

Course and Instructor Information

Term: Fall, 2023

Instructor Information

Instructor: John L. Teall

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Office Hours: By appointment: Telephone, Skype, Zoom, etc.

Course Information

Credit Hours: 3

Class Times: Online, without specific meeting times

Course Location: Online

Course Description:

This course provides students a thorough introduction to the theoretical and practical aspects of forwards, futures, options, and swaps. Derivatives are important tools in financial markets, and students will learn how to price, value, and use them from a practical perspective. This course is particularly important for students seeking to work in finance. Topics covered include no arbitrage-based pricing, the pricing of forwards and futures, interest rate products and commodities, valuation based on market prices, and option pricing and strategies. Prerequisite: 440.601 Microeconomic Theory. Corequisites: 440.606 Econometrics and 440.640 Financial Economics.

About Your Course

Please note that course details are subject to change.

Course Structure

This course is offered online, on an asynchronous basis, making use of the Canvas platform, with the instructor's website as a backup, Zoom, Skype and a series of video and multimedia presentations. While no in-person sessions will be offered, students are encouraged to reach out to the course instructor for any assistance or further discussion as might be suitable. Students are encouraged to contact the course instructor to resolve any problems or difficulties that might arise.

What to Expect in this Course

This course is 15 weeks in length and includes individual and group activities in weekly cycles and over the course of the term of instruction. Please review the course syllabus thoroughly to learn about specific course outcomes and requirements. Be sure to refer to the Checklist each week, which provides a week-at-a-glance and shows targeted dates for the completion of activities.

Course Overview

This course will introduce students to the trading, pricing, management and mathematical foundations of derivatives. Students will also learn some of the basic stochastic processes that underlie derivatives pricing as well as basic term structure models.

Course Learning Objectives

When you successfully complete the course, you will be able to:

- Derive and apply commonly used models to estimate market-based prices for forwards, futures, and options under varying scenarios.
- Employ various concepts such as probability measures, changes of measure and stochastic processes to analyze financial complications in an inter-temporal world of uncertainty.
- Evaluate common hedging strategies.
- Describe derivatives markets and participants
- Create, analyze and optimize hedged, synthetic and leveraged positions
- Evaluate fair payoffs for forwards, futures, and swaps.
- Devise and apply option trading strategies.

While these objectives are particular to this course and the way that I teach it, AAP has a more formal set of objectives, both for the way that the course fits into its applied economics programs and specific to this course:

- PLO2 Apply advanced economic theory to different economic sectors and disciplines, in this case, finance.
- CLO1 Apply commonly used models to determine market-based prices for forwards, futures, and options.
- CLO2 Evaluate common hedging programs,
- CLO3 Build synthetic positions,
- CLO4 Evaluate fair payoffs for forwards, futures, and swaps,
- CLO5 Employ option trading strategies

Recommended Text and Other Materials (refer to appendix for full reading list)

Textbook

The following text is recommended for this course:

Options, Futures and other Derivatives, 11th edition by John Hull (2022)

Pearson (or Prentice Hall)

ISBN-10: 013693997X (11th ed.); 013447208X (10th ed.)

ISBN-13: 9780136939979 (Rental); 9781292410654 (International); 9780134472089 (10th ed.)

The 10th edition (2018) will be just as good for this course and the 9th edition almost as good as the 10th, etc., so use your own judgment to balance costs and benefits. The text is available in a variety of formats, hardcover, paperback, international, digital, rental, etc., and all these formats should be acceptable. This book is a highly respected Wall Street standard, recognized and appreciated for its careful explanations and derivations, and likely to be an excellent addition to your personal collection. The book also presents material in a manner somewhat differently from the instructor, from a perspective that some students might find quite helpful. However, for at least a few students on a tight budget, the text might not be essential because of the notes, slides and workbooks prepared by the course instructor. The text's downside is that it is somewhat encyclopedic, with 848 pages, covering more than twice as much material as we will be able to over the course of this term. Of course, this also makes it more useful for further reading after the course is completed. In addition, some students might want to get the student solutions manual for the text:

Student Solutions Manual and Study Guide for Options, Futures, and Other Derivatives, 11th edition by John Hull (2022).

For those students that wish to work through additional problems and appreciate having a solutions manual on hand. This manual would be less useful than the textbook:

ISBN-10: 0134083652; 013462999X (10th ed.)

