Discrete Time Option Pricing Models Thomas Eap

An in-depth guide to understanding probability distributions and financial modeling for the purposes of investment management In Financial Models with Lévy Processes and Volatility Clustering, the expert author team provides a framework to model the behavior of stock returns in both a univariate and a multivariate setting, providing you with practical applications to option pricing and portfolio management. They also explain the reasons for working with non-normal distribution in financial modeling and the best methodologies for employing it. The book's framework includes the basics of probability distributions and explains the alpha-stable distribution and the tempered stable distribution. The authors also explore discrete time option pricing models, beginning with the classical normal model with volatility clustering to more recent models that consider both volatility clustering and heavy tails. Reviews the basics of probability distributions Analyzes a continuous time option pricing model (the so-called exponential Lévy model) Defines a discrete time model with volatility clustering and how to price options using Monte Carlo methods Studies two multivariate settings that are suitable to explain joint extreme events Financial Models with Lévy Processes and Volatility Clustering is a thorough guide to classical probability distribution methods and brand new methodologies for financial modeling.

The Second Edition of this best-selling book expands its advanced approach to financial risk models by covering market, credit, and integrated risk. With new data that cover the recent financial crisis, it combines Excel-based empirical exercises at the end of each chapter with online exercises so readers can use their own data. Its unified GARCH modeling approach, empirically sophisticated and relevant yet easy to implement, sets this book apart from others. Five new chapters and updated end-of-chapter questions and exercises, as well as Excel-solutions manual, support its step-by-step approach to choosing tools and solving problems. Examines market risk, credit risk, and operational risk Provides exceptional coverage of GARCH models Features online Excel-based empirical exercises

While mainstream financial theories and applications assume that asset returns are normally distributed, overwhelming empirical evidence shows otherwise. Yet many professionals don’t appreciate the highly statistical models that take this empirical evidence into consideration. Fat-Tailed and Skewed Asset Return Distributions examines this dilemma and offers readers a less technical look at how portfolio selection, risk management, and option pricing modeling should and can be undertaken when the assumption of a non-normal distribution for asset returns is violated. Topics covered in this comprehensive book include an extensive discussion of probability distributions, estimating probability distributions, portfolio selection, alternative risk measures, and much more. Fat-Tailed and Skewed Asset Return Distributions provides a bridge between the highly technical theory of statistical distributional analysis, stochastic processes, and econometrics of financial returns and real-world risk management and investments.

The first essay presents an extension of the Cox-Ross-Rubinstein simplified approach to Option pricing. In this approach, a discrete time binomial model is used to value an option on a single asset by arbitrage considerations. By taking this model to the limit in the appropriate way, the well known continuous time models (eg. Black-Scholes) may

be elegantly derived. This essay shows how to extend the binomial approach to the case of multiple stochastic process. It is shown how this technique may be used to value options on a portfolio, stock options in the presence of stochastic interest rates, etc. Finally, some insight into the technique is gained by demonstrating the results of erroneous application of the method.

This book explores the mathematics that underpins pricing models for derivative securities such as options, futures and swaps in modern markets. Models built upon the famous Black-Scholes theory require sophisticated mathematical tools drawn from modern stochastic calculus. However, many of the underlying ideas can be explained more simply within a discrete-time framework. This is developed extensively in this substantially revised second edition to motivate the technically more demanding continuous-time theory.

This book demonstrates the power of neural networks in learning complex behavior from the underlying financial time series data. The results presented also show how neural networks can successfully be applied to volatility modeling, option pricing, and value-at-risk modeling. These features mean that they can be applied to market-risk problems to overcome classic problems associated with statistical models.

The past twenty years have seen an extraordinary growth in the use of quantitative methods in financial markets. Finance professionals now routinely use sophisticated statistical techniques in portfolio management, proprietary trading, risk management, financial consulting, and securities regulation. This graduate-level textbook is intended for PhD students, advanced MBA students, and industry professionals interested in the econometrics of financial modeling. The book covers the entire spectrum of empirical finance, including: the predictability of asset returns, tests of the Random Walk Hypothesis, the microstructure of securities markets, event analysis, the Capital Asset Pricing Model and the Arbitrage Pricing Theory, the term structure of interest rates, dynamic models of economic equilibrium, and nonlinear financial models such as ARCH, neural networks, statistical fractals, and chaos theory. Each chapter develops statistical techniques within the context of a particular financial application. This exciting new text contains a unique and accessible combination of theory and practice, bringing state-of-the-art statistical techniques to the forefront of financial applications. Each chapter also includes a discussion of recent empirical evidence, for example, the rejection of the Random Walk Hypothesis, as well as problems designed to help readers incorporate what they have read into their own applications.

