高等院校双语教材·金融系列

FINANCIAL ENGINEERING PRINCIPLES

A UNIFIED THEORY FOR FINANCIAL PRODUCT ANALYSIS AND VALUATION

金融工程

佩里·H·博蒙特 (Perry H. Beaumont) 著

林清泉 编审

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出版说明

随着金融全球化进程的不断加快，金融人才的竞争日益激烈，用国际通用的英语来思考、工作、交流的能力也越来越重要。如何顺应这一潮流，培养和造就专业知识和语言水平都具有竞争力的金融人才，一直是各大高等院校和一些主要教材出版单位思考的重要问题，开展双语教学是教育界的共识。双语教学在我国主要指采用汉语和国际通用的英语教学，目的是培养全面的适合国际交流的高素质人才。由于我国长期以来缺乏英语交流的环境，开展双语教学面临着特殊的困难，我们认为双语教学从一开始就应该使用原版的优秀教材，保证语言的原汁原味。

顺应这一潮流，中国人民大学出版社携手国际著名的出版公司，推出了适合经济金融专业的双语系列教材。本套教材具有如下几个特色：

第一，精选教材。本套教材遴选了一批国外优秀的教材，涉及金融学、投资学、公司理财、金融市场与机构、国际货币与金融、国际投资、跨国公司财务管理、金融工程、银行管理、保险学等10门课程，涵盖了金融专业开设的主要必修科目。

第二，保持原教材的特色。本套双语教材广泛听取了一线任课教师的意见和建议，考虑到课时要求，采用了删减影印加中文注释的形式，主要是删减了一些相互重复的以及不适应我国国情的内容，但在体系结构和内容特色方面都保持了原教材的风貌。

第三，中文注释，重点突出。为了方便双语教学的开展，我们邀请了金融专业一线的优秀教师对该系列教材添加了中文批注。中文注释主要是针对重点、难点内容，而且在每章的前面都加注了中文导读，方便学生对重点内容的把握。

本套教材主要适用于高等财经院校经济金融专业的本科教学，同时也适用于金融行业从业人员以及对金融专业感兴趣的人士。

本套教材是对双语教学的积极探索，错误遗漏之处在所难免，恳请广大读者指正。

中国人民大学出版社

审译者前言

金融工程是一门新兴且快速发展的学科。金融全球化与金融自由化的背景为金融创新提供了有利的环境，越来越多的新型金融产品不断涌现，其中包括各种各样的金融衍生产品，与此同时也促进了现代金融学的不断发展，而金融工程思想正是萌芽并成型于这一过程当中。当人们越来越倾向于使用金融工程的思想和技术来解决复杂的金融、财务问题，并不断地发展和完善相应的理论体系的时候，金融工程学科的产生也就自然而然了。

1991年，国际金融工程师协会（International Association of Financial Engineers，IAFE）的成立标志着金融工程学的正式诞生。作为金融学的最新发展，金融工程要求综合运用金融、数学、工程等思想和方法来设计并开发新型金融产品，创造性地解决金融问题。金融工程的核心在于“创新”与“创造”，它要求人们根据市场需求，开发和设计出最优的金融工具，应用工程的思想和方法提出高效的解决方案。这一特点使金融工程学有别于传统的金融学科，也使其成为金融学科中最具活力的一个分支。在实践中，金融工程的迅速发展对整个金融行业乃至整个经济领域已经产生了深远的影响。

随着中国金融行业的全面开放，中国的经济将更多地融入到全球化的潮流当中。逐渐深化的金融体制改革使得国内金融市场不断发展和完善，同时也不断提出新的问题和要求。如何设计适合我国的新型金融产品和工具，如何为投资者提供行之有效的风险管理方案，如何帮助政府实现有效的金融市场监管，这些问题的解决不仅可以促进金融体制的进一步改革，还可以有效地保证金融市场的平稳发展。毫无疑问，金融工程的思想和技术为上述问题的解决提供了行之有效的途径。

