COURSE DESCRIPTION

The course is intended to give students an in-depth treatment of fixed income analytics. A solid understanding of the bond pricing and yield curve material from the Investments course is necessary. There are three sections to the semester.

A.) The first part of the course will cover bond valuation and various measures of bond risk. We will study: bootstrapping and the creation of a theoretical spot curve; valuing bonds with embedded options; many kinds of duration; and convexity.

B.) The second part of the course will cover the securitization process. We will study the general securitization process and the specific attributes of various mortgage-backed securities. We will use Monte Carlo simulations to value asset-backed securities.

C.) The third part of the course will deal with measures of portfolio risk and how factors such as spread risk and convexity affect the value of a bond portfolio when interest rates change. We will also look at return and risk attribution for the individual bonds in a portfolio that I will supply.

COURSE MATERIALS

Required Texts.


The text is comprehensive and challenging. The text has an accompanying workbook, which is superb. There are as many concept questions as there are quantitative questions, and both types help students learn the material. The workbook provides thorough solutions to all questions.

Learning Objectives.

a.) To understand the characteristics and risks of non-callable bonds, callable bonds, corporate bonds, convertible bonds, tax-exempt bonds, inflation indexed bonds, floating rate securities, and mortgage-backed and asset-backed securities.

b.) To understand the importance of duration as a measure of risk. We will study Macaulay duration, modified duration, effective duration, dollar duration, spread duration, portfolio duration, and key rate duration.
c.) To understand how movements in the yield curve affect bond valuation and price volatility. We will study parallel shifts, non-parallel shifts, and butterfly shifts in the yield curve. We will also study bootstrapping and the construction of the theoretical spot curve for the Treasury market.

d.) To understand convexity, both positive and negative. How convexity changes between callable and non-callable bonds. How convexity and duration are related for callable and non-callable bonds. Students will also study the convexity adjustment to the duration pricing formula.

e.) To understand the valuation of bonds with embedded options. Callable and putable bonds. Calculate an option-adjusted spread using the binomial method.

f.) To understand the securitization process for home mortgages and other credit assets, such as auto loans, credit card receivables, and student loans. We will study the structures of pass-throughs, agency and non-agency CMOs, IOs, POs, and PAC bonds.

g.) To master the key concepts of applied risk management. Tracking error. Multi-factor risk models. Portfolio duration. Performance attribution analysis. Managing a portfolio to a benchmark bond index.

h.) To provide preparation for those students who are studying for the CFA Level 1 exam.

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**FINAL GRADE ASSIGNMENT**

Students will be evaluated based on two mid-term exams, problem sets, and a project, which will serve as the final exam. Problems will be assigned for most chapters, and some Bloomberg assignments might be required also.

Some problem sets will use Excel spreadsheets that I developed. These spreadsheets cover accrued interest, risk and return attribution, comparing bullet and barbell portfolios, tracking error, the information ratio, and managing a bond portfolio.

The mid-term exam dates are approximate.

For grading:

Exam 1: 35%.
Exam 2: 35%.
Final Exam Project: 20%.
Problem Sets: 10%.

The grading scale:

A: 91 – 100.
B+: 86 – 90.
B: 81 – 85.
C+: 75 – 80.
C: 70 – 74.
D: 60 – 69.
COURSE SCHEDULE

Week 1: January 21.
Overview of Course.

Week 2: January 28.
Chapter 5: Introduction to the Valuation of Debt Securities.
   a.) Review of bond price mechanics.
   b.) Accrued interest.
   c.) Arbitrage-free valuation.

Week 3: February 4.
Chapter 6: Yield Measures, Spot Rates, and Forward Rates.
   a.) Traditional yield measures.
   b.) Spread measures for floating rate securities.
   c.) Theoretical spot rates.
   d.) Zero-volatility spread.
   e.) Option-adjusted spread.
   f.) General formula for computing implied forward rates.

Week 4: February 11.
Chapter 7: Introduction to the Measurement of Interest Rate Risk.
   a.) Handout on the “Rules for Bond Pricing.”
   b.) Macaulay duration.
   c.) Modified duration.
   d.) Dollar duration.
   e.) Volatility characteristics of callable and non-callable bonds.
   f.) Convexity adjustments.
   g.) DV01.
   h.) The importance of yield volatility.

Week 5: February 18.
Chapter 8: Term Structure and Volatility of Interest Rates.
   a.) Butterfly shifts.
   b.) LIBOR swap curve.
   c.) Key rate duration.

Week 6: February 25.
Chapter 9: Valuing Bonds with Embedded Options.
   a.) Binomial interest-rate tree.

Exam 1.

Week 7: March 4.
Chapter 9: Valuing Bonds with Embedded Options.
   b.) Option-adjusted spread.
Chapter 10: Mortgage-Backed Sector of the Bond Market.
   a.) Mortgage pass through securities.

Week 8: March 11.
Chapter 10: Mortgage-Backed Sector of the Bond Market.
   b.) Agency CMOs.
      i.) Plain vanilla.
      ii.) With an accrual tranche (Z-tranche).
      iii.) With floating-rate and inverse floating-rate tranches.
      iv.) Planned Amortization Class bonds (PAC).
   c.) Stripped MBS.
   d.) Non-agency CMOs.

Week 9: March 18.
Spring Break.

Week 10: March 25.
Chapter 11: Asset-Backed Sector of the Bond Market.
   a.) The securitization process.
   b.) Credit enhancements.
   c.) Credit tranching.
   d.) Senior-subordinated structures.

Week 11: April 1.
Chapter 12: Valuing Mortgage-Backed and Asset-Backed Securities.
   a.) A Monte Carlo simulation example.

Exam 2.

Week 12: April 8.
Chapter 17: Measuring a Portfolio’s Risk Profile.
   a.) Standard deviation.
   b.) Target semi-variance.
   c.) Shortfall risk.
   d.) Value at Risk.

Week 13: April 15.
Chapter 17: Measuring a Portfolio’s Risk Profile.
   e.) Tracking error.
   f.) Individual security contributions to portfolio duration.
   a.) Multi-factor risk models.

Week 14: April 22.
Chapter 18: Managing Funds Against a Bond Market Index.
   a.) Spread duration.
   b.) Risk and return attribution.
   c.) Active versus passive investment strategies.
   d.) Portfolio duration.
   e.) Portfolio simulations.

Week 15: April 29.
Chapter 19: Portfolio Immunization and Cash Flow Matching.
   a.) Immunization for a single liability.
      i.) Rebalancing.
   b.) Contingent immunization.
   c.) Immunization for multiple liabilities.

Monday, May 4: Portfolio projects are due.