The stock market crash of 1987 had a tumultuous effect on the world of finance. The reverberations of this collapse are still being felt and a number of issues and problems are still unresolved. New Directions in Finance discusses these issues and looks to future developments in international finance. The book contains sections which look at capital structure; the cost of capital and agency issues; mergers and takeovers, and options, futures and forward trading. Including a contribution by Nobel Laureate Merton Miller, New Directions in Finance presents a state of the art guide to international finance.

This collection of original articles—8 years in the making—shines a bright light on recent advances in financial econometrics. From a survey of mathematical and statistical tools for understanding nonlinear Markov processes to an exploration of the time-series evolution of the risk-return tradeoff for stock market investment, noted scholars Yacine

Aït-Sahalia and Lars Peter Hansen benchmark the current state of knowledge while contributors build a framework for its growth. Whether in the presence of statistical uncertainty or the proven advantages and limitations of value at risk models, readers will discover that they can set few constraints on the value of this long-awaited volume. Presents a broad survey of current research—from local characterizations of the Markov process dynamics to financial market trading activity Contributors include Nobel Laureate Robert Engle and leading econometricians Offers a clarity of method and explanation unavailable in other financial econometrics collections

Contains lectures presented at the Courant Institute's Mathematical Finance Seminar.

This comprehensive guide offers traders, quants, and studentsthe tools and techniques for using advanced models for pricingoptions. The accompanying website includes data files, such asoptions prices, stock prices, or index prices, as well as all ofthe codes needed to use the option and volatility models describedin the book. Praise for Option Pricing Models & Volatility UsingExcel-VBA "Excel is already a great pedagogical tool for teaching optionvaluation and risk management. But the VBA routines in this bookelevate Excel to an industrial-strength financial engineeringtoolbox. I have no doubt that it will become hugely successful as areference for option traders and risk managers." —Peter Christoffersen, Associate Professor of Finance,Desautels Faculty of Management, McGill University "This book is filled with methodology and techniques on how toimplement option pricing and volatility models in VBA. The booktakes an in-depth look into how to implement the Heston and Hestonand Nandi models and includes an entire chapter on parameterestimation, but this is just the tip of the iceberg. Everyoneinterested in derivatives should have this book in their personallibrary." —Espen Gaarder Haug, option trader, philosopher, andauthor of Derivatives Models on Models "I am impressed. This is an important book because it is thefirst book to cover the modern generation of option models,including stochastic volatility and GARCH." —Steven L. Heston, Assistant Professor of Finance,R.H. Smith School of Business, University of Maryland

Working in a binomial framework, Boyle and Vorst (1992) derive self-financing strategies perfectly replicating the final payoffs to long positions in European call and put options, assuming proportional transactions costs on trades in the stocks. The initial cost of such a strategy yields, by an arbitrage argument, an upper bound for the option price. A lower bound for the option price is obtained by replicating a short position. However, for short positions, Boyle and Vorst have to impose three additional conditions. The authors' first aim in this paper is to remove Boyle and Vorst's conditions for the replication of short calls and puts. Boyle and Vorst's algorithm calculates the current holdings in stocks and bonds in terms of those at the following period. This is unlike the case of no transaction costs where the current cost of the option can be calculated directly from the costs at the following period. The authors' second aim is to show that even in the case of transactions costs the cost of replication can be directly calculated also. As a by-product, the authors are able to derive upper bounds for the cost of replication which are valid for long positions and also for short positions when two of Boyle and Vorst's additional conditions hold. The authors' third aim is to show that the time of computation using the backward recursion can be halved. This seems to to be a new observation, even in the case of no transactions costs.

