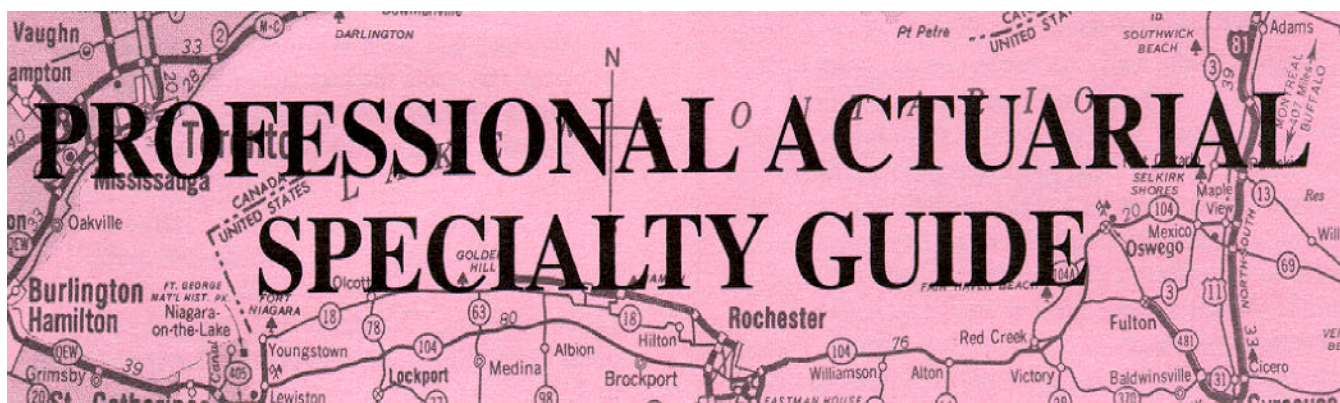


SOCIETY OF ACTUARIES



LIFE INSURANCE COMPANY INVESTMENTS

Overview

This guide lists sources that an actuary can use to gain knowledge on investments and asset/liability management. It can be viewed as a preliminary road map for the actuary seeking direction to enhance his or her knowledge in these areas. The emphasis of this guide is on fixed-income securities. We do not assume the reader to have studied the Society of Actuaries Courses 220 and 230.

Many insurance companies do not subscribe to research journals. In compiling this guide, we have given preference to books that are readily available. Some articles have been selected from actuarial or insurance journals and Society of Actuaries Study Notes.

Most of the basic reading list is compiled from two books: W.F. Sharpe and G.J. Alexander, *Investments*, 4th ed., and F.J. Fabozzi and T.D. Fabozzi (ed.), *The Handbook of Fixed Income Securities*, 4th ed. Although these two books are not unique in their coverage, we have selected them because they enable the actuary to rapidly gain a good knowledge of investments and fixed-income securities without the need to seek out additional sources. Sharpe and Alexander is a standard textbook on investments at the MBA level; an Instructor's Manual, which provides answers to the questions at the end of each chapter, is available. (Professor Sharpe was one of three financial economists awarded the 1990 Nobel Memorial Prize in Economics.) Fabozzi and Fabozzi is a textbook for SOA Courses 220 and 230 and for the Chartered Financial Analyst examinations.

The main source for the reading list at the intermediate level is again Fabozzi and Fabozzi. We also list some books and articles that complement and supplement Sharpe and Alexander and Fabozzi and Fabozzi. For the more adventurous and mathematically inclined actuaries, we have some suggestions at the advanced level.

This guide is not organized along subtopic lines

within the general topic of "Life Insurance Company Investments." An actuary who wishes to investigate a particular subtopic can do so by noting chapter headings, which are, for the most part, quite definitive; both Sharpe and Alexander and Fabozzi and Fabozzi have extensive indexes. (At the end of Sharpe and Alexander there is a glossary of investment terminology.) However, there are two subtopics of special interest for which we have provided cross-indexed references at the end of this guide. These two subtopics are Asset/Liability Management and Options and Derivative Securities.

