THE THEORY OF FINANCIAL DECISIONS

Haley/Schall

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Second Edition

Charles W. Haley
Lawrence D. Schall

*Department of Finance, Business Economics,
and Quantitative Methods
University of Washington*

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The primary objective of this book is the same as that of the first edition. We wish to provide a rigorous, consistent development of the theory of finance and its implications for managerial decisions. The first edition found widespread use at the graduate level, often in introductory course sequences. It frequently served as a unifying text for graduate seminars and for advanced undergraduate classes. The changes made in this revision are designed to enhance these applications. We have reviewed the entire text and made changes to improve its clarity and readability. A substantial amount of new material has been added to extend our basic analysis in some areas and to reflect recent work in the field. As before, our emphasis is on theory rather than practice; therefore, empirical work is not discussed in depth.

The first three chapters introduce the basic concepts under assumptions of perfect capital markets and certainty. Chapter 4 provides a review of subjective probabilities and mathematical statistics. Chapter 5 examines individual choice under uncertainty and develops the concept of utility functions of the Von-Neuman and Morgenstern type. New in this edition is an appendix to Chapter 5 which covers the mathematical properties of utility functions and the measures of risk aversion for an individual. Chapter 6 is an introduction to portfolio theory, and Chapters 7 and 8 discuss the single-period mean-variance model of capital market equilibrium and its implications for financial decisions. A new appendix to Chapter 8 examines alternative specifications of the required rate of return (discount rate) for firm investment decisions. Most of the changes in these first eight chapters are of an editorial nature. The only exceptions are the new appendixes to Chapters 5 and 8 and a change made in Chapter 3. The project analysis approach of Chapter 3 was revised in response to problems faced by students regarding the definitions of alternatives within a project. Users of the first edition please take note.

The remaining chapters of the book have been substantially revised and reorganized. Chapter 9 introduces the problem of multiperiod valuation under uncertainty in discrete time. We have added a new section containing a multi-period extension of the mean-variance model. Appendix 9A is now a formal presentation of the time-state preference model that is introduced in the text of Chapter 9. (Material from Appendix 9A of the first edition dealing with the firm's objective is now part of Chapter 17.) Chapter 10 and Appendix 10A are entirely new in this edition. We provide here an introduction to continuous time valuation and the option pricing model of Black and Scholes. The chapter itself is a general presentation without extensive mathematics, and the appendix provides the basics of stochastic calculus and a derivation of the Black-Scholes model. Chapters 11, 12, and 13 examine the financing and investment decisions of firms under assumptions of perfect markets. These chapters reflect only modest revisions from their counterparts, Chapters 10, 12, and 13 of the first edition.

Chapters 14 through 17 examine financial decisions under imperfect markets. Almost all this material is new to the book. Chapter 14 is an introduction to problems posed by departures from the perfect market assumptions used in the book to that point. This chapter also summarizes much of the material found in the subsequent chapters. Many instructors may find Chapter 14 a suitable point to stop. Chapter 15 presents a theoretical analysis of the impact of agency costs, bankruptcy costs, personal taxes, and other imperfections on the financing and investment decisions of the firm. Chapter 16 examines issues regarding leasing and merger decisions under both perfect and imperfect markets. Chapter 17 concerns the theory of firm objectives. Although Chapter 17 as well as the appendixes to Chapters 14 through 16 are directed primarily toward doctoral students, we have tried to present issues and concepts in a manner appropriate for MBA students majoring in finance and for exceptional under-graduates. This material reflects the state of the art in finance and deals with difficult problems. It therefore relies more heavily on mathematical logic than do other parts of the book. Throughout we attempt to achieve a compromise between the requirements of general, rigorous proofs and an objective readabil-ity and intuitive understanding.

A one-quarter course for students lacking prior preparation in financial theory can be built around Chapters 1 through 8. An alternative, somewhat more difficult sequence for the same students is Chapters 1 to 3, Chapter 9, and Chapters 12 to 14. If students have the requisite background, the instructor has much more latitude in the selection of material to be covered.

