Introduction to Pricing Financial Instruments

Course Overview

Purpose:
This survey course builds the intuition for, and describes the mathematical foundation of, modern methods to price, hedge, and measure the risk of individual financial instruments across asset classes. You will gain an understanding of what purpose these instruments serve, how they are related to other instruments, what factors influence their value, and to some degree how they are traded. More broadly, you will see the fundamental importance (and, in some cases, the limitations) of the no-arbitrage assumption in modern finance, and will gain an understanding of other assumptions upon which the field commonly relies.

The focus of the course is not primarily mathematical rigor; nor is it programming or software design. Nevertheless, these things—addressed more fully in your other courses—will be integrated in presentations of key concepts, and to some degree in your assignments.

Instructor:
Bob Spruill will teach the course. He can best be contacted through QuantNet, where his screen name is bob.

The instructor will be available on a limited basis for individual meetings, primarily after class.

Course Texts:
John Hull—Options, Futures, and Other Derivatives, Seventh Edition
Class notes posted on QuantNet

Assignments:
Weekly group homework assignments consisting of problems from Hull and relatively brief programming assignments

In-class quizzes, which may be given at any time with no prior notice by the instructor

Final
Topics:
Each of the Roman numerals below represents the topics for one or two class meetings, depending upon the pace that seems best for the group. If time permits, other topics may be added to provide some flavor of how the fundamental ideas illustrated by these simple instruments may be expanded to related, more complex instruments and more elaborate views of the financial universe.

I. Interest
zero-coupon bond, discount factors, zero rates, compounding, forward rates, interpolation, FRA
Reference: Hull Chapter 4

II. Yield
fixed-coupon bond, yield, bootstrapping, duration and DV01
Reference: Hull Chapter 4

III. Credit
hazard rate and risky discount factor, credit spread, FRN, duration under credit risk, spread duration and DV01, CDS
Reference: Hull Chapters 22, 23

IV. Swaps
fixed-floating swaps, cross-currency swaps, total return swaps, swap sensitivities and practical uses
Reference: Hull Chapters 7, 23

V. Forwards and Futures
forward contracts, FX and equity forwards, FX and equity futures, commodity futures, basis risk, minimum-variance hedge ratio
Reference: Hull Chapters 2, 3, 5

VI. Options in Discrete Time
put-call parity, binomial asset pricing model, statistical versus risk-neutral measures, European versus American options
Reference: Hull Chapters 8, 11

VII. Options in Continuous Time
geometric Brownian motion and the lognormal distribution, continuous-time self-financing replication, the Black-Scholes PDE, a solution for vanilla European options
Reference: Hull Chapters 12, 13

VIII. Option Greeks
definitions of standard Greeks, analytic Greeks for the Black-Scholes model, numerical estimation of Greeks, interpretations and practical uses
Reference: Hull Chapters 10, 17

IX. Other Option Payoffs
binaries, asset-or-nothing calls, barrier options, pricing of path-dependent options on trees, lookback options
Reference: Hull Chapter 24

X. Interest-Rate Options
forwards again, Black’s formula, change of numeraire, caps and floors, swaptions
Reference: Hull Chapters 27, 28