Stochastic finance and financial engineering have been rapidly expanding fields of

science over the past four decades, mainly due to the success of sophisticated quantitative methodologies in helping professionals manage financial risks. In recent years, we have witnessed a tremendous acceleration in research efforts aimed at better comprehending, modeling and hedging this kind of risk. These two volumes aim to provide a foundation course on applied stochastic finance. They are designed for three groups of readers: firstly, students of various backgrounds seeking a core knowledge on the subject of stochastic finance; secondly financial analysts and practitioners in the investment, banking and insurance industries; and finally other professionals who are interested in learning advanced mathematical and stochastic methods, which are basic knowledge in many areas, through finance. Volume 1 starts with the introduction of the basic financial instruments and the fundamental principles of financial modeling and arbitrage valuation of derivatives. Next, we use the discrete-time binomial model to introduce all relevant concepts. The mathematical simplicity of the binomial model also provides us with the opportunity to introduce and discuss in depth concepts such as conditional expectations and martingales in discrete time. However, we do not expand beyond the needs of the stochastic finance framework. Numerous examples, each highlighted and isolated from the text for easy reference and identification, are included. The book concludes with the use of the binomial model to introduce interest rate models and the use of the Markov chain model to introduce credit risk. This volume is designed in such a way that, among other uses, makes it useful as an undergraduate course.

Derivatives Markets is a thorough and well-presented textbook that offers readers an introduction to derivatives instruments, with a gentle introduction to mathematical finance, and provides a working knowledge of derivatives to a wide area of market participants. This new and accessible book provides a lucid, down-to-earth, theoretically rigorous but applied introduction to derivatives. Many insights have been discovered since the seminal work in the 1970s and the text provides a bridge to and incorporates them. It develops the skill sets needed to both understand and to intelligently use derivatives. These skill sets are developed in part by using concept checks that test the reader's understanding of the material as it is presented. The text discusses some fairly sophisticated topics not usually discussed in introductory derivatives texts. For example, real-world electronic market trading platforms such as CME’s Globex. On the theory side, a much needed and detailed discussion of what risk-neutral valuation really means in the context of the dynamics of the hedge portfolio. The text is a balanced, logical presentation of the major derivatives classes including forward and futures contracts in Part I, swaps in Part II, and options in Part III. The material is unified by providing a modern conceptual framework and exploiting the no-arbitrage relationships between the different derivatives classes. Some of the elements explained in detail in the text are: Hedging, Basis Risk, Spreading, and Spread Basis Risk Financial Futures Contracts, their Underlying Instruments, Hedging and Speculating OTC Markets and Swaps Option Strategies: Hedging and Speculating Risk-Neutral Valuation and the Binomial Option Pricing Model Equivalent Martingale Measures: The Modern Approach to Option Pricing Option Pricing in Continuous Time: from Bachelier to Black-Scholes and Beyond. Professor Goldenberg’s clear and concise explanations and end-of-chapter problems, guide the reader through the derivatives markets, developing the reader’s skill sets needed in order to incorporate

and manage derivatives in a corporate or risk management setting. This textbook is for students, both undergraduate and postgraduate, as well as for those with an interest in how and why these markets work and thrive.

The current world financial scene indicates at an intertwined and interdependent relationship between financial market activity and economic health. This book explains how the economic messages delivered by the dynamic evolution of financial asset returns are strongly related to option prices. The Black Scholes framework is introduced and by underlining its shortcomings, an alternative approach is presented that has emerged over the past ten years of academic research, an approach that is much more grounded on a realistic statistical analysis of data rather than on ad hoc tractable continuous time option pricing models. The reader then learns what it takes to understand and implement these option pricing models based on time series analysis in a self-contained way. The discussion covers modeling choices available to the quantitative analyst, as well as the tools to decide upon a particular model based on the historical datasets of financial returns. The reader is then guided into numerical deduction of option prices from these models and illustrations with real examples are used to reflect the accuracy of the approach using datasets of options on equity indices.

In 1908, Vinzenz Bronzin, a professor of mathematics at the Accademia di Commercio e Nautica in Trieste, published a booklet in German entitled Theorie der Prämiengeschäfte (Theory of Premium Contracts) which is an old type of option contract. Almost like Bachelier’s now famous dissertation (1900), the work seems to have been forgotten shortly after it was published. However, almost every element of modern option pricing can be found in Bronzin’s book. He derives option prices for an illustrative set of distributions, including the Normal. - This volume includes a reprint of the original German text, a translation, as well as an appreciation of Bronzin's work from various perspectives (economics, history of finance, sociology, economic history) including some details about the professional life and circumstances of the author. The book brings Bronzin's early work to light again and adds an almost forgotten piece of research to the theory of option pricing.