Actuary's Role

Actuaries measure, model and manage risk. Risk associated with the investment function is one of the most important risks faced by man insurance companies. Actuaries involved with insurance companies should have knowledge of the asset side of the balance sheet and how it relates to the liability side. Specifically, such knowledge should include the operation of Financial markets, the instruments available (particularly those involving fixed income), the options imbedded in such instruments, and the synthetic instruments available to the insurance companies. In addition, the financial reporting actuary and the product development actuary must both understand the relationship of the company's assets to liabilities, so as to reflect the risks inherent in the insurer's business and thereby enhance its profitability or possibly even its solvency. Investment products are continually being redesigned, updated, expanded, and replaced. The practicing actuary must be aware of these changes (to have a basic knowledge of how they affect the company) and able to communicate regarding them with the company's portfolio managers (or be part of such portfolio management). The coordination of product development, investment operations and financial reporting is essential for a successful insurance company. Actuaries are singular in having the technical education to perform this coordination function.

The Committee on Financial and Investment Management Specialty Guides of the Society of Actuaries provides this Specialty Guide for continuing education purposes. It is intended to provide the user with a summary of representative sources of current general knowledge. Neither the Society of Actuaries nor the Committee intends or represents this Specialty Guide to be complete or its use necessarily required or sufficient for meeting continuing education requirements or any other professional competency standards of any organization.

Basic Reading List

1. Sharpe, W.F., and Alexander, G.J. *Investments*, 4th ed. Englewood Cliffs, N.J.: Prentice-Hall 1990.
 - Chapter 2 “Securities and Markets,” 17–66.
 - Chapter 3 “Investment Value and Market Price,” 67–81.
 - Chapter 4 “The Valuation of Riskless Securities,” 82–111.
 - Chapter 5 “The Valuation of Risky Securities,” 112–133.
 - Chapter 6 “The Portfolio Selection Problem,” 134–153.
 - Chapter 7 “Portfolio Analysis,” 154–193.
 - Chapter 8 “The Capital Asset Pricing Model,” 194–240.
 - Chapter 12 “Fixed-Income Securities,” 316–354.
 - Chapter 13 “Bond Analysis,” 355–377.
 - Chapter 14 “Bond Portfolio Management,” 378–402.
 - Chapter 15 “Common Stocks,” 403–460.
 - Chapter 18 “Options,” 533–593.
 - Chapter 19 “Futures,” 594–632.
2. Fabozzi, F.J., and Fabozzi, T.D. (ed.) *The Handbook of Fixed Income Securities*, 4th ed., Burr Ridge, Ill.: Irwin, 1995. This is a textbook for Society of Actuaries Courses 220 and 230.
 - Chapter 1 “Overview of the Types and Features of Fixed Income Securities” (by F.J. Fabozzi, T.D. Fabozzi and M.G. Ferri), 3–19.
 - Chapter 2 “Risks Associated with Investing in Fixed Income Securities” (by R.E. Dattatreya, F.J. Fabozzi and T.D. Fabozzi), 20–27.
 - Chapter 5 “Price Volatility Characteristics of Fixed Income Securities” (by F.J. Fabozzi, M. Pitts and R.E. Dattatreya), 83–112.
 - Chapter 6 “The Structure of Interest Rates” (by F.J. Fabozzi), 113–138.
 - Chapter 7 “Treasury and Agency Securities” (by F.J. Fabozzi, and T.D. Fabozzi), 141–154.
 - Chapter 10 “Corporate Bonds” (by F.J. Fabozzi, R.S. Wilson, H.C. Sauvain and J.C. Ritchie, Jr.), 203–232.
 - Chapter 15 “The High-Yield Corporate Bond Market” (by J.C. Bencivenga), 307–326.
 - Chapter 23 “Mortgages” (by F.J. Fabozzi and L.M. Edens), 483–501.
 - Chapter 24 “Mortgage Pass-Through Securities” (by L.S. Hayre, C. Mohebbi and T.A. Zimmerman), 502–548.
 - Chapter 42 “Bond Immunization: As Asset/Liability Optimization Strategy” (by P.E. Christensen, F.J. Fabozzi and A. LoFaso), 896–926.
 - Chapter 50 “Introduction to Interest-Rate Futures and Options Contracts” (by M. Pitts and F.J. Fabozzi), 1079–1105.
 - Chapter 54 “An Overview of Fixed Income Option Models” (by L.J. Dyer and D.P. Jacob), 1171–1203.

3. Stapleford, R.H., and Stewart, K.W. “Introduction to the Formation of Investment Strategy for Life Insurance Companies and Pension Plans,” *Society of Actuaries Study Note 220–24–91*, 34 pages.

