth Model

The three-stage growth model assumes that:

- The firm will enjoy a high growth rate for a certain period (usually 3 to 7 years).
- The high growth period will be followed by a transition period during which the growth rate will decline in linear increments.
- The transition period will be followed by a stable growth rate forever.

Hence the value of the firm is expressed as follows:

Value of the firm = PV of FCF during the high growth period + PV of FCF during the transition period + PV of terminal value

The three-stage growth model may be illustrated with an example. Multiform Limited is being appraised by an investment banker. The following information has been assembled.

Base Year (Year 0) Information

- Revenues = 1000 million
- EBIT = 250 million
- Capital expenditure = 295 million
- Depreciation and amortisation = 240 million
- Net working capital as a percentage of revenues = 20 percent

- Tax rate = 40 percent (for all time to come)

Inputs for the High Growth Period

- Length of the high growth period = 5 years
- Growth rate in revenues, depreciation, EBIT, and capital expenditures = 25 percent
- Net working capital as a percentage of revenues = 20 percent
- Cost of debt = 15 percent (pre-tax)
- Debt-equity ratio = 1.5
- Risk free rate = 12 percent
- Market risk premium = 6 percent
- Equity beta = 1.583
- WACC = 0.4 [12 + 1.583(6)] + 0.6 [15(1-0.4)] = 14.00 percent

Inputs for the Transition Period

- Length of the transition period = 5 years
- Growth rate in EBIT will decline from 25 percent in year 5 to 10 percent in year 10 in linear movements of 3 percent each year
- Net working capital as a percentage of revenues = 20 percent
- The debt-equity ratio during this period will drop to 1:1 and the pre-tax cost of debt will be 14 percent
- Risk-free rate = 11 percent
- Market risk premium = 6 percent
- Equity beta = 1.10
- WACC = 0.5 [11 + 1.1(6)] + 0.5 [14 (1-0.4)
  = 13.00 percent

Inputs for the Stable Growth Period

- Growth rate in revenues , EBIT, capital expenditure, and depreciation = 10 percent
- Net working capital as a percentage of revenues = 20 percent
- Debt-equity ratio = 0:1
- Pre-tax cost of debt = 12 percent
- Risk free rate = 10 percent
- Market risk premium = 6 percent
- Equity beta = 1.00

- WACC = 1.0 [10 + 1 (6)]
  = 16.00 percent

The above inputs are used to estimate free cash flows to the firm, the cost of capital, and the present values during the high growth and transition period as shown in Exhibit 2C.2.

Exhibit 2C.2 ***Forecasted FCF : Multiform Limited***

Period	Growth rate (%)	EBIT (1-t)	Cap Exp	Dep	NWC	ΔNWC	FCF	D/E	Beta	WACC (%)	Present Value
1	25	187.5	368.8	300	250	50	68.7	1.5	1.583	14	60.26
2	25	234.4	460.9	375	312.5	62.5	85.9	1.5	1.583	14	66.10
3	25	293.0	576.2	468.8	390.6	78.1	107.3	1.5	1.583	14	72.43
4	25	366.2	720.2	585.9	488.3	97.7	134.2	1.5	1.583	14	79.45
5	25	457.8	900.3	732.4	610.4	122.1	167.8	1.5	1.583	14	87.15
6	22	558.5	1098.3	893.6	744.6	134.2	219.6	1.0	1.100	13	100.93
7	19	664.6	1307.0	1063.3	886.1	141.5	279.4	1.0	1.100	13	113.64
8	16	770.9	1516.1	1233.5	1027.9	141.8	346.5	1.0	1.100	13	124.72
9	13	871.1	1713.2	1393.8	1161.5	133.6	418.1	1.0	1.100	13	133.18
10	10	958.2	1884.6	1533.2	1277.7	116.2	490.6	1.0	1.100	13	138.30

The terminal value at the end of year 10 can be calculated based on the FCF in year 11, the stable growth rate of 10 percent, and the WACC of the stable growth period, 16 percent.

$$FCF_{11} = FCF_{10} \times (1.10) = 490.6\,(1.10) = 539.7 \text{ million}$$

$$\text{Terminal value}_{10} = \frac{FCF_{11}}{WACC - g} = \frac{539.7}{0.16 - 0.10} = 8995 \text{ million}$$

$$\text{Present value of terminal value} = \frac{8995}{(1.14)^5\,(1.13)^5} = 2535.62 \text{ million}$$

The value of Multiform Limited is arrived at as follows:

Present value of FCF during the high growth period	: 365.39 million
Present value of FCF in the transition period	: 610.77 million
Present value of the terminal value	: 2535.62 million
Value of the firm	: 3511.78 million

SOLVED PROBLEMS

1. Magnavision Corporation is expected to grow at a higher rate of 4 years; thereafter the growth rate will fall and stabilise at a lower level. The following information has been assembled:

Base Year (Year 0) Information

• Revenues	3000 million
• EBIT	500 million
• Capital expenditure	350 million
• Depreciation	250 million
Net working capital as a percentage of revenues	25%
• Corporate tax rate (for all time)	30%
• Paid-up equity capital (10 par)	400 million
• Market value of debt	1200 million

Inputs for the High Growth Phase

• Length of high growth phase	4 years
• Growth rate in revenues, depreciation, EBIT and capex	20 %
• Net working capital as a percentage of revenues	25 %
• Cost of debt (pre-tax)	13 %
• Debt-equity ratio	1:1
• Risk-free rate	11 %
• Market risk premium	7 %
• Equity beta	1.129

Inputs for the Stable Growth Period

• Expected growth rate in revenues and EBIT	10 %
• Capital expenditure are offset by depreciation	
• Net working capital as a percentage of revenues	25 %
• Cost of debt (pre-tax)	12.14%
• Risk-free rate	10%
• Market risk premium	6%
• Equity beta	1.0
• Debt-equity ratio	2:3

(i) What is the WACC for the high growth phase and the stable growth phase?

(ii) What is the value of the firm?

Solution

(i) According to the CAPM, the cost of equity during the high growth phase will be:
11% + 1.129 (7%) = 18.90 %
The cost of debt during the high growth phase will be:
13% (1 – 0.30) = 9.10%
The WACC for the high growth phase will be:
$$\text{WACC} = 0.5 \times 18.90 + 0.5 \times 9.10$$
$$= 14.0\%$$
According to the CAPM, the cost of equity during the stable growth phase will be:
10% + 1.0 (6%) = 16%
The cost of debt during the stable growth phase will be:
12.14 (1 – 0.30) = 8.50%
The WACC during the stable growth phase will be:
$0.4 \times 8.50\% + 0.60 \times 16\% = 13.0\%$

(ii) The forecasted FCF during the high growth period and the terminal year are given below:

Exhibit 2C.3 ***Forecasted FCF: Magnavision Corporation***

in million

	1	2	3	4	Terminal year
1. Revenues	3600	4320	5184	6220.8	6842.9
2. EBIT	600	720	864	1036.8	1140.5
3. EBIT (1–*t*)	420	504	604.8	725.8	798.3
4. Capital expenditure-depreciation	120	144	172.8	207.4	-
5. Δ Net working capital	150	180	216	259.2	155.5
6. FCF (3 – 4 – 5)	150	180	216	259.2	642.8

The present value of the FCF during the explicit forecast period is:

$$\frac{150}{(1.14)} + \frac{180}{(1.14)^2} + \frac{216}{(1.14)^3} + \frac{259.2}{(1.14)^4} = 569.3 \text{ million}$$

The present value of the terminal value is:

$$\frac{642.8}{0.13 - 0.10} \times \frac{1}{(1.14)^4} = 12686.3 \text{ million}$$

The value of the firm is:

$$569.3 \text{ million} + 12686.3 \text{ million} = 13255.6 \text{ million}$$

Problems

1. Televista Corporation is expected to grow at a higher rate for 4 years; thereafter the growth rate will fall and stabilise at a lower level. The following information is available:

Base Year (Year 0) Information

Revenues	=	1600 million
EBIT	=	240 million
Capital expenditure	=	200 million
Depreciation	=	120 million
Working capital as a percentage of revenues	=	25 percent
Corporate tax rate (for all time)	=	35 percent
Paid up equity capital (10 par)	=	180 million
Market value of debt	=	600 million

Inputs for the High Growth Period

Length of the high growth period	=	4 years
Growth rate in revenues, depreciation, EBIT and capital expenditure	=	20 percent
Working capital as a percentage of revenues	=	25 percent
Cost of debt	=	15 percent(pre-tax)
Debt equity ratio	=	1.5 : 1
Risk-free rate	=	12 percent
Market risk premium	=	7 percent
Equity beta	=	1.25

Inputs for the Stable Growth Period

Expected growth rate in revenues and EBIT	=	10 percent
Capital expenditures are offset by depreciation		
Working capital as a percentage of revenues	=	25 percent
Cost of debt	=	14 percent (pre-tax)
Debt-equity ratio		1:1
Risk-free rate	=	12 percent
Market risk premium	=	6 percent
Equity beta	=	1.00

Calculate the value of the firm.

2. You have been asked to appraise Multisoft Limited for which the following information has been assembled:

Base Year (Year 0) Information

Revenues	=	320 million
EBIT	=	90 million
Capital expenditure	=	100 million
Depreciation	=	60 million
Working capital as a percentage of revenues	=	20 percent
Tax rate	=	0 percent

Inputs for the High Growth Period

Length of the high growth period	=	5 years
Growth rate in revenues, depreciation, EBIT and capital expenditure	=	40 percent
Working capital as a percentage of revenues	=	20 percent
Cost of debt	=	15 percent (pre-tax)
Tax rate will increase to 30 percent in linear increments of 6 percent		
Debt equity ratio	=	1 : 1
Risk-free rate	=	12 percent
Market risk premium	=	7 percent
Equity beta	=	1.3

Inputs for the Transition Period

Length of the transition period	=	5 years
Growth rate in revenues, depreciation EBIT, and capital expenditures will decline from 40 percent in year 5 to 10 percent in year 10 in linear increments of 6 percent each year.		
Working capital as a percentage of revenues	=	20 percent
Debt-equity ratio	=	0.8 : 1
Cost of debt	=	14 percent (pre-tax)
Risk-free rate	=	11 percent
Market risk premium	=	6 percent
Equity beta	=	1.1
Tax rate	=	30 percent

Inputs for the Stable Growth Period

Growth rate in revenues, EBIT, capital expenditure and depreciation	= 10 percent
Working capital as a percentage of revenues	= 20 percent
Debt-equity ratio	= 0.5 : 1.0
Cost of debt	= 13 percent (pre-tax)
Risk-free rate	= 11 percent
Market risk premium	= 5 percent
Equity beta	= 1.0
Tax rate	= 30 percent

What value would you put on Multisoft Limited?

CHAPTER 3

The Cost of Capital

Providers of capital (shareholders and lenders) want to be suitably compensated for investing funds in the firm. The cost of capital reflects what they expect. It is the discount rate used for converting the expected free cash flow into its present value. Hence, its definition must be consistent with that of the free cash flow. This means that the cost of capital should have the following features:

- It represents a weighted average of the costs of all sources of capital, as the free cash flow reflects the cash available to all providers of capital.
- It is calculated in post-tax terms because the free cash flow is expressed in post-tax terms.
- It is defined in nominal terms, since the free cash flow is stated in nominal terms.
- It is based on market value weights for each component of financing, as market values, not book values, represent the economic claims of various providers of capital.
- It reflects the risks borne by various providers of capital.

This chapter discusses how the cost of capital is computed. It is divided into eight sections as follows:

- Concept of cost of capital
- Cost of equity: CAPM approach
- Cost of equity: alternative approaches
- Estimating the equity beta of an unlisted company
- Cost of debt and preference
- Target weights for determining the cost of capital
- Weighted average cost of capital
- Misconceptions surrounding cost of capital

3.1 CONCEPT OF COST OF CAPITAL

A company's cost of capital is the weighted average cost of various sources of finance used by it, viz., equity, preference, and debt.

Suppose that a company uses equity, preference, and debt in the following proportions: 50, 10, and 40. If the component costs of equity, preference, and debt are 16 percent, 12 percent, and 8 percent respectively, the weighted average cost of capital (WACC) will be:

WACC = (Proportion of equity) (Cost of equity) + (Proportion of preference) (Cost of preference) + (Proportion of debt) (Cost of debt)

= (0.5)(16) + (0.10)(12) + (0.4)(8) = 12.4 percent

Bear in mind the following in applying the above formula:

- For the sake of simplicity, we have considered only three types of capital (equity; nonconvertible, noncallable preference; and nonconvertible, noncallable debt). We have ignored other forms of capital like convertible or callable preference, convertible or callable debt, bonds with payments linked to stock market index, bonds that are puttable or extendable, warrants, so on and so forth. Calculating the cost of these forms of capital is somewhat complicated. Fortunately, more often than not, they are a minor source of capital. Hence, excluding them may not make a material difference.
- Debt includes long- term debt as well as short-term debt (such as working capital loans and commercial paper). Some companies leave out the cost of short-term debt while calculating the weighted average cost of capital. In principle, this is not correct. Investors who provide short-term debt also have a claim on the earnings of the firm. If a company ignores this claim, it will misstate the rate of return required on its investments.
- Since the above equation does not include items such as accounts payable and deferred taxes, you might think that something is missing. After all, accounts payable represent a short term "loan" from the suppliers and, as some argue, deferred taxes may be viewed as a "loan" from the tax department. You are right in the sense that these items should not be ignored. But remember that they affect the cash flows and not the WACC. Hence, in deriving the cash flows they are duly concerned.

To determine the WACC, we have to calculate the cost of equity, preference, and debt and the weights associated with them. Since none of these can be observed directly, we employ various models and methods to estimate them.

3.2 COST OF EQUITY: CAPM APPROACH

While the cost of debt and preference can be determined fairly easily, the cost of equity is rather difficult to estimate because there is no contractual commitment on the part of the company to pay dividends.

Since the cost of equity looms large in the calculation of cost of capital, several approaches have been suggested: the capital asset pricing model (CAPM), Fama-French model, arbitrage pricing theory, bond yield plus risk premium approach, dividend discount model, and earnings/price approach. The capital asset pricing model currently is the most widely used approach for calculating the cost of approach. So, we will devote more space to it. The other approaches will be covered in the section that follows.

Because the CAPM is discussed at length in investment and finance textbooks, we will not go into the details of theory here. Instead we will focus on its implementation.

According to the CAPM, the expected rate of return on any security is equal to the risk-free rate plus the risk premium — the risk premium is equal to the security's beta times the market risk premium.

$$E\,(R_i) = R_f + \beta_i\,[\,E\,(R_M) - R_f\,] \tag{3.1}$$

where $E\,(R_i)$ is the expected return on security i, R_f is the risk-free rate, β_i is the beta of security i which reflects its sensitivity to the market, and $E(R_M)$ is the expected return on the market. $[E\,(R_M) - R_f\,]$ is referred to as the market risk premium.

As per the CAPM, while the risk-free rate and the market risk premium are the same for all companies, beta varies across companies.

Although the CAPM is grounded on solid theory (William Sharpe, a primary author of the model, received the 1990 Nobel Prize in Economics), the model per se does not provide much guidance for implementation.

To apply the CAPM, you need estimates of the following factors:

- Risk-free rate
- Market risk premium
- Beta

Risk-free Rate

The risk-free rate is the return on a security (or a portfolio of securities) that is free from default risk and is uncorrelated with returns from anything else in the economy. Theoretically, the return on a zero-beta portfolio is the best estimate of the risk-free rate. Constructing zero-beta portfolios, however, is costly and complex. Hence they are often unavailable for estimating the risk-free rate.

In practice, we look at the yield on government bonds as they are supposed to be default-free. Government bonds have maturities ranging from one month to 20 years or even more, and different maturities generate different yields. Which maturity should be used?

Ideally, you should discount each cash flow with the yield of a government bond with the same maturity. For example, a cash flow generated 5 years hence should be discounted by a cost of capital derived from a 5-year zero coupon bond (known as STRIPS). Investment banks and dealers may separate coupons from the principal (called residue) of coupon bonds to create a supply of zero coupon bonds. The process is called stripping and the contracts of zero coupon bonds are called STRIPS. STRIPS stands for Separate Trading of Registered Interest and Principal Securities. Zero coupon bonds are preferable to coupon bearing bonds, because the effective maturity of the latter is shorter than their stated maturity.

In reality, practitioners generally use a single yield to maturity of a government STRIPS that matches well with the entire cash flow stream being valued. The yield to maturity on a 10-year government STRIPS is the most commonly used proxy for the risk-free rate.

Market Risk Premium

In the CAPM, the market portfolio is the weighted portfolio of all assets, financial, real, as well as human. Since it is impractical to measure the market portfolio, a proxy is necessary. It is a common practice to use a value weighted equity index as a proxy for the market portfolio. In the U.S., S&P 500 is generally used. In India, BSE Sensex and Nifty are commonly used.

Determining the market risk premium is perhaps the most contentious issue in finance. No single method for estimating the market risk premium is universally accepted. The market risk premium may be estimated on the basis of historical data or forward looking data.

Historical Market Risk Premium Since investors are risk- averse, they expect a premium for holding stocks rather than bonds. If the investor risk aversion has not changed over time, then the historical risk premium may be a reasonable proxy for future risk premium.

The following guidelines may be followed to measure the historical risk premium.

1. *Calculate the premium in relation to long-term government bonds* As explained earlier, the duration of a company's cash flow is matched better by the duration of long-term bonds. So analysts generally prefer to compare historical market returns with the return on 10-year government bonds.
2. *Use the longest possible period* How long should the measurement period be? Since the equity cult in India began in late 1970s, we can look at a measurement period from 1978-1979 (the base year for Sensex computation) to now. Alternatively, we

can consider a measurement period from April 1, 1991 (marking the economic reform era) to now. Use the longest possible historical period, absent any trends in risk premium over time.

3. *Choose an appropriate average* Should the average return be defined as the arithmetic average or geometric average? The arithmetic average is the average of the annual rates of return over the measurement period whereas the geometric average is the compounded annual return over the measurement period. The difference between the two may be illustrated with a simple example where we have two years of returns:

Year	Price	Return
0	100	
1	140	40%
2	154	10%

The arithmetic average over the two years is 25.0% [(40 + 10) / 2], whereas the geometric mean is 24.0% [$1.54^{0.5} - 1 = 0.24$]. The advocates of arithmetic average argue that it is more consistent with the mean-variance framework and can better predict the return in the next period. The votaries of geometric average argue that it takes into account compounding and can better predict the average premium in the long term.

A Technical Digression Since we are relying on the past to get a handle over the future, which historical average best estimates the expected future rate of return? Statistical principles suggests the arithmetic average is the best unbiased estimate of the mean (expectation) for any random variable. So, the arithmetic average of many one-period returns is the best unbiased estimate for the expected return for the following period. You cannot, however, use a one-period return to value a company with cash flows extending over many years. Instead you have to use a compounded rate of return to discount long- dated cash flows. But when the arithmetic average is compound, it will produce an upwardly biased discount factor. When you look at historical returns, you can easily understand the reason for the difference between geometric average and arithmetic average. The former measures the actual rate of return earned per year on average, compound annually; the latter measures the rate of return earned in a typical year. So, you should use the measure that is appropriate to the question you have in mind.

A somewhat difficult question relates to forecasting the future. If you have estimates of both the geometric and arithmetic average returns, then which one should you choose? The former is perhaps too low for shorter periods whereas the latter is perhaps too high for longer periods.

Marshal Blume has suggested a simple formula for combining the two averages. Suppose you have calculated geometric and arithmetic average returns from N years of past data and you want to use these inputs, to forecast a T-year average return, $R(T)$ where $T < N$. Here's is how you do it with the Blume formula:

$$R(T) = \frac{T-1}{N-1} \times \text{Geometric average} + \frac{N-T}{N-1} \times \text{Arithmetic average}$$

To illustrate, suppose that from 20 years of data on annual returns, you find that the geometric and arithmetic average returns are 12 percent and 15 percent respectively. You want to forecast 1-year, 5-year, and 10-year average return forecasts. According to the Blume formula, these average return forecasts are as follows:

$$R(1) = \frac{1-1}{20-1} \times 12\% + \frac{20-1}{20-1} \times 15\% = 15\ \%$$

$$R(5) = \frac{5-1}{20-1} \times 12\% + \frac{20-5}{20-1} \times 15\% = 14.37\ \%$$

$$R(10) = \frac{10-1}{20-1} \times 12\% + \frac{20-10}{20-1} \times 15\% = 13.58\ \%$$

$$R(20) = \frac{20-1}{20-1} \times 12\% + \frac{20-20}{20-1} \times 15\% = 12\ \%$$

The average return forecasts given above are the forecasts of geometric average returns, not the forecasts of arithmetic average returns. Remember what matters finally is the geometric average return over the period of investment as it reflects the compound rate of return. Note that the inputs used in the above analysis are the historical geometric average returns and arithmetic average returns.

Equity Risk Premium in India

Using the data for the period 1981-2006, J.R. Varma and S.K. Barua estimated that the equity risk premium is abouy 8.75 percent on a geometric mean basis and about 12.5 percent on an arithmetic mean basis. They found very little difference between the pre-reform and post- reform period.

Source: J.R. Varma and S.K. Barua, "A First Cut Estimate of the Equity Risk Premium in India," *IIMA Working Paper*, June 2006.

Implied Risk Premium The historical approach assumes that investors expect future results, on average, to be the same as past results. Many investors believe that the future risk premium may not equal the historical risk premium. So they try to develop the forward looking risk premium independently.

A commonly used procedure for estimating the forward looking risk premium is as follows:

Step 1: Estimate the expected market rate of return using the constant growth dividend discount model.

Expected market rate of return = Dividend yield + Constant growth rate

The dividend yield for the market, as measured by some broad stock market index, can be predicted quite accurately. The constant growth rate may be equated with the expected growth rate in corporate earnings.

Step 2: Calculate the market risk premium.

Market risk premium = Expected market rate of return – Risk free rate.

To illustrate, consider the following:

- Stock market index = 6000
- Expected dividend yield on the index = 2 percent
- Expected growth in earnings and dividends = 13 percent
- Current risk-free rate = 8 percent

The implied market risk premium is obtained as follows:

Expected market rate of return = 2 + 13 = 15%

Implied market risk premium = 15% – 8% = 7%

The advantages, of this method are that it is current, it is market driven, and it does not require historical data. Its limitations are that it assumes that the valuation model employed is right, the inputs to that model are reliable, and the market is priced correctly.

What Drives the Market Risk Premium In the main, three factors seem to influence the market risk premium:

Variance in the Underlying Economy If the underlying economy is more volatile, the market risk premium is likely to be large. For example, the market risk premium for emerging markets, given their high-growth and high-risk economies, are larger than the market risk premiums for developed markets.

Political Risk Market risk premiums are larger in markets subject to higher political instability. Remember that political instability causes economic uncertainty.

Market Structure If the companies listed on the market are mostly large, stable, and diversified, the market risk premium is smaller. On the other hand, if the companies listed on the market are generally small and risky, the market risk premium is larger.

According to Aswath Damodaran, in developed markets with limited listings and stable economies (for example Germany and Switzerland) the market risk premium over the government bond rate may be 3.5 to 4.5 percent; on the other hand in emerging markets with political risk(e.g., China and Russia) the market risk premium may be 7.5 to 9.5 percent.

The above figures are fairly reflective of the general view of finance academics and practitioners, which is perhaps derived largely from the experience in the U.S. A different view has been expressed by Elroy Dimson, Paul March, and Michel Stanton in a book titled *Triumph of the Optimists* published in 2001. They looked at equity returns for 16 rich countries using newly gathered data going back to 1900. They estimated that the global historical equity premium for the 20th century was 4.6 percent and they have argued that the best estimate of equity premium worldwide in future is 4 to 5 percent.

Beta

According to the CAPM, the expected return on a security is driven by its beta which measures the volatility of the security with respect to the market. While estimating beta, you should bear in mind its two basic characteristics. First, beta measures the risk added on to a diversified portfolio and not total risk. Second, beta measures the relative risk of a security and thus is standardised around one.

Since beta is not directly observed, we have to estimate is value. To do this we first measure raw beta with the help of regression and then make some adjustments to refine it. The regression equation commonly used to estimate a stock's raw beta is the market model.

$$R_{jt} = \alpha_j + \beta_j R_{Mt} + e_{jt} \tag{3.2}$$

where R_{it} is the return on investment i (a project or a security) in period t, R_{Mt} is the return on the market portfolio in period t, α_i (pronounced as alpha) is the intercept of the linear regression relationship between R_{jt} and R_{Mt}, β_j (pronounced as beta) is the slope of the linear regression relationship between R_{jt} and R_{Mt}, and e_{jt} is the error term.

To measure the systematic risk of a project, we have to calculate the slope of the regression. The estimate of the slope of the regression model is:

$$\beta_j = \frac{\text{Cov}\,(R_j, R_M)}{\sigma_M^2} \tag{3.3}$$

where β_i is the estimate of the slope of the regression model, Cov (R_j, R_M) is the covariance between the return on security j and the return on market portfolio, and $\sigma_M{}^2$ is the standard deviation of the return on market portfolio.

An example will help in understanding what β_j is and how it is calculated. The returns on security j and the market portfolio for a 10-year period are given below:

Year	*Return on Security j* (%)	*Return on Market Portfolio* (%)
1	10	12
2	6	5
3	13	18
4	–4	–8
5	13	10

6	14	16
7	4	7
8	18	15
9	24	30
10	22	25

The beta for security j, β_j is calculated in Exhibit 3.1. For the sake of completeness, the intercept term, α_j, has also been computed in Exhibit 3.1.

Exhibit 3.1 ***Calculation of Beta***

Year	R_{jt}	R_{Mt}	$R_{jt} - \overline{R}_j$	$R_{Mt} - \overline{R}_M$	$(R_{jt} - \overline{R}_j)(R_{Mt} - R_M)$	$(R_{Mt} - \overline{R}_M)^2$
1	10	12	−2	−1	2	1
2	6	5	−6	−8	48	64
3	13	18	1	5	5	25
4	−4	-8	−16	−21	336	441
5	13	10	1	−3	−3	9
6	14	16	2	3	6	9
7	4	7	-8	−6	48	36
8	18	15	6	2	12	4
9	24	30	12	17	204	289
10	22	25	10	12	120	144
	$\Sigma R_{jt} = 120$ $\overline{R}_j = 12$	$\Sigma R_{Mt} = 130$ $\overline{R}_M = 13$			$\Sigma(R_{jt} - \overline{R}_j)(R_{Mt} - \overline{R}_M) = 778$	$\Sigma(R_M - \overline{R}_M)^2 = 1022$

Cov $(R_{jt}, R_{Mt}) = 778/9 = 86.4$ $\sigma^2 = 1022/9 = 113.6$

$$\text{Beta: } \beta_j = \frac{\text{Cov }(R_j, R_M)}{\sigma_M^2} = \frac{86.4}{113.6} = 0.76$$

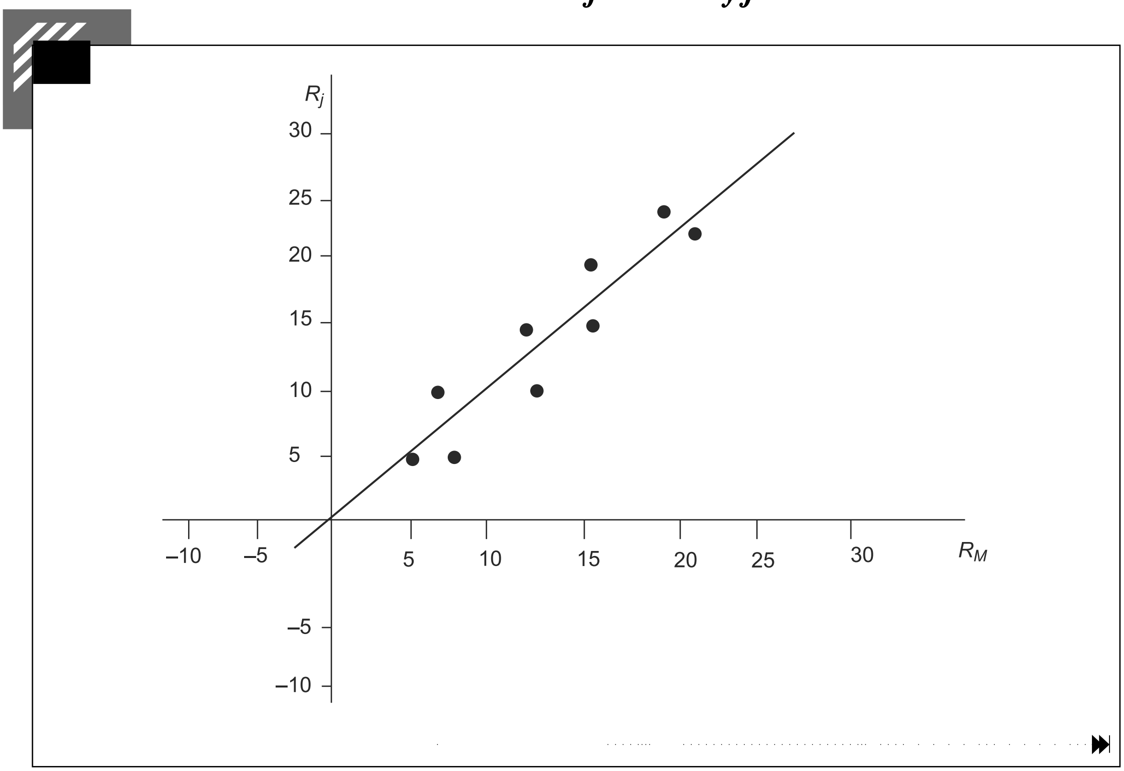
Alpha: $\alpha_j = R_j - \beta_j R_M = 12 - (0.76)(13) = 2.12\%$

Given the values of $\beta_j(0.76)$ and $\alpha_j(2.12$ percent), the regression relationship between the return on security $j(R_j)$ and the return on market portfolio (R_M) is shown graphically in Exhibit 3.2. The graphic representation is commonly referred to as the characteristic line. Since security j has a beta of 0.76, we infer that its return is less volatile than the return on the market portfolio. If the return on market portfolio rises/falls by 10 percent, the return on security j would be expected to increase/decrease by 7.6 percent (0.76 × 10%). The intercept term for security $j(\alpha_j)$ is equal to 2.12 percent. It represents the expected return on security j when the return on the market portfolio is zero.

Spreadsheet Calculation You can calculate the beta and alpha using the Excel. Enter the returns on security *j* for the years 1 to 10 in the cells B2 to K2 and enter the returns on the market portfolio in the cells B3 to K3. Select F4 and type = slope (). Excel will prompt you to fill inside the bracket known *y*'s and known *x*'s which mean the *y* and *x* coordinate values, which in this case are between columns B and K. So, what you type inside F4 will be= slope (B2:K2, B3:K3). Press Enter and you will get the result. Similarly to get the alpha in K4, inside that cell type =intercept (B2:K2,B3:K3) and press Enter. Alternatively you may get the same results by going to the menu item Insert and then selecting the statistical functions slope and intercept. The spreadsheet is shown below.

	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*K*
1	Year	1	2	3	4	5	6	7	8	9	10
2	Return on security *j* (%)	10	6	13	–4	13	14	4	18	24	22
3	Return on market portfolio (%)	12	5	18	–8	10	16	7	15	30	25
4		= Slope (B2:K2, B3:K3)			→	0.76	Intercept	= Intercept (B2*K2,B3:K3)		→	2.10

Exhibit 3.2 ***Characteristic Line for Security j***



Measurement Issues The key measurement issues in beta calculation relate to estimation period, return interval, and market index.

Estimation Period A longer estimation period provides more data but the risk profile of the firm may change over that period. Given this trade off, data providers such as Morningstar Ibbotson and most analysts use five years of monthly data to estimate beta. This practice originated as a rule of thumb in the early days of CAPM testing and was vindicated subsequently as appropriate by researchers.

Return Interval Returns may be calculated on an annual, monthly, bi-weekly, or daily basis. Using daily returns increases the number of observations, but introduces a bias due to non-trading. If a stock is illiquid, using daily or even weekly returns is problematic because many reported returns will be zero. Consequently, the estimate of beta will have a downward bias. Hence, it makes sense to use monthly returns.

Market Index The standard practice is to estimate the beta of a stock in relation to the index of the market to which it belongs. Thus, the betas of Indian stocks are estimated relative to Nifty index (or any other Indian stock market index) and the betas of U.S. stocks are estimated relative to S&P 500 index (or any other U.S. market index). While this practice provides an acceptable measure of risk for a parochial investor, it may not be appropriate for an international investor.

Adjusting Historical Beta The beta calculated above reflects a measure of historical alignment of the price of a stock with that of the market. Hence many regard it as a "measurement" of past relationship that cannot be naively used as an "estimate" of future risk. Why? Two reasons are commonly given:

- The historical alignment may have been significantly influenced by chance factors.
- A company's beta may change over time.

To overcome these limitations, some adjustment may be required. A procedure that is sometimes recommended is to take a weighted average of the historical beta, on the one hand, and 1.0 (the value of market beta) on the other. The weighting scheme should take into account the degree of historical estimation error and the dispersion of individual firms around the average. If the historical estimation error is large, the weight assigned to the historical beta should be small. If the dispersion of individual firms around the average is large, the weight assigned to 1.00 (the market beta) should be small. By balancing these factors, a suitable weighting scheme can be developed. Note that Merrill Lynch, in its beta prediction, assigns a weight of 0.66 to historical beta and a weight of 0.34 to average value (see Merrill Lynch's booklet *Security Risk Evaluation Service*).

Problems with CAPM

There are several problems or limitations of CAPM

- CAPM is based on several unrealistic assumptions such as (a) risk is measured by variance, (b) the marginal investor is diversified, (c) all investors have homogeneous expectation, and (d) there are no transaction costs.
- It is not possible to estimate the parameters of the model, such as market risk premium and beta, with precision.
- The empirical evidence in favour of the model is weak. If the model is right, the returns should be linearly related to beta and beta should be the only driver of returns. In reality, the relationship between beta and returns in weak and other variables, such as size and price-book ratio, seem to better explain the variations in returns.

Notwithstanding the problems mentioned above, the CAPM is the most widely used risk return model. As Nancy Nichols wrote in a 1993 *Harvard Business Review* article: "Yet even as the academic world debated whether beta was the appropriate measure of risk, the corporate world embraced it. CAPM is now taught in business schools and accepted in board rooms across the country. Its assumptions, prescriptions, and calculations are embedded in countless computers nationwide." Its popularity may be attributed to the following factors:

- Some objective estimate of risk premium is better than a completely subjective estimate or no estimate.
- CAPM is a simple and intuitively appealing risk- return model. Its basic message that diversifiable risk does not matter is accepted by nearly every one.
- While there are plausible alternative risk measures, no consensus has emerged on what course to follow if beta is abandoned. It appears that the CAPM remains popular not because there is no competition, but because there is excess of it.

The situation perhaps may change as additional evidence is gathered in favour of arbitrage pricing theory and operational guidelines for applying that theory are developed further. As of now, however, the CAPM appears to be the model of choice in practice.

3.3 ALTERNATIVES TO THE CAPM

While the CAPM represents a seminal contribution to the field of finance, many empirical studies have pointed towards its deficiencies in explaining the relationship between risk and return. So in recent decades financial economists began looking for alternative risk-return models. Two of them deserve a special mention: Fama-French model and Arbitrage Pricing theory. Apart from these, we will also discuss the following approaches: bond yield plus risk premium approach, dividend discount model approach, and earnings-price approach.

Fama-French Model

Fama and French proposed the following three factors model in their celebrated paper "Common Risk Factors in the Returns on Stocks and Bonds," published in the January 1993 issue of the *Journal of Financial Economics:*

$$(R_{jt} - RFR_t) = \alpha_j + b_{j1}(R_{Mt} - RFR_t) + b_{j2}SMB_t + b_{j3}HML_t + e_{jt} \tag{3.4}$$

In this model, in addition to $(R_{Mt} - RFR_t)$, the excess return on a stock market portfolio, there are two other microeconomic risk factors: SMB_t and HML_t. SMB_t (i.e., small minus big) is the return to a portfolio of small capitalisation stocks less the return to a portfolio of large capitalisation stocks and HML_t (i.e., high minus low) is the return to a portfolio of stocks with high ratios of book-to-market values less the return to a portfolio of low book-to-market value stocks.

In this model, *SMB* is intended to capture the risk associated with firm size while *HML* is meant to reflect risk differentials associated with "growth" (i.e., low book-to-market ratio) and "value" (i.e., high book-to-market ratio) stocks.

It may be emphasised that a company does not earn a risk premium just because it is small or it has a high book-to-market ratio. Rather, the company receives a risk premium if its stock returns are correlated with those of small stocks or high book-to-market companies. The SMB and HML portfolios are supposed to reflect unobservable risk factors that cause small companies with high book-to-market values to earn returns in excess of their CAPM returns.

Arbitrage Pricing Theory

Developed initially by Stephen Ross, the arbitrage pricing theory (APT) looks like a generalised version of the Fama-French three factors model. According to the APT, the returns of a security are generated by k factors and random noise.

$$R_j = \alpha_j + \beta_{j1} F_1 + \beta_{j2} F_2 + \ldots \beta_{jK} F_K + e_j \tag{3.5}$$

where R_j is the return on security j, α_j is a constant, β_{ji} is the sensitivity of security j's return to the common risk factor i (i = 1, 2 …. k), and F_i is the return on risk factor i, and e_j is a random error term.

Since rational investors would create well-diversified factor portfolios, the expected return on a security must equal the risk- free rate plus the sum of its exposure to each factor times the factor's risk premium (λ)

$$E(R_j) = R_f + \beta_{j1}\lambda_1 + \beta_{j2}\lambda_2 + \cdots + \beta_{jK}\lambda_K \tag{3.6}$$

Otherwise, it would be possible to arbitrage and earn positive return with zero risk.

Unlike the CAPM, the APT does not specify *a priori* what the underlying risk factors are. So, a test of APT calls for first discovering the basic risk factors by employing multivariate techniques like factor analysis and then examining whether these basic risk factors correspond to some economic or behavioral variables.

Empirical studies of this kind so far suggest that there is hardly any consistency in terms of (i) the number of basic factors, (ii) the interpretation that may be put on these factors (typically, the factors identified are artificial constructs representing several economic variables), and (iii) the stability of these factors from test to test. Due to these problems, APT has not found much acceptance in practice and is largely confined to academia.

Bond Yield Plus Risk Premium Approach

Analysts who do not have faith in the CAPM approach often resort to a subjective procedure to estimate the cost of equity. They add a judgmental risk premium to the observed yield on the long-term bonds of the firm to get the cost of equity:

$$\text{Cost of equity} = \text{Yield on long-term bonds} + \text{Risk premium}$$

The logic of this approach is fairly simple. Firms that have risky and consequently high cost debt will also have risky and consequently high cost equity. So it makes sense to base the cost of equity on a readily observable cost of debt.

The problem with this approach is how to determine the risk premium. Should it be 2 percent, 4 percent, or *n* percent? There seems to be no objective way of determining it. Most analysts look at the operating and financial risks of the business and arrive at a subjectively determined risk premium that normally ranges between 2 percent and 6 percent. While this approach may not produce a precise cost of equity, it will give a reasonable ballpark estimate.

Dividend Discount Model Approach

The price of an equity stock depends ultimately on the dividends expected from it:

$$P_0 = \frac{D_1}{(1+r)^1} + \frac{D_2}{(1+r)^2} + \cdots$$

$$= \sum_{t=1}^{\infty} \frac{D_t}{(1+r)^t} \tag{3.7}$$

where P_0 is the current price of the stock, D_t is the dividend expected to be paid at the end of year t, and r is the equity shareholders' required rate of return.

If dividends are expected to grow at a constant rate of g percent per year, then Eq.(3.8) becomes:

$$P = \frac{D_1}{(1+r)^1} + \frac{D_1(1+g)}{(1+r)^2} + \frac{D_1(1+g)^2}{(1+r)^3} + \cdots \infty \tag{3.8}$$

This simplifies to what is called the Gordon model:

$$P = \frac{D_1}{r - g} \tag{3.9}$$

Solving the above equation for r, we get:

$$r = \frac{D_1}{P_0} + g = \frac{D_0(1+g)}{P_0} + g \tag{3.10}$$

Thus, the expected return to shareholders, which in equilibrium is also the required return, is equal to the dividend yield plus the expected growth rate.

For a publicly traded company, it is fairly easy to determine the dividend yield. However, estimating the expected growth rate, g, is difficult. You can estimate g by using the following methods:

1. You can get a handle over g by relying on analysts' forecasts for the future growth rates. Analysts' forecasts may be available from a variety of sources. Since different sources are likely to give different estimates, a simple approach may be to obtain multiple estimates and then average them.
2. You can look at dividends for the preceding 5–10 years, calculate the annual growth rates, and average them. Suppose you observe the following dividends for some stock.

Year	*Dividend*	*Dividend change*	*Growth*
1	3.00	-	-
2	3.50	0.50	16.7
3	4.00	0.50	14.3
4	4.25	0.25	6.3
5	4.75	0.50	11.8

   If you average the four growth rates, the result is 12.3 percent, so you can use this as an estimate of the expected growth rate, g.
3. You can use the retention growth rate method. Here, you first forecast the firm's average retention rate (this is simply 1 minus the dividend payout rate) and then multiply it by the firm's expected future return on equity (ROE).

$$g = \text{(Retention rate) (Return on equity)}$$

For example, if the forecasted retention rate and return on equity are 0.60 and 15 percent, the expected growth rate is: $g = (0.6)\ (15\%) = 9$ percent.

The dividend growth model is simple. It is easy to understand and easy to apply. However, there are some problems associated with it.

- First, it cannot be applied to companies that do not pay dividends or to companies that are not listed on the stock market. Even for companies that pay dividends, the assumption that dividends will grow at a constant rate may not be valid.
- Second, it does not explicitly consider risk. There is no direct adjustment for the risk associated with the estimated growth. Of course, there is an implicit adjustment for risk as the current stock price is used.

Earnings-Price Ratio Approach

According to this approach, the cost of equity is equal to:

$$E_1 / P_0 \tag{3.11}$$

where E_1 is the expected earnings per share for the next year, and P_0 is the current market price per share.

E_1 may be estimated as: (Current earnings per share) × (1 + growth rate of earnings per share).

This approach provides an accurate measure of the rate of return required by equity investors in the following two cases:

- When the earnings per share are expected to remain constant and the dividend payout ratio is 100 percent.
- When retained earnings are expected to earn a rate of return equal to the rate of return required by equity investors.

The first case is rarely encountered in real life and the second case is also somewhat unrealistic. Hence, the earnings-price ratio should not be used indiscriminately as the measure of the cost of equity capital.

How Companies Estimate the Cost of Equity

A survey of corporate finance practices in India revealed that the following methods (in the order of decreasing importance) are followed by companies in India to estimate the cost of equity:

	%companies considering as very important or important
• Capital asset pricing model	54.3
• Gordon's dividend discount model	52.1
• Earnings-yield (Earnings per share/Market price per share)	34.2
• Dividend-yield	26.2
• Multifactor model	7.0

Source: Manoj Anand, "Corporate Finance Practices in India: A Survey," *Vikalpa*, October-December 2002.

3.4 ESTIMATING THE EQUITY BETA OF AN UNLISTED COMPANY

As discussed earlier, to estimate the equity beta of a listed company, we employ the market model in which the return on the company's equity is regressed on the return on the market portfolio. The return for a period is calculated as:

$$\frac{\text{Dividend} + (\text{Ending price} - \text{Beginning price})}{\text{Beginning price}}$$

Obviously, this procedure cannot be employed to estimate the equity beta of an unlisted company, as price data is not available.

What is the way out? The procedure that is commonly employed to estimate the equity beta for an unlisted company involves calculating the asset betas for listed companies engaged in similar business and adjusting the same for the capital structure and tax rate applicable to the unlisted company.

Before we discuss this procedure, it is helpful to understand the link between equity beta and asset beta.

Equity Beta and Asset Beta

To explore the relationship between equity beta and asset beta, we will initially ignore taxes. Look at Zenith Limited which has the following balance sheet:

Equity : 50	Assets : 100
Debt : 50	

If you buy all the securities of Zenith (its entire equity as well as debt), you will own all its assets. So the beta of your portfolio (β_P) of Zenith's securities is equal to the beta of Zenith's assets (β_A)

$$\beta_p = \beta_A \tag{3.12}$$

Now, the beta of your portfolio is simply the weighted arithmetic average of the betas of its components, viz., equity (E) and debt (D)

Hence
$$\beta_p = \beta_E \frac{E}{E+D} + \beta_D \frac{D}{E+D} \tag{3.13}$$

$$\beta_A = \beta_E \frac{E}{E+D} + \beta_D \frac{D}{E+D} \tag{3.14}$$

Juggling Eq. (3.15) a bit, you get:

$$\beta_E = \beta_A + (\beta_A - \beta_D)\frac{D}{E} \tag{3.15}$$

If the beta of debt, β_D, is assumed to be zero (this means that debt is considered to be risk-free)[1]

$$\beta_E = \beta_A + \beta_A \frac{D}{E} = \beta_A \left(1 + \frac{D}{E}\right) \tag{3.16}$$

So far we assumed that taxes don't exist. What happens in a world of taxes[2] where interest on debt is a tax-deductible expense? In this case, as Robert Hamada[3] and others have shown

$$\beta_E = \beta_A \left(1 + \frac{D}{E}(1-T)\right) \qquad (3.17)^4$$

This means

$$\beta_A = \left(\frac{\beta_E}{1 + \frac{D}{E}(1-T)}\right) \tag{3.18}$$

Eqns. (3.18) and (3.19) show how equity beta and asset beta are related.

Determinants of Assets Betas

The two key determinants of asset betas are cyclicality and operating leverage.

Cyclicality If a firm's revenues and earnings are strongly dependent on the state of the business cycle, it is likely to have a high asset beta. Cyclicality influences asset beta.

Operating Leverage Just the way financial leverage (implying a commitment to fixed financing costs) increases the beta of an investment portfolio, operating leverage (implying a commitment to fixed operating costs) increases the beta of a capital project.

Procedure for Calculating the Equity Beta of an Unlisted Company

The procedure for calculating the equity beta for an unlisted company involves the following steps:

Step 1: *Find a sample of listed firms engaged in the same line of business* Identify a sample of listed firms which are engaged wholly or largely in the same line of business.

1. This is a reasonable assumption for the debt of financially strong companies.
2. This, indeed, is a more realistic representation of the real world.
3. Robert Hamada, "Portfolio Analysis, Market Equilibrium, and Corporate Finance," *Journal of Finance*, March 1969.
4. In Eq. (3A.6), T stands for the tax rate.

Step 2: *Obtain equity betas for the sample firms* To calculate the equity beta of a firm, employ the procedure discussed earlier. Regress the monthly return of the equity stock of the firm on the monthly return of the market portfolio for 50 to 60 months. Where 50 to 60 observations of monthly returns are not available, you may use 50–60 observations of fortnightly returns.

Step 3: *Derive asset betas after adjusting equity betas for financial leverage* For each firm in the sample, the asset beta can be derived from its equity beta using the following relationship:

$$\beta_A = \frac{\beta_E}{\left(1 + \frac{D}{E}(1 - T)\right)} \tag{3.19}$$

Step 4: *Find the average of asset betas* Once the asset betas for the sample firms are obtained, the average can be readily calculated.

Step 5: *Figure out the equity beta for the unlisted company.* The equity beta for the unlisted company can be derived by adjusting the average asset beta (obtained in the previous step) for the financial leverage. Remember the formula:

$$\beta_E = \beta_A \left(1 + \frac{D}{E}(1 - T)\right) \tag{3.20}$$

Illustration

Dowtek Limited is an unlisted company engaged in the manufacture of industrial chemicals. Dowtek has a debt-equity ratio of 0.8 and a tax rate of 30 percent.

Dowtek's equity beta may be calculated as follows:

Step 1: *Find a sample of listed firms engaged in similar business* According to the CEO of Dowtek, the following firms are engaged in similar business: Apex Chemicals, Modern Chemicals, and Sintex Industries

Step 2: *Obtain equity betas for the sample of firms engaged in similar business* The equity betas of the three companies, obtained by regressing their monthly equity returns on the market portfolio for the past 60 months, are as follows:

Apex Chemicals	: 1. 20
Modern Chemicals	: 1.10
Sintex Industries	: 1.05

Step 3: *Derive asset betas after adjusting equity betas for financial leverage and tax rate.* The debt-equity ratio for the three firms, namely, Apex Chemicals, Modern Chemicals, and Sintex Industries are 1.2, 1.1, and 1.2 respectively. The effective tax rate for all of them is 30 percent. Their asset betas are derived by using the formula:

$$\beta_A = \beta_E / [1 + D/E\ (1 - T)]$$

Apex Chemicals: $\dfrac{1.2}{[1+1.2(0.7)]} = 0.65$

Modern Chemicals: $\dfrac{1.1}{[1+1.1(0.7)]} = 0.62$

Sintex Industries: $\dfrac{1.05}{[1+1.2(0.7)]} = 0.57$

Step 4: *Find the average of the asset betas* The average of asset betas of Apex Chemicals, Modern Chemicals, and Sintex Industries is:

$$(0.65 + 0.62 + 0.57) / 3 = 0.61$$

Step 5: *Figure out the equity beta for Dowtek Chemicals* The equity beta for Dowtek Chemicals is:

$$\beta_E = \beta_A \,[1 + D/E\,(1 - T)]$$
$$= 0.61\,[1 + 0.8\,(1 - 0.3)] = 0.95$$

3.5 COST OF DEBT AND PREFERENCE

Since debt and preference stock entail more or less fixed payments, estimating the cost of debt and preference is relatively easy.

Cost of Debt

Conceptually, the cost of a debt instrument is the yield to maturity of that instrument. Let us apply this concept to different types of debt instruments such as debentures, bank loans, and commercial paper.

The *cost of a debenture* is the value of r_D in the following equation.

$$P_0 = \sum_{t=1}^{n} \frac{I}{(1+r_D)^t} + \frac{F}{(1+r_D)^n} \tag{3.21}$$

where P_0 is the current market price of the debenture, I is the annual interest payment, n is the number of years left to maturity, and F is the maturity value of the debenture.

Computation of r_D, which is the internal rate of return in the above equation, requires a trial-and-error procedure. If you are not inclined to follow the trial and error procedure, you can employ the following formula which gives a very close approximation to the correct value.

$$r_D = \frac{I + (F - P_0)/n}{0.6\,P_0 + 0.4\,F} \tag{3.22}$$

To illustrate this formula, consider the following debenture of Multiplex Limited.

Face value	: 1,000
Coupon rate	: 12 percent
Remaining period to maturity	: 4 years
Current market price	: 1040

The approximate yield to maturity of this debenture is:

$$r_D = \frac{120 + (1000 - 1040)/4}{0.6 \times 1040 + 0.4 \times 1000} = 10.7 \text{ percent}$$

Unlike a debenture, a bank loan is not traded in the secondary market. The *cost of a bank loan* is simply the current interest the bank would charge if the firm were to raise a similar loan now. Suppose that Multiplex Limited has a 300 million outstanding bank loan on which it is paying an interest of 12 percent. However, if Multiplex Limited were to raise a loan now the bank would charge the same. This then represents the cost of the bank loan.

A commercial paper is a short-term debt instrument which is issued at a discount and redeemed at par. Hence the *cost of commercial paper* is simply its implicit interest rate. Suppose, Multiplex Limited has outstanding commercial paper that has a balance maturity of 6 months. The face value of one instrument is 1,000,000 and it is traded in the market at 965,000. The implicit interest rate for 6 months is:

$$\frac{1,000,000}{965,000} - 1 = 0.0363 \text{ or } 3.63 \text{ percent}$$

The annualised interest rate works out to:

$$(1.0363)^2 - 1 = 0.0739 \text{ or } 7.39 \text{ percent}$$

When a firm uses different instruments of debt, the average cost of debt has to be calculated. To illustrate this calculation, let us look at the following data on the debt employed by Multiplex Limited.

Debt Instrument	*Face Value*	*Market Value*	*Coupon Rate*	*YTM or Current Rate*
Non-convertible debentures	100 million	104 million	12%	10.7%
Bank loan	200 million	200 million[@]	12%	12.0%
Commercial paper	50 million	48.25 million	N.A.	7.39%
		352.25 million		

[@] Since the bank loan does not have a secondary market we have, for the sake of simplicity, equated market value with face value.

The average cost of debt is calculated using the market value proportions and yields (current rates) of various debt instruments.

The average cost of debt for Multiplex Limited works out to:

$$10.7\% \, [104/352.25] + 12.0\% \, [200/352.25] + 7.39\% \, [48.25/352.25] = 10.98\%$$

Note that we use the yields to maturity or the current rates as they reflect the rates at which the firm can raise *new* debt. Put differently, we are interested in calculating the marginal cost of debt. Hence, coupon rates that reflect the *historical* or *embedded* interest rates at the time the debt was originally raised are not relevant for our purposes.

What we have calculated so far is the pre-tax cost of debt. Since interest on debt is a tax-deductible expense, the pre-tax cost of debt has to be adjusted for the tax factor to arrive at the post-tax cost of debt.

$$\text{Post-tax cost of debt} = \text{Pre-tax cost of debt } (1 - \text{Tax rate})$$

The tax rate to be used in this calculation is the marginal tax rate applicable to the company. If we assume that the marginal tax rate for Multiplex Limited is 30 percent, the post-tax cost of debt for Multiplex Limited is:

$$\text{Post-tax cost of debt} = 10.98 \text{ percent } (1 - 0.30) = 7.69 \text{ percent}$$

Cost of Preference

Preference capital carries a fixed rate of dividend and is redeemable in nature. Even though the obligations of a company towards its preference shareholders are not as firm as those towards its debenture holders, we will assume that preference dividend will be paid regularly and preference capital will be redeemed as per the original intent.

Thus, preference stock will be considered much like a bond with fixed commitments. However, preference dividend, unlike debt interest, is not a tax-deductible expense and hence does not produce any tax saving[5].

Given the fixed nature of preference dividend and principal repayment commitment and the absence of tax deductibility, the cost of preference is simply equal to its yield. To illustrate, consider the preference stock of Multiplex Limited for which the following data is available:

Face value	: 100
Dividend rate	: 11 percent
Maturity period	: 5 years
Market price	: 95

5. In addition, a company in India presently has to pay a dividend distribution tax. We have ignored this from our calculation.

The yield on this preference stock, if we apply the approximate yield formula, works out to:

$$\frac{11+(100-95)/5}{0.4\times 100+0.6\times 95}=12.37 \text{ percent}$$

If a company has more than one issue of preference stock outstanding, the average yield on all preference issues may be calculated, just the way it was done for debt issues.

Yield to Maturity and Default Risk Corporate bonds (as well as preference stock) are subject to default risk. So, you must distinguish between the bond's stated YTM and the bond's expected YTM. The stated or promised YTM will be realised only if the issuing firm meets all the obligations on the bond issue. Thus, the stated YTM is the maximum possible YTM on the bond. The expected YTM, however, takes into account the possibility of a default.

An example may be given to illustrate the difference between the two measures of YTM. Alpha Corporation issued 1,000 par value, 12 percent coupon bonds 10 years ago. The bonds now have five years left until its maturity. Alpha is experiencing financial difficulties. Bondholders believe that Alpha will meet the remaining interest payments, but at the time of maturity bondholders will receive only 80 percent of par value. The bond is currently selling at 850.

The following inputs would be used to calculate YTM:

Inputs	*Expected YTM*	*Stated YTM*
Coupon payment	120	120
Number of semiannual periods	10 periods	10 periods
Final payment	800	1000
Price	850	850

Using the approximate formula the YTM based on expected payments works out 13.25 percent, whereas the YTM based on promised payments works out to 16.48 percent.

3.6 TARGET WEIGHTS TO DETERMINE THE COST OF CAPITAL

After estimating the cost of equity, cost of debt, and cost of preference you have to blend the three expected returns to get the weighted average cost of capital. To do so, use the weights in the target capital structure as stated in market value (not book value) terms.

What is the rationale for using market values rather than book values for weighting? The WACC is supposed to reflect the opportunity foregone by investors on alternative investments that have the same risk. Instead of reinvesting capital in the business, the management can return the capital to investors (equity shareholders and debt holders), who can invest it elsewhere. For returning capital without altering the capital structure, management can buy back shares and repay debt, but the same has to be done at market values. Note that book values represent a historical cost which is not relevant.

Another way of looking at it is to understand that the cost of capital, as a forward-looking measure, reflects the cost of raising new funds to acquire the firm today. Since new equity and debt have to be raised in the market at the currently prevailing prices, the weights must represent market value.

Many analysts, however, continue to use book value weights. They justify this on the following grounds, none of which are convincing:

1. Book value, as it is less volatile, is more reliable than market value. The intrinsic value of a firm tends to change over time as new information about the firm and the economy becomes available. The market value, with its volatility, is usually a better proxy of intrinsic value than the book value.
2. Since accounting returns are computed using book value, cost of capital should also be computed using book value. Using book values for both accounting return and cost of capital may seem consistent, but it does not make economic sense. Since the funds invested in a firm can be invested elsewhere to earn market returns, the costs should also be computed at market rates using market value weights.
3. Debt ratios are estimated more conservatively when book value, rather than market value, weights are used. Typically, the book value of debt is close to its market value, whereas the book value of equity is less (often much less) than its market value. So, debt ratios based on book value are higher (that is more conservative) than debt ratio based on market value. However, since the cost of debt is much lower than the cost of equity, the cost of capital calculated with book value weights will be lower than that calculated with market value weights, making it less conservative, not more.

What is the logic of using the target capital structure rather than the current capital structure? At any point, the current capital structure may not reflect the capital structure that may prevail over the life of the business. The current capital structure may be distorted by short-term swings in the company's stock price or ready availability of some source of finances. Such aberrations are likely to be corrected or rebalanced by management over time. So it makes sense to use the target capital structure.

The target capital structure may be developed by estimating the company's current market-value based capital structure, reviewing the capital structure of similar companies, and examining the management's implicit approach to financing the business.

Weights Used by Companies to Compute the Weighted Average Cost of Capital

The frequency with which various weights are used in practice, as found in a survey done by Manoj Anand, reported in the October–December 2002 issue of *Vikalpa* is shown below:

	% of Use*
• Book value weights	41.8
• Market value weights	22.8
• Target capital structure weights	39.2

* A few respondents use more than one basis of weighting.

3.7 WEIGHTED AVERAGE COST OF CAPITAL

Given the cost of specific sources of financing and the scheme of weighting, the weighted average cost of capital (WACC) can be readily calculated by multiplying the specific cost of each source of financing by its proportion in the capital structure and adding the weighted values. In symbols, the weighted average cost of capital may be expressed as follows:

$$\text{WACC} = w_E\, r_E + w_p\, r_P + w_D\, r_D\,(1 - T_c) \tag{3.23}$$

where WACC is the weighted average cost of capital, w_E is the proportion of equity, r_E is the cost of equity, w_P is the proportion of preference, r_P is the cost of preference, w_D is the proportion of debt, r_D is the cost of debt, and T_c is the corporate tax rate.

Let us look at an example The cost of specific sources of capital for Bharat Nigam Limited are: r_E = 16.0 percent, r_P = 14.0 percent, r_D = 12.0 percent.

The market value proportions of equity, preference, and debt are : $w_E = 0.60$, $w_p = 0.05$, $w_D = 0.35$.

The tax rate for Bharat Nigam Limited is 30 percent.

The WACC for Bharat Nigam Limited is calculated in Exhibit 3.3

Exhibit 3.3 ***Calculation of the WACC for Bharat Nigam Limited***

Source of Capital	*Proportion*	*Cost*	*Weighted Cost*
	(1)	*(2)*	*[(1) x (2)]*
Equity	0.60	16.0%	9.60%
Preference	0.05	14.0%	0.70%
Debt	0.35	8.4%	2.94%
			WACC = 13.24 %

Best Global Practices in Estimating the Cost of Capital

- WACC is the dominant discount rate used in DCF analyses.
- Weights are based on market, not book, value mixes of debt and equity
- The after-tax cost of debt is predominantly based on marginal pre-tax cost and marginal or statutory tax rates.
- The CAPM is the dominant model for estimating the cost of equity

3.8 MISCONCEPTIONS SURROUNDING COST OF CAPITAL

The cost of capital is a central concept in financial management linking the investment and financing decisions. Hence, it should be calculated correctly and used properly in investment evaluation. Despite this injunction, we find that several errors characterise the application of this concept. The more common misconceptions, along with suggestions to overcome them, are discussed below.

