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DEBT INSTRUMENTS AND MARKETS
NEW YORK UNIVERSITY, STERN SCHOOL

Syllabus

Summer 2009

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Office Hours: M W 5:15-6:00 pm (or by appointment)

Class Time and Location

Monday and Wednesday, 6:00 – 9:00 pm, KMC 3-65

Course Description

This course describes the important fixed income securities and markets, and in turn develops tools for valuing these securities and managing their interest rate and credit risk. Historically, *fixed-income* refers to securities which promise fixed cash flows over their lives. Now, we generally view any fixed-income instrument as one in which its value depends on the level of interest rates and/or the health of the underlying assets. Thus, along with an analysis of fixed-rate bonds, we will also look at other securities, such as floaters, inverse floaters, bond options, caps/floors, callable bonds, interest rate swaps, credit default swaps and mortgage-backed securities.

The study of fixed income securities is highly quantitative in nature. Students should be comfortable with mathematics such as algebra, linear algebra and basic calculus, as well as statistical concepts such as probability distributions, mean, variance, covariance, and regression. A basic background in finance is required, such as the core course, *Foundations of Finance*. Although some previous coursework in options is helpful, it is not necessary to have taken an options course as the analysis of fixed-income derivatives will be self-contained. Students will need to use a calculator that can raise a number to an arbitrary power, and are expected to be familiar with a spreadsheet package like *Excel* (including, for example, its solver function).

Course Materials

The main course material is a collection of presentation slides which will be used in each lecture. Hardcopies of these slides will be available online. Students should make notes directly onto their hardcopy, and thus can spend more time listening and participating in the lecture. Additional readings may be handed out during the semester.

The required textbook is:

Tuckman, **Fixed Income Securities**, Wiley, 2nd University edition, 2002.

This is available at the bookstore, as well as a chain like Barnes and Noble or online at Amazon.com. The Tuckman book coincides closely to some of the lectures as Tuckman uses a similar methodology to value fixed-income securities.

Course Requirements

There will be weekly problem sets due each Monday, two short exams, and a final. The overall grade is based on the following:

Problem Sets:	10%
Short Exam 1:	25%
Short Exam 2:	25%
Final Exam:	40%

Because the material is analytical and new concepts build on old ones, it will be essential to do the problem sets in order to follow the lecture and succeed on the exams. While students can discuss the problem sets together, each student must complete their own problem set. Class participation will be a consideration for grading in borderline cases.

With respect to the exams, you are allowed one 8.5x11 inch page of notes for the short exams and three 8.5x11 inch pages of notes for the final, the two previous one page notes and a new page. You should bring a calculator that can raise numbers to arbitrary powers. Laptop computers are not allowed.

On the next page, I provide a tentative schedule for the lectures in the class.

TENTATIVE SCHEDULE OF LECTURES

Topic I: Introduction

Course overview and survey of major fixed income markets (July 1).

Topic II: Valuation of Fixed Cash Flows

This part of the course covers the valuation of fixed cash flows, including an analysis of the discount function, no arbitrage valuation, bond portfolio replication, and important concepts such as yield-to-maturity and forward rates. This material is covered fairly quickly as the basic concepts were already covered in the core course.

- July 1: Valuation (Tuckman, chapter 1-2, pp. 3-27)
- July 1: Yield-to-Maturity (Tuckman, chapter 3, pp.41-52)
- July 6: Forward Rates (Tuckman, chapter 2, pp. 28-39)

Topic III: The Interest Rate Sensitivity of Instruments with Fixed Cash Flows

This part of the course covers the interest rate sensitivity of fixed cash flows, including the important concepts of duration and convexity, and how these concepts apply to a portfolio of securities. These tools are then used to show how to hedge the interest rate risk of securities with fixed cash flows. The basic concepts here were also covered in the *Foundations* course, so the material is also covered more quickly than otherwise.

- July 6: Duration (Tuckman pp. 89-101, 109-111, 115-127)
- July 8: Convexity (Tuckman pp.101-113, 127-131)
- July 8: Hedging (Tuckman pp. 95-98, 103-105, 108-109, 111-113)

Topic IV: The Repo Market

This lecture discusses an important financing market in the fixed income area, namely the repo market. As an application, using our knowledge from Topic III, we discuss how Orange County lost \$1.7 billion in the mid 90s, leading to their declaration of bankruptcy.

- July 13: Repo Market (Tuckman, chapter 15, pp. 303-324)

Topic V: Introduction to Variable Cash Flows

These lectures provide an introduction to markets with variable cash flows. As a starting point, we discuss the valuation and interest rate sensitivity of floating rate notes and inverse floaters. The next lecture covers one of the more important securities in the fixed income market, the interest rate swap.

- July 13: Floaters and Inverse Floaters (Tuckman, chapter 18, pp. 374-376)

Short Exam #1 covers Topics II-IV (In class:July 15)

Topic V: Introduction to Variable Cash Flows continued

- July 15: Introduction to Swaps (Tuckman, chapter 18)

- July 15: Valuation and Risk of Swaps (Tuckman, chapter 18)

Topic VI: Valuation and Interest Rate Sensitivity of Interest-Rate Dependent Cash Flows

This part of the course covers the techniques for valuing cash flows which depend on interest rates. The lectures will include a description of the major characteristics of interest rates, the development of a popular Wall Street one-factor model of interest rates, and a valuation and hedging methodology for this model.

- July 20: Interest Rate Model and Valuation Methodology (Tuckman, chapters 9-12)

Topic VII: Fixed-Income Options

These lectures will focus on the valuation of fixed-income options, and embedded options in fixed-income securities. As options are a building block for many securities, these lectures are crucial for the understanding of later concepts. I will start with an overview of options, and then show how to value options and measure their interest rate sensitivity using the valuation framework within a one-factor setting.

- July 22: Options Review & Basics
- July 22: Valuation & Hedging of Fixed-Income Options (Tuckman, chapter 19)

Topic VIII: Fixed-Income Options - Applications

This part of the course covers important applications of interest rate options, in particular, common embedded options in the fixed-income market such as (i) callable bonds, (ii) caps, floors or collars, and (iii) swaptions. (November 3,8,10).

- July 22: Callable Bonds (Tuckman, pp. 405-413)
- July 27: Swaptions (Tuckman, pp. 413-420)
- July 27: Interest Rate Caps & Floors (Tuckman, pp. 413-420)

Topic IX: The Credit Market

This topic covers the important area of credit markets. In order to value fixed income securities that face credit risk, it is necessary for us to build a second factor, namely that of the underlying assets of the firm. After building this model, we will show you how to value bonds of different priority and the underlying equity of the firm. The final application will be to discuss the motivation, pricing and risk of credit default swaps.

- July 27: Introduction to Credit Risk

Short Exam #2 covers Topics V-VIII (In class: July 29)

Topic IX: The Credit Market continued

- July 29: Valuation of Credit – a Structural Approach
- August 3: Credit Default Swaps

TopicX: Mortgage-Backed Securities

This series of lectures covers a description of the mortgage market, including mortgages, mortgage-backed securities and collateralized mortgage obligations. The analysis will not only provide a description of these markets, but also will analyze the distribution rules for of mortgage backs.

- August 3: Introduction to the Mortgage Market (Tuckman, pp.455-464)
- August 3: Distribution Rules for MBS cash flows (Tuckman, pp.475-477)
- August 5: Valuation & Hedging of MBSs (Tuckman, pp. 464-475)

TopicXI: Course Review

An overview of the important concepts of the course. (August 5)

Final Exam covers Topics II-X (with some emphasis on IX & X) (August 10)