CHAPTER 1

Introduction

The past century has seen amazing strides in the area of financial economics. In this span, brief by historical standards, we have seen the development of the idea of equities being valued on the basis of discounted cash flow streams to perpetuity. In short order, there followed measures of bond duration, principles of portfolio diversification, development of risk-based asset pricing models, and theories of capital structure and dividend strategy. In more recent years, we have welcomed the rigorous theory of option and other derivatives pricing and we have, as a profession, grappled with questions of just how efficient financial markets may (or may not) be. Our collective thoughts have also turned to the theoretical questions of how price and volatility series evolve over time. To shed light on these questions, some researchers have focused on econometrics and microeconomic theory, while others have looked to the areas of psychology, behavioral studies, and experimental economics.

The focus of this book is on equity valuation, risk, and investment. The admittedly ambitious goal is to integrate and apply the insights of these theories to the day-to-day decisions that need to be made by portfolio managers, investment strategists, securities analysts, corporate managers, regulators, policy makers, and, ultimately, their investment public constituency.

Right off the bat, however, we face the problem that the body of theory in this area of study is not unified. Specifically, there are gaps and often outright contradictions between and among the various disciplines and schools of thought. To make things worse, difficulties are not always just at the periphery or the frontiers of our subject.

It is into this arena that we investment professionals and individual investors are thrown. We do not have the luxury to bemoan the absence of a unified theory, nor can we postpone our decisions as we wait and hope for theoretical and empirical clarification. We have no choice; each day we must decide what to buy, sell, and hold; how much; and at what prices. And, not to decide . . . is still to decide.

THEORETICAL PRECISION OR THEORETICAL RESILIENCE?

In essence, we have to establish an operational analytical framework—or theory—that is consistent with the basic fundamental principles of modern finance, but that can operate in a world where there are still significant unsettled questions. The modeling approach undertaken in this work is therefore necessarily epistemologically modest.

By contrast, in recent years, the development of finance and investment theory has focused heavily in those areas where computational brute force, complicated mathematics, and reams of data have been able to produce results with a high degree of precision. The greatest beneficiaries of this study have been in the areas of derivatives valuation. Consequently, if we know the prices of individual securities, short-term interest rates, and the general characteristics of their respective volatilities and correlations, we can make highly accurate valuation estimates—relative to the underlying securities prices.

What we do *not* know with nearly the same degree of precision is *why* the underlying securities prices are what they are. In essence, the valuation of equities is a discipline where computational brute force, complicated mathematics, and reams of historical data do *not* necessarily produce a high degree of precision.

Our dilemma is that investment researchers seem to be inherently drawn to precision. (Call it an occupational hazard.) The question of why investment researchers are drawn so strongly to, say, derivatives research is reminiscent of the story of the drunk who lost his car keys down the block but searches for them at the corner under the streetlight. When asked why, he replies, "Because the light is better over here." While the basic questions in our field relate to the valuation of primary securities, the "light"—that is, the precision—is "better over here" in the derivatives field.

On the bright side, however, I hope to show that integrating a little bit of accepted basic theory can go a long way toward obtaining robust results in a study of equity securities where contingency and human nature feature so prominently. What is necessarily sacrificed in the way of precision and elegance is balanced by resilient ballpark results.

Said differently, we find ourselves in circumstances similar to those of the ancient Roman engineers as they designed roads, bridges, and aqueducts. Although the systematic understanding of force, energy, fluid mechanics, and system dynamics was almost two millennia in their future, they were nevertheless able to make very effective use of the basic math and empirical observations that they did have.