1. **The concept of cost of capital is too academic or impractical** Some companies do not calculate the cost of capital because they regard it as 'academic' or 'impractical' or 'irrelevant' or 'imprecise.' These misgiving about cost of capital appear to be unjustified. Such reservation can be dispelled by emphasising the following points:
   - The cost of capital is an essential ingredient of discounted cash flow analysis. Since discounted cash flow analysis is now widely used, cost of capital can scarcely be considered 'academic' or 'impractical'.
   - Out of the various inputs required for discounted cash flow analysis, viz., project life, project cash flows (consisting of initial investment, operating cash flows, and terminal cash flow), and cost of capital, the last one, viz., the cost of capital can be calculated most reliably and accurately. So a concern about its imprecision seems to be misplaced.
2. **Current liabilities (accounts payable and provisions) are considered as capital components** Sometimes it is argued that accounts payable and accruals are sources of funding to be considered in the calculation of the WACC. This view is not correct because what is not provided by investors is not capital.

   Current liabilities arise on account of an operating relationship of the firm with its suppliers and employees. They are deducted when the investment requirement of the project is determined. Hence, they should not be considered in calculating the WACC. Of course, current liabilities are not ignored in capital budgeting because they appear in the cash flows of the project. Put differently, current liabilities affect a project's cash flows, but not its WACC.
3. **The coupon rate on the firm's existing debt is used as the pre-tax cost of debt** The coupon rate on the firm's existing debt reflects a historical cost. What really matters in investment decision making is the interest rate the firm would pay if it issues debt today. Hence use the current cost of debt, not the historical cost of debt.

4. **When estimating the market risk premium in the CAPM method, the historical average rate of return is used along with the current risk-free rate.** Consider the following information:
    - Historical average return on common stocks = 19 percent
    - Historical return on long-term Treasury bonds = 10 percent
    - Current expected return on common stocks = 14 percent
    - Current return on long-term Treasury bonds = 7 percent

    Sometimes, the market risk premium is calculated as the difference between the historical average return on common stocks and the current return on long-term Treasury bonds. This is not correct.

    To calculate the market risk premium, you can use the historical risk premium (19 percent – 10 percent) or the current risk premium (14 percent – 7 percent) , but not the difference between the historical average return on common stocks and the current return on long-term Treasury bonds(19 percent – 7 percent).
5. **The cost of equity is equal to the dividend rate or return on equity** It appears that the cost of equity is sometimes measured incorrectly. For example, it may be measured as the current dividend rate (dividend per share as a percentage of face value per share) or as return on equity. Only by accident do these measures represent the cost of equity correctly.

    It should be clearly understood that the cost of equity is the rate of return required by equity investors given the risk they are exposed to. It has nothing to do with the current dividend rate or return on equity, which are mere historical numbers.
6. **Retained earnings are either cost free or cost significantly less than external equity** Often firms impute a negligible or low cost to retained earnings under the influence of wrong notions like "retained earnings have no cost because shareholders are satisfied with dividends" or "retained earnings are already with the firm and hence some nominal returns on them may suffice."

    The error in such reasoning stems from ignoring the opportunity cost associated with retained earnings. When a firm retains a portion of its earnings, equity shareholders are denied dividends to that extent. If the same were distributed as dividends, equity shareholders can invest elsewhere to earn a rate of return comparable to the cost of equity. Hence the opportunity cost of retained earnings is more or less equal to the cost of equity funds.
7. **Depreciation has no cost** Similar to the misconception that retained earnings are more or less cost-free is the notion that depreciation-generated funds are also virtually cost free. Recall the observation of a participant in the survey: "Depreciation is capital already in the company. Since it does not have to be raised, even in an indirect sense of retained earnings, it clearly has no cost."

    To guard against such an error, invoke the opportunity cost principle once again.

    Theoretically, the firm can return the depreciation-generated funds to its shareholders and lenders (the parties which provided the finance for asset acquisition) and they, in turn, can invest these funds elsewhere. Hence, the opportunity cost of depreciation-generated funds is the average return the shareholders and lenders would earn on these funds by investing them elsewhere. And this would be more or less equal to the average cost of capital of the firm.

8. **Book value weights may be used to calculate the WACC** Often firms use book value weights in the existing capital structure to calculate the WACC. This is not correct.

   Weights should be based on market values, not book values. Ideally, the target capital structure (in market value terms) should determine the weights for the WACC. If the target capital structure is not specified, use the current market value weights.

SUMMARY

- The cost of capital is the weighted average of the cost of all sources of capital. It is calculated in post-tax terms, defined in nominal terms, based on market value weights, and reflects the risks borne by various providers of capita.
- The weighted average cost of capital (WACC) in its simplest form is the market- based weighted average of the cost of equity and post-tax cost of debt:

$$\text{WACC} = r_E(E/V) + r_D\ (1 - T)\ (D/V)$$

- Several approaches are used to estimate the cost of equity: the capital asset pricing model (CAPM) approach, the dividend discount model approach, the bond yield plus risk premium approach, and the earnings-price approach.
- According to the CAPM, the expected rate of return on any security is equal to the risk-free rate plus the risk premium—the risk premium is equal to the security's beta times the market risk premium.
- According to the dividend discount model approach, the cost of equity is equal to the dividend yield plus the expected growth rate.
- According to the bond yield plus risk premium approach, the cost of equity is equal to the yield on long-term bonds plus a risk premium.
- According to the earning-price ratio approach, the cost of equity is equal to the expected earnings per share for the next year dividend by the current market price per share.
- The cost of debt is the return expected by the providers of debt capital, adjusted for the tax rate because interest on debt is a tax-deductible expense.
- To find the weighted average cost of capital, use the weights in the target capital structure stated in market value terms.
- Despite the importance of the cost of capital in financial management, we find that several misconception characterise its application in practice.

Questions

1. What features should the cost of capital have?
2. Discuss the concept of cost of capital.
3. What is the cost of equity according to the CAPM?
4. How will you estimate the risk-free return?
5. Discuss the guidelines to be followed in measuring the historical risk premium.
6. Explain Marshal Blume's formula.
7. How would you estimate the forward looking risk premium?
8. What drives the market risk premium?
9. How is beta measured?
10. Discuss the key measurement issues in estimating beta.
11. How is historical beta adjusted?
12. Discuss the Fama-French model.
13. Discuss the arbitrage pricing theory.
14. What are the pros and cons of using the bond yield plus risk premium approach to calculate the cost of equity?
15. How is cost of equity calculated using the dividend growth model approach?
16. What are the pros and cons of using the dividend growth model approach to calculate the cost of equity?
17. What is the link between equity beta and asset beta?
18. How would you calculate the equity beta of an unlisted company?
19. How is the cost of debt calculated?
20. How is the cost of preference calculated?
21. Discuss the following bases for determining the proportions (or weights) in the WACC calculation: book values, target capital structure, and market values.
22. What are the common misconceptions surrounding cost of capital in practice? How would you dispel then?
23. What are the best global practices in measuring the cost of capital?

Problems

1. The returns on the equity stock of Auto Electricals Limited and the market portfolio over a 12-year period are given below:

Year	*Return on Auto Electricals Ltd. (%)*	*Return on Market Portfolio (%)*
1	15	12
2	-6	1
3	18	14
4	30	24
5	12	16
6	25	30
7	2	-3
8	20	24
9	18	15
10	24	22
11	8	12

(a) Calculate the beta for the stock of Auto Electricals Limited.

(b) Establish the characteristic line for the stock of Auto Electricals Limited.

2. Magnum Cements is an unlisted cement company whose debt-equity ratio is 1.8 and tax rate is 30 percent. There are three listed firms, A, B, and C engaged wholly in cement manufacturing. Their equity betas, debt-equity ratios, and tax rates are as follows:

	Equity beta	*Debt-equity ratio*	*Tax rate*
A	1.25	1.9	25
B	1.15	1.7	30
C	1.10	1.6	35

What is the equity beta for Magnum Cements?

3. Max Steels is an unlisted steel company whose debt-equity ratio is 1.6 and tax rate is 25 percent. There are three listed firms, P,Q, and R, engaged in similar steel business. Their equity betas, debt-equity ratios, and tax rates are as follows:

	Equity beta	*Debt-equity ratio*	*Tax rate*
P	1.1	1.9	0.30
Q	1.2	2.1	0.25
R	1.05	1.8	0.35

What is the equity beta for Max Steels?

4. Abascus Limited issued 15-year, 14 percent bonds five years ago The bond which has a face value of 100 is currently selling for 108.
   a. What is the pre-tax cost of debt?
   b. What is the after-tax cost of debt? (Assume a 35 percent tax rate)
5. Omega Enterprises issued 10 year, 9 percent preference shares four years ago. The preference share which has a face value of 100 is currently selling for 92. What is the cost of preference shares?
6. Rao Corporation has a target capital structure of 60 percent equity and 40 percent debt. Its cost of equity is 18 percent and its pre-tax cost of debt is 13 percent. If the relevant tax rate is 35 percent, what is Rao Corporation's WACC?
7. Unix Limited's equity beta is 1.2. The market risk premium is 7 percent and the risk-free rate is 10 percent. Unix has a debt equity ratio of 2:3. Its pre-tax cost of debt is 14 percent. If the tax rate is 35 percent, what is the WACC?
8. Azeez Corporation's WACC is 12 percent and its tax rate is 35 percent. Azeez's pre-tax cost of debt is 10 percent and its debt-equity ratio is 1:1. The risk-free rate is 11 percent and the market risk premium is 8 percent. What is the beta of Azeez's equity?
9. Satish Kumar, CEO of Vanguard Enterprises is trying to figure out the cost of debt and equity.
   a. Vanguard's balance sheet has total debt of 200 million and Vanguard's total interest burden for the forthcoming year will be 24 million. Satish argues, "We owe 200 million and we will pay 24 million interest. So the cost of our debt is 12 percent (24/200)." What is the flaw in this argument?
   b. Vanguard's equity currently sells for 100 per share and the dividend per share will probably be 6. Satish reasons "Since we plan to pay a dividend of 6 per share which has a market price of 100 our cost of equity is 6 percent". What is the error in this reasoning?
10. Samanta Company has 20 million equity shares outstanding. The book value per share is 40 and the market price per share is 120. Samanta has two debenture issues outstanding. The first issue has a face value of 300 million, 12 percent coupon, and sells for 90 percent of its face value. It will mature in 5 years. The second issue has a face value of 200 million, 14 percent coupon, and sells for 102 percent of its face value. It will mature in 6 years. Samanta also has a bank loan of 200 million on which the interest rate is 15 percent.
    a. What are Samanta's capital structure weights on a book value basis and on a market value basis ?
    b. Which weights would you use? Why?

MINICASE

The latest balance sheet of Omega is given below:

Liabilities		*Assets*	
Equity capital	250	Fixed assets	700
Preference capital	100	Investments	100
Reserves and surplus	200	Current assets, loans and advances	400
Debentures	450		
Current liabilities & provisions	200		
	1200		1200

- Omega's target capital structure has 50 percent equity, 10 percent preference, and 40 percent debt
- Omega has ₹ 100 par, 10 percent coupon, annual payment, noncallable debentures with 8 years to maturity. These debentures are selling currently at ₹ 112.
- Omega has ₹ 100 par, 9 percent, annual dividend, preference shares with a residual maturity of 5 years. The market price of these preference shares is ₹ 106.
- Omega's equity stock is currently selling at ₹ 80 per share. Its last dividend was ₹ 2.80 and the dividend per share is expected to grow at a rate of 10 percent in future.
- Omega's equity beta is 1.1, the risk-free rate is 7 percent, and the market risk premium is estimated to be 7 percent.
- Omega's tax rate is 30 percent.

Required

(a) What sources of capital would you consider relevant for calculating the weighted average cost of capital?

(b) What is Omega's post-tax cost of debt?

(c) What is Omega's cost of preference?

(d) What is Omega's estimated cost of equity using the dividend discount model?

(e) What is Omega's estimated cost of equity using the capital asset pricing model?

(f) What is Omega's weighted average cost of capital? Use the capital asset pricing model to estimate the cost of equity.

CHAPTER 4

Other DCF Models

Several models are used to value a company or its equity using the DCF approach:

- **Enterprise DCF Model** The enterprise DCF model discounts the free cash flow to the firm (FCFF) at the weighted average cost of capital.
- **Equity DCF Model** There are two variants of the equity DCF model: the dividend discount model and the free cash flow to equity model. The dividend discount model discounts the expected dividend stream at the cost of equity. The free cash flow to equity model discounts the free cash flow to equity at the cost of equity.
- **Adjusted Present Value (APV) Model** The APV model discounts the unlevered equity cash flow (which is the same as the free cash flow to the firm) at the unlevered cost of equity (the cost of equity assuming the firm has no leverage) and adds to it the discounted value of the interest tax shield on debt.
- **Economic Profit Model** The economic profit model discounts the economic profit stream at the weighted average cost of capital and adds to it the current invested capital.

The previous chapter discussed at length the enterprise DCF model, the most popular DCF model in practice. This chapter discusses the remaining three DCF models. It also discusses accounting for value and the maintainable profits method.

4.1 EQUITY DCF MODEL: DIVIDEND DISCOUNT MODEL

The enterprise DCF model is the standard DCF model used commonly in valuation practice. Its principal advantage is that it incorporates the costs and benefits of borrowing in an easily understandable manner. The impact of changes in financial leverage on firm value can be readily examined.

There are, however, some problems with the enterprise DCF model.

- Intuitively, it is easier to understand the free cash flows to equity than the free cash flows to the firm. When we are asked to define cash flows, we tend to think like owners and look at cash flows after debt related payments (interest as well as principal). In other words, equity cash flows make more sense to us. The focus of enterprise cash flows on pre-debt cash flows can sometimes hide the problem of potential financial distress. For example, a firm may have a free cash flow to the firm of 50 million but may have a debt servicing burden of 150 million. To survive, it will have to raise 100 million of new financing. This problem is highlighted by the free cash flow to equity, not the by the free cash flow to the firm.

- The calculation of weighted average cost of capital calls for making implicit assumptions that may not be reasonable. For instance, an assumption that the market value debt ratio is 40 percent means that a growing firm will have to issue large amounts of debt in future years to maintain that ratio. This implies that the book value debt ratio may become unreasonably high.

In view of the above problems, valuation practitioners sometimes value equity directly employing either the dividend discount model or the free cash flow to equity model. This section discusses the dividend discount model and the following section discusses the free cash flow to equity model.

Since equity shares have no maturity period, they may be expected to bring a dividend stream of infinite duration. Hence the value of an equity share may be put as:

$$P_0 = \frac{D_1}{(1+r)} + \frac{D_2}{(1+r)^2} + \cdots + \frac{D_\infty}{(1+r)^\infty} = \sum_{t=1}^{\infty} \frac{D_t}{(1+r)^t} \tag{4.1}$$

where P_0 is the price of the equity share today, D_1 is the dividend expected a year hence, D_2 is the dividend expected two years hence, … D_∞ is the dividend expected at the end of infinity, and r is the required return.

Equation (4.1) represents the valuation model for an infinite horizon. Is it applicable to a finite horizon? Yes. To demonstrate this consider how an equity share would be valued by an investor who plans to hold it for n years and sell it thereafter for a price of P_n. The value of the equity share to him is:

$$P_0 = \frac{D_1}{(1+r)^1} + \frac{D_2}{(1+r)^2} + \cdots + \frac{D_n}{(1+r)^n} + \frac{P_n}{(1+r)^n}$$

$$= \sum_{t=1}^{n} \frac{D_t}{(1+r)^t} + \frac{P_n}{(1+r)^n} \tag{4.2}$$

Now, what is the value of P_n in Eq. (4.2)? Applying the dividend capitalisation principle, the value of P_n would be the present value of the dividend stream beyond the nth year, evaluated as at the end of the nth year. This means:

$$P_n = \frac{D_{n+1}}{(1+r)} + \frac{D_{n+2}}{(1+r)^2} + \cdots + \frac{D_n}{(1+r)^n} \tag{4.3}$$

Substituting this value of P_n in Eq. (4.3) we get:

$$P_0 = \frac{D_1}{(1+r)^1} + \frac{D_2}{(1+r)^2} + \cdots + \frac{D_n}{(1+r)^n}$$

$$+ \frac{1}{(1+r)^n}\left(\frac{D_{n+1}}{(1+r)} + \frac{D_{n+2}}{(1+r)^2} + \cdots + \frac{D_\infty}{(1+r)^{\infty-n}}\right)$$

$$= \frac{D_1}{(1+r)} + \frac{D_2}{(1+r)^2} + \cdots + \frac{D_n}{(1+r)^n} + \frac{D_{n+1}}{(1+r)^{n+1}} + \cdots \frac{D_\infty}{(1+r)^\infty}$$

$$= \sum_{t=1}^{\infty} \frac{D_t}{(1+r)^t} \tag{4.4}$$

This is the same as Eq.(4.1) which may be regarded as a generalised multi-period valuation formula. Eq.(4.4) is general enough to permit any dividend pattern, constant, rising, declining, or randomly fluctuating. For practical applications it is helpful to make simplifying assumptions about the pattern of dividend growth. The more commonly used assumptions are as follows:

- The dividend per share remains constant forever, implying that the growth rate is nil (the zero growth model).
- The dividend per share grows at a constant rate per year forever (the constant growth model).
- The dividend per share grows at a constant rate for a finite period, followed by a constant normal rate of growth forever thereafter (the two-stage model).
- The dividend per share, currently growing at an above-normal rate, experiences a linearly declining rate of growth for a while. Thereafter, it grows at a constant normal rate (the *H* model).

Zero Growth Model

If we assume that the dividend per share remains constant year after year at a value of D, Eq.(4.4) becomes :

$$P_0 = \frac{D}{(1+r)} + \frac{D}{(1+r)^2} + \cdots + \frac{D}{(1+r)^n} + \cdots\infty \tag{4.5}$$

Equation (4.5), on simplification, becomes:

$$P_0 = \frac{D}{r} \tag{4.6}$$

Constant Growth Model

One of the most popular dividend discount models assumes that the dividend per share grows at a constant rate (g). The value of a share, under this assumption, is:

$$P_0 = \frac{D_1}{(1+r)} + \frac{D_1(1+g)}{(1+r)^2} + \cdots \frac{D_1(1+g)^n}{(1+r)^{n+1}} + \cdots \tag{4.7}$$

Applying the formula for the sum of a geometric progression, the above expression simplifies to:

$$P_0 = \frac{D_1}{r-g} \tag{4.8}$$

What Drives Growth Most stock valuation models are based on the assumption that dividends grow over time. What drives this growth? The two major drivers of growth are: (a) ploughback ratio and (b) return on equity (ROE). To see why this is so let us consider an example. Omega Limited has an equity (net worth) base of 100 at the beginning of year 1. It earns a return on equity of 20 percent. It pays out 40 percent of its equity earnings and ploughs back 60 percent of its equity earnings. The financials of Omega Limited for a 3 year period are shown in Exhibit 4.1. From this exhibit we find that dividends grow at a rate of 12 percent per annum - from 8 to 8.96 and then from 8.96 to 10.04. The growth figure is the product of:

Ploughback ratio × Return on equity = 0.6 × 20% = 12%

Exhibit 4.1 ***Financials of Omega Limited***

	Year 1	*Year 2*	*Year 3*
• Beginning equity	100	112	125.44
• Return on equity	20%	20%	20%
• Equity earnings	20	22.4	25.1
• Dividend payout ratio	0.4	0.4	0.4
• Dividends	8	8.96	10.04
• Ploughback ratio	0.6	0.6	0.6
• Retained earnings	12	13.44	15.06

Two Stage Growth Model

The simplest extension of the constant growth model assumes that the extraordinary growth (good or bad) will continue for a finite number of years and thereafter normal growth rate will prevail indefinitely. Assuming that the dividends move in line with the growth rate, the price of the equity share will be:

$$P_0 = \left(\frac{D_1}{(1+r)} + \frac{D_1(1+g_1)}{(1+r)} + \frac{D_1(1+g_1)^2}{(1+r)^3} \cdots + \frac{D_1(1+g_1)^{n-1}}{(1+r)^n} \right) + \frac{P_n}{(1+r)^n} \tag{4.9}$$

where P_0 is the current price of the equity share, D_1 is the dividend expected a year hence, g_1 is the extraordinary growth rate applicable for n years, and P_n is the price of the equity share at the end of year n.

The first term on the right hand side of Eq. (4.10) is the present value of a growing annuity. Its value is equal to:

$$D_1 \left(\frac{1 - \left(\frac{1+g_1}{1+r} \right)^n}{r - g_1} \right) \tag{4.10}$$

Hence

$$P_0 = D_1 \left(\frac{1 - \left(\frac{1+g_1}{1+r} \right)^n}{r - g_1} \right) + \frac{P_n}{(1+r)^n} \tag{4.11}$$

Since the two-stage growth model assumes that the growth rate after n years remains constant, P_n will be equal to:

$$\frac{D_{n+1}}{r - g_2} \tag{4.12}$$

where D_{n+1} is the dividend for year n+1 and g_2 is the growth rate in the second period.

D_{n+1}, the dividend for year n+1, may be expressed in terms of the dividend in the first stage.

$$D_{n+1} = D_1 (1 + g_1)^{n-1} (1 + g_2) \tag{4.13}$$

Substituting the above expression, we have:

$$P_0 = D_1 \left(\frac{1 - \left(\frac{1+g_1}{1+r} \right)^n}{r - g_1} \right) + \left(\frac{D_1 (1+g_1)^{n-1} (1+g_2)}{r - g_2} \right) \left(\frac{1}{(1+r)^n} \right) \tag{4.14}$$

Example The current dividend on an equity share of Vertigo Limited is 2.00. Vertigo is expected to enjoy an above-normal growth rate of 20 percent for a period of 6 years. Thereafter, the growth rate will fall and stabilise at 10 percent. Equity investors require a return of 15 percent. What is the intrinsic value of the equity share of Vertigo?

The inputs required for applying the two-stage model are:

$$g_1 = 20 \text{ percent}$$
$$g_2 = 10 \text{ percent}$$
$$n = 6 \text{ years}$$
$$r = 15 \text{ percent}$$
$$D_1 = D_0\,(1 + g_1) = \text{Rs}2(1.20) = 2.40$$

Plugging these inputs in the two-stage model, we get the intrinsic value estimate as follows:

$$P_0 = 2.40\left(\frac{1-\left(\dfrac{1.20}{1.15}\right)^6}{0.15-0.20}\right) + \left(\frac{2.40(1.20)^5(1.10)}{0.15-0.10}\right)\left(\frac{1}{(1.15)^6}\right)$$

$$= 2.40\left(\frac{1-1.291}{-0.05}\right) + \left(\frac{2.40(2.488)(1.10)}{0.05}\right)(0.432)$$

$$= 13.968 + 56.750$$

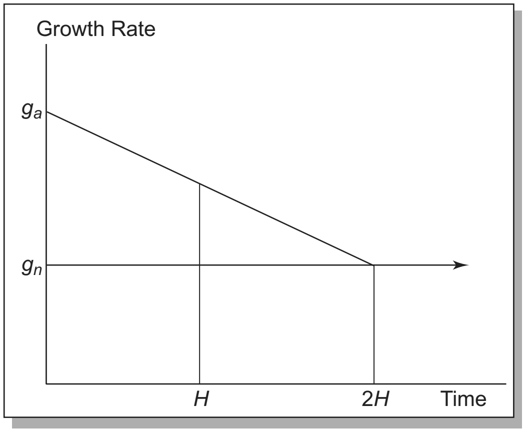
$$= 70.72$$

H Model

The *H* model is also a two-stage model for growth. Unlike the classic two-stage model, the *H* model assumes that the growth rate in the initial stage does not remain constant but declines linearly over time till it reaches a stable rate in the steady stage.

Developed by Fuller and Hsia, the *H* model assumes that the earnings growth rate begins at a high initial rate (g_a), and declines at a linear rate over a period of $2H$ years to a stable growth rate (g_n) which is maintained forever. It assumes that the dividend payout rate and cost of equity remain constant over time and are not influenced by the changing growth rates. Exhibit 4.2 shows the pattern of expected growth rate in the *H* model.

Exhibit 4.2 ***Dividend Growth Rate Pattern for H model***



While the derivation of the *H* model is rather complex, the valuation equation for the *H* model is quite simple:

$$P_0 = \frac{D_0[(1+g_n)+H(g_a-g_n)]}{r-g_n} \tag{4.15}$$

where P_0 is the intrinsic value of the share, D_0 is the current dividend per share, r is the rate of return required by investors, g_n is the normal long-run growth rate, g_a is the current growth rate, and H is one-half of the period during which g_a will level off to g_n.

Equation (4.15) may be re-written as

$$P_0 = \frac{D_0(1+g_n)}{r-g_n} + \frac{D_0H(g_a-g_n)}{r-g_n} \tag{4.16}$$

Expressed this way, the *H* model may be interpreted in a simple, intuitive manner. The first term on the right hand side of Eq. (4.16)

$$\frac{D_0(1+g_n)}{r-g_n}$$

represents the value based on the normal growth rate, whereas the second term reflects the premium due to abnormal growth rate:

$$\frac{D_0\,H(1-g_n)}{r-g_n}$$

Example The current dividend on an equity share of International Computers Limited is 3.00. The present growth rate is 50 percent. However, this will decline linearly over a period of 10 years and then stabilise at 12 percent. What is the intrinsic value per share of International Computers Limited, if investors require a return of 16 percent?

The inputs required for applying the *H*-model are:

$$\begin{aligned} D_0 &= 3.00 \\ g_a &= 50 \text{ percent} \\ H &= 5 \text{ years} \\ g_n &= 12 \text{ percent} \\ r &= 16 \text{ percent} \end{aligned}$$

Plugging these inputs in the *H*-model we get the intrinsic value estimate as follows:

$$P_0 = \frac{3.00[(1.12) + 5(0.50 - 0.12)]}{0.16 - 0.12} = 226.5$$

Compared to the two-stage model in which the growth rate abruptly declines after a certain period, the *H* model is more realistic as it allows for a gradual decrease in growth rate. However, the assumption that the dividend payout rate is constant in all phases of growth seems unrealistic. This makes the model inappropriate for any firm that has nil or low current dividends. By requiring a combination of high growth and high payout, the model's applicability is quite limited.

Three Stage Growth Model

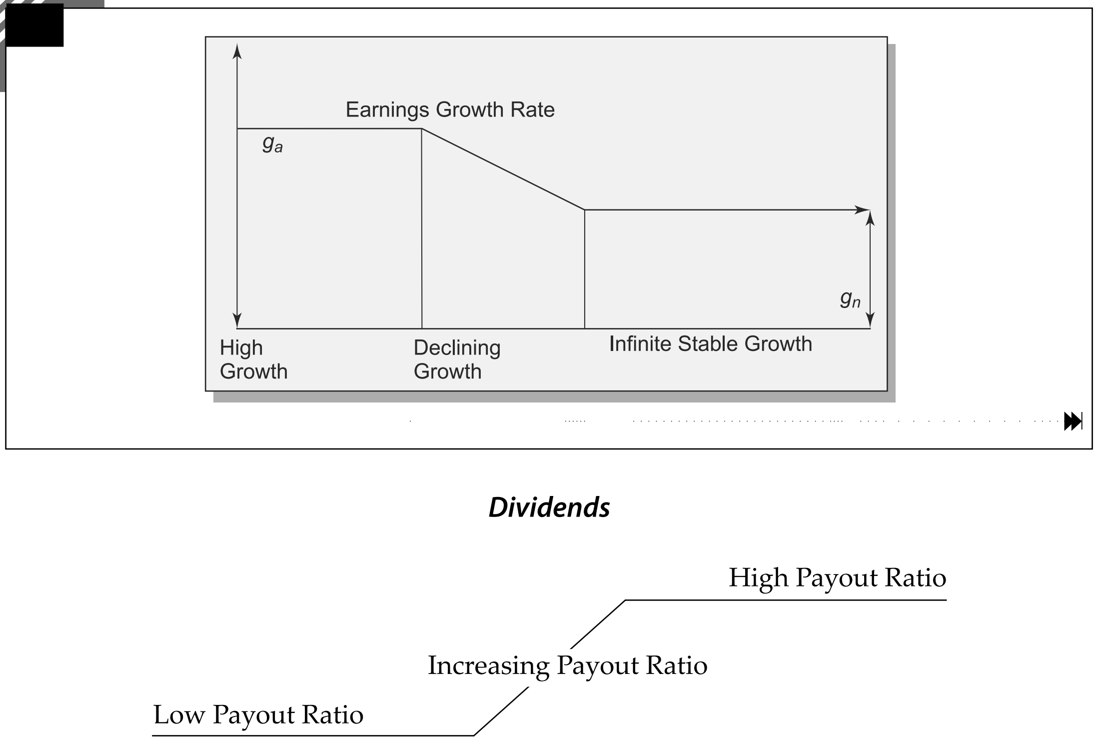
The three-stage growth model is an amalgam of the two-stage model and the H model. It assumes an initial period of stable high growth, a second period of linearly declining growth period, and a third period of stable low growth, that extends forever. Exhibit 4.3 graphs the expected growth over the three time periods. It is a very general model, as it does not impose any restriction on the payout ratio.

The value of the stock, as per this model, is:

$$P_0 = \sum_{t=1}^{t=n_1} \frac{EPS_o\,(1+g_a)^t \pi_a}{(1+r_h)^t} + \sum_{t=n_1+1}^{t=n_2} \frac{DPS_t}{(1+r_{tr})^t} + \frac{EPS_{n2}(1+g_n)\pi_n}{(r_s - g_n)(1+r_s)^{n2}} \tag{4.17}$$

where EPS_t is earnings per share in year t, DPS_t is dividend per share in year t, g_a is the growth rate in the high growth phase which lasts n_1 years, g_n is the growth rate in the stable growth phase, π_a is the payout ratio in the high growth phase, π_n is the payout ratio in the stable growth phase, r_h is the cost of equity in the high growth phase, r_{tr} is the cost of equity in the transition phase, and r_s is the cost of equity in the stable phase.

Exhibit 4.3 ***Expected Growth in the Three-Stage Dividend Discount Model***



Example The current earnings per share (EPS_0) of Gamma Limited is 5.00. For the next five years, the earnings per share is expected to grow at 20 percent and the dividend payout ratio in the high growth period will be 20 percent. The growth rate in earnings per share will decline linearly for the following five years to 10 percent per year. During this period, the dividend payout ratio will increase linearly from 20 percent to 60 percent. After the tenth year, the growth rate in earnings per share will remain stable at 10 percent for ever. During the stable growth rate period, the payout ratio will be 60 percent. During the high growth period, the cost of equity will be 18 percent; during the transition period, the cost of equity will fall by 0.8 percent per year; finally, during the stable growth period, the cost of equity will be 14 percent.

What is the intrinsic value per share as per the three-stage dividend discount model?

The projected earnings per share, dividend per share, and present value of dividends during the high growth phase and the transition phase are shown in the table below.

Year	EPS	Expected Growth Rate	Payout Ratio	DPS	Cost of Equity	Cumulated Cost of Equity	Present Value of DPS
Current	5.00						
1	6.00	20.0%	20.0%	1.20	18.0%	1.18	1.02
2	7.20	20.0	20.0	1.44	18.0	1.39	1.04
3	8.64	20.0	20.0	1.73	18.0	1.64	1.05
4	10.37	20.0	20.0	2.07	18.0	1.94	1.07
5	12.44	20.0	20.0	2.49	18.0	2.29	1.09
Present value of dividends in high growth phase							5.27
6	14.68	18.0%	28.0	4.11	17.2	2.68	1.53
7	17.03	16.0	36.0	6.13	16.4	3.12	1.96
8	19.41	14.0	44.0	8.54	15.6	3.61	2.37
9	21.74	12.0	52.0	11.30	14.8	4.14	2.73
10	23.92	10.0	60.0	14.35	14.0	4.72	2.98
Present value of dividends in the transition phase							11.57

Note that during the transition phase, the growth rate, the payout ratio, and the cost of equity change in equal annual installments from the values of the high growth period to the values of the stable growth period.

The terminal value of the stock at the end of year 10 can be calculated based on the earnings per share in year 11, the growth rate of 10 percent, the payout ratio of 60 percent, and a cost of equity of 14 percent.

$$\text{Terminal value} = \frac{23.92(1.10)(0.6)}{0.14 - 0.10} = 394.68$$

To obtain the present value, we divide the above value by the cumulated cost of equity in year 10 (from the table).

$$\text{Present value of terminal value} = \frac{394.68}{4.72} = 83.62$$

The value of the stock is:

Present value of dividends in the high growth phase	5.27
+ Present value of dividends in the transition phase	11.57
+ Present value of terminal value at the end of the transition phase	83.62
= Value of the stock	100.46

Applicability of the Dividend Discount Model

Some, particularly the proponents of the Benjamin Graham school of investing, swear by the dividend discount model. Others, however, consider it too narrow. The dividend discount model offers certain advantages:

1. It is simple and intuitively appealing. After all, dividends are the only cash flows that the shareholders receive from the firm.
2. Fewer assumptions are required to forecast dividends than to forecast free cash flows. Dividend forecast can be obtained by applying growth rate estimate to dividend paid last year. Free cash flow forecast requires assumptions about net operating profit after tax, capital expenditure, depreciation, and working capital.
3. Firms generally pursue a smoothed dividend policy. Hence, while a company's earnings and reinvestments tend to be volatile, dividends are more predictable. So a valuation based on dividends tends to be more stable than a valuation based on cash flows.

The dividend discount model, however, suffers from a serious limitation because it equates dividends to cash flows. In the real world, many firms hold back substantial cash flows which they can otherwise pay out as dividends. As a result, they have a large build up of cash balances. While shareholders cannot directly claim these cash balances, they have an ownership stake in these cash balances. So equity values should reflect these claims. Such firms tend to be undervalued by the dividend discount model.

At the other end of the spectrum, there are some firms that pay dividends in excess of their cash flows. Obviously, they have to bridge the gap with new debt or equity issues. Such firms tend to be overvalued by the dividend discount model.

4.2 EQUITY DCF MODEL: FREE CASH FLOW TO EQUITY (FCFE) MODEL

The FCFE is the cash flow left for equity shareholders after the firm has covered its capital expenditure and working capital needs and met all its obligations toward lenders and preference shareholders. It may be defined as follows:

$$\begin{aligned}\text{FCFE} = {} & (\text{Profit after tax} - \text{Preference dividend}) \\ & - (\text{Capital expenditure} - \text{Depreciation}) \\ & - (\text{Change in net working capital})\end{aligned}$$

+ (New debt issue – Debt repayment)
+ (New preference issue – Preference repayment)
– (Change in investment in marketable securities)

The equity value is the present value of the FCFE stream, where the discounting rate is the cost of equity (r_E)

$$\text{Equity value} = \sum_{t=1}^{\infty} \frac{\text{FCFE}_t}{(1+r_E)^t} \tag{4.18}$$

The free cash flow to equity (FCFE) model may be viewed as an extension of the dividend discount model in which we discount potential dividends instead of actual dividends.

The FCFE model implicitly assumes that the FCFE will be paid out to shareholders. This means that there will be no surplus cash build up in the firm. So, the expected growth in FCFE will reflect only growth in income from operating assets.

The FCFE model regards the shareholders in a publicly traded firm like the owners of a private business who can claim all cash flows available in the firm after meeting taxes, debt-related payments, and reinvestment needs. Essentially, the FCFE model, when applied to a listed company, assumes that there is an excellent corporate governance system in place. Even if managers do not pay the entire FCFE as dividends, they ensure that the cash that is held back is not deployed uneconomically.

Illustration

To illustrate the FCFE valuation, let us look at the data for Matrix Limited for year 3, the year that has just ended, and for the next five years, years 4 through 8. This data has been extracted from Exhibits 2.1, 2.8, and 2.10.

in million

	3	*4*	*5*	*6*	*7*	*8*
• Profit after tax	24	29	28	32	38	40
• Preference dividend	-	-	-	-	-	-
• Fixed assets (net)	190	220	240	266	294	324
• Investments	25	10	-	-	-	-
• Net current assets	70	75	88	90	100	109
• Debt	134	140	150	161	177	192
• Preference	-	-	-	-	-	-

The FCFE forecast for the explicit forecast period, years 4 through 8, is worked out below:

	4	*5*	*6*	*7*	*8*
(Profit after tax – Preference dividend)	29	28	32	38	40
– (Capital expenditure – Depreciation)	–30	–20	–26	–28	–30
– (Change in net current assets)	–5	–13	–2	–10	–9
+ (New debt issue – Debt repayment)	+6	+10	+11	+16	+15
– (Change in investment in marketable securities)	+15	+10	-	-	-
FCFE	15	15	15	16	16

To understand the above numbers remember the following accounting identities:

Change in net fixed assets = Capital expenditure – Depreciation

Change in debt = New debt issue – Debt repayment

If we assume that the FCFE grows at a constant rate of 10 percent per year after the explicit forecast period, the equity value using the FCFE valuation method can be calculated as follows:

$$\text{Equity Value}_3 = \frac{\text{FCFE}_4}{(1+r_E)^1} + \frac{\text{FCFE}_5}{(1+r_E)^2} + \frac{\text{FCFE}_6}{(1+r_E)^3} + \frac{\text{FCFE}_7}{(1+r_E)^4} + \frac{\text{FCFE}_8}{(1+r_E)^5} + \frac{\text{FCFE}_9}{(r_E - 0.10)} \times \frac{1}{(1+r_E)^5}$$

Plugging the FCFE estimates and the cost of equity (r_E) value of 18.27 percent, we get:

$$\text{Equity value}_3 = \frac{15}{(1.1827)} + \frac{15}{(1.1827)^2} + \frac{15}{(1.1827)^3} + \frac{16}{(1.1827)^4} + \frac{16}{(1.1827)^5} + \frac{16(1.10)}{(0.1827 - 0.10)} \times \frac{1}{(1.1827)^5}$$

$$= 137.86 \text{ million}$$

Equity Value Under Enterprise DCF Model and Free Cash Flow to Equity Model

Under the enterprise DCF model, the value of equity is obtained as follows:

Value of equity = Enterprise DCF value – Debt value

$$\text{Value of equity} = \sum_{t=1}^{\infty} \frac{\text{Free cash flow to firm}_t}{(1+\text{WACC})^t} - \text{Debt Value}$$

Under the free cash flow to equity model, the value of equity is obtained as follows:

$$\text{Value of equity} = \sum_{t=1}^{\infty} \frac{\text{Free cash flow to equity}_t}{(1+\text{Cost of equity})^t}$$

Will the value of equity be the same under both the methods? Yes, if you make consistent assumptions about financial leverage. This point may be illustrated with an example.

Firm A is a zero-growth, perpetual firm. Its debt ratio will remain constant over time. Its earnings before interest and tax (EBIT) is 314.29 million and its tax rate is 30 percent. Assume that the market value of its equity and debt are 1200 million and 800 million respectively. The cost of equity is 14.13 percent and the pre-tax cost of debt is 9 percent.

A's cost of capital can be estimated:

$$\text{Cost of capital } = 14.13 \times \frac{1200}{2000} + 9.00 \times (1 - 0.3) \times \frac{800}{2000} = 11\%$$

Since A is a zero-growth firm, its net investment is zero and the free cash flow to the firm is EBIT $(1 - t)$. Hence the value of the firm is:

$$\text{Value of the firm } = \frac{\text{EBIT}(1-t)}{\text{Cost of capital}} = \frac{314.29(1-0.3)}{0.11} = 2000 \text{ million}$$

$$\begin{aligned}\text{Value of equity} &= \text{Value of the firm} - \text{Value of debt}\\ &= 2000 - 800\\ &= 1200 \text{ million}\end{aligned}$$

Now, let us derive the value of equity using the free cash flow the equity. Since A is a zero-growth, perpetual firm with a constant debt ratio, its free cash flow to equity is simply its net income. Hence, the value of equity is obtained as follows:

$$\begin{aligned}\text{Value of equity } &= \frac{\text{Net income}}{\text{Cost of equity}}\\ &= \frac{(\text{EBIT} - \text{Interest})(1-t)}{\text{Cost of equity}}\\ &= \frac{(314.29 - 0.09 \times 800)(1-0.3)}{0.1413}\\ &= 1200 \text{ million}\end{aligned}$$

Note that in the above example, we made three assumptions, implicitly or explicitly.

1. For computing the cost of capital, we used the values of equity (1200 million) and debt (800 million) which were the same as the values we derived in the valuation. There is a circularity in reasoning: you need the values of equity and debt to obtain the cost of capital and you need the cost of capital to derive the value of the firm (which is equity plus debt value). Notwithstanding this circularity, it implies that the firm must be fairly priced in the first place, for the cost of capital model (based on market value weights) to yield the same value for equity as the free cash flow to equity model.

2. There are no extraordinary or non operating items. Hence, net income is simply: operating income – interest – taxes.
3. The pretax cost of debt is multiplied by the market value of debt to calculate the interest expenses.

If the above assumptions are not fulfilled, equity value may be different under the two approaches. Further, for a growing firm, the scope of inconsistency increases. In this case, the firm must borrow enough money to finance new investments so that its debt ratio remains unchanged over time.

4.3 ADJUSTED PRESENT VALUE MODEL

The enterprise DCF model uses a constant discount rate to value the enterprise cash flows. This makes sense when the capital structure of the firm remains more or less constant over time. In situations where the capital structure of the firm is likely to substantially change over time, the adjusted present value (or APV) approach is more appropriate.

The APV approach defines enterprise value[1] as the sum of two components:

$$\text{Enterprise value} = \begin{pmatrix} \text{Value of the} \\ \text{unlevered} \\ \text{equity free} \\ \text{cash flows} \end{pmatrix} + \begin{pmatrix} \text{Value of} \\ \text{the} \\ \text{interest} \\ \text{tax shields} \end{pmatrix}$$

The first component on the right hand side of the above equation is the present value of the firm's operating cash flows. Since the operating cash flows do not depend on how the firm is financed, they may be referred to as the unlevered equity free cash flows. The second component on the right hand side of the above equation is the present value of the interest tax shields arising from the use of debt financing. By decomposing the enterprise value in this way, the APV approach captures easily the impact of changing capital structure.

Procedure

The APV approach is typically implemented using a procedure that we followed for estimating the enterprise value using the WACC approach, wherein the enterprise value (or firm value) was estimated as the sum of the present value of the free cash flows during the planning period (explicit forecast period) and the present value of the estimated terminal value at the end of the planning period.

1. For simplicity sake we assume that there are no non-operating assets.

The steps involved in implementing the APV approach are described below.

Step 1: *Estimate the present value of the cash flow during the planning period.*

The planning period cash flow comprises of (a) unlevered equity free cash flow and (b) interest tax shield.

The unlevered equity free cash flow, which is the same as the free cash flow to the firm, is obtained as follows:

Net operating income
– Taxes
= Net operating profit less adjusted taxes (NOPLAT)
+ Depreciation expense
– Capital expenditure
– Increase in net working capital
= Unlevered equity free cash flow (= FCFF)

The present value of the unlevered equity free cash flow during the planning period is:

$$\sum_{t=1}^{n} = \frac{\text{FCFF}_t}{(1+r_{UE})^t} \tag{4.19}$$

where FCFF_t is the free cash flow to the firm for year t, r_{UE} is the cost of unlevered equity, and n is the planning period.

The present value of the interest tax shield during the planning period is:

$$\sum_{t=1}^{n} = \frac{I_t \times T}{(1+r_D)^t} \tag{4.20}$$

where I_t is the interest expense for period t, T is the tax rate, r_D is the firm's borrowing rate, and n is the planning period.

The present value of the cash flows during the planning period is:

$$\sum_{t=1}^{n} \frac{\text{FCFF}_t}{(1+r_{UE})^t} + \sum_{t=1}^{n} \frac{I_t \times T}{(1+r_D)^t} \tag{4.21}$$

Step 2: *Estimate the terminal value of the firm at the end of the planning period.*

The terminal value of the firm at the end of the planning period is:

$$\frac{\text{FCFF}_n (1+g)}{\text{WACC} - g} \tag{4.22}$$

where FCFF_n is the free cash flow to firm at the end of the planning period, g is the perpetual growth rate in FCFF beyond the planning period, and WACC is the weighted average cost of capital, beyond the planning period.

Note that the above formula for the terminal value of the firm at the end of the planning period assumes that: (a) after the planning period, the capital structure of the firm remains constant, and (b) the firm's cash flows beyond year n would grow at a constant rate of g which is less than *WACC*.

Step 3: *Add the present values of cash flows during the planning period and terminal value*

The enterprise value, as per the APV approach, is the sum of the following:

Present value of planning period cash flows
$$: \sum_{t=1}^{n} \frac{\text{FCFF}_t}{(1+r_{UE})^t} + \sum_{t=1}^{n} \frac{I_t \times T}{(1+r_D)^t} \tag{4.23}$$

Present value of the terminal value
$$: \left(\frac{\text{FCFF}_n(1+g)}{\text{WACC}-g}\right)\left(\frac{1}{1+r_{UE}}\right)^n \tag{4.24}$$

Illustration

You have developed the following projections for Optex Limited:

					in million
	Years				
	1	*2*	*3*	*4*	*5*
• Free cash flow to the firm	200	250	300	340	380
• Interest-bearing debt	500	400	300	200	100
• Interest expense	60	48	36	24	12

Calculate the enterprise value of Optex Limited using the following assumptions:

- Beyond year 5, the free cash flow to the firm of Optex will grow at a constant rate of 10 percent per annum.
- Optex's unlevered cost of equity is 14 percent.
- After year 5, Optex will maintain a debt-equity ratio of 4:7.
- The borrowing rate for Optex will be 12 percent.
- The tax rate for Optex is 30 percent.
- The risk-free rate is 8 percent.
- The market risk premium is 6 percent.

The present value of the unlevered equity free cash flow (which is the same as the free cash flow to firm) during the planning period is:

$$\sum_{t=1}^{n} \frac{\text{FCFF}_t}{(1+r_{UE})^t} = \frac{200}{(1.14)} + \frac{250}{(1.14)^2} + \frac{300}{(1.14)^3} + \frac{340}{(1.14)^4} + \frac{380}{(1.14)^5}$$

$$= 969 \text{ million}$$

The present value of the interest tax shield during the planning period is:

$$\sum_{t=1}^{n} \frac{I_t \times T}{(1+r_D)^t} = \frac{60 \times 0.3}{(1.12)} + \frac{48 \times 0.3}{(1.12)^2} + \frac{36 \times 0.3}{(1.12)^3} + \frac{24 \times 0.3}{(1.12)^4} + \frac{12 \times 0.3}{(1.12)^5}$$

$$= 41.9 \text{ million}$$

The present value of the terminal value at the end of the planning period is:

$$\frac{\text{FCFF}_n\,(1+g)}{\text{WACC} - g} \left(\frac{1}{1+r_{UE}}\right)^n$$

$$= \frac{380\,(1.10)}{0.1349 - 0.10} \left(\frac{1}{1.14}\right)^5 = 6220.5 \text{ million}$$

Hence the enterprise value of Optex Limited is:

$$969.0 + 41.9 + 6220.5 = 7231.4 \text{ million}$$

It may be noted that the WACC value of 13.29 percent used above has been arrived as follows.

1. Given that is r_{UE} is 14 percent, β_{UE}, the unlevered equity beta, was calculated by solving the following equation:

r_{UE}	=	Risk-free rate	+	β_{UE}	$\times$	Market risk premium
14	=	8	+	β_{UE}	$\times$	6
β_{UE}	=	1				

2. Given $\beta_{UE} = 1$, $\beta_{LE,}$ the levered equity beta was calculated:

$$\beta_{LE} = \beta_{UE}[\,1 + D/E\,(1 - T)]$$
$$= 1\,[1 + 4/7\,(1 - 0.3)]$$
$$= 1.4$$

3. Given $\beta_{LE} = 1.4$, $r_{LE,}$ the cost of levered equity was calculated:

$$r_{LE} = 8 + 1.4 \times 6 = 16.4 \text{ percent}$$

4. Given r_{LE} = 16.4 percent, *WACC*, the weighted average cost of capital was calculated.

$$\begin{aligned} \text{WACC} &= 7/11 \times 16.4 + 4/11 \times 12 \times (1 - 0.3) \\ &= 10.44 + 3.05 \\ &= 13.49 \text{ percent} \end{aligned}$$

4.4 ECONOMIC PROFIT MODEL

The enterprise DCF model is endorsed by academics and practitioners alike because it focuses squarely on cash flows in and out of the business. However, it has a shortfall in the sense that the cash flow of a single year hardly provides any insight into the performance of the firm. A declining free cash flow may mean deteriorating performance or investment for future returns. In this respect, the economic profit model is more informative. While it produces a valuation that is identical to that of the enterprise DCF model, it also gives a clear picture of how and where the firm creates value.

Economic profit (EP) is simply the surplus left after making an appropriate charge for the capital invested in the business. The EP of a single period is defined as:

$$\text{EP} = \text{IC} \times (\text{ROIC} - \text{WACC}) \tag{4.25}$$

where IC is the invested capital, ROIC is the return on invested capital, and WACC is the weighted average cost of capital.

Since ROIC is equal to NOPLAT (net operating profit less adjusted taxes) divided by IC, we can rewrite the equation for EP.

$$\text{EP} = \text{NOPLAT} - \text{IC} \times \text{WACC} \tag{4.26}$$

According to the EP model, the value of a firm (V_0) is equal to the current invested capital plus the present value of the future economic profit stream. In symbols

$$V_0 = \text{IC}_0 + \sum_{t=1}^{\infty} \frac{\text{IC}_{t-1} \times (\text{ROIC}_t - \text{WACC})}{(1 + \text{WACC})^t} \tag{4.27}$$

Equivalence of the Enterprise DCF Model and the EP Model

How does the valuation as per the EP model compare with valuation as per the enterprise DCF model? Our economic intuition tells us that the two models should lead to identical valuation. Indeed, this is true. This may be demonstrated with an example.

Global Limited has an invested capital of 50 million. Its return on invested capital (ROIC) is 12 percent and its weighted average cost of capital (WACC) is 11 percent. The expected growth rate in Global's invested capital will be 20 percent for the first three years, 12 percent for the following two years, and 8 percent thereafter for ever. The forecast of Global's free cash flow is given in Exhibit 4.4.

Exhibit 4.4 ***Free Cash Flow***

in million

Year	*1*	*2*	*3*	*4*	*5*	*6*	*7*
Invested capital (Beg)	50.00	60.00	72.00	86.40	96.77	108.38	117.05
NOPLAT	6.00	7.20	8.64	10.37	11.61	13.01	14.05
Net investment	10.00	12.00	14.40	10.37	11.61	8.67	9.36
Free cash flow	(4.00)	(4.80)	(5.76)	-	-	4.34	4.69
Growth rate (%)	20	20	20	12	12	8	8

The present value of free cash flow (FCF) during the planning period is:

$$PV\ (\text{FCF}) = \frac{-4.00}{(1.11)} + \frac{-4.80}{(1.11)^2} + \frac{-5.76}{(1.11)^3} + \frac{0}{(1.11)^4} + \frac{0}{(1.11)^5} + \frac{4.33}{(1.11)^6} = -9.4 \text{ million}$$

The horizon value at the end of six years, applying the constant growth model, is:

$$V_H = \frac{\text{FCF}_{H+1}}{\text{WACC} - g} = \frac{4.69}{0.11 - 0.08} = 156.2 \text{ million}$$

The present value of V_H is:

$$\frac{156.2}{(1.11)^6} = 83.6 \text{ million}$$

Adding the present value of free cash flow during the planning period and present value of horizon value, gives the enterprise DCF value:

$$V_0 = -9.4 + 83.5 = 74.1 \text{ million}$$

Let us now value the Global Limited using the EP approach under the same set of assumptions. The projected EPs for 7 years are shown in Exhibit 4.5.

Exhibit 4.5 ***EP Projection***

in million

Year	*1*	*2*	*3*	*4*	*5*	*6*	*7*
Invested capital (Beg)	50.00	60.00	72.00	86.40	96.77	108.38	117.05
NOPLAT	6.00	7.20	8.64	10.37	11.61	13.00	14.05
Cost of capital (%)	11	11	11	11	11	11	11
Capital charge	5.50	6.60	7.92	9.50	10.64	11.92	12.88
EP	0.50	0.60	0.72	0.87	0.97	1.08	1.17
Growth rate(%)	20	20	20	12	12	8	8

The present value of the EP stream is :

$$\frac{0.50}{(1.11)}+\frac{0.60}{(1.11)^2}+\frac{0.72}{(1.11)^3}+\frac{0.87}{(1.11)^4}+\frac{0.97}{(1.11)^5}+\frac{1.08}{(1.11)^6}+\frac{1.17}{(0.11-0.08)}\times\frac{1}{(1.11)^6}=24.0 \text{ million}$$

Adding the invested capital to the present value of EP stream gives the enterprise value:

$$V_0 = 50 + 24 = 74 \text{ million}$$

Thus, the two models lead to identical valuation.

4.5 ACCOUNTING FOR VALUE

In his book, *Accounting for Value* (published by Columbia University Press, 2011), Stephen Penman argues that using free cash flow in valuation is perverse because an investment reduces FCF whereas a disinvestment increases FCF. As he put it, "In short FCF is not good accounting for value. Walmart, Home Depot, and GE have negative FCF because they invest. In 2003, GE had positive FCF, but only because it reduced investment. Is this a value-adding move?"

Penman's argument is questionable because while an investment reduces FCF during the year of investment, it generates (or is expected to generate) positive FCF when it bears fruit in future. Likewise, a disinvestment increases FCF during the year of disinvestment but deprives the firm of positive FCF in future years. Notwithstanding the error in this, there is a merit in what Penman says. Valuation based on FCF can become speculative more easily than valuation based on book value.

Penman believes that accrual accounting is better than cash accounting as it has two desirable properties. First, in accrual accounting, investments are shown as assets on the balance sheet and not deducted from cash flows from operations. As assets, they are expected to produce future value. Second, cash flows from operations are changed by "accruals" for items like retirement liabilities and stock option. This means that accrual accounting brings the future forward in time, anticipating future cash flows.

In accrual accounting, book value serves as an anchor. To this, a speculative element is added. Since speculation can lead us astray, we need to discipline it and accounting provides that discipline. If valuation is anchored to book value, one should add value to book value only when the expected rate of return on book value exceeds the required return (Superior returns are expected).

Value of equity = Book value + Value attributable to superior returns.

Suppose, we look at forecast earnings and book value over the next three years. Then,

$$\text{Value of equity}_0 = B_0 + \frac{(\text{ROE}_1 - r)\times B_0}{1+r} + \frac{(\text{ROE}_2 - r)\times B_1}{(1+r)^2} + \frac{(\text{ROE}_3 - r)\times B_2}{(1+r)^2\,(r-g)}$$

$$= B_0 + \frac{\text{Residual earnings}_1}{1+r} + \frac{\text{Residual earnings}_2}{(1+r)^2} + \frac{\text{Residual earnings}_3}{(1+r)^2\,(r-g)} \tag{4.28}$$

where B_0 is the current book value of equity, ROE_t is the book rate of return on equity defined as expected earnings in year t divided by expected book value in year $t-1$, r is the return required by equity investors, and g is the rate at which residual earnings are expected to grow after year 3.

The ideas here somewhat similar to the fundamentalist position articulated by Benjamin Graham and David. L. Dodd in their classic book *Security Analysis*, published in 1934. "It is essential to bear in mind that a private business has always been valued primarily on the basis of the "net worth" as shown by its statement. A man contemplating the purchase of a partnership or stock interest in a private undertaking will always start with value of that interest as shown "on the books," i.e., the balance sheet, and will then consider whether the record and prospects are good enough to make such a commitment attractive. An interest in a private business may, of course, be sold for more or less than its proportionate asset value; but the book value is still invariably the starting point of the calculation, and the deal is finally made and viewed in terms of the premium or discount from value involved."

The residual earnings model is equivalent to the dividend discount model for going concerns. So it is congruent with the principle that value is the present value of expected dividends.

The residual earnings model can be rearranged as follows:

$$\text{Value of equity}_0 = \frac{\text{Dividend}_1}{1+r} + \frac{\text{Dividend}_2}{(1+r)^2} + \frac{B_2}{(1+r)^2} + \frac{(\text{ROE}_3 - r)B_2}{(1+r)^2\;(r-g)} \tag{4.29}$$

Example The various valuation metrics for Maxima Limited for years 0, 1, 2, and 3 are as follows.

		0	*1*	*2*	*3*
•	Book value per share (BPS)	100	111	122.66	134.93
•	Book return on equity (ROE)		22%	21%	20%
•	Earnings per share (EPS)		22	23.31	24.53
•	Dividends per share (DPS)		11	11.65	12.26
•	Residual earnings (15% charge)		7	6.66	6.13

Beyond year 3, the ROE will be 20 percent, the required return by equity investors will be 15 percent, and the growth rate will be 10 percent. What will be the value of equity?

The value of equity as per Eq (4.28) is:

$$\text{Value of equity}_0 = 100 + \frac{(0.22-0.15)\times 100}{1.15} + \frac{(0.21-0.15)\times 111}{(1.15)^2} + \frac{(0.20-0.15)\times 122.66}{(1.15)^2(0.15-0.10)}$$

$$= 100 + 6.09 + 5.04 + 92.75$$

$$= 203.88$$

The value of equity as per Eq (4.29) is:

$$\text{Value of equity}_0 = \frac{11}{1.15} + \frac{11.65}{(1.15)^2} + \frac{122.66}{(1.15)^2} + \frac{(0.20-0.15)\times 122.66}{(1.15)^2(0.15-0.10)}$$

$$= 9.57 + 8.81 + 92.75 + 92.75 = 203.88$$

In the above calculation, the last term has a value of 92.75 and it is based on the assumption that residual earnings would continue to grow at 10 percent. The 10 percent growth rate of residual earnings is based on the assumption that from year 3 onwards the firm will earn an ROE of 20 percent both on existing book value and on new investments which will come out of retained earnings which in turn will be equal to 50 percent of earnings.

The fundamentalist may argue that one must be wary of such projections going forward indefinitely. As Stephen Penman put it, "Understand what you know and don't mix what you know with speculation and anchor a valuation on what you know rather than speculation."

Suppose, in the above case, you feel confident about your forecast for three years ahead. Thereafter, you assume, on a conservative note, that the residual earnings will remain constant and not grow. In this case, the value of equity is given by the following model.

$$\text{Value of equity}_0 = B_0 + \frac{(\text{ROE}_1 - r)\times B_0}{1+r} + \frac{(\text{ROE}_2 - r)\times B_1}{(1+r)^2} + \frac{(\text{ROE}_3 - r)\times B_2}{(1+r)^2 \times r}$$

Plugging in the numbers of our numerical example in the above model, we get,

$$\text{Value of equity}_0 = 100 + \frac{(0.22-0.15)\times 100}{1.15} + \frac{(0.21-0.15)\times 111}{(1.15)^2} + \frac{(0.20-0.15)\times 122.66}{(1.15)^2 \times 0.15}$$

$$= 100 + 6.09 + 5.04 + 30.92$$

$$= 142.05$$

Comparing this value estimate (142.05) with the earlier value estimate (203.88), one may argue that the difference (61.85) represents the value of speculative growth.

Applications of Residual Earnings Approach

In his book *Accounting for Value*, Stephen Penman illustrates the residual earnings approach using the following financial numbers of Microsoft after it published its annual report for the fiscal year ending June 30, 2008.

• Price per share	\$25
• Market capitalisation	\$228.8 billion
• Book capital	\$36.286 billion
• Net operating assets	\$12.624 billion
• Cash	\$23.662 billion
• After-tax operating income from the business	\$16.835 billion
• Interest income after taxes	\$846 million
• Total net income	\$17.681 billion

Assuming a 9 percent discount rate and applying a residual earnings no-growth valuation, Penman estimated the equity value as follows.

$$\begin{aligned}\text{Equity value} &= \text{Value of operations} + \text{Value of cash}\\ &= \text{Net operating assets}_{2008} + \frac{\text{Residual operating income}_{2009}}{0.09} + \text{Cash}_{2008}\\ &= 12.624 + \frac{16.835 - (0.09 \times 12.624)}{0.09} + 23.662\\ &= \$\,210.718 \text{ billion or } \$\,23.03 \text{ per share}\end{aligned}$$

Anchoring on Earnings: The P/E Multiple

In the above discussion, we started with book value and then determined the value to be added to the book value. Thus, the thrust was on the P/B multiple. Analysts, however, tend to talk more in terms of the price-earnings (P/E) multiple rather than the P/B multiple. And their focus is on earnings and earnings growth, rather than book value and residual earnings. Will a focus on earnings produce a different result? No. A fundamental valuation with earnings as the anchor will also produce the same result.

