B40.3333
DEBT INSTRUMENTS & MARKETS

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Course Description: This course covers the valuation and risk assessment of fixed income securities with an eye toward risk management of fixed income portfolios and corporate balance sheets of financial institutions. The fixed income assets studied include, but not limited to, fixed-rate bonds, floaters, inverse floaters, interest rate forwards, interest rate options, caps/floors, option embedded bonds, interest rate swaps, credit default swaps and mortgage-backed securities. Several interest rate models are studied with a critical eye and risks associated with the model choice are discussed. Important concepts such as leverage, liquidity, and uses and abuses of derivatives are examined based on case studies such as the Orange County debacle of 1994 and the LTCM collapse of 1998.

The study of fixed income securities is highly quantitative in nature. Students should be comfortable with mathematics such as linear algebra and 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. The lecture notes for the course are based on the lecture notes of Professor Matthew Richardson of NYU and 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).

Grading: There will be 5 bi-weekly problems sets, one term paper, one midterm exam and a final. Problem sets will be graded on a $+\checkmark, \checkmark, -\checkmark$ and $\times$ basis and will contribute to your participation grade, although your class participation will be the main determinant of your participation grade. Your overall grade will be based on:

Participation	10%
Term Paper	20%
Midterm	30%
Final	40%

The assignment, exam and term paper presentation dates as well as term paper topics for this semester are given in the course schedule document.

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. 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.

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. .

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.

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.

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.

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.

Additional topics we may cover if time permits

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.

Topic VIII: The Mortgage-Backed Securities Market

This topic 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. Note that with the recent nationalization of Fannie and Freddie, the mortgage market may change substantially so if we can cover this topic, I may have to make changes to the above.