Our reorganization of the book reflects our views of the proper sequencing of material; however, it is possible to skip over some chapters in order to cover later ones. Chapters 1 to 3 serve as a general introduction, but students can proceed rapidly through them if their previous course work includes some financial theory. Chapters 4 to 8 may be omitted without serious problem. The section in Chapter 9 on the multiperiod mean-variance model assumes knowl-edge of the single-period model developed in Chapter 7, but otherwise the

discussions in Chapters 9 to 17 do not rely on Chapters 4 to 8. Chapters 4 to 7 can serve as a quick review for students with a background in portfolio theory so that it is possible for these students to move rapidly to the analysis of firm financial decisions in Chapter 8.

Chapter 9 serves as the keystone of the remainder of the book and is a prerequisite for Chapters 10 to 17. Chapter 10 may be omitted or included as desired. To a degree, the Chapter 10 continuous time framework is a contrast to the Chapter 9 valuation models, but it also relies on the time-state model presented in Appendix 9A. Although it is certainly not required, we feel that if Chapter 10 is to be used, it would best be assigned immediately following Chapter 9. Chapters 11, 12, and 13 are designed to be covered in that sequence; however, Chapter 13 may be omitted at the option of the instructor. Chapter 14 relies on the development of Chapters 11 and 12 and, somewhat, of Chapter 13. Chapter 14 is an essential prerequisite to Chapter 15 and helpful for Cahpters 16 and 17. Chapter 15 is not needed for an understanding of Chapter 16 and may be skipped in order to move directly from Chapter 14 to Chapter 16. The primary prerequisite to Chapter 17 is Chapter 9, although coverage of Chapters 11, 12, and 14, and 15 prior to Chapter 17 is recommended.

College algebra remains the only mathematical prerequisite for the main portion of the text. Many of the appendixes and some special sections denoted by a † require calculus. A background in mathematical programming is recommended for the section in Chapter 15 concerning investment decisions.

We have been greatly helped by many of our students and colleagues in the profession in writing both this and the first edition. The original contributions of Robert Hamada and Robert Winkler remain in this edition. We are also indebted to three of our University of Washington colleagues who reviewed sections of the manuscript and provided many valuable comments—Ritchie Campbell, Richard Castanias, and Harry DeAngelo. G. O. Bierwag, John J. McConnell, and David A. Umstead deserve special thanks for very carefully reviewing the manuscript before its final stage. Our appreciation also goes to one of our students, Linda Lashlee, who saved us some embarrassment and readers considerabie confusion by reviewing and proofreading all new material in the text. And we thank the numerous other people who have, over the years, offered us both encouragement and constructive criticism.

Some of the discussion and proofs presented here appeared in articles in *The Journal of Business, The Journal of Finance, The Journal of Financial and Quantitative Analysis,* and *The Review of Economics and Statistics.* We thank these journals for allowing us to draw on such works in preparing the material presented here.

Charles W. Haley
Lawrence D. Schall

FREQUENTLY USED SYMBOLS

The table provides the generic definitions of symbols which are frequently used in the text. Generally, those variables which are found in only one chapter are not included. The page references are to a more complete discussion of the meaning of the variable. The variables may appear with special subscripts to indicate the use of the variable in some particular sense; for example X_t, the value of X at time t. The symbols appear in boldface in later chapters of the text to indicate that they are vectors; see the discussion at the beginning of Chapter 9 on this notation. A tilde over a symbol is used to indicate that the variable takes on its values according to a probability distribution. A "bar" indicates the expected value of the variable.

