B40.3333.01
DEBT INSTRUMENTS AND MARKETS
NEW YORK UNIVERSITY, STERN SCHOOL

Syllabus Fall 2005

Professor Matthew Richardson
Office: 9-60
Telephone: (212)998-0349
Fax: (212)995-4220
E-mail: mrichardson@stern.nyu.edu
Office Hours: Tu/Thurs 3:00-4:30PM
(or by appointment)
Administrative Assistant: Robyn Vanterpol
Telephone: (212) 998-0703

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 in 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 **very** familiar with a spreadsheet package like *Excel* (including, for example, its solver function). It is my experience that if students do not satisfy this criteria, then they tend to struggle in the class.

Course Materials

The main course material is a collection of presentation slides which will be used in each lecture. Hardcopies of these slides are available online and also at the bookstore. Students should make notes directly onto their hardcopy, and thus can spend more time listening and participating in the lecture. A secondary course material is a collection of readings, which provide additional discussion of the issues brought up during the lectures. These materials will be handed out periodically during the semester.

Two recommended readings (but *not required*) are:
Tuckman, **Fixed Income Securities** , Wiley, 2nd edition, 2002 and
Sundaresan, **Fixed Income Markets and Their Derivatives**, 2nd edition, South-Western, 2001.
These readings should be available at any large chain, such as Barnes and Noble or online at Amazon.com. The Tuckman book coincides a little closer to the lecture materials in that Tuckman uses a similar methodology to value fixed-income securities. On the other hand, Sundaresan's book contains more institutional material, has more examples, and reads more like a standard textbook. However, the Sundaresan book is much more expensive.

For those of you who are planning a career in the fixed-income sector, any of the following three books may also be helpful:
Das, **Swap & Financial Derivatives**, 3rd edition, John Wiley, 2003.
Fabozzi, **The Handbook of Fixed Income Securities**, 6th edition, Irwin, 2000.
Bomfim, **Understanding Credit Derivatives and Related Instruments**, Academic Press, 2004.
These are all highly regarded books, which are very encompassing in their particular area. Again, these books should be available at any large bookstore. I do not recommend them here because the course is self contained and these books are very expensive (in the $100 plus range).

Course Requirements

Grades will be based mainly on exam scores: midterm (40%), and final (60%). Problem sets will be graded on a check, check-plus, check-minus, or no credit basis. These problem sets count for borderline cases, of which 20% of the class found themselves in, for example, past years.
With respect to the exams, you are allowed one 8.5x11 inch page of notes for the midterm and two 8.5x11 inch pages of notes for the final.
With respect to the problem sets, because the material in the course is analytical and new concepts build on old ones, it will be essential to do the problem sets in order to follow the lectures and succeed on the exams. In order to facilitate learning, I encourage students to work together on these problem sets. Groups of students working together should submit just one assignment. All students in the same group will get the same grade. I will not accept late assignments even if a dog ate it. (Someone's did a few years back).

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 (September 6).

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. (September 8,13,15).

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. (September 20,22,27).

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. (September 29).

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. (October 6,11).

Midterm Exam (In class: October 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. (October 20,25).

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. (October 27; November 1).

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).

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. (November 15,17,22,29).

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 cash flows, as well as providing a method for valuing and measuring the interest rate sensitivity of mortgage backs. (December 1,6,8).

TopicXI: Course Review

An overview of the important concepts of the course. (December 13)

Final Exam (12/16-12/22, TBA)