Interest rates and credit risk

Fields Program on Quantitative Finance **Jan-April 2010**

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Lecture Dates: Course starts on January 6th and will meet at the Fields Institute weekly on Wednesdays from 1:30 to 4:15 for roughly 13 weeks until the end of March.

In addition to this regular time slot, this course will occasionally meet on Thursdays from 1:30 to 4:15, when guests will deliver lectures as part of the course.

Guest Lecturers: We are excited to have Tomas Björk from the University of Stockholm and Kay Giesecke from Stanford University coming to give advanced lectures as an integral part of the course.

Outline: Building on mathematical foundations of arbitrage pricing theory laid down in a first course on stochastic calculus for finance, this Ph.D. level course addresses the modeling of the world's bond markets, and the derivative securities associated with them. Bond markets are less transparent than equity markets, but have a total value about double that of equity markets, and a richer underlying structure. Sovereign bonds, issued by central banks of developed countries, can be assumed to be "default-risk-free". The theory of default free bonds, also called interest rate theory or fixed income theory, will be reviewed in the first two or three weeks of the course. Bonds issued by corporations cannot be considered free of default risk, and the modeling of default events, and the losses in bond value following a default event, is called credit risk modeling. The theory of credit risk is the main focus of the course. Along the way, essential probability theory will be developed, as well as an understanding of the factors that influence default risk. Towards the end of the course, we shall cover some of the portfolio credit derivatives that have become such an important class of investment instruments, and such an important aspect of the ongoing financial turmoil.

Prerequisites: We expect everyone to have completed at least one course in stochastic calculus for continuous time finance. Suitable textbooks that cover this material are

- Arbitrage Theory in Continuous Time, Tomas Björk, Oxford University Press.
- Stochastic Calculus for Finance, Volume II: continuous Time Finance, by Steven Shreve, Springer
- Stochastic Calculus and Financial Applications, J.M. Steele, Springer-Verlag, Berlin Heidelberg New York, 2000.

References: The course material will be summarized in courseware notes "Credit Risk Modeling" by Grasselli and Hurd, we will make available at the beginning of the course.

The following reference texts will also be useful:

- Interest rate models: theory and practice, by D. Brigo and F. Mercurio, Springer
- Credit risk: pricing, measurement and management, by D. Duffie and K. Singleton, Princeton
- Credit derivatives pricing models, by P. Schönbucher, Wiley
- Credit risk: modeling, valuation and hedging, by T. Bielecki and M. Rutkowski, Springer

Assignments: There will be a number of homework assignments to be handed in during the term. All will be due in class on Wednesdays. Marked assignments will be returned in class.

Tests: There will be a 90 minute test scheduled in classtime in early March and a take-home final exam in early April.

Evaluation: Tentative: to be finalized in January. Students from participating universities of the Fields Institute should be able to obtain credit from their home institutions: details to follow.

- Homework 40%
- Midterm Test 15%
- Final exam 45%