Symbol	Definition	Pages on which defined
English letter symbols:		
B	Value of the firm's bonds (debt)	282
B^N	The value of new bonds issued to finance investment	304
$B^{O'}$ and B^O	The zero investment and postinvestment values of the firm's old bonds	304
cov[,]	Covariance between two variables enclosed by the brackets	82
D	Dividends paid by the firm	23
D_0' and D_0	Current (time 0) dividends to old shares with zero investment and with the investment budget, respectively	304
DP	Depreciation	215
$E[\ \ ]$	Expected value of the terms enclosed by the brackets	76
F	The costs of financial distress	446

Symbol	Definition	Pages on which defined
i	Riskless rate of interest	18, 144
k	Equilibrium rate of return	199, 227
I	Firm investment	209
r	Rate of return*	145, 191
R	Interest payments to bonds	215
R^O	Interest to the firm's old bonds	292
S	Value of the firm's shares	282
S^N	The value of new shares issued to finance current investment	304
$S^{O'}$ and S^O	The zero investment and postinvestment values of the firm's old shares	303
V	The value of the firm, where $V = S + B$†	282
V'	The value of the firm with zero investment	303
$V[\ \ ]$	Market value of the term in brackets, e.g., $V[\tilde{Y}]$ is the market value of income stream $\tilde{Y}$	218
var[ ]	Variance of the terms enclosed by the brackets	77
W_S	Wealth of the firm's old shareholders provided by their ownership of the firm	304
X	Firm cash income (revenues less expenses)	209
Y	Net cash flow paid to owners of the firm's securities $(= Y^B + Y^S)$††	210
Y'	Zero investment net cash flow paid to owners of the firm's securities	307
Y^B	Net cash flow paid to all bonds of the firm	210
Y^{BO}	Net cash flow paid to old bonds	213, 291
Y^S	Net cash flow paid to all shares of the firm	210
Y^{SO}	Net cash flow paid to old shares	213
Z	The net cash flow generated by project Z	317
Greek letter symbols:		
γ	The proportion of investment financed with debt	329
θ	Ratio of outstanding bonds to the total value of the firm	337
λ'	Slope of the capital market line $(\lambda = \lambda'/\sigma_M)$	147
ρ	Correlation coefficient	82
σ, σ^2	Standard deviation; variance	78
τ	Tax rate (the firm tax rate if no subscript or superscript; personal tax rates have subscripts or superscripts)	215
ϕ	The proportion of current investment financed by new stock or new bonds, i.e., $\phi = (S^N + B^N)/I_0$	304

* This is referred to as the "internal rate of return" in Chap. 3.
† This also signifies the value of the firm given the capital budget that is adopted; see page 303.
†† In Chap. 2, Y is used to signify any income stream received by an individual.

CONTENTS

INTRODUCTION

The topic of this book is the theory of financial decisions of individuals and business firms. All theory involves abstraction from the complexities of actual experience. In this initial chapter we present the fundamental abstractions from reality that form the basis of our discussion in later chapters. We are primarily interested in individual decisions as they affect firm decisions. Therefore, the theoretical development of individual decisions is less extensive than that of firm decisions. Nevertheless, substantial analysis will be devoted to the problems of individuals. Our first concern must be the nature of financial decisions and the objectives of the decision maker.

FINANCIAL DECISIONS IN GENERAL

People are making decisions all the time. Some decisions involve relationships with other people; some decisions involve purchases of goods and services; some decisions involve the commitment of time to activities. Financial decisions may be broadly characterized by three factors: money, time, and risk. The theory of finance is concerned with the problem of evaluating alternative future monetary flows or values. Since the future is in general uncertain, the problem becomes one of evaluating risky monetary flows or values over time.[1]

. [1] We shall use the words "risk" and "uncertainty" as meaning the same thing. This usage differs from that of some authors who distinguish between the two. See chap. 4 for additional discussion.

For the present discussion, the risk factor will be ignored, as it will be our major concern beginning with Chap. 4. Let us therefore look at the problems posed by money and time.

First, our view of the world must be organized into a form that is convenient for analysis. We assume that there are three components to the world which are important to financial decisions—individuals, firms, and financial markets.[2] Individuals own the firms and purchase the goods and services provided by them. Firms are devices for the production of goods and services (including financial services) that are managed by people who make decisions with respect to their operation. We therefore have two kinds of people: individuals and managers. Individuals are consumers and owners of firms' securities; managers are people who operate firms. The financial markets are most conveniently thought of as a place where transfers of securities occur. In the real world, of course, the financial markets are anywhere such transfers occur. The term "financial markets" really refers to the existence of an undefined means of effecting transfers of securities. This is consistent with the general use of the concept of a "market" in economics.

