

Contents

- 1 Overview 1
- I Theory
- 2 Theory of Dynamic Programming 7
 - 2.1 Overview 7
 - 2.2 Indirect Utility 7
 - 2.2.1 Consumers 7
 - 2.2.2 Firms 8
 - 2.3 Dynamic Optimization: A Cake-Eating Example 9
 - 2.3.1 Direct Attack 10
 - 2.3.2 Dynamic Programming Approach 12
 - 2.4 Some Extensions of the Cake-Eating Problem 16
 - 2.4.1 Infinite Horizon 16
 - 2.4.2 Taste Shocks 20
 - 2.4.3 Discrete Choice 22
 - 2.5 General Formulation 24
 - 2.5.1 Nonstochastic Case 24
 - 2.5.2 Stochastic Dynamic Programming 29
 - 2.6 Conclusion 31
- 3 Numerical Analysis 33
 - 3.1 Overview 33
 - 3.2 Stochastic Cake-Eating Problem 34
 - 3.2.1 Value Function Iterations 34
 - 3.2.2 Policy Function Iterations 40
 - 3.2.3 Projection Methods 41
 - 3.3 Stochastic Discrete Cake-Eating Problem 46
 - 3.3.1 Value Function Iterations 47

- 3.4 Extensions and Conclusion 50
 - 3.4.1 Larger State Spaces 50
- 3.5 Appendix: Additional Numerical Tools 52
 - 3.5.1 Interpolation Methods 52
 - 3.5.2 Numerical Integration 55
 - 3.5.3 How to Simulate the Model 59
- 4 Econometrics 61
 - 4.1 Overview 61
 - 4.2 Some Illustrative Examples 61
 - 4.2.1 Coin Flipping 61
 - 4.2.2 Supply and Demand Revisited 74
 - 4.3 Estimation Methods and Asymptotic Properties 79
 - 4.3.1 Generalized Method of Moments 80
 - 4.3.2 Maximum Likelihood 83
 - 4.3.3 Simulation-Based Methods 85
 - 4.4 Conclusion 97
- II Applications**
- 5 Stochastic Growth 103
 - 5.1 Overview 103
 - 5.2 Nonstochastic Growth Model 103
 - 5.2.1 An Example 105
 - 5.2.2 Numerical Analysis 107
 - 5.3 Stochastic Growth Model 111
 - 5.3.1 Environment 112
 - 5.3.2 Bellman's Equation 113
 - 5.3.3 Solution Methods 115
 - 5.3.4 Decentralization 120
 - 5.4 A Stochastic Growth Model with Endogenous Labor Supply 122
 - 5.4.1 Planner's Dynamic Programming Problem 122
 - 5.4.2 Numerical Analysis 124
 - 5.5 Confronting the Data 125
 - 5.5.1 Moments 126
 - 5.5.2 GMM 128
 - 5.5.3 Indirect Inference 130
 - 5.5.4 Maximum Likelihood Estimation 131

- 5.6 Some Extensions 132
 - 5.6.1 Technological Complementarities 133
 - 5.6.2 Multiple Sectors 134
 - 5.6.3 Taste Shocks 136
 - 5.6.4 Taxes 136
- 5.7 Conclusion 138

- 6 Consumption 139
 - 6.1 Overview and Motivation 139
 - 6.2 Two-Period Problem 139
 - 6.2.1 Basic Problem 140
 - 6.2.2 Stochastic Income 143
 - 6.2.3 Portfolio Choice 145
 - 6.2.4 Borrowing Restrictions 146
 - 6.3 Infinite Horizon Formulation: Theory and Empirical Evidence 147
 - 6.3.1 Bellman's Equation for the Infinite Horizon Problem 147
 - 6.3.2 Stochastic Income 148
 - 6.3.3 Stochastic Returns: Portfolio Choice 150
 - 6.3.4 Endogenous Labor Supply 153
 - 6.3.5 Borrowing Constraints 156
 - 6.3.6 Consumption over the Life Cycle 160
 - 6.4 Conclusion 164

- 7 Durable Consumption 165
 - 7.1 Motivation 165
 - 7.2 Permanent Income Hypothesis Model of Durable Expenditures 166
 - 7.2.1 Theory 166
 - 7.2.2 Estimation of a Quadratic Utility Specification 168
 - 7.2.3 Quadratic Adjustment Costs 169
 - 7.3 Nonconvex Adjustment Costs 171
 - 7.3.1 General Setting 172
 - 7.3.2 Irreversibility and Durable Purchases 173
 - 7.3.3 A Dynamic Discrete Choice Model 175

- 8 Investment 187
 - 8.1 Overview and Motivation 187
 - 8.2 General Problem 188

| | | |
|--------|--|-----|
| 8.3 | No Adjustment Costs | 189 |
| 8.4 | Convex Adjustment Costs | 191 |
| 8.4.1 | Q Theory: Models | 192 |
| 8.4.2 | Q Theory: Evidence | 193 |
| 8.4.3 | Euler Equation Estimation | 198 |
| 8.4.4 | Borrowing Restrictions | 201 |
| 8.5 | Nonconvex Adjustment: Theory | 202 |
| 8.5.1 | Nonconvex Adjustment Costs | 203 |
| 8.5.2 | Irreversibility | 208 |
| 8.6 | Estimation of a Rich Model of Adjustment Costs | 209 |
| 8.6.1 | General Model | 209 |
| 8.6.2 | Maximum Likelihood Estimation | 212 |
| 8.7 | Conclusion | 213 |
| 9 | Dynamics of Employment Adjustment | 215 |
| 9.1 | Motivation | 215 |
| 9.2 | General Model of Dynamic Labor Demand | 216 |
| 9.3 | Quadratic Adjustment Costs | 217 |
| 9.4 | Richer Models of Adjustment | 224 |
| 9.4.1 | Piecewise Linear Adjustment Costs | 224 |
| 9.4.2 | Nonconvex Adjustment Costs | 226 |
| 9.4.3 | Asymmetries | 228 |
| 9.5 | The Gap Approach | 229 |
| 9.5.1 | Partial Adjustment Model | 230 |
| 9.5.2 | Measuring the Target and the Gap | 231 |
| 9.6 | Estimation of a Rich Model of Adjustment Costs | 235 |
| 9.7 | Conclusion | 238 |
| 10 | Future Developments | 241 |
| 10.1 | Overview and Motivation | 241 |
| 10.2 | Price Setting | 241 |
| 10.2.1 | Optimization Problem | 242 |
| 10.2.2 | Evidence on Magazine Prices | 244 |
| 10.2.3 | Aggregate Implications | 245 |
| 10.3 | Optimal Inventory Policy | 248 |
| 10.3.1 | Inventories and the Production-Smoothing Model | 248 |
| 10.3.2 | Prices and Inventory Adjustment | 252 |
| 10.4 | Capital and Labor | 254 |

| | |
|---|-----|
| 10.5 Technological Complementarities: Equilibrium Analysis | 255 |
| 10.6 Search Models | 257 |
| 10.6.1 A Simple Labor Search Model | 257 |
| 10.6.2 Estimation of the Labor Search Model | 259 |
| 10.6.3 Extensions | 260 |
| 10.7 Conclusion | 263 |
| | |
| Bibliography | 265 |
| Index | 275 |