



INVESTMENT VALUATION

Tools and techniques
for determining the value
of *any* asset

ASWATH DAMODARAN

INVESTMENT VALUATION

Tools and techniques
for determining the value
of *any* asset

ASWATH DAMODARAN



John Wiley & Sons, Inc.

New York • Chichester • Brisbane • Toronto • Singapore

This text is printed on acid-free paper.

Copyright © 1996 by Aswath Damodaran
Published by John Wiley & Sons, Inc.

All rights reserved. Published simultaneously in Canada.

Reproduction or translation of any part of this work beyond that permitted by Section 107 or 108 of the 1976 United States Copyright Act without the permission of the copyright owner is unlawful. Requests for permission or further information should be addressed to the Permissions Department, John Wiley & Sons, Inc.

This publication is designed to provide accurate and authoritative information in regard to the subject matter covered. It is sold with the understanding that the publisher is not engaged in rendering legal, accounting, or other professional services. If legal advice or other expert assistance is required, the services of a competent professional person should be sought.

Library of Congress Cataloging-in-Publication Data:

Damodaran, Aswath.

Investment valuation / Aswath Damodaran.

p. cm.

ISBN 0-471-13393-0 (cloth) ISBN 0-471-11213-5 (paper)

1. Corporations—Valuation—Mathematical models. I. Title.

II. Series.

HG4028.V3D353 1996

658.15—dc20

95-7418

Printed in the United States of America

10 9 8 7 6 5 4

This book is dedicated to Michele, whose patience and support made it possible; to Ryan and Brendan, who helped in their own way; and to Kendra, who arrived just in time to be included.

Preface

This is a book about valuation—the valuation of stocks, bonds, options, futures, and real assets. It is a fundamental precept of this book that any asset can be valued, albeit imprecisely in some cases. I have attempted to provide a sense of not only the differences among the models used to value different types of assets, but also the common elements in these models.

In the process of presenting and discussing the various models available for valuation, I have tried to adhere to four basic principles. First, I have attempted to be as comprehensive as possible in covering the ranges of valuation models that are available to an analyst doing a valuation, while presenting the common elements in these models and providing a framework that can be used to pick the right model for any valuation scenario. Second, I have used real world examples, warts and all, to capture some of the problems inherent in applying the models. There is the obvious danger that some of these valuations be proven hopelessly wrong in hindsight, but this risk is well worth the benefits. Third, in keeping with my belief that valuation models are universal and not market-specific, throughout the book I have interspersed illustrations from markets outside the United States. Finally, I have tried to make the book as modular as possible, enabling a reader to pick and choose sections to read without a significant loss of continuity.

In applying valuation models to real-world examples, I have used the capital asset pricing model (CAPM) as my model for risk and beta as my measure of risk. I am well aware of the controversy surrounding the CAPM, and I have discussed its limitations as well as alternative models in Chapter 4, Estimation of Discount Rates. There are four reasons for my dependence on the CAPM in this book. First, the estimation of the cost of equity, which is where I have used the CAPM, is just one component of valuation. The valuation models described in this book require a cost of equity, and any model that provides one can be used instead of the CAPM without any loss of generality. Second,

the data that are available often determine usage. The betas of both domestic and foreign firms are estimated by a number of information services, and they are easily accessible. I could have attempted to estimate the parameters of an alternative model for the stocks that I have valued, but that would have diverted me from my primary focus, which was valuation. Third, the CAPM provides a convenient forum for discussing more general issues that are important in valuation, such as the effects of financial leverage on risk and the relationship between risk and growth opportunities. Finally, in spite of all the criticism of the CAPM, I am not convinced that alternative models do much better in predicting expected returns, although there is evidence that they do better at explaining past returns.

OUTLINE OF THE BOOK

Chapter 1 examines the general basis for valuation models and the role that valuation plays in different investment philosophies. Chapter 2 provides an overview to the three basic approaches to valuation—discounted cashflow valuation, relative valuation, and contingent claim valuation. The rest of the book delves into the details of using these models.