佩里·H·博蒙特博士的《金融工程》一书为金融工具的分析和定价提供了一个统一的理论框架。书中展示了如何运用独特的三角分析方法来分解和构建金融产品和工具，从而进行最优的投资决策。全书的理论框架有三个基本因素：产品（股票、债券和外汇）、现金流（现货、远期与期货、期权）和信用（从产品、现金流和发行人三方面进行分析），在此基础上，本书介绍了如何分析运用上述基本因素进行投资分析和决策，通过介绍和分析金融工程、风险管理和市场环境三方面的内容，作者为投资者详尽地阐述了如何更好地评估市场机会并构建有效的投资组合。

全书有两个突出的特点，一是其特有的三角分析方法，书中的每一章都分为三个主题，构成三角分析法中的三个点，而且三个主题既相互联系，又相对独立，共同构成每章完整的分析框架。每三章又构成一个大的三角框架，前三章构成了全书理论框架的基础，而后三章又是前三章的运用。二是与其他分析金融产品的书籍不同，本书主要介绍不同金融产品的相似之处，分析如何将具体的金融产品分解为前面所述的三个基本因素的组合，而不是重点介绍产品之间的区别和不同。

林清泉、张建龙、杨丰、荣祺、刘伟琳、魏刚、马荷等参与本书的翻译，全书由林清泉教授审校。

林清泉

2007年4月于北京

Foreword

Casting aside the traditional notion of financial products grouped within distinct, relatively isolated asset classes, Beaumont insightfully uncovers common characteristics that allow the practitioner to better understand interrelationships between bonds, equities, and currencies. Importantly, the author drafts a hands-on roadmap to help investors manage these asset management building blocks within an integrated portfolio context.

Moving aggressively away from "box thinking," the author creatively develops an applied geometry of self-contained triangles to accent the essential functional qualities of various product or cash flow categories. Macrotopics are then added around the perimeter of these triangles to illustrate common traits or themes that the author pulls together to help weave the complex fabric of financial engineering.

The text and the entire Appendix for Chapter 4 are peppered with practical examples that give *Financial Engineering Principles* a "real world" flavor. In this way, professionals and laypersons alike have access to a virtual Global Positioning System to safely and swiftly navigate the most challenging of financial straits, even as the market environment changes, strategic courses are recalibrated, and new investment vehicles evolve.

Particularly timely, in a global financial arena marked by periods of excessive volatility and widespread uncertainty, Beaumont devotes an entire chapter to strategies and instruments that can help the portfolio manager better quantify, allocate, and manage (or hedge) critical investment risks. By employing a fresh cross-market approach, the author draws not just on product-related risk drivers, but also on cash flow and credit interrelationships to develop a richer, more powerful approach to risk management.

Financial Engineering Principles combines the best of a well-crafted "practitioner's guide" with an invaluable "reference work" to give readers a financial engineering tool that will undoubtedly become one of the most used tools in their investment management tool chest.

Gilbert A. Benz
Executive Director
Investment Solutions
UBS, Zurich, Switzerland

Preface

After nearly 20 years in the financial industry, and with assignments that have taken me to every corner of the globe, it is only now that I feel this book could be written.

In my first text, *Fixed Income and Synthetic Assets,* the idea was to trek from the front of the yield curve to the back and provide ideas for how a properly equipped financial toolbox could help identify trading strategies and perhaps even assist with creating new financial products in the world of fixed income.

Here my goal is to introduce a unifying theory among the various factors that make up the world of finance. The three fundamental factors to this unified theory are products, cash flows, and credit. With a solid grounding in these first principles, we will show how any financial security can be better understood by financial professionals, students, or individual investors who desire to go beyond more basic financial concepts.

After having spent years teaching about the financial markets, I continue to find it disheartening that some students feel that global markets are far more disparate than they are similar and shy away from thinking in a more eclectic and encompassing way about the world. There are many common elements across markets, and the potential insights to risk and reward that can be gained from a more unified approach are simply tremendous.