To understand how valuation is done with earnings as the anchor, we will need a new concept, viz., 'abnormal earnings growth' or AEG. AEG is earnings growth is excess of growth at the required rate of return.

$$\text{AEG} = [\text{Earnings} + (r \times \text{Prior dividend})] - [(1 + r) \times \text{Prior earnings}]$$

To illustrate the calculation of AEG, let us look at the following data of Omega Limited.

	Year 1	*Year 2*
Earnings per share (EPS)	30	36
Dividend per share (DPS)	10	11
Retained earnings per share (REPS)	20	25

The required rate of return (r) is 15 percent.

Given the above data, the AEG for year 2 is calculated as follows:

$$\text{AEG} = [36 + (0.15 \times 10)] - [(1.15) \times 30] = \text{Rs. } 3$$

In AEG calculation, the earnings of a year are compared with the earnings of the prior year growing at the required rate of return (which is essentially the cost of equity). Thus, if earnings grow only at the required rate of return, there is no AEG. It should be emphasised that earnings are cum-dividend earnings, meaning that they include earnings from reinvesting the prior year's dividends.

The AEG of 3 for year 2 may be understood as follows. The EPS for year 2 is 36. On the DPS of 10 for year 1, shareholders can generate an additional earnings of 1.5. So the adjusted EPS for year 2 is 37.5. The EPS of 30 for year 1 should grow by 15 percent (the required return) to 34.5 (30 × 1.15). The difference between 37.5 and 34.5 represents the AEG.

AEG can also be regarded as "change in residual earnings." So, a valuation model which anchors on earnings for year 1 and AEG for the following two years (assuming that one can forecast confidently for this period) will be as follows:

$$\text{Value of equity}_0 = \frac{\text{Earnings}_1}{r} + \frac{1}{r}\left[\frac{\text{AEG}_2}{(1+r)} + \frac{\text{AEG}_3}{(1+r)^2}\right] + \text{Value of speculative growth}$$

It is called the AEG (or Abnormal Earnings Growth) model or the Ohlson-Juettiner model after its developers. Essentially, it reckons growth for the short-term but avoids speculation about growth in the long-term.

Equivalence of the Two Approaches

Whether value is anchored on book value or earnings, we get the same result, as long as we make the same assumptions about return on equity and dividend payout ratio. This proposition may be easily demonstrated with a numerical example of a hypothetical company, Sigma Corporation, presented below.

Sigma Corporation

		0	1	2	3
•	Book value per share (BPS)	100	110	121	133.1
•	Book return on equity (ROE)		20%	20%	20%
•	Earnings per share (EPS)		20	22	24.2
•	Dividends per share (DPS)		10	11	12.1
•	Retained earnings per share (REPS)		10	11	12.1
•	Residual earnings (RE)		5	5.50	6.05
•	Abnormal earnings growth (AEG)			0.5	0.55

If we ignore the value of speculative growth beyond year 3, the equity value under the book value approach is:

$$\text{Value of equity}_0 = \text{Book value}_0 + \frac{\text{Residual earnings}_1}{1+r} + \frac{\text{Residual earnings}_2}{(1+r)^2} + \frac{\text{Residual earnings}_3}{(1+r)^2 \times r}$$

$$= 100 + \frac{5}{1.15} + \frac{5.50}{(1.15)^2} + \frac{6.05}{(1.15)^2 \times (0.15)}$$

$$= 139$$

The value of equity under the earnings approach is:

$$\text{Value of equity}_0 = \frac{\text{Earnings}_1}{r} + \frac{1}{r}\left(\frac{\text{AEG}_2}{(1+r)} + \frac{\text{AEG}_3}{(1+r)^2}\right)$$

$$= \frac{20}{0.15} + \frac{1}{0.15}\left(\frac{0.5}{1.15} + \frac{0.55}{(1.15)^2}\right)$$

$$= 139$$

As expected, the two value estimates are identical.

4.6 MAINTAINABLE PROFITS METHOD

This method calls for estimating the average future maintainable profits and capitalising the same at an appropriate rate to arrive at the equity value.

Average Future Maintainable Profits

Determining the average future maintainable profits is a complex task. To do so, the analyst typically calculates the past pre-tax average profits and then projects the future pre-tax maintainable profits.

Calculation of Past Pre-tax Average Profits For calculating the past pre-tax average profits, the following guidelines may be followed

- Look at a period which is reasonably long. For a cyclical business, the period should cover the length of a business cycle. For other businesses, the period may be three years.
- Make adjustments for non-recurring items such as losses on account of fire or exceptional capital gains or losses
- Assign different weights to different years. Assign the highest weight to the most recent year and progressively lesser weights to the previous years.

Projection of Future Pre-tax Maintainable Profits To project the future pre-tax maintainable profits, the analyst considers the past pre-tax average profits, evaluates the likely changes in the performance of the company, and develops an estimate of projected pre-tax maintainable profits. Obviously this a difficult task characterised by a great deal of imprecision. More so, in today's business environment where uncertainties have increased significantly.

Rate of Capitalisation

The projected pre-tax maintainable profits has to be converted into a post-tax maintainable profits by applying a tax rate applicable to the firm. This, then, has to be capitalised to arrive at the value of the equity capital of the company. For example, if the projected future post-tax maintainable profits are 1000 million and the capitalisation rate is 15 percent, the value of the equity capital of the company will be.

$$\frac{1,000}{0.15} = 6,667 \text{ million}$$

Akin to the discount rate in a DCF model, the capitalisation rate is a function of the riskiness of the firm. Lower the riskiness of the firm, lower the capitalisation rate; higher the riskiness of the firm, higher the capitalisation rate.

4.7 APPLICABILITY AND LIMITATIONS OF DCF ANALYSIS

The DCF method requires credible estimates of future cash flows and discount rates. It is easily applicable to assets and firms when (a) current cash flows are positive, (b) future cash flows can be estimated reliably, and (c) the risk profile is stable.

The more removed a situation is from this idealised setting, the more difficult it is to apply the DCF method. In the following situations it may be difficult to apply the DCF method or it may be necessary to make substantial modification to the DCF method:

- Firms which are in distress
- Firms which have highly cyclical operations
- Firms with substantial unutilised assets
- Firms with significant patents and product options
- Firms which are under restructuring
- Firms involved in acquisitions
- Private firms

DCF analysis has its limitations. To understand this let us look at where it is helpful and where it is not. The following table shows that:

Securities	***Corporate Analogs***
• DCF is the standard for valuing fixed-income securities	• DCF can be easily used for valuing safe cash flow such as the cash flows of financial leases.
• DCF can be sensibly used for valuing stocks of mature companies paying regular dividends	• DCF can be readily applied for valuing cash cows. It also works well for "engineering investments" such as replacement projects.
• DCF is not very helpful in valuing stocks of companies that have substantial growth opportunities. You can stretch the DCF model and say that the value of the stocks is equal to the present value of dividends the firm may eventually pay. But it is more helpful to think of value as: $P_0 = \frac{\text{EPS}}{r}$ + Present value of growth opportunities	• DCF is not very helpful in valuing a business with significant growth or intangible assets. Put differently, it provides only a partial answer when options account for a significant portion of the value of a business.
• DCF is never used for valuing call and put options. They are valued using the option pricing model which is very different from the DCF model.	• DCF does not make any sense for valuing R&D projects. The value of such project is represented by their option value.

SUMMARY

- There are several models for valuing a company or its equity thereof using the DCF approach: enterprise DCF model, equity DCF model, adjusted present value model, economic profit model, residual earnings model, and maintainable profits model.
- The enterprise DCF model discounts the free cash flow to firm at the weighted average cost of capital

- Valuation practitioners sometimes value equity directly employing either the dividend discount model or the free cash flow to equity model. According to the dividend discount model, the value of an equity share is the present value of the dividends expected from its ownership.
- The commonly used versions of the dividend discount model are : zero growth model, constant growth model, two-stage growth model, H model, and three- stage growth model.
- The free cash flow to equity model discounts the free cash flow to equity (FCFE) at the levered cost of equity
- The adjusted present value (APV) model discounts the unlevered equity cash flow (which is the same as the free cash flow to firm) at the unlevered cost of equity and adds to it the discounted value of the interest tax shield on debt.
- The economic profit model discounts the economic profit stream at the weighted average cost of capital and adds to it the current invested capital.
- The residual earnings model, advocated by Stephen Penman, is similar to the economic profit model, but it focuses on equity value and is more conservative.
- The maintainable profits method calls for estimating the average future maintainable profits and capitalising the same at an appropriate rate to arrive at the equity model.

Questions

1. What are the problems with the enterprise DCF model?
2. Discuss the following dividend discount models: zero growth model, constant growth model, two stage growth model, *H* model, and three stage growth model.
3. What are the advantages and disadvantages of the dividend discount model?
4. How do you measure free cash flow to equity?
5. How is enterprise value defined under the APV approach?
6. What is economic profit (EP)? How is the value of the firm defined under the EP model?
7. Discuss the applicability and limitations of the DCF model.
8. How is the value of equity calculated as per the residual earnings model.
9. How is the value of equity calculated as per the maintainable profits model.

Problems

1. The equity stock of Max Limited is currently selling for 32 per share. The dividend expected next is 2.00. The investors' required rate of return on this stock is 12 percent. Assume that

the constant growth model applies to Max Limited. What is the expected growth rate of Max Limited?

2. Fizzle Limited is facing gloomy prospects. The earnings and dividends are expected to decline at the rate of 4 percent. The previous dividend was 1.50. If the current market price is 8.00, what rate of return do investors expect from the stock of Fizzle Limited?

3. The Commonwealth Corporation's earnings and dividends have been growing at the rate of 12 percent per annum. This growth rate is expected to continue for 4 years. After that the growth rate would fall to 8 percent for the next four years. Beyond that the growth rate is expected to be 5 percent forever. If the last dividend was 1.50 and the investors' required rate of return on the stock of Commonwealth is 14 percent, how much should be the market value per share of Commonwealth Corporation's equity stock ?

4. Determine the intrinsic value of an equity share, given the following data :

Last dividend (D_0)	: 2.00
Growth rate for the next five years	: 15 percent
Growth rate beyond 5 years	: 10 percent

Assume a required rate of return

5. The current dividend on an equity share of Dizzy Limited is 2.00. Dizzy is expected to enjoy an above-normal growth rate of 18 percent for 6 years. Thereafter the growth rate will fall and stabilise at 12 percent. Equity investors require a return of 16 percent from Dizzy's stock. What is the intrinsic value of the equity share of Dizzy.

6. The current dividend on an equity share of International Chemicals Limited is 4.00. The present growth rate is 20 percent. However, this will decline linearly over a period of 8 years and stabilise at 10 percent. What is the intrinsic value per share of International Chemicals Limited if investors require a return of 18 percent?

7. You have been given the following projections for Magnum Limited:

in million

	Year				
	1	*2*	*3*	*4*	*5*
• Free cash flow of the firm	300	360	440	520	600
• Interest-bearing debt	800	700	600	500	700
• Interest expense	100	85	74	60	50

Compute the enterprise value of Magnum Limited using the following assumptions:

- Beyond year 5, the cash flow to the firm of Magnum Limited will grow at a constant rate of 10 percent per annum
- Magnum's unlevered cost of equity is 15 percent and its borrowing rate will be 12 percent
- After year 5, Magnum will maintain a debt-equity ratio of 1:2.

- The tax rate for Magnum is 30 percent
- The risk-free rate is 7 percent
- The market risk premium is 8 percent

Calculate the enterprise value of Magnum Limited.

8. The following projections have been developed for Omega Limited

					in million
			Year		
	1	*2*	*3*	*4*	*5*
• Profit after tax	60	75	72	80	90
• Preference dividend	2	2	-	-	-
• Fixed assets (net)	300	360	380	410	440
• Investments	40	20	-	-	0
• Net current assets	80	100	110	120	130
• Debt	200	250	260	280	300
• Preference capital	20	-	-	-	-

The cost of equity for Omega Limited is 16 percent.

The FCFE will grow at a constant rate of 12 percent after 5 years, what is the value of Omega's equity?

9. Vijay Limited has an invested capital of 100 million. Its return on invested capital (ROIC) is 14 percent and its weighted average cost of capital (WACC) is 12 percent. The expected growth rate in Vijay Limited' revenues and invested capital will be 20 percent for the first four years, 12 percent for the following three years, and 10 percent thereafter forever.
   (a) Calculate the enterprise DCF value of Vijay Limited
   (b) Calculate the enterprise value of Vijay Limited using the economic profit model.

10. You have been given the following projections for Spectrum Corporation

					in million
			Year		
	1	*2*	*3*	*4*	*5*
• Free cash flow of the firm	500	620	720	800	900
• Interest bearing debt	2,000	1,800	1,600	1,400	1,200
• Interest expense	200	180	160	140	120

Compute the enterprise value of Spectrum Corporation, using the adjusted present value method, under the following assumptions.

- Beyond year 5, the cash flow to the firm for Spectrum Corporation will grow at rate of 9 percent.

- Spectrum's unlevered cost of equity is 14 percent, and its borrowing rate will be 10 percent.
- After year 5, Spectrum will maintain a debt-equity ratio of 2:3.
- The tax rate for Spectrum is 30 percent.
- The risk-free rate is 8 percent and the market risk premium is 7 percent.

11. Apex Limited has an invested capital of 1,000 million. Its return on invested capital (ROIC) is 18 percent and its weighted average cost of capital (WACC) is 14 percent. The expected growth rate in Apex's revenues and invested capital will be 18 percent for the first three years, 15 percent for the following three years, and 12 percent thereafter forever.

    (a) Calculate the enterprise DCF value of Apex Limited

    (b) Calculate the enterprise value of Apex Limited using the economic profit model.

12. The current earnings per share (E_0) of Metatools Limited is Rs.10.00. For the next five years, the earnings per share is expected to grow at 15 percent and the dividend payout ratio in this period will be 30 percent. The growth rate in earnings per share will decline linearly for the following five years to 10 percent. During this period, the dividend payout ratio will increase linearly from 30 percent to 50 percent. After the tenth year, the growth rate in earnings per share will remain stable at 10 percent. During the stable growth period, the payout ratio will be 50 percent. During the high growth period, the cost of equity will be 20 percent, during the transition period the cost of equity will fall by 1 percent per year, and during the stable growth period, the cost of equity will be 15 percent.

    What is the intrinsic value per share, as per the three-stage dividend discount model?

13. The various metrics of Modern Retail for years 0, 1, 2, and 3 are as follows:

	0	*1*	*2*	*3*
• Book value per share (BVPS)	500	550	602.25	638.39
• Book return on equity (ROE)		20%	19%	18%
• Earnings per share (EPS)		100	104.5	108.41
• Dividend per share (DPS)		50	52.25	54.20
• Residual earnings (12% charge)		40	38.5	36.1

Beyond year 3, ROE will be 18%, the required return by equity investors will be 12%, and the growth rate will be 9%. What will be the value of equity? Compute the value using the residual earning model as well as the dividend discount model.

APPENDIX 4A

EQUIVALENCE OF THE ENTERPRISE DCF MODEL AND THE ECONOMIC PROFIT MODEL

In Appendix 2B we learnt that the growing free cash flow perpetuity model

$$V_0 = \frac{\text{FCF}_1}{\text{WACC} - g} \tag{4A.1}$$

can be converted into a value driver formula:

$$V_0 = \left(\frac{\text{NOPLAT}_1 \left(1 - \frac{g}{\text{ROIC}}\right)}{\text{WACC} - g} \right) \tag{4A.2}$$

For the sake of simplicity we assume that the return on new invested capital is the same as the existing return in invested capital.

We can rearrange Eq.(4A.2) into a formula based on economic profit (EP). Our objective is to show that the enterprise DCF model and the EP model produce identical valuation.

Since NOPLAT_1 equals $\text{IC}_O \times \text{ROIC}$, restate Eq. (4A.2) as follows:

$$V_0 = \left(\frac{\text{IC}_0 \times \text{ROIC} \times \left(1 - \frac{g}{\text{ROIC}}\right)}{\text{WACC} - g} \right) \tag{4A.3}$$

Now, simplify by distributing ROIC in the numerator:

$$V_0 = \text{IC}_0 \times \frac{\text{ROIC} - g}{\text{WACC} - g} \tag{4A.4}$$

Eq. (4A.4) clearly highlights that the value driver formula can be used only when both ROIC and WACC are greater than g. If WACC < g, cash flows grow faster than they can be discounted and the value approaches infinity, an impossibility. If ROIC < g, cash flows are negative, which means that value is negative. This situation is impractical because investors would not finance such a company.

Continuing further, subtract and add WACC in the numerator:

$$V_0 = \text{IC}_0 \times \frac{\text{ROIC} - \text{WACC} + \text{WACC} - g}{\text{WACC} - g} \tag{4A.5}$$

Next, separate the fraction into two components and then simplify:

$$V_0 = \mathrm{IC}_0 \times \frac{\mathrm{ROIC} - \mathrm{WACC}}{\mathrm{WACC} - g} + \mathrm{IC}_0 \times \frac{\mathrm{WACC} - g}{\mathrm{WACC} - g}$$

$$\mathrm{IC}_0 + \frac{\mathrm{IC}_0 \times (\mathrm{ROIC} - \mathrm{WACC})}{\mathrm{WACC} - g} \qquad (4A.6)$$

Since EP is equal to IC (ROIC – WACC), restate the above equation:

$$V_0 = \mathrm{IC}_0 \times \frac{\mathrm{EP}_1}{\mathrm{WACC} - g} \qquad (4A.7)$$

Thus we find that the enterprise DCF model and the EP model lead to identical valuation.

CHAPTER 5

Relative Valuation

In DCF valuation, an asset is valued on the basis of its cash flow, growth, and risk characteristics. In relative valuation, an asset is valued on the basis of how similar assets are currently priced in the market. As Dan Ariely put it: "Everything is relative even when it shouldn't be. Humans rarely choose in 'absolute terms.' We don't have an internal meter that tells us how much things are worth. Rather, we focus on the relative advantage of one thing over another, and estimate value accordingly."

Common sense and economic logic tell us that similar assets should sell at similar prices. Based on this principle, one can value an asset by looking at the price at which a comparable asset has changed hands between a reasonably informed buyer and a reasonably informed seller. For example, if you want to sell your residential flat, you can estimate its appropriate asking price by looking at market comparables. Suppose your flat measures 2000 square feet and recently a flat in the neighbourhood measuring 1500 square feet sold for 4,500,000 (at the rate of 3,000 per square feet). As a first pass, you can put a value of $2000 \times 3000 = 6{,}000{,}000$ for your flat.

Relative valuation is often considered as a substitute for DCF valuation. However, as our discussion in this chapter shows, the DCF approach provides the conceptual foundation for most relative valuation metrics. Hence the two approaches should be seen as complementary.

5.1 STEPS INVOLVED IN RELATIVE VALUATION

Relative valuation involves the following steps:

1. **Analyse the Subject Company** To begin with, an in-depth analysis of the competitive and financial position of the subject company (the company to be valued) must be conducted. The key aspects to be covered in this analysis are as follows:
   - Product portfolio and market segments covered by the firm
   - Availability and cost of inputs

- Technological and production capability
- Market image, distribution reach, and customer loyalty
- Product differentiation and economic cost position
- Managerial competence and drive
- Quality of human resources
- Competitive dynamics
- Liquidity, leverage, and access to funds
- Turnover, margins, and return on investment.

2. **Select Comparable Companies** After the subject company is studied, the next step is to select companies which are similar to the subject company in terms of the lines of business, nature of markets served, scale of operation, and so on. Often, it is hard to find truly comparable companies because firms are engaged in a variety of businesses, serve different market segments, and have varying capacities. Hence, in practice, the analyst has to make do with companies which are comparable in some ways. He should make every effort to look carefully at 10 to 15 companies in the same industry and select at least 3 to 4 which come 'as close as possible' to the subject company. Understandably, a good deal of subjective judgment is involved in this process.

   Finding the right comparable companies is challenging. Indeed, the ability to do so distinguishes sophisticated veterans from novices. After compiling an initial list of comparables, you have to dig deeper. Examine each company and ask some critical questions. Why do multiples differ across the peer group? Do some companies have superior products, better customer reach, sustainable revenues, or economies of scale? These advantages translate into superior ROICs and growth rates and hence justify higher multiples.

3. **Choose the Valuation Multiple(s)** A number of valuation multiples are used in practice. They may be divided into two broad categories: (a) equity valuation multiples (price-earnings ratio, price-book value ratio, and price-sales ratio), and (b) enterprise valuation multiples (EV-EBITDA ratio, EV-FCFF ratio, EV-book value ratio, and EV-sales ratio).

   Since none of the valuation multiples is perfect, it makes sense to use two to three multiples that seem appropriate for the task on hand. Generally, the valuation multiples used in enterprise valuation are EV-EBITDA ratio, EV-book value ratio, and EV-sales ratio.

4. **Calculate the Valuation Multiples for the Comparable Companies** Based on the observed financial attributes and values of the comparable companies, calculate the valuation multiples for them. To illustrate, suppose that there are two comparable companies, *P* and *Q*, with the following financial numbers.

	P	*Q*
• Sales	3000	5000
• EBITDA	500	800
• Book value of assets	2000	3000
• Enterprise value	4000	5600

The valuation multiples for the companies are:

	P	*Q*	*Average*
EV-EBITDA	8.0	7.0	7.5
EV-book value	2.0	1.87	1.94
EV-sales	1.33	1.12	1.23

5. **Value the Subject Company** Given the observed valuation multiples of the comparable companies, the subject company may be valued. A simple way to do is to apply the average multiples of the comparable companies to the relevant financial attributes of the subject company and obtain several estimates (as many as the number of valuation multiples used) of enterprise value for the subject company and then take their arithmetic average.

   A more sophisticated way to do is to look at how the growth prospects, risk characteristics, and size of the subject company (the most important drivers of valuation multiples) compare with those of comparable companies and then take a judgmental view of the multiples applicable to it.

Illustration

The following financial information is available for company *D*, an unlisted pharmaceutical company, which is being valued.

- EBITDA : 400 million
- Book value of assets : 1,000 million
- Sales : 2,500 million

Based on an evaluation of a number of listed pharmaceutical companies, *A*, *B*, and *C* have been found to be comparable to company *D*. The financial information for these companies is given below:

	A	*B*	*C*
• Sales	1600	2000	3200
• EBITDA	280	360	480
• Book value of assets	800	1000	1400
• Enterprise value (EV)	2000	3500	4200

Three valuation multiples, as shown below, have been considered

	A	*B*	*C*	*Average*
• EV-EBITDA	7.1	9.7	8.8	8.5
• EV-book value	2.5	3.5	3.0	3.0
• EV-sales	1.25	1.75	1.31	1.44

Applying the average multiples to the financial numbers of firm *D* gives the following enterprise value estimates:

EBITDA Basis		*Book Value Basis*		*Sales Basis*	
• Average EV-EBITDA	: 8.5	• Average EV-book value	: 3.0	• Average EV-sales	: 1.44
• EBITDA of D	: 400 million	• Book Value of D	: 1000 million	• Sales of D	: 2500 million
• EV of D	: 3400 million	• EV of D	: 3000 million	• EV of D	: 3600 million

A simple arithmetic average of the three estimates of EV is:

$$\frac{3400 + 3000 + 3600}{3} = 3333 \text{ million}$$

5.2 EQUITY VALUATION MULTIPLES

The commonly used equity valuation multiples are: price-to-earnings (P/E)multiple, price-to-book value (P/B) multiple, and price-to-sales (P/S) multiple.

P/E Multiple

In the first edition of their seminal work *Security Analysis,* published in 1934, Benjamin Graham and David L. Dodd described equity valuation based on price-to-earnings (P/E) multiple as the standard method of that time. The P/E multiple continues to be most popular valuation measure even today.

A widely used valuation ratio, the P/E multiple is commonly defined as follows:

$$\text{P/E multiple} = \frac{\text{Market price per share}}{\text{Earnings per share}}$$

While the numerator of this multiple is the current market price per share, the denominator of this multiple may be the earnings per share (EPS) for the previous financial year or the EPS for the trailing 12 months or the expected EPS for the current year or the expected EPS for the following year. In its most common version, it is measured as the expected EPS for the current year. So, the price-earnings multiple may be expressed as:

$$\frac{P_0}{E_1} \tag{5.1}$$

where P_0 is the current market price per share and E_1 is the expected earnings per share a year from now.

Fundamental Determinants of the P/E Multiple From a fundamental point of view

$$P_0 / E_1 = \frac{(1-b)}{r - \text{ROE} \times b} \tag{5.2}$$

where (1 – b) is the dividend payout ratio, r is the cost of equity, ROE is the return on equity, and b is the ploughback ratio.

Example Alpha Company's ROE is 18 percent and its r is 15 percent. Alpha's dividend payout ratio is 0.4 and its ploughback ratio 0.6. So, from a fundamental point of view, Alpha's P/E multiple is:

$$P_0 / E_1 = \frac{0.4}{0.15 - 018 \times 0.6} = 9.52$$

Reasons for Using P/E Multiple The following reasons are offered for using P/E multiple:

- Earning power is a major driver of investment value and hence EPS looms large in security valuation. A survey of AIMR members found that earnings ranked first among four variables – earnings, cash flow, book value, and dividends – as an input in equity valuation.
- Empirical research suggests that low P/E stocks tend to outperform the market.

There are some drawbacks to using P/E, arising from the following characteristics of EPS:

- When EPS is negative, P/E does not make any economic sense.
- The maintainable components of earnings are really important in determining intrinsic value. Since earnings often have volatile, non-recurring components, the task of the analyst becomes difficult.
- Within the framework of acceptable accounting practices, management has some discretion to manipulate EPS. Such manipulations can vitiate comparability of P/Es across companies.

P/B Multiple

Like the P/E multiple, the price to book value (P/B) multiple has been used for a long time by investment analysts.

In the P/E multiple, the denominator (EPS) is a flow measure coming from income statement. By contrast, in the P/B multiple, the denominator (book value per share, B) is a stock measure, coming from the balance sheet. The book value per share (B) is:

$$\frac{\text{Share holders' funds} - \text{Preference capital}}{\text{Number of outstanding equity shares}}$$

Note that in the numerator of this multiple we have deducted preference capital because we are interested in finding the book value per equity share.

The P/B multiple has always drawn the attention of investors. During the 1990s Eugene Fama and others suggested that the P/B multiple explained to a significant extent the returns from stocks. The findings of researchers like Kim and others, however, have cast some shadow over the role of the P/B multiple.

Fundamental Determinants of the P/B Multiple From a fundamental point of view,

$$\frac{P_0}{B_0} = \frac{\text{ROE}\,(1-b)}{r-g} \tag{5.3}$$

where ROE is the return on equity, g is the growth rate, $(1 - b)$ is the dividend payout multiple, and r is the rate of return required by equity investors.

Example Magna Corporation's ROE is 20 percent and its r is 16 percent. Magna's dividend payout ratio is 0.4 and its g is 12 percent. From a fundamental point of view, Magna's P/B multiple is:

$$\frac{P_0}{B_0} = \frac{0.20\,(0.4)}{0.16 - 0.12} = 2.00$$

Reasons for Using P/B Multiple There are several reasons for the popularity of the P/B multiple.

- Because book value is a stock figure, it is generally positive even when EPS is negative.
- Compared to EPS, book value per share is more stable. When EPS is unusually high or low or highly volatile, P/B multiple may be more meaningful than the P/E multiple.
- Empirical research suggests that differences in the P/B multiple are related to differences in long-term average returns.

The P/B multiple, however, suffers from some drawbacks:

- Intangible assets like human capital and brand equity are not reflected on the conventional balance sheet.
- Inflation and technological changes drive a wedge between the book value and the market value of an asset.
- Different business models may require different levels of assets. When such differences are significant, the P/B multiple can be misleading.

P/S Multiple

In recent years, the price/sales multiple (P/S multiple) has received a lot of attention as a valuation tool. The P/S multiple is calculated by dividing a company's current stock price by its revenue per share for the most recent twelve months. Alternatively, it may be obtained by dividing the current market value of equity capital by annual sales of the firm. The P/S multiple essentially reflects what the market is willing to pay per rupee of sales.

Investors may have certain concerns or problems in using the P/E multiple: earnings may be highly erratic; earnings may be negative; earnings may be defined in different ways; earnings may be 'managed'. These concerns or problems are eliminated or substantially mitigated when the P/S multiple is used.

In the book *What Works on Wall Street*, published by McGraw Hill Publishing Company, James O' Shaugnessy analysed various investment tools used to select equity stocks, such as book value, return on equity, P/E multiple, yield, P/S multiple, and so forth. He found the P/S multiple to be a useful tool: portfolios of low P/S multiple stocks tend to outperform portfolios of high P/S multiple stocks.

A popular rule of thumb says that a P/S multiple of 1.0 may be used as a norm for all companies. Hence stocks which trade at a P/S multiple that is considerably less than 1.0, say 0.5, may be regarded as bargains. Obviously, such a simplistic approach is likely to have very limited applicability. P/S multiple are bound to differ across industries and firms due to variations in factors like net profit margin, growth rate, asset turnover, and so on.

So, a more sophisticated approach would call for interpreting the P/S multiple in relation to the drivers of P/S multiple. Since the net profit margin is a key driver of P/S multiple, it makes sense to look at P/S multiple/Net profit margin. Further, a company's P/S multiple should be compared with that of the industry average and its own history, as P/S multiple is a technique of relative valuation.

Fundamental Determinants of the P/S From a fundamental point of view,

$$\frac{P_0}{S_0} = \frac{\text{NPM}\,(1+g)\,(1-b)}{r-g} \tag{5.4}$$

where NPM is the net profit margin ratio, g is the growth rate, $(1 - b)$ is the dividend payout multiple, and r is the rate of return required by equity investors.

Example Black Limited has a NPM of 8 percent and a growth rate 12 percent. Black's dividend payout ratio $(1 - b)$ is 0.3 and its r is 0.16. From a fundamental point of view, Black's P/S multiple is:

$$\frac{P_0}{S_0} = \frac{0.08\,(1.12)\,(0.3)}{0.16 - 0.12} = 0.67$$

Reasons for Using Price to Sales Multiple Analysts offer the following reasons for using the P/S multiple.

- Compared to EPS and book value, sales are generally less amenable to manipulation.
- While EPS or even book value may be negative, sales are always positive. So, the PS ratio can be used even when EPS is negative.
- Generally, sales are more stable than EPS, which is affected by operating and financial leverage. Hence, the P/S multiple is typically more stable compared to the P/E multiple.
- Empirical evidence suggests that differences in the P/S multiple may be related to differences in long-term average returns.

Companion Variables and Modified Multiples Let us look at the equations for P/E multiple, P/B multiple, and P/S multiple.

$$P/E = \frac{(1-b)}{r - \text{ROE} \times b} = \frac{(1-b)}{r-g} \tag{5.5}$$

$$P/B = \frac{\text{ROE}\,(1-b)}{(r-g)} \tag{5.6}$$

$$P/S = \frac{\text{NPM}\,(1+g)\,(1-b)}{r-g} \tag{5.7}$$

Looking at these equations, we find that there is one variable that dominates when it comes to explaining each multiple – it is g for P/E, ROE for P/B and NPM for P/S. This variable – the dominant explanatory variable – is called the companion variable.

Taking into account the importance of the companion variable, investment practitioners often use modified multiples which are defined below.

- P/E to growth multiple, referred to as PEG : $\dfrac{P/E}{g}$
- P/B to ROE multiple, referred to as value ratio : $\dfrac{P/B}{\text{ROE}}$

- P/S to NPM multiple, referred to as PSM : $\dfrac{P/S}{\text{NPM}}$

Among these modified multiples, the PEG multiple is a favourite multiple of financial analysts. Prima facie, a PEG multiple of less than 1 suggests that the stock is undervalued and a PEG multiple of more than 1 suggests that the stock is overvalued.

5.3 ENTERPRISE VALUATION MULTIPLES

While equity multiples focus on the value of equity, enterprise value multiples focus on the value of the enterprise (firm). The enterprise value is usually related to some measure of earnings, assets, or sales. The commonly used enterprise value multiples are:

- EV/EBITDA multiple
- EV/EBIT multiple
- EV/FCFF multiple
- EV/BV multiple
- EV/Sales multiple

EV to EBITDA Multiple

A widely used multiple in company valuation, the EV-EBITDA multiple is defined as:

$$\frac{\text{Enterprise value (EV)}}{\text{Earning before interst, taxes, depreciation, and amortisation (EBITDA)}}$$

EV is defined as the sum of the values of the firm's equity and interest-bearing debt. Put differently, EV is firm value (value of equity plus interest-bearing debt). The market value of equity is simply the number of outstanding equity shares times the price per share. As far as the interest-bearing debt is concerned, if it is in the form of traded debt securities, its market value can be observed. If the interest-bearing debt is in the form of loans, its market value has to be imputed. Generally, a rupee of loan is deemed to have a rupee of market value.

Fundamental Determinants From a fundamental point of view,

$$\frac{\text{EV}_0}{\text{EBITDA}_1} = \frac{\text{ROIC} - g}{\text{ROIC} \times (\text{WACC} - g)} \times (1 - \text{DA})(1 - t) \tag{5.8}$$

where ROIC is the return on invested capital, g is the growth rate, DA is the depreciation and amortisation charges as a percent of EBITDA, t is the tax rate, and WACC is the weighted average cost of capital.

Example Zenith Company's ROIC is 18 percent and its g is 12 percent. Zenith's DA is 10 percent and its tax rate is 30 percent. Zenith's WACC is 14 percent. From a fundamental point of view, Zenith's

$$\frac{\text{EV}}{\text{EBITDA}} = \frac{0.18 - 0.12}{0.18 \times (0.14 - 0.12)} \times (1 - 0.1)(1 - 0.3) = 10.50$$

Analysts often consider EBITDA as a crude proxy for FCFF. EBITDA, however, is not the same as the free cash flow to firm. It is instructive to compare the two:

$$\begin{aligned} \text{FCFF} = {} & \text{EBIT } (1 - \text{T}) + \text{Depreciation and amortization} \\ & - \text{Capital expenditure (CAPEX)} - \text{Change in net working capital (NWC)} \end{aligned}$$

$$\text{EBITDA} = \text{EBIT} + \text{Depreciation and amortization}$$

So,

$$\text{FCFF} = \text{EBITDA} - \text{T} \times \text{EBIT} - \text{CAPEX} - \text{NWC}$$

From the above, it is clear that FCFF tends to be more volatile. This is so because FCFF takes into account new outlays on capital equipment (CAPEX) and net working capital (NWC), which are subject to variation – they rise in good times and contract in bad times. Thus, in years when large investments are made, EBITDA significantly exceeds FCFF.

Although EBITDA is a very unreliable proxy for FCFF, EBITDA multiples are more commonly used. Why? These are several possible reasons. First, EBITDA provides a fairly good measure of pre-tax cash flows produced by the existing assets of the firm. So, when most of the value of the firm comes from existing assets (as in the case of stable, mature businesses), EBITDA multiples make a lot of sense. Second, EBITDA is much more stable compared to FCFF – the latter apart from being highly volatile, is also likely to be negative when the firm is growing rapidly.

EV/EBIT Multiple

EV/EBIT ratio is defined as:

$$\frac{\text{Enterprise value (EV)}}{\text{Earnings before interest and taxes (EBIT)}}$$

Earnings before interest and taxes is earnings from operating assets, prior to taxes.

A variant of this ratio is:

$$\frac{\text{EV}}{\text{EBIT}(1 - \text{Tax})} \tag{5.9}$$

The denominator of this multiple is operating income after tax or net operating income after tax (NOPAT)

Fundamental Determinants From a fundamental point of view,

$$\frac{EV_0}{EBIT_1} = \frac{(1-t)\,(1-\text{Reinvestment rate})}{\text{WACC}-g}$$

where t is the tax rate, WACC is the weighted average cost of capital, and g is the growth rate.

Example Kiturt Company has a tax rate of 30 percent and a reinvestment rate of 80 percent. Kiturt's WACC is 14 percent and growth rate is 11 percent. From a fundamental point of view, Kiturt's

$$\frac{EV_0}{EBIT_1} = \frac{(1-0.3)\,(1-0.8)}{0.14-0.11} = 4.67$$

EV/FCFF Multiple

EV/FCFF multiple is defined as:

$$\frac{\text{Enterprise value (EV)}}{\text{Free cash flow to firm (FCFF)}}$$

Fundamental Determinants From a fundamental point of view

$$\frac{EV_0}{FCFF_1} = \frac{1}{\text{WACC}-g} \tag{5.10}$$

where WACC is the weighted average cost of capital and g is the growth rate.

Example Montech Limited's WACC is 15 percent and its g is 12 percent. From a fundamental point of view, Montech's

$$\frac{EV_0}{FCFF_1} = \frac{1}{0.15-0.12} = 33.3$$

EV/BV Multiple

EV/BV multiple is defined as:

$$\frac{\text{Enterprise value (EV)}}{\text{Book value of assets (BV)}}$$

Fundamental Determinants From a fundamental point of view,

$$\frac{EV_0}{BV_0} = \frac{\text{ROIC}-g}{\text{WACC}-g} \tag{5.11}$$

where ROIC is the return on invested capital, g is the growth rate, and WACC is the weighted average cost of capital.

Example Felix Company has an ROIC of 15 percent, g of 10 percent, and WACC of 12 percent. From a fundamental point of view Felix's:

$$\frac{EV_0}{BV_0} = \frac{0.15 - 0.10}{0.12 - 0.10} = 2.5$$

EV/Sales Multiple

EV/Sales multiple is defined as

$$\frac{\text{Enterprise value(EV)}}{\text{Sales}}$$

Fundamental Determinants From a fundamental point of view,

$$\frac{EV_0}{S_0} = \frac{\text{After tax operating margin } (1+g)\,(1-\text{Reinvestment rate})}{WACC - g} \tag{5.12}$$

where g is the growth rate and WACC is the weighted average cost of capital.

Example Moderna Limited's after-tax operating margin is 12 percent and growth rate is 11 percent. Its reinvestment rate is 70 percent and its WACC is 13 percent. From a fundamental point of view, Moderna's

$$\frac{EV_0}{S_0} = \frac{0.12\,(1.11)\,(1-0.7)}{0.13-0.11} = 2.00$$

Operational Multiples

An operational multiple expresses the enterprise value (EV) in relation to a specific operational variable, which is usually a key driver of revenue or cash flow. Some examples of operational multiples from different industries are shown below:

Industry	*Operational Multiple*
Energy	EV/KWH production capacity
Hotel	EV/Number of rooms
Media	EV/Number of subscribers
Telecommunications	EV/Number of subscribers
E-commerce	EV/Number of members

From a fundamental point of view, the general formula for an operational multiple is:

$$\frac{\text{EV}}{\text{Unit}} = \frac{\text{ROIC} - g}{\text{ROIC} \times (\text{WACC} - g)} \times \frac{\text{NOPLAT}}{\text{Unit}} \tag{5.13}$$

where ROIC is the return on invested capital, g is the growth rate, WACC is the weighted average cost of capital, NOPLAT is the net operating profit less adjusted taxes, and unit is the measure of the operational variable.

Operational multiples can be used to get an early indication of key business elements or to evaluate the potential outcome of a strategy. For example, the number of members of an E-commerce portal may provide some clue regarding future revenues and cash flows.

However, operational multiples may not provide enough information to appropriately assess the value of a company. Differences in strategy, business model, pricing, cost structure, and other factors may lead to large differences in multiples for different companies within the same industry.

5.4 CHOICE OF MULTIPLE

Since different multiples produce different values, the choice of multiple can make a big difference to your value estimate. Which multiple should you use? As Aswath Damodaran argues, you can adopt the multiple that reflects your bias (the cynical view), or use all the multiples (the bludgeon view), or pick the "best" multiple.

The Cynical View You can choose a multiple that serves a preconceived notion. If you want to sell (buy) a business, choose the multiple that gives the highest (lowest) value. While this may appear like manipulation and not analysis, it seems to be a fairly common practice.

Even if you do not have such perverse intentions, you should learn how to guard yourself against its consequences. First, if you delegate the task of valuation to an analyst, who will have a natural tendency to follow his biases, you should approve what the multiple and the comparable firms should be. Second, when you examine a relative valuation report, ask what would be the value, if some other multiple or different comparables were used.

The Bludgeon View You can value a company using a number of multiples and then arrive at a final recommendation. There are three ways of doing this. First, you can arrive at a range of values, generated by the various multiples. The problem here is that the range is likely to be too wide to be useful for decision making. Second, you can calculate a simple average of the various values thrown up by the different multiples. The advantage of this approach is its simplicity. However, it assigns equal weight to the values from each multiple, even though some multiples may be more appropriate than others. Third, you can calculate a weighted average—the weight assigned to each value reflecting its relative precision.

The Best Multiple Although you may not like to discard any information, the best estimate of value is perhaps obtained by using the one multiple that is most appropriate for the firm being valued.

There are three ways to find the best multiple. The **fundamental approach** suggests that we should use the variable that has the highest correlation with the firm's value. For example, there is a high degree of correlation between current earnings and value in consumer product companies, but not in cyclical companies. So, price-earnings multiples are suited for the former, but not the latter.

The **statistical approach** calls for regressing each multiple against the fundamentals that theoretically affect the value and using the multiple with the highest R-squared.

The **conventional approach** involves using the multiple that has become the most commonly used one for a specific situation or sector. Here are some suggestions in this regard:

- The P/E multiple is more appropriate for firms that have (a) a proven track record of positive earnings, and (b) no significant non cash expenses.
- The PEG multiple is more suitable for firms that have stable EPS growth rates and risk characteristics.
- The P/B multiple is more appropriate for firms whose balance sheets reflect reasonably well the market value of their assets. Examples: banks and financial institutions.
- The EV/EBITDA multiple is more suitable for firms that have substantial noncash expenses (depreciation and amortisation). Examples: capital intensive firms like airliners, telecom operators, refineries.
- The EV/FCFF multiple is more appropriate for firms that have stable growth and predictable capital expenditures.
- The EV/sales multiple makes sense for young firms that have not yet established positive earnings.

5.5 BEST PRACTICES USING MULTIPLES

A judicious use of multiples can provide valuable insights, whereas an unthinking application of multiples can result in confusion and distortion. Bear in mind the following best practices with respect to multiples:

- Define multiples consistently.
- Choose comparables with similar profitability and growth prospects.
- Identify the fundamental determinants.
- Use multiples that use forward-looking estimates.
- Prefer enterprise-value multiples.

Define Multiples Consistently Make sure that the multiple is defined consistently and measured uniformly across the firms being compared.

Choose Comparables with Similar Growth and Profitability Prospects The key drivers of valuation multiples are growth and profitability prospects. So, as far as possible, the comparables, whose multiples are used as benchmarks, must have growth and profitability prospects that are similar to the target firm (the firm that is being valued). Of course, since it is not possible to find truly comparable firms, you will have to adjust for differences between firms on fundamental characteristics.

Identify the Fundamental Determinants You should identify the fundamental determinants that determine each multiple and how variations in these fundamentals bear on the value of the multiple.

Use Multiples that Use Forward Looking Estimates Multiples should be based on projected, not historical, profits or cash flows. Since a company's value is equal to the present value of its future cash flow, forward-looking multiples are consistent with the theory of valuation. Empirical evidence, too, suggests that forward-looking multiples are better predictors of value.

Prefer Enterprise-Value Multiples The price-earnings multiple, despite its popularity, has two major shortcomings: (a) The price-earnings multiple is affected by capital structure. (b) The net profit figure (which determines the EPS) is calculated after non-operating gains and losses. Thus, a non operating gain, arising out of sale of assets can significantly increase earnings (without much effect on value), causing the price-earnings multiple to be artificially low.

Given the limitations of the price earnings ratio, it makes more sense to use the enterprise value-EBITDA ratio. This ratio is less amenable to manipulation by changes in capital structure because enterprise value includes both equity and debt and EBIDTA is the profit available to all investors.

5.6 ASSESSMENT OF RELATIVE VALUATION

In theory, discounted cash flow valuation is emphasised, but in practice most assets are valued on a relative basis. Wit the following:

- Investment rules of thumb are typically stated in terms of multiples. For example, a stock is considered cheap if its price-earnings multiple is less than the expected growth rate in earnings per share or if its price-book multiple is less than 1.
- Equity research reports are generally based on multiples like enterprise value-to-EBITDA multiple, price-earnings multiple, price-book multiple, and price-sales multiple. Even when discounted cash flow analysis is included, the recommendations are usually based on valuation multiples.

- While discounted cash flow valuation is commonly done as part of acquisition analysis, the value paid is usually determined or justified in terms of some multiple(s).

Why Is Relative Valuation so Popular

Despite the convincing logic underlying the DCF approach to valuation, why are earnings multiples commonly used in equity research reports and investment banking pitches? Multiples serve as a convenient shorthand for communication and provide a useful check for valuation.

A DCF valuation requires projections about ROIC, growth, and free cash flow. Since predicting the future is a difficult task requiring subjective forecasts, analysts find it convenient to use earnings multiples. If the expected ROIC, growth, and risk are similar for a given set of companies, they should command similar multiples. So, if an analyst does not have much information about a company's expected performance, he will probably assume that its performance will be similar to its peers and value it by applying their average multiple to its earnings.

Naively using the industry average multiple, however, can be misleading. Companies differ in terms of their growth prospects, profitability, risk, capital structure, accounting policies, and corporate governance standard factors which cause differences in multiples. If an analyst considers all these factors in establishing an appropriate multiple, he may have to put a great deal of effort. He may as well develop a good set of cash flow forecasts.

Multiples can, however, serve as a convenient shorthand for communication, particularly for informed investors. Relative valuation is easier to sell as well as defend. Discounted cash flow analysis may be difficult to explain, particularly when the sales pitch is short. While an analyst may do DCF valuation, he may prefer to communicate his findings in terms of imputed multiples. For example, he might argue, "Company A deserves a higher multiple than company B, thanks to its superior growth prospects, higher profit margins, and lower risk." Multiples can also be used as a sanity check. You can compare a company's implied multiple with its peers and see if you can explain the difference in terms of fundamental factors (profitability, growth, and risk).

The primary advantage of the relative valuation method is that it employs market-based values and is not driven by assumptions like the discounted cash flow method. For this reason, this method is popularly used in so-called "fairness opinions" which investment bankers may be asked to give for seeking shareholder approval of an acquisition. As it is generally viewed as more objective than alternative methods, the relative valuation method also is used commonly in legal cases.

Weaknesses of Relative Valuation

Notwithstanding its popularity, relative valuation suffers from certain weaknesses.

- As the underlying assumptions of relative valuation are not explicitly defined, it provides the analyst greater scope for manipulation. The analyst may be able to justify his valuation, however biased it may be, by choosing an appropriate multiple(s) and a comparable firm(s). While the potential for subjective bias exists with the DCF approach as well, the analyst there has to be much more explicit about his assumptions and has lesser scope to hide his biases in unstated assumptions.
- The multiples used in the relative valuation approach reflect the valuation errors (over-valuation or under-valuation) of the market. Thus, if software companies in general are over-valued applying the average price-earnings multiple of listed software companies to determine the value of an unlisted company may lead to over-valuation. In contrast, the DCF approach is grounded on firm-specific cash flows and growth rates and hence is likely to be less affected by market valuation errors.

Reconciling Relative and DCF Valuation

Discounted cash flow valuation and relative valuation generally produce different estimates of value for the same firm. It is quite possible that one approach concludes that the stock is over-valued while the other suggests that it is under-valued. Further, even within relative valuation, you can obtain different estimates of value, depending on which multiple you use and which firms you use as comparison firms.

Why do the two valuation methods produce different value estimates? The main reason is that they are based on different views of market efficiency (or inefficiency). Discounted cash flow valuation assumes that the markets make mistakes (which may apply to the entire market or parts thereof), but correct these mistakes over time. Relative valuation assumes that on average the markets are correct, although they may make mistakes on individual stocks. For example, when you value a new power company relative to other power companies you assume that on average the market has priced these companies correctly, ever though it may have mispriced them individually. Thus, a stock may be undervalued on a discounted cash flow basis but overvalued on a relative basis, if the comparison firms are all underpriced in the market. The opposite would happen if an entire sector or market were overpriced.

5.7 MARKET TRANSACTION METHOD

A variant of the market comparable method, the market transaction method employs transaction multiples in lieu of trading multiples. As the name suggests, transaction multiples are the multiples implicit in recent acquisitions/disposals of similar companies.

The primary advantage of this method is that the transaction multiples are based on negotiation between more informed buyers and sellers and hence are less likely to be affected by market inefficiencies. However, its limitations are that the characteristics of recently transacted companies and the conditions under which they may have been transacted are likely to be very different. Further, the requisite information relating to transactions, particularly when unlisted companies are involved, may not be available.

While using transaction multiples, the following factors should be considered: nature of transaction (friendly or hostile), the prevailing market sentiment at the time of transaction, form of compensation (stock or cash), contingent payments (if any), and so on.

SUMMARY

- In relative valuation, an asset is valued on the basis of how similar assets are currently priced in the market.
- The relative valuation of a company involves the following steps: (i) analyse the subject company, (ii) select comparable companies, (iii) choose the valuation multiple (s), (iv) calculate the valuation multiple(s) for the comparable companies, and (v) value the subject company.
- The commonly used equity valuation multiples are: price-to-earnings multiple, price-to-book value multiple, and price –to-sales multiple.
- The commonly used enterprise valuation (EV) multiples are: EV-FCFF-ratio, EV-EBITDA multiple, EV-book value multiple, and EV-sales multiple..
- Since different multiples produce different values, the choice of multiple can make a big difference to your value estimate.
- In choosing the multiple the analyst can adopt the multiple that reflects his bias (the cynical view), or use all the multiples (the bludgeon view), or pick the "best" multiple.
- There are three ways to find the best multiple. The fundamental approach suggests that we should use the variable that has the highest correlation with the firms value. The statistical approach calls for regressing each multiple against the fundamentals that theoretically affect the value and using the multiple with the highest R-squared. The conventional approach involves using the multiple that has become the most commonly used one for a specific situation or sector.
- The following are the best practices with respect to multiples: (a) choose comparables with similar profitability and growth prospects. (b) use multiples that use forward-looking estimates, (c) prefer enterprise-value multiples.
- Relative valuation seems to be more popular compared to DCF valuation because (a) it relies on multiples that are easy to relate to and easy to obtain, and (b) it is easier to sell as well as defend.
- Notwithstanding its popularity, relative valuation suffers from certain weakness: (a) it provides the analyst greater scope for valuation; (b) the multiples used in relative valuation reflect the valuation errors (overvaluation or undervaluation of the market).

Questions

1. Discuss the steps involved in relative valuation.
2. Discuss the following equity valuation multiples: price-to-earnings multiple, price-to-book value multiple, and price-to-sales multiple.
3. Discuss the following enterprise valuation (EV) multiples: EV-FCFF multiple, EV-EBITDA multiple, EV-book value multiple, and EV-sales multiple.
4. What ratios are commonly used for various situations or sectors?
5. What are the best practices with respect to multiples?
6. Why is relative valuation so popular? What are weakness of relative valuation?

SOLVED PROBLEMS

1. The following information is available for Gamma Company:

ROE = 20 percent
Cost of equity = 15 percent
Dividend payout ratio = 0.4
Book value per share = 50
Net profit margin = 10 percent

Calculate the following for Gamma Company.

(a) P_0/E_1
(b) P_0/B_0
(c) P_0/S_0
(d) PEG
(e) Value ratio

Solution

(a) $$P_0/E_1 = \frac{(1-b)}{r - \text{ROE} \times b} = \frac{0.4}{0.15 - 0.20 \times 0.6} = 13.33$$

(b) $$P_0/B_0 = \frac{\text{ROE}\,(1-b)}{r-g} = \frac{0.20(.4)}{0.15-0.12} = 2.67$$

(c) $$P_0/S_0 = \frac{\text{NPM}\,(1+g)\,(1-b)}{r-g} = \frac{0.10\,(1.12)\,(0.4)}{0.15-0.12} = 1.49$$

(d) $\text{PEG} = \dfrac{P/E}{g} = \dfrac{13.33}{12.00} = 1.11$

(e) $\text{Value ratio} = \dfrac{P_0/B_0}{\text{ROE}} = \dfrac{2.67}{0.20} = 13.33$

2. Pioneer Limited's ROIC is 16 percent and its g is 10 percent. Pioneer's DA is 8 percent and its tax rate is 30 percent. Pioneer's WACC is 13 percent and its EBITDA is 300 million. What is Pioneer's EV?

Solution

Pioneer's EV/EBITDA is :

$$\frac{\text{EV}}{\text{EBITDA}} = \frac{\text{ROIC} - g}{\text{ROIC} \times (\text{WACC} - g)} \times (1 - \text{DA})\,(1 - t)$$

$$= \frac{0.16 - 0.10}{0.16 \times (0.13 - 0.10)} \times (1 - 0.08)\,(1 - 0.3)$$

$$= 8.05$$

Since EBITDA is 300 million,

Pioneer's EV is :

$$\text{EV} = 300 \times 8.05 = 2{,}415 \text{ million}$$

Problems

1. Vidyut Company's ROE is 20 percent and its r is 16 percent. Vidyut's dividend payout ratio is 0.3. What is Vidyut's P/E multiple from a fundamental point of view?
2. Delta Corporation's ROE is 16 percent and its r is 14 percent. Delta's dividend payout multiple is 0.25 and its g is 12 percent. What is Delta's P/B multiple from a fundamental point of view?
3. White Limited has a NPM of 7 percent and a growth rate of 11 percent. White's dividend payout ratio is 0.4 and its r is 0.15. From a fundamental point what is White's PS multiple?
4. Avinash Limited's ROE is 24 percent and its r is 18 percent. Avinash's dividend payout ratio is 0.3. What is Avinash's PEG multiple?
5. Cheran Corporation's ROE is 15 percent and its r is 16 percent. Cheran's dividend payout ratio is 0.8 and its g is 3 percent. What is Cheran's value ratio?

6. MTM Limited has a NPM of 8 percent, and a growth rate of 12 percent. MTM's dividend payout multiple is 0.35 and its *r* is 16 percent. What is MTM's PS to NPM multiple?
7. Solitaire Company's ROIC is 20 percent and its *g* is 12 percent. Solitaire's DA is 8 percent and its tax rate is 25 percent. What is Solitaire's EV/EBITDA multiple? The WACC is 13%.
8. Muthot Company has a tax rate of 30 percent and a reinvestment rate of 70 percent. Muthot's WACC is 12 percent and growth rate is 10 percent. What is Muthot's EV/EBIT multiple?
9. Samtel Limited's WACC is 14 percent and its *g* is 10 percent. What is Samtel's EV/FCFF multiple?
10. Micron Company has an ROIC of 20 percent, *g* of 12 percent, and WACC of 15 percent. What is Macron's EV/BV multiple?
11. VSK Limited's after-tax operating margin is 10 percent and growth rate is 12 percent. Its reinvestment rate is 60 percent and its WACC is 14 percent. What is VSK's EV/Sales multiple?

MINICASE

Sundaram Paints is a large privately held decorative paints company which has been in existence for nearly three decades. Founded by Shankar Sundaram, it is presently managed by Ravi Sundaram, the only son of the founder. Ravi Sundaram wants to expand the business and take it global. For this the firm needs access to the capital market. So, Ravi has engaged the services of Integral Capital Services, a merchant banking firm.

Praveen Chopra, the CEO of Integral Capital Services, has entrusted you with the task of doing a preliminary valuation of Sundaram Paints. You have asked your analyst Pawan Kumar to gather relevant financial information on International Paints Company, Elegant Paints Limited, and Modern Paints Corporation (the three largest listed companies in the decorative paints industry) as well as on Sundaram Paints Limited.

Pawan Kumar assembled the following information.

Financial Information (in million)	*International*	*Elegant*	*Modern*	*Sundaram*
Revenues	19600	15400	12750	10800
EBITDA	2840	2520	1675	1890
PAT	1588	1098	791	886
Shareholders' Funds	8750	7540	6260	4820
Loan Funds	5060	5150	4500	2880
Total Assets	13810	12690	10760	7700

Net Profit Margin	8.1%	7.1%	6.2%	8.2%
Debt-equity Ratio	57.8%	68.3%	71.9%	59.8%
Paid-up Equity Capital (Par value per share in all cases is 10)	2400	2000	1800	1440
Expected EPS growth (5 years)	14.0%	12.0%	10.2%	15.0%
Market price per share	96.8	68.4	43.2	
Beta	1.10	1.20	1.28	

Assume that the market value of debt is the same as its book value.

(a) What is the Enterprise value/EBITDA of International, Elegant, and Modern?

(b) What is the retrospective and prospective P/E ratio for International, Elegant, and Modern?

(c) What factors do you think explain the differences in the valuation ratios of the three firms?

(d) What will be your recommendation for the issue price if Sundaram Paint wants to raise 250 million by way of an IPO? Why?

APPENDIX 5A

FUNDAMENTAL DETERMINANTS OF VALUATION MULTIPLES

In Chapter 5 several equations were given showing the fundamental determinants of various valuation multiple. This appendix discusses the derivation of these equations:

P/E Multiple

The determinants of the P/E multiple can be derived from the constant growth dividend discount model.

$$P_0 = \frac{D_1}{r - g} \tag{5A.1}$$

where P_0 is the current market price share, D_1 is the dividend per share expected a year hence, r is the rate of return required by equity shareholders, and g is the dividend growth rate.

D_1 can be expressed as the product of E_1 (earnings per share) and (1 – b), the payout ratio, g can be expressed as the product of ROE (return on equity) and b (ploughback ratio). Effecting these substitutions in Equation (5A.1) we get:

$$P_0 = \frac{E_1(1-b)}{r - \text{ROE} \times b} \tag{5A.2}$$

Dividing both the sides of Equation (5A.2) by E_1, we get:

$$P_0 / E_1 = \frac{(1-b)}{r - \text{ROE} \times b} \tag{5A.3}$$

Thus, the determinants of the price-earnings multiple are:

- The dividend payout ratio ,$(1 - b)$
- The required rate of return, r
- Return on equity, ROE
- Ploughback ratio, b

P/B Multiple

To understand the determinants of the P/B multiple, let us start with the constant growth dividend discount model:

$$P_0 = \frac{D_1}{r - g} \tag{5A.4}$$

D_1, the dividend for the next period, may be stated in terms of this period's earnings per share, E_0, growth rate, g, and the dividend payout multiple, $(1 - b)$, as follows:

$$\begin{aligned} D_1 &= E_1(1-b) \\ &= E_0(1+g)\,(1-b) \end{aligned}$$

Substituting this in Eq. (5A.4) gives:

$$P_0 = \frac{E_0(1+g)(1-b)}{r - g} \tag{5A.5}$$

Since E_1 is the product of book value per share (BV_0) and return on equity (ROE), Eq. (5A.5) can be rewritten as:

$$P_0 = \frac{BV_0(\text{ROE})(1-b)}{r - g} \tag{5A.6}$$

Dividing both sides of Eq. (5A.6) by BV_0 results in:

$$P/B \text{ multiple} = \frac{P_0}{BV_0} = \frac{\text{ROE}\,(1-b)}{r - g} \tag{5A.7}$$

The numerator of Eq.(5A.7) shows that, other things being equal, a higher ROE increases the P/B multiple. The denominator of Eq. (5A.7) shows that a higher ROE increases the P/B multiple indirectly as well because g = (Retention multiple) (ROE) = (b) (ROE).

P/S Multiple

To understand the determinants of the P/S multiple, let us start with Eq. (5A.7)

$$P_0 = \frac{E_0\,(1+g)\,(1-b)}{r-g} \tag{5A.8}$$

Since E_0 (earnings per share) is equal to sales per share (S_0) times net profit margin (NPM), Eq. (5A.8) can be written as:

$$P_0 = \frac{S_0\,(\text{NPM})\,(1+g)\,(1-b)}{r-g} \tag{5A.9}$$

Dividing both sides of Eq. (5A.9) by S_0 results in:

$$\text{P/S Multiple} = \frac{P_0}{S_0} = \frac{\text{NPM}\,(1+g)\,(1-b)}{r-g} \tag{5A.9a}$$

EV/EBITDA Multiple

As per Eq 4A.4 given in Appendix 4A:

$$V_0 = \text{IC}_0 \times \frac{\text{ROIC}-g}{\text{WACC}-g} \tag{5A.10}$$

where V_0 is the enterprise value (EV), IC_0 is the invested capital, ROIC is the return on invested capital, g is the growth rate, and WACC is the weighted average cost of capital.