ISBN-13: 978-0134083650; 978-0134629995 (10th ed.)

Be aware that required readings will be available to students through the Canvas platform (often referred to as the "Coursepack" and through the "Course Slides." These readings should be available through the instructor's personal website as well at www.jteall.com. These readings will follow lectures and slides step-by-step and will include problems and exercises. Readings are detailed in **Appendix B** to this syllabus.

Other equipment/software/websites/online resources

While this course does not require resources beyond a computer browser, Adobe Reader (or other pdf reader) and basic MS-Office applications, there are a variety of software packages and mathematics readings and packages that students might wish to explore. If you need any assistance with these, do let the course instructor know.

Specific Technology Requirements & Skills for this Course

This course requires the use of a computer that complies with the following hardware specifications:

- MS-Windows 10 or 11. In many cases, Windows 7 or 8 operating systems will suffice, or:
- An Apple computer capable of effectively running MS Office, version 2007 or later.

Learning online requires some basic knowledge of computer technology. At a minimum, you need to be able to:

- Navigate in and use Canvas; the Canvas Student Orientation course on your “My Institution” page
- Create, use and save MS Word (version 2007 and later) documents; review [MS Word training and tutorials](#) for PC users (all versions); [Word Help](#) for Mac users
- Create, download and use MS Excel files, including some that are macro-enabled. Students will need to use Excel paste function applications and many students will benefit from using VBA/Excel macros.
- Use audio-enabled PowerPoint slides
- Find basic resources on the Internet
- Create and organize files & folders on your computer
- Send, receive, and manage email

It is further recommended, but by no means required, that students develop some basic knowledge of additional computer-based technology, including one or more of the following:

- *Python* or *R*, for those students wishing to employ more intensive mathematical applications.
- *MS Excel* Add-ins, as students opt, such as the Regression Analysis add-in.
- *DeriveaGem* software, the derivatives package prepared by John Hull for users of his textbook.

Evaluation and Grading Policy

In the table below, you will find a brief description of the various course requirements including assignment weights, and frequency (Replace Paper, Quiz, Exam, etc. with the requirements for your course). Please see Appendices A & B for the full course outline and schedule.

Course Requirements	Assignment Value
<p>Course Project: <i>Analytical Project for Derivatives</i> - Students, working individually or in groups of 2, 3 or 4, are expected to develop "user-friendly" entirely original spreadsheet files of professional quality capable of performing one of several tasks to be provided on Canvas.</p>	25%
<p>Quiz: A quiz covering the first approximately 40% of the course will be administered during the course of the term.</p>	30%
<p>Exam: An exam covering approximately the latter 60% of the term will be administered at the end of the term. This exam will be "cumulative only to the extent that course material builds on itself.</p>	35%
<p>Course Engagement: You are expected to have a timely and active presence in course discussions, and complete course activities as noted in the assignment guidelines to maximize your learning and your classmates' learning. Participation in activities should be timely, consistent, of high quality, and reflect both a high level of academic thinking and your own personal perspectives, opinions, and ideas. Comments such as "I agree with . . .," basic definitions or comprised of text copied from other sources are not helpful unless they are expanded upon with original ideas. Canvas discussions will be key here; employ appropriate etiquette, remember that your questions and insights can be very helpful to your classmates and instructor and that timely (within a few days of the end of the module's week), cogent, relevant, original and articulate comments can be useful to all of us. Don't assume that the instructor merely counts comments for grading purposes.</p>	10%
<p>Total</p>	100%

Grading Scale

A	94 to 100
A-	90 to 93.99
B+	88 to 89.99
B	84 to 87.99
B-	80 to 83.99
C	70 to 79.99
F	0 to 69.99

The grading of this course will follow the [Advanced Academic Programs Grading Policies](#).

Assignment Submission

Students are required to adhere to the following guidelines when submitting written work:

- Consistently use either APA, MLA, Chicago or Turabian or other (as approved by the course instructor) formats for papers, original spreadsheets and other work (not exams) as you see fit. The Johns Hopkins University Sheridan Libraries ["Citing Sources" site](#) may be very helpful with this.
- Adhere to constraints and restrictions as posted in assignment notifications
- It is essential that you properly cite sources used for your work. Feel free to discuss this issue with the course instructor.
- Do review the JHU Academic Conduct, Ethics & Plagiarism statements below prior to assignment submission.