Basic Valuation Tools

The first section of the book presents the basic tools needed for valuation, starting with models for analyzing risk and return and for estimating discount rates in Chapters 3 and 4. Chapter 5 provides an introduction to financial statements, and the process of estimating cashflows is discussed in Chapter 6. Chapter 7 examines the process of estimating growth rates in earnings and cashflows from historical and fundamental data.

Market Efficiency and the Efficacy of Investment Screens

The next section looks at the issue of market efficiency as a vehicle for developing investment screens and developing investment strategies. Chapter 8 examines the question of how to test an investment scheme, and Chapter 9 summarizes the empirical evidence on a wide variety of investment strategies, ranging from those based upon past prices to those based upon financial fundamentals such as the PE ratio.

Discounted Cashflow Models

The next section examines different discounted cashflow models to value both equity and the firm. Chapter 10 describes the basis dividend discount model and its variants. Chapter 11 starts off with a discussion of why free cashflows to equity (FCFE) are different from dividends for most firms. The two-stage

and three-stage FCFE discounted cashflow models are described and applied to high-growth firms that do not pay dividends. Chapter 12 examines the alternative of valuing the firm by discounting free cashflows to the firm at the weighted average cost of capital. The advantages of this approach are discussed, with caveats on its usage. Chapter 13 is dedicated to the valuation of firms that do not fit easily into traditional discounted cashflow models. In particular, the problems in valuing cyclical and troubled firms are discussed, and possible solutions are suggested.

Relative Valuation Models

The section on relative valuation encompasses three chapters. Chapter 14 discusses the use and misuse of price/earnings (PE) and price/cashflow ratios, beginning with an examination of the determinants of price/earnings ratios, and continuing with an analysis of why PE ratios change over time and why earnings multiples are different across industries and countries. Chapter 15 explores the relationship between price and book value, and attempts to clear misconceptions about the relationship. The determinants of price/book value ratios are examined, and a rationale is presented for why some firms sell for less than book value while others sell for more. Finally, there is a discussion of how to use price/book value ratios sensibly in investing. Chapter 16 examines the price/sales ratio and reasons for differences across firms and industries on this multiple. The price/sales ratio is also a useful tool to examine the value of a brand name and the effects of changes in corporate strategy.

Contingent Claim Valuation Models

Contingent claim valuation is discussed in two chapters. Chapter 17 develops the basic concepts of option pricing. It describes the payoff diagrams on call and put options and provides the rationale for option pricing models. The binomial model and the Black-Scholes model are presented and contrasted, and extensions on these models and their limitations are described. Chapter 18 applies these models in pricing a number of contingent claim securities such as warrants, and explores the use of option pricing models in pricing assets that have option-like features such as equity in a firm, natural resource rights, and product patents.

Valuing Fixed Income Securities

The next section looks at the valuation of fixed-income securities in two parts. In Chapter 19, the determinants of the level of rates, the term structure, and the default premia are examined. Chapter 20 looks at special features of bonds, including conversion and call options, as well as the effect of caps and floors on floating-rate bonds.

Valuing Futures and Real Assets

Chapter 21 examines the pricing of futures contracts on perishable and storable commodities and extends the lessons to valuing futures on stock indices, bonds, and currencies. Chapter 22 provides an introduction to the use of discounted cashflow models and comparables in the valuation of real estate, while Chapter 23 analyzes the valuation of other assets, including private businesses and franchises.

CHOOSING THE RIGHT MODEL

The problem in valuation is not that there are not enough models; it is that there are too many. Consequently, the final chapter, Chapter 24, may be the most important one in this book. It provides a framework for picking the right model for any occasion, based upon the characteristics of the asset being valued.

ACKNOWLEDGMENTS

I would like to express my appreciation to Value Line and Bloomberg. Without their data the practical examples that I have worked out in this book would not have been possible.