Dividing both the sides of Eq. (5.10) by EBITDA, we get:

$$\frac{\text{EV}_0}{\text{EBITDA}_1} = \frac{\text{IC}_0}{\text{EBITDA}_1} \times \frac{\text{ROIC}-g}{\text{WACC}-g} \tag{5A.11}$$

By definition:

$$\text{NOPLAT} = \text{EBITDA}\,(1-\text{DA})\,(1-t) \tag{5A.12}$$

where NOPLAT is net operating profit less adjusted taxes, EBITDA is earnings before interest, taxes, depreciation, and amortisation, DA is the depreciation and amortisation expense as a percent of EBITDA, and t is the tax rate.

So,

$$\text{EBITDA}_1 = \text{NOPLAT}_1/(1-\text{DA})\,(1-t) \tag{5A.13}$$

Substituting this in the R.H.S. of Eq.(5A.13), we get:

$$\frac{EV_0}{EBITDA_1} = \frac{IC_0}{NOPLAT/(1-DA)(1-t)} \times \frac{ROIC - g}{WACC - g} \tag{5A.14}$$

Since ROIC is NOPLAT/ IC_0, Eq(5A.14) can be rewritten as:

$$\frac{EV_0}{EBITDA_1} = \frac{ROIC - g}{ROIC \times (WACC - g)} \times (1-t) \times (1-DA) \tag{5A.15}$$

EV/EBIT Multiple

To derive the determinants of EV/EBIT multiple, begin with the stable growth firm valuation model.

$$EV_0 = \frac{FCFF_1}{WACC - g} \tag{5A.16}$$

where EV_0 is the enterprise value now, $FCFF_1$ is the free cash flow to firm in year 1, WACC is the weighted average cost of capital, and g is the growth rate.

$FCFF_1$ is equal to: $EBIT_1$ (1 – t) (1 – Reinvestment rate)

So,

$$EV_0 = EBIT_1 \frac{(1-t)(1-\text{Reinvestment rate})}{WACC - g} \tag{5A.17}$$

This leads to:

$$\frac{EV_0}{EBIT_1} = \frac{(1-t)(1-\text{Reinvestment rate})}{WACC - g} \tag{5A.18}$$

EV/FCFF Multiple

To derive the determinants of EV/FCFF multiple, we begin with the stable growth firm valuation model:

$$EV_0 = \frac{FCFF_1}{WACC - g} \tag{5A.19}$$

where WACC is the weighted average cost of capital and g the growth rate.

Dividing both the sides of this equation with $FCFF_1$, we get:

$$\frac{EV_0}{FCFF_1} = \frac{1}{WACC - g} \tag{5A.20}$$

EV/BV Multiple

To derive the determinants of EV/BV multiple, we begin with:

$$EV_0 = \frac{EBIT_1(1-t)(1-\text{Reinvestment rate})}{WACC-g} \tag{5A.21}$$

where EBIT is earnings before interest and taxes, t is the tax rate, WACC is the weighted average cost of capital, and g is the growth rate.

Dividing both sides of this equation by the beginning book value of capital (BV_0), gives:

$$\frac{EV_0}{BV_0} = \frac{\frac{EBIT_1(1-t)}{BV_0}(1-\text{Reinvestment rate})}{WACC-g} \tag{5A.22}$$

Recall that:

$$\frac{EBIT_1(1-t)}{BV_0} = ROIC$$

and

$$\text{Reinvestment rate} = \frac{g}{ROIC}$$

So,

$$\frac{EV_0}{BV_0} = \frac{ROIC\left(1-\frac{g}{ROIC}\right)}{WACC-g}$$

$$= \frac{ROIC-g}{WACC-g} \tag{5A.23}$$

EV/Sales Multiple

To derive the determinants of EV/Sales multiple, we begin with the stable growth firm valuation model:

$$EV_0 = \frac{FCFF_1}{WACC-g} \tag{5A.24}$$

where EV_0 is the enterprise value now, $FCFF_1$ is the free cash flow to firm for year 1, WACC is the weighted average cost of capital, and g is the growth rate.

Since $FCFF_1$ is equal to $EBIT_1$ $(1 - t)$ (1 – Reinvestment rate), the above equation can be rewritten as:

$$EV_0 = \frac{EBIT_0\,(1+g)\,(1-t)\,(1-\text{Reinvestment rate})}{WACC - g} \tag{5A.25}$$

Dividing both sides of this equation with current sales (S_0), gives:

$$\frac{EV_0}{S_0} = \frac{\dfrac{EBIT_0}{S_0}\,(1+g)\,(1-t)\,(1-\text{Reinvestment rate})}{WACC - g} \tag{5A.26}$$

$$= \frac{\text{After}-\text{tax operating margin}\,(1+g)\,(1-\text{Reinvestment rate})}{WACC - g}$$

APPENDIX 5B

SUMMARY OF THE STEPS IN THE RELATIVE VALUATION METHOD

1. Determine the criteria for selecting comparable publicly traded companies.
2. Identify the companies that meet the criteria.
3. Decide on the relevant time period for comparative analysis.
4. Obtain the financial statements for the subject company and comparable publicly limited companies for the time period decided in Step 3, and make appropriate adjustments to the same.
5. Compile the relevant financial ratios for the subject and comparable companies.
6. Decide the value multiples to be used.
7. Obtain the market price for the equity stock for each comparable company as of the valuation date. If the enterprise valuation multiples are used, obtain the market value of all securities included in the invested capital.
8. Compile the value multiple tables for all the comparable companies.
9. Analyse the value multiples of the comparable companies in conjunction with the comparative financial analysis of the subject company and comparable companies and decide on the appropriate value of the multiples to be used for the subject company.
10. Calculate the indicative value of the subject company according to each value multiple, by multiplying the appropriate value of the multiple with the relevant financial variable for the subject company.
11. Obtain a weighted average of the indicative values determined in Step 10 to get an estimate of "value as if publicly traded" (a marketable, minority ownership interest value).
12. Adjust this value, if appropriate, for factors not reflected in the value as if publicly traded, such as premium for control or discount for lack of marketability.

CHAPTER 6

Other Non-DCF Approaches

The DCF approach and the relative valuation approach are the primary approaches used in corporate valuation. However, given the complexity and uncertainty characterising valuation, practitioners rely on some other approaches as well. Notable among them are the book value approach, the stock and debt approach, the contingent claim approach, and the strategic approach.

The book value approach relies on the information found on the balance sheet, typically adjusted to reflect replacement cost. The stock and debt approach, also called the market approach, relies on the observed market values of the investor claims on the company. The contingent claim approach, also called the option valuation approach, seeks to assess the real options enjoyed by the firm – it is typically used as a supplement to the conventional DCF approach. The strategic approach to valuation builds value in terms of three tranches viz., asset value, franchise value, and growth value, keeping in focus the strategic dimension of business.

6.1 BOOK VALUE APPROACH

The simplest approach to valuing a firm is to rely on the information found on its balance sheet. There are two equivalent ways of using the balance sheet information to appraise the value of a firm. First, the book values of investor claims may be summed directly. Second, the assets of the firm may be totaled and from this total, non-investor claims (like accounts payable and provisions) may be deducted. To illustrate this approach, let us look at an example. Exhibit 6.1 presents the balance sheet of Horizon Limited as on 31/3/20X1. From the balance sheet the value of the firm can be calculated using the investor claim approach or the asset-liabilities approach as illustrated in Exhibit 6.2.

Exhibit 6.1 ***Balance Sheet of Horizon Limited as on March 31, 20 X 1***

				in million
Liabilities		*Assets*		
Share capital	1500	Fixed assets (net)		3300
Equity	1500		Gross block	5900
Preference	–		Acc. depr'n	2600
Reserves & surplus	1120	Investments		150
Secured loans	1430			
Term loans	700	Current assets, loans,		2340
Debentures	730	and advances		
Unsecured loans	690	Cash and bank		100
Bank credit	250	Debtors		1140
Inter-corporate loans	440	Inventories		1050
Current liabilities and provisions	1050	Pre-paid exp.		050
		Miscellaneous expenditures and losses		–
	5790			5790

Exhibit 6.2 ***Balance Sheet Valuation***

			in million
Investor Claims Approach		*Asset-Liabilities Approach*	
Share capital	1500	Total assets	5790
Reserves & surplus	1120	Less: Current liabilities and provisions	1050
Secured loans	1430		
Unsecured loans	690		
	4740		4740

Some people argue that book values on a balance sheet are a more reliable estimate of value compared to values based on shaky future forecasts. Indeed, the original ideal of accounting was that the balance sheet would provide a reliable estimate of the value of the assets and equity in the firm. In a 1934 article published in *The Accounting Review,* M.B. Damels lays out this ideal as follows: "In short the lay reader of financial statements usually believes that the total asset figure of the balance sheet is indicative, and is intended to be so, of the value of the company. He probably is understanding this 'value' as what the business could be sold for, market value – the classic meeting of the minds between a willing buyer and seller."

Accountants have struggled to put this ideal into practice. They have weighed the importance that has to be assigned to the historical cost of an asset in relation to its estimated current value and arrived at certain rules. For example, fixed assets are valued at original cost less depreciation on account of use and current assets are valued at cost or realisable market value, whichever is lower. However, accountants have not figured out how to value intangible assets like brand equity and technical know-how. So, they have, by and large, chosen to ignore them.

When can the book value be a good proxy for true value? For a tangible asset, with limited or nil growth opportunities and no prospects for earning superior returns, book value is a good proxy for real value. For a firm with considerable growth opportunities and potential for earning superior returns, book value will diverge significantly from true value.

The accuracy of the book value approach depends on how well the net book values of the assets reflect their fair market values. There are three reasons why book values may diverge from market values:

- Inflation drives a wedge between the book value of an asset and its current value. The book value of an asset is its historical cost less depreciation. Hence it does not consider inflation which is definitely a factor influencing market value.
- Thanks to technological changes some assets become obsolete and worthless even before they are fully depreciated in the books.
- Organisational capital, a very valuable asset, is not shown on the balance sheet. Organisational capital is the value created by bringing together employees, customers, suppliers, and managers in a mutually beneficial and productive relationship. An important characteristic of organisational capital is that it cannot be easily separated from the firm as a going entity.

Adjusting Book Value to Reflect Replacement Cost

Though an asset's earning power may not be related to its book value, especially if the asset is old, it is likely to be related to its current replacement cost. Hence, book values may be substituted by current replacement costs. The various assets are valued as follows:

Cash Cash is cash. Hence there is no problem in valuing it. Indeed, it is gratifying to have an asset which is so simple to value.

Debtors Generally debtors are valued at their face value. If the quality of debtors is doubtful, prudence calls for making an allowance for likely bad debts.

Inventories Inventories may be classified into three categories: raw materials, work-in-process, and finished goods. Raw materials may be valued at their most recent cost of acquisition. Work-in-process may be approached from the cost point of view (cost of raw materials plus the cost of processing) or from the selling price point of view (selling price of the final product less expenses to be incurred in translating work-in-process into sales). Finished goods inventory is generally appraised by determining the sale price realisable in the ordinary course of business less expenses to be incurred in packaging, handling, transporting, selling, and collection of receivables.

Other Current Assets Other current assets like deposits, prepaid expenses, and accruals are valued at their book value.

Fixed Tangible Assets Fixed tangible assets consist mainly of land, buildings and civil works, and plant and machinery. Land is valued as if it is vacant and available for sale. Buildings and civil works may be valued at replacement cost less physical depreciation and deterioration. The value of plant and machinery may be appraised at the market price of similar (used) assets plus the cost of transportation and installation.

Non-operating Assets Assets not required for meeting the operating requirements of the business are referred to as non-operating assets. The more commonly found non-operating assets are financial securities, excess land, and infrequently used buildings. These assets are valued at their fair market value.

Adjusted Book Value Approach: An Illustration

In October 1999, the market price of the equity of Reliance Industries Limited (RIL) was hovering around 400 per share. At that time the paid-up equity capital of RIL was about 1000 crore, 100 crore shares of 10 each. Anil Ambani issued a public statement that the market was significantly undervaluing the RIL share. He argued that the intrinsic value per share of RIL was about 650 per share. He arrived at this number as follows:

• Replacement cost of RIL's plants	40,000 crore
• Value of RIL's 50 percent shareholding in Reliance Petroleum Limited	15,000 crore
• Value of RIL's shareholdings in BSES and L&T	10,000 crore
• Value of RIL's 30 percent stake in Panna, Mukti,and Tapti oil ventures	2600 crore
• Cash holdings	6,000 crore
A: Value of Assets	73,600 crore
Less: Outstanding Debt	9,000 crore
B: Net Asset Value (NAV)	64,600 crore
C: NAV Per Share (64,600/100)	646

Adjusting Book Values to Reflect Liquidation Values

The most direct approach for approximating the fair market value of the assets on the balance sheet of a firm is to find out what they would fetch if the firm were liquidated immediately. If there is an active secondary market for the assets, liquidation values equal secondary market prices. However, active secondary markets do not exist for many business assets. In such cases, the appraiser must try to estimate the hypothetical price at which the assets may be sold.

The principal weakness of the liquidation value approach is that it ignores organizational capital. Instead of valuing the firm as a going concern, it values it as a collection of assets to be sold individually. This approach makes sense only for a firm that is worth more dead than alive.

Problems with Asset-Based Valuation

Asset-based valuation basically attempts to redo the balance sheet by (a) obtaining the current market values for assets and liabilities listed on the balance sheet and (b) identifying assets and liabilities not listed on the balance sheet and imputing a market value to them.

Seemingly simple, it presents some very difficult problems:

- Assets listed on the balance sheet may not be actively traded, so market values may not be readily obtainable.
- Even if available, market values may not reflect intrinsic values due to market inefficiencies.
- The market value of an asset may not represent the value in the particular use to which the asset is put to by the firm. The current replacement cost of an asset or its selling price (liquidation value) may not reflect the value of its use in a particular going concern.
- As far as omitted assets are concerned, their identification and valuation are problematic. Omitted assets are typically intangible assets. Identifying and valuing them is problematic.
- Even if individual assets can be identified and valued, the sum of the individual values of all identified assets will probably not equal the value of the assets in totality. As Stephen Penman put it, "Assets are used jointly. Indeed, entrepreneurs create firms to combine assets in a unique way to generate value. The value of the 'synergy' asset is elusive. Determining the intrinsic value of the firm—the value of the assets combined—is the valuation issue."

The Bottom Line

The unadjusted book value approach makes sense only in rare cases, such as the appraisal of regulated industries. The adjusted book value approach—replacement cost approach or liquidation value approach—makes sense for firms which derive their value mainly from owning tangible resources. Even such situations are not common because most firms have valuable organizational capital. Thus, in most real life situations, the book value approach has limited applicability.

Fair Value Accounting

From late 1990s, accounting rule makers and regulators have been pushing for "fair value accounting." Apparently, this initiative has been inspired by the ideal that the balance sheet should provide a reliable estimate of the value of the assets and equity in the firm.

The accounting community, however, seems to be divided on the issue of fair value accounting. Proponents of fair value accounting argue that it will improve the alignment of accounting statements and value and provide useful information to financial markets.

Opponents of fair value accounting believe that it will increase the scope for accounting manipulation and financial statements would become less informative. They point toward the widespread manipulation that was prevalent in the U.S. when firms revalued their assets at fair value until 1934, before the SEC plugged this practice.

Further, they argue that the market will be ahead of corporate accounting. As Aswath Damodaran put it: "We believe that fair value accounting, at best, will provide a delayed reflection of what happens in the market. In other words, goodwill will be impaired (as it was in many technology companies in 2000 and 2001) after the market value has dropped and fair value adjustments will convey little." He added: "If in the process of marking to market, some of the raw data that is now provided to investors is replaced or held back, we will end up with accounting statements that reflect neither market value nor invested capital."

The fundamentalist, however, may have a problem with fair value accounting because they are skeptical of prices. Prices can diverge from fundamentals. Indeed, price bubbles occur in markets. The fair value gains and losses reported by Cisco Systems, Intel, and Microsoft during the fiscal years 1998–2002, as shown below, highlight the problem.

Fair Value Gains and Losses on Investments Reported by Intel, Microsoft, and Cisco Systems, Fiscal-Years 1998–2002 (in millions of dollars).

	1998	*1999*	*2000*	*2001*	*2002*
Cisco Systems	234	3,240	(3,812)	224	
Intel	545	3,188	(3,596)	(163)	(19)
Microsoft	627	1,052	(283)	(1,460)	5

Note: As the three firms had different fiscal years, the drop in the prices of their technology holdings (at about the same time) affected them in different fiscal years.

During the technology bubble, these firms held significant investments in technology companies for strategic reasons. Their investments were not trading portfolios. As required by GAAP, these investments were marked to market, leading to significant unrealised gains during the bubble followed by a decimation of asset value when the bubble burst.

As Paul A. Volcker, Chairman of the Trustees, International Accounting Standards Committee Foundation, stated:

"A fundamental conceptual issue (facing accounting standard setters) is the extent to which the standards should move away from traditional cost based accounting to marking assets and liabilities to market, euphemistically referred to as "fair value" accounting. There is without doubt considerable momentum to move toward fair value methodologies, but there are also significant questions about the practical and useful application of that approach to certain industries and firms."

'Fair value' has a ring of modernity whereas 'historical cost' suggests antiquity. 'Far value' has great appeal. After all, value is what accountants should be focused on. By contrast 'historical cost' sounds old-fashioned. As Stephen Penman put it, "Historical cost accounting (it is said) is 'accounting for the industrial age,' unsuitable for the 'information age,' and unsuitable for valuation. No wonder fair value accounting has become the vanguard of contemporary accounting policy. However, is it good accounting policy?"

Putting prices in the financial statements violates a fundamentalist principle. Beware of putting price in the calculation, when you are calculating value to challenge price. Such a practice can be dysfunctional, as was evident during the Internet bubble. As Stephen Penman put it, "Such accounting can even promote bubbles; that is, investors infer higher prices from higher reported earnings and book values, but those higher earnings and book values are due to higher prices… Such feedback loops may be quite dangerous, leading to crashes and adding to systemic risk."

The real estate bubble of the mid-2000s was a similar phenomenon when using the fair value accounting principle, the market value of mortgages and the securities that were derived from them increased. As Stephen Penman put it, "Mark-to–market accounting brought these speculative gains into accounts, increasing bank's capital ratios, encouraging more dubious lending to record even more fair value gains. Such a bubble must burst, with prices now cascading downward as the sorry aftermath tells."

While this debate continues, the accounting standards boards have adopted a number of rules for fair value accounting which essentially require more assets to be marked to market on the balance sheet.

But what happens if there is no real market? One has to rely on some model and "mark-to-model" is substituted for "mark-to-market." This can lead to potential errors. As Warren Buffett put it in his comments on the valuation of derivatives: "This substitution can bring on large-scale mischief. As a general rule, contracts involving multiple reference items and distant settlement dates increase the opportunities for counterparties to use fanciful assumptions… in the extreme case, mark-to-model degenerates into what I would call mark-to-myth." Indeed, Enron used fair-value accounting to manipulate the worth of its energy contracts.

Notwithstanding these concerns, the march toward "fair value" accounting seems unstoppable because many accountants are convinced that "fair value" numbers are up-to-date and more relevant than their static but verifiable precursors. But "fair value" accounting will also mean more volatile profits and heavy dependence on estimates for many items that do not have a ready market. It is hard to guess what will be the implications of volatility in reported profits and accounting values. In the worst scenario, it may frighten many investors away from equities.

Financial Balance Sheet

While the accounting balance sheet provides useful information about how a firm has raised capital and invested the same, it is backward looking. To get a more forward-looking picture, you can look at the financial balance sheet, as illustrated below:

A Financial Balance Sheet

Equity and Liabilities	*Assets*
• Market value of equity	• Value of assets in place
• Market value of debt	• Value of growth assets

Superficially, a financial balance sheet resembles an accounting balance sheet. However, it differs in two important ways.

- It does not classify assets on the basis of asset life or tangibility, instead it classifies them into assets in place (these represent the investments already made by the company) and growth assets (these represent the investments the company is expected to make in future).
- The values assigned to these investments are not what has already been invested, but based upon expectations for the future.

6.2 STOCK AND DEBT APPROACH

When the securities of a firm are publicly traded its value can be obtained by merely adding the market value of all its outstanding securities. This simple approach is called the **stock and debt approach** by property tax appraisers. It is also referred to as the market approach.

The valuation of Horizon Limited provides an example of stock and debt approach. On March 31, 20X1, the firm had 1.5 billion outstanding shares. At the closing price of 20 on that day, Horizon's equity had a market value of 30 billion. On March 31, 20X1 the firm also had outstanding debt with a market value of 21 billion. Adding the market value of the equity to the market value of debt gives a total firm value of 51 billion for Horizon as on March 31, 20X1.

Efficient Market Hypothesis

Since the stock and debt approach assumes market efficiency, it is worth exploring the idea of efficient market hypothesis. In the mid-1960s Eugene Fama introduced the idea of an "efficient" capital market to the literature of financial economics. Put simply the idea is that the intense competition in the capital market leads to fair pricing of debt and equity securities.

This is indeed a sweeping statement. No wonder it continues to stimulate insight and controversy even today. Benjamin Friedman refers to efficient market hypothesis as a "credo"—a statement of faith and not a scientific proposition. Warren Buffett, perhaps the most successful investor of our times, has characterised the market as "a slough of fear and greed untethered to corporate realities." For most financial economists, however, the efficient market hypothesis is a central idea of modern finance that has profound implications.

Foundations of Market Efficiency

According to Andrei Shleifer, any one of the following three conditions will lead to market efficiency: (i) investor rationality, (ii) independent deviation from rationality, and (iii) effective arbitrage.

Investor Rationality If all investors are rational, stock prices will adjust rationally to the flow of new information. Suppose Dr. Reddy's Laboratories announces an acquisition. If investors understand fully the implications of the acquisition for the value of the company and act rationally, the stock price of Dr. Reddy's Laboratories will quickly reflect this piece of information.

Independent Deviation from Rationality Suppose the announcement of acquisition by Dr. Reddy's Laboratories is not understood by most investors. As a result, some may react in an overly optimistic manner while others may react in an overly pessimistic manner. As long as the deviations from rationality are independent and uncorrelated, errors tend to cancel out and the market price will still be an unbiased estimate of intrinsic value.

Effective Arbitrage Let us assume that there are two types of market participants, viz., irrational amateurs and rational professionals. Irrational amateurs are driven by emotions. At times they become euphoric and drive down prices to unreasonably low levels.

What happens when the market is thronged by rational professionals as well? Rational professionals are supposed to value companies in a thorough and methodical fashion and evaluate evidence fairly objectively. Based on their analysis, they will take actions to exploit mispricing of securities caused by the behavioral of irrational amateurs. If they find that Tata Motors is overpriced relative to Maruti Suzuki, they will sell Tata Motors and buy Maruti Suzuki.

By simultaneously buying and selling different, but substitute, securities, they earn arbitrage profits. If the arbitrage operation of professionals counters the irrationality of amateurs, and makes the market efficient.

What is an Efficient Market

An efficient market is one in which the market price of a security is an unbiased estimate of its intrinsic value. Note that market efficiency does not imply that the market price equals intrinsic value at every point in time. All that it says is that the errors in the market prices are unbiased. This means that the price can deviate from the intrinsic value but the deviations are random and uncorrelated with any observable variable. If the deviations of market price from intrinsic value are random, it is not possible to consistently identify over or under-valued securities.

Market efficiency is defined in relation to information that is reflected in security prices. Eugene Fama suggested that it is useful to distinguish three levels of market efficiency:

Weak-form efficiency Prices reflect all information found in the record of past prices and volumes.

Semi-strong form efficiency Prices reflect not only all information found in the record of past prices and volumes but also all other publicly available information.

Strong-form efficiency Prices reflect all available information, public as well as private.

Misconceptions about the Efficient Market Hypothesis

The efficient market hypothesis has often been misunderstood. The common misconceptions about the efficient market hypothesis are stated below along with the answers meant to dispel them.

Misconception : The efficient market theory implies that the market has perfect forecasting abilities.

Answer : The efficient market theory merely implies that prices impound all available information. This does not mean that the market possesses perfect forecasting abilities.

Misconception : As prices tend to fluctuate, they would not reflect fair value.

Answer : Unless prices fluctuate, they would not reflect fair value. Since the future is uncertain, the market is continually surprised. As prices reflect these surprises they fluctuate.

Misconception : Inability of institutional portfolio managers to achieve superior investment performance implies that they lack competence.

Answer : In an efficient market, it is ordinarily not possible to achieve superior investment performance. Market efficiency exists because portfolio managers are doing their job well in a competitive setting.

Misconception : The random movement of stock prices suggests that the stock market is irrational.

Answer : Randomness and irrationality are two different matters. If investors are rational and competitive, price changes are bound to be random

Evidence in Favour of Efficient Market Hypothesis

There are three important predictions of the EMH, which are fairly supported by empirical evidence.

1. If security prices reflect all publicly available information, then even professional investors (such as mutual fund managers) cannot earn superior risk—adjusted rates of return.

   The results of empirical studies strongly support the EMH. Neither technical investors, who use mechanical trading rules, nor professional fund managers, as a group, have been able to consistently outperform a simple buy and hold strategy. (Of course, there are exceptions of extraordinary individuals like Warren Buffett and Peter Lynch.)

   Even the legendary Benjamin Graham, in an interview given shortly before his death, said: "I am no longer an advocate of elaborate techniques of security analysis in order to find superior value opportunities. This was a rewarding activity, say 40 years ago when Graham and Dodd was first published; but the situation has changed..[Today] I doubt whether such extensive efforts will generate superior selections to justify their cost…I'm on the side of the 'efficient market' school of thought."

2. Since the current stock price reflects all currently available information, price changes only in response to new information that, by definition, is unrelated to previous information (otherwise it will not be new information). Because new information cannot be predicted in advance, price changes too cannot be forecast. Hence prices behave like a random. This prediction of the EMH has also been supported by empirical evidence over time.

3. Stock prices respond immediately and unbiasedly to new information. For example, suppose that Tata Steel announces unexpectedly lower earnings and as a result the stock drops from 525 to 500. As per the EMH, the decline should occur immediatedly following the announcement. The drop should not occur gradually over several days, nor should the market "overreact" and then recover.

   A number of event studies have examined the response of stock prices to announcements regarding earnings, bonus issues, dividends, takeover bids, and so on. By and large, these studies have found that stock prices respond immediately and unbiasedly to new information.

Evidence Against Market Efficiency

While the bulk of the empirical evidence supports the EMH, a number of inefficiencies have been found. They fall into three general categories as follows:

Patterns in Stock Prices Researchers have found some seasonal patterns. One well documented anomaly is the "day of the week" effect—stock returns tend to be lower on Mondays than during the rest of the week. Another puzzling calendar anomaly is the January effect. Stock prices seem to rise more in January than in any other month of the year.

Mispricing of Securities There is empirical evidence that suggests some mispricing of securities:

- Banz and others have found that investors in small firms have earned significantly higher returns than investors in large firms, after adjustment for risk.
- A number of studies have found that value stocks (stocks with high book-value-to stock-price prices ratios and/or low price-earnings ratios) tend to outperform growth stocks (stocks with low book-value-to-stock-price ratios and/or high price-earnings ratios).

Excess Volatility in Stock Returns Robert Shiller's pioneering work sparked a debate regarding the volatility of stock prices. He has presented evidence that stock prices jump around much more than what is justified by variations in corporate dividends and cash flow. The stock market crash of October 19, 1987, when Dow Jones Industrial Average fell by 23 percent in one day, provides the most dramatic evidence in support of Shiller's hypotheses. There was obviously no new fundamental information to justify such a dramatic decline in stock prices. Hence the idea that the market prices reflects intrinsic value appears less appealing. Were the prices irrationally high before the Black Monday or irrationally low afterward?

What is My Position?

In this great debate between efficiency and inefficiency, I believe that no market is completely efficient or inefficient—it is just a matter of degree. While I welcome the opportunities that inefficiency can provide, I respect the concept of market efficiency. I agree with Howard Marks when he says, "In the end, I've come to an interesting resolution: Efficiency is not so universal that we should give up on superior performance. At the same time, efficiency is what lawyers call a 'rebuttable presumption'—something that should be presumed to be true until someone proves otherwise."

Market Inefficiency and Valuation

Although market inefficiency remains an actively researched area, its implications for valuation are limited. To be useful in practice, it is necessary to have documented and predictable inefficiencies that valuers can incorporate in their valuation analysis. For example, a valuer when he observes a stock's market price to be 100 may conclude that the true value is about 120, taking into account well known market inefficiencies. There is, however, no scientific evidence to support such adjustment. It is one thing to admit the possibility of market inefficiency, but it is another thing to agree on how the valuer can quantify the effect of inefficiency on valuation. Though the market may not be perfectly efficient, it is likely to value securities more accurately than appraisers who work with limited information and whose judgments are colored by their biases.

What is the bottom line? Although the market may not be perfectly efficient, no other pricing mechanism seems to be consistently better. As Winston Churchill once commented on democracy, "No one pretends that democracy is perfect or all wise. Indeed, it has been said that democracy is the worst form of government except all those other forms that have been tried from time to time." The same applies to markets.

The efficient market hypothesis has two important implications for appraisal practice:

- Where stock and debt approach can be employed, it will produce the most reliable estimate of value.
- The securities of the firm should be valued at the market price obtaining on the lien date (valuation date). Averaging of prices over a period of time is not correct. It reduces the accuracy of appraisal.

Indirect Applications of the Stock and Debt Approach Since the stock and debt approach can be applied directly only to companies which are traded on the market, its usefulness may seem limited. However, the stock and debt approach provides valuable inputs in other appraisal procedures. In particular, it serves as the basis for developing multiples that are used in the direct comparison approach (relative valuation approach). For example, an investment banker may use the price-earnings ratios of listed stocks and apply the same to the earnings per share of an unlisted company to set its offering price in an IPO (initial public offering). The stock and debt approach provides a useful benchmark for testing the valuation done by other methods.

6.3 STRATEGIC APPROACH TO VALUATION

The DCF approach is widely used in valuing companies because it is conceptually sound and consulting firms have developed practical methodologies for applying it. However, it suffers from certain limitations. To a great extent these limitations can be overcome by using the strategic approach to valuation along with the DCF approach to valuation.

Limitations of the DCF Approach

The DCF approach seems to suffer from three limitations.

1. First, it mixes reliable information and unreliable information in assessing the value of a company. In a typical DCF valuation, cash flows are estimated explicitly

for a period of five to ten years (the explicit forecast period). Cash flows beyond the explicit forecast period are lumped together and reflected in a "terminal value." How is the terminal value estimated? A common method is to apply a suitable price-earnings multiple to the accounting earnings of the terminal year. If the accounting earnings are projected to be 100 million and the appropriate price-earnings multiple is 12, then the terminal value is 1200 million.

How does one arrive at the appropriate price-earnings multiple? It is usually established by looking at the prevailing price-earnings multiple of publicly traded companies whose current operating characteristics are similar to those forecast for the enterprise in its terminal year. The key characteristics for selecting similar companies are profitability, riskiness, growth rates, and capital intensity.

Despite its apparent precision, this approach is highly conjectural. It is difficult to forecast the characteristics of an enterprise five to ten years in future with any degree of precision. Further, selection of comparison companies is subjective.

An alternative to the ratio valuation approach is the growing free cash perpetuity method. This method assumes that the operations of the company stabilise after the end of the terminal value. This means that profitability, growth rate, risk (and hence the cost of capital), and capital intensity are assumed to remain constant beyond the terminal year. Given these assumptions, the terminal value is equal to:

$$\text{Terminal value} = \frac{\text{Free cash flow in the first post terminal year}}{\text{Cost of capital} - \text{Growth rate}}$$

Thus, according to this method the valuation factor applied to the free cash flow in the first post-terminal year is $1/(r - g)$, where r is the cost of capital and g is the growth rate.

The advantage of this method is that it makes explicit the assumptions underlying the valuation factor. A closer look, however, reveals that the valuation factor can vary widely even for small changes in the underlying factors, viz., cost of capital and growth rate. To illustrate this, assume that r is 12 percent and g is 8 percent. The valuation factor corresponding to these values of r and g is:

$$\frac{1}{0.12 - 0.08} = 25$$

Now, if r increases to 0.13, g remaining unchanged, the valuation factor drops to 20 (1/(0.13-08)). Similarly, if g increases to 0.09, r remaining unchanged, the valuation factor increases to 33.3 (1/(0.12-0.09)).

Thus, the valuation factor is highly sensitive to minor variations in the underlying factors. This makes the estimate of terminal value highly imprecise.

The problem with the DCF approach is that it combines reliable information (usually near-term cash flow information) with unreliable information (terminal value). It is an axiom of engineering that a combination of good information and bad information does not result in information of average quality. Rather, the bad information dominates the whole calculation.

2. A second limitation of the DCF approach is that it discards a great deal of information that is relevant for calculating the value of a company. There are two aspects of value. The first is the resources or assets employed by the company. The second is the distributable cash flows that are produced by the resources invested in the company. The DCF approach relies only on the cash flows. In a competitive environment, assets earn a rate of return which is very similar to the cost of capital. So, the two facets of value are closely aligned. Hence, information about resources invested convey a great deal about expected future cash flows. Ignoring this would mean discarding valuable information.
3. A third limitation of the DCF approach is that it relies on assumptions that are difficult to make but ignores assumptions that can be made with greater confidence. For example, it is hard to forecast how rapidly Ford's sales will grow over the next two decades, what profit margin it will enjoy, or how much capital it will have to invest per dollar of revenue. Yet, these estimates have to be made to arrive at the value of Ford using the DCF approach. But it is easier to assume that, given the intensity of competition in the automobile sector, no automobile manufacturer (Ford included) is likely to enjoy significant competitive advantages over others, twenty years down the road.

A Strategic Approach to Valuation

Is there an alternative approach to valuation that overcomes the shortcomings of the DCF approach? Fortunately, there is one which may be called the 'Strategic Approach to Valuation.' This approach segregates reliable and unreliable information; it relies on strategic judgments about the current and future state of competition in the industry; and it does take into account the resources invested in the company. Interestingly, this approach has been developed and applied by Benjamin Graham, Warren Buffett, and others.

The strategic approach to valuation involves valuing a company at three levels, viz., asset value, earnings power value, and total value and decomposing the value of a company in terms of three tranches, viz., asset value, franchise value, and growth value.

Asset Value For valuing a company, the most reliable information is the information on its balance sheet. Assets and liabilities are shown as they exist presently and can be inspected, even though some of them may be intangible. Valuing the balance sheet items does not generally require any projection of future developments. For items like cash, marketable securities, and short-term debt there is hardly any uncertainty about their value. For other items, the valuation may be more complicated, involving judgments.

The first important judgment relates to whether the product market in which the company operates will be economically viable in future. If it is believed that the business will not be economically viable, the assets must be valued at their **liquidation value**. Cash is valued at its balance sheet value. Marketable securities are valued at their market value. Accounts receivable may be valued at a slight discount over their balance sheet value. Inventories may be valued at a larger discount, compared to accounts receivable. General purpose plant and machinery as well real estate usually have active second hand markets and hence may be valued at what they are likely to realise in these markets. Industry-specific plant and machinery may be worth only its scrap value. Intangibles like brands and customer relationships, for an economically nonviable business, may have limited or nil value in liquidation. From the value of the assets, the liabilities must be subtracted in full because in any liquidation, other than bankruptcy, they are fully paid off.

If the business is considered viable, the assets will have to be reproduced at some point. So, they should be valued at **reproduction cost**, the cost of reproducing the economic function of the asset as efficiently as possible.

For cash and marketable securities, the reproduction cost is simply the accounting book value. For accounts receivable, the reproduction cost will be slightly higher than the accounting book value because in the normal course of business some receivables are not collected. For inventories, the reproduction cost is the cost of producing equivalent amounts of salable inventory. For plant and machinery, the reproduction cost is the cost of acquiring similar plant and machinery from the cheapest source, new or second hand. For land and buildings, the reproduction cost is the cost of buying land and constructing similar buildings.

For a viable business, intangible assets like customer relationships, product portfolios, and manpower skills have a positive reproduction costs. These can be estimated by asking: How much would it cost to develop the market and build customer relationships? What R&D expenditure is required to develop the current product portfolio? How much would it cost to acquire and train the manpower? While it may not be easy to answer these questions, educated guesses can be made. Of course, it must be realised that the estimates of the value of intangible assets are far less certain than those of tangible assets. To highlight this, it may be desirable to show the reproduction costs of intangible assets separately from the reproduction costs of tangible assets.

Current Earnings Power Value After the assets and liabilities, the next most reliable basis for determining the value of a company is the current earnings power of the company. Conceptually, the earnings power may be defined as distributable earnings that can be sustained with the existing operations of the firm. To arrive at the "earnings power" certain adjustments have to be made to reported earnings.

- First, to abstract away the effects of financial leverage begin with operating earnings or EBIT (earnings before interest and taxes), rather than net profit. This ensures that we ignore the interest payments and the tax shield associated with debt financing.

- Second, make adjustments for "nonrecurring items" such as gains or losses from sale of assets and restructuring charges, the timing of which is often chosen by management with the purpose of managing the bottom line. One way to adjust for them is to calculate their average level over a period of time and add or subtract this average level to the operating earnings before nonrecurring items.
- Third, after eliminating the effect of accounting manipulation, adjust the current earnings for the cyclical factor that may cause them to be either above or below their sustainable level. A simple way to do this is to calculate the average operating margin (EBIT divided by sales) over a business cycle and apply the same to current sales to arrive at the normalised current operating earnings. If in addition to the operating margin, sales are also sensitive to the cycle, they should also be adjusted to an average level.
- Fourth, supplant accounting depreciation with economic depreciation. Accounting depreciation relies on certain conventional rules for allocating the historical cost of the asset over its estimated life. Economic depreciation, on the other hand, is the amount that needs to be spent in a year to protect the productive capacity of the firm. It is equivalent to maintenance capital expense.
- Finally, apply an average sustainable tax rate to the normalised pre-tax earnings to get the earnings power of the company, the amount that can be distributed to investors each year without diminishing the productive assets of the firm.

Earnings power, which represents the annual flow of funds, has to be divided by the weighted average cost of capital to get the **earnings power value** (EPV). For example if the earnings power is 1,000 million and the weighted average cost of capital is 12 percent, the earnings power value will be 8,333 million (1,000 million/0.12).

Note that the EPV represents the value of the company as a whole. If you want to get the value of equity, subtract the value of the firm's outstanding debt from the EPV.

Franchise Value Ignoring the issue of growth, we have estimated the value of the company as asset value or EPV. A comparison between them suggests three possibilities: EPV>Asset value; EPV=Asset value; EPV<Asset Value.

The first possibility is that the EPV exceeds the asset value. This means that the company enjoys sustainable competitive advantages that enable it to earn superior returns (defined as returns in excess of cost of capital). The difference between the EPV and the asset value may be called the **'franchise value'**, the value attributable to the competitive advantages enjoyed by the company. Competitive advantage may stem from customer captivity, proprietary technology, and economies of scale. So, when a company has a franchise value, particularly a large franchise value, carefully examine the sources and sustainability of its competitive advantages. Can it charge higher prices because it has captive customers? Can it produce at a lower cost because of proprietary technology or economies of scale?

The second possibility is that the EPV and the asset value are more or less the same. This is what one would expect in a majority of industries where no firm enjoys any significant competitive advantages.

The last possibility is that the EPV is less than the asset value. If both the valuations have been done properly, the discrepancy can be attributed to managerial deficiency. The management of the firm is not able to generate earnings commensurate with the value of assets employed. In such a case, efforts should be made to strengthen or to replace the management.

Total Value We looked at the value of assets and the earnings power value. We now look at the total value.

Theoretically, the total value of a company is equal to the present value of its future cash flows. If a company lacks sustainable competitive advantage, its total value is equal to its asset value. If a company enjoys a sustainable competitive advantage (which means that it has a franchise value) but cannot leverage the same for growing profitably, its total value is equal to its earnings power value. Finally, if a company enjoys a sustainable competitive advantage that can be leveraged successfully for profitable growth than its total value is equal to its earnings power value plus the value of growth.

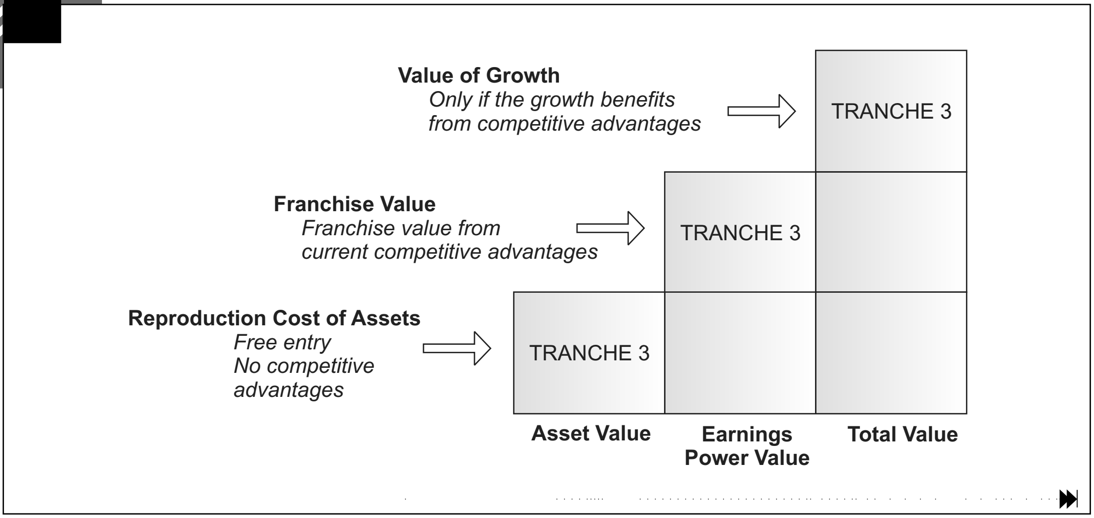
Value of Growth Growth is bad when the asset value exceeds the EPV. In this case the management is doing a poor job in managing the current resources of the firm. Put differently, it is earning a rate of return which is less than the cost of capital. Obviously, such a company lacks competitive advantage. In these circumstances growth will destroy value.

Growth is neutral when the asset value equals the EPV and strategic analysis suggests that the firm has no competitive advantage. In such a case, the company earns a rate or return which is equal to its cost of capital. This implies that growth neither creates value nor destroys value. In this case, it is quite appropriate to ignore growth in the valuation exercise.

Growth is good when the EPV exceeds the asset value and strategic analysis confirms that the firm enjoys sustainable competitive advantages which can be leveraged. In such a case, the company earns a rate of return that exceeds its cost of capital. Thanks to sustainable competitive advantages, the firm can make further investments that would generate a rate of return in excess of its cost of capital. Put differently, growth benefits from competitive advantage and hence is valuable.

Summing Up To sum up, the strategic approach to valuation builds value in terms of three tranches viz., asset value, franchise value, and growth value as shown in Exhibit 6.3. This helps in going from the most reliable component (the asset value) to the least reliable component (the growth value). Throughout the valuation exercise, the strategic dimension is kept in focus. Is the business economically viable? If so, does it have sustainable competitive advantage? Can it leverage its sustainable competitive advantage to grow profitably?

Exhibit 6.3 *Three Tranches of Value*



Source: Bruce Greenwald and Judd Kahn, *Competition Demystified,* New York: Portfolio, 2005.

6.4 GUIDELINES FOR CORPORATE VALUATION

We have explored various approaches to valuation and touched upon the difficulties and pitfalls that the appraiser encounters. Let us wrap up our discussion by presenting important guidelines that an appraiser should bear in mind.

Understand How the Various Approaches Compare The various approaches to valuation compare as follows:

- The adjusted book value approach makes sense when liquidation is being considered a distinct possibility or when you want to establish a minimum benchmark price.
- The stock and debt approach is eminently suitable when the securities of the firm are actively traded and there is no price manipulation.
- The relative valuation approach is quite appropriate when (a) the current earnings of the firm are reflective of future earnings capacity, (b) the company expects to enjoy stable growth rate, and (c) there are comparable companies.
- The discounted cash flow approach is ideally suited when (a) fairly credible business plans and cash flow projections are available for the explicit forecast period of five to ten years or even more and (b) the firm is expected to reach a steady state at the end of the explicit forecast period.

Use at Least Two Different Approaches Every approach has its limitations. Hence exclusive reliance on a single approach may lead to biases in valuation. Practical wisdom suggests that in most real life valuation exercises, the appraiser must use at least two different approaches. The final value indicator may be arrived at by taking a weighted average of the valuation figures produced by two or more different approaches. Weighting should be based on the judgement of the appraiser, not on a mechanical formula.

Use Parsimonious Models Thanks to technology and availability of data, it has become feasible to apply more complex valuation models. However, often it makes sense to use simpler models that require fewer inputs.

Work with a Value Range Valuation is an inherently imprecise, inexact, and uncertain exercise. Given an inescapable indeterminateness characterising valuation, it is naïve and foolhardy to attach great precision to any single value estimate. A more sensible approach would be to look at two to three plausible scenarios and define a value range, based on the value indicators for these scenarios, to take care of the imponderables.

Tell a Story but Support it with Data Human beings have a natural tendency to tell a story to justify why a company should command a certain value. Often these stories are meant to rationalise our preconceptions about companies. As a valuer, you have an obligation to support the story with data.

Go Behind the Numbers As we have seen, there are several value drivers, viz., invested capital, return on invested capital, growth rate, and cost of capital. Often, appraisers have difficulty in getting a handle over return on invested capital, perhaps the most critical value driver. Since the return on invested capital is mainly a function of entry barriers, the appraise must go behind the numbers and examine carefully entry barriers like economies of scale, product differentiation, technological edge, access to distribution channels, patent protection, and governmental license.

Value Flexibility The discounted cash flow approach to valuation is based on cash flows forecasted on the basis of a current assessment of future prospects. This approach, in an important sense, is incomplete as it does not take into account the value of flexibility. Remember that the management may change its policies in the light of future developments and can exercise a variety of options suited to the needs of the unfolding environment. Flexibility and options are quite valuable. To ignore them is to overlook an important source of value.

Blend Theory with Judgement Valuing real companies calls for combining theory, judgement, and experience. As Milton Rock said : "In the end , even when armed with the results of various analyses such as DCF values, secondary market trading levels, a history of comparable transactions, and estimates of liquidation or replacement values, the evaluator moves from the arena of seeming precision and science to the realm of judgement and art. " Bradford Cornell echoed a similar view: "Valuing a company is neither an art nor a science but an odd combination of both. There is enough science that appraisers are not left to rely solely on experience, but there is enough art that without experience and judgements, failure is assured."

Avoid Reverse Financial Engineering In valuation exercises, the appraiser may sometimes start with a given value estimate and then work backwards to specify the assumptions that produce the pre-determined value figure. This may be referred to as 'reverse financial engineering'. Obviously this is an elaborate attempt to give a veneer of sophistication or provide pseudo- scientific justification for a foregone conclusion. At best it is futile and at worst it is highly misleading. A professionally honest appraiser should resist the temptation to do reverse financial engineering.

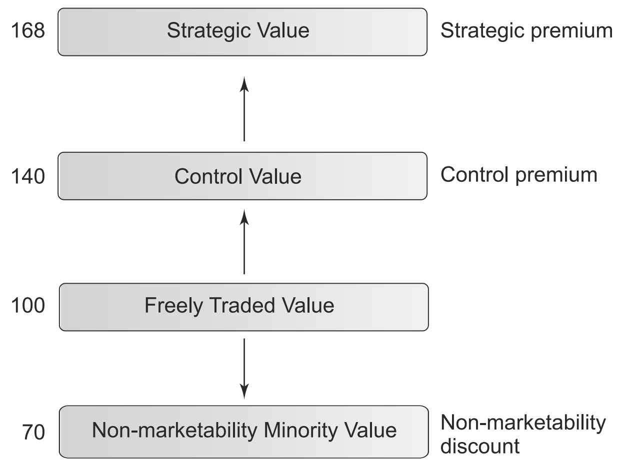
Beware of Possible Pitfalls Valuation is a complex and difficult exercise in which one can easily commit mistakes. Here are some common pitfalls that a careful analyst should avoid:

- *Use of Shortcuts* As Copeland, Koller and Murrin said "Too often, analysts forecast only the income statement and a partial balance sheet, for example, changes in working capital and new investment. This approach does not allow them to cross check the validity of their assumptions by studying financial ratio changes during the forecast period. "
- *Belief in Hockey Stick* A forecast based on a dramatic turnaround of a lacklustre performer is an example of a "hockey stick." If the analyst assumes a hockey stick, he must specify clearly an action plan required to bring about a successful turnaround and argue convincingly that the incumbent management is capable of implementing the action plan.
- *Short Forecast Horizons* Analysts often use a short horizon period for valuation as they equate it with the planning period of the firm which may be five years or so. If the analyst employs a cash flow method (either the growing free cash flow perpetuity method or a value driver method) for estimating the continuing value, the horizon period should be such that, at the end of it, the growth rate stabilises or the return on invested capital becomes equal to the cost of capital. Typically this period is longer than the planning period of the firm.

Adjust for Control Premia and Non-Marketability As shown in Exhibit 6.4, there can be different levels of value depending on (a) the control rights associated with ownership stake, (b) the marketability of the ownership stake, and (c) the strategic premium that a potential acquirer is willing to pay. Here are some indicative guidelines:

- In an unlisted company, a partial stake which lacks any control rights may be valued at a 30 percent discount to the freely traded value.
- For a partial interest that gives effective control rights add a control premium of 40 percent over the pro-rata value of the firm, irrespective of whether the firm is listed or not.
- A prospective acquirer who can derive synergistic gains may pay a strategic premium of 20 percent over control value.

Exhibit 6.4 ***Levels of Value***



Debunk the Myths Surrounding Valuation Here are some popular myths surrounding valuation along with the reality corresponding to them

Myths	*Reality*
• Since valuation involves quantitative models, it is an objective exercise.	• The key inputs in valuation models rely heavily on subjective judgement.
• A well-done valuation is timeless	• Valuation changes over time in response to new developments.
• What matters is the product of valuation; the process is not important.	• The process of valuation is perhaps as important as the product thereof.

SUMMARY

- The simplest approach to valuing a firm is to rely on the information found on its balance sheet, typically adjusted to reflect replacement cost.
- When the securities of a firm are publicly traded, the value of the firm can be obtained by merely adding the market value of all its outstanding securities. This approach is called the stock and debt approach or the market approach. This approach assumes an efficient market – a market in which the price of a security is an unbiased estimate of its intrinsic value.
- The DCF approach mixes reliable information and unreliable information, discards a great deal of information that is relevant for calculating the value of a company, and relies on

assumptions that are difficult to make but ignores assumptions that can be made with greater confidence.

- The strategic approach to valuation segregates reliable and unreliable information, does take into account the resources invested in a company, and relies on strategic judgements about the current and future state of competition in the industry.
- The strategic approach to valuation involves valuing a company at three levels, viz., asset value, earnings power value, and total value. This approach decomposes the value of a company in terms of three tranches, viz., asset value, franchise value, and growth value.
- The following are the important guidelines for valuation that an appraiser should bear in mind: (i) Understand how the various approaches to valuation compare. (ii) Use at least two different approaches. (iii) Use parsimonious models. (iv) Work with a value range (v) Tell a story but support it with data. (vi) Go behind the numbers. (vii) Value flexibility (viii) Blend theory with judgment (ix) Beware of possible pitfalls. (xi) Adjust for control premia and non-marketability factor. (xii) Debunk the myths surrounding valuation.

Questions

1. Discuss the reasons for the potential divergence between book value and market value.
2. How are various assets valued to reflect replacement cost?
3. What is fair value accounting? What are the pros and cons of fair value accounting?
4. What is an efficient market? Distinguish three levels of market efficiency.
5. What are the common misconceptions about the efficient market hypothesis and how would you dispel them?
6. What is the empirical evidence in favour of and against market efficiency?
7. Discuss the implications of efficient market hypothesis for appraisal practice.
8. What are the limitations of DCF approach?
9. How is asset value assessed under the 'strategic approach to valuation'?
10. How is current earnings power value estimated under the 'strategic approach to value'?
11. What is franchise value?
12. What is total value?
13. How would you decompose the value of a firm in terms three tranches viz., asset value, franchise value, and growth value?
14. Discuss the guidelines for corporate valuation.
15. What is reverse financial engineering?
16. How would you adjust for control and non-marketability?
17. What are some of the popular myths surrounding valuation and the reality corresponding to them?

MINICASE

In October 92, Associated Cement Companies (ACC) had an installed capacity of 7.5 million tons. Its plants were of different vintages, some using wet technology and others using dry technology (the latter is considered to be more efficient). At that time, ACC's paid up capital was ₹50 crore (0.5 crore shares of ₹100 par) and ACC had very little outstanding debt.

The market price per share of ACC was around ₹11,000 per share. In a talk given in Mumbai, Harshad Mehta, who was then an active speculator in the ACC scrip, justified the market price. His argument ran as follows. "It costs ₹300 crore per ton to set up a new cement plant of 1 million tons. So, ACC's plants have a replacement cost of ₹2250 crore (7.5 X ₹300 crore). However, it takes about 3 years to create such a capacity and during this period the cost would double to ₹4500 crore. Since ACC has negligible debt, the net asset value per share on a replacement cost basis works out to ₹9000 (₹4500 crore/0.5 crore). In a buoyant market a price of ₹11,000 is okay."

Critically evaluate Harshad Mehta's reasoning.

APPENDIX 6A

INFLATION AND ASSET REVALUATION

In an inflationary period, the book values of assets, typically reflecting historical cost less accumulated depreciation, do not reflect their true values. Hence, it may be worthwhile to consider revaluation of assets periodically so that the asset values shown in the balance sheet reflect economic reality more accurately.

Objectives of Revaluation

Revaluation of assets is undertaken with one or more of the following objectives in mind:

- To attract investors by indicating to them the current values of assets.
- To make depreciation provision which will enable the firm to meet replacement needs adequately.
- To provide a more reasonable and accurate perspective regarding the true worth of assets in the event of a possible takeover or merger.
- To help management in (i) assessing the "true profitability" of different divisions, (ii) formulating a more sensible dividend policy, (iii) pricing its products realistically, (iv) fixing the machine hour rates in a job order situation, and (v) determining the desirable insurance cover for the assets.
- To enhance the borrowing capacity of the firm.

It may be noted that irrespective of the objective/s sought by a firm from the revaluation study, an important advantage of such an exercise is that the capital asset records of the company are streamlined.

Concept and Measures of Value

For valuing (and by implication revaluing) assets the following concept championed eloquently by J.C. Bonbright, is widely followed. "The value of a property (or asset) to its owner should be identical to the loss, direct and indirect, the owner might expect to suffer if he is deprived of the property (or asset)".

This concept appears to be the obverse of the economic concept of opportunity cost according to which the cost of an action is "the gain foregone by sacrificing the best possible alternative course of action in order to adopt the proposed course of action." While the opportunity cost reflects the cost of a proposed course of action, the value concept, as suggested by Bonbright, reflects the value of something which has been acquired in the past.

How should the value of an asset, as represented by "loss on deprivation," be measured? There broad categories of measures have been suggested:

1. Replacement Cost This is the cost that will be incurred to replace the asset. It may be measured in terms of (i) gross current replacement cost or (ii) net current replacement cost.

2. Realisable Value This represents the value that can be realised on the disposal of the asset. It may be measured as (i) the current open market sales value of the asset, or (ii) the "forced sale" value of asset, i.e. the amount likely to be obtained for the asset if the same is sold under conditions adverse to the seller.

3. Economic Value This denotes the value derivable from the economic use of the asset. It may be calculated as (i) the value related to the earnings potential of the asset, or (ii) the "alternative use value" i.e. the value of the asset for a prospective purpose other than the purpose for which it is used at present, or (iii) the "going concern" value, i.e. the value of the asset to a firm, assuming that the firm will be a going entity.

Choice of Measure

Which measure—realisation value, replacement value, or economic value—should be used? Before we answer this question, let us look at the six possible relationships among these measures.

Case 1: Realisation Value > Economic Value > Replacement Value.

Case 2: Realisation Value > Replacement Cost > Economic Value

Case 3: Economic Value > Replacement Cost > Realisation Value

Case 4: Economic Value > Realisation Value > Replacement Cost

Case 5: Replacement Cost > Economic Value > Realisation Value

Case 6: Replacement Cost > Realisation Value > Economic Value

Having enumerated the six possible cases, let us determine the choice under each of them. In cases 1 and 2, as the realisation value exceeds the economic value, it is advantageous to dispose the asset rather than use it. However, the maximum loss suffered by the firm, using the 'deprivation principle' in these cases is the replacement cost, not the realisation value, because by buying another asset of the same type, the firm can restore the deprivation suffered by it. Hence, in cases 1 and 2, the value of the asset is to be measured by the replacement cost.

In cases 3 and 4, as the economic value is greater than the realisation value, it is advantageous to use the asset rather than dispose it . However, here too, as in cases 1 and 2, the loss suffered by the firm, when deprived of the asset is reflected by the replacement cost because this is the amount needed to restore the asset to generate earnings stream.

In case 5 the loss suffered by the firm, if it is deprived of the asset, is the economic value of the asset. Hence this represents the value of the asset. In case 6, the loss suffered by the firm, if it is deprived of the asset, is the realisation value of the asset and, hence, this is the measure of asset value in this case.

While we have, for the sake of completeness, considered all possible relationships, cases 1, 2, and 6 may be discarded for all practical purposes because for industrial assets realisable value cannot exceed economic value.

Thus we are left with three relevant cases, viz., 3, 4, and 5, and, as discussed above, the basis for valuation in these cases shall be as follows:

Case 3	: Replacement Cost
Case 4	: Replacement Cost
Case 5	: Economic Value

The specific measures to be employed may be as follows:

Replacement Cost	: Net Current Replacement Cost
Economic Value	: Present Value of Earnings Expected from the Use of the Asset

A study by Nand Dhaneja found that replacement cost is the most commonly used method for revaluing fixed assets in India.

CHAPTER

7

Valuation of Real Options

The discounted cash flow (DCF) analysis has been the basic framework for valuing assets, real and financial, since the 1950s. The DCF valuation, however, does not consider the value of managerial flexibility. In real life, managers adjust their plans and strategies in response to changes in the economic environment. For example, if the response to a new product introduction is favourable, the firm may scale up its investment. On the other hand, if the response is lukewarm, the firm may scale back the production or even abandon it, if continuation looks unpromising. This flexibility has value which cannot be a captured by a single projection or even an analysis of multiple scenarios.

Uncertainty and managerial flexibility are not the same. A company or project with a highly uncertain future, such as a start-up, may involve just a single decision at the time of inception. It can be valued using the standard DCF method. To consider its risk, multiple scenarios may be evaluated and a weighted average value may be calculated. Flexibility refers to the options available to managers to adjust their plans in response to events.

Flexibility (or options) occurs mostly at the level of an individual project or business. So, instead of incorporating the value of flexibility in a corporate-wide valuation model, we will focus on how to value flexibility in the context of an individual project or business.

The DCF model was initially developed for valuing financial securities like bonds and stocks. Investors in these securities are generally passive. Barring exceptional circumstances, they can hardly do anything to enhance the interest or dividend they get from such financial assets. However, real assets cannot be considered as passive investments because managers can, through their actions, influence the outcomes of such assets. As a capital expenditure unravels, chance plays an important role and managers can respond to changing conditions and actions of competitors. The opportunities that managers have are called managerial options or real options, as they involve real assets, not financial assets.

The thrust of this chapter is on the valuation of real options with the help of the binomial model and the Black-Scholes model. It is organised into nine sections as follows:

- Uncertainty, flexibility, and value
- Types of real options

- How options work
- Factors determining option values
- Binomial model
- Black and Scholes model
- Applications of the binomial model
- Applications of the Black and Scholes model
- Mistakes made in real option valuation

7.1 UNCERTAINTY, FLEXIBILITY, AND VALUE

To understand the value of flexibility, consider a simple example.[1] Suppose you have to decide whether to invest ₹ 10 million a year from now to manufacture and distribute a new drug which is an advanced stage of development. The decision to invest, however, has to be taken now. The drug has to undergo further clinical trials on patients for one year, for which all the required investments have been made. There are two possible outcomes of these trials. The drug may prove to be highly effective or only somewhat effective. If it is the former, it will generate an annual cash flow of 1.2 million forever; if it is the latter, it will produce an annual cash flow of 0.4 million forever. Both the outcomes are equiprobable.

