Each chapter includes end-of-chapter questions to help readers test their knowledge of the concepts discussed as well as refine any computational skills needed to succeed.

Understanding fixed income analytics is essential in today’s dynamic financial environment. The Second Edition of Introduction to Fixed Income Analytics will help you build a solid foundation in this field.

FRANK J. FABOZZI, PhD, CFA, CPA, is Professor in the Practice of Finance and Business Fellow at the Wharton School of Management and Editor of the Journal of Portfolio Management. He is an Affiliate Professor at the University of Karlsruhe’s Institute of Statistics, Econometrics, and Mathematical Finance and on the Advisory Council for the Department of Operations Research and Financial Engineering at Princeton University.

STEVEN V. MANN, PhD, is Professor of Finance at the Moore School of Business, University of South Carolina. He has published over ninety articles in finance journals and many books on fixed income and derivatives topics, including The Global Money Market, Measuring and Controlling Interest Rate and Credit Risk, Securities Finance (as coeditor), and The Handbook of Fixed Income Securities (as an assistant editor). Mann is an active consultant to clients that include some of the largest investment/ commercial banks in the world as well as a number of Fortune 500 companies.

INTRODUCTION to FIXED INCOME ANALYTICS

With the Second Edition of Introduction to Fixed Income Analytics, Frank Fabozzi and Steven Mann return with a fully updated guide to the discipline of fixed income analysis. Written for both financial professionals and fixed income newcomers, this essential resource carefully covers the crucial elements of today’s complex bond marketplace—from the various issues associated with investing in fixed income securities to the fundamentals of valuation and interest rate risk.

Fabozzi and Mann offer invaluable fixed income insights, with discussions of relative value analysis and value-at-risk measures; analysis of mortgage-backed and asset-backed securities, convertible fixed income securities, and volatility estimation; and information on instruments like Treasury inflation-protected securities (TIPS). They also highlight one of the most popular systems relied upon by fixed income professionals—the Bloomberg Terminal—and tie in important analytics and functionality.

The fixed income market is one of the largest in the world. It spans many sectors, from Treasuries to mortgages to high yield bonds. If you want to gain a firm understanding of the tools and techniques needed to succeed in this field, look no further than Introduction to Fixed Income Analytics, Second Edition.
Introduction to Fixed Income Analytics
Second Edition
The Frank J. Fabozzi Series

Fixed Income Securities, Second Edition by Frank J. Fabozzi

Focus on Value: A Corporate and Investor Guide to Wealth Creation by James L. Grant and James A. Abate

Handbook of Global Fixed Income Calculations by Dragomir Krgin

Managing a Corporate Bond Portfolio by Leland E. Crabbe and Frank J. Fabozzi

Real Options and Option-Embedded Securities by William T. Moore

Capital Budgeting: Theory and Practice by Pamela P. Peterson and Frank J. Fabozzi

The Exchange-Traded Funds Manual by Gary L. Gastineau

Professional Perspectives on Fixed Income Portfolio Management, Volume 3 edited by Frank J. Fabozzi

Investing in Emerging Fixed Income Markets edited by Frank J. Fabozzi and Efstatia Pilarinu

Handbook of Alternative Assets by Mark J. P. Anson

The Global Money Markets by Frank J. Fabozzi, Steven V. Mann, and Moorad Choudhry

The Handbook of Financial Instruments edited by Frank J. Fabozzi

Collateralized Debt Obligations: Structures and Analysis by Laurie S. Goodman and Frank J. Fabozzi

Interest Rate, Term Structure, and Valuation Modeling edited by Frank J. Fabozzi

Investment Performance Measurement by Bruce J. Feibel

The Handbook of Equity Style Management edited by T. Daniel Coggin and Frank J. Fabozzi

The Theory and Practice of Investment Management edited by Frank J. Fabozzi and Harry M. Markowitz

Foundations of Economic Value Added, Second Edition by James L. Grant

Financial Management and Analysis, Second Edition by Frank J. Fabozzi and Pamela P. Peterson

Measuring and Controlling Interest Rate and Credit Risk, Second Edition by Frank J. Fabozzi, Steven V. Mann, and Moorad Choudhry

Professional Perspectives on Fixed Income Portfolio Management, Volume 4 edited by Frank J. Fabozzi

The Handbook of European Fixed Income Securities edited by Frank J. Fabozzi and Moorad Choudhry

The Handbook of European Structured Financial Products edited by Frank J. Fabozzi and Moorad Choudhry

The Mathematics of Financial Modeling and Investment Management by Sergio M. Focardi and Frank J. Fabozzi

Short Selling: Strategies, Risks, and Rewards edited by Frank J. Fabozzi

The Real Estate Investment Handbook by G. Timothy Haight and Daniel Singer

Market Neutral Strategies edited by Bruce I. Jacobs and Kenneth N. Levy

Securities Finance: Securities Lending and Repurchase Agreements edited by Frank J. Fabozzi and Steven V. Mann

