Columbia Business School

B8835-002 - Security Pricing: Models & Computation - Spring 2008

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Time: Tuesday 9:00-10:30am Mudd 303
               Thursday 9:00-10:30am Mudd 303

Office Hours: Tuesday 11:00am-12:00pm Uris 416
               Thursday 11:00am-12:00pm Uris 416

Course Description: Financial models have come to be used extensively in the securities industry. In this course we will study models for pricing and hedging equity, fixed income and credit derivative securities. The course begins by developing a standard tool for hedging and risk management known as regression hedging. Models and theoretical underpinnings for pricing equity options are covered next. In addition to standard European and American equity options on a single underlying asset, we will investigate the pricing and hedging of path-dependent options, such as barriers, lookbacks, and Asian options, and multi-asset options, including spread, outperformance, and basket options. We will study the standard Black-Scholes model and its multi-asset extension, and will also cover jump-diffusion and stochastic volatility models which are capable of explaining some observed deviations of option prices from the Black-Scholes model, e.g., the implied volatility smile. Since derivative securities are typically held as part of larger portfolios, we will briefly cover the topics of asset allocation and portfolio optimization. Investments over long time horizons can have very different characteristics than short-term investments, so we will also study multiperiod investment planning. The pricing of fixed income derivatives requires a model of the evolution of the entire yield curve. After investigating the statistical properties of yield curve movements, we will study the Ho-Lee and Black-Derman-Toy single-factor interest rate models and then proceed to the general multi-factor Heath-Jarrow-Morton interest rate model. These models will be used to price caps, floors, swaptions, callable bonds, and other interest-rate sensitive securities. The course will conclude with a brief introduction to the pricing and hedging of credit sensitive securities, e.g., credit default swaps.

B8835-002 is the 'technical' section of this course and homework assignments and the final exam will require students to program in Visual Basic.

Prerequisites: This course assumes a working knowledge of statistics (at the level of the B6014 Statistics course) and optimization and simulation (at the level of the B6015

Decision Models course). Students must also be familiar with basic options concepts (at the level of the B8311 Options Markets course) and fixed income concepts (at the level of the B8308 Debt Markets course). A good review for the course would be to read or reread chapters 1-12 of Hull's textbook. Students must also be proficient in Excel, the use of the Solver (Excel's built-in optimizer), and Crystal Ball for spreadsheet simulation. This course is intended to be complementary to the B8312 Advanced Derivatives course.

In this technical section of the course students must be able to program in Visual Basic in order to complete the homework assignments and final exam. For links to free VBA books, use the Columbia library Books 24x7:
http://www.columbia.edu/cu/lweb/eresources/databases/3262539.html
Follow this link and then choose programming languages and then Visual Basic. Particular books to see are:

http://library.books24x7.com.arugula.cc.columbia.edu:2048/book/id_9043/toc.asp

http://library.books24x7.com.arugula.cc.columbia.edu:2048/book/id_4210/toc.asp

http://library.books24x7.com.arugula.cc.columbia.edu:2048/book/id_8218/toc.asp

A very good book on VBA is VBA for Modelers by Albright, Duxbury Press: http://www.amazon.com/VBA-Modelers-Developing-Decision-Microsoft/dp/0495106836/sr=8-1/qid=1162823336/ref=pd_bbs_sr_1/103-2871111-6879058?ie=UTF8&s=books

Method of Evaluation: The grade for the course will be based on homework assignments and a final exam. The homework will count for 60% of the final grade. The final exam will count for 40% of the final grade. There will be approximately eight homework assignments throughout the term. Students may work on the homework in groups of three or less. Homework assignments done in groups of four or more people will receive only 50% credit for the assignment. The recommended way to work in a group is to do all of the assigned problems individually. Only after that should the group get together to meet to check the results for consistency and resolve any discrepancies.

Students taking this course in the past have described the workload as heavy. If you decide to take this course, you should be prepared to spend a significant amount of time outside of the lectures to learn the material, solve the homework assignments, and prepare for the final exam. The homework and final exam questions will be designed to be as relevant, applicable and instructive as possible. They are not 'make-work.' But as a consequence, the time requirement will be substantial. If you are not prepared to make this commitment, do not take this course.

MBA students from sections B8835-001 and B8835-002 will be graded together as a group, with the Visual Basic programming questions being graded as extra credit.