Given the above information, the expected future net cash flow is 0.8 million, the probability-weighted average of 1.2 million and 0.4 million. It may be assumed that the success in developing the drug and the value of the drug are not related to what happens in the economy. This means that the risk of the drug can be fully diversified away by the company's investors. So, the cost of capital for the drug will be the risk-free rate, say 8 percent, because only non diversifiable risk requires a premium. If we assume that the first year's cash flow will be realised immediately upon completion of trial, the investment's net present value (NPV) is:

$$\text{NPV} = \frac{-10.00}{1.08} + \sum_{t=1}^{\infty} \frac{0.8}{(1.08)^t} = 0.74 \text{ million}$$

To calculate the NPV, the incremental expected project cash flows are discounted at the cost of capital. Prior development expenses do not matter because they represent sunk costs. If the project is cancelled, its NPV is zero. So, it makes sense to approve the incremental investment of ₹ 10 million. The NPV calculation can be expressed in terms of the probability-weighted values of the drug:

$$\text{NPV} = 0.5\left[\frac{-10.00}{0.08} + \sum_{t=1}^{\infty} \frac{1.2}{(1.08)^t}\right] + 0.5\left[\frac{-10.00}{1.08} + \sum_{t=1}^{\infty} \frac{0.4}{(1.08)^t}\right]$$

1. A. Dixit and R.Pindyck, *Investment under Uncertainty,* (Princeton, NJ: Princeton University Press, 1994).

$$\text{NPV} = 0.5(5.74) + 0.5\,(-4.26) = 0.74 \text{ million}$$

In this calculation, the NPV is expressed as the weighted average of two different possibilities: a positive NPV of 5.74 million when the outcome of the trial is favorable and a negative NPV of –4.26 million when the outcome of the trial is unfavorable.

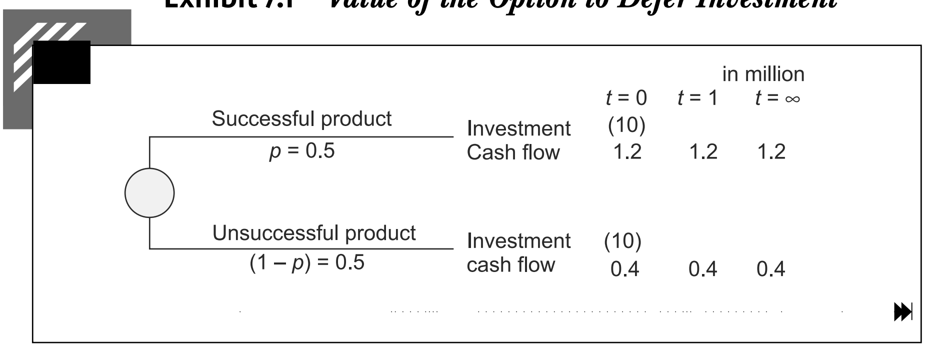
If the decision to invest can be postponed until trial results are known, the attractiveness of the project increases significantly. More specifically, if the outcome of the trial is unfavorable, the project can be terminated, thereby avoiding the negative NPV. The investment needs to be made only when the outcome of the trial is favorable.

To value the option to defer the investment decision, we can employ a contingent NPV approach. To calculate the contingent NPV you work from right to left in the payoff tree displayed in Exhibit 7.1

$$\text{NPV} = 0.5 \times \text{Max}\left[\left(\frac{-10.00}{1.08} + \sum_{t=1}^{\infty}\frac{1.2}{(1.08)^t}\right), 0\right] + 0.5 \times \text{Max}\left[\left(\frac{-10.00}{1.08} + \sum_{t=1}^{\infty}\frac{0.4}{(1.08)^t}\right), 0\right]$$

$$= 0.5(5.74) + 0.5\,(0) = 2.87 \text{ million}$$

Exhibit 7.1 ***Value of the Option to Defer Investment***



The contingent NPV of 2.87 million is substantially higher than the 0.74 million, the NPV if the investment is committed now.

What is the value of the option to defer the investment? It is the difference between the value of the project with and without the flexibility: 2.87 million – 0.74 million = 2.13 million.

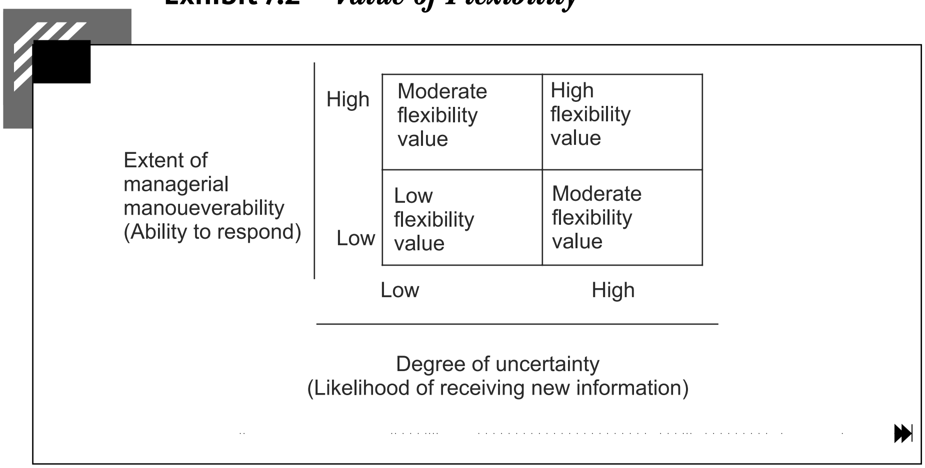
Based on the preceding discussion, we can distinguish between the standard and contingent NPVs. The standard NPV is the maximum of the expected discounted cash flows or zero, if the investment decision is made today. On the other hand, the contingent NPV is the expected value of the maximums, decided on arrival of information, of the discounted cash flows in each future state or zero.

$$\text{Standard NPV} = \underset{t=0}{\text{Max}}\left[\frac{\text{Expected (cash flows)}}{\text{Cost of capital}},\ 0\right]$$

$$\text{Contingent NPV} = \text{Expected } t=0\left[\text{Max}\left(\frac{\text{Cash flows contingent on information}}{\text{Cost of capital}}\right),\ 0\right]$$

Since the contingent NPV reflects the flexibility of making the decision after the information arrives, it will always exceed or equal the standard NPV. The value of flexibility depends on the degree of uncertainty and the extent of manoueverability available to management, as shown in Exhibit 7.2.

Exhibit 7.2 ***Value of Flexibility***



7.2 TYPES OF REAL OPTIONS

Contingent valuation helps managers to make value-maximising decisions when confronted with strategic or operating flexibility. In real life, however, flexibility is not so well-defined as our previous illustration suggests and its value not so easily realisable. A great deal depends on the ability of management to recognise, structure, and manage opportunities to derive value from operating and strategic flexibility.

To recognise opportunities for deriving value from flexibility, managers should be as explicit as possible about events, decision alternatives, and payoffs.

Events: What are the key uncertainties characterising the project? Which events will provide new information and when?

Decision Alternatives: In response to events, what are the possible decisions management can take?

Payoffs: What are the payoffs of various decisions? If a decision has a positive NPV, the same should be derived from sustainable competitive advantage

As far as *structuring* flexibility, some projects or strategies have inherent flexibility. For example, a research and development (R&D) project for a new drug involves trials in different phases and the outcome of the trial at each phase provides a natural occasion to decide whether to continue or terminate the investment. In other cases, flexibility can be built into the project to maximise value. For example, an airport may be built in stages, depending on how the traffic grows.

In the final analysis, flexibility matters only if managers actual *manage* it well. Often there is a significant gap between the theoretical and realised values of real options because of a disconnect between the way options are valued and the way options are managed. To promote a more timely and rational exercise of real options, the planning and budgeting system of the firm should identify the trigger points, specify the rules governing the exercise decisions, clearly assign responsibilities, and motivate people.

A variety of options are embedded in real projects. They may be classified into four broad types: investment timing options, growth options, flexibility options, and abandonment options.

Investment Timing Options Traditional NPV analysis assumes that a project may be accepted or rejected, implying that it may be undertaken now or never. Often, however, the firm has the option of making the investment now or deferring the decision to future. The "wait and watch" option is a common real option.

Delaying the investment may help in resolving some uncertainty about the value of the project. The option to delay is more valuable to a firm which is protected by entry barriers like proprietary technology, patents, and licenses, as these factors diminish the threat of competition.

Growth Options A growth option allows a firm to grow in different ways. First, the firm may expand the capacity of an existing product line, if the market response to the product is favourable. Sometimes, capacity expansion can be achieved at a modest cost by making debottlenecking investments. Second, the firm may add new related products or newer versions of the original product. Michael Porter calls the original investment as a "beachhead" as it opens up new opportunities in future. For example, Procter and Gamble acquired the Charmin Paper Company which served as a beachhead to launch a cluster of products like disposable diapers, paper towels, and bathroom tissues. Third, the firm may enter newer geographic markets. For example, Disneyland has successfully entered newer markets in Europe and Japan.

Flexibility Options Apart from the options that naturally exist in most projects, managers can incorporate flexibility in designing the project. The designed-in options may take the form of input flexibility options and output flexibility options.

An ***input flexibility*** option allows a firm to switch between alternative inputs. For example, an electric power plant may go for a flexible dual-fuel boiler which can switch between gas or oil as fuel, depending on which resource of energy is cheaper at a given point of time.

An ***output flexibility*** option allows a firm to alter the product mix. Oil refineries, for example, are typically designed with this flexibility. This permits them to switch from one product mix to another, depending on which product mix is the most profitable at a given point of time.

Abandonment Options The DCF analysis assumes that a project will continue till the end of its specified economic life. While some projects may be somewhat irreversible in nature, others offer a possibility of premature abandonment. If a project does not perform well and there is very little promise for improvement, the firm can consider the exit option. The firm need not continue with an uneconomic activity indefinitely. An abandonment option reduces the downside risk of the project.

Some projects also provide the option of temporary closure. For example, an iron ore mining project may be closed for a while if the output price of the iron ore is depressed. In general, shut down options are more valuable when the variable costs are high.

Key Differences between Financial and Real Options

There are two key differences between financial and real options:

1. The information required for valuing options and making decisions about exercising them is more readily available for financial options than for real options. For example, a holder of call option on the stock of Reliance Industries can look at the current stock price and decide. However, the value of an untested drug cannot be read off from the NSE screen.
2. While the right to exercise a financial option is unambiguous, the holder of a real option often is unclear what the precise right is and how long the same will last.

7.3 HOW OPTIONS WORK

Since option valuation models were developed in the context of financial options, let us understand how financial options work and what their payoffs are. An option is a special contract under which the option owner enjoys the right to buy or sell something without the obligation to do so. Options have a special terminology associated with them.

- The option to buy is a *call option* (or just call) and the option to sell is a *put option* (or just put).

- The *option holder* is the buyer of the option and the *option writer* is the seller of the option.
- The fixed price at which the option holder can buy and/or sell the underlying asset is called the *exercise price* or *strike price.*
- The date when the option expires or matures is referred to as the *expiration date* or *maturity date*. After the expiration date, the option is worthless.
- The act of buying or selling the underlying asset as per the option contract is called *exercising the option.*
- A European option can be exercised only on the expiration date whereas an *American option* can be exercised on or before the expiration date.
- Options traded on an exchange are called *exchange-traded options* and options not traded on an exchange are called *over-the-counter options*.
- Options are said to be *at the money* (ATM) or *in the money* (ITM) or *out of the money* (OTM) as shown below:

Call option	*Put option*
ATM: Exercise price = Market price	Exercise price = Market price
ITM: Exercise price < Market price	Exercise price > Market price
OTM: Exercise price > Market price	Exercise price < Market price.

Exchange-traded options are standardised in terms of quantity, trading cycle, expiration date, strike prices, type of option, and mode of settlement. For example, option contracts on individual securities on the National Stock Exchange shall be in multiples of 100, shall have a maximum of three-month trading cycle, shall expire on the last Thursday of the month, shall have five strike prices stipulated by the exchange, shall be European style, and shall be cash settled.

The value of an option, if it were to expire immediately, is called its intrinsic value. The excess of the market price of any option over its intrinsic value is called the time value of the option. To illustrate, suppose the market price of a share is ₹ 260, the exercise price of a call option on the share is ₹ 250, and the market price of the call option is ₹ 15. In this case, the intrinsic value of the option is ₹ 10 (₹ 260 – ₹ 250) and the time value of the option is ₹ 5 (₹ 15 – ₹ 10).

Call Option

The most common type of option, the *call option*, gives the option holder the right to buy an asset at a fixed price during a certain period. While there is no restriction on the kind of asset, the most popular type of call option is the option on stocks. For example, investors can buy call options on Reliance Industries stock (and many other stocks) on the National Stock Exchange and Bombay Stock Exchange. A typical call option on Reliance Industries stock entitles the investor to buy 100 shares of Reliance Industries on or before say July 25, 200X at an exercise price of ₹ Y. Such an option is valuable if there is some likelihood that the price of the common (equity) stock of Reliance Industries will rise above ₹ Y on or before July 25, 200X. To provide protection to the option holder, the option contract generally specifies that the exercise price and the number of shares will be adjusted for stock splits and stock dividends. For example, if the Reliance Industries stock splits 4 to 1, the option contract will be for 400 shares at an exercise price of ₹ Y/4. Of course, no adjustment is made for cash dividends. Remember that the holder of a call option is not entitled to receive cash dividends.

Payoff of a Call Option What is the payoff of a European call option? To answer this question let us look at the possible payoffs of the call option just before expiration.[2]

The payoff of the call option (C) just before expiration depends on the relationship between the stock price (S_1) and the exercise price (E). Formally,

	If $S_1 > E$	If $S_1 < E$
Value of the call option	$S_1 - E$	0

This means that the value of call option is: Max ($S_1 - E$, 0), Exhibit 7.3 shows graphically the value of call option. When $S_1 - E$, the call is said to be "out of money" and is worthless. When $S_1 - E$, the call is said to be "in the money" and its value is $S_1 - E$.

Put Option

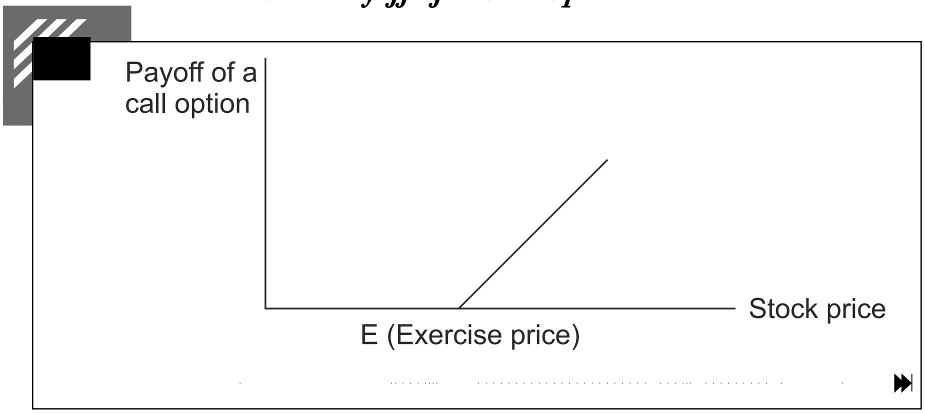
The opposite of a call option is a *put option*. While the call option gives the holder the right to buy a stock at a fixed price, the put option gives the holder the right to sell a stock at a fixed price. For example, a put option on the Reliance Industries stock may give its holder the right to sell 100 shares of Reliance Industries on or before a certain date at a price of ₹ Y per share. Such an option is valuable if there is some possibility that the price of Reliance Industries stock will fall below ₹ Y per share on or before a certain date.

Payoff of a Put Option The payoff of a put option just before expiration depends on the relationship between the exercise price (E) and the price of the underlying stock (S_1). If $S_1 < E$, the put option has a value of $S_1 - E$, and is said to be "in the money". On the other hand, if $S_1 > E$, the put option is worthless, and is said to be "out of money". Thus the payoff of a put option just before expiration is:

	If $S_1 < E$	If $S_1 > E$
Value of the put option	$E - S_1$	0

2 Recall that such an option can be exercised only at the time of expiration.

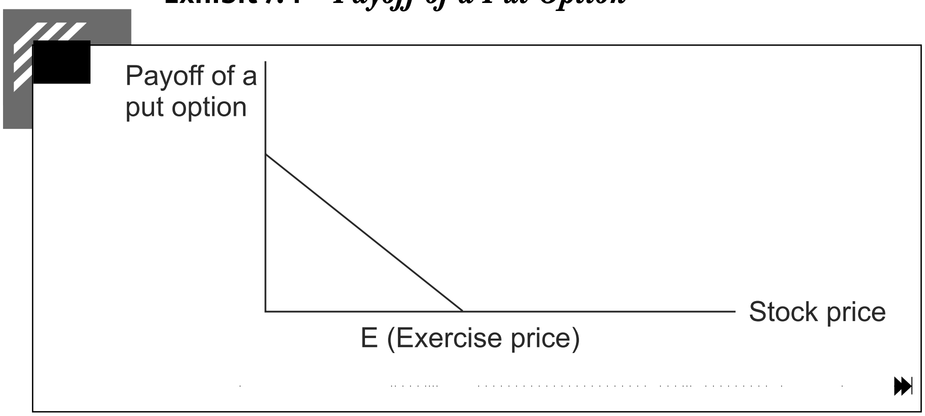
Exhibit 7.3 ***Payoff of a Call Option***



Put differently, just before expiration the payoff of a put option is Max ($E - S_1$,0).

Exhibit 7.4 plots the relationship between the value of the underlying stock and the payoff of the put option.

Exhibit 7.4 ***Payoff of a Put Option***



7.4 FACTORS DETERMINING OPTION VALUES

In the previous section, we looked at the payoffs of options just before the expiration date. Now we determine the present value of options.

Boundaries Before we identify the factors determining option values, it is helpful to specify the boundaries within which the value of an option falls.

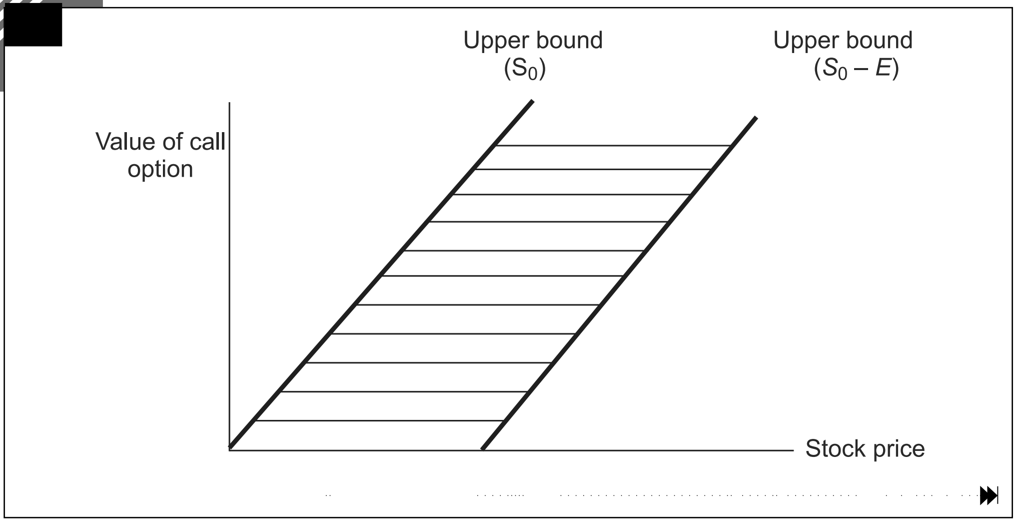
The minimum value at which a call option sells before the expiration date, say, at time zero, is Max (0, $S_0 - E$). This means that C_0, the value of a call option, can never fall below zero (this happens when $S_0 < E$). Also, it means that the value of a call option cannot fall below $S_0 - E$ (this happens when $S_0 > E$). To see why this is so, consider a call option with $E = 150$, $S_0 = 250$, and $C_0 = 75$. In this case it pays an investor to buy the call option for 75, exercise it for 150, and finally sell the stock for 250. By doing so he earns a profit of:

$$S_0 - (C_0 + E) = 250 - (75 + 150) = 25$$

This profit, reflecting arbitrage profits, comes without incurring any risk or cost. Such a profit cannot occur in a well functioning financial market. Hence in such a market C_0 cannot sell for less than $S_0 - E$.

What is the upper limit for the option price? A call option entitles the holder to buy the underlying stock on payment of a certain exercise price. Hence its value cannot be greater than that of the underlying stock. If it were so, the investor would be better off by buying the stock directly. The upper and lower bounds for the value of a call option are shown in Exhibit 7.5.

Exhibit 7.5 ***Upper and Lower Bounds for the Value of Call Option***



Key Factors Driving Option Value As indicated above, the price of a call option must fall in the shaded region of Exhibit 7.5. Put formally,

$$\text{Max}\,(S_0 - E, 0) \le C_0 \le S_0 \qquad (7.1)$$

Where exactly in the shaded region will the value of a call option be? The precise location of the option value depends on five key factors:

- Exercise price
- Expiration date

- Stock price
- Stock price variability
- Interest rate

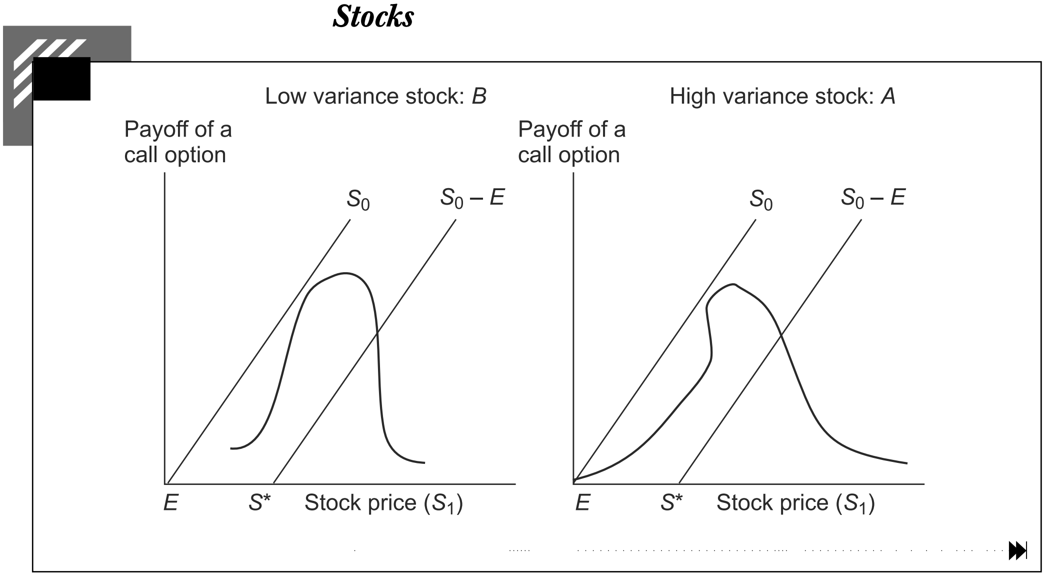
Exercise Price By now it is obvious that, other things being constant, the higher the exercise price the lower the value of the call option. Remember that the value of a call option can never be negative; regardless of how high the exercise price is set. Further it has a positive value if there is some possibility that the stock price will be higher than the exercise price before the expiration date.

Expiration Date Other things being equal, the longer the time to expiration date the more valuable the call option. Consider two American calls with maturities of one year and two years. The two-year call obviously is more valuable than the one year call because it gives its holder one more year within which it can be exercised.

Stock Price The value of a call option, other things being equal, increases with the stock price. This point is obvious from the figures showing the relationship between the stock price and the value of call option.

Variability of the Stock Price A call option has value when there is a possibility that the stock price exceeds the exercise price before the expiration date. Other things being equal, the higher the variability of the stock price, the greater the likelihood that the stock price will exceed the exercise price. This point is graphically illustrated in Exhibit 7.6.

Exhibit 7.6 ***Value of Call Options for Low Variability and High Variability Stocks***



In Exhibit 7.6, the price distribution of two stocks, *A* and *B*, is given. While both *A* and *B* have the same expected value, *A* has a lower variance than *B*. Given an exercise price of *E*, a call option on *B* is more valuable than that on *A*. This is so because the holder of a call option gains when the stock price exceeds the exercise price and does not lose when the stock price is less then the exercise price.

So fundamental is this point that it calls for another illustration. Consider the probability distribution of the price of two stocks, *P* and *Q*, just before the call option (with an exercise price of 80) on them expires.

P		*Q*	
Price	*Probability*	*Price*	*Probability*
60	0.5	50	0.5
80	0.5	90	0.5

While the expected price of stock *Q* is same as that of stock *P*, the variance of *Q* is higher than that of *P*. The call option, given an exercise price of 80, on stock *P* is worthless as there is no likelihood that the price of stock *P* will exceed 80. However, the call option on stock *Q* is valuable because there is a distinct possibility that the stock price will exceed the exercise price.

Remember that there is a basic difference between holding a stock and holding a call option on the stock. If you are a risk-averse investor you try to avoid buying a high variance stock, as it exposes you to the possibility of negative returns. However, you will like to buy a call option on that stock because you receive the profit from the right tail of the probability distribution, while avoiding the loss on the left tail. Thus, regardless of your risk disposition, you will find a high variance in the underlying stock desirable.

Interest Rate When you buy a call option you do not pay the exercise price until you decide to exercise the call option. Put differently, the payment, if any, is made in future. The higher the interest rate, the greater the benefit will be from delayed payment and vice versa. So the value of a call option is positively related to the interest rate.

Functional Relationship The manner in which the five variables discussed above influence the value of a call option is shown in the following relationship:

$$C_0 = f\,[\underset{+}{S_0},\quad \underset{-}{E},\quad \underset{+}{\sigma^2},\quad \underset{+}{t},\quad \underset{+}{r_f}] \tag{7.2}$$

where C_0 is the value of the call option, S_0 is the price of the underlying stock (or asset in general), *E* is the exercise price, σ^2 is the variance of the return on the underlying asset, *t* is the time left to expiration, and r_f is the risk-free interest rate.

The sign (+, –) put below a variable denotes the nature of its influence on the value of the call option. You must be eager to know the precise relationship between these variables and the value of call option. Black and Scholes developed their celebrated option pricing model which expresses this relationship. Before we look at their model, it is helpful to understand the two-state or binomial option valuation model.

7.5 BINOMIAL MODEL FOR OPTION VALUATION

The standard DCF (discounted cash flow) procedure involves two steps, viz. estimation of expected future cash flows and discounting of these cash flows using an appropriate cost of capital. There are problems in applying this procedure to option valuation. While it is difficult (though feasible) to estimate expected cash flows, it is impossible to determine the opportunity cost of capital because the risk of an option is virtually indeterminate as it changes every time the stock price varies.

Since options cannot be valued by the standard DCF method, financial economists struggled to develop a rigorous method for valuing options for many years. Finally, a real breakthrough occurred when Fisher Black and Myron Scholes[3] published their famous model in 1973. The basic idea underlying their model is to set up a portfolio which imitates the call option in its payoff. The cost of such a portfolio, which is readily observed, must represent the value of the call option.

The key insight underlying the Black and Scholes model may be illustrated through a single-period binomial (or two-state) model. The following assumptions may be employed to develop this model.

- The stock, currently selling for S, can take two possible values next year, uS or dS ($uS > dS$).
- An amount of B can be borrowed or lent at a rate of r the risk-free rate. The interest factor $(1 + r)$ may be represented, for the sake of simplicity, as R.
- The value of R is greater than d but smaller than $u (d < R < u)$. This condition ensures that there is no risk-free arbitrage opportunity.
- The exercise price is E.

The value of the call option, just before expiration, if the stock price goes up to uS, is

$$Cu = \text{Max}\ (uS - E, 0) \tag{7.3}$$

Likewise, the value of the call option, just before expiration, if the stock price goes down to dS is

$$Cd = \text{Max}\ (dS - E, 0) \tag{7.4}$$

Let us now set up a portfolio consisting of Δ shares of the stock and B rupees of borrowing. Since this portfolio is set up in such a way that it has a payoff identical to that of a call option at time 1, the following equations will be satisfied:

3 Fisher Black and Myron Scholes, "The Pricing of Options and Corporate Liabilities," *Journal of Political Economy*, Vol. 81, May–June 1973.

Stock price rises: $\Delta\, uS - RB = Cu$ (7.5)

Stock price falls: $\Delta\, dS - RB = Cd$ (7.6)

Solving Eqs (7.5) and (7.6) for Δ and B, we get

$$\Delta = \frac{C_u - C_d}{S(u-d)} = \frac{\text{Spread of possible option prices}}{\text{Spread of possible share prices}} \tag{7.7}$$

$$B = \frac{dC_u - uC_d}{(u-d)R} \tag{7.8}$$

Δ is referred to as the option delta or hedge ratio.

Since the portfolio (consisting of Δ shares and B debt) has the same payoff as that of a call option, the value of the call option is

$$C = \Delta\, S - B \tag{7.9}$$

Note that the value of option is found out by looking at the value of a portfolio of shares and loan that imitates the option in its payoff. So this may be referred to as the option equivalent calculation.

To illustrate the application of the binomial model consider the following data for Pioneer's stock:

$$S = ₹\ 200,\ u = 1.4,\ d = 0.9$$

$$E = ₹\ 220,\ r = 0.10,\ R = 1.10$$

$$C_u = \text{Max}\ (uS - E, 0) = \text{Max}\ (₹\ 280 - ₹\ 220, 0) = ₹\ 60$$

$$C_d = \text{Max}\ (dS - E, 0) = \text{Max}\ (₹\ 180 - ₹\ 220, 0) = 0$$

Given the preceding data, we can get the values of Δ and B by using Eqs (7.7) and (7.8)

$$\Delta = \frac{C_u - C_d}{(u-d)S} = \frac{60}{0.5(200)} = 0.6$$

$$B = \frac{dC_u - uC_d}{(u-d)R} = \frac{0.9(60)}{0.5(1.10)} = ₹\ 98.18$$

Thus the portfolio consists of 0.6 of a share plus a borrowing of ₹ 98.18 (entailing a repayment of ₹ 98.18(1.10) = 108 after one year). The identity of the payoffs of the portfolio and call option is as follows:

	Portfolio	*Call Option*
When u occurs	$1.4 \times 200 \times 0.6 - 108 = 60$	$C_u = 60$
When d occurs	$0.9 \times 200 \times 0.6 - 108 = 0$	$C_d = 0$

Given the equivalence of the call option and the portfolio, the value of the call option is:

$$C = \Delta S - B = 0.6 \times 200 - 98.18 = ₹\ 21.82$$

Note that we could establish the value of the call option without any idea about the probability that the stock would go up or come down. An optimistic investor may think that the probability of an upward move is high whereas a pessimistic investor may think that it is low. Yet the two will agree that the value of the call option is ₹ 21.82. Why? The answer lies in the fact that the current stock price of ₹ 200 already incorporates the views of the optimists as well as the pessimists. And the option value, in turn, depends on the stock price.

Risk-Neutral Valuation Why should the call option on Pioneer stock sell for ₹ 21.82? If the option price exceeds ₹ 21.82, you can make a certain profit by borrowing ₹ 98.18, selling a call option, and buying 0.6 of a share of Pioneer's stock. Likewise, if the option price is less than ₹ 21.82, you can make a certain profit by selling 0.6 of a share of Alpha's stock, lending ₹ 98.18, and buying a call option. In either case you have an opportunity to make money without incurring any risk. Put differently, you have a money machine.

Since there cannot be a money machine, the equilibrium price of the call option is ₹ 21.82. Note that we established the equilibrium price of the call option without knowing anything about the attitude of investors toward risk. The price of the option does not depend on the investor attitude toward risk. It does not matter whether investors love risk or hate risk.

This suggests that there is an alternative method for valuing the option. In this alternative method, called the risk-neutral valuation method, we assume that investors are risk-neutral (indifferent to risk), calculate the expected future value of the option, and convert it into its present value by using the risk-free rate.

If investors are risk-neutral, the expected return on the equity stock of Pioneer must be equal to the risk-free rate.

Expected return on Pioneer's stock = 10 percent

Since Pioneer's stock can either rise by 40 percent to 280 or fall by 10 percent to ₹ 180, we can calculate the probability of a price rise in the hypothetical risk-neutral world.

Expected return = [Probability of rise × 40%] + [(1 – Probability of rise) × –10%] = 10%

Therefore the probability of rise is 0.40[4]. This is called the risk-neutral probability.

We know that if the stock price rises, the call option has a value of ₹ 60 and if the stock price falls the call option has a value of ₹ 0.

Hence, if investors are risk-neutral, the call option has an expected future value of:

(Probability of rise × ₹ 60) + (1 – Probability of rise) × ₹ 0

4 Note that this is the probability of rise in our hypothetical risk-neutral world. Since real world investors are risk averse and not –risk – neutral, they will require a higher expected return from a risky stock. Hence the true probability of rise will be greater than 0.40.

$= 0.40 \times ₹\ 60 + 0.60 \times ₹\ 0 = ₹\ 24.$

The current value of the call option is the present value of the expected future value:

$$\frac{\text{Expected future value}}{1 + \text{Risk-free rate}} = \frac{₹\ 24}{(1.10)} = ₹\ 21.82$$

Not surprisingly, this is exactly the answer we got by using the option equivalent method.

Thus, we have two ways of calculating the value of an option in the binomial world.

Option Equivalent Method Find a portfolio of shares and loan that imitates the option in its payoff. Since the two alternatives have identical payoffs in the future, they must command the same price today.

Risk Neutral Method Assume that investors are risk-neutral, so that the expected return on the stock is the same as the interest rate. Calculate the expected future value of the option and discount it at the risk-free interest rate.

7.6 BLACK AND SCHOLES MODEL

The above analysis was based on the assumption that there were two possible values for the stock price at the end of one year. If we assume that there are two possible stock prices at the end of each six-month period, the number of possible end-of-year prices increases. As the period is further shortened (from six months to three months or one month), we get more frequent changes in stock price and a wider range of possible end-of-years prices. Eventually, we would reach a situation where prices change more or less continuously, leading to a continuum of possible prices at the end of the year. Theoretically, even for this situation we could set up a portfolio which has a payoff identical to that of a call option. However, the composition of this portfolio will have to be changed continuously as the year progresses.

Calculating the value of such a portfolio and through that the value of the call option in such a situation appears to be an unwieldy task, but Black and Scholes developed a formula that does precisely that. Their formula is:

$$C_0 = S_0\, N(d_1) - \frac{E}{e^{rt}}\, N\,(d_2) \tag{7.10}$$

where C_0 is the equilibrium value of a call option now, S_0 is the price of the stock now, E is the exercise price, e is the base of natural logarithm, r is the continuously compounded risk-free annual interest rate, t is the length of time in years to the expiration date, and $N(d)$ is the value of the cumulative normal density function.

$$d_1 = \frac{\ln(S_0/E) + (r + 1/2\ \sigma^2)t}{\sigma\sqrt{t}} \tag{7.11}$$

$$d_2 = d_1 - \sigma\sqrt{t} \tag{7.12}$$

where ln is the natural logarithm and σ is the standard deviation of the continuously compounded annual rate of return on the stock.

Though one of the more complicated formulae in finance, it is one of the most practical. The formula has great appeal because four of the parameters, namely, S_0, E, r, and t are observable. Only one of the parameters, namely, σ^2, has to be estimated. Note that the value of a call option is affected by neither the risk aversion of the investor nor the expected return on the stock.

Assumptions You may have guessed by now that the Black and Scholes model, like other important models in economics and finance, is based on a set of simplifying assumptions. Yes, you are right. The assumptions underlying the Black and Scholes model are as follows:

- The call option is the European option
- The stock price is continuous and is distributed log normally
- There are no transaction costs and taxes
- There are no restrictions on or penalties for short selling
- The stock pays no dividend
- The risk-free interest rate is known and constant.

These assumptions may appear very severe. However when some of them do not hold, a variant of the Black and Scholes model applies. Further, empirical studies indicate that the Black and Scholes model applies to American options as well.

Applying the Black-Scholes Formula Although the Black-Scholes formula appears difficult it is fairly easy to apply. This may be illustrated with an example.

Consider the following data for a certain stock

- Price of stock now = S_0 = ₹ 60
- Exercise price = E = ₹ 56
- Standard deviation of continuously compounded annual returns = σ = 0.3
- Years to maturity = t = 0.5
- Risk-free interest rate per annum = 0.14

Applying the Black-Scholes formula involves four steps.

Step 1: Calculate d_1 and d_2

$$d_1 = \frac{\ln(S_0/E)+(r+1/2\ \sigma^2)t}{\sigma\sqrt{t}}$$

$$= \frac{0.068993 + 0.0925}{0.2121} = \frac{0.161493}{0.2121} = 0.7614$$

$$d_2 = d_1 - \sigma\sqrt{t}$$

$$= 0.7614 - 0.2121 = 0.5493$$

Step 2: Find $N(d_1)$ and $N(d_2)$

$N(d_1)$ and $N(d_2)$ represent the probabilities that a random variable that has a standardised normal distribution will assume values less than d_1 and d_2. The simplest way to find $N(d_1)$ and $N(d_2)$ is to use the Excel function NORMSDIST.

$$N(d_1) = N\,(0.7614) = 0.7768$$

$$N(d_1) = N\,(0.5493) = 0.7086$$

If you don't have easy access to the Excel function NORMSDIST, you can get a very close approximation by using the Normal Distribution given in Table A.5 in Appendix A at the end of the book. The procedure for doing that may be illustrated with respect to N (0.7614) as follows:

1. 0.7614 lies between 0.75 and 0.80
2. According to the table, N (0.75) = 1 – 0.2264
   = 0.7736 and N (0.80) = 1 – 0.2119 = 0.7881
3. For a difference of 0.05 (0.80 – 0.75) the cumulative probability increases by 0.0145 (0.7881 – 0.7736)
4. The difference between 0.7614 and 0.75 is 0.0114
5. So, N (0.7614) = N(0.75) + $\frac{0.0114}{0.05} \times 0.0145 = 0.7736 + 0.0033 = 0.7769$

This value is indeed a close approximation for the true value 0.7768.

Step 3: Estimate the present value of the exercise price, using the continuous discounting principle

$$\frac{E}{e^{rt}} = \frac{₹\,56}{e^{0.14\times 0.5}} = ₹\,52.21$$

Step 4: Plug the numbers obtained in the previous steps in the Black-Scholes formula

$$C_0 = ₹\,60 \times 0.7768 - ₹\,52.21 \times 0.7086$$

$$= ₹\,46.61 - ₹\,37.00 = ₹\,9.61$$

A spreadsheet illustration of the above is as under:

Price of stock now S_0		60
Exercise price E		56
Standard deviation of continuously compounded annual return σ		0.3
Years to maturity t		0.5
Interest rate per annum r		0.14
d_1	=(LN(C1/C2) + (C5 +(C3^2)/2)*C4)/(C3*(C4^0 5))	0.7613
d_2	= C6 – C3* (C4/0.5)	05492
Equilibrium value of call option now C_0	=C1*NORMSDIS T (C6) – (C2/EXP(C5*C4)) *NORMSDIST (C7)	9.61

Replicating Portfolio Note that the principle of replicating portfolio used in the binomial model also undergirds the Black-Scholes model. Exhibit 7.7 shows the replicating portfolios for calls and puts, in the binomial and the Black-Scholes models.

Exhibit 7.7 ***Replicating Portfolio for Calls and Puts***

Option Position	*Binomial Model*	*Black–Scholes Model*
Buy Call Option	Borrow B	Borrow $Ee^{-rt}N(d_2)$
	Buy Δ shares of stock	Buy $N(d_1)$ shares of stock
Sell Call Option	Lend B	Lend $Ee^{-rt}N(d_2)$
	Sell short Δ shares	Sell short $N(d_1)$ shares
Buy Put Option	Lend B	Lend $Ee^{-rt}(1 - N(d_2))$
	Sell short Δ shares	Sell short $(1 - N(d_1))$ shares
Sell Put Option	Borrow B	Borrow $Ee^{-rt}(1 - N(d_2))$
	Buy Δ shares	Buy $(1 - N(d_1))$ shares

Adjustment for Dividends The Black-Scholes model given in Eq. (7.10) assumes that the stock pays no dividend. When dividend is paid the stock price diminishes. Hence, call options become less valuable and put options become more valuable. To reflect dividend payments, two adjustments are commonly made, one for options that have a short life and the other for options that have a long life.

Short-term Options When options expire in less than one year, the present value of dividends expected during the life of the option is subtracted from the current value of the stock to obtain a 'dividend-adjusted value', which is then used as the input for S in the Black-Scholes model.

$$\text{Adjusted stock price} = S' = S - \sum \frac{Div_t}{(1+r)^t} \tag{7.13}$$

$$\text{Value of call} = S'N(d_1) - Ee^{-rt}N(d_2) \tag{7.14}$$

where

$$d_1 = \frac{\ln(S_0/E) + (r + 1/2\ \sigma^2)t}{\sigma\sqrt{t}}$$

$$d_2 = d_1 - \sigma\sqrt{t}$$

Long-term Options Computing the present value of dividends and adjusting for the same is tedious and difficult in the case of long-term options. If the dividend yield (y = dividend/current stock price) is expected to remain fairly stable during the life of the option, the Black-Scholes model can be modified to reflect dividend payment

$$C = Se{-}yt\ N(d_1) - Ee^{-rt}\ N(d_2) \tag{7.15}$$

where

$$d_1 = \frac{\ln(S_0/E) + (r + 1/2\ \sigma^2)t}{\sigma\sqrt{t}}$$

$$d_2 = d_1 - \sigma\sqrt{t}$$

This adjustment essentially does two things: (i) it discounts the value of the stock to the present at the dividend yield to reflect the expected drop in value on account of dividend payments, and (ii) it offsets the interest rate by the dividend yield to reflect the lower cost of carrying the stock (in the replicating portfolio).

7.7 APPLICATIONS OF THE BINOMIAL MODEL

This section discusses two applications of the binomial model, one for valuing a vacant land, which can be developed now or in future, and the other for valuing an option to abandon.

Valuing a Vacant Land Vacant land has value because it can be used for a variety of purposes. For example, a particular plot of land may be used for building apartments or a shopping complex. Further, the construction can be done now or in future. The developer would like to develop the property now or in future so that the present value of the difference between benefits and costs is maximised. While the best possible use of land presently can be established easily, its best possible future use may not be known now.

The option valuation approach can be used to determine the value of a vacant land that provides the option to choose one of several possible uses now or in future. The procedure for doing so involves the following steps:

1. Compute the risk-neutral probabilities associated with various outcomes by observing the market prices of traded investments (price of apartments or office blocks and the risk-free rate of interest).
2. Calculate the expected cash flow next year. For this calculation use the risk-neutral probabilities and assume that the best alternative will be chosen under each outcome.
3. Compute the current value of land by discounting the expected cash flow at the risk-free interest rate.

Illustration A builder owns a plot of land that can be used for either eight or twelve apartment units. The construction cost for these two alternatives are ₹ 36 million and ₹ 62 million respectively. The current market price per apartment is ₹ 6 million. The yearly rental (net of expenses) per unit is ₹ 0.5 million and the risk-free interest rate is 12 percent per annum. If the market for apartments is buoyant next year, each apartment unit will sell for ₹ 7.5 million; if the market is sluggish each apartment unit will sell for ₹ 5.4 million. What is the value of the vacant plot? Assume that the construction cost will remain unchanged.

Presently, an eight unit building yields a profit of ₹ 12 million (= 8 × 6 – 36) and a twelve unit building yields a profit of ₹ 10 million (= 12 × 6 – 62). Hence an eight-unit building is the best alternative if the builder has to construct now.

However, if the builder waits for a year, his payoffs will be as follows:

Alternative	*Market Condition*	
	Buoyant (apartment price: ₹ 7.5 million)	*Sluggish (apartment price: ₹ 5.4 million)*
8-unit building	7.5 x 8 – 36 = 24	5.4 x 8 – 36 = 7.2
12-unit building	07.5 x 12 – 62 = 28	5.4 x 12 – 62 = 2.8

Thus, if the market turns out to be buoyant the best alternative is the 12-unit building (payoff: ₹ 28 million) and if the market turns out to be sluggish the best alternative is the eight-unit building (payoff: ₹ 7.2 million).

Given the preceding information, we can apply the binomial method for valuing the vacant land.

Step 1: Calculate the risk-neutral probabilities The binomial tree given in Exhibit 7.8 shows that a ₹ 6 million investment in an apartment this year yields a year end value of ₹ 8 million (₹ 7.5 million plus ₹ 0.5 million in rent) or ₹ 5.9 million (₹ 5.4 million plus ₹ 0.5 million in rent) depending on market conditions. Given a risk-free rate of 12 per cent, the risk-neutral probabilities must satisfy the following condition:

₹ 6 million = [$p \times$ ₹ 8 million + $(1 - p) \times$ ₹ 5.9 million]/(1.12)

Solving this we get $p = 0.39$ and $1 - p = 0.61$

Step 2: Calculate the expected cash flow next year The expected cash flow next year is:

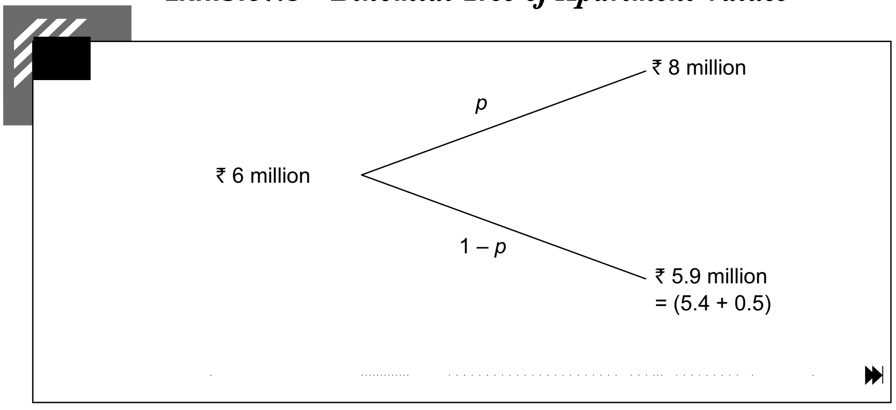
$0.39 \times 28 + 0.61 \times 7.2 =$ ₹ 15.31 million

Step 3: Compute the current value The current value of land applying the risk-free rate of 12 percent is:

₹ 15.31/1.12 = ₹ 13.67 million

Since ₹ 13.67 million is greater than ₹ 12 million the profit from constructing an eight-unit building now, it is advisable to keep the land vacant. The value of the vacant land is ₹ 13.67 million.

Exhibit 7.8 ***Binomial Tree of Apartment Values***



Valuing an Option to Abandon Your firm has decided to manufacture a new product labelled Titus. It is evaluating two alternative machines, both costing the same, to manufacture Titus.

Alternative A: A special purpose machine designed for Titus. While it reduces the cost of production, it does not have much resale value.

Alternative *B*: A general purpose machine. Though it involves a higher cost of production, it has a good resale value

The demand for Titus may be strong or weak. The payoffs (measured as the project's cash flow for the first year plus the present value of future cash flows) of the two alternatives under different market conditions will be as follows:

	Payoff (₹ in million)	
	Alternative A	*Alternative B*
Strong demand	30.0	28.0
Weak demand	14.0	12.0

From the DCF point of view, alternative *A* is clearly superior to alternative *B*. However, alternative *B* offers an advantage in the form of valuable flexibility. If the demand turns out to be weak, the general purpose machine can be sold for ₹ 16 million at the end of year 1, an amount that is greater than ₹ 12 million, the payoff associated with weak demand. Note that alternative *A* does not offer valuable flexibility because the special purpose machine can be sold for only ₹ 10 million at the end of year 1, an amount that is less than ₹ 14 million, the payoff associated with weak demand.

Given the option to sell the machine, the payoffs to alternative *B* are as follows:

Strong demand ⟶ Continue production ⟶ Own a project worth ₹ 28 million

Weak demand ⟶ Exercise the option to sell the machine ⟶ Receive ₹ 16 million

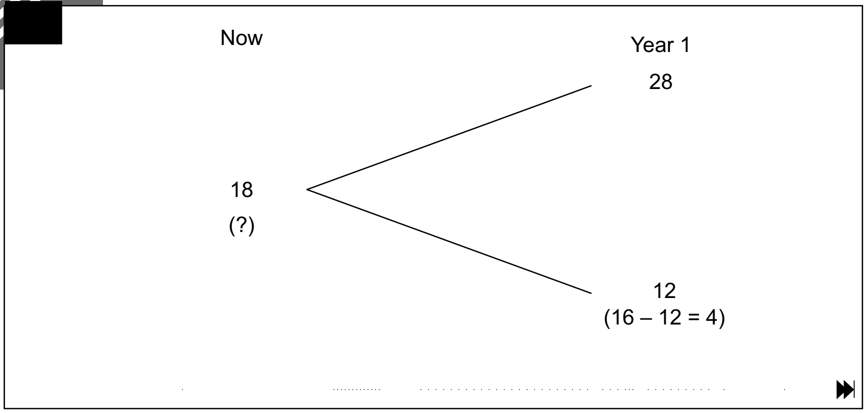
Value of the Abandonment Put Suppose that the value of alternative *B*, ignoring the option of abandonment, is ₹ 18 million. This represents the value of the underlying asset today, assuming that your firm is obliged to continue producing Titus irrespective of how profitable it turns out to be. If the demand turns out to be strong, the value at year 1 rises to ₹ 28 million giving a return of 55.6 percent; on the other hand, if the demand turns out to be weak, the value at year 1 falls to ₹ 12 million, giving a return of –33.3 percent.

Now let us introduce the put option. Clearly your company would like to continue with the project if the demand turns out to be strong. However, should the demand turn out to be weak, your company will be better off if it abandons the project and sells the machine. The put option in this case will have a value of ₹ 4 million (₹ 16 million – ₹ 12 million). The payoffs to the put option are summarised below:

	Year-end Values of the Project (₹ in million)	
	12	28
Value of put option	16 – 12 = 4	0

Exhibit 7.9 shows the present and future values of the underlying project. While the future values of the abandonment option are shown in the parenthesis, the present value of the abandonment option has yet to be calculated—it is shown as a question mark.

Exhibit 7.9 ***Binomial Tree***



As the project has only two possible outcomes, we can apply the binomial model. Recall that there are two methods of applying the binomial model: option equivalent method and risk-neutral method.

For our purposes we will apply the risk-neutral method. The return on the proposed project will be 55.6 percent or –33.3 percent. Hence the expected return is:

Expected return = (Probability of strong demand) × 55.6%
+ (1 – Probability of weak demand) × –33.3%

The risk neutral method assumes that investors do not care about risk. So the return required by them is simply the risk-free return. Suppose the risk-free return is 6 per cent. Then the probability of strong demand in this hypothetical risk-neutral world can be calculated as follows:

Expected return = (Probability of strong demand) × 55.6%
+ (1 – Probability of strong demand) × –33.3% = 6%

Probability of strong demand = 0.44

Probability of weak demand = 1 – 0.44 = 0.56

The payoff to the put option at the end of year 1 will be either 0 or ₹ 4 million. Hence the expected payoff to the put option is:

Expected payoff to put option = (Probability of strong demand) × 0
+ (1 – Probability of strong demand) × 4
= 0.44 × 0 + 0.56 × 4 = ₹ 2.24 million

Discounting ₹ 2.24 million for one year at 6 percent gives a value of 2.24/1.06 = ₹ 2.11 million. Thus the abandonment option has a value of ₹ 2.11 million.

7.8 APPLICATIONS OF THE BLACK AND SCHOLES MODEL

This section discusses two applications of the Black and Scholes model, one for valuing an option to make a follow on investment and the other for valuing a natural resource option.

Valuing an Option to Make a Follow on Investment Your firm is looking at a proposal to manufacture an electronic educational aid called Electriad-I. The projected cash flows for this proposal are shown in Exhibit 7.10.

Exhibit 7.10 ***Cash Flows and Financials for Electriad-I***

(₹ in million)

	Year					
	0	*1*	*2*	*3*	*4*	*5*
Initial outlay	(150)					
After-tax operating cash flow		20	40	50	50	40
Terminal cash flow						30
Net cash flow	(150)	20	40	50	50	70
Present value at 18 percent	(150)	16.9	28.7	30.5	25.8	30.6
Present value of cash inflows	= 16.9 + 28.7 + 30.5 + 25.8 + 30.6 = 132.5					
Investment outlay	= 150					
Net present value	= 132.5 – 150 = -17.5					

Although the proposal has a negative NPV, the chief executive of your firm thinks that the project may be worthwhile. He argues, "If we undertake Electriad-I now we will be in a position to make a follow on investment in an advanced version, Electriad-II, four years down the road. If conditions are favourable, such a follow on investment can be very profitable."

Sensing the possibility of applying the option pricing model for valuing the option to make the follow on investment, you request him to provide key financial estimates for the follow on investment opportunity. He furnishes the following information:

- Electriad-II will be double the size of Electriad-I. It will require an investment of ₹ 300 million (this is akin to the exercise price of a call option).
- The expected cash inflows of Electriad-II too will be twice those of Electriad-I.

Hence, they will have a present value of ₹ 265 million as at the end of year four.

You need one more crucial piece of information: the degree of uncertainty characterising the cash inflows of Electriad-II. Your chief executive is not able to provide an estimate of this. You look at the stock price behaviour of your company and find that it has a standard deviation of 40 percent per year. In the absence of any other information, you assume that the cash inflows of Electriad-II too would have the same standard deviation. The risk-free interest rate is 12 percent per annum.

The preceding information may be cast in terms of the inputs required by the Black-Scholes formula.

S_0 = present value of the asset = $265 \times e^{-.18 \times 4}$ = ₹ 129 million
E = exercise price = ₹ 300 million
σ = standard deviation of continuously compounded annual returns = 0.4
t = years to maturity = 4
r = risk-free interest rate = 12 percent

Step 1: Calculate d_1 and d_2

$$d_1 = \frac{\ln(S_0/E) + (r + 1/2\ \sigma^2)t}{\sigma\sqrt{t}} = \frac{-0.844 + (0.12 + (0.16/2))4}{0.4\sqrt{4}} = -0.055$$

$$d_2 = d_1 - \sigma\sqrt{t} = -0.055 - 0.8 = -0.855$$

Step 2: Find $N(d_1)$ and $N(d_2)$

$$N(d_1) = 0.4781$$

$$N(d_2) = 0.1963$$

Step 3: Estimate the present value of the exercise price

$$E\ .e\text{–}rt = 300/1.6161 = ₹\ 185.63 \text{ million}$$

Step 4: Plug the numbers obtained in the previous steps in the Black-Scholes formula

$$C_0 = ₹\ 129 \text{ million} \times 0.4781 - ₹\ 185.63 \text{ million} \times 0.1963$$
$$= ₹\ 25.23 \text{ million}$$

Based on this calculation you argue that a call value of ₹ 25.23 million more than offsets the negative NPV of ₹ 17.5 million and hence Electriad-I is a worthwhile proposition. Your chief executive too agrees with you because your quantitative evaluation squares with his intuitive reflection, though he is not sure how you came up with a value of ₹ 25.23 million for the call option. Of course, you have a different concern about that number because you are not sure whether the assumptions underlying the calculation are realistic.

Valuing a Natural Resource Option An important application of real option valuation has been to natural resources. In a natural resource investment, the underlying asset is the natural resource and the exercise price is the cost of development. If the estimated value of the natural resource is V and the cost of development X, the potential payoffs from a natural resource are:

When	*Payoff*
$V > X$	$V - X$
$V \leq X$	0

Thus the payoff function of an investment in a natural resource option is similar to that of a call option.

To value a natural resource option, you have to estimate the following:

- Value of the available reserves of the resource
- Development cost
- Time to expiration of the option
- Variance in value of the underlying asset
- Dividend yield

Value of the Available Resources The value of the available resources (the asset under consideration) is a function of the quantity and price of the natural resource. For instance, geologists can provide reasonably reliable estimates of the quantity of oil in a particular oil basin and oil economists can provide a forecast of oil price.

Development Cost The development cost represents the exercise price of the option. A knowledge of past costs and an understanding of the specifics of the investment is required to get a handle on the development cost.

Time to Expiration of the Option The life of a natural resource option is usually defined in two ways: (i) The period over which the natural resource can be exploited. For example, the government may grant a base period of 20 years for an oil basin. (ii) The time taken to exhaust the inventory of the natural resource. For example, if a gold mine has an inventory of 900,000 ounces and the capacity output rate is 60,000 ounces per year, the inventory will be exhausted in 15 years and this represents the life of the natural resource option.

Variance in the Value of the Underlying Asset The variance in the value of the underlying asset depends on the variability in the estimate of available reserve and the variability in the price of the resource. If the quantity of the available reserve is known, the variance of the value of the asset depends on the variability of the price of the resource.

Cost of Delay Conceptually similar to the dividend yield in a stock, the cost of delay in a natural resource option represents the loss in production for each year of delay. It may be estimated as annual net production revenue as a percentage of the market value of the reserve.

For natural resource options, you have to consider the development lag as well. This is the time lag between the decision to extract the resource and the actual extraction. A simple way to adjust for this lag is to discount the value of the developed reserve for the time lag involved in development at the net production revenue / asset value ratio (or the dividend yield).

Valuing an Oil Reserve ONG, an oil major, is assessing the value of the option to extract oil from a particular oil basin. The following information has been gathered:

- The estimated oil reserve in the basin is 100 million barrels of oil. It may be assumed that there is no variability characterizing this quantity.
- The development cost is \$1 billion.
- The right to exploit the basin will be enjoyed for 25 years.
- The marginal value per barrel of oil presently is \$20—this represents the difference between the price per barrel of oil and the marginal cost of extracting a barrel of oil. The standard deviation of *ln*(oil price) is estimated to be 0.2.
- Once developed, the net production revenue each year will be 4 percent of the value of the reserve.
- The risk-free rate is 8 percent.
- The development lag is two years.

Given the preceding information, the inputs to the Black-Scholes formula can be estimated as follows:

S_0 = current value of the asset = value of the developed reserve discounted back for two years (the development lag) at the dividend yield = $\$20 \times 100/(1.04)^2 = \$\ 1849.11$ million

E = exercise price = development cost = \$ 1000 million. This is assumed to be fixed over time.

σ = standard deviation of the *ln* (oil price) = 0.2

t = life of the option = 25 years

r = risk-free rate = 8 percent

y = dividend yield = net production revenue/value of reserve = 4 percent

Given these inputs, the call option is valued as follows:

Step 1: Calculate d_1 and d_2

$$d_1 = \{ln\ (1849.11/1000) + [.08 - .04 + (.04/2)]\ 25\} \div 0.2\ \sqrt{25}$$
$$= 0.6147 + 1.5 = 2.1147 \div 1 = 2.1147$$

$$d_2 = d_1 - \sigma\sqrt{t}$$
$$= 2.1147 - 1.000 = 1.1147$$

Step 2: Find $N(d_1)$ and $N(d_2)$

$$N(d_1) = N\ (2.1147) = 0.9828$$

$$N(d_2) = N\ (1.1147) = 0.8675$$

Step 3: Estimate the present value of the exercise price

$$E/e^{rt} = 1000/e^{0.08 \times 25} = \$\ 135.33 \text{ million}$$

Step 4: Plug the numbers obtained in the previous steps in the Black-Scholes formula

$$\begin{aligned} C &= \$1849.11 \text{ million} \times 0.9828 - \$135.33 \text{ million} \times 0.8675 \\ &= \$1699.91 \text{ million} \end{aligned}$$

Merits of the Binomial Option Model

The Black-Scholes model can be applied to a situation where there is a single source of uncertainty and a single decision date. If there are multiple sources of uncertainties and several decision dates, the solution cannot be obtained analytically. In such cases, specialised mathematical tools called numerical methods are required.

For handling complex real options, John Cox and Stephen Ross introduced the risk-neutral approach which was applied by them and Mark Rubinstein in a very useful manner in the binomial option model. The fundamental insight of the risk-neutral approach is that since option values are indifferent to risk preferences, we can apply the risk free discount rate. This simplifies calculations immensely.

The binomial option model offers three advantages:

1. It can cover a wide range of real options, including fairly complex ones.
2. Many users feel comfortable with it as it has the appearance of DCF analysis.
3. It depicts uncertainty and the consequences of contingent decisions in a natural way, producing good visual images.