Individual Financial Decisions

An individual's financial decisions are made within the confines of two constraints: wealth and opportunities. An individual's wealth consists of two components—nonhuman assets and human assets. The latter is the value of labor income, which results from the individual's employment as a producer of goods and services. We shall assume throughout that the characteristics of basic labor income are given and that the individual's financial decisions do not affect this income. The individual's human assets are assumed to be nontradable and given, whereas the nonhuman assets are assumed to be tradable in the market. Of course, the attributes of labor income very much affect the individual's financial decisions. Nonhuman assets in general can be divided into several types—money, securities, and physical assets. To keep our analysis of individual decisions simple we shall assume that individuals do not have physical assets.[3] Physical assets will be assumed to be held by firms. We shall use the

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[2] Governments will also be assumed to exist in considering tax effects. The existence of government securities (bonds) is also assumed. However, the investment and other expenditure activities of governments will be ignored.

[3] Assets refer to possessions yielding future benefits. The physical assets an individual might hold include "consumer durables," which yield future services (and therefore have current value), and physical assets held for investment. Inclusion of these assets into the analysis of individual decisions would substantially increase the discussion required without adding appreciably to the main topic of this book, the theory of firm decisions. In analyzing *firm* financial decisions, no restriction is imposed on the nature of individual asset holdings; i.e., individuals may hold consumer durables or producers' goods.

term "cash" instead of "money" to refer to spendable funds (currency, coin, demand deposits) and shall assume that an individual's cash balances are held only to pay for current consumption (more about this later). The remaining asset is securities—"paper" claims against the future income of firms. Therefore, we can consider an individual's wealth position to be determined by the individual's total income (labor income plus income from securities) and cash balances.

An individual's opportunities consist of consumption over time, purchase or sale of financial securities, and issuing personal financial securities (claims against future income). *We shall assume that the fundamental problem for the individual is how to allocate consumption over time given the individual's wealth and opportunities.* In analyzing the choices an individual might make, we assume that individuals are rational in the sense that they do the best they can in achieving the maximum satisfaction from their consumption patterns. The financial decisions an individual must make in achieving this objective are:

1. The amount of consumption in each period over time (consumption)
2. The amount and type of securities to be held in each period (investment)
3. The amount and type of claims to be issued in each period (financing)

Much of the subsequent analysis in this book is devoted to developing theories of how individuals might make such decisions. Note that the choice of which goods and services to consume in each period is not included in the list above. This decision, although clearly related to the individual's financial decisions, is not considered here. Of interest here is the total outlay for consumption and not the allocation of that outlay to particular commodities. A more detailed analysis of the consumption decision is beyond the scope of this text.

Firm Financial Decisions

Perhaps the fundamental economic and financial decision of the firm is that of determining the level and composition of its investment. Firms can invest in either physical assets or financial assets (securities). Such investment decisions determine the firm's future income. The returns from investment are influenced by factors that are either out of the control of management (conditions in the markets for the firm's products or services) or, in the case of operating decisions, excluded from the analysis.

A firm must make two additional and related financial decisions: first, how much of its current income to pay out to the owners of the firm (the dividend decision), and second, the amount and type of financial securities to issue (the financial structure decision). These constitute the financing decisions of the firm. Therefore, firms are considered to make two general types of financial decisions: *investment decisions* and *financing decisions*. These are the principal subjects of this text.

MANAGERIAL OBJECTIVES AND THE AGENCY RELATIONSHIP

Although we shall continually refer to "firm decisions," firms in fact do not make decisions, managers do. Some firms are managed by their owners; other firms have managers hired directly or indirectly by their owners. The fact that a great deal of economic activity is carried on by firms whose management is hired only indirectly by the owners presents a basic problem. The owners of a firm are individuals who are concerned with achieving their desired patterns of consumption over time. The managers may or may not have direct knowledge of the preferences of the owners and in any case may have considerable freedom to pursue a variety of objectives. Three problems result:

1. *Should* managers seek to act in the best interests of the owners?
2. *Do* managers seek to act in the best interests of the owners?
3. *If* management is to act in the best interests of the owners, what criteria should management use in making financial decisions?