While one overall goal of the book is to highlight the unifying aspect of my approach to these key financial markets, the chapters can be quite instructive on a stand-alone basis. By this I mean that a reader who is primarily interested in bonds will not have to read any chapters beyond those within the bond sections to fully capture the essence of that product type. To this end, it bears emphasizing that when I refer to a unifying theory of the financial markets, I am referring both to a unifying aspect within each market segment and across them.

We are most certainly at a crucial juncture of the markets today. Recent lessons have shown us that a new market dialogue is required. The generic labels commonly used within finance today do not convey the same meaning and value that they did years ago. A blanket reference to a bond versus an equity ought no longer to evoke a sense of the former being a safer investment than the latter; just the opposite may be true in today's highly engineered marketplace. Unfortunately, the new kind of dialogue that financial professionals must now practice does not fit the easy classifications that suited the marketplace for decades if not centuries. It is not nearly enough

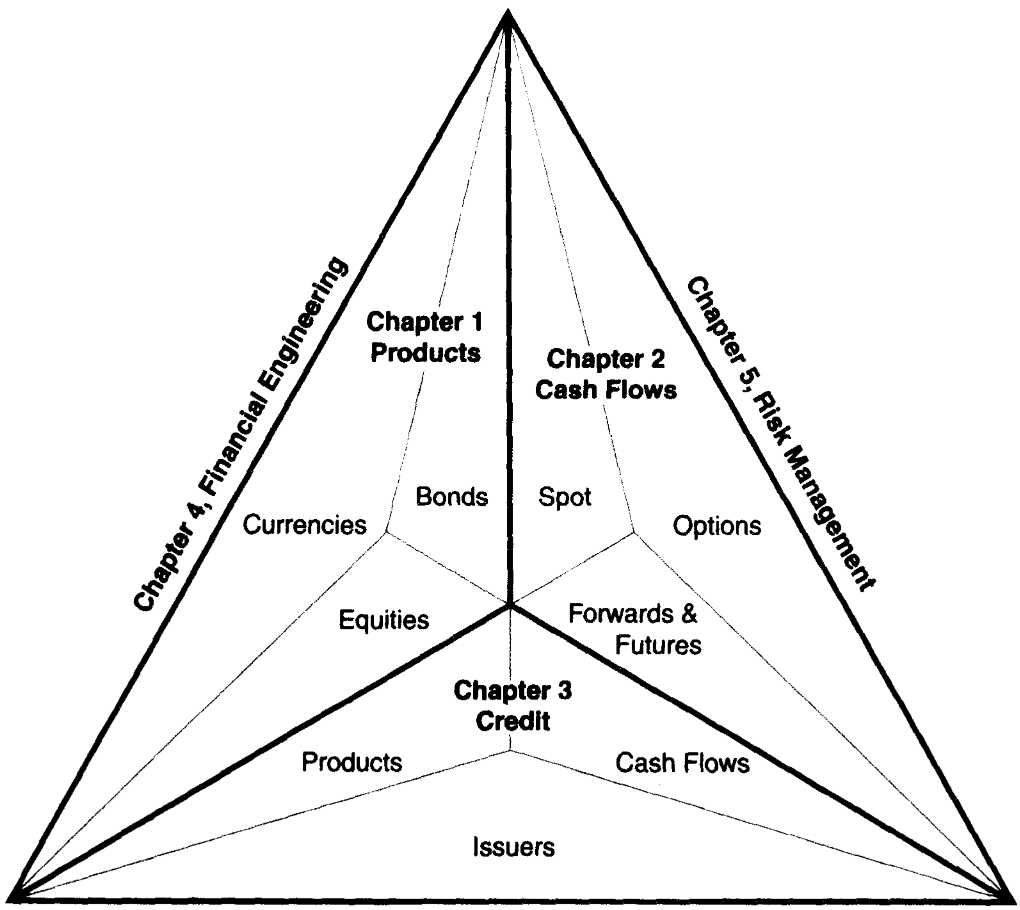

FIGURE P.1 High-level overview of chapters and topics.

to state that credit is a factor that permeates all markets, or that legal considerations are key when determining what happens in the event of a default. What is now absolutely essential is a clear understanding of the interrelationships among these (and many other) market dynamics and how the use of such tools as probability theory and historical experience can help to guide informed and prudent decision making.

