Foreword by Paul A. Samuelson Preface			xi xiii
Par		ntroduction to Finance and the Mathematics of Continuous-Time Models	
1	Mode	ern Finance	3
2		duction to Portfolio Selection and Capital Market ry: Static Analysis	16
	2.1	Introduction	16
	2.2		17
	2.3	Risk Measures for Securities and Portfolios in the One-Period Model	25
	2.4	Spanning, Separation, and Mutual-Fund Theorems	33
3		ne Mathematics and Economics Assumptions of nuous-Time Models	57
	3.1	Introduction	57
	3.2	Continuous-Sample-Path Processes with "No Rare Events"	65
	3.3	Continuous-Sample-Path Processes with "Rare Events"	81
	3.4	Discontinuous-Sample-Path Processes with "Rare Events"	86
Par		Optimum Consumption and Portfolio Selection in Continuous-Time Models	

4 Lifetime Portfolio Selection Under Uncertainty: The

Continuous-Time Case

iv

	4.1	Introduction	97
	4.2	Dynamics of the Model: The Budget Equation	98
	4.3	The Two-Asset Model	100
	4.4	Constant Relative Risk Aversion	104
	4.5	Dynamic Behavior and the Bequest Valuation Function	106
	4.6	Infinite Time Horizon	108
	4.7	Economic Interpretation of the Optimal Decision Rules for Portfolio Selection and Consumption	111
	4.8	Extension to Many Assets	116
	4.9	Constant Absolute Risk Aversion	117
	4.10	Other Extensions of the Model	119
5		um Consumption and Portfolio Rules in a nuous-Time Model	120
	5.1	Introduction	120
	5.2	A Digression on Itô Processes	121
	5.3	Asset-Price Dynamics and the Budget Equation	124
	5.4	Optimal Portfolio and Consumption Rules: The Equations of Optimality	127
	5.5	Log-Normality of Prices and the Continuous-Time Analog to Tobin–Markowitz Mean–Variance Analysis	131
	5.6	Explicit Solutions for a Particular Class of Utility Functions	137
	5.7	Noncapital Gains Income: Wages	143
	5.8	Poisson Processes	145
	5.9	Alternative Price Expectations to the Geometric Brownian Motion	151
	5.10	Conclusion	164
6		er Developments in the Theory of Optimal imption and Portfolio Selection	166
	6.1	Introduction	166
	6.2	The Cox-Huang Alternative to Stochastic Dynamic	169
	5.2	Programming	
	6.3	Optimal Portfolio Rules When the Nonnegativity Constraint on Consumption is Binding	184
	6.4	Generalized Preferences and Their Impact on Optimal Portfolio Demands	201

324

7	Utilit		215
	(with	Paul A. Samuelson)	
	7.1	Introduction	215
	7.2	Cash-Stock Portfolio Analysis	215
	7.3	Recapitulation of the 1965 Samuelson Model	220
	7.4	Determining Average Stock Yield	223
	7.5	Determining Warrant Holdings and Prices	224
	7.6	Digression: General Equilibrium Pricing	227
	7.7	Utility-Maximizing Warrant Pricing: The Important	229
		"Incipient" Case	22)
	7.8	Explicit Solutions	231
	7.9	Warrants Never to be Converted	235
	7.10	Exact Solution to the Perpetual Warrant Case	236
	7.11	Illustrative Example	239
	7.12		243
		Yield of Common Stock	2010
	7.13	Conclusion	245
8	Theor	y of Rational Option Pricing	255
	8.1	Introduction	255
	8.2	Restrictions on Rational Option Pricing	256
	8.3	Effects of Dividends and Changing Exercise Price	268
	8.4	Restrictions on Rational Put Option Pricing	276
	8.5	Rational Option Pricing along Black-Scholes Lines	281
	8.6	An Alternative Derivation of the Black-Scholes	201
		Model	284
	8.7	Extension of the Model to Include Dividend	294
		Payments and Exercise Price Changes	
	8.8	Valuing an American Put Option	298
	8.9	Valuing the "Down-and-Out" Call Option	300
	8.10	Valuing a Callable Warrant	303
	8.11	Conclusion	305
9	Option Discor	Pricing When Underlying Stock Returns are attinuous	309
	9.1	Introduction	309
	9.2	The Stock-Price and Option-Price Dynamics	312
	9.3	An Option Pricing Formula	318