We suggest that, having read Sharpe and Alexander, one is ready for investment journals such as *Financial Analysts Journal*, *Journal of Fixed Income* and *Journal of*

Intermediate Reading List

4. Tilley, J.A., “The Application of Modern Techniques to the Investment of Insurance and Pension Funds,” *Transactions of the 23rd International Congress of Actuaries, Helsinki, R (1988)*: 301–326. This paper is also available as *Society of Actuaries Study Note 220–27–90*.

This paper discusses applications of modern option-pricing theory, such as the valuation of stochastic cash flows and generalization of Redington's theory of immunization.
5. Lamm-Tennant, J., “Asset/Liability Management for the Life Insurer: Situation Analysis and Strategy Formulation,” *Journal of Risk and Insurance* 56, Vol. 3 (1989): 501–517.

This paper examines the current operational status and planning procedures of seven asset/liability management processes appropriate for life insurers.
2. Fabozzi, F.J., and Fabozzi T.D. (ed.) *The Handbook of Fixed Income Securities*, 4th ed., Burr Ridge, Ill.: Irwin, 1995.
 - Chapter 9 “Private Money Market Instruments” (by F.J. Fabozzi), 186–202.
 - Chapter 11 “Medium-Term Notes” (by L.E. Crabbe), 233–254.
 - Chapter 12 “Domestic Floating-Rate and Adjustable-Rate Debt Securities” (by R.S. Wilson), 255–264.
 - Chapter 13 “Nonconvertible Preferred Stock” (by R.S. Wilson), 265–289.
 - Chapter 14 “Convertible Securities” (by J.C. Ritchie, Jr.), 290–306.
 - Chapter 16 “Eurocapital Markets” (by H.Q. Tran and P. Paradiso), 327–353.
 - Chapter 25 “Collateralized Mortgage Obligations” (by A.S. Carron), 549–582.
 - Chapter 28 “Valuation of Bonds with Embedded Options” (by F.J. Fabozzi, A.J. Kalotay and G.O. Williams), 611–634.
 - Chapter 29 “Option-Adjusted Spread Analysis” (by L.S. Hayre and K. Lauterbach), 635–664.
 - Chapter 30 “OAS and Effective Duration” (by D. Audley, R. Chin, S. Ramamurthy and S. Volin), 665–681.
 - Chapter 37 “The Term Structure of Interest Rates” (by R.W. McEnally and J.V. Jordan), 779–829.
 - Chapter 43 “Dedicated Bond Portfolios” (by P.E. Christensen and F.J. Fabozzi), 927–941.

- Chapter 51 "Pricing Futures and Portfolio Applications" (by F.J. Fabozzi and M. Pitts), 1106–1118.
- Chapter 52 "Treasury Bonds Futures Mechanics and Basis Valuation" (by D.T. Kim), 1119–1144.
- Chapter 55 "Hedging with Futures and Options" (by M. Pitts and F.J. Fabozzi), 1204–1235.
- Chapter 56 "Interest-Rate Swaps" (by A.K. Bhattacharya and F.J. Fabozzi), 1236–1254.
- Chapter 57 "Interest-Rate Caps and Floors and Compound Options" (by A.K. Bhattacharya), 1255–1274.

In addition to the above, there are many other sources from which an actuary can learn about investments and asset/liability management. Below are some papers in actuarial journals and readily available books. We also list the titles of chapters of particular interest.

6. Cummins, J.D., and Lamm-Tennant, J. (ed.) *Financial Management of Life Insurance Companies*, Huebner International Series on Risk, Insurance, and Economic Security. Boston: Kluwer, 1993.
7. Doherty, M., and Luckner, W. "Final Report: 1986–1989 Credit Risk Event Loss Experience, Commercial Mortgage Loans and Private Placement Bonds," *Proceedings of the 4th AFIR International Colloquium, Orlando*, April 20–22, 1994, 1439–1469.
8. Fabozzi, F.J. (ed.) *Fixed-Income Portfolio Strategies*. Chicago, Ill.: Probus Publishing Co., 1989.
- Chapter 7 "Finding the Immunizing Investment for Insurance Liabilities: The Case of the SPDA" (by P.D. Noris and S. Epstein), 97–141. This paper is also available as *Society of Actuaries Study Note 230–22–91*.
- Chapter 17 "Hedging with Futures and Options" (by L.S. Goodman), 321–344.
- Chapter 21 "Capping the Interest Rate Risk in Insurance Products" (by D.F. Babbel, P. Bouyoucos and R. Strickler), 445–474.
9. Fabozzi, F.J. (ed.) *Portfolio and Investment Management: State-of-the-Art Research, Analysis and Strategies*. Chicago, Ill.: Probus Publishing Co., 1989.
- Chapter 4 "Active Equity Management" (by T.D. Coggin), 51–72.
- This paper outlines the various active equity management styles and models commonly used for equity valuation.
10. Fen, A.M. "Interest Rate Futures: An Alternative to Traditional Immunization in the Financial Management of Guaranteed Investment Contracts," *TSA* 37 (1985): 153184; Discussion 185–186.
11. Global Derivatives Study Group, *Derivatives: Practices and Principles*. Washington D.C.: Group of Thirty, 1993.