Fat-Tailed and Skewed Asset Return Distributions by Svetlozar T. Rachev, Christian Menn, and Frank J. Fabozzi

Financial Modeling of the Equity Market: From CAPM to Cointegration by Frank J. Fabozzi, Sergio M. Focardi, and Petter N. Kolm


Analysis of Financial Statements, Second Edition by Pamela P. Peterson and Frank J. Fabozzi


Handbook of Alternative Assets, Second Edition by Mark J. P. Anson

Introduction to Structured Finance by Frank J. Fabozzi, Henry A. Davis, and Moorad Choudhry

Financial Econometrics by Svetlozar T. Rachev, Stefan Mittnik, Frank J. Fabozzi, Sergio M. Focardi, and Teo Jasic

Developments in Collateralized Debt Obligations: New Products and Insights by Douglas J. Lucas, Laurie S. Goodman, Frank J. Fabozzi, and Rebecca J. Manning

Robust Portfolio Optimization and Management by Frank J. Fabozzi, Peter N. Kolm, Dessislava A. Pachamanova, and Sergio M. Focardi

Advanced Stochastic Models, Risk Assessment, and Portfolio Optimizations by Svetlozar T. Rachev, Stogan V. Stoyanov, and Frank J. Fabozzi

How to Select Investment Managers and Evaluate Performance by G. Timothy Haight, Stephen O. Morrell, and Glenn E. Ross

Bayesian Methods in Finance by Svetlozar T. Rachev, John S. J. Hsu, Biliana S. Bagasheva, and Frank J. Fabozzi

Structured Products and Related Credit Derivatives by Brian P. Lancaster, Glenn M. Schultz, and Frank J. Fabozzi

Quantitative Equity Investing: Techniques and Strategies by Frank J. Fabozzi, CFA, Sergio M. Focardi, and Petter N. Kolm
Introduction to Fixed Income Analytics
Second Edition

Relative Value Analysis, Risk Measures, and Valuation

FRANK J. FABOZZI
STEVEN V. MANN

John Wiley & Sons, Inc.
FJF
To my wife Donna
and my children Patricia, Karly, and Francesco

SVM
To my wife, Mary – TDA
Preface xiii
About the Authors xv

CHAPTER 1
Time Value of Money 1
Future Value of a Single Cash Flow 1
Present Value of a Single Cash Flow 4
Compounding/Discounting When Interest Is Paid
More Than Annually 8
Future and Present Values of an Ordinary Annuity 10
Yield (Internal Rate of Return) 20
Concepts Presented in this Chapter 26
Appendix: Compounding and Discounting in Continuous Time 27
Questions 31

CHAPTER 2
Yield Curve Analysis: Spot Rates and Forward Rates 33
A Bond Is a Package of Zero-Coupon Instruments 33
Theoretical Spot Rates 34
Forward Rates 44
Dynamics of the Yield Curve 57
Concepts Presented in this Chapter 60
Questions 60

CHAPTER 3
Day Count Conventions and Accrued Interest 63
Day Count Conventions 63
Computing the Accrued Interest 74
Concepts Presented in this Chapter 76
Questions 76
CHAPTER 4
Valuation of Option-Free Bonds

- General Principles of Valuation
- Determining a Bond’s Value
- The Price/Discount Rate Relationship
- Time Path of Bond
- Valuing a Zero-Coupon Bond
- Valuing a Bond Between Coupon Payments
- Traditional Approach to Valuation
- The Arbitrage-Free Valuation Approach
- Concepts Presented in this Chapter
- Questions

77

CHAPTER 5
Yield Measures

- Sources of Return
- Traditional Yield Measures
- Yield to Call
- Yield to Put
- Yield to Worst
- Cash Flow Yield
- Portfolio Yield Measures
- Yield Measures for U.S. Treasury Bills
- Yield Spread Measures Relative to a Spot Rate Curve
- Concepts Presented in this Chapter
- Appendix: Mathematics of the Internal Rate of Return
- Questions

109

CHAPTER 6
Analysis of Floating Rate Securities

- General Features of Floaters
- Valuing a Risky Floater
- Valuation of Floaters with Embedded Options
- Margin Measures
- Concepts Presented in this Chapter
- Questions

141

CHAPTER 7
Valuation of Bonds with Embedded Options

- Overview of the Valuation of Bonds with Embedded Options
- Option-Adjusted Spread and Option Cost

169
## Contents

- Lattice Model 172
- Binomial Model 175
- Illustration 196
- Concepts Presented in this Chapter 198
- Questions 198

### CHAPTER 8

#### Cash Flow for Mortgage-Backed Securities and Amortizing Asset-Backed Securities 199

- Cash Flow of Mortgage-Backed Securities 199
- Amortizing Asset-Backed Securities 238
- Concepts Presented in this Chapter 242
- Questions 244