A Possible Answer to an Empirical Puzzle

9.4

Part III: Warrant and Option Pricing Theory

330

413

415

419

423

10 Further Developments in Option Pricing Theory

vi

13.1 Introduction

13.2

13.3

13.4

	10.1	Introduction	330
	10.2	Cox-Ross "Risk-Neutral" Pricing and the Binomial	334
		Option Pricing Model	
	10.3	Pricing Options on Futures Contracts	347
Par	ı IV.	Contingent-Claims Analysis in the Theory of	
1 us	117.	Corporate Finance and Financial Intermediation	
11	Marl	ynamic General Equilibrium Model of the Asset xet and Its Application to the Pricing of the Capital cture of the Firm	357
	11.1	Introduction	357
	11.2	A Partial-Equilibrium One-Period Model	358
	11.3		361
	11.4		367
	11.5	Model I: A Constant Interest Rate Assumption	373
	11.6		380
	11.7	Model III: The General Model	382
	11.8	Conclusion	386
12		he Pricing of Corporate Debt: The Risk Structure of rest Rates	388
	12.1	Introduction	388
	12.2		389
	12.3		392
	12.4		396
		Structure	
	12.5		404
	12.6		409
	12.7	Conclusion	411
13		he Pricing of Contingent Claims and the	413
	Mod	igliani-Miller Theorem	

A General Derivation of a Contingent-Claim Price

Applications of Contingent-Claims Analysis in

Corporate Finance

On the Modigliani-Miller Theorem with Bankruptcy

	Contents		vii
14	Finan	cial Intermediation in the Continuous-Time Model	428
	14.1	Introduction	428
	14.2	Derivative-Security Pricing with Transactions Costs	428
	14.3	Production Theory for Zero-Transaction-Cost	441
		Financial Intermediaries	441
	14.4	Risk Management for Financial Intermediaries	450
	14.5 On the Role of Efficient Financial Intermediation in the Continuous-Time Model		457
	14.6	Afterword: Policy and Strategy in Financial Intermediation	467
Pai	t V: _/	An Intertemporal Equilibrium Theory of Finance	
15	An In	tertemporal Capital Asset Pricing Model	475
	15.1	Introduction	475
	15.2	Capital Market Structure	477
	15.3	Asset Value and Rate of Return Dynamics	478
	15.4 Preference Structure and Budget-Equation Dynamics		484
	15.5	The Equations of Optimality: The Demand Functions for Assets	485
	15.6	Constant Investment Opportunity Set	488
	15.7	Generalized Separation: A Three-Fund Theorem	490
	15.8	The Equilibrium Yield Relation among Assets	493
	15.9	Empirical Evidence	496
	15.10	An (m+2)-Fund Theorem and the Security Market Hyperplane	499
	15.11	The Consumption-Based Capital Asset Pricing Model	512
	15.12	Conclusion	519
6	A Cor Financ	nplete-Markets General Equilibrium Theory of the in Continuous Time	524
	16.1	Introduction	524
	16.2	Financial Intermediation with Dynamically- Complete Markets	528
	16.3	Optimal Consumption and Portfolio Rules with Dynamically-Complete Markets	537
	16.4	General Equilibrium: The Case of Pure Exchange	549
	16.5	General Equilibrium: The Case of Production	554

viii

	16.7	Asset Pricing Model Obtains Conclusion	574
Part	VI:	Applications of the Continuous-Time Model to Selected Issues in Public Finance: Long-Run Economic Growth, Public Pension Plans, Deposit Insurance, Loan Guarantees, and Endowment Management for Universities	
17	An A	Asymptotic Theory of Growth Under Uncertainty	579
	17.1		579
	17.2		580
	17.3		584
	17.4	The Cobb-Douglas/Constant-Savings-Function Economy	580
	17.5		592
18	On (Consumption-Indexed Public Pension Plans	600
	18.1	Introduction	600
	18.2	A Simple Intertemporal Equilibrium Model	609
	18.3	On the Merits and Feasibility of a	616
		Consumption-Indexed Public Plan	
19	and :	Analytic Derivation of the Cost of Deposit Insurance Loan Guarantees: An Application of Modern Option ng Theory	625
	19.1	Introduction	625
	19.2	A Model for Pricing Deposit Insurance	62
20	On Sur	the Cost of Deposit Insurance When There are veillance Costs	63-
	20.1	Introduction	634
	20.2	Assumptions of the Model	63
	20.3	The Evaluation of Federal Deposit Insurance Corporation Liabilities	63
	20.4		64
	20.5		64
	20.6	6 Conclusion	64

642

644

646

ix

21	Optimal Investment Strategies for University Endowment Funds		
	21.1	Introduction	649
	21.2	Overview of Basic Insights and Prescriptions for Policy	651
	21.3	The Model	656
	21.4	Optimal Endowment Management with Other	664

21.4	Optimal Endowment Management with Sources of Income	Other	66
Bibliograp	hy		67
Author Index			71

Bibliography	67
Author Index	71
Subject Index	71