

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-float 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