PRACTICAL DIFFICULTIES AS WELL

It should go without saying that theoretical concerns are naturally compounded by practical difficulties. After all, everyday observation of human nature indicates that we have pronounced and consistent cognitive difficulties in dealing with (1) nonlinear relationships, (2) the simultaneous impact of multiple variables, and (3) interactions among multiple variables. These cognitive difficulties have been systematically studied since the pathbreaking work in the 1970s by Amos Tversky and Daniel Kahneman in the application of behavioral psychology to economics. Such cognitive difficulties have also been recognized in the field of experimental economics pioneered by Vernon Smith.[1]

A simple example demonstrates the nature of these difficulties. We utilize the familiar Gordon constant dividend growth model. Its simple representation is

$$P_0 = \frac{D_0 (1 + g)}{k - g} \tag{1.1}$$

where P_0 = price of a common stock at initial time zero
D_0 = current annualized dividend rate at initial time zero
g = constant annualized growth rate of dividends to perpetuity
k = annualized discount rate (or alternatively, internal rate of return, or annualized expected return) to perpetuity

Let us hypothesize an unleveraged company with these characteristics: annualized dividend rate of $1.00 per share, a growth factor of 4% per year, and an annualized discount rate of 7.0% per year. Plugging these values into equation (1.1) produces a common equity value of $34.67.

Let us further imagine that company management decides to leverage the capital structure, forecasting that doing so will permit an increase in expected earnings and dividends per common share but also necessarily bring about an increased volatility of earnings and equity values. As a result, the discount factor must also rise.

Finally, management is assumed to increase the common dividend rate by 20%, which will detract somewhat from the long-term dividend growth

[1] By fitting coincidence, Kahneman and Smith were both recipients of the Nobel Prize in economics in 2002. Tversky had died by 2002 and therefore not eligible for a Nobel Prize.

TABLE 1.1 Sensitivity of Valuation Estimates to Cognitive Errors

	Base Case	Revised Case	Error 1	Error 2	Error 3
Dividend Rate	$1.00	$1.20	$1.20	$1.20	$1.20
Discount Factor *k*	7.0%	8.0%	7.0%	8.0%	7.0%
Growth Factor *g*	4.0%	4.385%	4.0%	4.0%	4.385%
Equity Price	$34.67	$34.65	$41.60	$31.20	$47.90
Price Difference versus Base Case		−0.1% (rounding error)	+20.0%	−10.0%	+38.2%

factor[2] but which will still permit a new growth rate of 4.385%, given the increase in debt leverage.

In a transparent, efficient capital market, the particular management recapitalization cannot, in and of itself, impact the valuation of common equity. In fact, an 8.0% annualized discount rate, together with a $1.20 revised dividend rate and a 4.385% growth factor, results in a share price of $34.65. (This is essentially an unchanged price, adjusted for rounding.)

Table 1.1 demonstrates the types of cognitive errors often made by investors that do not simultaneously reflect the impact of *all* the underlying valuation factors.

Under the heading Error 1, the investment analyst or investor has reflected the higher dividend rate but has not correctly accounted for a higher discount factor and growth rate. As a result, the estimated equity price overstates the correct price by the 20% dividend rate change. Under Error 2, the discount factor is correctly reflected, but the analyst/investor has not properly reflected that higher leverage also produces a higher expected long-term growth factor. As a result, the equity price is underestimated by 10.0%. The last column shows a case where the analyst/investor properly captures the higher growth factor due to leveraging but fails to make the proper adjustment to the discount factor to account for higher prospective earnings and price volatility. As a result, Error 3 overestimates the price by 38.2%.

Basically, even if there is an existing, accepted standard for equity valuation, cognitive mistakes by market participants can create highly different valuation assessments. As participants attempt to reconcile these differences in the capital markets through buying and selling, the results likely would be

[2] See Appendix A on the derivation of discount rates as a function of dividend payouts, returns on book equity, and the impact of common stock issuances and buybacks on long-term growth factors.

manifested as excessive volatility and/or long lag times between news events and the eventual arrival at a fully agreed-upon market consensus price that is consistent with the underlying fundamentals.