The world of finance is not necessarily a more complex place today, but it is most certainly a different place. A large step toward understanding the new order is to embrace the notion of how similar financial products truly are rather than to perpetuate outlived delineations of how they are so different. The dialogue in support of this evolution does not require a new, different vocabulary; rather we must use our existing vocabulary in a richer and more meaningful way to portray more accurately a relevant perspective of a security's risk and reward profile. Terms like "duration" and "beta" have been around for a long time and are commonly used, though they are woefully insufficient now as stand-alone concepts; they are much more valuable to investors when seen in broader context alongside other financial measures. This text shows why and presents new ways that long-standing metrics of risk and return can be combined to assist with divining creative and meaningful market insights.

Figure P.1 presents the layout of the entire book within a single diagram. The concepts of products (bonds, equities, and currencies), cash flows (spot, forwards and futures, and options), and credit (products, cash flows, and issuers) are intended to represent more specific or micro-oriented considerations for investors. Conversely, the concepts of financial engineering (product creation, portfolio construction, and strategy development), risk management (quantifying risk, allocating risk, and managing risk), and market environment (tax, legal and regulatory, and investors) are intended to represent more general or macro-oriented considerations. While the microtopics are presented pictorially as self-contained triangles to suggest that these are the building blocks of finance, the macrotopics are presented around the perimeter of the triangle to suggest that these are broader and more encompassing concepts. Two of the three topics in Chapter 3 are the titles of Chapters 1 and 2. The significance of this is twofold: It highlights the interrelated nature of markets, and it points out that credit is an extremely important aspect of the market at large.

Let's begin!

Acknowledgments

A work of this type typically is successful only because of the support and assistance of a variety of individuals, and for me this is one of the most rewarding aspects of engaging in a project such as this. The sacrifices asked of immediate family, in particular, are usually great, and I am most grateful to my wife, Aly, and my sons, Max, Jack, and Nicholas, for indulging their husband and father in this latest work. Another dimension of this book is that during the time of its writing I had the good fortune to live and work on two continents and with global responsibilities. These experiences provided considerable food for thought, and I am grateful for that. I also want to thank the anonymous reviewers of this text, though I fully accept any errors as being completely my own. Finally, for their assistance with preparing this book, I want to thank Elena Baladron and Thomas Cooper.

Introduction

This text presents, for the first time, a single unified approach to building bridges across fundamental financial relationships. The top layer of this new methodology is comprised of products, cash flows, and credit. Products are financial securities including equities, bonds, and currencies. "Cash flow" refers to the structure of a security and denotes if the asset is a spot, forward or future, or option. Credit is a factor that winds its way through all of the above. As recent market events readily attest, understanding credit risk is paramount to successful investing.

While laying the fundamental groundwork, the text examines implications for investment-making decisions and develops a framework for how investors and portfolio managers can evaluate market opportunities. Specific trading strategies are presented, including detailed suggestions on how portfolio managers can build optimal portfolios.

In short, this text provides a simple yet powerful introduction to identifying value in any financial product. While primarily intended for professional portfolio managers, individual investors and students of the financial markets also will find the text to be of value. Key financial terms are highlighted in italics throughout the book for easy reference and identification.

While one obvious benefit of specialized texts is that they offer an in-depth view of particular classes of financial products, an obvious shortcoming is that readers gain little or no appreciation for hybrid securities or alternative investments. Is a preferred stock an equity by virtue of its credit rating and the fact that it pays dividends, or is it a bond owing to its fixed maturity date and its maturity value of par? With the rapid pace of financial innovation, convenient labels simply do not apply, and this is especially the case today with credit derivatives. Thus, by virtue of its focus on the dynamics of processes and interrelationships as opposed to more definitional and static concepts, this text provides a financial toolbox that is equipped to build or deconstruct any financial product that may evolve. To reinforce this, each chapter builds on the previous one, and key concepts are continuously reinforced.