Assignment Feedback

The instructor will aim to return assignments turned in on time back to you within 5-7 days at the instruction of the student. You will receive grade feedback in the Grades area of the Canvas course site, which can be accessed via the navigation menu. More specific grading details and written comments and feedback can be directly obtained by email request to the course instructor through email response.

Late Policy

You are expected to contact your instructor in advance if you think you cannot meet an assignment deadline. However, if an assignment is late and prior arrangements have not been made with the instructor, the assignment score will be reduced by 10 points for each week or fraction thereof.

Directions for Students

Next Steps: Carefully review the remaining sections of the syllabus before beginning the first week's activities, which are located in the **Module** area, Module 01 of the navigation menu in your online Canvas platform.

Once you feel that you are ready to dive into the first week's activities, select **Modules** on the navigation menu. Then, select **Module 01** to begin. Some students might wish to first view the Preliminaries Module, especially the Elementary Mathematics Review.

Course Policies

Course Conduct

Time Management Expectations

It is expected that you plan ahead to schedule your time. Plan to complete coursework across several days of the week rather than all in one day. Be sure to consider how group activities impact your schedule as well. Some assignments require that you work on them for multiple weeks. Be sure to review the assignment directions at the beginning of the course so that you can plan your time accordingly.

Please seek help before becoming frustrated and spending a significant amount of time to resolve an issue. For some students, one such issue might involve mathematics. Students are expected to have met certain requirements for calculus, matrix mathematics and statistics prior to enrolling in the M.S. program, or by having taken one or more remedial courses. Nevertheless, problems might arise, and these problems should be resolved as quickly as possible, preferably within a week of the course start. The instructor will make reading materials targeted towards students enrolled in this course and will be happy to provide other assistance as affected students might require.

Course Communication

You should communicate often with your classmates and the instructor. Much of the communication will take place within the Canvas Discussion forums. Feel free to use these forums for both questions concerning course content and for questions concerning administrative issues (e.g., exam content and dates, etc.). When you have a question about an assignment or a question about the course, you can also contact your instructor, or post your question in the course's "Syllabus & Assignment Question" forum.

Participation Expectations

Active participation within our online course requires you to log into Canvas multiple times throughout the week - a daily check-in is recommended. You are expected to have an active presence in course discussions, read all announcements, and complete course activities as noted in the assignment guidelines to maximize your learning. Participation in activities should be consistent, of high quality, and reflect both a high level of academic thinking and your own personal perspectives, opinion, and ideas.

Group Work

Group work may be assigned as part of this course, either in project form for a grade or simply as assignments for class discussion. If group work is required (as with certain projects to be submitted), you are expected to work equitably within your group to

complete collaborative group activities. If group work is assigned, you will have an opportunity to privately rate your own participation and that of your groupmates.

Online Etiquette

In this course, online discussion will primarily take place in our online discussion board. In all textual online communication, it is important to follow proper rules of online etiquette - communicating with others in a proper and respectful way. For helpful tips, please refer to these [Ground Rules for Online Discussions](#). In addition, try to make your participation in course discussion useful to your classmates, as they are as busy as you are.

Course Protocols and Getting Help

Amendments to the Course

Changes to the course will be posted in the Announcements section of your course. Please check announcements every time that you log into your online course.

Email Communication

For questions regarding course activities and assignments that would be of general interest to other students, please post those in the Canvas Discussion forum. If you have a question regarding course activities and assignments of a personal nature, please send an email message to the instructor and observe the following guidelines:

- Include the title of the course in the subject field (e.g., JHU Insert Name of Course).
- Keep messages concise, and check spelling and grammar.
- Sign your full name (the sender's email is not always obvious).

If we communicate frequently by email, some of these formalities may be dropped, and feel free to also contact your instructor at his personal email address at jteall@jteall.com or on Skype at [johnlteall](#).

Feel free to contact your instructor with comments, questions, and concerns. I emphasize this point, in part because our physical distance inhibits our ability to meet. All email messages will be sent to you via your JHU email account, so you should be in the habit of checking that account everyday or you should ensure that your JHU email account forwards messages to another account of your choice. I will aim for timely responses to email messages, usually in less than 24-48 hours.

