**B40.3333.01**
**DEBT INSTRUMENTS & MARKETS**
FALL 2007

**Instructor:** Dr. T. Sabri Öncü, K-MEC 9-99, 212-998-0311, email: soncu@stern.nyu.edu

**Time and Location:** T, Th 13:30 - 14:50, K-MEC 2-26

**Office Hours:** T/Th 15:00 - 16:00 or by appointment.

**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 linear algebra and deterministic calculus, as well as basic probability theory such as probability distributions, mean, variance, covariance, and the like. 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).

**Textbook:** Although there are many available fixed income books in the market, there is no required text book for this course, since none of the available books closely correspond to course material. However, I recommend:

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

as a companion to this course. The book is available at any large chain, such as Barnes and Noble, but can often be found substantially discounted online at Amazon.com or at sites that sell university books. Another useful companion to this course is the lecture notes of Professor Matthew Richardson of NYU, which are available on line and also at the bookstore. I will follow his lecture notes as closely as I can, deviating from them mostly in presentation.

One drawback of the Tuckman book is that it does not contain much institutional detail in contrast to say:

**Fabozzi** (with Mann), The Handbook of Fixed Income Securities , McGraw-Hill, 7nd edition, 2005

or

**Sundaresan**, Fixed Income Markets and Their Derivatives, South-Western, 2nd edition, 2002.

I will try to cover as much institutional detail in the course as I can, but for those of you who are interested in a fixed income career, although expensive, the Fabozzi book might be a useful addition to your personal libraries (I always keep a copy of its most recent edition in my personal library).

The following list of books, although by no means comprehensive, would be useful to know for those of you who are mathematically inclined and have interest in a quantitative fixed income career:

1) **Duffie** and **Singleton**, Credit Risk, Princeton University Press, 2003;
2) **Lando**, Credit Risk Modelling, Princeton University Press, 2004;
3) **Rebonato**, Interest-rate Option Models, Wiley, 2nd edition, 2000;
4) **Shreve**, Stochastic Calculus for Finance, The Binomial Asset Pricing Model, Springer-Verlag, 2004;
5) **Shreve**, Stochastic Calculus for Finance, Continuous Time Models, Springer-Verlag, 2004.

**Grading:** There will be weekly problems sets, two midterm exams and a final. Problem sets will contribute to your participation grade. Your overall grade will be based on:

| | |
|---|---|
| Participation | 20% |
| Midterm I | 20% |
| Midterm II | 20% |
| Final | 40% |

**Exams:** All exams will be open book(any book or books)-open notes. Bring a decent calculator that can raise numbers to arbitrary powers. Laptop computes are not allowed.

## Tentative Schedule of the Lectures

**Topic I: Introduction & Valuation of Fixed Cash Flows**
A brief course overview and review of basic valuation. 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 4, 6).

**Topic II: 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 11,18,20).

**Topic III: 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. We also cover one of the more important securities in the fixed income market, the interest rate swap. (September 25).

**Midterm Exam I (In class: October 2)**

**Topic IV: 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. (September 27, October 4).

**Topic V: 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 9).

**Topic VI: 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. (October 11, 16,18,23,26).

**Midterm Exam II (In class: October 30)**

**Topic VII: 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 1,6 8,13,15).

**Topic VIII: The Mortgage-Backed Securities Market**

This lecture provides a brief description of the mortgage market, including mortgages, mortgage-backed securities and collateralized mortgage obligations. Issues associated with the distribution rules for cash flows and a method for valuing and measuring the interest rate sensitivity of mortgage backs will also be discussed. (November 27,29, December 4,6).

**Topic IX: Course Review**
An overview of the important concepts of the course. (December 11)

**Final Exam (December 20)**

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FALL 2007

**Instructor:** Dr. T. Sabri Öncü, K-MEC 9-99, 212-998-0311, email: soncu@stern.nyu.edu

**Time and Location:** Th 18:00 - 21:00, K-MEC 5-140

**Office Hours:** T/Th 16:30-17:30 or by appointment.

**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.

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**Midterm Exam I (In class: October 18)**

**Topic IV: Valuation and Interest Rate Sensitivity of Interest-Rate Dependent Cash Flows**
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**Midterm Exam II (In class: November 8)**

**Topic VII: 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, 29).

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the distribution rules for cash flows and a method for valuing and measuring the interest rate sensitivity of mortgage backs will also be discussed. (December 6,13).

**Topic IX: Course Review**
An overview of the important concepts of the course. (December 13)

**Final Exam (December 20)**