Each chapter begins with a reference to a triangle of three themes that will be explored within the chapter. A convenient property of any triangle is that it has three points. Accordingly, if we were to label these three points as A, B, and C respectively, point A is always one step away from either B or C. The same can be said for point B relative to points A and C, or for point C relative to A and B. This is a useful consideration because it supports the notion that while I may refer to three distinguishable niches of the marketplace (as with equities, bonds, and currencies), I wish also to stress how the three particular niches are also related—that they are always just one step away from one another.

Chapter 1 provides fundamental working definitions of what is meant precisely by equities, bonds, and currencies.

Chapter 2 presents cash flows—the way that a product is structured. The three basic cash flow types are spot, forwards and futures, and options.

Chapter 3 presents credit. In its most fundamental form, credit risk is the uncertainty that a counterparty cannot or will not honor its promise to provide a good, service, or payment, and in a timely fashion. The chapter examines credit risk from the perspective of products, cash flows, and issuers.

Chapter 4 demonstrates intra- and interrelationships among the triangles presented in previous chapters and in a product creation context and shows how hybrids can be analyzed. Indeed, with the new building block foundation, the text demonstrates how straightforward it can be to construct or decompose any security. Also presented are ideas on how to construct and trade optimal portfolios relative to various strategies including indexation.

Chapter 5 continues the presentation of the unifying methodology in the context of risk management and considers risk: quantifying, allocating, and managing it.

Chapter 6 presents the market environment, by which is meant the more macro-influences of market dynamics. Three fundamental macro-influences include tax, legal and regulatory, and investor considerations.

Many senior institutional investors and those with considerable market experience traditionally have viewed the bond, equity, and currency markets as rather distinct and generally differentiated asset classes. Indeed, it would not be too difficult at all to assemble a list of how these asset types are unique. For example, the stock market is generally an *exchange-traded* or *listed* market (including the New York Stock Exchange, NYSE), while the currency market is generally an *unlisted* or *over-the-counter* (OTC) market, (meaning not on an exchange), while bonds are more OTC than not, although this situation is changing rapidly. Another point of distinction is that over long periods of time (several years), equities generally have sported superior returns relative to bonds, although also with a greater level of risk. In this context, *risk* is a reference to the variability of returns. That is, the returns of equities may be more variable year-to-year relative to bonds, but over a long period of time the return on equities tends to be greater.

However, similarities among the big three products (equities, bonds, and currencies) are much more dominating and persuasive than any differences. But before listing these similarities, it is worthwhile to list the three points of conventional wisdom that places these asset types into three very different spheres.

1. Stemming largely from their different risk-reward profiles, market professionals who actively trade within these three asset classes generally tend to specialize. Accordingly, equity trading often is protected and isolated from bond trading, and vice versa; currencies also are typically seen as being in their own world.
2. If only from a pure marketing perspective, if asset classes are "packaged" differently and are marketed as truly unique and individual products, it is perhaps easy to understand why the firms that sell these products (as well as many that buy them) are keener to accept differences than similarities.
3. Some powerful ideas within portfolio theory suggest that meaningful diversification can allow for appreciable return enhancement opportunities while also reducing risk profiles. With this particular orientation, the drive to carve out separate and distinct asset classes becomes more understandable.

To avoid misunderstanding, I must emphasize that I do not mean to suggest that equities, bonds, and currencies are identical or even virtually so. However, I do wish to show how these broad asset classes are interrelated and to indicate that while they typically have different characteristics in different market environments, the big three are best understood as being more like one another than unlike. That is, the big three have many things in common, and a pedigogical approach that embraces these commonalities has theoretical and practical value.