University Policies

This course adheres to all University policies described in the academic catalog. Please pay close attention to the following policies:

Academic Conduct

All JHU students assume an obligation to conduct themselves in a manner appropriate to the Johns Hopkins University's mission as an institution of higher education and with accepted standards of ethical and professional conduct. Students must demonstrate personal integrity and honesty at all times in completing classroom assignments and examinations, in carrying out their fieldwork or other applied learning activities, and in their interactions with others. Students are obligated to refrain from acts they know or, under the circumstances, have reason to know will impair their integrity or the integrity of the University. Students and faculty in Advanced Academic Programs are required to adhere to the academic integrity guidelines and process laid out in the Policy. Refer to the website for more information regarding the academic misconduct policy.

Please note that student work may be submitted to an online plagiarism detection tool at the discretion of the course instructor. If student work is deemed plagiarized, the course instructor will follow university policy and procedures governing academic misconduct.

Ethics & Plagiarism

JHU Ethics Statement: The strength of the university depends on academic and personal integrity. In this course, you must be honest and truthful. Ethical violations include cheating on exams, plagiarism, reuse of assignments, improper use of the Internet and electronic devices, unauthorized collaboration, alteration of graded assignments, forgery and falsification, lying, facilitating academic dishonesty, and unfair competition. Report any violations you witness to the instructor and read and adhere to JHU's [Notice on Plagiarism](#).

Copyright Policy

All course materials are the property of JHU and/or John L. Teall and are to be used for the student's individual academic purpose only. Any dissemination, copying, reproducing, modification, displaying, or transmitting of any course material content for any other purpose is prohibited, will be considered misconduct under the [JHU Copyright Compliance Policy](#), and may be cause for disciplinary action. This policy applies to course exams and solutions thereto as well. In addition, encouraging academic dishonesty or cheating by distributing information about course materials or assignments which would give an unfair advantage to others may violate AAP's [Code of Conduct](#) and the University's [Student Conduct Code](#). Specifically, recordings, course materials, and lecture notes may not be exchanged or distributed for commercial purposes, for compensation, or for any purpose other than use by students enrolled in the class. Other distributions of such materials by students may be deemed to violate the above University policies and be subject to disciplinary action.

Students with Disabilities

Johns Hopkins University is committed to providing reasonable and appropriate accommodations to students with disabilities. Students with documented disabilities should contact the coordinator listed on the [Disability Accommodations](#) page. Further information and a link to the Student Request for Accommodation form can also be found on the [Disability Accommodations](#) page.

Dropping the Course

You are responsible for understanding the university's policies and procedures regarding withdrawing from courses found in the current catalog. You should be aware of the current deadlines according to the [Academic Calendar](#).

Getting Help

You have a variety of methods to get help on Canvas. Please consult the resource listed in the "Canvas Help" link for important information. If you encounter technical difficulty in completing or submitting any online assessment, please immediately contact the designated help desk listed on the [AAP online support page](#). Also, contact your instructor at the email address listed in the syllabus.

Title IX Confidentiality and Mandatory Reporting

As an instructor, one of my responsibilities is to help create a safe and inclusive learning environment on our campus. I also have mandatory reporting responsibilities related to my role as a Responsible Employee under the Sexual Misconduct Policy & Procedures (which prohibits sexual harassment, sexual assault, relationship violence and stalking), as well as the General Anti-Harassment Policy (which prohibits all types of protected status-based discrimination and harassment). It is my goal that you feel able to share information related to your life experiences in classroom discussions, in your written work, and in our one-on-one meetings. I will seek to keep information you share private to the greatest extent possible. However, I am required to share information that I learn of regarding sexual misconduct, as well as protected status-based harassment and discrimination, with the Office of Institutional Equity (OIE). For a list of individuals/offices who can speak with you confidentially, please see Appendix B of the [JHU Sexual Misconduct Policies and Laws](#).

For more information on both policies mentioned above, please see: [JHU Relevant Policies, Codes, Statements and Principles](#). Please also note that certain faculty and other University community members also have a duty as a designated Campus Safety Authority under the Clery Act to notify campus security of certain crimes, as well as a duty under State law and University policy to report suspected child abuse and/or neglect.