INVESTMENT VALUATION

Contents

CHAPTER 1: INTRODUCTION TO INVESTMENT VALUATION	1
A Philosophical Basis for Valuation	1
Generalities About Valuation	2
The Role of Valuation	4
Conclusion	7
Questions and Short Problems	7
CHAPTER 2: APPROACHES TO VALUATION	9
Discounted Cashflow Valuation	9
Relative Valuation	13
Contingent Claim Valuation	15
Conclusion	17
Questions and Short Problems	17
CHAPTER 3: RISK AND RETURN—THEORY	20
Ingredients for a Good Risk and Return Model	20
General Models for Risk and Return	21
A Comparative Analysis of Risk and Return Models	39
Models of Default Risk	40
Conclusion	45
Questions and Short Problems	45
CHAPTER 4: ESTIMATION OF DISCOUNT RATES	47
Cost of Equity	47
Dividend Growth Model	61
Weighted Average Cost of Capital (WACC)	62
Conclusion	65
Questions and Short Problems	65

CHAPTER 5: UNDERSTANDING FINANCIAL STATEMENTS	69
Principal Financial Statements	69
Financial Ratios	79
Other Issues in Analyzing Financial Statements	92
Conclusion	93
Questions and Short Problems	94
CHAPTER 6: ESTIMATION OF CASHFLOWS	98
Cashflows to Equity	98
Cashflows to the Firm	107
Inflation, Cashflows, and Value	108
Personal Taxes and Cashflows	112
Cashflows and Asset Life	116
Conclusion	117
Questions and Short Problems	117
CHAPTER 7: ESTIMATION OF GROWTH RATES	120
The Use of Historical Growth Rates	120
The Use of Analysts' Forecasts of Earnings	129
The Determinants of Earnings Growth	132
General Issues in Estimating Growth	140
Conclusion	143
Questions and Short Problems	143
CHAPTER 8: MARKET EFFICIENCY—DEFINITION AND TESTS	146
Market Efficiency and Investment Valuation	146
What Is an Efficient Market?	147
Implications of Market Efficiency	148
Necessary Conditions for Market Efficiency	149
Propositions About Market Efficiency	149
Testing Market Efficiency	151
The Cardinal Sins in Testing Market Efficiency	156
Some Lesser Sins That Can Be a Problem	156
Conclusion	157
Questions and Short Problems	157
CHAPTER 9: MARKET EFFICIENCY—THE EVIDENCE	160
Time Series Properties of Price Changes	160
Market Reaction to Information Events	168
Market Anomalies	172
Evidence on Insiders and Investment Professionals	183
Conclusion	188
Questions and Short Problems	188
CHAPTER 10: DIVIDEND DISCOUNT MODELS	191
The General Model	191
Versions of the Model	192

Issues in Using the Dividend Discount Model	211
Tests of the Dividend Discount Model	212
Caveats on the Use of the Dividend Discount Model	214
Conclusion	216
Questions and Short Problems	216
CHAPTER 11: FREE CASHFLOWS TO EQUITY DISCOUNT MODELS	219
Free Cashflows to Equity Versus Dividends	219
FCFE Valuation Models	222
FCFE Model Valuation Versus Dividend Discount Model Valuation	233
Conclusion	234
Questions and Short Problems	234
CHAPTER 12: VALUING A FIRM—THE FREE CASHFLOWS TO THE FIRM APPROACH	237
Free Cashflows to the Firm	237
Models for Valuing the Firm	239
Firm Value and Leverage	247
Conclusion	257
Questions and Short Problems	258
CHAPTER 13: SPECIAL CASES IN DISCOUNTED CASHFLOW VALUATION	267
Cyclical Firms	267
Firms in Financial Distress	275
Firms with Product Options	280
Private Firms	282
Conclusion	288
Questions and Short Problems	288
CHAPTER 14: PRICE/EARNINGS MULTIPLES	291
The Use and Misuse of PE Ratios	291
Estimating PE Ratios from Fundamentals	292
Comparisons of PE Ratios	299
Problems with PE Ratios	307
Variants of the PE Ratio	309
Price/Dividend Ratios and Dividend Yields	312
PE Ratios and Stock Returns	314
Conclusion	315
Questions and Short Problems	315
CHAPTER 15: PRICE/BOOK VALUE MULTIPLES	318
General Issues in Estimating and Using PBV Ratios	318
Estimating PBV Ratios from Fundamentals	319
Estimating PBV Ratios from Comparables	330
PBV Ratios and Investment Strategies	333
Variants on PBV Ratios	334
Conclusion	336
Questions and Short Problems	336

