

# Table of Contents

|   |    |
|---|----|
| <b>Introduction</b>   | 1  |
| Acknowledgments   | 5  |
| <br>  |    |
| <b>1 Making Decisions in Infrastructure Investment</b>                      | 7  |
| 1.1 Introduction  | 7  |
| 1.2 Fiscal Constraints and Infrastructure Investment                        | 10 |
| 1.2.1 An Illustrative Model   | 10 |
| 1.3 Some Evidence from the Introduction of the EMU                          | 13 |
| 1.4 Counterfactual Evaluation and Project Appraisal                         | 21 |
| References  | 23 |
| <br>  |    |
| <b>2 Assessing Financial Profitability of Infrastructure Investment</b>     | 27 |
| 2.1 Introduction  | 27 |
| 2.2 Basics of Financial Analysis  | 28 |
| 2.3 Private Participation in Infrastructure Investment                      | 31 |
| 2.4 The Case of Milan's M4 Metro Line                                       | 35 |
| References  | 38 |
| <br>  |    |
| <b>3 Introduction to Cost–Benefit Analysis</b>                              | 41 |
| 3.1 Basic Structure of Cost–Benefit Analysis                                | 41 |
| 3.2 A Discussion of the Theoretical Framework of CBA                        | 42 |
| 3.3 The Calculation of the Variation in Social Welfare                      | 50 |
| 3.4 Wider Economic Effects and Impact Analysis                              | 55 |
| 3.4.1 Quantifying Wider Economic Benefits                                   | 55 |
| 3.4.2 A Case Study: The Evaluation of Wider Economic Benefits<br>of the HSR | 57 |
| References  | 61 |
| <br>  |    |
| <b>4 From Market Prices to Shadow Prices</b>                                | 65 |
| 4.1 Shadow Prices and the Social Planner                                    | 65 |
| 4.2 Empirical Approaches for Estimating Accounting Prices                   | 67 |
| 4.3 The Social Cost of Labor  | 70 |
| References  | 72 |

|          |   |     |
|----------|---|-----|
| <b>5</b> | <b>The Evaluation of External Costs and Benefits</b>                    | 75  |
| 5.1      | Introduction  | 75  |
| 5.2      | Revealed Preference Methods   | 76  |
| 5.2.1    | Market Analogy Method   | 77  |
| 5.2.2    | Intermediate Good Method  | 79  |
| 5.2.3    | Defensive Expenditure Models and Averting Behavior                      | 79  |
| 5.2.4    | Hedonic Price Method  | 80  |
| 5.2.5    | The Value of Time   | 87  |
| 5.2.6    | Travel Cost Method  | 88  |
| 5.3      | Stated Preferences Methods: Contingent Valuation                        | 90  |
| 5.4      | Measuring External Costs from Transportation                            | 98  |
| 5.4.1    | Accidents: Valuing Risks Borne by Others                                | 98  |
| 5.4.2    | Air Pollution: Health, Crops, Materials, and Biodiversity               | 98  |
| 5.4.3    | Climate Change: Valuing Carbon Consistently                             | 99  |
| 5.4.4    | Noise: Exposure and the Valuation of Decibels                           | 99  |
| 5.4.5    | Congestion: Time Lost and Deadweight Costs                              | 99  |
| 5.4.6    | Well-to-Tank Emissions: Counting Upstream Externalities                 | 99  |
| 5.4.7    | Habitat Damage: Land Take, Fragmentation, and Sensitive Areas           | 100 |
|          | References  | 100 |
| <br>     |   |     |
| <b>6</b> | <b>Discounting Costs and Benefits</b>                                   | 103 |
| 6.1      | Introduction  | 103 |
| 6.2      | The Baseline Approach   | 104 |
| 6.3      | Anomalies in Individual Time Preference                                 | 106 |
| 6.4      | Social Discounting  | 111 |
| 6.5      | Relevance of Social Discounting for Resource and Environmental Policy   | 115 |
| 6.6      | Concluding Remarks  | 117 |
|          | References  | 117 |
| <br>     |   |     |
| <b>7</b> | <b>Accounting for Risk and Uncertainty in Infrastructure Investment</b> | 123 |
| 7.1      | Introduction  | 123 |
| 7.2      | The Evaluation of Risk and Uncertainty                                  | 125 |
| 7.3      | The Global Sensitivity Analysis   | 130 |
| 7.4      | Local Sensitivity Analysis  | 130 |
| 7.5      | Concluding Remarks  | 135 |
|          | References  | 136 |
| <br>     |   |     |
| <b>8</b> | <b>Conclusion</b>   | 139 |
| 8.1      | Summary of the Book   | 139 |
| 8.2      | The Political Economy of Project Appraisal                              | 140 |
| 8.3      | Infrastructure, Climate Change, and Sustainable Appraisal               | 142 |
| 8.4      | Bringing the Threads Together: Toward an Integrated Framework           | 143 |
|          | References  | 144 |