

Recent Advances in Corporate Finance

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*In memory of our fathers: Sidney Altman and
Marti Mannariah Gurunath*

Preface

For several decades, financial academicians and practitioners have been working on parallel paths toward the analysis of problems which confront the financial community. Periodically, a number of concerned analysts have attempted to bring these separate efforts toward a central meeting point to foster a dialogue and even engage in joint work. The general line of attack is to take some of the more important conceptual breakthroughs and attempt to apply them to current practical problems and, in so doing, raise the level of performance of financial markets and the financial institutions, firms, and individual investors who deal in these markets. The attempt to integrate financial theory with practice has been particularly observable and successful in the field of *investments*, broadly defined. The works of Harry Markowitz on portfolio theory from the 1950s, William Sharpe, John Lintner, Jan Mossin, and Jack Treynor on the capital asset pricing model from the 1960s, and Fisher Black-Myron Scholes and Robert Merton on option pricing from the 1970s, among others, have found their way into the halls of investment houses and the trading floors of financial institutions around the world. Numerous capital market institutes of research have been funded, mainly by "Wall Street," to build data bases and sponsor inquiry into the concepts and numbers which have now become common practice, even amongst less sophisticated analysts. It is fair to say that there has been a *successful meeting of the minds in the field of investments*, as is evidenced by the increasing role of academics as researchers and strategists in some of the major financial institutions.

Unfortunately, the same progress has not taken place in another major area of the financial world, namely the *corporate financial theory and management* area. Despite some efforts by professional associations, as well as research institutes through periodic confer-

ences, there has not, in our opinion, been the same level of interaction and dialogue between academicians and practitioners as is found in the investments area. Of course, some of the more prominent works in corporate finance, such as those by Modigliani and Miller, have on occasion found their way to corporate boardrooms and top corporate financial executives, but for the most part, the related concerns and efforts of academics and practitioners in corporate finance are still on a parallel but not intersecting path. The major areas of corporate financial policy, namely liquidity, capital structure, dividend and valuation analysis have been discussed and debated both within and between these two groups with little or no consensus.

Why has this apparent failure to merge ideas and efforts taken place? One possible reason is the lack of a serious attempt to bring the two groups together—both in terms of dialogue and financial resources. In terms of funding, corporate finance research projects have enjoyed nowhere near the level of support available to research on capital markets. Several questions come readily to mind in this connection. Have we tried hard enough to bring the busy corporate financial executive away from his day-to-day pressures to sit back and view the major issues from a more objective and considered vantage point? Have the practitioners reached out to academics and other theorists both in terms of internships and funding? Have the investment banks played their crucial role effectively in this interface? It is difficult to answer these questions in the affirmative.

The purpose of this volume is to make an attempt at improving the interface between the worlds of academia and practice and also to highlight some of the more significant trends and seminal works in the field of corporate finance. We invited some of the most important researchers in the field to present survey papers in their areas that would be rigorous and yet accessible to nonmathematically oriented readers. And we asked a number of sophisticated and concerned senior corporate financial and investment banking practitioners to assess, critique and comment upon the works and the issues presented. We also invited several researchers to present current works in these same areas to round out the discussion. The format for this interface was a conference sponsored by the Salomon Brothers Center for the Study of Financial Institutions at New York University's Graduate School of Business Administration on November 9 and 10, 1983. The compendium of papers and comments written for the conference and edited in subsequent months is the content of this book.

The four areas that we have selected to launch our idea of corporate financial interface are (1) *contingent claims* or the application of option pricing techniques to corporate finance; (2) *agency theory* or the analysis of interface and conflicts of interest between owners, creditors, and managers; (3) *taxation* and its pervasive impact on firm strategy; and (4) *inflation* and its impact. These surveys were written and presented respectively by Robert Merton and Scott Mason (No. 1), Michael Jensen and Clifford Smith, Jr. (No. 2), Robert Hamada and Myron Scholes (No. 3), and Rich Cohn and Franco Modigliani (No. 4). The practitioners who discussed these surveys were respectively Martin Leibowitz and Andrew Kalotay (No. 1), John Hackett and Robert Kay (No. 2), J. P. Valles (No. 3) and Richard Goeltz and L. M. Ribiero Dias (No. 4). The research papers were by Thomas Ho (No. 1), Avner Kalay and Kose John (No. 2), James Poterba and Lawrence Summers (No. 3), and Michel Levasseur and Itzhak Swary (No. 4). The complete list of participants and their biographical notes are provided at the end of this book.