In this text we focus primarily on the third problem. We usually assume that management is attempting to promote the welfare of the firm's owners in making financial decisions or, at least, is concerned as to the impact of financial decisions on the firm's owners. Therefore, we wish to specify precisely how financial decisions should be made so as to benefit the owners of the firm. The first two problems, although interesting and important, are only in part within the theory of finance and enter into other realms of economic and social theory.[4] Even so, some comments regarding these issues are appropriate here, and aspects of these two problems will be examined in future chapters.

The question of whose objectives should be pursued by management raises issues of public policy and economic organization. The objectives of at least five groups might be considered: the managers themselves, the firm's owners (stockholders), the owners plus all people holding financial claims issued by the firm, all parties involved in the firm's operations including workers and the firm's customers, and the total society. Under classical capitalism, maximum social welfare is assumed to be achieved through private ownership of firms which are operated to benefit the owners. In socialistic societies, ownership is vested in the government, and managers are presumed to act more directly to benefit the total society. In both cases managers are considered to be agents of the owners—everyone under socialism and a subset of society (capitalists) under capitalism. Regardless of the form of ownership, there are divergent views as to the "social responsibility" of management. Many people in

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[4] For a more comprehensive discussion of some of the issues here, see Solomon, "The Theory of Financial Management," chap. 2, and Jensen and Meckling, "Theory of the Firm: Managerial Behavior, Agency Costs, and Ownership Structure" (both works are listed in the Suggested Readings at the end of this chapter).

capitalistic societies believe that the managers of large firms should be directly concerned with the welfare of society, not merely the owners or other participants in the firm. Many people in socialistic societies believe that managers should concern themselves with efficient operation of their enterprises and leave the social policy questions for government officials to resolve. These broad issues are clearly outside the scope of finance.

More narrowly, in this text we might examine the interests of those parties who have a direct financial stake in the success or failure of the firm. We can divide this group into two classes—creditors and owners. The creditor group consists of all parties that hold fixed financial claims against the firm. Such claims include pension liabilities, trade accounts payable, wages and salaries payable, liabilities to customers under warranties on prepaid purchases, various forms of debt (leases, notes, mortgages, bonds, etc.), and other securities issued by the firm such as preferred stock. The owners of the firm (common stockholders) have the rights to residual income and assets after creditor claims have been met. The interests of creditors need not coincide with the interests of owners, and we consider the problems posed by this lack of coincidental interests later, especially in Chap. 17. Here we note only that, under conditions assumed throughout most of the book, the interests of the owners are served by acting in ways that benefit both owners and creditors. This topic definitely falls within the scope of finance and is becoming an important issue in the theoretical literature.

The first problem noted above is, largely, a theoretical and philosophical issue; the second one considers how managers behave in practice. Do managers generally act to promote the owner's welfare, or do they serve one of the other groups? A possibility of concern since the time of Adam Smith (1776) is that managers act in their own personal interests and pursue objectives that may or may not contribute to the welfare of owners, of other participants in the firm's activities, or of society at large.

Managers can be viewed as agents of the owners, hired to operate the firm for the owners' benefit. If the firm is owned and managed by the same person, there is no possible conflict in objectives. This is one extreme case. At the other end of the spectrum, the firm's management has no ownership interest in the firm or, in a socialist society, only a minute portion as members of the total society. Thus managers may be owners or purely agents of the owners or anywhere in between. Suppose we assume that managers operate to serve their own best interests. Will their best interests coincide with those of the owners? To the extent that there is a divergence in interests, the owners are less well off than would be so if no divergence existed. The owners' losses are costs of the agency relationship.

Are such agency costs large? The answer is not clear at present, but there are some theoretical arguments that suggest that they are not great. Under idealized conditions (perfect markets), managers have no choice but to strive to maximize the welfare of the owners. Otherwise they would be fired. This is so