OVERVIEW OF OUR ANALYSIS

To grapple with both theoretical and practical concerns, the discussion in this book starts with the valuation of default-free debt securities, both traditional and inflation-protected bonds. This framework allows us to enhance traditional models of unleveraged equities including variations of the Franchise Value analysis introduced by Martin Leibowitz. (The key insight in this area—and simple math—depends on the concept of *real* or *inflation-adjusted annuities*.) The next step is to introduce leverage in the context of Merton Miller's seminal 1977 article "Debt and Taxes."

With the basic framework then in mind, we are able to calibrate the model intuitively to observable real-world results by utilizing U.S. data on aggregate corporate capital investment and profitability. We will find this to be useful in dealing with difficulties encountered in any or all of (1) valuing high-growth companies, (2) evaluating the impact of common stock buybacks and other leveraged recapitalizations, and (3) assessing mergers/acquisitions.

In addition to selected case studies, we test the model cross-sectionally at several points in time for a robust sample of common equities. Doing this will help us draw inferences about expected returns in general and draw specific inferences regarding market efficiency and portfolio management.

To complete the analysis, we extend the model in a probabilistic way to deal with questions of performance attribution and, ultimately, the degree of investment risk. This latter analysis produces interesting and useful results with regard to volatility, correlations, and portfolio allocation.

The model presented in this book has the advantage of being able, at least conceptually—and to a rough degree, practically—to evaluate each of the key valuation factors *separately*. In contrast, in the traditional dividend discount model, the discount rate, the growth rate, the dividend rate, and leverage are all interrelated in complex and often nonintuitive ways.

Our expositional model has been heavily shaped by the writings of Benjamin Graham, particularly the classic *Security Analysis*. As a result, this work is likely to be useful more to the practitioner than to the scholarly community. Where possible, I have tried throughout to present the arguments and discussion in three different forms: textual, pictorial, and mathematical. Much of the math must be included in the textual part of the exposition. However, the more formal mathematical treatment is relegated to

appendices and footnotes for those who desire to pursue the topic with greater rigor.

I have benefited in my study of other fields from the historical background of how different theories have developed. This is in contrast to the formal treatment that typifies mathematics and physical sciences. For example, once I understood the historical development of set theory, the discussion of what rigorously defines a mathematical function made sense. In contrast, a typical math text contains row after row of axioms and theorems about "infinitely populated, but sparse and 'immeasurable' sets" that seem to be contextually adrift and accessible only to the most pedantic student with a strong aptitude for memorization.

As an example, I recall a one-hour extemporaneous lecture from my professor of a first-year inorganic chemistry class during college. A freshman interrupted the lecture and demanded to know "how do you know that atoms exist when we cannot see them?" The professor's historical recitation included the seminal experiments and insights from Boyle to Priestly, Dalton, Avogadro, Mendeleev, Curie, Rutherford, and Bohr. From that point on, every subsequent specific fact was riveted for me onto a particular context and meaning. Consequently, it was far easier to understand how and why things hung together as they did. Understanding the linkages made memorization easier than just trying to retain disconnected facts.

The last chapter of this book therefore provides a brief history of how the equity valuation model in this text developed in response to market circumstances and certain key findings of modern financial economics. I hope that readers will find the treatment useful in cementing the concepts set forth herein. However, nothing will be lost if readers choose to skip that section in its entirety.

A QUICK AND IMPORTANT NOTE ON MATHEMATICAL NOTATION

For purposes of exposition, I believe that it is best to be flexible in the use and development of mathematical notation. The reader is therefore cautioned that subscripts on certain variables and the use of certain Greek letters may be highly dependent on the particular context of a certain section or chapter. I have three reasons for occasionally changing notation:

1. It is often pedagogically useful to introduce subscript or notation changes as a way of developing and presenting a new concept.
2. Attempting to use uniformly consistent notation throughout the entire volume would tax the limited availability of English and Greek

alphabetic symbols and/or would require a rigorous adoption of superscripts and subscripts that would impede the textual flow.

3. Where possible, I use flexible notation in order to maintain some sense of familiarity with what has been used in various diverse books and articles by prominent financial academics and practitioners.

I apologize in advance if this format creates undue hardships for the reader.