This book on recent advances in corporate finance and its implications is appropriate for sophisticated practitioners in the world of finance, including corporate financial personnel, financial market practitioners and investment analysts. It is also particularly useful for upper-level courses in corporate finance at the MBA level and for doctoral seminars. Students and instructors who may not be familiar with all of the diverse writings in these areas and wish to have a comprehensive survey and discussion of the issues and practical implications will find the book of value, especially since it is written by the individuals credited with seminal contributions and by those who can appreciate the works and their potential for application.

We sincerely appreciate the participation of those authors and commentators who agreed to speak and write on this important area. We are also appreciative of financial support from the Salomon Brothers Center for the Study of Financial Institutions, under the direction of Dr. Arnold Sametz.

Edward I. Altman
Marti G. Subrahmanyam

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Part I

Valuation of Corporate Securities: Applications of Contingent Claims Analysis: Introduction

One of the most significant developments in financial economics in recent years was that of the theory of option pricing. The origin of this literature can be traced to the pioneering work by Fischer Black and Myron Scholes in a paper in the *Journal of Political Economy* in 1973. The Black-Scholes model, in particular, and option pricing theory, in general, is a notable development in financial economics for two important reasons. First, option pricing theory has had a considerable impact on practitioners as evidenced by the widespread use of the Black-Scholes model, or a variant, in the valuation of traded options on common stocks and related instruments. Second, and perhaps equally important from the academic viewpoint, option pricing theory provides a rich framework for the valuation of corporate assets and liabilities.

The popularity of option pricing theory in the investment community can, in part, be traced to the fortuitous timing of the initial work by Black and Scholes which virtually coincided with the opening of the first organized market in options, the Chicago Board Options Exchange. More importantly, the practical appeal of the model is due to the fact that the model relies on observable variables. Unlike many other models in finance, it eschews reliance on both investor preferences and expectations. In fact, the only nonobservable input

to the model is the volatility of the stock price, which is certainly less difficult to estimate than, say, the expectation of the future stock price. The reason for the economy in estimating inputs to the model is that the theory of option pricing is largely based on the principle of arbitrage and is oriented toward development of a relative valuation for the option in terms of the value of the underlying stock—an observable variable.

The principles of option pricing theory are surprisingly general in their applicability to the valuation of both financial and real assets. As originally pointed out by Black and Scholes, corporate securities may be viewed as options, or more generally, contingent claims on the value of the firm. The most obvious example of this insight is that the equity of a levered firm may be thought of as a European call option written on the firm's value, with the exercise price being the promised payment on the debt and the expiration date being the maturity date of the debt. Other corporate securities may also be modeled in this framework as contingent claims and valued using the techniques of contingent claims analysis.

More recently, academic researchers in the area have focused attention on another application of the framework. Most of the early applications of contingent claims analysis dealt with the financing side of the firm's activities through the valuation of corporate liabilities such as the call feature on bonds or the value of a convertible bond. In particular, the traditional notion that the risk of a corporate claim depends on business risk, financial risk, the rate of interest, and the nature of the covenants imposed on the firm can be given specific content. For example, it is possible, using the methods of contingent claims analysis, to place a value on individual features of a security such as the covenants imposed on the firm.

The same recent developments in the area apply to the investment decision of the firm as well through the valuation of corporate assets. Specifically, attention is focused on the "option" aspects of investment projects such as project timing, the scale of the investment, and the right to abandon the project. Further, even after the project is accepted, operating choices do exist in terms of the choice of inputs and outputs in the actual production decision.

Although the past achievements and future promise of contingent claims analysis are impressive, it is only proper to point out some of the difficulties in applying the framework, particularly to the valuation of corporate assets. Many of these issues are receiving attention in the literature of the field and may be addressed by researchers over the next several years.

Much of the option pricing theory and its corporate finance counterpart, contingent claims analysis, relies on the principle of arbitrage which, by its very nature, applies only to traded assets. Of course, there are methods of valuation, either when at least some of the assets involved are traded or there are close substitutes to the nontraded ones in the marketplace. However, the option framework is sufficiently rich to be useful for gaining insights into the problem even when the assets are not traded, or when the cost of replicating an options position is prohibitive. An alternative to the arbitrage method that is independent of preferences but requires that the assets be tradable is the preference-based approach first analyzed by Rubinstein in the *Bell Journal of Economics*, in 1976. It is interesting to note that, under certain circumstances, the two approaches lead to the same valuation result. Hence, the precise choice between the two approaches should be made depending on the nature of the specific problem at hand and how closely it approximates the two alternative sets of assumptions.