CHAPTER 16: PRICE/SALES MULTIPLES	338
Issues in Using PS Multiples	338
PS Ratios and Fundamentals	339
PS Ratios and Profit Margins	342
The Mismatch That Should Draw Attention	350
PS Ratios and Cross-Sectional Data	350
Using PS Ratios in Investment Strategies	352
Conclusion	353
Questions and Short Problems	353
CHAPTER 17: OPTION PRICING THEORY	356
What Is an Option?	356
Determinants of Option Value	358
Option Pricing Models	360
Conclusion	372
Questions and Short Problems	372
CHAPTER 18: APPLICATIONS OF OPTION PRICING THEORY TO EQUITY VALUATION	375
Application of Option Pricing Models to Valuation	375
Valuing Equity as an Option	376
Valuing Natural Resource Options/Firms	385
Valuing Product Patents as Options	390
Conclusion	394
Questions and Short Problems	395
CHAPTER 19: THE DETERMINANTS OF INTEREST RATES	397
Bond Prices and Interest Rates	397
Determinants of Interest Rates	403
Conclusion	420
Questions and Short Problems	420
CHAPTER 20: SPECIAL FEATURES IN BONDS	423
Convertibility	423
Callability	427
Prepayment Option	432
Interest Rate Caps and Floors	435
Other Features	439
Conclusion	440
Questions and Short Problems	441
CHAPTER 21: VALUING FUTURES CONTRACTS	443
Futures, Forward, and Option Contracts	443
Traded Futures Contracts—Institutional Details	446
Pricing of Futures Contracts	448
Effects of Special Features in Futures Contracts	458

Conclusion	459
Questions and Short Problems	460
CHAPTER 22: VALUING REAL ESTATE	462
Real Versus Financial Assets	462
Discounted Cashflow Valuation	462
Comparable/Relative Valuation	479
A Regression Approach	481
Conclusion	481
Questions and Short Problems	481
CHAPTER 23: VALUING OTHER ASSETS	484
Classifying Assets	484
Cashflow-Producing Assets	484
Non-Cashflow-Producing Assets	498
Assets with Option Characteristics	498
Conclusion	499
Questions and Short Problems	499
CHAPTER 24: OVERVIEW AND CONCLUSION	501
Choices in Valuation Models	501
Determinants of Choice	502
Conclusion	507
Questions and Short Problems	508
REFERENCES	509
INDEX	515



Introduction to Investment Valuation

Every asset, financial as well as real, has value. The key to successfully investing in and managing these assets lies in understanding not only what the value is, but the sources of the value. Any asset can be valued, but some assets are easier to value than others, and the details of valuation will vary from case to case. Thus, the valuation of a share of a real estate property will require different information and follow a different format from the valuation of a publicly traded stock. What is surprising, however, is not the differences in valuation techniques across assets, but the degree of similarity in basic principles. There is undeniably uncertainty associated with valuation. Often that uncertainty comes from the asset being valued, although the valuation model may add to that uncertainty.

This chapter lays out a philosophical basis for valuation, together with a discussion of how valuation is or can be used in a variety of frameworks, from portfolio management to corporate finance.

A PHILOSOPHICAL BASIS FOR VALUATION

A surprising number of investors subscribe to the “bigger fool” theory of investing, which argues that the value of an asset is irrelevant as long as there is a “bigger fool” around who is willing to buy the asset from them. While this may provide a basis for some profits, it is a dangerous game to play, since there is no guarantee that such an investor will still be around when the time to sell comes.

A postulate of sound investing is that an investor does not pay more for an asset than its worth. This statement may seem logical and obvious, but it is forgotten and rediscovered at some time in every generation and in every market. There are those who are disingenuous enough to argue that value is in the eyes of the beholder, and that any price can be justified if there are other investors willing to pay that price. That is patently absurd. Perceptions may be all that matter when the asset is a painting or a sculpture, but investors do not (and should not) buy most assets for aesthetic or emotional reasons; financial assets are acquired for the cashflows expected from owning them. Conse-

quently, perceptions of value have to be backed up by reality, which implies that the price that is paid for any asset should reflect the cashflows it is expected to generate. The models of valuation described in this book attempt to relate value to the level and expected growth of these cashflows.