Derivative Pricing in Discrete TimeSpringer Science & Business Media

Behavioral finance is the study of how psychology affects financial decision making and financial markets. It is increasingly becoming the common way of understanding investor behavior and stock market activity. Incorporating the latest research and theory, Shefrin offers both a strong theory and efficient empirical tools that address derivatives, fixed income securities, mean-variance efficient portfolios, and the market portfolio. The book provides a series of examples to illustrate the theory. The second edition continues the tradition of the first edition by being the one and only book to focus completely on how behavioral finance principles affect asset pricing, now with its theory deepened and enriched by a plethora of research since the first edition Publisher Description

Working in a binomial framework, Boyle and Vorst derived self-financing strategies perfectly replicating the final payoffs to long positions in European call and put options, assuming proportional transactions costs on trades in the stocks. The initial cost of such a strategy yields, by an arbitrage argument, an upper bound for the option price. A lower bound for the option price is obtained by replicating a short position. However, even when a contingent claim has a unique replicating portfolio, there may exist super

replicating portfolios of lower cost. Nevertheless, Bensaid, Lesne, Pages and Scheinkman gave conditions under which the cost of the replicating portfolio does not exceed the cost of any super replicating portfolio. These results were generalised by Stettner and Rutkowski to the case of asymmetric transcations costs. Palmer gave a further slight generalisation with what seemed to be a simpler proof. It is known from these results that no super replicating portfolio for long positions in calls and puts can have a lower cost than the replicating portfolio. However, even when a short call or put has a unique replicating portfolio, there may exist super replicating portfolios of lower cost when transactions costs are sufficiently large. Then a lower bound for the call or put price would be the negative of the least possible cost of such a super replicating portfolio. So it is important to be able to calculate this cost. Now the cost of the replicating portfolio can easily be calculated by backward recursion. However, as there are possibly infinitely many super replicating portfolios, it is not immediately obvious how the least possible cost of a super replicating portfolio can be efficiently calculated. The aim of this paper is to show how this cost can be calculated in the one-period case.contemplating priv ?

Derivatives are financial entities whose value is derived from the value of other more concrete assets such as stocks and commodities. They are an important ingredient of modern financial markets. This book provides an introduction to the mathematical modelling of real world financial markets and the rational pricing of derivatives, which is part of the theory that not only underpins modern financial practice but is a thriving area of mathematical research. The central theme is the question of how to find a fair price for a derivative; defined to be a price at which it is not possible for any trader to make a risk free profit by trading in the derivative. To keep the mathematics as simple as possible, while explaining the basic principles, only discrete time models with a finite number of possible future scenarios are considered. The theory examines the simplest possible financial model having only one time step, where many of the fundamental ideas occur, and are easily understood. Proceeding slowly, the theory progresses to more realistic models with several stocks and multiple time steps, and includes a comprehensive treatment of incomplete models. The emphasis throughout is on clarity combined with full rigour. The later chapters deal with more advanced topics, including how the discrete time theory is related to the famous continuous time Black-Scholes theory, and a uniquely thorough treatment of American options. The book assumes no prior knowledge of financial markets, and the mathematical prerequisites are limited to elementary linear algebra and probability. This makes it accessible to undergraduates in mathematics as well as students of other disciplines with a mathematical component. It includes numerous worked examples and exercises, making it suitable for self-study.

In this thesis, I will discuss the fundamental methods to value the options in Financial Mathematics, more specifically, the discrete time Binomial Tree Model and a generalization, the Trinomial Tree Model. This is based on the assumption that the model is risk-free and we use the replication portfolio method to find option price. In addition, I will show that the option price is depending on the numbers of steps of the underlying stock price go up/down in a small amount and the numbers of steps of stock price go up/down in large amount. But it doesn't depend on when it will occur. This shows that the option price is not only

depending on the replication method. This study explains that the binomial model can only work with stock prices with low volatility.