Diversity

Johns Hopkins is a community committed to sharing values of diversity and inclusion in order to achieve and sustain excellence. We firmly believe that we can best promote excellence by recruiting and retaining a diverse group of students, faculty, and staff and by creating a climate of respect that is supportive of their success. This climate for diversity, inclusion, and excellence is critical to attaining the best research, scholarship, teaching, health care, and other strategic goals of the Health System and the University. Taken together these values are recognized and supported fully by the Johns Hopkins Institutions leadership at all levels. Further, we recognize that the responsibility for excellence, diversity, and inclusion lies with all of us at the Institutions: leadership, administration, faculty, staff, and students. For more information on JHU's commitment to diversity, please visit the [Diversity at JHU](#) website.

Student Conduct Code

The fundamental purpose of the Johns Hopkins University's (the "University" or "JHU") regulation of student conduct is to promote and to protect the health, safety, welfare, property, and rights of all members of the University community as well as to promote the orderly operation of the University and to safeguard its property and facilities. As members of the University community, students accept certain responsibilities which support the educational mission and create an environment in which all students are afforded the same opportunity to succeed academically. For a full description of the code please visit the [Student Conduct Code](#) website.

Course Evaluation

Please remember to complete an online course evaluation survey for this course. These evaluations are an important tool in the ongoing efforts to improve instructional quality and strengthen programs. The results of the course evaluations are kept anonymous – your instructor will only receive aggregated data and comments for the entire class. An email with a link to the online course evaluation form will be sent to your JHU email address close to the end of the semester.

Appendix A

Tentative Course Schedule

Activity and assignment details will be explained in detail within each week's corresponding learning module in Canvas. If you have any questions, please contact your instructor. All problems in the Coursepack are assigned, though need not be submitted. This schedule is subject to change with fair notice. Any changes will be posted via Announcements in Canvas.

Week/ Module	Course Learning Objectives	Topics	Activities & Assessments	Due Dates
1 (08/28)		A Brief Introduction to Derivatives and Financial Markets	Readings: Chap. 01	
2 (09/04)	CL01, CL02, CL03, CL04, CL05	Pricing, Returns, Arbitrage and No Arbitrage Models	Readings: Chap. 02	
3 (09/11)	CL01, CL02, CL03, CL04, CL05	Continuous Time and Continuous State Models	Readings: Chap. 03	
4 (09/18)	CL01, CL04	Structure and Mechanics of Forward and Futures Markets & Pricing and Hedging with Forward and Futures Contracts	Readings: Chaps. 04 and 05	
5 (09/25)		Structure and Mechanics of Options Markets	Readings: Chap. 06; Start Chap. 07	
6 (10/02)	CL02, CL05	Stochastic Processes: Introduction for Option Pricing	Readings: Chap. 07	
7 (10/09)		Quiz	Study, Quiz	Approx. 10/15
8 (10/16)	CL01, CL02, CL03, CL05	Binomial Option Pricing	Readings: Chap. 08	
9 (10/23)	CL05	Fundamentals of Stochastic Calculus	Readings: Chap. 09	
10 (10/30)	CL01, CL02, CL03, CL05	The Black-Scholes Model	Readings: Chap. 10	
11 (11/06)	CL01, CL02, CL03, CL05	The Greeks, Dividend Adjustments and Early Exercise	Readings: Chap. 11	
12 (11/13)	CL01, CL02, CL03, CL05	Beyond Plain Vanilla Options on Stock	Readings: Chap. 12	
13 (11/27)	CL01, CL02, CL03, CL05	Other Derivatives and Markets	Readings: Chap. 13	
14 (12/04)			Study	
15 (12/11)			Project; Exam	12-17: Exam; 12-17: Project due
Readings are all from the Coursepack and PowerPoint slides. Work through all exercises at the end of the corresponding Coursepack chapters. Solutions to exercises immediately follow the exercises.				

Appendix B

Timeline for Course and Detailed Topics & Readings

The following are the readings and detailed listing of topics for this course. All readings should be regarded as being required unless otherwise noted. Problem sets following the readings are solved in the Coursepack and are expected to be completed but not submitted by students. All readings should be available on the on the Canvas platform and the instructor's personal website for this course.