### CHAPTER 9

#### Valuation of Mortgage-Backed and Asset-Backed Securities 247

- Static Cash Flow Yield Analysis 247
- Monte Carlo Simulation/OAS 249
- Concepts Presented in this Chapter 270
- Questions 270

### CHAPTER 10

#### Analysis of Convertible Bonds 273

- General Characteristics of Convertible Bonds 273
- Tools for Analyzing Convertibles 276
- Call and Put Features 278
- Convertible Bond Arbitrage 279
- Other Types of Convertibles 283
- Concepts Presented in this Chapter 285
- Questions 285

### CHAPTER 11

#### Total Return 287

- Computing the Total Return 287
- OAS-Total Return 290
- Total Return to Maturity 291
- Total Return for a Mortgage-Backed Security 299
- Portfolio Total Return 301
- Total Return Analysis for Multiple Scenarios 301
- Concepts Presented in this Chapter 314
- Questions 314
### CHAPTER 12
**Measuring Interest Rate Risk**
- The Full Valuation Approach 317
- Price Volatility Characteristics of Bonds 324
- Duration 334
- Other Duration Measures 350
- Convexity 360
- Price Value of a Basis Point 365
- The Importance of Yield Volatility 367
- Concepts Presented in this Chapter 369
- Questions 370

### CHAPTER 13
**Value-at-Risk Measure and Extensions**
- Value-at-Risk 373
- Conditional Value-at-Risk 384
- Concepts Presented in this Chapter 385
- Questions 386

### CHAPTER 14
**Analysis of Inflation-Protected Bonds**
- Breakeven Inflation rate 388
- Valuation of TIPS 389
- Measuring Interest Rate Risk 394
- Concepts Presented in this Chapter 397
- Questions 397

### CHAPTER 15
**The Tools of Relative Value Analysis**
- How Portfolio Managers Add Value 399
- Yield Spreads over Swap and Treasury Curves 400
- Asset Swaps 403
- Credit Default Swaps 410
- Concepts Presented in this Chapter 413
- Questions 414

### CHAPTER 16
**Analysis of Interest Rate Swaps**
- Description of an Interest Rate Swap 417
- Interpreting a Swap Position 419
- Terminology, Conventions, and Market Quotes 421
<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>Estimating Yield Volatility</td>
<td>451</td>
</tr>
<tr>
<td></td>
<td>Historical Volatility</td>
<td>451</td>
</tr>
<tr>
<td></td>
<td>Implied Volatility</td>
<td>455</td>
</tr>
<tr>
<td></td>
<td>Forecasting Yield Volatility</td>
<td>459</td>
</tr>
<tr>
<td></td>
<td>Concepts Presented in this Chapter</td>
<td>463</td>
</tr>
<tr>
<td></td>
<td>Questions</td>
<td>463</td>
</tr>
</tbody>
</table>

**Contents**

Valuing Interest Rate Swaps 424  
Primary Determinants of Swap Spreads 440  
Dollar Duration of a Swap 445  
Concepts Presented in this Chapter 447  
Questions 447  

**INDEX**

465
Participants in the fixed income market are inundated with terms and concepts in both the popular press and, more typically, in research reports and professional journal articles. Making life more difficult for professionals in this market sector is the fact that for some important analytical concepts, the same concept is referred to in different ways by different dealer firms and asset management firms. The purpose of this book is to describe the key analytical concepts used in the fixed income market and illustrate how they are computed. The book is not only intended for professionals but also newcomers to the field. It is for this reason that we provide end of chapter questions.

Although market professionals often want a walk through demonstration of how a metric is computed, once they are comfortable with the concept and its computation, professionals then rely on vendors of analytical systems. Probably the most popular system relied upon by fixed income professionals is the Bloomberg System. For this reason, every chapter ties in the analytical concepts that are available on Bloomberg and walks the reader through the relevant Bloomberg screens. We want to thank Bloomberg Financial for granting us permission to reproduce the screens that we used in our exhibits.

We begin the book with an explanation of the most basic concept in finance: the time value of money. In Chapter 2, we describe yield curve analysis, discussing the importance of spot rates and forward rates. The fixed income market has adopted various conventions for determining the number of days when computing accrued interest when trades are settled. These market conventions are the subject of Chapter 3.

The basics of bond valuation are covered in Chapter 4. Our focus in this chapter is on option-free bonds (i.e., bonds that are not callable, puttable or convertible) and that have a fixed coupon rate. Yield measures for bonds are covered in Chapter 5.

The analysis of floating rate securities and bonds whose coupon interest is linked to some inflation measure are the subjects of Chapters 6 and 14, respectively. Bonds with embedded options are the subjects of Chapters 7, 9, and 10. Chapter 7 explains how to analyze callable and putable agency and corporate bonds. All residential mortgage-backed securities and certain