Since the appearance of seminal works by R. Merton, and F. Black and M. Scholes, stochastic processes have assumed an increasingly important role in the development of the mathematical theory of finance. This work examines, in some detail, that part of stochastic finance pertaining to option pricing theory. Thus the exposition is confined to areas of stochastic finance that are relevant to the theory, omitting such topics as futures and term-structure. This self-contained work begins with five introductory chapters on stochastic analysis, making it accessible to readers with little or no prior knowledge of stochastic processes or stochastic analysis. These chapters cover the essentials of Ito's theory of stochastic integration, integration with respect to semimartingales, Girsanov's Theorem, and a brief introduction to stochastic differential equations. Subsequent chapters treat more specialized topics, including option pricing in discrete time, continuous time trading, arbitrage, complete markets, European options (Black and Scholes Theory), American options, Russian options, discrete approximations, and asset pricing with stochastic volatility. In several chapters, new results are presented. A unique feature of the book is its emphasis on arbitrage, in particular, the relationship between arbitrage and equivalent martingale measures (EMM), and the derivation of necessary and sufficient conditions for no arbitrage (NA). {\it Introduction to Option Pricing Theory} is intended for students and researchers in statistics, applied mathematics, business, or economics, who have a background in measure theory and have completed probability theory at the intermediate level. The work lends itself to self-study, as well as to a one-semester course at the graduate level.

Financial market modeling is a prime example of a real-life application of probability theory and stochastics. This authoritative book discusses the discrete-time approximation and other qualitative properties of models of financial markets, like the Black-Scholes model and its generalizations, offering in this way rigorous insights on one of the most interesting applications of mathematics nowadays.

Competitive Strategy provides a rigorous yet pragmatic and intuitive approach to strategy formulation. It synthesizes research in the areas of strategy, economics, and finance in a way that is accessible to readers not necessarily expert in the various fields involved. The book will be of interest to scholars, students, and academically trained practicing managers interested in applying these ideas.

This book describes the modelling of prices of ?nancial assets in a simple d-crete time, discrete state, binomial framework. By avoiding the mathematical technicalitiesofcontinuoustime?nancewehopewehavemadethematerial accessible to a wide audience. Some of the developments and formulae appear here for the ?rst time in book form. We hope our book will appeal to various audiences. These include MBA s-dents,upperlevelundergraduatestudents,beginningdoctoralstudents,qu- titative

analysts at a basic level and senior executives who seek material on new developments in ?nance at an accessible level. The basic building block in our book is the one-step binomial model where a known price today can take one of two possible values at a future time, which might, for example, be tomorrow, or next month, or next year. In this simple situation “risk neutral pricing” can be de?ned and the model can be applied to price forward contracts, exchange rate contracts and interest rate derivatives. In a few places we discuss multinomial models to explain the notions of incomplete markets and how pricing can be viewed in such a context, where unique prices are no longer available. The simple one-period framework can then be extended to multi-period m-els.TheCox-Ross-RubinsteinapproximationtotheBlackScholesoptionpr- ing formula is an immediate consequence. American, barrier and exotic - tions can all be discussed and priced using binomial models. More precise modelling issues such as implied volatility trees and implied binomial trees are treated, as well as interest rate models like those due to Ho and Lee; and Black, Derman and Toy.

The author successfully passed the CFA (Chartered Financial Analyst), CPA (Certified Public Accountant), and FRM (Financial Risk Manager) exams "WITHOUT ANY RETAKES". Based on a true experience, the author also wrote how to pass the CFA exams after studying for two weeks.