7.9 MISTAKES MADE IN REAL OPTION VALUATION[5]

There are two important differences between financial options and real options. First, the underlying assets (such as stocks or currencies) of financial options are traded continously whereas the underlying assets (such as land, buildings, factories) of real options are traded infrequently. Second, the exercise of choice is fairly straightforward for financial options but quite complicated for real options. The holder of a stock option has merely to decide whether to buy the stock at some predetermined price. It is not so simple for real options. For example, the owner of a vacant land must decide more than just whether he should build on his land. He has to decide what to build (apartments, independent villas, resort, and so forth) and how soon to build.

5 Sheridan Titman, John D. Martin, and V. Ravi Anshuman (2008), *Valuation* (Section 11.6) and published by Pearson Education, Inc.

Given the difficulties in valuing and exercising real options, it is not surprising that mistakes are made in real option valuation. The more common mistakes characterising real option valuation in practice are described below:

Unthinking Application of the Black-Scholes Model Analysts often tend to "force-fit" the Black-Scholes model to real option problems, even when the realities of the situation are not consistent with the assumptions underlying the Black-Scholes model. (There is an old saying: "Give a little boy a hammer and he finds that everything that he comes across needs pounding.")

Use of Wrong Volatility To value the options embedded in natural resource investments, analysts often wrongly use the volatility of the commodity price rather than the volatility of the value of the underlying asset (like the oil field). In general, the volatility of the commodity price is greater than the volatility of the value of the underlying asset.

Assumption of a Fixed Exercise Price While the exercise price of a financial option is fixed, the exercise price of a real option may vary over time. For example, the cost of developing an oil field tends to increase over time. So, it is not correct to assume a fixed exercise price.

Overestimation of the Value of Flexibility Often there is a disconnect between the way real options are valued and the way they are managed. For example, management may delay expansion due to a procrastination tendency or fail to shut down an uneconomic facility in a timely manner due to inertia or emotional attachment. Hence, the value of options, which are exercisable in theory but often not exercised in practice, is likely to be overestimated.

Abuse of Real Options to Justify a Project on Strategic Grounds It is fairly easy for a project sponsor to invoke real options in defence of a pet project. He can spell out various options that are created by the initial investment and justify the project as having "strategic significance."

Failure to Consider Feedback Effects The actions of a firm can have an impact on the environment in which it operates. For example, power companies in the U.S. invest in "peaker plants" that are turned on in response to peak demand when electricity prices rule high. Peaker plants are valued as an option to sell power when electricity prices are very high. The emergence of many peaker plants in the late 1990s in the U.S., however, led to a higher availability of capacity during peak-load periods, leading to a reduction in the volatility of electricity prices. Failure to consider such feedback effects causes an overvaluation of options.

7.10 EVALUATION

Contingent claim or option valuation offers certain advantages:

- Assets like patents, which derive their value almost entirely from their option characteristics, cannot be valued with conventional value models.
- Option pricing models provide more realistic estimates of value for assets when significant benefits emanate from learning and flexibility.
- Option pricing models underscore a very significant facet of risk. While DCF and relative valuation models almost invariable view risk negatively, the value of options increases with volatility. In some cases, volatility can be exploited to create additional value.

While the contingent claim valuation appears promising and alluring, it has its limitations:

- Learning and flexibility have value only if the firm enjoys a certain degree of exclusivity. If its competitors can imitate the firm, options may not be valuable.
- Option pricing models assume constant variance and dividend yield. While these assumptions may apply to short-term options on traded assets, they do not apply to long-term options on nontraded assets.

SUMMARY

- The standard DCF analysis calls for evaluating a project on the basis of its cash flows over its economic life. Such an evaluation, however, does not capture the value of options embedded in the project.
- The strategic NPV of a project is defined as:

  Strategic NPV = Conventional NPV + Real Option Value (ROV)

- The standard NPV is the maximum of the expected discounted cash flows or zero, if the investment decision is made today. On the other hand, the contingent NPV is the expected value of the maximums, decided on arrival of information, of the discounted cash flows in each future state or zero.
- Since the contingent NPV reflects the flexibility of making the decision after the information arrives, it will always exceed or equal the standard NPV. The value of flexibility depends on the degree of uncertainty and the extent of maneuverability available to management.
- To recognize opportunities for deriving value from flexibility, managers should be as explicit as possible about events, decision alternatives, and payoffs.
- A variety of options are embedded in real projects. They may be classified into four broad types: investment timing options, growth options, flexibility options, and abandonment options

- An option is a special contract under which the option owner enjoys the right to buy or sell something without the obligation to do so.
- There are two basic types of options: call options and put options. A call option gives the option holder the right to buy a stock (or some other asset) at a fixed price on or before a certain date. A put option gives the holder the right to sell a stock (or some other asset) at a specified price on or before a certain date.
- The value of a call option depends on five factors: exercise price, expiration date, stock price, stock price variability, and interest rate.
- The key insight underlying the Black and Scholes model may be illustrated through a single-period binomial (or two-state) model.
- There are two ways of calculating the value of an option in the binomial world: (i) *Option Equivalent Method*: Find a portfolio of shares and loan that imitates the option in its payoff. Since the two alternatives have identical payoffs in the future, they must command the same price today. (ii) *Risk Neutral Method*: Assume that investors are risk-neutral, so that the expected return on the stock is the same as the interest rates. Calculate the expected future value of the option and discount it at the risk-free interest rate.
- Fisher Black and Myron Scholes published their celebrated option pricing model in 1973. Black and Scholes developed the following formula (referred to commonly as the Black-Scholes model) showing how the value of a call option is related to the basic factors:

$$C_0 = S_0 N(d_1) - N\ (d_2)$$

- The Black-Scholes model assumes that the stock pays no dividend. To reflect dividend payments, two adjustments are commonly made, one for options that have a short life and the other for options that have a long life.
- Options embedded in real life projects may be valued with the help of the binomial model or the Black-Scholes model, if suitable quantitative estimates can be defined.
- Where quantitative estimates cannot be defined with a measure of confidence, Black-Scholes model cannot be applied meaningfully. Yet, the insights provided by this model can be combined with well-informed, experienced judgment to get a handle over option values.
- Firms that employ real options for strategic reasons must learn to manage them well.
- Given the difficulties in valuing and exercising real options, it is not surprising that mistakes are made in real option valuation.

Questions

1. What are the limitations of the DCF model?
2. What is the difference between standard NPV and contingent NPV?
3. What factors influence the value of flexibility?

4. Describe the different types of options embedded in real projects.
5. Define the following terms: option holder, option writer, exercise price, maturity date.
6. What is the payoff of a European call option and put option?
7. Define the payoffs of a call option and a put option from the point of view of the option writer (or seller).
8. Specify the boundaries within which the value of a call option falls.
9. Discuss the key factors that have a bearing on the value of a call option.
10. Show why a higher variability of the stock price has a positive effect on the value of call option.
11. Derive the value of call option in the binomial world using the option equivalent method.
12. What is the value of a call option as per the Black-Scholes model?
13. State the assumptions underlying the Black-Scholes model.
14. Describe the risk-neutral valuation method.
15. Discuss the adjustments made for dividend payment in the Black-Scholes model.
16. What are the merits of the binomial option model?
17. What mistakes are made in real option valuation.
18. Assess the use of option valuation.

? Problems

1. You have to decide whether to invest ₹ 50 million a year from now to manufacture and distribute a new drug which is in an advanced stage of development. The drug has to undergo further clinical trials on patients for one year, for which all the required investments have been made. There are two possible outcomes of these trials. The drug may prove to be highly effective or only somewhat effective. If it is the former, it will generate an annual cash flow of ₹ 8 million forever; if it is the latter, it will produce an annual cash flow of ₹ 2 million forever. Both the outcomes are equiprobable.

   What is the NPV of this proposal, if the decision to invest has to be taken now (although the investment will be made a year from now) ? Assume a cost of capital of 8 percent.

   What is the NPV of this proposal if the decision to invest can be postponed until trial results are known? Assume a cost of capital of 8 percent.
2. Alpha Company's equity is currently selling for ₹ 100 per share. In a year from now it can rise to ₹ 150 or fall to ₹ 90. The interest rate is 15 percent. What is the value of a call option on Alpha Company's equity as per the Binomial model? The exercise price is ₹ 100.
3. Beta Company's equity is currently selling for ₹ 60. In a year from now it can rise or fall. On the downside it may fall to ₹ 45. The call option on Beta's equity has a value of ₹ 5. If the

interest rate is 16 percent, to what level would Beta's equity rise on the upside? Assume that the excise price is ₹ 60.

4. The following information is available for Abhishek Industries:

$$S_0 = ₹\ 70,\ E = ₹\ 72,\ rf = 0.12,\ \sigma = 0.30$$

Calculate the price for a six month call option as per the Black-Scholes model.

5. What is the value of a European call option (no dividends) with an exercise price of ₹ 50 and an expiration date three months from now if the stock price is ₹ 40, the variance of the stock is 0.40, and the risk-free rate is 14 percent?

6. Your firm is looking at a proposal to manufacture a certain computer called Comp-I. The projected cash flows for this proposal are as follows:

	₹ in million				
	Year				
	0	1	2	3	4
Initial outlay	(100)				
After-tax operating cash flow		20	50	50	20
Terminal cash flow					10

The discount rate applicable to this proposal is 20 percent.

If your firm undertakes Comp-I proposal, it will be in a position to make a follow on investment in an advanced version, Comp-II, four years from now. Comp-II will be double the size of Comp-I in terms of investment outlay and cash inflows. The cash inflows of Comp-II would have a standard deviation of 30 percent per year.

(a) What is the net present value of the cash flows of Comp-I?

(b) What is the value of the option to invest in Comp-II?

Assume that the risk-free rate is 12 percent.

7. A builder owns a plot of land that can be used for either nine or fifteen apartment units. The construction costs of these two alternatives are ₹ 9 million and ₹ 17 million respectively. The current price per apartment is ₹ 1.2 million. The yearly rental (net of expense) per unit is ₹ 0.10 million and the risk-free interest rate is 10 percent per annum. If the market for apartments is buoyant next year, each apartment unit will sell for ₹ 1.5 million; if the market is sluggish each apartment unit will sell for ₹ 1.1 million. What is the value of the vacant plot? Assume that the construction cost will remain unchanged.

8. Max Oil Limited is assessing the value of the option to extract oil from a particular oil basin. The following information has been gathered:

- The estimated oil reserve in the basin is 100 million barrels of oil. Assume that there is no variability characterising this quantity.
- The development cost is $600 million.

- The right to exploit the basin will be enjoyed for 20 years.
- The marginal value per barrel of oil presently is \$22—this represents the difference between the price per barrel of oil and the marginal cost of extracting a barrel of oil. The standard deviation of *ln* (oil price) is estimated to be 0.25.
- Once developed, the net production revenue each year will be 5% of the value of the reserve.
- The risk-free rate is 8%.
- The development lag is three years.

What is the value of the option to extract oil?

MINICASE

Your firm is looking at a proposal to manufacture a portable music system called Harmonica- I. The projected cash flows of this proposal are shown in the following table.

					₹ *in million*
	0	*1*	*2*	*3*	*4*
• Initial outlay	(550)				
• After-tax operating cash flow		120	240	240	120
• Terminal cash flow		50			

The discount rate applicable to Harmonica-I is 18 percent.

Prima facie, the cash flows of the project do not suggest that the project is attractive. However, Laxman Rao, the chief executive of your firm, a scientist turned entrepreneur, is quite excited about the project. He believes that if the firm undertakes Harmonica-I proposal now, the firm will be in a position to make a follow on investment in an advanced version, Harmonica-II , four years from now. He is quite confident that the firm will have all the capabilities to do so, if it undertakes Harmonica-I initially.

In a recent meeting of the capital budgeting committee, Laxman Rao provided the following estimates:

- Harmonica-II will be twice the size of Harmonica-I. It will require an investment of ₹1100 million.
- The expected cash inflows of Harmonica-II will be twice those of Harmonica-I.
- The standard deviation of the cash inflows of Harmonica-II will be 30 percent.
- The risk free interest rate is 10 percent.

(a) What is the net present value of Harmonica –I?

(b) What factors will determine the value of the option to invest in Harmonica-II?

(c) What is the value of the option to invest in Harmonica-II?

(d) What are the differences between financial options and real options?

(e) What are the kinds of real options found in capital projects?

(f) What is the upside change if the standard deviation of the annualised return on the underlying asset is 30 percent?

(g) What are the advantages of the binomial model?

(h) Discuss how the value of options embedded in capital projects may be judgmentally evaluated.

CHAPTER

8

Advanced Issues in Valuation

In applying the basic principles and techniques of corporate valuation to different kinds of companies you have to take into account their idiosyncratic characteristics. For example, a multi-business company has certain characteristics which makes it more difficult to value than a single business company. Likewise valuing a financial institution (like bank or insurance company) presents very different issues compared to those faced while valuing a manufacturing company.

Apart from the nature of operations of a company, the context in which valuation is done is also relevant. For example, valuation in emerging markets presents its own challenges because emerging economies are characterised by high macroeconomic uncertainty, considerable volatility in exchange rates, inflation, and interest rates, control over capital flows, and somewhat lax disclosure norms. Likewise, valuation of a private company tends, in some ways, to be more difficult than the valuation of a public company.

This chapter (a) highlights the unique issues that arise in valuing companies of different kinds and valuing companies in different contexts and broadly suggests how these issues may be handled, and (b) touches upon certain 'loose ends' of valuation. It is organised into three sections:

- Valuation of companies of different kinds
- Valuation in different contexts
- Loose ends of valuation

8.1 VALUATION OF COMPANIES OF DIFFERENT KINDS

This section discusses the issues which become relevant in valuing multi-business companies that have subsidiaries, high growth companies, cyclical companies, commercial banks, and insurance companies. It draws heavily on McKinsey & Company et al. *Valuation: Measuring and Managing the Value of Companies*, 4e, John Wiley & Sons, 2005.

Valuation of Multi-business Companies

Most large companies are engaged in multiple businesses. Reliance Industries Limited has a portfolio consisting of oil and gas, refining, petrochemicals, textiles, and retail. General Electric is engaged in four main businesses viz., technology, energy infrastructure, finance, and media.

Since the different businesses of a multi-business company have different financial characteristics (ROIC, growth rate, and risk), it is best to value each business separately and then sum the parts to obtain the value of the entire company.

While the principles of valuation remain the same, there are some unique issues that arise in the context of a multi-business company. These relate to:

- Creation of business unit financial statements.
- Estimation of cost of capital for each business unit.
- Interpretation of results

Creation of Business Unit Financial Statements To value a business unit, you need its financial statements, viz. income statement, balance sheet, and cash flow statement. To create the financial statements of different business units, you have to allocate corporate costs, deal with inter-company transactions, deal with inter-company receivables/payables, value financial subsidiaries, and deal with incomplete information.

Corporate Costs Most multi-business companies incur costs for shared services and corporate overheads. Which of these costs should be allocated to business units and which retained at the corporate level?

When the corporate centre provides shared services like accounting, human resources, and information technology, you have to allocate these costs to various business units using appropriate cost drivers. For example, the cost of human resources services provided by the corporate centre may be allocated to various business units on the basis of the number of employees.

Corporate overheads such as CEO compensation and charitable contributions should not be allocated to business units. Instead, they should be retained as a corporate centre cost for two reasons. (a) If corporate centre costs are allocated to business units (which generally have their own chief executives and CFOs), their comparability with pure play business unit peers diminishes. (b) It makes it easier to measure the drag that the corporate centre may have on the value of the company.

Intercompany Sales Sometimes business units sell goods and services to one another. Such intercompany sales must be recorded at the value at which they would be transacted with third parties in an arm's length relationship. Otherwise, there will be a distortion in the relative valuation of business units.

Intercompany Receivables and Payables Generally, in a multi-business company cash and debt for all business units are managed centrally. Units with positive cash flow remit the same to the corporate centre, leading to an intercompany receivable from the corporate parent. Likewise, units with negative cash flow get cash from the parent, leading to an intercompany payable to the parent. As these intercompany receivables and payables are not like third party receivables and payables, they should not be considered as part of operating working capital. Instead, they should be regarded as intercompany equity for calculating the invested capital.

Financial Subsidiaries Some companies have financial subsidiaries. The balance sheet of a financial company is structured very differently from that of a manufacturing or service company. Its assets are mostly financial and it has a high debt-equity ratio. As we argue in a following section, a financial business should be valued by discounting its cash flow to equity at the cost of equity.

When valuing a financial subsidiary, avoid double counting its debt in the overall valuation of the company. It makes sense to rework the consolidated company's income statements and balance sheets to treat the financial subsidiary as a nonconsolidated subsidiary. If you do so, the resulting financial statements will have a single line in the income statement reflecting the net income of the subsidiary and a single line in the balance sheet representing the subsidiary's net equity.

Estimation of Cost of Capital for Each Business Unit Because the systematic risk (beta) of operating cash flows and debt capacities tend to vary across business units, each business unit must be valued at its own cost of capital. The cost of capital of a business unit may be calculated as follows:

1. Estimate the business unit's target capital structure. Use the median capital structure of publicly traded peers, if most of them have similar capital structures. If peers are not available or if their capital structures differ widely, allocate the consolidated corporate debt to various business units, so that the interest coverage ratio (EBITA/interest expense) is the same for each unit.
2. Determine the levered beta for each business unit. This involves estimating an unlevered sector median beta and then re-levering it using the business unit's capital structure derived in step 1.
3. Calculate the cost of equity for each business unit. The cost of equity of a business unit is:

   Risk-free return + Levered beta × Market risk premium
4. Estimate the cost of capital for each business unit. The cost of capital of a business unit is:

   Cost of capital = Weight of equity × Cost of equity + Weight of preference × Cost of preference + Weight of debt × Cost of debt $(1 - t)$

Summation of Parts and Interpretation of Results Estimate the DCF value of each business unit (on the basis of its forecasted free cash flow and cost of capital), sum the business unit values, and subtract the corporate costs to derive the operating enterprise value.

Add the value of nonoperating assets to the operating enterprise value to get the figure of total enterprise value. From this figure, subtract nonequity claims to obtain the value of equity.

Business unit analysis often provides valuable insights into where value is created or destroyed within the firm. It provides a roadmap for reorganising the business portfolio to create shareholder value.

Valuation of Companies that Have Subsidiaries

Many companies have subsidiaries or associate companies in which they have significant equity stakes that usually range between 25 percent and 100 percent. To ascertain the intrinsic value per share of such companies the sum of the parts (SOTP) method of valuation is commonly employed. The SOTP method involves the following steps:

1. Determine the value per share attributable to the core business. One way to do so is to calculate the earnings per share from the core business and apply a suitable multiple to it.
2. Find the value per share for each of the listed subsidiaries. In computing this value a discount factor of 15 to 20 percent is generally applied to the observed market value of the equity stake in the listed subsidiary.
3. Assess the value per share for each of the unlisted subsidiaries. To do this, the analyst has to first estimate the market value using an earnings multiple or some other basis as there is no observed market value and then apply a discount factor of 15 to 25 percent to the same.
4. Add the per share values for the core business, for listed subsidiaries, and for unlisted subsidiaries, to get the total value per share.

An illustrative sum of the parts (SOTP) valuation of Mahindra and Mahindra done in 2007 is given in Exhibit 8.1.

Exhibit 8.1 ***SOTP Valuation – Based on FY08E***

Business	*M&M Stake*	*Multiple*	*Parameter*	*Discount (%)*	*Per Share Value*
Core Auto Business	-	10.5	EPS	-	451.7
Mahindra and Mahindra Financial Services	68%		Market Cap	20%	48.6
Mahindra Gesco Developers	39%		Market Cap	20%	27.6
Tech Mahindra	44%		Market Cap	20%	250.2
Mahindra Ugine Steel Co Ltd	55%		Market Cap	20%	5.2
Mahindra Forgings	47%		Market Cap	20%	11.6
Mahindra Holidays and Resorts	100%		PAT	25%	37.0
Mahindra Holdings and Finance	100%		PAT	25%	8.0
Total Subsidiaries Value					388.3
Total Value per share (₹)					840.0

Source: Company, CSEC Research

Valuation of High Growth Companies

The rise and fall of Internet stocks suggests that valuing high-growth, high-uncertainty companies is challenging – some practitioners even consider it as despairing.

The valuation principles discussed in this book apply to high-growth companies as well. Perhaps the best way to value such companies is to use scenario based DCF analysis supported by microeconomic fundamentals.

To value an established company, we start with an analysis of historical performance. But for a nascent high-growth company, historical performance provides little clue about future prospects. So one must begin with the future and work backward to link it to the present. More specifically, the following procedure may be followed.

1. *Start from the Future* To value high-growth companies, start by defining what the industry and company might look like when it reaches a steady state (sustainable, moderate growth rate) in future.
2. *Work Backward to Current Performance* After developing the forecast for total market size, market share, and ROIC, interpolate back to current performance. To do this, you have to assess how the firm and industry will transition from current performance to future long-term performance. Your estimates must reflect economic principles and industry characteristics.

3. *Develop Scenarios* To handle uncertainty associated with high-growth companies, develop a few possible scenarios. Estimate the revenues, pre-tax margins, capital turns, and DCF equity values for the different scenarios.
4. *Estimate the Expected Equity Value* Estimate the probability of occurrence of each scenario. Obtain the expected equity value by multiplying the equity value under each scenario by the probability of its occurrence and adding these products across all scenarios.

Valuation of Cyclical Companies

A cyclical company experiences significant increases and decreases in its earnings in a repetitive pattern. Companies in industries such as steel, paper, airlines, and chemicals seem to be characterised by cyclicality.

Since it is not possible to precisely predict the earnings cycle, it makes sense to use the multiple-scenario probabilistic approach for valuing a cyclical company. This approach avoids the trap of a single forecast.

The procedure for a two-scenario approach (of course, you can consider more than two scenarios) for valuing cyclical companies is as follows:

1. Based on information about past cycles, construct and value the "normal cycle" scenario. Take into account the long-term trend of ROIC, growth rate, operating profits, and cash flow as they impact valuation significantly. Estimate the continuing value on the basis of a normalised level of cash flow (a point that lies on the company's long-term trend line), not the peak level or the trough level.
2. Based on the recent performance of the company, construct and value a "new trend-line" scenario. As in step 1, focus mainly on the long-term trend line.
3. Develop the economic justification for each of the two scenarios, viz., normal scenario and new trend-line scenario, taking into account factors like demand growth, entry or exit of companies, and technological developments.
4. Based on economic rationale, assign probabilities to the two scenarios and calculate a weighted value of the scenarios.

Herding Behaviour and Cyclicality

In many cyclical industries, the herd like behaviour of companies itself drives cyclicality. Empirical evidence suggests that collectively companies in cyclical industries invest massively when prices and returns are high. The large addition to capacity in turn puts pressure on capacity utilisation, prices, and ROIC. Thus, cyclical investment in capacity, not volatility in consumer demand, is the principal driver of cyclical profitability.

Managers, who are knowledgeable about their product markets, should do a better job than the financial market in understanding the cycle and then taking suitable actions. Still they do not do so as they succumb to herding behaviour which is caused by three factors. First, it is easier to get board approval for investment when profits are high. Second, when profits are high cash is available. Third, managers are concerned about losing market share to their competitors.

Herding behaviour sends confusing signals to the stock market. An optimistic signal (investment expansion) before the cycle turns down and a pessimistic signal (investment contraction) before the cycle turns up confuses the market. No wonder, the stock market has difficulty in valuing cyclical companies.

Valuation of Banks

Financial institutions – banks and insurance companies – are some of the most complex companies to value, especially for outside analysts as they do not have some critical information (such as asset-liability mismatch) about these companies. Further, as these institutions are highly geared, their valuations are extremely sensitive to small changes in key drivers.

The enterprise DCF model is the model of choice for non-financial companies as their operating and financing decisions are more or less separate. However, for financial companies, which are by nature highly levered, the equity cash flow approach is more appropriate for the following reasons:

- Financial companies by their very nature are highly levered institutions. Their operations cannot be valued separately from interest income and interest expense, as these are the dominant components of their income statements.
- The invested capital of a non-financial company is more or less independent of how its assets are financed. However, financing decisions are central to how financial companies like banks and insurance companies produce earnings.

When you apply the equity cash flow approach to value banks, bear in mind the following:

- Net interest income (NII) and fee income are the most important sources of income for a bank. NII is the difference between the interest income a bank earns from lending and the interest expense it pays on its borrowings. NII consists of two separate components. The first represents a true customer spread – the lending rate is higher than the borrowing rate. The second reflects a maturity mismatch income. This arises because the duration of the bank's assets is different from that of its liabilities and the bank earns a spread by operating on different parts of the yield curve. Unlike the true customer spread which is value-creating, the mismatch income may not be value-creating, after considering the risk of taking positions on the yield curve.
- Fee income is the income derived from services rendered to customers in areas such as retail banking, private banking, M & A, and asset management and also

non-fund based activities like letters of credit and guarantees. Fee income is easy to understand, as it is independent of financing.

- Apart from NII and fee income, banks may derive income from other activities such as proprietary trading or investment in securities. These incomes tend to be highly volatile.
- On the cost side, a major item is the provision for loan losses. It is difficult for an outside analyst to evaluate the quality of the bank's loan portfolio and assess future loan losses. Another major cost item is selling, general, and administrative expenses. It is fairly easy to estimate it.
- The major assets of a bank are its loan portfolio and its securities and cash portfolio. Fixed assets and working capital usually represent a small portion of a bank's assets. On the liabilities side, the major items are deposits, debt, and equity.

Challenges in Valuing Banks

There are two major challenges in valuing banks (as well as insurance companies and investment banks):

- For non- financial firms we measure capital as the sum of debt and equity, but for financial service firms, debt has a different meaning. It is a raw material that has to be transformed into financial products that can be sold at a profit. Hence, for financial firms capital is generally equated with only equity, a definition endorsed by regulatory authorities as well.
- Defining cash flows to equity for a bank is difficult because there is a problem in measuring net capital expenditure and working capital.
- Manufacturing companies invest in plant, machinery, and other fixed assets to support growth. Banks, on the other hand, invest mainly in intangible assets such as human capital and brand name. These investments for future growth are often treated as operating expenses. If we define net working capital as current assets minus current liabilities, the bulk of a bank's balance sheet would fall into either of these categories. Changes in net working capital can be large and volatile with hardly any relationship to reinvestment for future growth.

To tackle the above problems, analysts generally value equity (rather than the firm) and regard dividends as the measure of cash flow.

Valuation of Insurance Companies

Like banks, insurance companies are difficult to value. While valuing an insurance company bear in mind the following:

- It is difficult for an outside analyst to assess the amount of capital an insurer needs to meet unexpected claims. Remember that insurers themselves employ actuaries and risk management experts, while regulators and credit rating agencies provide external scrutiny.

- The cash flows of insurers extend over long periods. Hence, it is difficult to match revenues and expenses and measure an insurer's true profitability.
- Insurers derive revenues from several sources: premium income, interest and dividend income, capital gains (or losses), and fee income.
- *Premium income* represents what customers pay for their policies. As most policies run for more than one year, the premium income for any given year is just a portion of a longer-term cash flow.
- There is a time lag between the receipt of premiums and the payment of benefits and claims. During this period, insurers earn *investment income* (interest and dividend) by investing the funds lying with them.
- On their investment portfolios, insurers can also realise *capital gains* or suffer *capital losses.* From an economic point of view it makes no difference whether the insurer realises these gains (or losses) in any given year (except that it may have possible tax implications). However, this decision can have an important bearing on the insurer's reported net income for any given year.
- Insurers may earn *fee* from selling financial products like mutual funds.
- There are several industry-specific items on the cost side of insurers: cost of reinsurance, benefits and claims, and commission and other policy acquisition costs. *Cost of reinsurance* is incurred when an insurer shifts the underlying risk of a policy to a reinsurer. The cost of reinsurance is generally netted against premium income rather than reported as a separate item. *Benefits and claims* represent the cost of meeting the claims of policyholders. It is usually the largest expense item. *Commissions and other policy acquisition costs* represent the costs incurred in selling insurance policies.
- The ratio of total costs to premium income is called the combined ratio. For many insurers the combined ratio exceeds 100 (this means all costs exceed premiums). These insurers remain in business by investing the premiums and earning returns on them.
- The assets side of an insurer's balance sheet consists of investments, "separate account" assets, "deferred policy acquisition cost asset," and "typical assets." *Investments* dominate the asset side of an insurer. "S*eparate account"* assets represent funds entrusted to the insurer to be invested on behalf of customers (such as mutual funds). These assets are exactly matched by "separate account" liabilities, since the insurer has no claim on the underlying assets. Since insurance policies are expected to generate premium income over multiple years, GAAP permits insurers to capitalise policy acquisition costs and reflect them on their balance sheets as an asset called *"deferred policy acquisition cost"* which is written off over a period of time. Finally, as any other company, insurers have a number of "typical" assets such as fixed assets, working capital, and goodwill on their balance sheet.

- The liabilities side of an insurer's balance sheet consists of the following: reserves, and debt and equity financing. The major liability for any insurer is its *reserves,* which reflect the present value of expected benefits and claims to be paid out (for life insurers this is reduced by the present value of expected premiums under the existing policies). Like any other company, insurers also have *debt and equity financing.* Debt is measured in a fairly straight forward fashion. Calculation of equity is somewhat complicated by pension accounting, foreign-currency translation, and so on.

Valuation of Intangible–Intensive Companies

Till the late 1970s, manufacturing companies, utilities, transportation, and oil and gas companies dominated the stock market, deriving their value from physical assets—land, plant and machinery, vehicles, oil reserves, and so on. The most successful companies of recent decades have been technology and service companies, relying mainly on intangible assets such as technological know how, human resources, and brand name. In valuing an intangible-intensive firm, the analyst has to navigate one problem: *accounting for intangible assets is not done properly*. A basic principle of accounting says that capital expenses must be separated from operating expenses. An expense that produces benefits over many years is a capital expense, whereas an expense that provides benefit only in the current year is an operating expense.

Accountants adhere to this distinction for manufacturing companies. Outlays on plant, equipment, and buildings are treated as capital expenses, whereas raw material, energy, and labour expenses are regarded as operating expenses. However, this principle is ignored for firms with intangible assets. Technology and pharmaceutical companies spend substantial sums of money on R&D to develop new products, consumer product companies have large advertising budgets to promote brand name, and service and consulting firms spend a lot of money on training and development to build human capital. While such outlays are in the nature of capital expenses, accountants treat them as operating expenses, invoking the argument that the benefits generated by them are too uncertain. As a result, earnings and capital expenditures for intangible-intensive firms tend to be understated.

Restating the Financial Statements To value intangible-intensive firms, the mis-categorisation of capital expenses has to be corrected. This means R&D expenses, brand name promotional expenses, and manpower development expenses have to be capitalised.

To illustrate how this should be done, let us look at a pharmaceutical company, Omega Pharma, which spends substantial sums on R&D. Instead of treating R&D outlays as operating expenses, it should capitalise them and then amortise the same over a reasonable period. Since drug development and approval is a time consuming process, we may assume that the amortisable life is fairly long, say 10 years. Further, for the sake of simplicity, we will assume that amortisation is done uniformly over time.

Given these assumptions, we gather data on R&D expenses over the past ten years, the amortisable life of the R&D asset, as shown in the first two columns of Exhibit 8.2. R&D expenses are amortised uniformly over ten years following the year in which they are incurred and not written off wholly in the year of incurrence, as is the current accounting practice. As a consequence, the current year R&D expense and the unamortised portion of the R&D expenses of the prior years is shown as an R&D asset of ₹ 5988 million. This will augment the book value of the firm's assets, and by extension, the book value of equity.

Adjusted book value of equity
= Reported book value equity + Capitalised value of R&D

The adjusted reported income is calculated as follows. First, the R&D expenses are added back to the reported income, since they are reclassified as capital expenses. Second, the amortisation of R&D assets is treated like depreciation. These adjustments mean that:

Adjusted operating = Reported operating + R&D expenses
– Amortisation of R&D income

Adjusted net income = Reported net income + R&D expenses
– Amortisation of R&D

For firms which have growing R&D expenses, the adjusted operating income (adjusted net income) will be higher than the reported operating income (reported net income).

You may follow a similar procedure to make adjustments for advertising and promotional outlays and training and development expenses. However, I am much less enthusiastic about capitalising such expenses as I am about R&D expenses.

Exhibit 8.2 ***R&D Amortisation for Omega Pharma***

Year	*R&D Expenses*	*Unamortised Proportion*	*Unamortised Amount*	*Amortisation This year*
Current	1500	1.00	1500	
–1	1340	0.90	1206	134
–2	1200	0.80	960	120
–3	1050	0.70	735	105
–4	920	0.60	552	92
–5	800	0.50	400	80
–6	710	0.40	284	71
–7	640	0.30	192	64
–8	550	0.20	110	55
–9	490	0.10	49	49
–10	420	0.00	0.00	42
			5988	812

Technological Progress and Valuation

In the 1990s, the term New Economy was regarded as synonymous with rapid technological and structural changes that would lead to profit bonanza and surge in market valuation. The reality is that historically there is very little evidence of correlation between rapid technological progress and growth of corporate profits and stock prices. It appears that the ultimate beneficiary of technological change is always the consumer, and not the firm, in the form of lower prices of goods and services.

8.2 VALUATION IN DIFFERENT CONTEXTS

This section discusses cross border valuation, valuation in emerging markets, valuation of a private company, valuation in a private equity setting, pricing of an IPO ,and valuation under the erstwhile CCI guidelines.

Cross-Border Valuation

To value a company in another country, follow the principles and methods discussed earlier. However, bear in mind the following:

1. International accounting differences, an important issue earlier, are becoming less of an issue for two reasons: (a) Most major countries in Europe and Asia have adopted or are adopting International Financial Reporting Standards (IFRS). (b) The IFRS and U.S. GAAP, the two most common set of accounting standards, have been converging in recent years. However, when you analyse long term financial performance, you will find that former differences still matter because companies provide only a few years of results based on similar principles.
2. Tax regimes differ across countries. You must know how taxable income is calculated and what the relevant tax rate is. You must take into account reliefs available through tax exemptions, tax credits, and tax treaties.
3. The value of a company should be the same, regardless of the currency (or currencies) in which its cash flows are projected. You may use any of the following methods for valuing cash flows.
   (a) *Spot rate method*: Project foreign cash flows in foreign currency, discount these cash flows at the foreign cost of capital, and finally convert the present value of cash flows into domestic currency applying the spot exchange rate.
   (b) *Forward rate method*: Project foreign cash flows in foreign currency, convert the foreign currency cash flows into domestic currency applying the forward exchange rates, and finally discount the converted cash flows at the domestic cost of capital.

4. While estimating the cost of capital for a foreign entity, it is important to ensure that the currency of the discount rate is consistent with the currency of the cash flow.
5. The cost of capital should ideally be estimated from the perspective of a global investor. This implies that both the market risk premium and beta have to be measured against a global market portfolio, not a local (domestic or foreign) market portfolio.
6. The weighted average cost of capital should not include an additional risk premium for perceived currency risk. The spot and forward exchange rates that are used to translate currencies are supposed to reflect currency risk premium, if any.

Valuation in Emerging Markets

The emerging economies in Asia and South America are expected to register strong growth over the coming decades. These economies are characterised by high macroeconomic uncertainty, considerable volatility in exchange rates, inflation, and interest rates, controls over capital flows, shallow capital markets, not so rigorous accounting standards, inadequate disclosures, and high political risk. There is no consensus as yet on how to address these challenges. Practitioners use different methods and often make subjective adjustments based on intuition and limited evidence.

In applying the framework of DCF valuation to companies in emerging markets, you have to bear in mind the higher inflation and greater macroeconomic risks characterising these markets. The following considerations and guidelines seem to be helpful in valuing companies in emerging markets.

1. Since emerging markets experience greater fluctuation of exchange rates, inflation, and interest rates, estimates of future financial results (in domestic or foreign currency) and cost of capital must be based on the same set of assumptions. When estimating the effect of exchange rate movements on cash flow forecasts, assume that purchasing power parity holds in the long run. Any other assumption means taking a bet on future real exchange rate movements.
2. Even with consistent assumptions about inflation, interest rates, and exchange rates, forecasting financial performance is challenging. Since inflation distorts the financial statements, analysing historical performance or forecasting future performance tends to be difficult. You can develop financial projections in nominal or real terms. Since neither approach is perfect, combine elements of both to develop consistent financial projections.
3. To reflect the higher level of risk characterising companies in emerging markets, it is common to add a country risk premium to the discount rate. A better alternative is to model risks explicitly in the cash flow projections in what may be called the *scenario DCF approach.* This approach involves the following steps: (i) Project cash

flows under different scenarios. At a minimum, two scenarios are considered: business-as-usual scenario and downward scenario. (ii) Calculate the DCF value for each of the scenarios, using the company cost of capital. Don't add any risk premium as it would tantamount to double-counting risk. (iii) Assign probabilities to each of the scenarios and calculate the probability-weighted DCF value of the company.

4. For estimating the cost of capital in emerging markets, adopt the perspective of an international investor who has a globally diversified portfolio. Local investors may not hold a well-diversified global portfolio and their cost of capital may differ from that of international investors. However, as long as global investors can invest locally, local prices will be based on an international cost of capital. Further, as emerging markets are becoming increasingly integrated with global capital markets, the international cost of capital would become the norm in future.
5. To estimate the cost of equity in emerging markets, use the CAPM. While the CAPM may not be a very robust model for emerging markets as they are not fully integrated with the global market, there seems to be no better alternative model.
6. For applying the CAPM (i) set the risk-free rate equal to the 10-year U.S. government bond yield plus the projected inflation differential between local currency and dollars, (ii) estimate beta relative to a global market index, and (iii) use a market risk premium of say 4.5 to 5.5 percent that global investors use.
7. As most emerging markets have illiquid markets for corporate bonds, very little market information is available for estimating the cost of debt.
8. If you are not using DCF scenario analysis but considering only business-as-usual cash flows, you should add country risk premium to the WACC. While there is no standard method for estimating this premium, the following guidelines are helpful: (i) Do not simply equate country risk premium with sovereign risk premium. (ii) Don't set the country risk premium too high.
9. Since valuation of companies in emerging markets tends to be more volatile, triangulate scenario DCF valuation with country risk premium DCF valuation and multiples–based valuation.

Valuation of Private Companies

Valuation of private companies is difficult for several reasons:

1. Many private companies are in a nascent stage with negative free cash flows. They are expected to evolve rapidly. Hence, getting a handle over their forecast free cash flows is difficult.
2. For most private companies, thanks to their short history, the number of years for which past information is available is limited. Further, the quality of this information is generally less reliable than that of public companies.

3. In the absence of stock price data, it is difficult to estimate the equity beta (which is required for computing the cost of equity) for private companies.
4. Shareholders of a private company usually do not have a diversified portfolio. So they expect a premium for bearing unsystematic risk. Hence, the CAPM underestimates the real cost of equity for such firms.

Pricing an Initial Public Offering

When the shares of a company are offered for sale for the first time in the public market, the process of offering those shares is called initial public offering or IPO. In the pricing of IPOs, the market comparables approach plays an important role.

To begin with, the lead merchant banker, who manages the IPO process, establishes a price range in consultation with the company. This is typically based on comparable valuation analysis using valuation ratios such as EV-EBITDA ratio, price-book ratio, price-earnings ratio, and so on.

Once the price range is fixed, the company uses the mechanism of book building. This involves inviting subscriptions from potential investors wherein they are asked to indicate how much they are willing to buy and at what price.

Once the demand function is ascertained through the book building mechanism, the merchant banker and the company executives finalise the initial offering price. The determination of this price is judgmental, which takes into account an up-to-date comparative valuation analysis, the demand function revealed in the book building process, and a desire to "leave something on the table" for the allottees (this means that the IPO is priced at a discount to the price the shares are expected to trade on listing).

Valuation in a Private Equity Setting

Private equity has become an integral part of the financial services industry globally in the last two decades or so and the top private equity funds have established an impressive track record. Thanks to a paradigm shift in the investment model in the past 2 to 3 decades, partnership and mutual dependence have become the core of the relationship between private equity investors and investee companies. As David Rubenstein, co-founder, The Carlyle Group, argues: "Large private equity firms have the experience, organisation, processes, and risk appetite to evaluate and close investments. It is the only class of investors who have the ability, track record, and willingness to add value without any ultimate control desires."

In recent years, India too has witnessed a surge of private equity investment. What has fuelled this growth? On the demand side, high growth firms have found private equity to be an attractive form of capital. The tremendous success of firms like Bharti which depended on private equity demonstrated that private equity is long-term, dependable, non-intrusive, and value-enhancing (through strategic contributions). No wonder, leading BPO companies like SpectraMind, Daksh, WNS, EXL, and even Progeon depended on PE capital in their formative years.

On the supply side, western pension funds and other institutions have been looking for alternative investment avenues to earn a higher return so that they can meet their obligations. The search for higher returns has brought them to a well-performing emerging market like India, which has become an attractive global investment destination.

Private Versus Public Equity Investing Private equity investing differs from public equity investing in several ways.

Illiquid Investment Private equity investment tends to be illiquid as there is no organised market or there may be restrictions on transfer of securities.

Active Role Private equity investors generally play an active role in the management of investee companies. In contrast, mutual funds and others who invest mainly in public equity markets follow a "hands off" investment style.

Finite Horizon Private equity funds are generally organised as a limited partnership with a life of 7 to 10 years. At the end of this period, the fund is liquidated and the proceeds are returned to the partners. In contrast, mutual funds often have no fixed liquidation date.

High Return Expectation Private equity investors require a rate of return of (often in the range of 25% to 50%) as they bear higher risk and suffer illiquidity.

Procedure for Valuation Private equity investors (referred to hereafter as PE, for the sake of simplicity) generally participate in the equity of investee companies that they hold for few years before liquidating the same. Their returns come mainly from liquidating their investments, as they expect negligible dividends during the holding period. The procedure used by the PE in valuing the assisted entity and structuring the deal typically involves the following steps:

1. The PE establishes a rate of return that it expects to realise from the investment (K_{PE}).
2. The PE's required rate of return is used to determine the rupee value the PE hopes to realise at the end of its planned holding period, *H* years, which is usually four to seven years.

$$\text{PE Investment}_{\text{Today}}\,(1 + K_{PE})^H = \text{Required Value of PE Investment}_H$$

3. The PE estimates the value of the firm's equity at the end of year *H*, applying a multiple to the firm's projected EBITDA for year *H*.

$$\text{Estimated Equity Value}_H = \text{EBITD}A_H \times \text{EBITDA Multiple}_H + \text{Cash}_H - \text{Debt}_H$$

4. The PE determines the ownership share needed to generate its required rate of return.

$$\text{Ownership Share} = \frac{\text{Required Value of PE Investment}_H}{\text{Estimated Equity Value}_H}$$

Illustration Omega Capital Ventures, a PE investor, is considering investing 1000 million in the equity of Mylan Laboratories, a start-up biotech company. Omega's required rate of return from this investment is 30 percent and its planned holding period is 5 years. Mylan has projected an EBITDA of 1500 million for year 5. An EBITDA multiple of 7 for year 5 is considered reasonable. At the end of year 5, Mylan Laboratories is likely to have a debt of 1000 million and a cash balance of 300 million. What ownership share in Mylan Laboratories should Omega Capital Ventures ask for?

The required ownership share is determined as follows:

1.	K_{PE} (required rate of return)	= 30 percent
2.	Required Value of PE Investment$_5$	$= 1000\ (1.30)^5$
		= 3,713 million
3.	Estimated Equity Value$_5$	$= 1500 \times 7 + 300 - 1000$
		= 9,800 million
4.	Ownership Share	= 3713/9800 = 37.9 percent

Pre-and Post-Money Value of the Firm's Equity Apart from looking at the value of the firm at the future date when the PE plans to exit, the PE also estimates the current value of the business in which it invests. The implied current value of the equity of the firm is reflected in something called the **post-money investment value**. For instance, in the Mylan Laboratories example, the VC gets an equity stake of 37.9 percent by investing 1000 million. This means that the current value of Mylan's equity after (post) the PE's investment is:

Post-Money Investment Value of the Firm's Equity

$$= \frac{\text{Funds Provided by the PE}}{\text{PE's Ownership Interest (\%)}}$$

$$= \frac{1000 \text{ million}}{0.379} = 2638 \text{ million}$$

Another term used by PE is **pre-money investment value** which is simply the difference between the post-money investment value and the funding provided by the PE firm. In Mylan's case, the pre-investment value is:

$$\begin{array}{ccccc} \text{Pre-Money Investment} & = & \text{Post-Money Investment} & - & \text{Funding Provided} \\ \text{Value of the Firm's Equity} & & \text{Value of the Firm's Equity} & & \text{by the PE} \\ & = & 2638 & - & 1000 \\ & = & 1638 \text{ million} & & \end{array}$$

Valuation for Foreign Direct Investment

Under the Foreign Direct Investment (FDI) Scheme, investments can be made in shares, mandatorily and fully convertible debentures, and mandatorily and fully convertible preference shares of an Indian company by non-residents through the automatic route (the foreign investor or the Indian company does not require any approval from the Reserve Bank or the Government of India) and the government route (the foreign investor or the Indian company require prior approval of the Government of India, Ministry of Finance, Foreign Investment Promotion Board).

The pricing guidelines for foreign direct investment are as follows:[1]

- **Fresh issue of shares:** The price of fresh shares issued to persons resident outside India under the FDI Scheme shall be (a) on the basis of SEBI guidelines in the case of listed companies and (b) not less than fair value of shares determined by a SEBI registered Merchant Banker or a Chartered Accountant as per the discounted free cash flow (DCF) method in case of unlisted companies.
- **Preferential allotment:** In case of issue of shares on preferential allotment, the issue price shall not be less than the price as applicable to transfer of shares from resident to non-resident.
- **Rights shares:** The price of shares offered on rights basis by the Indian company to non-resident shareholders shall be: (i) In the case of shares of a company listed on a recognised stock exchange in India, at a price determined by the company. (ii) In the case of shares of a company not listed on a recognised stock exchange in India, at a price which is not less than the price at which the offer on right basis is made to resident shareholders.
- **Acquisition/transfer of existing shares (private arrangement):** The acquisition of existing shares from Resident to Non-resident (i.e. to incorporated non-resident entity other than erstwhile OCB, foreign national, NRI, FII) would be at a (a) negotiated price of shares of companies listed on a recognized stock exchange in India which shall not be less than the price at which the preferential allotment of shares can be made under the SEBI guidelines—the price per share arrived at should be certified by a SEBI registered Merchant Banker or a Chartered Accountant; (b) negotiated price of shares of companies which are not listed on a recognised stock exchange in India which shall not be less than the fair value to be determined by a SEBI registered Merchant Banker or Chartered Accountant as per the discounted free cash flow (DCF) method.

Valuation under the CCI Guidelines

The guidelines issued by the office of the Controller of Capital Issues (referred to as CCI Guidelines) under the Capital Issues (Control) Act, 1947 were in vogue for all public issues

1. As per Notification No. FEMA 205/2010-RB date April 7, 2010.

till the said Act was repealed in 1992 and the office of CCI abolished. However, even now, the CCI method is used for calculating the price of unlisted companies in certain contexts, although its use has substantially diminished as the DCF approach and the relative valuation approach have gained in prominence.

According to the CCI Guidelines, the "Fair Value (FV)" of a company's shares is computed as the arithmetic average of the values obtained by the "Net Asset Value (NAV)" method and the "Profit Earning Capacity Value (PECV)" method.

The NAV Method Conceptually, the NAV of a share is the net worth of the company divided by the number of outstanding shares.

As per the CCI Guidelines, the NAV calculation is done as follows.

- The NAV is computed on the basis of the latest available audited balance sheet.
- If a fresh issue of shares is contemplated, the *face value* of the fresh issue of equity capital is added to the existing 'net worth.'
- Intangible assets such as patents, trademarks, copyrights, and goodwill should not be reckoned as assets for determining the net worth.
- Revaluation of fixed assets should not be taken into account unless it was done more than 10 years back.
- Any reserve that has not been created out of cash profits should not be considered.
- Provision for gratuity and other terminal employee benefits should be determined and deducted as liabilities in computing the net worth.
- Liabilities like preference dividend, unclaimed dividend, debit balance in profit and loss account, and liabilities not provided for should be deducted in computing the net worth.
- If contingent liabilities are likely to impair the networth of the company, the same should be provided for after obtaining clarifications from the auditors of the company.
- Depreciation shall be as per the method (straight line method or written down value method) consistently followed by the company. If the company has switched from one method to the another in the past five years, the written down value method shall be adopted for determining the net worth. However, if the company consistently follows from inception different methods for different blocks of assets, the same is accepted for purpose of valuation.

The PECV Method The PECV method determines the value of a share by capitalising the profits of the company at a suitable capitalisation rate and dividing the same by the number of outstanding shares. To illustrate, if the profits are 100 million, capitalisation rate is 15 percent, and the number of outstanding shares is 10 million, the PECV share works out to:

$$100/(0.15)\,(10) = 66.7$$

According to the CCI Guidelines, the following norms have to be followed in applying the PECV method.

1. The PECV is calculated by capitalising the average profits at the following rates:
   a. 15 percent in the case of manufacturing companies.
   b. 20 percent in the case of trading companies.
   c. 17.5 percent in the case of intermediate companies (companies whose turnover from trading activity is between 40 and 60 percent of their total turnover).
   d. 12 percent in cases where the capitalisation rate may have to be lowered in view of intangible value or other parameters.
2. As far as the computation of average profits is concerned the guidelines state that: "The crux of estimating the Profit Earning Capacity Value lies in the assessment of the future maintainable earnings of the business. While the past trends in profits and profitability would serve as a guide, it should not be overlooked that valuation is for the future and that it is the future maintainable stream of earnings that is of great significance in the process of valuation. All relevant factors that have a bearing on future maintainable earnings of the business must, therefore, be given due consideration." However, the computational methodology in the guidelines seems to rely mainly on the past performance. More specifically, the following have been emphasised.
   - Ordinarily the profits are averaged for the last three or five years of profit as per audited accounts.
   - A greater weightage is to be given for the most recent year's performance when past profits show a steadily increasing or decreasing trend.
   - If a business has sustained losses in all the three years or even in the latest two years, the PECV will have to be regarded as nil because it would not then be realistic to assume that the business would earn profits in the near future.
   - In computing the average profits, provision for taxation, barring some exceptions, is calculated on the basis of the current statutory rate under the Income Tax Act.
   - Where a fresh issue of capital is made for financing expansion or new projects or for meeting working capital requirements, it could be assumed that the fresh capital could contribute to the profits up to a maximum of 50 percent of the existing rate of profitability. This will be added to the existing profits after tax and the total will be divided by the *enlarged* capital base to arrive at the future maintainable earnings per share.
   - Where the fresh capital is sought to be raised… for general reasons like modernisation and replacement of assets... it would not be advisable to assume that the fresh capital will contribute to the profitability of the business in any tangible manner in the near future.

8.3 LOOSE ENDS OF VALUATION[2]

This section looks at what Aswath Damodaran aptly calls the "loose ends of valuation." It briefly explores certain facets of valuation, which are generally glossed over in the books and discussions on valuation. It is divided into seven sub-sections:

- Cash, cross holdings, and other assets
- Employee equity options
- The value of control
- The value of liquidity
- The value of synergy
- The value of transparency
- The cost of distress

Cash, Cross Holdings, and Other Assets

Most firms have some non-operating assets on their balance sheets: cash and near-cash investments; equities and bonds in other firms; other non-operating assets.

Cash and Near-Cash Investments Every firm holds some cash and near-cash investments (cash, for simplicity). As John Maynard Keynes put it, there are three possible motives for this: transaction motive, precautionary motive, and speculative motive.

For purposes of valuation, it is useful to break cash into two parts, non-wasting cash and wasting cash. Investments in liquid schemes of mutual funds, fixed deposits of banks, Treasury bills, or commercial paper earn a fair return in relation to risk. They are essentially zero-NPV investments and hence represent non-wasting cash. Wasting cash represents cash that produces a return that is less than the risk-adjusted return. Thus, excess cash lying in a checking account, which earns no interest, is wasting cash.

How can the amount of wasting cash be determined? A simple procedure for doing so is to calculate the interest income earned by a company as a percent of its average cash balance during the year and compare it with the market interest rate during the period. If the two rates are the same, there is no wasting cash. If the book rate of return is less than the market rate of return, there is some wasting cash. To illustrate, let us consider an example. Digitech Limited had an average cash balance of 200 million in a year and it earned an interest income of 10 million on it (average rate of return of 5 percent). If the average market rate of return (say Treasury bill rate) during the period was 6 percent, you can figure out the wasting cash component as follows.

[2] This section is adapted from Part Three of *Damodaran on Valuation* by Aswath Damodaran and published by John Wiley & Sons in 2006.

Proportion of cash balance that is wasting cash

$$= 1 - \frac{\text{Book interest rate}}{\text{Market interest rate}}$$

$$= 1 - \frac{.05}{.06} = 0.1667 \text{ or } 16.67 \text{ percent}$$

Thus, 16.67 percent of 200 million (33.34 million) will be deemed as wasting cash and included, like inventory and receivables, as part of operating working capital. The balance amount of 166.66 million will be treated as non-wasting cash and added to the value of the operating assets of the firm.

Equities and Bonds of Other Firms Apart from holding cash and near-cash investments, firms also hold equities and bonds of other firms. These investments are made to earn a higher rate of return or to serve a strategic purpose.

The simplest approach for dealing with such investments is to obtain or estimate their current market value and add the same to the value of operating assets.

Other Non-operating Assets Firms may have unutilised assets like a closed factory or idle land.

Identify such non-operating assets, estimate their market value, and add the same to the value of operating assets. Of course, an outside analyst will not be in a position to identify such assets due to informational problems.

Employee Equity Options

In recent years, employee stock option plans have become popular, particularly in technology firms. These plans are supposed to align the interest of managers with shareholders, conserve cash, and improve employee retention.

When a firm grants stock options to employees, existing shareholders have to pay for these options. So, how do stock options affect the value of equity? We can look at three levels at which stock options have a bearing on equity value per share.

- The effect that granting options in the current year has on the current earning of the firm. According to SEBI Guidelines on Employee Stock Option Scheme, the accounting value of options should be written off as employee cost uniformly over the vesting period. The accounting value of options may be determined either by the Black-Scholes model or as the difference between the market price (when options are granted) and the exercise price.
- The potential dilution that can occur on account of cumulative outstanding options. While these options may be exercised in future, the expectation of that happening will have a bearing on the value per share today.

- The effect of not just the cumulative outstanding options but also the continued granting of options on expected future earnings and hence on value per share.

The Value of Control

When valuing a company, you have a choice. You can value the company as it is run by the incumbent management and estimate a *status quo value* or you can value the company with a supposedly optimal management team and derive an *optimal value.* The difference between the optimal value and the status quo value may be regarded as the *value of control.*

Value may be enhanced by managing existing assets better, building competitive advantages, stepping up profitable investments, curtailing unprofitable investments, restructuring debt, returning excess cash to shareholders, or increasing the transparency of operations.

The value of control, of course, will vary across firms. It is a function of why a firm is performing badly and how easy is it to make the desired management changes.

The Value of Liquidity

When you buy some asset, you are likely to experience buyer's remorse: you may want to reverse your decision by selling what you just bought. The cost of remorse depends on the liquidity of the asset. Higher the illiquidity, greater the cost of remorse. Because investors value liquidity, they would be willing to pay more for liquid assets than for otherwise similar illiquid assets.

How is liquidity measured? Since any asset, no matter how illiquid it is considered to be, can be sold by lowering its price, liquidity may be measured in terms of transaction costs. The higher the transaction costs, the lesser the liquidity; the lower the transaction costs, the greater the liquidity.

What makes up transaction costs? There are four components of transaction costs: commission cost, spread, price impact, and opportunity cost of waiting. *Commission cost* is what the broker charges when you buy or sell through him. *Spread* is the difference between the dealer's ask price and the dealer's bid price. *Price impact* is the effect on price on account of buying or selling. The buyer tends to push the price up; the seller tends to push the price down. The final element of transaction costs is the *opportunity cost of waiting.* An investor could reduce the bid-ask spread and impact cost by splitting a large block into small blocks and trading in a staggered fashion over time. However, if he waits he may lose an opportunity to sell at a higher price or an opportunity to buy at a lower price.

Three approaches have been suggested by researchers to examine the effect of illiquidity on value.

- The present value of expected future transaction costs is deducted from the value of the asset to account for illiquidity.

- The required rate of return on asset is adjusted to reflect its degree of illiquidity – the more illiquid an asset, the higher the rate.
- The loss of liquidity may be valued as an option – the holder of an illiquid asset is assumed to lose the option to sell the asset when its price is high.

Value of Synergy

Synergy refers to the additional value created by combining two (or more) firms. If two firms, *A* and *B*, combine to form *AB*, synergy is expressed as follows:

$$V(AB) - [V(A) + V(B)]$$

where $V(AB)$ is the value of the combined entity *AB* and $V(A)$ and $V(B)$ are the stand-alone values of *A* and *B*.

It is common to look at two kinds of synergy: operating synergies and financial synergies. Operating synergies enable firms to increase their operating income from existing assets, enhance growth, or both. Operating synergies stem from economies of scale, greater pricing power on account of diminished competition, combination of complementary functional strengths (such as manufacturing excellence and distribution reach), and higher growth in new or existing markets.

Operating synergies may be valued as follows: (i) Value the combining firms as stand-alone firms, by discounting each firm's expected cash flow by its weighted average cash flow. (ii) Value the combined firm, taking into account the effect of synergy on growth rate and cash flow. (iii) Obtain the value of synergy as the difference between the value of the combined entity and the sum of the stand-alone values of the combining entities.

Financial synergies may stem from a more profitable use of cash slack, a better utilisation of tax benefits, and an increase in debt capacity.

Cash slack is used more profitably when a publicly traded firm acquires a small, private firm that has promising investment opportunities but cash shortage. The value of cash slack would be the sum of the present values of the projects that the cash-poor firm would be forced to reject because of inadequate cash.

When a firm with accumulated losses and/or unabsorbed depreciation merges with a profit-making, tax-paying firm, tax shields are utilised better. The value of tax benefits is mostly in terms of an early utilisation of the tax shields. To illustrate, consider a firm that has 1000 million of accumulated depreciation and unabsorbed losses which are likely to be set off against its future profits over a period of 5 years, in an even manner – this means every year 200 million would be set off. If the firm merges with a profit making company, the entire amount of 1000 million would be set off in year 1 itself. The statutory tax rate is 35 percent and the discount rate is 10 percent. The value of tax benefit in this case is estimated as follows:

$$\text{Value of tax shield without the merger} = \sum_{t=1}^{5} \frac{200(0.35)}{(1.10)^t} = 265$$

$$\text{Value of tax shield with the merger} = \frac{1000(0.35)}{(1.10)} = 318$$

Value of tax shield attributable to merger = 318 – 265 = 53 million

When the cash flows of the acquiring and target firms are not perfectly positively correlated, the combined firm's cash flows will be less variable than the cash flows of individual firms. The reduction in variability can enhance debt capacity and consequently the value of the firm.

Value of Transparency

When valuing firms we need information on revenues, costs, earnings, assets, debt, and equity of the firm. For this purpose we draw heavily on financial statements. Financial statements are, however, not created equal. From a valuation perspective some are relatively transparent and others relatively complex.

Complexity stems from several sources:

1. The firm may resort to *accounting malpractice.* In such a case financial statements provide incorrect information or suppress relevant and material information.
2. Due to *lax regulatory requirements,* the financial statements may omit relevant information.
3. Firms may enjoy considerable discretionary power in the measurement of income and capital because of *fuzzy accounting standards*.
4. The increased *disclosure requirements,* even though guided by noble intentions, has made financial statements much longer and more complex. They sometimes look like data dumps that are difficult to navigate.
5. Some firms – General Electric (GE) being a conspicuous example – operate in *multiple businesses.* Analysing GE therefore is much more difficult than analysing Walmart.
6. Firms grow through internal projects or through *acquisitions*. In general accounting for internal projects is more transparent than accounting for acquisitions.
7. Not long ago firms relied only on straight debt and equity. In recent decades, the use of *hybrid securities* (convertible debentures, warrants, and so on) has increased, making the financial statements more complex.

There are different ways (not necessarily mutually exclusive) of dealing with complexity in a valuation exercise.

1. Adjust the cash flows for the degree of complexity characterising the financial statements. This process is called "haircutting the cash flows."
2. Adjust the expected growth rate and / or the length of growth period for complexity.
3. Adjust the discount rate (cost of capital) for complexity.

4. Apply a complexity discount to the value figure arrived at using unadjusted cash flows, growth rates, and discount rate.