There are many areas in valuation where there is room for disagreement, including how to estimate true value and how long it will take for prices to adjust to true value. But there is one point on which there can be no disagreement. Asset prices cannot be justified merely by using the argument that there will be other investors around willing to pay a higher price in the future.

GENERALITIES ABOUT VALUATION

Like all analytical disciplines, valuation has developed its own set of myths over time. This section examines and debunks some of these myths.

Myth 1: Since valuation models are quantitative, valuation is objective.

Valuation is neither the science that some of its proponents make it out to be nor the objective search for true value that idealists would like it to become. The models that we use in valuation may be quantitative, but the inputs leave plenty of room for subjective judgments. Thus, the final value that we obtain from these models is colored by the bias that we bring into the process.

The obvious solution is to eliminate all bias before starting on a valuation, but this is easier said than done. Given the exposure we receive to external information, analyses, and opinions about an asset such as a firm, it is unlikely that we embark on most analyses without some bias. There are two ways of reducing the bias in the process. The first is to avoid taking strong public positions on the value of a firm before the valuation is complete. In far too many cases, the decision on whether a firm is under- or overvalued precedes the actual valuation,¹ leading to seriously biased analyses. The second is to minimize the stake we have in whether the firm is under- or overvalued, prior to the valuation.

Institutional concerns also play a role in determining the extent of bias in valuation. For instance, it is an acknowledged fact that equity research analysts are more likely to issue buy rather than sell recommendations,² that is, that they are more likely to find firms to be undervalued than overvalued. This can be traced partly to the difficulties they face in obtaining access to and collecting information on firms that they have issued sell recommendations on, and partly to pressure that they face from portfolio managers, some of whom might have large positions in the stock.

When using a valuation done by a third party, the biases of the analyst(s) doing the valuation should be considered before decisions are made on its basis. For instance, a self-valuation done by a target firm in a takeover is likely to be positively biased. While this does not make the valuation worthless, it suggests that the analysis should be viewed with skepticism.

Myth 2: A well-researched and well-done valuation is timeless.

The value obtained from any valuation model is affected by firm-specific as well as marketwide information. As a consequence, the value will change as new information is revealed. Given the constant flow of information into financial markets, a valuation done on a firm ages quickly and has to be updated to reflect current information. Thus, pharmaceutical companies that were valued highly in early 1992, on the assumption that the high growth from the 1980s would continue into the future, would have been valued much less in early 1993, as the prospects of health reform and price controls dimmed the future outlook. With the benefit of hindsight, the valuations of these companies (and the analyst recommendations) made in 1992 can be criticized, but they were reasonable given the information available at that time.

Myth 3: A good valuation provides a precise estimate of value.

Even at the end of the most careful and detailed valuation, there will be uncertainty about the final numbers, colored as they are by assumptions that we make about the future of the company and the economy. It is unrealistic to expect or demand absolute certainty in valuation, since cashflows and discount rates are estimated with error. This also means that analysts have to give themselves a reasonable margin for error in making recommendations on the basis of valuations.

Myth 4: The more quantitative a model, the better the valuation.

The usefulness of the models presented in this book is circumscribed by the time and effort analysts spend in coming up with the inputs to the model. If they do not do their homework and the inputs are wrong, the output from the models will reflect those errors. In general, the quality of a valuation will be directly proportional to the time spent in collecting the data and in understanding the firm being valued.

Myth 5: The market is generally wrong.

The benchmark for comparison in most valuations remains the market price. When the value from an analysis is significantly different from the market price, there are two possibilities: One is that the valuation is incorrect and the market is right; the other is that the valuation is correct and the market is not. The presumption should be that the market is correct and that it is up to the analyst to convince himself or herself (and others) that his or her valuation offers a better estimate of value than the market price. This higher standard may lead investors to be more cautious in following through on valuations, but given the difficulty of beating the market, this is not an undesirable outcome.

Myth 6: The product of valuation (i.e., the value) is what matters; the process of valuation is not important.

As valuation models are introduced in this book, there is the risk of focusing exclusively on the outcome, that is, the value of the company, and whether it