Week 1. A Brief Introduction to Derivatives and Financial Markets

- A. Derivative Securities: A Brief Introduction
- B. Financial Securities, Instruments and Markets: A Brief Review
 - Securities and Instruments
 - Financial Markets
 - Market Efficiency
- C. Introduction to Commodities, Forward and Futures Markets
 - Commodities
 - Forward and Futures Contracts
 - Futures Contracts and Business Risk
- D. Introduction to Options Contracts and Markets
 - European and American Options
 - Options Markets
- E. Introduction to Swaps and Other Derivative Instruments
 - Swap Contracts
 - Collateralized Debt Obligations
- F. The Dark Side of Derivatives

Week 2. Pricing, Returns, Arbitrage and No Arbitrage Models (Will overlap into Week 3)

- A. Brief Review of Time Value
 - Yield Curves
 - The Term Structure of Interest Rates
- B. Arbitrage and No-Arbitrage
- C. Probability and Risk
 - Sets and Measures
 - Probability Spaces
 - Random Variables
 - Conditional Probability
- D. Discrete State Models
 - Outcomes, Payoffs and Pure Securities
 - Spanning and Complete Markets

- Arbitrage and No Arbitrage Revisited
- The Equivalent Martingale: Synthetic Probabilities
- The Risk Neutrality Argument
- Binomial Option Pricing: One Time Period
- Put-Call Parity: One Time Period
- Completing the State Space
- E. Discrete Time-Space Models
 - Discrete Time Models
 - Multiple Time Periods and States: Illustration

Week 3. Continuous Time and Continuous State Models (Will overlap into Week 4)

- A. Continuous Time Payment Models
 - Single Payment Model
 - Pricing a Bond with a Deterministic Continuous Rate
- B. Differential Equations in Financial Modeling: An Introduction
 - Separable Differential Equations and Growth Models
 - Security Returns in Continuous Time
 - Mean Reverting Interest Rates
- C. Continuous State Models
 - Option Pricing: The Elements
 - Expected Values of European Options
 - Call Options and Uniformly Distributed Stock Prices

Week 4. Structure and Mechanics of Forward and Futures Markets (Will overlap into Week 5)

- A. Forward Contracts and Markets
 - Forward Market Risks
 - Forward Market Regulation
- B. Futures Contracts and Markets
 - Futures Market Risks
 - Currency and Interest Rate Futures Markets
- C. Order Types and Liquidity
 - Orders
 - Liquidity
- D. Futures Clearing and Settlement
 - Trade Confirmation and Comparison
 - Novation and Netting
 - Trade Settlement
- E. Regulation of Futures Markets
 - Major Legislation

- The Commodity Futures Trading Commission
- F. Prediction Markets

Week 4. Pricing and Hedging with Forward and Futures Contracts

- A. Pricing Forward Contracts
 - The Expectations Hypothesis
 - Contango
 - Backwardation
 - The Net Hedging Hypothesis
- B. Forward and Futures Market Complications
 - Dividends
 - Carry Costs
 - FX and Interest Rates: Interest Rate Parity

Week 5. Structure and Mechanics of Options Markets (Will also include Section 7.A following)

- A. Option Contract Fundamentals
 - Option Payoff Functions
 - Minimum Option Market Values
- B. Options Exchanges
 - Options Technology
 - Options Clearing

Week 6. Stochastic Processes: Introduction for Option Pricing

- A. Random Walks and Martingales
 - Stochastic Processes: A Brief Introduction
 - Random Walks and Markov Processes
 - Martingales and Submartingales
 - Equivalent Probabilities and Equivalent Martingale Measures
- B. Binomial Processes: Characteristics and Modeling
 - Binomial Processes
 - Binomial Returns Process
 - Illustration: Binomial Outcome and Event Spaces
 - Pure Security Prices
 - Physical Probabilities, the Equivalent Martingale Measure and Change of Numeraire
 - Binomial Pricing, Change of Numeraire and Martingales
- C. Brownian Motion and Itô Processes
 - Brownian Motion Processes
 - Brownian Motion Processes with Drift

Itô Processes

- D. Option Pricing: A Heuristic Derivation of Black-Scholes
Estimating Exercise Probability in a Black-Scholes Environment
The Expected Expiry Date Call Value
Observations Concerning $N(d_1)$, $N(d_2)$ and c_0

Week 8. Binomial Option Pricing

- A. Binomial Option Pricing: One Period Case
The Hedge Ratio
Pricing the Call in the One Period Case
Risk-Neutral Setting: One-Period Case
Illustration: Binomial Option Pricing - One Period Case
- B. Multi-Period Framework
Extending the Binomial Model to Two Periods
- C. Multiplicative Upward and Downward Movements in Practice
The Binomial Model in Practice: An Illustration
Dividing an Interval Into Sub-Intervals