12. Ho, T.S.Y. *Strategic Fixed-Income Investment*. Homewood, Ill.: Dow Jones-Irwin, 1990.
- Chapter 6 "Duration," 61–81.
- Chapter 7 "Convexity," 82–107.
- Chapter 11 "Bond Options," 170–208
- Chapter 12 "Corporate Bonds (Investment Grade)," 210–250
- Chapter 15 "Factorization and Its Application in the Fixed-Income Market," 316–340.
13. Hull, J.C. *Options, Futures, and Other Derivative Securities*, 2nd ed., Englewood Cliffs, N.J.: Prentice-Hall, 1993. This is a textbook for Society of Actuaries Course F-480.
- This book was written for students in business and economics. Nonessential mathematical material has either been eliminated or included in end-of-chapter appendices.
- Chapter 2 "Futures Markets and the Use of Futures for Hedging," 18–44.
- Chapter 3 "Forward and Futures Prices," 45–79.
- Chapter 4 "Interest Rate Futures," 80–110.
- Chapter 5 "Swaps," 111–135.
- Chapter 9 "A Model of the Behavior of Stock Prices," 190–206.
- Chapter 10 "The Black-Scholes Analysis," 207–246.
- Chapter 12 "A General Approach to Pricing Derivative Securities," 274–294.
- Chapter 14 "Numerical Procedures," 329–369.
- Chapter 15 "Interest Rate Derivative Securities," 370–413.
- Chapter 19 "Review of Key Concepts," 469–472
14. *Moody's Special Report: Corporate Bond Defaults and Default Rates 1970–199X*. This report, updated in each January by Moody's, can be obtained from the Society of Actuaries as a Study Note for Course F-590.
15. Pedersen, H.W., Shiu, E.S.W., and Thorlacius, A.E. "Arbitrage-Free Pricing of Interest-Rate Contingent Claims," *TSA* 41 (1989): 231–265; Discussion, 267–279.
16. Platt, R.B. (ed.) *Controlling Interest Rate Risk: New Techniques and Applications for Money Management*. New York: Wiley, 1986.
- Chapter 2 "The Term Structure of Interest Rates" (by G.D. Latainer), 11–27.
- Chapter 3 "Use of Duration Analysis for the Control of Interest Rate Risk" (by A.L. Toevs), 28–61.
- Chapter 4 "Hedging with Financial Futures" (by A.L. Toevs and D.P. Jacob), 62–116.
- Chapter 7 "Hedging Interest Rate Risk of Fixed-Income Securities with Uncertain Lives" (by A.L. Toevs), 176–196.
- Chapter 9 "Risk Control Techniques for Life Insurance Companies" (by J.A. Tilley), 225–255).
17. Reitano, R.R. "Multivariate Duration Analysis," *TSA* 43 (1991): 335–376; Discussion 377–391.
18. Shiu, E.S.W. "On Redington's Theory of Immunization," *Insurance: Mathematics and Economics* 9, no. 2/3 (September 1990): 171–175.

19. Tilley, J.A., "An Actuarial Laymans Guide to Building Stochastic Interest Rate Generators," *TSA* 44 (1992): 509–538; Discussion 539–564.
20. Vanderhoof, I.T., Albert, F., Tenenbein, A., and Verni, R. "The Risk of Asset Default—Report of the Society of Actuaries C-1 Risk Task Force of the Committee on Valuation and Related Areas," *TSA* 41 (1989): 547–582; Discussion 583–591.

Advanced Reading List

21. Albrecht, P. "A Note on Immunization under a General Stochastic Equilibrium Model of the Term Structure," *Insurance: Mathematics and Economics* 4 (October 1985): 239–244.

This paper generalizes Redington's theory of immunization to the case of several state variables that are prescribed by stochastic differential equations.