The Cost of Distress

An implicit assumption in both DCF and relative valuation is that the firm being valued is a going concern and that any financial distress that it may face will be just temporary. Remember that terminal value, which lies far in future, usually accounts for a significant portion of DCF value.

What happens if the firm encounters distress which is not temporary? In such a case there is a very real chance that the firm will not survive to deliver the terminal value. Such a firm tends to be overvalued by the traditional valuation models.

How can financial distress be handled in valuation? There are several ways of handling financial distress in valuation.

Simulation In traditional valuation, we typically work with expected values of each of the variables such as growth rate in revenues and operating margin. In simulation we work with the entire distribution of each of the input variables, rather than just its expected value, to arrive at a value. Thus simulation enables us to deal explicitly with distress.

Modified DCF Valuation In modified DCF valuation, the effects of distress are incorporated in both expected cash flow and discount rates.

The expected cash flow for each year is:

$$\text{Expected cash flow}_t = \sum_{j=t}^{n} p_{jt} \cdot CF_{jt}$$

where p_{jt} is the probability of scenario j in period t and CF_{jt} is the cash flow under scenario j in period t.

To estimate the cost of equity for a distressed firm two options are available. First, CAPM betas may be adjusted for distress. Second, a separate distress factor may be added to the cost of equity.

To estimate the cost of debt for a distressed firm, use an interest rate based on the firm's bond ratings.

Dealing with Distress Separately You can value the effects of distress by estimating the cumulative probability that the firm will become distressed over the forecast period and obtaining the distress value. The value of the firm can then be expressed as follows:

$$\text{Firm value} = \text{Going concern value} \times (1 - p_d) + \text{Distress sale value} \times p_d$$

where p_d is the cumulative probability of distress over the valuation period.

Distress-Adjusted Multiples With relative valuation, you can adjust the multiples for distress or use the multiples of other distressed firms.

SUMMARY

- Since the different businesses of a multi-business company have different financial characteristics (ROIC, growth rate, and risk), it is best to value each business separately and then sum the parts to obtain the value of the entire company.
- To value a company in another country bear in mind international accounting differences and variations in tax regimes and estimate cost of capital from the perspective of a global investor.
- In applying the framework of DCF valuation to companies in emerging markets, bear in mind the higher inflation and greater macroeconomic risks characterising these markets. Since valuation of companies in emerging markets tends to be more volatile, triangulate scenario DCF valuation with country risk premium DCF valuation and multiples-based valuation.
- Perhaps the best way to value a high growth, high risk company is to use scenario based DCF analysis supported by microeconomic fundamentals.
- A cyclical company experiences significant increases and decreases in its earnings in a repetitive pattern. Since it is not possible to precisely predict the earnings cycle, it makes sense to use the multiple-scenario probabilistic approach for valuing a cyclical company.
- Financial institutions—banks and insurance companies—are some of the most complex companies to value, especially for outside analysts as they do not have some critical information (such as asset-liability mismatch) about these companies. Further, as these institutions are highly geared, their valuations are extremely sensitive to small changes in key drivers.
- For financial companies, which are by nature highly levered, the equity cash flow approach is more appropriate.
- In valuing an intangible-intensive form, the analyst has to navigate one problem: accounting for intangible assets is not done properly. Outlays on R&D, brand name, and manpower development are treated as operating expenses, though they are in the nature of capital expenses. To value intangible intensive, this miscategorisation has to be corrected.
- In certain situations like preferential allotments, open offers under SEBI takeover code, share buybacks, and delisting offers, pricing is subject to certain regulations.
- According to the CCI Guidelines, the "Fair Value (FV)" of a company's shares is computed as the arithmetic average of the values obtained by the "Net Asset Value (NAV)" method and the "Profit Earning Capacity Value (PECV)" method.
- Most firms have some non-operating assets on their balance sheet: cash and near-cash investments; equities and bonds in other firms; other non-operating assets. These assets have to be properly valued.
- You can value a company as it is run by the incumbent management and estimate a status quo value or you can value the company with a supposedly optimal management team and derive its optimal value. The difference between the two represents the value of control.

- Because investors value liquidity, they would be willing to pay more for liquid assets than for otherwise similar liquid assets.
- Synergy refers to the additional value created by combining two (or more firms). It is common to look at two kinds of synergy: operating synergies and financial synergies.
- From a valuation perspective, some firms are relatively transparent and others relatively complex. Complexity may stem from various sources like accounting malpractice, tax regulatory requirements, fuzzy accounting standards, increased disclosure requirements, multiple businesses, acquisitions, and hybrid securities.
- When a firm encounters distress, which is not temporary, there is a very real chance that it will not survive to deliver the terminal value. Hence, such a firm tends to be overvalued by the traditional valuation models.

Questions

1. Discuss the unique issues that arise in the context of a multi-business company
2. What are the special considerations that should be borne in mind in cross-border valuation?
3. Discuss the guidelines that are helpful in valuing companies in emerging markets.
4. What procedure may be followed for valuing a high growth company?
5. Discuss a two-scenario approach for valuing cyclical companies.
6. What considerations should be borne in mind while valuing a bank?
7. What considerations should be borne in mind while valuing an insurance company?
8. Discuss the CCI Guidelines for determining the "Fari Value" of a company's shares.
9. How should one value cash, cross holdings, and other non-operating assets.
10. How do stock options affect the value of equity?
11. What is the value of control?
12. What makes up transaction costs?
13. What are synergies? How are they valued?
14. What are the sources of complexity in financial statements?
15. How can financial distress be handled in valuation?
16. Discuss how miscategorisation of capital expenses in an intangible-intensive firm can be corrected

SOLVED PROBLEMS

1. Angel Ventures, a PE investor is considering investing 3000 million in the equity of Delta Systems, a start-up IT company. Angel's required return from this investment is 35 percent and its planned holding period is 5 years. Delta has projected an EBITDA of 4000 million for year 5. An EBITDA multiple of 6 for year 5 is considered reasonable. At the end of year 5, Delta Systems is likely to have a debt of 2500 million and a cash balance of 800 million.

(i) What ownership share in Delta Systems should Angel Ventures ask for?

(ii) What is the post-money investment value of the firm's equity?

(iii) What is the pre-money investment value?

Solution

$K_{PE} = 35\%$

Required Value of PE $\text{Investments}_6 = 3000 \times 4.484 = 13{,}452$

Estimated Equity $\text{Value}_5 = 4000 \times 6 + 800 - 2500$

$= 22{,}300$

$$\text{Ownership Share} = \frac{13{,}452}{22{,}300} = 60.32\%$$

Post-Money Investment value of the firm's equity

$$\frac{\text{Funds provided by the PE}}{\text{PE's Ownership interest (\%)}} = \frac{3000}{0.6032} = 4973 \text{ million}$$

$$\begin{array}{l} \text{Pre-Money Investment} \\ \text{Value of the Firm's Equity} \end{array} = \begin{array}{l} \text{Post-Money Investment} \\ \text{Value of the Firm's Equity} \end{array} - \begin{array}{l} \text{Funding Provided} \\ \text{by the PE} \end{array}$$

$= 4973 - 3000$

$= 1973$ million

Problems

1. Laxmi Capital Ventures, a PE investor, is considering investing 500 million in the equity of Omitech, a start-up IT company. Laxmi's required rate of return from this investment is 40 percent and its planned holding period is 4 years. Omitech's has projected an EBITDA of 700 million for year 4. An EBITDA multiple of 6 for year 4 is considered reasonable. At the end of year 4, Omitech is likely to have a debt of 750 million and a cash balance of 200 million.
   a. What ownership share in Omitech should Laxmi Capital Ventures ask for?
   b. What is the post-money investment value? Pre-money investment value?
2. Redstone Ltd, a PE investor is considering investing 7000 million in the equity of Orbital, a start-up IT company. Redstone's required return from this investment is 40 percent and its planned holding period is 6 years. Orbital has projected an EBITDA of 9000 million for year 6. An EBIDTA multiple of 14 for year 6 is considered reasonable. At the end of year 6, Orbital is likely to have a debt of 5000 million and a cash balance of 800 million.
   (i) What ownership share in Orbital should Redstone Ltd. ask for?
   (ii) What is the post-money investment value of the firm's equity?
   (iii) What is the pre-money investment value?

CHAPTER 9

Valuation of Intangible Assets

The terms knowledge assets, intellectual capital, and intangible assets are used interchangeably. Economists call them as knowledge assets, management experts refer to them as intellectual capital, and accountants call them as intangible assets or simply intangibles. All of them essentially represent a non-physical claim to future benefits. When the claim enjoys legal protection, such as in the case of patents, trademarks, or copyrights, the asset is referred to as intellectual property. For the sake of simplicity we will use the term intangible assets.

The primary drivers of wealth and growth in today's economy are intangible (intellectual) assets. Physical and financial assets are turning into commodities which at best can earn an average return on investment. Superior returns and dominant competitive position can be achieved only through a judicious use of intangible assets along with other assets. No wonder intangibles now loom large in managerial literature.

The dramatic rise in the importance and value of intangibles in the last three decades can be traced to fundamental changes in the structure and scope of business enterprises. More specifically, the heightened competition in the wake of globalisation, deregulation, and technological changes is forcing companies to depend on continual innovation of products and services to survive and grow. Innovation, in turn, is induced by investment in intangibles (R&D, information technology, employee training, brand equity, and so on). Hence intangibles play a major role in the world of business today.

Gary Hamel stated forcefully the growing importance of intangibles in the new era: "We are at the dawn of a new industrial order. We are leaving behind a world in which scale, efficiency, and reputation are everything. We are taking our first tentative steps into a world where imagination, experimentation and agility are, if not everything, at least essential catalysts of wealth creation."

All organisations employ tangible assets such as land, building, plant and machinery and intangible assets such as technical knowhow, employee talent, and brand equity. The proportions, in which tangible and intangible assets are employed, however, tend to vary widely across firms. Firms in sectors such as information technology, biotechnology, pharmaceuticals, and fast moving consumer goods seem to be more intangible-asset intensive, whereas firms in sectors such as oil, automobiles, and consumable durables are more tangible asset intensive.

Thanks to the heightened importance of intangible assets, there has been a growing recognition of the need to value these assets. This chapter discusses various issues involved in valuing intangible assets. It is organised into the following sections which represent various stages of the valuation process.

- Definition and classification of intangible assets
- Purpose and basis of valuation
- Identification, evaluation, and selection of principal methodology options
- Identification of key information requirements
- Risk analysis
- Verification of valuation data
- Valuation reporting

9.1 DEFINITION AND CLASSIFICATION OF INTANGIBLE ASSETS

An asset is a resource controlled by a firm, as a result of past events, which is expected to generate future net economic benefits to the firm. Applying this concept, we may define an intangible asset as a resource controlled by a firm, as a result of past events, which has the following attributes: (a) it is non-physical in nature, (b) it is capable of producing future economic benefits, and (c) it is protected legally or through a *de facto* right.

To have value, an intangible asset need not necessarily be separable from the firm. However, for measuring the value of a specific intangible asset, as distinct from the firm as whole, it must necessarily be separable. Otherwise, it is not possible to define the "boundaries" of the asset for purposes of valuation.

Classification

While it may be difficult to define all types of intangible assets, the following are the most common intangible assets.

- Brands
- Intellectual property
- Publishing rights
- Licenses
- Franchises

Brands According to Philip Kotler, a brand is "a name, term, sign, symbol or design, or a combination of them which is intended to identify the goods or services of one seller to differentiate them from those of competitors."

According to J. Hugh Davidson, "Brands enable *consumers* to identify products or services which promise specific benefits. They arouse expectations in the minds of customers about quality, price, purpose, and performance. A brand stands out from commodities because commodities lack identity."

There may be three components of a brand: trademark, get up, and product (or service). A trademark may consist of a word or words and/or any design, picture, or logo. A trademark may be registered or unregistered and enjoys indefinite legal protection. The get up of a brand refers to its physical features such as packaging or stylised presentation. The product component of a brand represents its functional characteristics such as the recipe for a chocolate drink. In legal terms this may not be a property right but a trade secret that may be protected through confidentiality or contract.

While the above elements of a brand represent its legal components, the brand may have a fourth element, viz., brand image. This represents its reputation and consumer perceptions and preferences built over time.

Publishing Rights A collection of creative and knowledge-based materials, publishing rights comprise trademark (the title of the newspaper, magazine, book, etc.), get up (format, appearance, or presentation of the newspaper, magazine, etc.), and copyright (editorials, articles, illustrations, photographs, etc.).

Intellectual Property The term intellectual property usually refers to patents, copyrights, trademarks, and registered designs. Patents and copyrights are perhaps the most important types of intellectual property. A *patent* is an invention that represents a new industrially applicable idea which is registered with the appropriate authorities. It confers a monopoly right for a limited period (usually 15 to 20 years) to the inventor, or other owner, to manufacture and sell the product or to use the process. A *copyright* is a right enjoyed by the creator of an original literary, musical, artistic, or dramatic work and provides protection against unauthorised use. This protection is automatic and does not require any registration. The copyright lasts for the lifetime of the author plus 50 years.

Licenses A license is an agreement under which the licensor grants certain rights to the licenses for a specified period in return for some form of compensation. Inter alia, licenses include TV licenses, airline routes, import quota, mining rights, distribution rights, and non-compete agreements.

Franchises A franchise confers on its owner the right to sell a branded product or service. Examples: McDonald's fast-food restaurants and dealerships of Tata Motors. Typically, the franchisee pays the franchisor (say McDonald) an upfront fee or an annual fee for operating the franchise business. In return, the franchisee gets technological and marketing support, apart from the power of the brand.

A franchise enables the franchisee to earn above-market returns during the life of the franchise. The sources of excess returns are the technological, marketing, and other support provided by the franchisor and the power of the brand. In some cases, the franchisee may also benefit from the grant of exclusive right to sell a product or service in a certain area or setting.

Of course, a franchise is not an unmixed blessing. The value of a franchise can be impaired in different ways. First, the problems of the franchisor naturally have an adverse impact on the business of the franchisee. Second, franchisors, thanks to their superior bargaining power, may take advantage of the franchisees. Third, the value of the franchise is diluted when the franchise is granted to a competitor.

9.2 PURPOSE AND BASES OF VALUATION

The valuer must understand the purpose of valuation in order to determine the appropriate basis of valuation.

Purpose Intangible assets are valued for one or more of the following purposes.

- Financial reporting
- Fund raising
- Taxation
- Mergers/ acquisitions
- Brand management
- Licensing arrangements

Basis of Valuation The most common bases for valuing intangible assets are: existing use value, market value, and liquidation or "break-up" value.

The *existing use value* reflects the value of the intangible asset to its present owner under the existing operating and marketing strategies. It does not take into account plans to exploit the intangible asset in different markets or distribution channels. If there are definite plans to exploit the intangible asset in different markets and distribution channels, the expected benefits of such actions must be reflected in an existing use valuation.

The *market value* is the price at which the intangible asset would change hands between a willing buyer and a willing seller when both parties are adequately informed and act at arm's length in an open market without any restrictions. The market value reflects the price that can be obtained within a reasonable period in the open market. It can be expected that in the process of negotiation the buyer and seller will take into account (a) the existing use value of the asset and (b) the value of the asset to the buyer under the strategies that the buyer will employ to exploit the asset.

The *liquidation value* is the value of the intangible asset in a forced sale situation, assuming that it is not part of a going concern. Thus, it is the price realised in a short period under a constrained sale environment.

Matching Bases to Purposes The valuation bases appropriate for different purposes are as follows:

Purpose	*Appropriate Valuation Bases*
• Financial reporting	• Existing use
• Fund raising	• Liquidation value/existing use/market value
• Taxation	• Market value/liquidation value
• Mergers/acquisitions	• Existing use/market value
• Brand management	
• Licensing arrangements	• Market value/existing use

9.3 SELECTION OF THE METHOD/S OF VALUATION

Conceptually, the value of an asset may be defined as the discounted value of the net benefits that can be derived from the use or sale of the asset. Three broad approaches are available for valuing intangible assets.

- Cost approach
- Market approach
- Economic approach

Cost Approach

The cost approach aggregates the costs incurred in developing the intangible asset to its present condition. There are two variants of the cost approach: historical cost approach and replacement cost approach.

The historical cost approach is apparently objective, reliable, and consistent. But, it is clearly not relevant. The value of an intangible asset depends on the future economic benefits expected from it and not on the cost incurred in its development. There is hardly any relationship between expenditure on an intangible asset and its value. For example, a poorly implemented advertising campaign or an unsuccessful research and development programme have very little value, however costly they may have been.

The replacement cost approach seeks to quantify the cost of replacing the intangible asset or recreating an equivalent asset. For example, the replacement cost of a brand is the total cost required to create an equivalent brand which offers, inter alia, similar turnover, contribution margin, customer loyalty, market image, and growth prospects.

While the replacement cost approach addresses the problem of translating a historical cost into a current cost, it is not a practical approach as it is extremely difficult to estimate the costs of recreating the asset.

To sum up, cost–based approaches should not be used unless the replacement cost can be estimated with a reasonable degree of reliability. However, cost can be regarded as a relevant benchmark for an intangible asset which has been purchased recently.

Market Approach

According to the market approach, the value of an intangible asset is determined on the basis of the prices obtained for comparable assets in recent merger and acquisition deals.

The market approach is credible, objective, and relevant. However, the level of activity in the market for intangible assets is limited. Given the uniqueness of individual intangible assets, arm's length transactions involving similar intangible assets in similar industries may be rare. Further, information concerning such transactions may not be publicly available.

Economic Approach

The economic approach to the valuation of an intangible asset involves two broad steps:

1. Estimate the cash flow/earnings
2. Capitalise the cash flow/earnings

Estimate the Cash Flow/Earnings The cash flows/earnings associated with an intangible asset may be estimated in the following ways:

- Direct identification method
- Brand contribution method
- Royalty method

Direct Identification Method If the only significant asset of the business is the intangible asset, it is possible to readily identify the cash flows/earnings associated with the intangible asset. Examples of this are the earnings/cash flows generated by a library of film, music, or copyrights.

Brand Contribution Method The brand contribution represents the profit or cash flow generated by an intangible asset which is in excess of the profit generated by the underlying business. There are four methods commonly used for estimating the brand contribution: utility cost method, return on capital method, premium profits method, and retail premium method.

Under the ***utility cost method***, the gross contribution of a brand is estimated by subtracting from the turnover generated by the branded product/service, the 'utility' cost charged by manufacturers of unbranded products or providers of unbranded services. From the gross brand contribution, marketing costs, other overheads, and taxes are deducted to arrive at the brand contribution after tax.

Under the ***return on capital method***, an appropriate remuneration on capital employed is deducted from the earnings of the business to identify the brand earnings. By deducting a return on capital, the value added by other assets of the firm such as fixed assets and net working capital is eliminated.

Under the ***premium profits method,*** an attempt is made to quantify the excess returns attributable to the intangible assets. The steps involved in applying this method are: (i) Calculate the current fair market value of the net tangible assets. (ii) Assess the return required by a knowledgeable investor from the tangible assets of the business. (iii) Figure out the excess return that is attributable to intangible assets. This is the difference between the return obtained by the branded product manufacturer and the return required from the tangible assets of the business.

Under the ***retail premium method***, brand earnings are equated with the price premium commanded by a branded product or service over and above that of an unbranded product or service. The steps involved in applying this method are: (i) Estimate the gross retail premium attributable to the brand as the difference between the average retail price of the branded product or service and the average retail price of the unbranded equivalent. (ii) From the gross retail premium, deduct incremental costs incurred for the branded product to sustain the premium and arrive at the retail premium before tax. (iii) Finally, deduct taxes from the retail premium before tax to get the retail premium after tax.

Royalty Method Under the royalty method, you ask the question: What is the estimated post-tax royalty (after deducting the costs associated with maintaining the licensing arrangements) that can be earned from the intangible asset under a hypothetical licensing arrangement? To answer this question, you have to get a handle over: (i) the turnover that the intangible asset is expected to generate, (ii) the royalty rate, and (iii) the cost of maintaining the licensing arrangement.

Capitalise the Cash Flows/Earnings Once the cash flows/earnings associated with an intangible asset have been estimated, the next step is to convert them into a capital value. The two commonly used methods of doing this are:

- Discounted cash flow method
- Earnings multiple method

Discounted Cash Flow Method According to the discounted cash flow method, the value of an intangible asset is equal to the present value of the net cash flows expected to be generated by the asset. The discount rate used for calculating the present value is the weighted average cost of capital, reflecting the business and financial risks associated with the investment.

Earnings Multiple Method According to the earnings multiple method, the value of an intangible asset is estimated by multiplying the earnings attributable to that intangible asset by a suitable earnings multiple (PE ratio).

The earnings multiple method is commonly used in valuation exercises. A business firm may be valued by looking at the PE (price-earnings) ratio for comparable companies and applying it to the earnings of the firm to be valued. The scope for applying the earnings multiple method to intangible assets may be somewhat limited because there are very few transactions involving the sale of intangible assets separated from the underlying business.

Illustration of the Royalty Method

The royalty method of intangible asset valuation is commonly used for valuing brands, patents, licenses, and franchises. The value of the intangible asset under this method is the capitalised value of the royalties associated with the asset. Exhibit 9.1 gives an illustration of this method.

The assumptions made in this illustration are as follows:

(i) Turnover will grow at 12% between 20X0 and 20X4 and at 8% between 20X4 and 20X8. Beyond 20X8 the growth rate will be nil. The post-tax royalty receivable in perpetuity beyond 20X8 is 37,463. So its value as at the end of Year 20X8 is: 37,463/0.11 = 340573.

(ii) All amounts are stated in nominal terms.

(iii) The cost of maintaining the licensing arrangement is negligible.

Selection of Valuation Methods

For brands and publishing rights the primary valuation methods are:

- Capitalisation of net cash flow /earnings
- Royalty method
- Brand contribution method

For intellectual property and licenses, the primary valuation methods are:

- Capitalisation of net cash flow/ earnings
- Royalty method

Exhibit 9.1 ***Illustration of the Royalty Method***

	20X0	*20X1*	*20X2*	*20X3*	*20X4*	*20X5*	*20X6*	*20X7*	*20X8*	*Residual*
Turnover	500,000	560,000	627,200	702,464	786,760	849,700	917,676	991,091	1070,378	1070,378
Royalty income @ 5%	25,000	28,000	31,360	35,123	39,338	42,485	45,884	49,555	53,519	
Taxation @ 30%	7,500	8,400	9,408	10,537	11,801	12,746	13,765	14,866	16,056	
Post-tax royalty income	17,500	19,600	21,952	24,586	27,537	29,740	32,119	34,689	37,463	340,573
Discount factor @ 11%	0.901	0.812	0.731	0.659	0.593	0.535	0.482	0.434	0.391	0.391
Net present value	15,768	15,915	16,047	16,202	16,329	15,911	15,481	15,055	14,648	133,164
Net present value of the royalty stream	274,520									

9.4 IDENTIFICATION OF KEY INFORMATION REQUIREMENTS

The valuer must obtain comprehensive knowledge and understanding of the asset, the company, and its market. The valuer must consider financial, legal, market, and industry information detailed below.

Financial Historical and prospective data on turnover, contribution, production, capital expenditure, R&D, and marketing.	**Market Characteristics** Market share/ position, product/ service awareness, consumer loyalty, geographical coverage, product life cycle, marketing mix, and demographics.
Industry Structure Structure of industry, barriers of entry, nature of competition, bargaining power of suppliers and buyers, availability of substitutes, distribution arrangements, major industry trends, social, political, regulatory, environmental, and economic factors.	**Legal** Common law or similar rights, registered or statutory rights, duration of property rights, details of licensing arrangements,

9.5 RISK ANALYSIS

After selecting the suitable valuation methods and gathering the key information required, the valuer can calculate the value. Since valuation is an inherently uncertain and imprecise exercise, the valuer must analyse risks while doing valuation. The most commonly used methods of risk analysis are sensitivity analysis, scenario analysis, and simulation analysis.

- *Sensitivity Analysis* Sensitivity analysis is "what–if" kind of analysis. It examines the effect of change in an underlying factor on the value of the asset. What happens to value, if the cash flow (or earnings) decreases by 5 percent? What happens to value, if the discount rate increases by 1 percent? Typically, sensitivity analysis examines the effect of 5 percent, 10 percent, and 15 percent adverse or favourable variation in key underlying factors on the value of the asset.
- *Scenario Analysis* In sensitivity analysis, one variable is changed at a time and its effect on value is assessed. In scenario analysis, changes in several variables are considered together Typically, scenario analysis involves the following steps:
  1. Identify possible scenarios that could be realised in the future (each scenario representing a certain combination of the underlying variables) and assess the value under each of the scenarios.
  2. Assign probabilities to the various scenarios.
  3. Calculate the expected value of various scenarios.

- *Simulation Analysis* A more advanced technique of risk analysis, simulation analysis involves the following steps:
  1. Specify the probability distributions of the variables that have a bearing on value.
  2. Select a value, at random, from the probability distributions of each of the variables.
  3. Determine the value corresponding to the randomly generated values of the underlying variables.
  4. Repeat steps (2) and (3) a number of times to get a large number of simulated values.
  5. Plot the frequency distribution of value.

9.6 VERIFICATION OF VALUATION DATA

Apart from substantiating the assumptions made and data utilised, it is worthwhile to make the following supplementary checks.

1. *Cross-check using alternative methodologies* There may be alternative ways of estimating the cash flow (or earnings) of the intangible asset. The valuer may cross-check his estimates using alternative methodologies.
2. *Carry out independent verification* A good professional practice is to arrange for an independent verification of data sources, assumptions, applications of valuation methodologies, and numerical computations.
3. *Use the asset approach.* When the intangible asset represents a significant part of the firm, the asset approach may be used as a cross-check. According to the asset approach, the value of the intangible asset may be derived from the following formula:

$$\begin{array}{l} \text{Value of the} \\ \text{firm as a} \\ \text{whole} \end{array} = \left(\begin{array}{l} \text{Fair value} \\ \text{of tangible} \\ \text{assets} \end{array} + \begin{array}{l} \text{Fair value} \\ \text{of good} \\ \text{will} \end{array} + \begin{array}{l} \text{Value of the} \\ \text{intangible} \\ \text{asset} \end{array} \right)$$

4. *Draw upon specialists* In certain valuation assignments, the valuer can benefit from consulting one or more specialists such as trademark lawyers and market research consultants. Ensure that the specialist consulted can offer independent and objective advice- the specialist's independence and objectivity may be impaired if he has a contractual or economic relationship with the client.

To determine the extent of verification work necessary, recognise that a valuer can report in two alternative capacities, advisory and opinion. A valuer serving in an advisory capacity relies heavily upon information furnished by management with minimal independent verification. A valuer offering opinion has to perform adequate independent verification to support his opinion. Obviously, such a valuer bears a higher degree of professional risk for his work.

9.7 VALUATION OF GOODWILL

An important intangible asset, goodwill is somewhat difficult to define. It represents an aggregation of all the advantages that a firm enjoys with respect to its reputation, relationships with various stakeholders, location, and so on. Since goodwill is generally inseparable from a business, it can fetch a price only if the business is sold as a going concern. Generally, the value of a business as a whole on a going concern basis is greater than the sum of the values of its assets when they are sold separately. The difference represents goodwill. In a way, goodwill is the capacity of a business to earn a rate of return higher than a fair rate of return.

Goodwill generally does not appear in the balance sheet of the firm, except when one company acquires another and pays more than the fair market value of the net assets (total assets-total liabilities). Goodwill is represented on the balance sheet as an intangible fixed asset. According to International Financial Reporting Standards (IFRS), goodwill is not amortised. The management, however, is responsible to value goodwill every year and determine whether an impairment is required. If the fair value falls below historical cost (the purchase price of goodwill), an impairment must be recorded and the fair market value lowered. An increase in the fair market value, however, is not accounted for in the financial statements.

Methods for Valuation of Goodwill

Measurement of goodwill is a complex task. It is very difficult to assess goodwill in a precise and scientific manner. Practitioners generally use simple rules of thumb which rely on subjective judgements. There are three commonly used methods for valuation of goodwill:

- Average profits method
- Super profits method
- Capitalisation method

Average Profits Method This is perhaps the simplest method for valuing goodwill. According to this method:

Goodwill = Average profits x Number of years of purchase

The average profits are calculated usually for a period of three to five years. Before calculating the average profits, adjustments should be made for any abnormal profits or losses and non-operating incomes.

The number of years of purchase is usually 3; sometimes it may be more.

Super Profits Method According to this method:

Goodwill = Super profits × Number of years of purchase

Super profits are profits in excess of normal profits. For example, if the normal rate of return in a certain type of business is 15 percent but firm A earns a rate of return of 20 percent on its capital of 200 million, the super profits are: 200(0.20 – 0.15) = 10 million.

The super profits are multiplied by the number of years of purchase which may be 3 to 5 years. If a 5 year period is used in the above case, then the goodwill works out to: 10 million × 5 = 50 million

Capitalisation Method There are two ways of calculating goodwill under the capitalisation method: capitalisation of average profits and capitalisation of super profits.

Capitalisation of Average Profits Method Under this method,

Goodwill = Capitalised value of average profits – Capital employed

$$\text{Capitalised value of average profits} = \frac{\text{Average profits}}{\text{Normal rate of return}}$$

Capital employed = Assets – Liabilities

To illustrate, the following data is available for ABC Limited.

Average profits = 20 million

Total assets = 200 million

Liabilities (outside) = 100 million

Normal rate of return = 15 percent

Capitalised value of average profits: $\frac{20}{0.15} = 133.33$ million

Capital employed: 200 – 100 = 100 million

Goodwill: 133.33 – 100 = 33.33 million

Capitalisation of Super Profits Under this method,

Goodwill = Super profits x (100/ Normal rate of return in percentage terms)

Super profits are profits in excess of normal profits.

To illustrate, PQR Limited earns a profit of 12 million by employing a capital of 50 million. The normal rate of return is 15 percent. Goodwill is calculated as follows:

Normal profits = 50 × 0.15 = 7.5 million

Super profits = 12 – 7.5 = 4.5 million

Goodwill = 4.5 × (100/15) = 30 million

9.8 VALUATION REPORTING

As there is no standard form of valuation report, the form and content of the valuation report will depend on the nature of the engagement and the understanding with the client. The valuer must exercise judgement in determining the extent to which actual data, assumptions, methodological details, and the reasoning behind the opinions are covered in the report. While doing this, he should be mindful of the legal consideration and the nature of business environment.

Ordinarily, the report should contain at least the following:

- Reference to the engagement letter or contract which sets forth the appointment of the valuer.
- A statement of the purpose as well as the basis of valuation.
- A description of the intangible asset along with any significant rights and restrictions on its usage.
- The date of valuation.
- The extent to which relevant information is included in the report and a clear explanation of the nature of verification, if any, carried out by the valuer.
- An expression of opinion relating to valuation.

Depending on the purpose of the report and the needs and expectations of the users, it may be appropriate to include the following:

- A description of the methodology used for valuation and a summary of the factors used for applying the methodology.
- A summary of the numerical calculations.
- Any other significant information relevant in the circumstances.

SUMMARY

- The terms knowledge assets, intellectual capital, and intangible assets are used interchangeably. For the sake of simplicity we will use the term intangible assets.
- The dramatic rise in the importance and value of intangibles in the last two to three decades can be traced to fundamental changes in the structure and scope of business enterprises.
- Thanks to the heightened importance of intangible assets, there has been a growing recognition of the need to value these assets.
- An intangible asset is a resource controlled by a firm, as a result of past events, which has the following attributes: (a) it is non-physical in nature, (b) it is capable of producing future economic benefits, and (c) it is protected legally or through a defined right.

- The following are the most common categories of intangible assets: brands, intellectual property, publishing rights, licenses, and franchises.
- Intangible assets are valued for one or more of the following purposes: financial reporting, fund raising, taxation, mergers/acquisitions, brand management, and licensing arrangements.
- Conceptually, the value of an asset may be defined as the discounted value of the net benefits that can be derived from the use or sale of the asset.
- Three broad approaches are available for valuing intangible assets: cost approach, market approach, and economic approach.
- There are two types of cost approach: historical cost approach and replacement cost approach.
- According to the market approach, the value of an intangible asset is determined on the basis of the prices obtained for comparable assets in recent deals.
- The economic approach to the valuation of an intangible asset involves two broad steps: (i) Estimate the cash flow/earnings. (ii) Capitalise the cash flow/earnings.
- The cash flows/earnings associated with an intangible asset may be estimated in the following ways: direct identification method, brand contribution method, and royalty method.
- Cash flows/earnings are capitalised in two ways: discounted cash flow method and earnings multiple method.
- The valuer must consider financial, legal, market, and industry information.
- Since valuation is an inherently uncertain and imprecise exercise, the valuer must analyse risks while doing valuation. The most commonly used methods of risk analysis are sensitivity analysis, scenario analysis, and simutation analysis.
- When the brand contribution method is used, there are four commonly used ways of estimating the brand contribution: utility cost method, return on capital method, premium profits method, and retail premium method.
- It is worthwhile to make the following supplementary checks: cross – check using alternative methodologies, carry out independent verification, use the asset approach, and draw on specialists.
- A valuer can report in two alternative capacities, advisory and opinion.
- Goodwill represents an aggregation of all the advantages a firm enjoys. Since goodwill is generally inseparable from a business, it can fetch a price only if the business is sold as a going concern.
- There are three commonly used methods for valuation of goodwill: average profits method, super profits methods, and capitalisation method.
- The form and content of the valuation report will depend on the nature of engagement and understanding with the client.

Questions

1. Discuss the importance of intangibles in today's economy.
2. What are the attributes of an intangible asset?
3. Describe the following intangible assets: brands, intellectual property, publishing rights, licenses, and franchises.
4. Discuss the purposes and bases for valuing intangible assets. How would you match them?
5. Discuss the following approaches for valuing intangible assets: cost approach, market approach, and economic approach.
6. Explain the following methods for estimating the brand contribution: utility cost method, return on capital method, premium profits method, and retail premium method.
7. Identify the key information required for valuing intangible assets.
8. What methods are commonly used for analysing risks in valuing intangible assets?
9. Discuss the types of supplementary checks to be used for verifying valuation data.
10. Ordinarily, what should the valuation report contain, at a minimum?
11. What is goodwill? How does it appear in the balance sheet of the firm?
12. Discuss the following methods for valuation of goodwill: average profits method, super profits method, and capitalisation method.

CHAPTER 10

Case Studies in Valuation

10.1 BHARAT HOTELS COMPANY[1]

Bharat Hotels Company (BHC) is a major hotel chain of India. The company operates 35 hotels of which 14 are owned by it and the rest are owned by others but managed by BHC.

BHC's principal strategy has been to serve the high end of the international and leisure travel markets in major metropolises, secondary cities, and tourist destinations. It plans to continue to develop new businesses and leisure hotels to take advantage of the increasing demand which is emanating from the larger flow of commercial and tourist traffic of foreign as well as domestic travellers.

BHC believes that the unique nature of its properties and the emphasis on personal service distinguishes it from other hotels in the country. Its ability to forge management contracts for choice properties owned by others has given it the flexibility to swiftly move into new markets while avoiding the capital intensive and time consuming activity of constructing its hotels.

BHC's major competitors in India are two other major Indian hotel chains and a host of other five star hotels which operate in the metropolises as an extension of multinational hotel chains. The foreign hotel majors are considerably stronger than the Indian hotels in terms of financial resources, but their presence in the country has historically been small. With the government committed to developing India as a destination for business and tourism, several hotel majors have announced their intention to establish or expand their presence in the country.

BHC's operating revenues and expenses for the year just concluded (year 0) were as follows:

1. Based on the valuation report prepared by the author in mid-1980s for a major chain of hotels whose name has been disguised at the client's request.

Operating Revenues	*Rupees (in million)*
• Room rent	1043
• Food and beverages	678
• Management fees for managed properties	73
Operating Expenses	
• Materials	258
• Personnel	258
• Upkeep and services	350
• Sales and general administration	350

BHC's assets and liabilities (in million rupees) at the end of year 0 were as follows:

Owners' Equity & Liabilities		*Assets*	
Net worth	1126	Net Fixed Assets	1510
Debt	900	Gross Block:	2110
		Accumulated depreciation:	600
		Net Current Assets	516
	2026		2026

BHC had no non-operating assets.

At the beginning of year 0, BHC owned 2190 rooms. It has planned the following additions for the next seven years. Most of the land needed by the company for these additions has been already acquired.

Year	*Rooms*	*Investment (in million rupees)*
1	90	200
2	130	300
3	80	240
4	130	500
5	186	800
6	355	1400
7	150	1300

A good portion of investment in year 7 would be toward purchase of land.

For the sake of simplicity assume that the addition will take place at the beginning of the year. For developing the financial projections of BHC, the following assumptions may be made.

- The occupancy rate will be 60 percent for year 1. Thereafter, it will increase by 1 percent per year for the next six years.

- The average room rent per day will be ₹2,500 for year 1. It is expected to increase at the rate of 15 percent per year till year 7.
- Food and beverage revenues are expected to be 65 percent of the room rent
- Material expenses, personnel expenses, upkeep and services expenses, and sales and general administration expenses will be, respectively, 15, 15, 18, and 18 percent of the revenues (excluding the management fees).
- Working capital (current assets) investment is expected to be 30 percent of the revenues.
- The management fees for the managed properties will be 7 percent of room rent. The room rent from managed properties will be more or less equal to the room rent from owned properties.
- The depreciation is expected to be 7 percent of the net fixed assets.
- Given the tax breaks it enjoys, the effective tax rate for BHC will be 20 percent.

Besides financial projections, the following information is relevant for valuation.

- The market value of equity of BHC at the end of year 0 is ₹3050 million. The imputed market value of debt is ₹900 million.
- BHC's stock has a beta of 0.921.
- The risk-free rate of return is 12 percent and the market risk premium 8 percent.
- The post-tax cost of debt is 9 percent.
- The free-cash flow is expected to grow at a rate of 10 percent per annum after 7 years.

DCF Value

The DCF value of BHC is calculated as follows.

Free Cash Flow Forecast Based on the information provided above, the forecast for revenues and operating expenses is developed in the first three panels of the table below. The free cash flow forecast is developed in the fourth panel of the table. The schedule for current assets, fixed assets, and depreciation is shown in the fifth panel.

Financial Projections

PANEL I

Year	*1*	*2*	*3*	*4*	*5*	*6*	*7*
A. Rooms	2280	2410	2490	2620	2806	3161	3311
B. Occupancy rate	0.60	0.61	0.62	0.63	0.64	0.65	0.66
C. Average room rent (in rupees)	2500	2875	3306	3802	4373	5028	5783

PANEL II*							
D. Room rent from owned properties	1248	1543	1863	2291	2866	3771	4612
E. Food & beverage revenues	811	1003	1211	1489	1863	2451	2998
F. Revenue from owned properties (D + E)	2060	2545	3074	3780	4729	6222	7610
G. Management fees from managed properties	87	108	130	160	201	264	323
H. Total revenues (F+G)	2147	2653	3204	3940	4930	6486	7933
PANEL III *							
I . Material expenses	309	382	461	567	709	933	1142
J. Personnel expenses	309	382	461	567	709	933	1142
K. Upkeep and service expenses	371	458	553	680	851	1120	1370
L. Sales and general admn expenses	371	458	553	680	851	1120	1370
M. Total operating expenses	1359	1680	2029	2495	3121	4107	5023
PANEL IV *							
N. EBDIT (H-K)	788	973	1176	1445	1809	2380	2910
O. Depreciation	120	132	140	165	210	293	363
P. EBIT	668	841	1036	1280	1599	2087	2547
Q. NOPLAT	534	673	829	1024	1279	1669	2038
R. Gross cash flow	654	805	968	1189	1489	1962	2401
S. Gross Investment (Fixed assets) + Current assets)	302	446	399	712	1085	1848	1716
T. Free cash flow from operations (R-S)	352	359	570	478	404	114	685
PANEL V *							
Year	*1*	*2*	*3*	*4*	*5*	*6*	*7*
A. Net current assets *	516	618	764	924	1134	1419	1867
B. Net current assets addition*	102	146	159	212	285	448	416
C. Gross block *	2110	2310	2610	2850	3350	4150	5550
D. Capital exp *	200	300	240	500	800	1400	1300
E. Acc deprn *	600	720	852	992	1157	1366	1659
F. Net block (C+D- E)	1710	1890	1998	2358	2993	4184	5191
G. Depreciation	120	132	140	165	210	293	363

- All figures in million rupees

*At the beginning of the year

Cost of Capital BHC has two sources of finance, equity and debt. The cost of capital for BHC is:

Cost = Weight of Equity × Cost of Equity + Weight of Debt × Cost of Capital Debt

The weights of equity and debt, based on market value, are as follows;

$$\text{Weight of Equity} = \frac{3050}{3950} = 0.772$$

$$\text{Weight of Debt} = \frac{900}{3950} = 0.228$$

The cost of debt is given to be 9 percent. The cost of equity using the capital asset pricing model is calculated below:

Cost of Equity of BHC = Risk-free rate + Beta of BHC (Market risk premium)
= 12 + 0.921(8) = 19.37

Given the component weights and costs, the cost of capital for BHC is:

(0.772)(19.37) + (0.228) (9) = 17.00 percent

Continuing Value The continuing value may be estimated using the growing free cash flow perpetuity method. The projected free cash flow for year 7 is ₹678 million. Thereafter it is expected to grow at a constant rate of 10 per cent per year. Hence the expected continuing value at the end of the seventh year is given by

$$CV_7 = \frac{FCF_8}{k-g} = \frac{685(1.10)}{0.17-0.10} = ₹10764 \text{ million}$$

Calculation and Interpretation of Results The value of equity is equal to:
Discounted free cash flow during the explicit forecast period
+ Discounted continuing value + Value of non-operating assets
– Market value of debt claims (as per excel spreadsheet calculation)

$$= \frac{352}{(1.17)} + \frac{359}{(1.17)^2} + \frac{570}{(1.17)^3} + \frac{478}{(1.17)^4} + \frac{404}{(1.17)^5} + \frac{114}{(1.17)^6} + \frac{685}{(1.17)^7} + \frac{10748}{(1.17)^7} + 0 - 900$$

= ₹4311 (million as per spreadsheet calculation)

Since the discounted continuing value [10764/(1.17)^7 = ₹3587 million looms large in this valuation, it is worth looking into it further. Its key determinant appears to be the expected growth rate in the free cash flow beyond the explicit forecast period. This has been assumed in the preceding analysis to be 10 percent. What happens to the estimate of equity value if the growth rate happens to be different? The sensitivity of the estimate of equity value to variations in the growth rate in a range of, say, 8 percent to 12 percent is shown below (as per excel spreadsheet calculation):

Growth rate (per cent)	*Equity value estimate (in million rupees)*
8	3465
9	3836
10	4311
11	4945

10.2 BHARAT HEAVY ELECTRICALS LIMITED (BHEL)

Established in 1964, BHEL, a public sector company is the largest engineering and manufacturing enterprise in India in the energy related/infrastructure sector. BHEL caters to core sectors of Indian economy viz., power generation and transmission industry, transportation, renewable energy, and defence.

In March 1992, BHEL was a 100 percent government-owned company. In the wake of the economic reforms initiated in 1991, BHEL felt that the scope for strategic alliance with foreign companies had increased. It also anticipated that the Government of India would partially disinvest its stake in BHEL. In this context it asked the author to do a valuation as on March 31, 1992 (the lien date).

The inputs for the valuation exercise came largely from the five year plan BHEL had developed for the period 1992-1997. From the detailed financial projections available in the plan, the free cash flow forecast for the five year period, 1992-1997, was prepared, as shown in the table below. Surprisingly, while the company had detailed plans and projections for five years, it did not have any projections for the period thereafter. So, the explicit forecast period was set at five years.

BHEL: Free Cash Flow Forecast

					₹in crore
	1992-93	*93-94*	*94-95*	*95-96*	*96-97*
• Turnover	3350	3700	4200	5000	6000
• EBDIT (12%)	402	444	504	600	720
• Depreciation (3.12%)	104.5	115.4	131.0	156.0	187.2
• EBIT (8.88%)	297.5	328.6	373.0	444.0	532.8
• Tax rate	45%	40%	35%	35%	35%
• Tax	133.9	131.4	130.6	155.4	186.5
• NOPLAT	163.6	197.2	242.4	288.6	346.3
• Add: Depreciation	104.5	115.4	131.0	156.0	187.2
• Gross Cash Flow	268.1	312.6	373.4	444.6	533.5
• Less: (CAPEX + ΔWC)	103.0	135.0	153.0	182.0	219.0
• Free Cash Flow	165.1	177.6	220.4	262.6	314.5

The free cash flow forecast was based on the following assumptions:

- EBDIT, depreciation, and EBIT would be 12.00 percent, 3.12 percent, and 8.88 percent respectively of the turnover.
- The tax rate would be 45 percent for the year 1992-1993. Thereafter it would decline by 5 percent each year for two years and stabilise at 35 percent beyond two years. This assumption was in line with the indication given by Dr. Manmohan Singh, the then Finance Minister.

The management of BHEL estimated its weighted average cost of capital at 12.5 percent.

The terminal value at the end of 5 years was estimated as a multiple (12X) of the free cash flow for year 5. The multiple was judgmentally determined.

Given the above projection and assumptions, the enterprise value was calculated as follows:

Present value of free cash flow during the explicit forecast period:

$$\underset{(FCF)}{PV} = \frac{165.1}{(1.125)} + \frac{177.6}{(1.125)^2} + \frac{220.4}{(1.125)^3} + \frac{262.6}{(1.125)^4} + \frac{314.5}{(1.125)^5}$$

= ₹780.3 crore.

Present value of horizon or terminal value:

$$PV\ (HV) = 314.5 \times 12 \times \frac{1}{(1.125)^5}$$

= ₹2094.3 crore

Enterprise value = 780.3 + 2094.3

= ₹2874.6 crore

On March 31, 1992, BHEL had a total debt of ₹775 crore on its balance sheet. It was assumed that the book value of debt was a good proxy for its market value.

So, the equity value was estimated as:

2874.6 – 775 = ₹2099.6 crore

As on March 31, 1992, BHEL had 24 crore shares outstanding of ₹10 each. So, the imputed value per share worked out to:

2099.6/ 24 = ₹87.5

10.3 VALUATION IN THE MERGER OF TOMCO AND HLL

Tata Oil Mills Company (TOMCO) was merged with Hindustan Lever Limited (HLL) in 1993. The effective date of merger was April 1, 1993. The exchange ratio finalised was 2:15. A dissenting shareholder challenged the valuation of shares. Initially, the Bombay High

Court and subsequently the Supreme Court overruled the objections. The salient facts and extracts from the judgments of Bombay High Court and Supreme Court are given below:

TOMCO

Market Prices on June 17, 1993: ₹52.50

As at	*31.03.93*	*31.03.92*	*31.03.91*
Face value (₹)	10	10	10
Book value (₹)	29.75	29.45	36.17
Dividend (%)	-	12.5	20.06
Earnings per share (₹)	0.30	0.50	5.19

HLL

Market Prices on June 17, 1993: ₹375

As at	*31.12.92*	*31.12.91*	*31.12.90*
Face value (₹)	10	10	10
Book value (₹)	23.80	20.75	27.36
Dividend (%)	42.0	38.5	42.0
Earnings per share (₹)	7.03	5.73@	6.29

@ There was a bonus issue in 1991.

With respect to valuation, the Bombay High Court observed as follows:

1. In arriving at the fair exchange ratio the author has considered all the three methods, namely, the yield value, the asset value, and the market value of the shares of both the companies and has given appropriate weightages to each of the above values.
2. Since both the companies are in similar business, uniform basis of capitalisation of profit has been adopted in determining the yield value.
3. The valuation was confirmed by two other auditors namely A.F. Ferguson and N.M. Raiji.

With respect to valuation, Supreme Court observed as follows:

1. If the market price basis as on 17.06.93 is adopted, the exchange ratio of 2:15 was very fair.
2. If the yield method is adopted, the ratio would be astronomically high in favour of HLL.
3. If book value is taken, then TOMCO shares would be higher than HLL.
4. The question was what should be adopted for arriving at a proper exchange ratio? The usual rule is that shares of the going concern must be taken at quoted market value.

10.4 BHORUKA POWER CORPORATION LIMITED[2]

Bhoruka Power Corporation Limited (BPCL., hereafter) is a highly profitable power generation company which has done very well right from its inception in 1992. It has grown at a healthy rate, achieved a high return on equity, and built impressive reserves and surplus. In terms of two key financial performance measures, viz., net profit to sales ratio, and return on net worth, BPCL outperformed all the listed power generation companies.

The superior financial performance of BPCL is attributable to three factors, in the main: (a) allotment of choice hydel sites by the government at a nominal water cess. (b) good project implementation and commendable technical and managerial capability, and (c) banking and wheeling arrangement.

While BPCL has done very well, its investments in group companies have soured. It had to write off nearly ₹4.5 crore of its loan to Bhoruka Steels and its investments in Prabhu Securities, an investment subsidiary, has eroded considerably. This raises serious concerns in the mind of any strategic investor.

BPCL is currently operating hydel power projects at Shivapur (18 MV) and Shahapur (6.6 MW) and is setting up a hydel project at Rajankollur (2 MW). BPCL has begun work on a thermal power project to be set up at Wadi (53 MW). It is exploring a few other options.

BPCL will enjoy superior returns on its existing hydel projects and even on the thermal project at Wadi (where it has worked out the tariff structure assuming a return on equity of 25 percent). However, it appears that the profitability of new hydel projects may not match the profitability of its existing projects. Hence its thrust in future will probably be in the area of thermal power where profitability is likely to be moderate.

Three methods have been employed for valuing BPCL's equity.

- Replacement cost method
- Earnings capitalisation method
- Discounted cash flow method

Replacement Cost Method According to the **replacement cost method,** the value of equity is derived as follows:

Value of equity = Replacement cost of fixed assets + Net current assets – Loan funds.

BPCL had 24.6 MW of hydel capacity in operation which may be assigned a replacement cost of ₹4.5 crore per MW. In addition, as on March 31, 1998 its other assets would be as follows:

- Capital works in progress : ₹10.1 crore
- Net current assets : ₹6.1 crore

2. Based on a valuation report prepared by the author as on March 31, 1998 (the lien date) at the request of the company.

The loan funds on that date would be ₹37.8 crore

BPCL's value of equity as per the **replacement cost method** is worked out below:

• Replacement cost of 24.6 MW of hydel capacity in operation (₹4.5 crore per MW)	= ₹110.7
+ Capital works in progress as on 31st March, 1998	= 10.1
+ Net current assets as on 31st March, 1998	= 6.1
– Loan funds as on 31st March 1998	= 37.8
	₹89.1 crore

Since the number of outstanding shares of BPCL is 0.825 crore, the replacement cost per share is: 89.1/0.825 = ₹108

Earnings Capitalisation Method According to **earnings capitalistion method,** the value of equity is estimated as:

Normal profit after tax × An appropriate P/E multiple

Normal profit after tax For a company that experiences a lot of variability in profit after tax it is a common practice to use a weighted average of profit after tax for 2 to 3 years. However, in the case of BPCL, profit after tax has been rising steadily and this is expected to continue in the foreseeable future. In such a situation, it suffices to look at profit after tax for the current year. This is expected to be ₹14.2 crore.

Appropriate P/E multiple How can one establish an appropriate P/E multiple? The P/E multiple is mainly function of the following factors:

- Growth prospects
- Risk characteristics
- Size of the company
- Liquidity
- Corporate governance

While BPCL scores well on the first two factors, it does not currently fare well on the remaining factors. (Its size is not large; since it is an unlisted company there is no secondary market; its funds have been used for subsidising group companies).

The P/E multiple for the power generation companies currently varies between 4.5 and 13.5 with an average of about 9.5.

Given the above evaluation of BPCL a P/E multiple of 7.0 seems appropriate for it.

Given a profit after tax figure of ₹14.2 crore and an appropriate multiple of 7, the value of BPCL's equity works out to:

$$14.2 \times 7 = ₹99.4 \text{ crore}$$

On a per share basis, it works out to:

$$99.4/0.825 = ₹120.5$$

Discounted Cash Flow Method Ordinarily, when a **DCF valuation** of company is done, one estimates the entity value by discounting the free cash flows to all providers of capital using the post-tax weighted average cost of capital as the discount rate. From the entity value, the value of debt is subtracted to arrive at the value of equity.

In the case of BPCL, however, we have looked at the cash flows to equity over a period of 15 years and discounted the same at a discount rate reflecting the cost of equity. This procedure has been followed because the capital structure is expected to change significantly over time.

How are cash flows to equity defined? The cash flows to equity represent the net cash flows accruing to equity shareholders after taking into account the operations, the financing from non-equity sources, and servicing of non-equity sources. More specifically, the cash flows to equity are defined as follows:

	Revenues
–	Operating expenses
=	Earnings before interest, taxes, depreciation, and amortisation (EBITDA)
–	Depreciation and amortisaton
=	Earning before interest and taxes (EBIT)
–	Interest expenses
=	Earnings before taxes
–	Taxes
=	Earnings (profits) after taxes
+	Depreciation and amortisation
=	Cash flow from operation
+	Proceeds of debt issues
+	Proceeds of preference issues
+	Sale of assets (fixed and current)
–	Increase in current assets (inventories, debtors, and others)
–	Preference dividends
–	Redemption of debt
–	Redemption of preference capital

The cash flow to equity stream for the period 1998-99 through 2012-2013 for BPCL is projected to be as follows:

Year	*Cash flow to equity (₹ in lakhs)*
1998-1999	1137
1999-2000	-580
2000-2001	2958
2001-2002	4363
2002-2003	4855
2003-2004	5236
2004-2005	4588
2005-2006	4078
2006-2007	6216
2007-2008	6456
2008-2009	7271
2009-2010	7337
2010-2011	7454
2011-2012	7763
2012-2013	6716 + 17288 = 24004 (Terminal value)

Note that the cash flow to equity is derived from the projected fund flow statement for the period 1998–2013.

At the end of 2012-2013 a terminal value of ₹17288 lakh has been obtained as follows:

Depreciated value of 80 MW	14400*
+ Net current assets excluding cash	+ 4996
– Long term debt	– 2108
	= 17288

The present value of equity-related cash flows and derivatively the intrinsic value per share has been worked out at two discount rates: 20% and 22%.

Discount Rate	*Present value of equity related cashflows*	*Intrinsic value per share*
20%	₹172.04 cr	₹208.5
22%	₹151.74 cr	₹183.9

Averaging Thus, we find that the three methods, not surprisingly, produce different estimates of intrinsic value per share:

* The depreciated value of 80 MW capacity has been arrived as follows: 80 × 450 (Cost per megawatt) × 0.40 = 14400.

- Replacement cost method : ₹108
- Earnings capitalisation method : ₹120.5
- DCF method (assuming a 22% discount rate) : ₹183.9

Why is there such a discrepancy? The discrepancy in the case of BPCL may be due to the following reasons:

- The replacement cost method does not capture the 'economic rents' BPCL expects from favourable circumstances.
- The earnings capitalisation method is influenced by the current valuation norms (P/E multiples) in the market which are somewhat depressed.

Since all the methods have their merits and demerits, prudence calls for taking an average of the values provided by the methods. A simple arithmetic average the values is:

$$(108 + 120.5 + 183.9) / 3 = ₹137.5$$

In private transactions of the equity of unlisted companies there is often a discount of 15%–25% over the intrinsic value. This discount is a function of (a) the faith the private equity investor has in the projections provided by the company and the quality of management and corporate governance and (b) the relative bargaining power of the two parties.

10.5 VALUATION IN THE MERGER OF ICICI WITH ICICI BANK

When the Reserve Bank of India announced in 2001 that it would encourage financial institutions to transform themselves into banks, the management of ICICI and ICICI Bank quickly initiated the process of amalgamating ICICI with ICICI Bank.

ICICI retained JM Morgan Stanley as its financial advisor; ICICI Bank retained DSP Merrill Lynch as its financial advisor; and ICICI and ICICI Bank retained Deloitte Haskins and Sells as an independent accounting firm in connection with the proposed amalgamation. These advisors rendered their valuation opinion dated October 25, 2001.

Based on the opinions provided by the advisors, the Boards of ICICI Bank and ICICI finally approved a swap ratio of 1:2.

JM Morgan Stanley

Based on publicity available information, financial forecasts and projections provided by the management of the companies, and discussions with the managements of the companies, JM Morgan Stanley performed three kinds of financial analysis: dividend discount analysis, historical market price analysis, and precedent transaction analysis.

Dividend Discount Analysis The dividend discount value was obtained as follows:

Present value of the projected dividend stream for 7 years	+	Present value of the terminal value

To determine the projected dividend stream, it was assumed that the ratio of tangible common equity to tangible risk – weighted assets would remain constant at 10 percent.

The terminal value at the end of 7 years was determined by applying the price-to-book value multiple derived from Gordon formula[3] using an estimated sustainable return on equity (ROE) and carrying out a sensitivity analysis assuming three perpetual growth rates to year 2008 projected value.

The dividend stream and "terminal value" were discounted to present value using discount rates of 16.5%, 17.0%, and 17.5% for ICICI and 14.9%, 15.4% and 15.9% for ICICI Bank which JM Morgan Stanley viewed as the appropriate range of discount rates for a company with ICICI's and ICICI Bank's risk characteristics, respectively.

The investments and subsidiaries of ICICI and ICICI Bank were separately valued through methods considered appropriate by JM Morgan Stanley and such value was added to the dividend discount value of ICICI and ICICI Bank respectively.

The above analysis implied an exchange ratio of 1 equity share of ICICI Bank for 1.83 to 2.11 equity shares of ICICI.

Historical Market Price Analysis For the one week, one month, and three month period ending August 31, 2001, the price and volume data for the equity shares of ICICI and ICICI Bank on the domestic stock exchanges (the BSE and the NSE) and the American Deposit Receipts (ADRs) of the these companies on the NYSE was examined. Data from September 1, 2001 was ignored because of the rumours in the market place of this transaction and the episode of 9/11.

On the basis of the volume-weighted average of the closing market price for one week, one month, and 3 – month period, the share exchange ratio ranged from 1 ICICI Bank share for 1.44 to 2.12 ICICI share. The share exchange ratio on the basis of one week volume – weighted average on NSE was 2.04.

Precedent Transaction Analysis JM Morgan Stanley selected seven international acquisition transactions that were structured as minority squeeze–out transactions similar to the proposed amalgamation.

The premium/(discount) paid in these transactions over unaffected market prices ranged from a high of 28.0 percent to a low of 15.2 percent.

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3. According to Gordon formula:

$$\frac{P_0}{BV_0} = \frac{\text{ROE}(1+g)(1-b)}{r-g}$$

The share exchange ratio of 1:2 that was finally approved implied the following premium / (discount) to the unaffected price of ICICI Bank price on August 30, 2001.

	Premium / (discount) to unaffected price of ICICI Bank
B.S.E	(1.7%)
N.S.E	(1.4%)
N.Y.S.E	18.9%

DSP Merrill Lynch

DSP Merrill Lynch performed three kinds of analysis which was historical market price analysis, dividend discount market price analysis, and precedent transaction analysis.

Historical Market Price Analysis Market price data of ICICI Bank and ICICI shares was examined for last 10 trading days to last 6 months. Based on this data, the share exchange ratio ranged from 1 ICICI Bank share for 1.6 to 2 ICICI shares.

Dividend Discount Analysis The dividend discount model was applied to the shares of both companies. The specifics of the application were as follows:

- A forecast horizon of 6 years (FY 03–08) was chosen.
- Major operating assumptions (operating assets, borrowings, deposits, yields, costs, provisions and other income) were based on estimates provided by the management of the respective companies and refined through subsequent discussions.
- The cash flow stream discounted was based on the maximum dividend payable subject to regulatory constraints in respect of capital adequacy and prudent transfers to statutory reserves.
- DSP Merrill Lynch used a cost of equity range of 17.6% to 19.6% for ICICI and 16.5% to 18.5% for ICICI Bank.
- The terminal value was derived using the perpetual growth rates estimated for both ICICI and ICICI Bank.

Based on the above assumptions, a share exchange ratio of 1 share of ICICI Bank for 1.8 to 2.0 share of ICICI was obtained.

Precedent Transaction Analysis Considering ICICI Bank as the target company, various transactions involving Indian banks were considered as appropriate comparables.

The following parameters were examined for each of the selected transactions: (a) P/E ratio, (b) P/BV ratio, and (c) Premium to 5 – day average market price.

ICICI Bank was valued based on the above parameters, resulting in a share exchange ratio in the range of 1 ICICI Bank share for 1.8 to 2.1 ICICI shares.