The method of analysis in the contingent claims approach to valuation of assets requires an exogenous specification of the stochastic process generating firm value. In many cases of corporate asset valuation, such as capital budgeting, the acceptance of the project may itself affect the stochastic process generating firm values. If the asset is to be viewed as a contingent claim on firm value, there is an obvious problem of simultaneity which has to be carefully modeled.

A related issue is the question of asymmetry of information between the owners of various corporate claims. This issue is discussed at length in Part II of the book, which deals with informational issues and agency costs and their impact on corporate financial decisions. The various claimholders of a firm, for example, debt and equity holders, may have different information regarding the firm's future prospects and, further, each class of investors will pursue its own self-interests. In a situation of conflict of interest between the claimholders, the decisions made by the managers who may represent the equity holders may be quite at variance with those implied by a full-information model. This point has particular relevance to contingent claims analysis, which views corporate assets and liabilities as options on the firm. For example, the exercise policies of these options and the issuance of such securities by the firm may be more fully explained by analyzing the problem of information asymmetry. This may explain why the predictions from contingent claims analysis about optimal financial structure policy of the firm are not borne out in actual practice.

Another issue that may be important for the valuation of securities from the viewpoint of corporate finance is the nature of the risk of the firm's investment projects over time. In particular, the pattern according to which the risk of a project is resolved over time will have an impact on how the claims issued against the project are valued. For example, an investment in a timber plantation may have considerable risk when the saplings are young, but the risk diminishes as the trees mature. By contrast, an investment in a typical industrial project may have growing risk over time. Since the pattern of resolution of uncertainty is different in the two cases, it follows that the values of the claims contingent on the pattern of the cash flows of the firm would be different. While much of the literature in the area, so far, has dealt with models where the resolution of uncertainty is smooth, i.e., where risk increases monotonically with futurity, there is increasing interest in models that incorporate more general patterns of risk resolution. There will be more of such models in the future.

The survey paper by Scott Mason and Robert Merton provides a synthesis of option-theoretic approaches in corporate finance. The authors first outline the principles of valuation of options on common stock and provide the motivation for the Black-Scholes model. They then develop the rationale for valuing corporate securities as options and provide a description of the methods of contingent claims analysis. Finally, they shed light on some of the likely future developments in this area the beginnings of which are already evident; in particular, models for valuing corporate assets. Using examples of the various types of options embedded in most investment projects, they provide convincing arguments for explicitly taking into account these options in capital budgeting decisions.

Mason and Merton emphasize the relevance of contingent claim analysis for the formulation of corporate strategy. Since options are virtually the same as "flexibility" in strategic terms, contingent claims analysis provides an integrated view of the valuation of the firm's assets and liabilities. On the financing side, the trade-offs between the various factors involved such as tax shields, financial distress, and the reduction of flexibility can be taken into account explicitly. In the case of investment decisions dealing with corporate assets, the various options that form an integral part of projects such as timing, scale, and the option to abandon the project can be properly evaluated.

Martin Leibowitz and Andrew Kalotay bring the practitioners' viewpoint into the discussion. Leibowitz argues that contingent claims analysis is a useful framework for viewing corporate assets

and liabilities in practice. However, he says that the explicit valuation methods used may not always be appropriate, since the practitioner may be more interested in the flavor of the problem than the actual numerical results.

Kalotay is concerned with his perception of the poor predictive power of the prescriptions of contingent claims analysis, particularly for callable convertible bonds. He emphasizes the impact of taxes, which does not receive much attention in the literature of valuing corporate securities. He argues that practitioners are less concerned with the optimality of their decisions than with efficiency and makes a plea for an "engineering" approach to solving actual valuation problems.

In the research paper of the first section, Thomas Ho analyzes the impact of interest rates on the valuation of bonds with a sinking-fund provision. This paper is somewhat different from many others in the literature on option valuation approaches in corporate finance since it focuses on interest-rate risk rather than the risk of default. He argues that issuers of bonds with a sinking-fund provision have a choice between two alternative methods of fulfilling their sinking-fund obligations: retirement of an appropriate portion of the outstanding bonds at par or purchase of this proportion in the open market. He models this choice, which is termed the delivery option, using the methods of contingent claims analysis.

Viewed in the context of contingent claims analysis, the sinking-fund bond may be seen as a combination of a pure discount bond and an options position. Making assumptions about the stochastic processes underlying the term structure of interest rates, Ho derives the relationship for the yield spread or the interest-rate differential resulting from the sinking-fund provision. He then presents some empirical evidence in support of his theoretical analysis.