22. Müller, H. "Modern Portfolio Theory: Some Main Results," *Astin Bulletin: Journal of the International Actuarial Association* 18, no.2 (1988): 127–145.

This paper gives an elegant presentation of the Markowitz portfolio theory and capital asset pricing model.

23. Vetzal, K.R. "A Survey of Stochastic Continuous Time Models of the Term Structure of Interest Rates," *Insurance: Mathematics and Economics* 14, no. 2 (May 1994): 139–161.

24. Brealey, R., and Edwards, H. (ed.) *A Bibliography of Finance*. Cambridge, Mass: MIT Press, 1991.

This book lists more than 12,000 entries and organizes them around 40 main entries such as hedging instruments, inflation, options, real estate, risk, etc.

25. Eatwell, J., Miglate, M., and Newman, P. *The New Palgrave: Finance*. New York: W.W. Norton, 1989.

This book is a collection of finance articles originally published in the four-volume encyclopedia of economics *The New Palgrave: A Dictionary of Economics*, Macmillan, London, 1987. An inexpensive paperback edition is available.

26. Bhattacharya, S., and Constantinides, G.M. (ed.) *Frontiers of Modern Financial Theory*, Vol. 1: *Theory of Valuation*. Totowa, N.J.: Rowan and Littlefield, 1989.

This book reprints, with commentaries, some of the most important papers on valuation theory.

27. Merton, R.C. *Continuous-Time Finance*. Oxford: Blackwell, 1990.

This book contains the classical papers written by Professor Merton, the expert among experts. It is highly mathematical.

The following are six textbooks written for doctoral students in finance.

28. Dothan, M.U. *Prices in Financial Markets*. New York: Oxford University Press, 1990.

29. Duffie, D. *Security Markets: Stochastic Models*. New York: Academic Press, 1988.

30. Duffie, D. *Dynamic Asset Pricing Theory*. Princeton N.J.: Princeton University Press, 1992.

31. Huang, C.-F., and Litzenberger, R.H. *Foundations for Financial Economics*. New York: Prentice-Hall, 1988.

32. Ingersoll, J.E., Jr. *Theory of Financial Decision Making*. Totowa, N.J. Rowan and Littlefield, 1987.

33. Jarrow, R.A. *Finance Theory*. Englewood Cliffs, N.J.: Prentice-Hall, 1988.

To conclude the advanced reading list, we note that the top journals in finance and investments are: *Journal of Finance*, *Journal of Financial and Quantitative Analysis*, *Journal of Financial Economics*, and *Review of Financial Studies*. The *Journal of Business* also contains many important articles on finance and investments.

The Journal of Business
University of Chicago Press
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Chicago, IL 60637
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The Journal of Finance
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1775 College Road
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Phone: (614) 292-8449

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Asset/Liability Management

Survey on Tools	[5]
Immunization (Duration and Convexity Analysis)	
Fixed and Certain Cash Flows	[1, Chapter 14], [2, Chapters 5,42], [12, Chapters 6,7], [16, Chapter 3], [18]
Interest-Sensitive Cash Flows	[2, Chapters 29,30], [8, Chapter 7], [16, Chapters 7, 9], [4]
Hedging with Futures	[10], [2, Chapter 55], [8, Chapter 17], [13, Chapters 2, 4], [16, Chapter 4]
Multivariate Models	[12, Chapter 15,] [17], [A1]
Scenario/Sensitivity Testing	[27], [16, Chapter 9]
Customized Interest Rate Contracts	[2, Chapter 57], [8, Chapter 21]

Options and Derivative Securities

Option Pricing Theory	
Stocks (Binomial, Black-Scholes)	[1, Chapter 18], [13, Chapters 9,10,14]
Fixed Income Securities	[2, Chapters 28, 54], [12, Chapter 11], [13, Chapter 15], [15], [19], [23]
Fundamental Derivative Instruments	
Options	[1, Chapter 18], [2, Chapters 50, 55], [13, Chapter 15]
Futures	[1, Chapter 19], [13, Chapters 2, 3, 4], [2, Chapters 50, 51, 52, 55]
Interest Rate Swaps	[13, Chapter 5], [2, Chapter 56]
Complex Derivative Instruments	
Caps, Floors and Swaptions	[2, Chapter 57], [8, Chapter 21], [13, Chapter 15]
Mortgage-Backed Securities	[2, Chapters 24,25]

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