Consider the following example. Typically, interest rate risk is perceived to be dominant among bonds while price risk is perceived to be the purview of equities. But consider the risk profile of a long-dated stock option. This instrument type actually trades on the Chicago Board of Options Exchange and is known as a LEAP (for long-term equity anticipation securities). As any knowledgeable LEAP trader will readily state, interest rate risk is quite easily a LEAP's single greatest vulnerability among the key market variables that are used to value an option. Why? Since an option can be seen as a leveraged play on the market, and since leverage means financing, the cost of that financing is measured by an interest rate. The longer the time that a strategy is leveraged, the greater the overall contribution that is being made by the relevant financing rate. Indeed, in some instances, an option need not have a final expiration much beyond six months to have a situation where, all else being equal, the price value of the LEAP responds more to an incremental change in the finance rate than an incremental change in the LEAP's underlying equity price. In other words, for certain longer-dated stock options, the greatest risk at a particular point in time may be the risk associated with financing rather than the underlying equity. Thus, the dominant risk of an equity future may not be an equity price risk but an interest rate risk: the dominant risk of bonds. Some LEAP traders actually buy or sell Eurodollar interest rate futures in combination with their equity option trades so as to help minimize any unwanted interest rate (financing risk) exposure. More on this later.

Without question, global financial markets do encompass much more than equities, bonds, and currencies. To name but a few other key market segments, there are also precious metals and commodities of every shape, size, color, and taste. By choosing to focus primarily on equities, bonds, and foreign exchange, this text highlights the commonality among these three markets; I do not mean to understate the depth and breadth of other financial markets. Indeed, Chapter 5 attempts to link the unified approach to these other markets. The underlying principles for the big three are applicable to every type of financial product.

Why focus on equities, bonds, and currencies? They are well-established markets, they are very much intertwined with one another, and collectively they comprise the overwhelming portion of global trading volume. Investors do themselves a disservice if they attempt to define the relative value of a particular corporate bond to the exclusion of balance sheet and income statement implications of that firm's equity outlook, and vice versa. And certainly both equity and bond investors are well advised to monitor the currency profile of their investments consistently. Even for locally based portfolio managers who are interested solely in locally denominated products (as with a U.S.-domiciled investor interested only in U.S.-dollar-denominated securities), the proliferation of venues to hedge away the currency component of a given security provides the ability to embrace a global investment outlook. With an American Depository Receipt (ADR), for example, a U.S.-based investor can purchase a U.S.-dollar-denominated equity listed with a U.S. equity exchange but with the equity issuer actually domiciled outside of the United States.

As an overlay to the analysis of key financial products, the text devotes considerable attention to credit issues and the ways that certain uses of capital can have profound implications. The notion of symmetry across a firm's capital structure and associated financial instruments is not necessarily a new idea, although it has become increasingly deserving of new and creative insights. In an important paper written in 1958 entitled "The Cost of Capital, Corporate Finance, and the Theory of Investment," Franco Modigliani and Merton Miller first suggested, among other propositions, that the financial instrument used by a firm to finance an investment is irrelevant to the question of whether the instrument is worthwhile; issuing debt to finance an acquisition, for example, will not make it a more profitable investment than issuing equity.[1] While the "M&M propositions" came under much attack when first introduced (notably for what were decried as unreasonable assumptions underlying the propositions), in 1990 Miller received the Nobel Prize in economics, largely due to his work in the area of capital structure, and Modigliani received the same prize in 1985.

It has been said that a useful way of thinking about the various (perhaps even heroic) assumptions[2] underlying the M&M propositions is that they at least contribute to a framework for analysis. If the framework argues for a particular type of symmetry between bonds and equities, asymmetries may be exposed in the process of questioning key assumptions. The same spirit of questioning ought also to be encouraged to better understand any practical or theoretical framework. Thus, students and practitioners of finance must question how existing financial relationships differ (or not) from theoretical contexts and explore the implications. In essence, such exploration is the mission of this text, which provides an innovative way to think about market linkages and synergies and sketches a practical blueprint that both students and practitioners can use for a variety of applications.

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[1]Franco Modigliani and Merton Miller, "The Cost of Capital, Corporate Finance, and the Theory of Investment," *American Economic Review*; December 1958, pp. 261–297.

[2]Within the theoretical context of presenting their ideas, Miller and Modigliani assumed that companies don't pay taxes and that all market participants have access to the same information. In actuality, companies certainly do pay taxes, and in most instances worldwide there is a tax advantage with debt offerings over equity offerings.

目　录