Week 9. Fundamentals of Stochastic Calculus

- A. Stochastic Calculus: An Introduction
Differentials of Stochastic Processes
Stochastic Integration
Elementary Properties of Stochastic Integrals
- B. A Digression on Taylor Series Expansions
Taylor Series and Two Independent Variables
Taylor Series and the Differential Notation
- C. Itô's Lemma
The Itô Process
Itô's formula
Itô's Lemma
Applying Itô's Lemma
Application: Geometric Brownian Motion

Week 10. The Black-Scholes Model

- A. Preliminaries
Self-Financing Strategies and Portfolios
Pricing a European Call Option and the Black-Scholes Formula
- B. Deriving the Black-Scholes Model
Black-Scholes Assumptions
The Self-Financing Replicating Portfolio and Black-Scholes

- The Black-Scholes Model
- Put-Call Parity
- The Black-Scholes Model: Simple Numerical Illustrations
- B. Simple Numerical Illustrations
- C. Implied Volatility
 - The Method of Bisection
 - The Newton Raphson Method
 - Smiles, Smirks and Aggregating Procedures
- D. Empirical Evidence
 - The Black-Scholes Study
 - The Galai and Bhattacharya Studies
 - Smiles and Smirks
 - Put-Call Parity

Week 11. The Greeks, Dividend Adjustments and Early Exercise

- A. The Greeks
 - Greeks Calculations for Calls
 - Greeks Calculations for Puts
- B. The Black-Scholes Model and Dividend Adjustments
 - The European Known Dividend Model
 - Modeling American Calls
 - Black's Pseudo-American Call Model
- C. Merton's Continuous Leakage Formula

Week 12. Beyond Plain Vanilla Options on Stock

- A. Compound Options
 - Estimating Exercise Probabilities
 - Valuing the Compound Call
 - The Roll-Geske-Whaley Compound Option Formula
 - Put-Call Parity for Compound Options
- B. Changing the Pricing Numeraire
- C. Exchange Options
 - The Margrabe Model
 - The Garman- Köhlagén Model
- D. Hedging Exchange Exposure with Currency Options
- E. Exotic Options
 - Locking in Profits
 - Path Dependent Options
 - Other Exotic Options

Week 13. Other Derivatives and Markets

- A. Swap Contracts
 - Equity Swaps
 - Total Return Swaps
 - Regulation of Swap Markets
- B. Structured Finance and Derivative Instruments
 - Securitized Instruments
 - Pass-through Securities
 - Collateralized Debt Obligations
 - Credit Derivatives
 - Interest Rate Derivatives
- C. ADRs
- D. Hybrids
 - Warrants
 - Convertible and Callable Bonds
- E. Index Contracts
 - Index Options
 - Index Construction
 - Portfolio Insurance and Program Trading
- F. Volatility Index Contracts

Readings from the Textbook (Hull)

Week/ Module	Hull Readings Page Numbers (11th ed.)	Topics
1 (08/28)	1-19	A Brief Introduction to Derivatives and Financial Markets
2 (09/04)	81-88; 238-240; 652	Pricing, Returns, Arbitrage and No Arbitrage Models
3 (09/11)		Continuous Time and Continuous State Models
4 (09/18)	24-41; 43-44; 49-60; 68-70; 102-126	Structure and Mechanics of Forward and Futures Markets & Pricing and Hedging with Forward and Futures Contracts
5 (09/25)	205-221; 255-269	Structure and Mechanics of Options Markets
6 (10/02)	652-662; 300-311; 314	Stochastic Processes: Introduction for Option Pricing
7 (10/09)		Quiz
8 (10/16)	266-286	Binomial Option Pricing
9 (10/23)	294-303; 305	Fundamentals of Stochastic Calculus
10 (10/30)	225-242; 316-336; 338-342; 429-430; 434-436; 520-522	The Black-Scholes Model
11 (11/06)	395-423	The Greeks, Dividend Adjustments and Early Exercise
12 (11/13)	337-339	Beyond Plain Vanilla Options on Stock
13 (11/27)	150-161; 171-172; 179-191; 340; 362-374; 565-573; 592- 606	Other Derivatives and Markets