Relying on the existence, in a complete market, of a pricing kernel, this book covers the pricing of assets, derivatives, and bonds in a discrete time, complete markets framework. It is primarily aimed at advanced Masters and PhD students in finance.-- Covers asset pricing in a single period model, deriving a simple complete market pricing model and using Stein's lemma to derive a version of the Capital Asset Pricing Model.-- Looks more deeply into some of the utility determinants of the pricing kernel, investigating in particular the effect of non-marketable background risks on the shape of the pricing kernel.-- Derives the prices of European-style contingent claims, in particular call options, in a one-period model; derives the Black-Scholes model assuming a lognormal distribution for the asset and a pricing kernel with constant elasticity, and emphasizes the idea of a risk-neutral valuation relationship between the price of a contingent claim on an asset and the underlying asset price.-- Extends the analysis to contingent claims on assets with non-lognormal distributions and considers the pricing of claims when risk-neutral valuation relationships do not exist.-- Expands the treatment of asset pricing to a multi-period economy, deriving prices in a rational expectations equilibrium.-- Uses the rational expectations framework to analyse the pricing of forward and futures contracts on assets and derivatives.-- Analyses the pricing of bonds given stochastic interest rates, and then uses this methodology to model the drift of forward rates, and as a special case the drift of the forward London Interbank Offer Rate in the LIBOR Market Model.

This book examines whether continuous-time models in frictionless financial economies can be well approximated by discrete-time models. It specifically

looks to answer the question: in what sense and to what extent does the famous Black-Scholes-Merton (BSM) continuous-time model of financial markets idealize more realistic discrete-time models of those markets? While it is well known that the BSM model is an idealization of discrete-time economies where the stock price process is driven by a binomial random walk, it is less known that the BSM model idealizes discrete-time economies whose stock price process is driven by more general random walks. Starting with the basic foundations of discrete-time and continuous-time models, David M. Kreps takes the reader through to this important insight with the goal of lowering the entry barrier for many mainstream financial economists, thus bringing less-technical readers to a better understanding of the connections between BSM and nearby discrete-economies. The proliferation of financial derivatives over the past decades, options in particular, has underscored the increasing importance of derivative pricing literacy among students, researchers, and practitioners. Derivative Pricing: A Problem-Based Primer demystifies the essential derivative pricing theory by adopting a mathematically rigorous yet widely accessible pedagogical approach that will appeal to a wide variety of audience. Abandoning the traditional "black-box" approach or theorists' "pedantic" approach, this textbook provides readers with a solid understanding of the fundamental mechanism of derivative pricing methodologies and their underlying theory through a diversity of illustrative examples. The abundance of exercises and problems makes the book well-suited as a text for advanced undergraduates, beginning graduates as well as a reference for professionals and researchers who need a thorough understanding of not only "how," but also "why" derivative pricing works. It is especially ideal for students who need to prepare for the derivatives portion of the Society of Actuaries Investment and Financial Markets Exam. ? Features Lucid explanations of the theory and assumptions behind various derivative pricing models. Emphasis on intuitions, mnemonics as well as common fallacies. Interspersed with illustrative examples and end-of-chapter problems that aid a deep understanding of concepts in derivative pricing. Mathematical derivations, while not eschewed, are made maximally accessible. A solutions manual is available for qualified instructors. The Author Ambrose Lo is currently Assistant Professor of Actuarial Science at the Department of Statistics and Actuarial Science at the University of Iowa. He received his Ph.D. in Actuarial Science from the University of Hong Kong in 2014, with dependence structures, risk measures, and optimal reinsurance being his research interests. He is a Fellow of the Society of Actuaries (FSA) and a Chartered Enterprise Risk Analyst (CERA). His research papers have been published in top-tier actuarial journals, such as ASTIN Bulletin: The Journal of the International Actuarial Association, Insurance: Mathematics and Economics, and Scandinavian Actuarial Journal. ? Introduction to Financial Mathematics: Option Valuation, Second Edition is a well-rounded primer to the mathematics and models used in the valuation of financial derivatives. The book consists of fifteen chapters, the first ten of which develop

option valuation techniques in discrete time, the last five describing the theory in continuous time. The first half of the textbook develops basic finance and probability. The author then treats the binomial model as the primary example of discrete-time option valuation. The final part of the textbook examines the Black-Scholes model. The book is written to provide a straightforward account of the principles of option pricing and examines these principles in detail using standard discrete and stochastic calculus models. Additionally, the second edition has new exercises and examples, and includes many tables and graphs generated by over 30 MS Excel VBA modules available on the author's webpage https://home.gwu.edu/~hdj/.

A new edition of a successful, well-established book that provides the reader with a text focused on practical rather than theoretical aspects of financial modelling Includes a new chapter devoted to volatility risk The theme of stochastic volatility reappears systematically and has been revised fundamentally, presenting a much more detailed analyses of interest-rate models