

Contents

Chapter One Introduction 3

- 1.1 Dynamic Economics and Optimization 3
- 1.2 Methods of Dynamic Optimization 7
- 1.3 Economic Growth 10
- 1.4 Theories of Market Equilibrium 12
- 1.5 Business Cycles 13
- 1.6 Dynamic Games 14
- 1.7 Models in Finance 15
- 1.8 Models of Investment 16
- 1.9 Numerical Methods for Solving First-Order Conditions in Dynamic Optimization Problems 17

Chapter Two Dynamic Optimization in Discrete Time 19

- 2.1 The Method of Lagrange Multipliers by an Example 19
- 2.2 The Method of Dynamic Programming by an Example 20
- 2.3 Solution of a Standard Dynamic Optimization Problem 22
- 2.4 Numerical Solution by Linear Approximations of λ and g 23
- 2.5 Sufficient Conditions for a Globally Optimal Solution 25
- 2.6 Relations to Known Results on Optimization Problems 28

Chapter Three Economic Growth 32

- 3.1 The Brock-Mirman Growth Model 32
- 3.2 A Multisector Growth Model 34
- 3.3 A Growth Model Based on Human Capital and Fertility 37
- 3.4 Technology and Economic Growth 42

3.5 Research and Development and Economic Growth 47
Problems 49

Chapter Four Theories of Market Equilibrium 51

4.1 Asset Prices of an Exchange Economy 51
4.2 Equilibrium in a Pure Currency Economy 53
4.3 A Pure Credit Economy with Linear Utility 55
4.4 Money and Interest in a Cash-In-Advance Economy 57
4.5 A One-Sector Model of General Equilibrium 66
4.6 Equilibrium of a Multisector Model 71
4.7 Equilibrium of a One-Sector Model with Tax Distortion 76
Problems 78

Chapter Five Business Cycles 80

5.1 Keynes and the Classics 80
5.2 Dynamic Properties of a Multisector Model with Technology Shocks 81
5.3 Estimating Economic Effects of Political Events in China 83
5.4 Estimating and Testing a Base-Line Real Business Cycle Model 85
5.5 Real Business Cycles and Labor Market Fluctuations 93
5.6 Oligopolistic Pricing and Aggregate Demand 100
5.7 Research on Real Business Cycles 107
Problems 109

Chapter Six Dynamic Games 111

6.1 A Formulation of Models of Dynamic Games 111
6.2 Price Determination of Duopolists with No Consumer Switching 112
6.3 A Characterization of Subgame Perfect Equilibrium for Infinitely Repeated Games 116
6.4 A Characterization of Subgame Perfect Equilibrium for Dynamic Games 119
6.5 Credible Government Policy 123
6.6 Credible Taxation to Redistribute Income 131
Problems 137

Chapter Seven Models in Finance 139

7.1 Stochastic Differential Equations 139
7.2 Dynamic Programming for a Continuous-Time Model 141
7.3 Solution of a Continuous-Time Optimization Problem by Lagrange Multipliers 142

- 7.4 An Algebraic Method for Finding the Optimal Control Function 145
- 7.5 Optimum Consumption and Portfolio Selection Over Time 147
- 7.6 Capital Asset Pricing with Shifts in Investment Opportunities 152
- 7.7 The Pricing of Options and Corporate Liabilities 154
- 7.8 Asset Pricing and Portfolio Selection with Noise in Supply 156
- 7.9 Asset Pricing and Portfolio Selection with Asymmetric Information 162
- 7.9a The Kalman Filter in Continuous Time 162
- Problems 167

Chapter Eight Models of Investment 172

- 8.1 Investment as Exercising an Irreversible Option to Invest 172
- 8.2 A Simple Model of Investment with Adjustment Cost 174
- 8.3 Investment as Gradual Capacity Expansion with Adjustment Cost 176
- 8.4 Optimal Policy for Replacement Investment 179
- 8.5 Optimal Policy to Retire Human Capital 181
- 8.6 Some Other Literature on Investment 182
- Problems 183

Chapter Nine Numerical Methods for Solving First-Order Conditions in Dynamic Optimization Problems 185

- 9.1 Introduction 185
- 9.2 Change of Variables 186
- 9.3 A Short-Cut to Log-Linearize First-Order Conditions 190
- 9.4 Solving Matrix Riccati Equations Rapidly 192
- 9.5 Solving Linear First-Order Conditions by the Method of Undetermined Coefficients 195
- 9.6 Quadratic Approximation to λ in Discrete Time 197
- 9.7 Quadratic Approximation to λ in Continuous Time 200
- 9.8 Solving First-Order Conditions by the Galerkin Method 202
- Problems 207

References 208

List of Mathematical Statements 214

Solutions to Selected Problems 216

Index 228