Deloitte Haskins and Sells

Deloitte Haskins and Sells performed three kinds of analysis: (a) net asset value analysis, (b) dividend discount analysis, and (c) historical market price analysis.

Net Asset Value Analysis The net asset value analysis was done as follows: (a) No adjustment was made to the value of the fixed assets. (b) The quoted investments of both companies were considered at market values as on June 30, 2001. (c) Provisions for non-performing assets were considered without further adjustments.

On the basis of the above, adjusted book value per share for ICICI and ICICI Bank worked out to 111.73 and 67.45 respectively suggesting an exchange ratio of 1 share of ICICI Bank for 0.6 share of ICICI.

Considering that ICICI was a term lending financial institution with considerable exposure to cyclical projects (such as steel) and ICICI Bank was a commercial bank with a new portfolio consisting mainly of working capital advances, it was felt that emphasis should be more on future earnings potential and less on net asset values.

Dividend Discount Analysis Deloitte Haskins Sells performed a dividend discount analysis based on estimates provided by the respective companies. It valued separately certain assets, like investment in subsidiaries and other investments, which were not considered as part of cash flow generating assets.

Based on dividend discount analysis, it arrived at an exchange ratio of 1 ICICI Bank share for 2.17 ICICI shares.

Historical Market Price Analysis Although Deloitte Haskins and Sells looked at historical prices over periods of 3 months, 6 months, and 12 months, it regarded the period June – August 2001 to be representative. The unaffected share prices of the two companies during this period were ₹65.23 for ICICI and ₹126.29 for ICICI Bank.

Based on this, it established an exchange ratio of 1 ICICI Bank share for 1.94 ICICI shares.

10.6 SASKEN COMMUNICATION TECHNOLOGIES[4]

Set up in 1989, Sasken Communication Technologies Limited (Sasken, hereafter) provides telecommunication software solutions and services to network equipment manufactures, terminal device manufacturers, and semiconductor companies around the world. Headquartered in Bangalore, Sasken has offices around the world. Sasken presently employs about 1350 persons.

4. Extracted from a valuation report of the equity shares of Sasken Communication Technologies Limited prepared by the author as on March 31, 2004 (the lien date).

Sasken is an unlisted public company. It prepares its financial statements in conformity with the Indian GAAP (this is required mandatorily) as well as the US GAAP (this is done optionally).

Sasken plans to issue stock options to its employees in April 2004. Sasken wants to ascertain the intrinsic value of its equity shares to structure its employee stock option scheme and determine the compensation cost associated with it.

The valuation of Sasken's equity shares was done using two methods, the DCF method and the direct comparison method – for a technologically intensive company like Sasken whose major assets are its human and intellectual capital, which are not reflected on the conventional balance sheet, the adjusted book value method is not considered appropriate. In this section we discuss the valuation of Sasken using the direct comparison method (relative valuation method).

Sasken's Performance

The revenues and profits of Sasken grew at an impressive rate right from its inception in 1989-90 to 2000-01; indeed, in terms of return on net worth, it was one of the most profitable companies in the software industry during the decade of 1990s. The following two years, 2001 – 2003, were a trying period because the shrinkage in the world telecom market adversely impacted the growth and margins of Sasken. However, in 2003 – 04, Sasken witnessed a distinct rebound and its performance improved appreciably. The key financial numbers of Sasken for the period 2000 – 2004 are given in table below.

Sasken Communication Financials

				₹ *in million* *(other than per share data)*
	00–01	*01–02*	*02–03*	*03–04*
Net sales	1428.3	1086.3	1092.6	1636.0
PAT	281.1	(156.4)	12.7	170.1
Net profit margin (%)	19.7	(14.4)	1.2	10.4%
Equity capital (`5 par)	125.7	126.7	127.1	151.6
Net worth	1017.0	905.2	1012.6	1163.0
Debt	317.7	353.9	267.5	14.0
Return on net worth	27.6%	(17.3%)	1.25%	14.6%
Earnings per share	11.2	(6.2)	0.5	5.6
Book value per share	40.0	35.6	40.0	38.4
Sales per share	56.1	42.8	43.0	54.0

Sasken's future looks promising for the following reasons: (a) The global telecom market is recovering (b) Sasken is well – positioned in those segments of the telecom market which are growing rapidly. (c) Sasken has restructured its licensing arrangement with its customers and this is expected to augment its overall income from licensing.

The combination of these factors is expected to generate a robust growth in revenues and improve the net profit margin over the next five years. The best current estimates of revenue growth and net profit margin are as follows.

Year	*Revenue growth rate*	*Net profit margin*
2004-05	62%	8%
2005-06	30%	10%
2006-07	20%	11%
2007-08	20%	14%
2008-09	10%	15%

Given the track record of Sasken and the improvement in business conditions, these are fairly credible estimates.

Comparable Companies

The software industry in India comprises firms varying widely in terms of size, focus area, revenue-mix (from products and services), technological intensity, and so on.

Sasken's focus is exclusively on telecommunication software solutions and services. Among the listed software companies in India, Hughes Software is perhaps closest to Sasken in terms of focus. Subex Systems is another company that may be used as a reference company. The following tables present the key financial numbers for Hughes Software, and Subex Systems.

Hughes Software Financials

				₹ in million (other than per share data)
	00–01	*01–02*	*02–03*	*03–04*
Net sales	1985.4	2348.8	2203.7	3440.0
PAT	629.3	522.5	378.4	748.0
Net profit margin	31.7%	22.3%	17.2%	21.7%
Equity capital (₹5 par)	167.1	167.5	168.0	168.0
Net worth	2001.3	2469.2	2651.5	3333.1
Debt	-	-	-	-
Return on net worth	31.4%	21.2%	14.3%	22.4%
Earnings per share	18.8	15.6	11.3	22.3
Book value per share	59.9	73.7	78.9	99.2
Sales per share	59.4	70.1	65.6	102.4

*Annualised on the basis of 9 months performance upto 31/12/03.

@ Assuming a dividend rate of 40 percent.

Subex Systems Financials

				₹ *in million* (*other than per share data*)
	00–01	*01–02*	*02–03*	*03–04*
Net sales	552.4	591.8	700.1	837.7
PAT	102.8	41.8	96.1	171.9
Net profit margin	18.6%	7.1%	13.7%	20.5%
Equity capital (₹10 par)	71.3	71.3	73.4	73.4
Net worth	488.5	367.2	474.9	639.5
Debt	123.1	304.6	437.2	-
Return on net worth	21.0%	11.4%	20.2%	26.9%
Earnings per share	14.4	5.9	13.1	23.4
Book value per share	68.5	51.5	64.7	87.1
Sales per share	77.5	83.0	95.4	114.1

*Annualised on the basis of 9 months performance upto 31\12\03.

@ Assuming a dividend rate of 10 percent.

The market price per share of Hughes Software and Subex Systems as on March 23, 2004 was:

Hughes Software : ₹570

Subex Systems : ₹280

The relevant multiples for Hughes Software and Subex Sytems are:

	Hughes Software	*Subex Systems*
Price to earnings per share	25.6	12.0
Price to book value	5.75	3.21
Price to sales share	5.62	2.45

A comparison of Hughes Software, Subex Systems, and Sasken suggests that:

- In terms of turnover Hughes is nearly twice the size of Sasken which in turn is nearly twice the size of Subex.
- Hughes Software has a renowned international parent. Sasken and Subex Systems do not have that advantage.
- Sasken has historically displayed greater volatility in performance compared to Hughes Software and Subex Systems.

Taking into account factors like size, volatility, technological intensity, international affiliation, capital structure and corporate governance, appropriate multiple values for Sasken were judgmentally estimated as follows:

P/E : 12.0

P/B : 3.3

P/S : 2.5

Based on these multiple values estimates for Sasken are:

- Value estimate based on P/E multiple = 12.0×5.6 = ₹67.2
- Value estimate based on P/B multiple = 3.3×38.4 = ₹126.7
- Value estimate based on P/S multiple = 2.5×54.0 = ₹135

Taking a simple arithmetic average of these three estimates, we get a direct comparison value of:

$$\frac{67.2 + 126.7 + 135}{3} = ₹109.3$$

10.7 CADMIN PHARMA[5]

Cadmin Pharma is a multinational pharmaceutical company headquartered in Hyderabad. The company has three state-of-the-art manufacturing facilities in Hyderabad, Ahmednagar, and Gangtok and a new facility coming up in Dahej SEZ. The company has an excellent track record of exports through 15 subsidiaries, the principal ones being in Brazil, Germany, Russia, and the U.S. Cadmin has a large R&D centre in Hyderabad with over 700 scientific personnel engaged in development and discovery research.

The company's strategy for emerging markets is to piggy-ride on the generic product portfolio developed for the large regulated markets (EU, US, and Brazil) and market these products either through front end marketing with own field force or through distributors. The company has identified Indonesia as an attractive market to enter.

Indonesia has a population of 242 million and an ethical pharmaceutical market valued at USD 2.5 billion, growing at a rate of 12 percent. There are 212 companies operating in the Indonesian pharmaceutical market. Out of this, 31 are innovator companies with a market share of 32 percent. Indonesian and other generic companies have a market share of 68 percent (in value).

Cadmin Pharma is primarily planning to enter into the areas of its competitive strength, i.e., the therapeutic areas of Cardiovascular, Diabetology, and Central Nervous System.

As per Indonesian law, the company needs to have a local manufacturing facility for getting marketing authorisations. Hence, the company has considered it appropriate to acquire a company having a local manufacturing facility. Such an acquisition will help the company fast track the submission of relevant dossiers and consequent marketing of the products. Presently, Indonesia permits foreign direct investment up to 75 percent of equity. Hence, the remaining 25 percent will have to be held by Indonesian investors.

5. Adapted from a valuation report prepared in early 2012.

After actively exploring acquisition opportunities over one year, Cadmin Pharma has identified an Indonesian company viz., PT AMIDCO DJAJA Pharmaceuticals (AMIDCO), which has a manufacturing facility in Indonesia. AMIDCO is engaged in production and sales of generic pharmaceuticals in Indonesia.

AMIDCO was set up in 1967 by Mr. Hamid and his family which presently holds 100 percent of the paid-up equity capital of IDR 31,500,000,000 (equivalent to 3,433,500 USD). AMIDCO has 171 employees with a manufacturing facility spread over 5100 square metres. Its area of land, including manufacturing facility, is 11400 square metres. AMIDCO's plant has the local FDA approval.

Proposed Ownership and Capital Investment

Presently, Indonesia permits foreign direct investment up to 75 percent of equity. The remaining 25 percent must be held by a local entity. It is proposed to acquire 100 percent equity of AMIDCO from Mr. Hamid and his family. 75 percent of equity will be acquired by Cadmin Pharma and the balance 25 percent of equity will be held by a yet-to-be-identified local entity. Once Indonesian laws permit 100 percent FDI by a foreign entity in pharmaceutical sector, Cadmin Pharma will take the necessary steps to step up its stake.

Cadmin Pharma will invest additional funds by way of equity and debt for expansion and modernisation of existing plant, acquisition of additional land, and working capital. The expansion and modernisation of the plant to its quality standards will cost USD 16.2 million and the purchase of additional 6000 metres of adjoining land will cost USD 1.65 million.

The business plan is as follows:

- Complete legal and other formalities in about six months time.
- Submit dossiers from January 2013 which require an approval time of 18 to 24 months.
- Upgrade and expand the plant in about 2 years with a capacity of 750 million tablets per year.
- Increase the marketing field force to 300 representatives initially and expand it to 600 in 5 years.

Financial Projections

Based on this plan, Cadmin Pharma has developed cash flow projections for the next ten years. Beyond ten years, the free cash flow is expected to grow at the rate of 6 percent year. The cash flow projections are given below:

Cash Flow Projections

₹ *in lakhs*

Year	*0*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
	FY 12–13	*FY 13–14*	*FY 14–15*	*FY 15–16*	*FY 16–17*	*FY 17–18*	*FY 18–19*	*FY 19–20*	*FY 20–21*	*FY 21–22*	*FY 22–23*
Sales	-	0	0	0	12,690	19,989	29,487	39,078	46,839	54,210	63,876
COGS	-	(0)	(0)	(0)	(2,742)	(4,107)	(6,060)	(7,854)	(9,399)	(10,293)	(13,002)
Contribution	-	0	0	0	9,948	15,882	23,427	31,224	37,440	43,917	50,874
Marketing exp		(558)	(441)	(3,414)	(9,303)	(14,370)	(17,391)	(21,693)	(25,593)	(29,424)	(33,011)
Admin exp	-	(0)	(0)	(0)	(222)	(351)	(576)	(786)	(933)	(1,086)	(1,257)
R&D exp [Exhibit batch + Dev]			(453)	(2,640)	(1,650)	(1,710)	(1,263)	-	-	-	-
Tax									(237)	(2,586)	(3,249)
Working capital			(0)	(0)	(4,824)	(2,727)	(3,582)	(3,546)	(2,649)	(2,913)	(3,369)
Add: Depreciation				117	162	198	282	351	417	486	567
Construction/Additional land cost	(2,460)	(4,893)	(1,632)	(408)	(408)	(408)	(408)	(408)	(408)	(408)	(408)
Free cash flow	(2,460)	(5,451)	(2,526)	(6,345)	(6,297)	(3,486)	489	5,142	8,037	7,986	10,147
Present value factor at 16%	1.00	0.862	0.743	0.641	0.552	0.476	0.410	0.354	0.305	0.263	0.227

DCF Valuation

While the free cash flow (FCF) grows in an uneven manner over the 10-year period, it is expected to grow at a constant rate of 6 percent beyond 10 years. So we can regard 10 years as the explicit forecast period (or planning period).

The DCF value of the acquisition is:

DCF value of acquisition = Present value of FCF during the 10-year planning period + Present value of terminal value

Present value of FCF during the 10-year planning period

$$= -2460(1.00) - 5451(0.862) - 2526(0.743) - 6345(0.641) - 6297(0.552) - 3486(0.476) + 489(0.410) + 5142(0.354) + 8037(0.305) + 7986(0.263) + 10147(0.227)$$

= –₹ 9362 lakh

Present value of terminal value = $\{10147(1.06)/[0.16\text{-}0.06]\} \times \{1/(1.16)^{10}\}$

= ₹ 24382 lakh

So, DCF value of acquisition = –9364 + 24382 = ₹ 15020 lakh

10.8 VALUATION OF INFOSYS BRAND[6]

From time-to-time, we have used various models for evaluating assets of the Balance Sheet to bring certain advances in financial reporting to the notice of our shareholders. The aim of such modeling is to lead the debate on the Balance Sheet of the next millennium. These models are still the subject of debate among researchers and using such models and data in projecting the future is risky. We are not responsible for any direct, indirect or consequential losses suffered by any person using these models or data.

A Balance Sheet discloses the financial position of a company. The financial position of an enterprise is influenced by the economic resources it controls, its financial structure, liquidity and solvency, and its capacity to adapt to changes in the environment. However, it is becoming increasingly clear that intangible assets have a significant role in defining the growth of a high-tech company.

Valuing the Brand

The wave of brand acquisitions in the late 1980s exposed the hidden value in highly branded companies, and brought brand valuation to the fore. The values associated with a product or service are communicated to the consumer through the brand. Consumers no longer want just a product or service, they want a relationship based on trust and familiarity.

6. Extracted from the 2007-2008 Annual Report of Infosys Technologies.

A brand is much more than a trademark or a logo. It is a 'trustmark' – a promise of quality and authenticity that clients can rely on. Brand equity is the value addition provided to a product or a company by its brand name. It is the financial premium that a buyer is willing to pay for the brand over a generic or less worthy brand. Brand equity is not created overnight. It is the result of relentless pursuit of quality in manufacturing, selling, servicing, advertising and marketing. It is integral to the quality of client experiences in dealing with the company and its services over a period.

The third annual BRANDZ™ Top 100 Most Powerful Brands ranking published in cooperation with the *Financial Times* was announced in April 2009 by Millward Brown. According to the report, Google topped the ranking with a brand value of US $100 billion. The market capitalization of Google at that time was US $84 billion. Thus, 119% of market capitalization represented its brand value. (*Source: www.nasdaq.com*).

Methodology

The task of measuring brand value is a complex one. Several models are available for accomplishing this. The most widely used is the brand-earnings-multiple model. There are several variants of this model.

We have adapted the generic brand-earnings-multiple model (given in the article 'Valuation of Trademarks and Brand Names' by Michael Birkin in the book, *Brand Valuation*, edited by John Murphy and published by Business Books Limited, London) to value our corporate brand, "Infosys." The methodology followed for valuing the brand is given as follows:

- Determine brand profits by eliminating the non-brand profits from the total profits.
- Restate the historical profits at present-day values.
- Provide for the remuneration of capital to be used for purposes other than promotion of the brand.
- Adjust for taxes.
- Determine the brand-strength or brand-earnings multiple.

Brand-strength multiple is a function of a multitude of factors such as leadership, stability, market, internationality, trend, support and protection. We have internally evaluated these factors on a scale of 1 to 100, based on the information available within.

			in ₹crore
	2009	*2008*	*2007*
Brand value	32,345	31,863	31,617
Market capitalization	75,837	82,362	1,15,307
Brand value as a percentage of market capitalization	42.7%	38.7%	27.4%
Brand value/revenue (x)	1.49	1.91	2.28

Brand Valuation

			₹ in crore
	2009	*2008*	*2007*
Profit before interest and tax	6,907	5,344	4,245
Less: Non-brand income	426	634	335
Adjusted profit before tax	6,481	4,710	3,910
Inflation factor	1.000	1.092	1.192
Present value brand profits	6,481	5,142	4,660
Weightage factor	3	2	1
Weighted average profits	5,731	-	-
Remuneration of capital	801	-	-
Brand-related profits	4,930	-	-
Tax	1,676	-	-
Brand earnings	3,254	-	-
Brand multiple	9.94	-	-
Brand value	32,345	-	-

Assumptions

- The figures above are based on consolidated Indian GAAP financial statements.
- Brand revenue is total revenue excluding other income after adjusting for cost of earning such income, since this is an exercise to determine our brand value as a company and not for any of our products or services.
- Inflation is assumed at 8.4% per annum, 5% of the average capital employed is used for purposes other than promotion of the brand and tax rate is at 33.99%.
- The earnings multiple is based on our ranking against the industry average based on certain parameters (exercise undertaken internally and based on available information).

10.9 CHALLENGES IN OF VALUING TECHNOLOGY COMPANIES[7]

In August 1995, Netscape a company that sold a piece of software known as a browser, shocked investors when its shares doubled in value on the first day of trading valuing the enterprise at US $ 2.9 bn. In 1997, Hotmail, one of the first email service providers was acquired for US $ 400 mn. In a more recent example in early 2012, Facebook was

7. Contributed by Dr. Sabarinathan of IIM Bangalore.

valued at $ 104 billion on revenues of $ 5 bn approximately. Again, in 2012 Facebook paid US $ 1 billion for Instagram, a company that was less than three years old. There have been similar, albeit less spectacular, instances of companies in India getting valued at such fancy levels.

All the examples exemplify the challenges in valuation that have emerged in the past two decades or so, since technology businesses assumed increasing importance. The term technology business is generally used to refer to enterprises that are somehow connected with the information and communication technologies. What sets these businesses apart from the more traditional manufacturing and services businesses is that many of them are built with the expectation that they would be sold to larger players for strategic reasons. Over the years, the time to acquire has shrunk steadily and enterprises have been acquired well before they even had meaningful revenues or customers, let alone profits and cash flows.

While the purchase and sale of these enterprises were dictated by the strategic demands of the technology business marketplace the discipline of valuation was playing catch up, trying to make financial sense of all the transactions. The source of revenue, let alone profitability of many of these enterprises are often not easy to establish for these highly innovative business ideas. Often the expectation appears to be that if they have enough users for their product or service, the franchise could be converted into cash flow, or "monetized." Thus Netscape was making losses when it went public, Hotmail did not have paying email users, Facebook was incurring huge losses, and Instagram did not even know where its revenue would come from.

So did these companies eventually justify the high valuations? Not all of them did. Companies like Google were positive exceptions. Does the frequent occurrence of such high valuations suggest that the principles of valuation are not relevant any longer? That would not be so. Fundamentally, the value of a company is the present value of its free cash flows. This is a time-tested rational approach to investing.

The valuation challenge in the examples discussed here is the paucity of data to justify the fair value ascribed to the enterprise. Absent sufficient history, the value attributed to these companies appears unachievable or unjustified. But the way to address that challenge is to keep applying these frameworks and look for new ones that will help make sense of the valuation without losing sight of the fundamental principle of valuation.

CHAPTER 11

Writing the Valuation Report

Several business valuation professional organizations—such as The Appraisal Foundation, American Society of Appraisers, National Association of Certified Valuation Analysts, Institute of Business Appraisers, and The Canadian Institute of Chartered Business Valuation have prescribed valuation reporting standards to be followed by their members. In this chapter we will briefly discuss the guidance provided by the Uniform Standards of Professional Appraisal Practice (USPAP) developed by The Appraisal Foundation.

USPAP defines appraisal as: "the act or process of developing an opinion of value," and an appraisal report as: "any communication, written or oral, of an appraisal, appraisal review or consulting service that is transmitted to the client upon completion of an assignment. "And, the USPAP defines an assignment as: "an appraisal, appraisal review, or consulting service provided as a consequence of an agreement between an appraiser and a client."

11.1 REPORTING STANDARDS

According to USPAP, each written or oral "business valuation" report must.

1. Clearly and accurately set forth the appraisal in a manner that will not be misleading.
2. Contain sufficient information to enable those who receive or rely on the report to understand it properly.
3. Clearly and accurately disclose any extraordinary assumption or limiting condition that directly affects the appraisal, and indicate its impact on the concluded value.

11.2 WRITTEN BUSINESS VALUATION REPORTING STANDARDS

USPAP guidelines require that each written "business appraisal report" complies with the following disclosure requirements.

1. Describe the business or business ownership interest that is being valued.
2. State why valuation is being done and the client's intended use of the valuation opinions and conclusions.
3. Define the standard of value that is being estimated.
4. Mention the effective or lien date of valuation and the date of the valuation report.
5. Describe the valuation process.
6. Spell out all assumptions and limiting conditions that have a bearing on the analyses, opinions, and conclusions
7. Specify the information considered, the analytical procedures followed, and the reasoning underlying the valuation opinions and conclusions.
8. Explain the rationale for the valuation methods and procedures followed.
9. Set forth any additional information that justifies compliance with or permitted departure from the USPAP "businesses appraisal development" standards.
10. Include a signed certificate stating compliance with USPAP Standards Rule 10-3. The thrust of this certificate is on the valuer declaring that the valuation is not biased or motivated.

CHAPTER 12

Value Enhancement

In our discussion on valuation so far, we have adopted the perspective of an analyst valuing a company from the outside: What value can we assign to a company, given how it is run by its incumbent management? In this chapter, we look at a company from the point of view of its management and ask: What decisions and actions can the management take to enhance the value of the firm? Put differently, the thrust of our discussion will shift from *value assessment* to *value enhancement.*

The idea that the primary responsibility of corporate management is to increase shareholder value has gained widespread acceptance in the United States in the past three decades or so. With the globalisation of capital markets, intensification of competition, and massive privatisation initiatives, shareholder value creation is gaining the attention of executives all over the world, including India. The interest in value creation has been stimulated by several developments:

- Institutional investors, who traditionally were passive investors, have begun exerting influence on corporate managements to create value for shareholders.
- Many leading companies, which have accorded value creation a central place in their corporate planning, serve as role model for others.
- The market for corporate control has made value destroyers more vulnerable to raiders.
- Business press is emphasising shareholder value creation in performance rating exercises.
- Greater attention is being paid to link top management compensation to shareholders returns.

To help firms create value for shareholders, value based management (VBM) systems have been developed. VBM is a generic term for a set of tools helpful in managing a firm's operations for enhancing shareholder value. VBM is a relatively recent innovation in financial practice. Many regard it as one of the most important developments in corporate management. VBM represents a synthesis of various disciplines like finance, strategy, accounting, and organizational behavior.

This chapter discusses two approaches to value creation: discounted cash flow approach and economic value added approach.

12.1 DISCOUNTED CASH FLOW (DCF) APPROACH TO VALUE CREATION[1]

According to the DCF model, the value of a firm is the present value of its expected cash flows, discounted at the cost of capital. So, an action creates value when it leads to one or more of the following:

- Increase in the cash flows generated from existing investments.
- Improvement in the growth trajectory of cash flows.
- Reduction in the cost of capital applied to discount the cash flows.

Increase in Cash Flows from Existing Investments

The search for value typically begins with the existing investments of the firm. There is a potential for value creation from the existing investments if these investments are earning less than their cost of capital or are earning less than what they could if they are optimally managed.

The following are the important ways by which greater value can be extracted from the existing investments.

- Continuation, divestiture, or liquidation of poor investments
- Improvement in operating efficiency
- Reduction of tax burden
- Reduction in net capital expenditure on existing investments
- Reduction in noncash working capital

Continuation, Divestiture, or Liquidation of Poor Investments Almost every firm has some investments that earn inferior returns (less than the cost of capital) or even lose money. Prima face, it would appear that such investments must be divested or liquidated. This is true if the firm can recover the original capital invested. But that may not be possible always and so you have to consider three different measures of value for an existing investment: the *continuing value* (present value of cash flows expected from continuing the investment till the end of its life), the *liquidation or salvage value* (the net cash flow that can be realised if the project is terminated immediately), and the *divestiture value* (the price, the highest bidder will pay for the investment). The option which has the highest value is the most preferable option.

Improvement in Operating Efficiency Operating efficiency is reflected in the operating margin which is defined as PBIT/Sales. Other things being equal, an increase in operating margin will create additional value.

1 This sections draws on Aswath Damodaran, *The Dark Side of Valuation*, Prentice-Hall, PTR, 2001.

Compare the operating margin of the firm with the industry average. If it is significantly less than the industry average, examine its cost structure and pricing power. Perhaps the firm can prune unnecessary costs or eliminate non-value adding costs. If the operating margin is low because of weak pricing power, greater emphasis should be put on increasing product differentiation to gain pricing power.

Reduction of Tax Burden Other things being equal, actions that can lower the tax burden of the firm will enhance value. Some possibilities, in this respect, are as follows:

- Multinational firms that have earnings in different markets may have some latitude in shifting income from high- tax locations to low-tax or nil-tax locations.
- A firm can, by acquiring another firm that has unutilised tax shelters (such as accumulated losses and unabsorbed depreciation), reduce its tax burden.
- By using risk management, a firm can smooth income over time. And this will result in a lower average tax rate over time because in most tax regimes the marginal tax rate rises as income increases.

Reduction is Net Capital Expenditure on Existing Investments The net capital expenditure is: capital expenditures – depreciation. As cash outflow, it decreases the free cash flow to the firm. While a part of the net capital expenditure is meant for future growth, another part, called maintenance capital expenditure, is meant for maintaining existing assets. A firm can increase value if it can reduce its maintenance capital expenditure without adverse consequences.

Reduction in Noncash Working Capital The difference between noncash current assets (mostly inventories and accounts receivable) and non-interest bearing current liabilities (mostly accounts payable) is called noncash working capital.

If a firm can reduce its noncash working capital as a percent of its revenues, it can increase its cash flows and, consequently, its value. Firms try to do this by managing inventories tightly, shortening the receivables period, and stretching payables.

Improvement in the Growth Trajectory of Cash Flows

The growth in free cash flows is an important driver of value. Firms continually strive to increase the expected growth rate and lengthen the period of high growth rate to create value.

Increasing the Expected Growth Rate The expected growth rate in operating income is the product of the reinvestment rate and the after-tax return on new investments (marginal return on investment capital).

$$\underset{\text{operating Income}}{\text{Expected growth in}} = \underset{\text{rate}}{\text{Reinvestment}} \times \underset{\text{invested capital}}{\text{Marginal return on}}$$

To increase the expected growth rate, the firm must either increase the reinvestment rate or the marginal return on invested capital or both.

If the firm increases the reinvestment rate, the expected growth rate increases but the free cash flow falls. The tradeoff of such an action is as follows:

Positive Effect	*Negative Effect*
Increases expected growth	Reduces free cash flow to firm
Expected growth rate =	FCFF = EBIT (1 – Tax rate)
Reinvestment rate ×	(1 – Reinvestment rate)
Return on invested capital	

Lengthening the Period of High Growth At some point of time, almost every firm will become a stable growth firm, growing at a rate more or less equal to that of the economy in which it operates. Firms try to lengthen the period of high growth rate before they reach the stable growth phase. Since growth contributes to value only when a firm earns superior returns, the thrust is on generating superior returns along with higher growth over an extended period of time.

This is a challenging task. Firms try to address this challenge by creating entry barriers. It appears that there are six main entry barriers.

- Economics of scale
- Product differentiation
- Cost advantage
- Marketing reach
- Technological edge
- Government policy

Economies of Scale Economies of scale means that an increase in the scale of production, marketing, or distribution results in a decline in the cost per unit. When substantial economies of scale are present, the existing firms are likely to be large in size. The more pronounced the economies of scale, the greater the cost advantage of the existing firms.

In order to exploit the economies of scale, new entrants require substantial investments in plant and machinery, research and development, and market development. Such capital needs serve as an entry barrier. The greater the capital requirement, the higher the barrier to entry. This seems to be especially true in industries like petroleum refining, mineral extraction, iron and steel, and aluminum.

Product Differentiation A firm can create an entry barrier by successfully differentiating its products from those of its rivals. The basis for differentiation may be one or more of the following:

- Effective advertising and superior marketing
- Exceptional service
- Innovative product features
- High quality and dependability

Cost Advantage If a firm can enjoy cost advantage vis-à-vis its competitors, it can be reasonably assured of earning superior returns. Cost advantage may stem from one or more of the following:

- Accumulated experience and comparative edge on the learning curve
- Monopolistic access to low cost materials
- A favourable location
- More effective cost control and cost reduction

Marketing Reach A penetrating marketing reach is an important source of competitive advantage. Two examples illustrate this:

- Avon Products markets its products through a worldwide network of 1,200,000 independent sales representatives. Avon's competitors find it almost impossible to replicate this. Thanks to such a nonpareil marketing network, Avon has been able to earn superior returns in a highly competitive industry.
- The breadth and depth of Hindustan Lever's distribution network is miles ahead of its competitors. Such a marketing reach has contributed to the superior returns earned by Hindustan Lever.

Technological Edge Technological superiority enables a firm to enjoy excellent returns. Firms like IBM and Xerox earned superior returns over extended periods of time due to, *inter alia*, the technological edge they had over their rivals. On the Indian scene, firms like Glenmark Pharmaceuticals and Lakshmi Machine Works have done well because of their technological strength.

Government Policy A government policy that shelters a firm from the onslaught of competition enables it to earn superior returns. Government policies that create entry barriers, partial or absolute, include the following:

- Restrictive licensing
- Import restrictions
- High tariff walls
- Environmental controls
- Special tax reliefs

A number of firms in India benefited substantially from government policies which offered considerable protection to them from potential competition, domestic as well as foreign, for many years. The liberalisation measures of recent years have, of course, dismantled, partly or substantially, entry barriers stemming from earlier government policies. Remember what the government can give, it can also take away.

Reduction in Cost of Capital

The cost of capital for a firm is the weighted average cost of different sources of finance (equity and debt mainly) employed by the firm. The value of a firm is simply its future cash flows discounted to the present at the cost of capital. Other things being equal, lower the cost of capital, higher the value of the firm. The following are the important ways by which a firm can reduce its cost of capital.

- Change in the operating risk
- Reduction in the operating leverage
- Change in the financing mix
- Change in the financing type

Change in the Operating Risk The operating risk of a firm depends on the kinds of products and services it provides and the degree to which they are discretionary from the point of view of the customer. A firm has a higher operating risk, if its products and services are more discretionary to the consumer. Higher operating risk adversely affects the cost of equity as well as debt.

To reduce its operating risk, a firm must try to make its products and services less discretionary to the consumer. Advertising can help in this respect. Also, finding new uses for its products and services can reduce a firm operating risk.

Reduction in the Operating Leverage The operating leverage of a firm reflects the proportion of its costs which are fixed in nature. Higher the proportion of fixed costs, higher the operating leverage. Other things being equal, the higher the operating leverage, the greater the variability of operating income and the higher the cost of capital.

Firms can reduce their operating leverage by resorting to outsourcing and increasing the proportion of variable component in the compensation of employees. Doing so will make the cost structure more flexible. A more flexible cost structure lowers the unlevered beta of the firm (because of lower operating leverage), reduces the cost of debt (due to lesser default risk), and enhances the optimal debt ratio. All three will reduce the cost of capital.

Change in the Financing Mix The advantage of debt is that it is a cheaper source of finance, partly because lenders are exposed to lesser risk and partly because of the tax shelter associated with debt. The disadvantage of debt is that it increases the risk of bankruptcy which, in turn, raises the cost of equity as well debt. The net effect will determine how the cost of capital will behave as the firm assumes more debt.

Even if a higher debt ratio reduces the cost of capital, it will have a positive effect on firm value only if the operating cash flows are not adversely affected by the higher debt ratio. Note that a higher debt ratio increases the riskiness of the firm which may affect its operations and cash flows.

Changing the Financing Type In choosing its debt instruments, the firm should match as closely as possible, the cash flows on the debt to the cash flows on the asset. A close matching reduces the risk of default and enhances debt capacity which, in turn, lowers the cost of capital, and increase firm value.

A mismatch between cash flows on debt and cash flows on assets—use of short-term debt to finance long-term assets, or use of floating-rate debt to finance assets whose cash flows are not linked to inflation, or use of debt in one currency to finance assets in another currency—increases the risk of default, diminishes debt capacity, increases the cost of capital, and lowers firm value.

12.2 ECONOMIC VALUE ADDED (EVA) APPROACH TO VALUE CREATION

The DCF model provides a rich framework for analysing the different ways in which a firm can enhance value. However, it can become complex because the number of inputs can increase. Further, it is very difficult to link managerial compensation to a DCF model, because it is easy to manipulate the inputs that go into the DCF model.

If markets are efficient, the estimated value from the DCF model can be replaced by the observed market price and managers can be rewarded or penalised on the basis of how the stock performs. An increase in stock price means value creation and a decrease in stock price means value erosion. Based on this premise, stock grants, stock appreciation rights, and options are commonly used in management compensation packages.

While stock prices are up to date and readily observable, they have their limitations. First, they tend to be noisy and fluctuate a great deal around the intrinsic value. Second, they are available only for the entire firm and hence not suitable for evaluating the performance of managers of individual divisions of the firm.

In the last two to three decades, firms have become more focused on value creation. To help firms in this endeavour, consulting organizations have developed measurement systems that are relatively simple, that are not overly influenced by market movements, and that require fewer estimates. Among various measurement systems, the EVA approach is perhaps the most popular one. The two key metrics in the EVA approach are: market value added (MVA) and economic value added (EVA).

Measure of Value Creation

To determine whether management has created or destroyed value, the market value of the firm's capital (both equity and debt capital) may be compared to the capital invested by shareholders and lenders (the capital employed in the firm). The difference between the market value of capital and capital employed is called the *market value added* or, simply, MVA.

Market value added (MVA) = Market value of capital – Capital employed

A positive MVA implies that value has been created; a negative MVA means that value has been destroyed.

MVA measures creation or destruction of value at a given point in time. If you want to measure the value created or destroyed during a period of time, look at the change in MVA during that period.

Computing MVA

To compute the MVA, you should know the market value of the firm's equity and debt capital as well as the amount of capital invested by shareholders and debtholders. Let us look at how these are estimated.

Market Value of Capital For a firm whose equity and debt securities are publicly traded, the market value of capital can be obtained from the financial market. If a firm's securities are not publicly traded, financial market information is not available for estimating MVA. In such a case, the MVA can be estimated if someone makes an offer to buy the firm.

Consider Metachem Limited, a pharmaceutical company set up in 20X0. As on March 31, 20X5, Metachem had debt with a market value of 200 million. The firm had 20 million shares outstanding that were trading at 35 a share. The market value of its equity (its market capitalisation) was 700 million. The market value of capital was 900 million (200 million of debt plus 700 million of equity).

Capital Employed The amount of capital employed by the firm can be derived from the balance sheet and the accompanying notes. Debt capital includes all forms of borrowings and other obligations like financial leases which are equivalent to debt obligations. Estimating the amount of equity capital is not so straight forward. To get a handle over the amount of equity capital employed in the firm, you have to add to the book value of equity reported in the balance sheet several items such as research and development expenses, amortisation of goodwill, deferred tax provision, and allowance for bad debt. These items arbitrarily classified as expenses, lower reported profits and retained earnings. As a consequence, the equity account in the balance sheet is understated.

Exhibit 12.1 presents two versions of Metachem's balance sheets as on March 31, 20X4 and 20X5. The first balance sheet , the *unadjusted balance sheet*, reports sources of funds (or capital employed) and application of funds (or invested capital) according to standard accounting conventions. The second balance sheet, the *adjusted balance sheet*, adds to book value of shareholders funds' (equity) and application of funds (invested capital) a few items that accounting conventions exclude. Loan funds (debt capital) as on 31 March, 20X5 (210 million), however, are the same in both types of balance sheets.

Notice that two adjustments have been made to the book value of shareholders' funds (equity) to get the adjusted shareholders' funds. These relate to amortisation of goodwill and research and development expenses. According to standard accounting conventions, these items are arbitrarily regarded as expenses. Consequently, reported profits, retained earnings, and shareholders' funds (equity) are understated. Hence adjustments are needed.

Exhibit 12.1 *Metachem's Balance Sheets as on March 31, 20X4 and 20X5*

Unadjusted Balance Sheet		*March 31, 20X4*		*March 31, 20X5*	
Sources of Funds					
1. Shareholders' funds			550		600
2. Loan funds			200		200
	Total		750		800
Application of Funds					
1. Net fixed assets			475		510
Property, plant and machinery (net)		400		460	
Goodwill (net)		75		50	
Gross value		125		125	
Accumulated amortisation		(50)		(75)	
2. Net current assets			275		290
	Total		750		800
Adjusted Balance Sheet		*March 31 20X4*		*March 31 20X5*	
Sources of Funds					
1. Adjusted shareholders' funds			640		725
Book value of shareholders' funds		550		600	
Accumulated goodwill amortization		50		75	
Capitalised R&D		40		50	
2. Loan funds			200		200
	Total		840		925
Application of Funds					
1. Net fixed assets			565		635
Property, plant, and equipment (net)		400		460	
Gross goodwill		125		125	
Capitalised R&D		40		50	
2. Net current assets			275		290
	Total		840		925

Properties of MVA

The importance of MVA stems from the following properties.

MVA Increases When the Firm Undertakes Positive NPV Remember that the net present value (NPV) of a project is:

NPV = Present value of cash inflows from the project – Capital employed in the project

Now look at the definition of MVA:

MVA = Market value of capital – Capital employed

In the MVA definition (a) the market value of capital is equal to the expected cash inflows from all the investment projects, past and present and (b) the capital employed is the capital employed in all the investment projects, past and present.

Thus, conceptually NPV and MVA are similar. The contribution of an investment project to a firm's MVA is equal to the NPV of that project.

Maximising MVA Is Consistent with Maximising Shareholder Value Shareholder value creation is represented by the difference between the market value of the firm's equity and the equity capital invested by shareholders. The former reflects the value imputed by the financial market on the equity of the firm and the latter reflects the actual amount of money contributed by equity shareholders by way of capital and retained earnings.

MVA, on the other hand, is the difference between the market value of total capital and the total capital employed. MVA can be expressed as follows:

MVA = Equity MVA + Debt MVA

Equity MVA is the difference between the market value of equity and the adjusted book value of equity.

Debt MVA is the difference between the market value of debt and the book value of debt. Debt MVA may differ from zero mainly because of interest rate change or credit rating change. If interest rates decline after the firm has issued debt securities, the market value of debt exceeds the book value of debt and vice versa. If credit rating declines after the firm has issued debt, the market value of debt is less than the book value of debt and vice versa.

If debt MVA differs from zero only on account of a change in interest rates, then, for a given level of interest rates, maximising MVA is equivalent to maximising equity MVA.

Drivers of Value Creation

There are three key drivers of value creation:

- The profitability of the firm, measured by its after-tax return on invested capital (ROIC).

- The weighted average cost of capital (WACC) of the firm.
- The growth rate of the firm.

The after-tax ROIC is defined as:

$$\text{ROIC} = \frac{\text{PBIT (1 – Tax rate)}}{\text{Invested capital}} = \frac{\text{NOPAT}}{\text{Invested capital}}$$

where PBIT is profit before interest and tax, NOPAT is net operating profit after tax (it is equal to PBIT (1 – Tax rate)), and invested capital is the sum of net fixed assets and net current assets.

The weighted average cost of capital or WACC is:

$$\text{WACC} = \begin{pmatrix} \text{Cost of equity} \times \text{Proportion of} \\ \text{equity capital} \end{pmatrix} + \begin{pmatrix} \text{Post tax cost} \times \text{Proportion of} \\ \text{of debt capital} \end{pmatrix}$$

To illustrate the calculation of ROIC and WACC, let us look at the adjusted balance sheet, given in Exhibit 12.1 and the adjusted profit and loss account, given in Exhibit 12.2.

Based on the figures in these exhibits, Metachem's post-tax return on invested capital is:

$$\text{ROIC} = \frac{200\ (1 - 0.30)}{925} = 15.1\%$$

Exhibit 12.2 ***Metachem's Profit and Loss Account for 20X5***

₹ *in million*

Unadjusted		*Adjusted*	
Sales	990	Sales	990
Cost of goods sold	520	Cost of goods sold	520
Selling, general, and administration expenses	200	Selling, general and administration expenses	200
Depreciation expense	50	Depreciation expense	50
R&D expenses	30	Amortisation of R&D expense	20
Goodwill amortisation	25		
Profit before interest and tax	165	Profit before interest and tax	200
Interest expenses	25	Interest expense	25
Profit before tax	140	Profit before tax	175
Tax (30%)	42	Tax	42
Profit after tax	98	Profit after tax	133

Metachem's estimated cost of equity is 15 percent and its pre-tax cost of debt is 12.5 percent. The market value of its equity and debt are 700 million and 200 million respectively. Thus, Metachem's WACC is:

$$\text{WACC} = 15\% \times \frac{700}{900} + 12.5\%(1 - 0.30) \times \frac{200}{900}$$

$$= 11.67 + 1.94 = 13.61\%$$

How MVA is Related to the Basic Drivers

To understand how ROIC, WACC, and growth rate interact to create value, let us examine the case of a firm that is expected to grow at a constant annual rate forever.[2] In this case, the MVA is given by the following formula:

$$\text{MVA} = \frac{(\text{ROIC} - \text{WACC}) \times \text{Invested capital}}{\text{WACC} - \text{Constant growth rate}}$$

In this formula, the constant growth rate must be less than the WACC.

Two important conclusions may be drawn from the above formula.

1. Value is created when the expected return spread (ROIC – WACC) is positive; value is destroyed when the expected return spread (ROIC – WACC) is negative; value is neither created nor destroyed when the expected return spread (ROIC – WACC) is nil. Bear in mind that it is the entire future stream of expected return spreads, and not the historical return spread, that drives value creation.
2. Growth *per se* does not create value. Growth is value-creating only when the expected return spread is positive (ROIC > WACC); growth is value-destroying when the expected return spread is negative (ROIC < WACC); growth is value-neutral when the expected return spread is nil (ROIC = WACC).

Delving Deeper into the Drivers of Value Creation

To delve deeper into the drivers of value creation, you can decompose the firm's expected ROIC into its fundamental components as follows:

$$\text{ROIC} = \frac{\text{PBIT}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Invested capital}} \times (1 - \text{Tax rate})$$

Thus, the ROIC of a firm can be increased through a combination of the following actions:

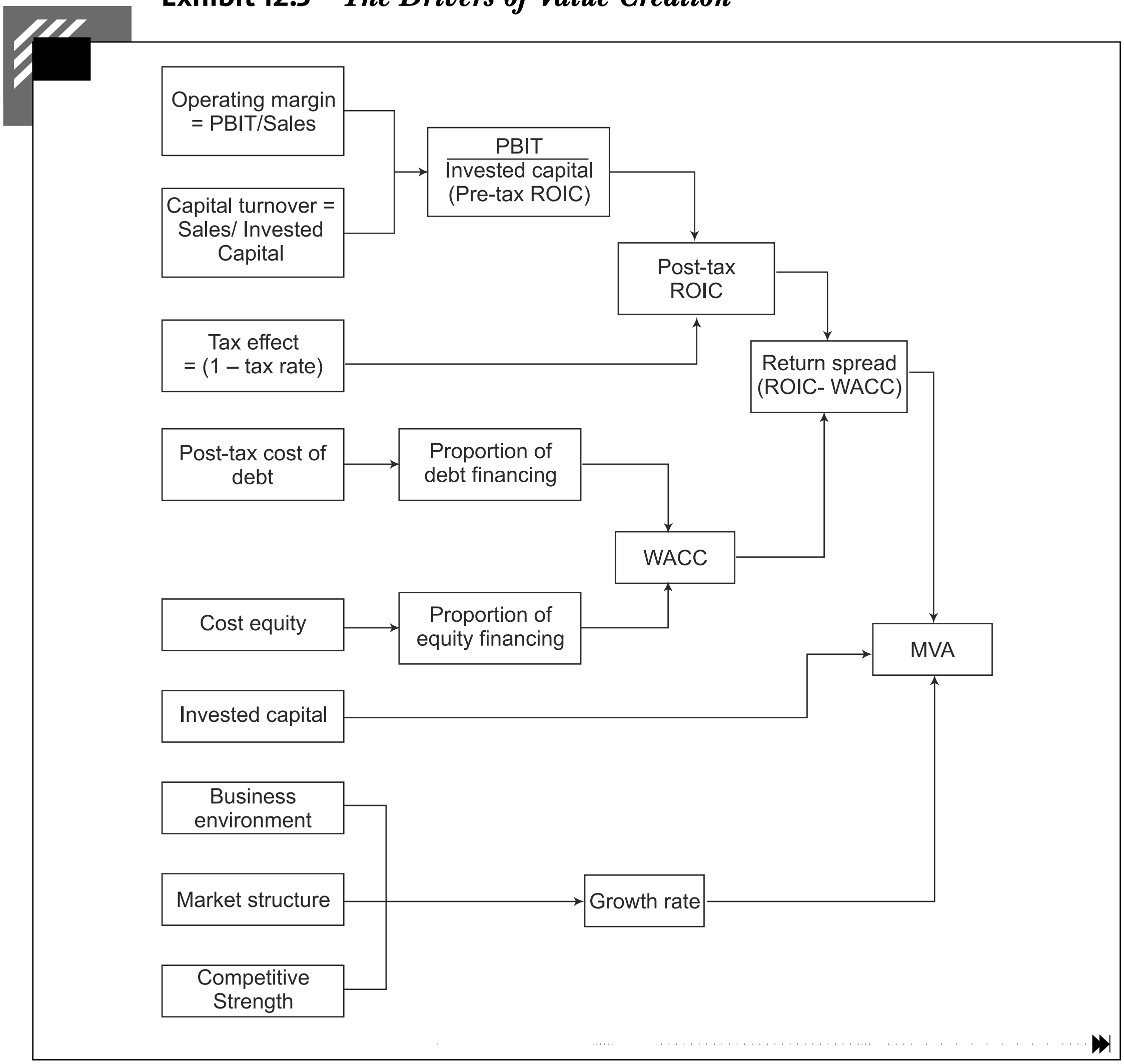
- The *operating profit margin* (PBIT/Sales) is improved.
- The *capital turnover* (Sales/Invested capital) is increased.

2 For expositional convenience we have assumed a constant growth rate. Note that the conclusions drawn from the formula are valid in general.

- The *effective tax rate* is reduced.

The drivers of value creation, viz., return on invested capital, weighted average cost of capital, invested capital, and growth rate, are summarised in Exhibit 12.3.

Exhibit 12.3 ***The Drivers of Value Creation***



Economic Value Added

Recall that for a firm that is expected to grow at a constant annual rate, MVA is equal to:

$$\frac{(\text{ROIC} - \text{WACC}) \times \text{Invested capital}}{\text{WACC} - \text{Growth rate}}$$

The numerator of this ratio is referred to as economic value added (EVA). EVA is essentially the surplus left after making an appropriate charge for the capital employed in the business. It may be calculated in any one the following, apparently different but essentially equivalent, ways:

EVA = NOPAT – WACC × INVESTED CAPITAL

EVA = (ROIC – WACC) × INVESTED CAPITAL

EVA = [PAT + INT (1 – TAX RATE)] – WACC × INVESTED CAPITAL

EVA = PAT – COST OF EQUITY × EQUITY

To illustrate the calculation of EVA using the above formulae let us look at the balance sheet and profit and loss account of Melvin Corporation given in Exhibit 12.4.

Exhibit 12.4 ***Balance Sheet and Profit & Loss Account of Melvin Corporation***

₹ in million

Balance Sheet as on 31-3-20X0				*Profit & Loss Statement for the Year Ending on 31-03-20X1*	
Liabilities		*Assets*		Net sales	300
Equity	100	Fixed assets	140	Cost of goods sold	258
Debt	100	Net current assets	60	PBIT	42
	200		200	Interest	12
				PBT	30
				Tax (30%)	9
				PAT	21

Melvin's cost of equity is 18 percent. The interest rate on its debt is 12 percent which, given a marginal tax rate of 30 percent, translates to a post tax cost of debt of 8.4 percent. Since Melvin employs debt and equity in equal proportions, its weighted average cost of capital is : 0.5 × 18.0 + 0.5 × 8.4 = 13.2 percent.

Melvin's NOPAT is: PBIT (1 – Tax rate) = 42(1 – 0.3) = 29.4 million. Given an INVESTED CAPITAL of 200 million, Melvin's ROIC works out to 29.4/200 = 0.147 or 14.7 per cent.

Based on the above information, Melvin's EVA may be computed in four different, yet equivalent, ways:

EVA = NOPAT – WACC × INVESTED CAPITAL

= 29.4 – (0.132) × 200 = 3 million

EVA = (ROIC – WACC) × INVESTED CAPITAL

$$= (0.147 - 0.132) \times 200 = 3 \text{ million}$$

$$\text{EVA} = [\text{PAT} + \text{INT } (1 - 0.3)] - \text{WACC} \times \text{INVESTED CAPITAL}$$

$$\text{EVA} = \text{PAT} - \text{COST OF EQUITY} \times \text{EQUITY}$$

$$= 21 - 0.18 \times 100 = 3 \text{ million}$$

While MVA is a *stock measure*, EVA is a *flow measure*. Hence EVA is eminently suitable as a periodic performance measure.

EVA as the Basis of an Integrated Financial Management System

The financial management system refers to financial measures, policies, methods, and procedures that guide the strategy and operations of a firm. It subsumes such things as setting financial goals, developing long-term strategic plans and short-term profit plans, making capital investment and disinvestment decisions, measuring operating performance, determining incentive compensation, and communicating with investors Companies often do not do these things in a unified, systematic, and cohesive manner. Corporate financial goals are defined in terms of earnings per share and return on net worth; individual lines of business are assessed in terms of return on assets; capital investment is analysed in terms of discounted cash flow; acquisitions are judged on the basis of contribution to earnings growth; departments are evaluated with reference to budgeted cost or profit figures; incentive compensation schemes are based on arbitrarily determined targets; and investor communication is primarily in terms of earnings per share and dividend policy.

It appears that a typical financial management system is hardly a system. As Al Ehrbar says: "Rather, it's a hodgepodge of rules, guidelines, and procedures that employs an array of frequently contradictory measures and objectives, that fosters confusion and conflict within an organization, that focuses on performance variables that bear little relation to the value of a business and often leads smart managers to do dumb things."[3] In many companies an obsolete financial management system confounds the search for value. These deficiencies call for an entirely different approach to financial management and the EVA financial management system seems to be the answer.

The EVA financial management system is based on the premise that EVA provides a single, unified, and accurate measure of performance. It links well forward looking valuation and capital budgeting analysis with actual performance measurement. For these reasons and more EVA may be used for goal setting and business planning, performance evaluation, bonus determination, investor communication, capital budgeting, and valuation.

3 Al Ehrbar, EVA: The Real Key to Creating Wealth, New York: John Wiley & Sons, 1998.

EVA is an excellent bedrock on which an integrated financial management system can be constructed, as it has the following features or characteristics.

- It is a performance measure that ties directly, theoretically as well as empirically, to shareholder wealth creation.
- It converts accounting information into economic reality that is readily grasped by non-financial managers. It is a simple yet effective way of teaching business literacy to everyone.
- It serves as a guide to every decision from strategic planning to capital budgeting to acquisitions to operating decisions.
- As the basis for incentive compensation, it truly aligns the interest of managers with that of shareholders and makes managers think and act like owners.
- It is an effective tool for investor communication.
- It serves as an anchor for an internal system of corporate governance that motivates everyone to work co-operatively and enthusiastically to achieve the best attainable performance.

12.3 THE CHALLENGE OF VALUE ENHANCEMENT

Given the importance of value enhancement, several value based management systems have been proposed. The major ones are:

- EVA approach
- DCF approach
- CFROI approach
- Marakon approach
- LEK/Alcar approach

As you consider various approaches to value enhancement, bear in mind the following:

- No value based management approach will work if managers are not committed to value maximisation. Conversely, if managers are truly committed to value maximisation, they will make any approach work for them.
- While it may be desirable or essential to link managerial compensation to a value enhancement metric, there is a possible negative consequence. Over time, managers become skillful in appearing better on that metric, even if doing so means reducing the firm value.
- There are no magical bullets for value creation. Value enhancement calls for hard work in competitive markets. A robust business model, sound execution, and good governance are necessary for sustained value creation.

SUMMARY

- With the globalisation of capital markets, intensification of competition, and massive privatisation initiatives, shareholder value creation is gaining the attention of executives all over the world, including India.
- To help firms create value for shareholders, value based management (VBM) systems have been developed. VBM is a generic term for a set of tools helpful in managing a firm's operation for enhancing shareholder value.
- According to the DCF model, the value of a firm is the present value of its expected cash flow, discounted at the cost of capital. So, an action creates value when it leads to one or more of the following: increase in the cash flows generated from existing investments; improvement in the growth trajectory of cash flows; and reduction in the cost of capital applied to discount the cash flows.
- The following are the important ways by which greater value can be extracted from the existing investments: continuation, divestiture, or liquidation of poor investments; improvement in operating efficiency; reduction of tax burden; reduction in net capital expenditure on existing investments; and reduction in noncash working capital.
- The growth in free cash flows is an important driver of value. Firms continually strive to increase the expected growth rate and lengthen the period of high growth rate to create value.
- The following are the important ways by which a firm can reduce its cost of capital: change in the operating risk; reduction in the operating leverage; change in the financing mix; and change in the financing type.
- Market value added (MVA), which represents the difference between market value of capital and capital employed, is a widely used measure of value creation.
- MVA depends on return on invested capital (ROIC), weighted average cost of capital (WACC), growth rate, and invested capital. The relationship between these factors and MVA is:

$$\text{MVA} = \frac{(\text{ROIC} - \text{WACC}) \times \text{Invested capital}}{\text{WACC} - \text{Constant growth rate}}$$

- Economic value added (EVA) is essentially the surplus left after making an appropriate charge for the capital employed in the business. It may be defined as follows:

$$\text{EVA} = (\text{ROIC} - \text{WACC}) \times \text{INVESTED CAPITAL}$$

- While MVA is a stock measure, EVA is a flow measure. Hence EVA is eminently suitable as a periodic performance measure.
- The EVA financial management system is based on the premise that EVA provides a single, unified, and accurate measure of performance. It links well forward looking valuation and capital budgeting analysis with actual performance measurement. For these reasons and more EVA may be used for goal setting and business planning, performance evaluation, bonus determination, investor communication, capital budgeting, and valuation.

Questions

1. What factors have stimulated greater interest in value creation?
2. What is value based management (VBM)?
3. Discuss the ways and means by which a firm can increase cash flows from existing investments.
4. What are the main entry barriers that give competitive edge to a firm?
5. Discuss the ways by which a firm can reduce its cost of capital.
6. What is market value added (MVA)?
7. What adjustments to the book value of shareholder's funds to get the adjusted shareholder's funds?
8. Discuss the properties of MVA.
9. What are the three key drivers of value creation? How is MVA related to the basic drivers?
10. What is economic value added (EVA) and what are the different ways of calculating EVA?
11. Why can EVA serve as a foundation for an integrated financial management system?
12. What considerations should you bear in mind, as you look at various approaches to value enhancement?

Problems

1. The balance sheet of International Computers Limited (ICL) at the end of 20X0 is given below:

Balance Sheet as on December 31, 20X0 *(In billion)*

Equity and Liabilities		*Assets*	
Equity	50	Fixed assets	80
Debt	50	Current assets	40
Non-interest bearing liabilities	20		
	120		120

The income statement for the year 20X1 is given below:

Revenues	90
Cost of goods sold	50
Gross profit	40
Operating expenses	16
Interest	4
PBT	20
Tax	7
PAT	13

ICL's equity has a beta of 0.9. The risk free return is 6 percent and the market risk premium is 6 percent. The interest rate on ICL's debt is 8 percent. The tax rate for ICL is 35 percent. Answer the following questions:

(a) What is the invested capital at the beginning of 20X1?

(b) What is the NOPAT for 20X1?

(c) What is the return on invested capital for 20X1?

(d) What is the cost of equity?

(e) What is the average cost of capital?

(f) What is the EVA for 20X1?

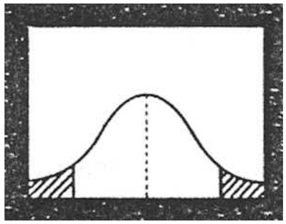
2. The following information is available for Adarsh Corporation:

- ROIC = 14 percent
- WACC = 12 percent
- Invested capital = 2000 million
- Constant growth rate = 10 percent

What is the MVA of Adarsh Corporation? What will happen to MVA, if the constant growth rate falls to 8 percent?

Table A *Normal Distribution*

Area of the Normal Distribution, that is, Z Standard Deviation to the Left or Right of the Mean



Number of Standard Deviations from Mean, (Z)	*Area to the left or Right (One tail)*	*Number of Standard Deviations from Mean (Z)*	*Area to the Left or Right (One tail)*
0.00	05000	155	0.0606
0.05	0.4801	1.60	0.0548
0.10	0.4602	1.65	0.0495
0.15	0.4404	1.70	0.0446
0.20	0.4207	1.75	0.0401
0.25	0.4013	1.80	0.0359
030	03821	1.85	0.0322
0.35	03632	1.90	0.0287
0.40	03446	1.95	0.0256
0.45	63264	2.00	0.0228
0.50	03085 *	2.05	0.0202
055	02912	2.10	0.0179
0.60	02743	2.15	0.0158
0.65	02578	2.20	0.0139
070	02420	2.25	0.0122
0.75	0.2264	230	0.0107
0.80	0.2119	235	0.0094
0.85	0.1977	2.40	0.0082
0.90	0.1841	2.45	0.0071
0.95	0.1711	2.50	0.0062
1.00	0.1587	255	0.0054
1.05	0.1469	2.60	0.0047
1.10	0.1357	2.65	0.0040
1.15	0.1251	2.70	0.0035

(*Contd.*)

Table A: (*Contd.*)

1.20	0.1151	2.75	0.0030
1.25	0.1056	2.80	0.0026
130	0.0968	2.85	0.0022
135	0.0885	2.90	0.0019
1.40	0.0808	2.95	0.0016
1.45	0.0735	3.00	0.0013
1.50	0.0668	3.05	'0.0011
		3.10	0.0010
		3.25	0.0006
		3.50	0.00023
		4:00	0.00003
		4.99	0.0000003

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Dr Prasanna Chandra, Director of Centre for Financial Management is an MBA, PhD (Finance). He has over four decades of teaching experience in postgraduate and executive education programmes. He was a professor of finance at Indian Institute of Management, Bangalore for nearly two decades. He was a visiting professor of finance at Southern Illinois University, USA for two years. He was appointed as a member of several committees including the Capital Issues Advisory Committee, the High Powered Committee on Insurance Sector Reforms, and the SEBI Committee on Derivatives. He has served on the boards of a number of organizations including Torrent Pharmaceuticals, Power Finance Corporation, Unit Trust of India, IFCI, IIM, (B), Templeton Mutual Fund, Bangalore Stock Exchange Limited, and Karnataka Soaps and Detergents Limited. He has been a consultant to many organizations.

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