### Contents

**List of Figures, Tables, and Boxes**

*Preface*  

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Modelling as a Method of Enquiry</td>
<td>1</td>
</tr>
<tr>
<td><strong>PART I: CHANGING THE PRACTICE OF ECONOMIC SCIENCE</strong></td>
<td></td>
</tr>
<tr>
<td>1. From Laws to Models, From Words to Objects</td>
<td>1</td>
</tr>
<tr>
<td>2. The Naturalization of Modelling in Economics</td>
<td>6</td>
</tr>
<tr>
<td>3. Practical Reasoning Styles</td>
<td>14</td>
</tr>
<tr>
<td>3.i Modelling as a Style of Reasoning</td>
<td>14</td>
</tr>
<tr>
<td>3.ii Modelling as a Reasoning Style in Economics</td>
<td>17</td>
</tr>
<tr>
<td><strong>PART II: MAKING MODELS, USING MODELS</strong></td>
<td>19</td>
</tr>
<tr>
<td>4. Making Models to Reason With: Forms, Rules, and Resources</td>
<td>19</td>
</tr>
<tr>
<td>4.i Giving Form</td>
<td>20</td>
</tr>
<tr>
<td>4.ii Becoming Formal</td>
<td>26</td>
</tr>
<tr>
<td>4.iii Reasoning Resources</td>
<td>27</td>
</tr>
<tr>
<td>6. Conclusion</td>
<td>37</td>
</tr>
<tr>
<td><strong>2 Model-Making: New Recipes, Ingredients, and Integration</strong></td>
<td>44</td>
</tr>
<tr>
<td>1. Ricardo, The “Modern” Economist?</td>
<td>44</td>
</tr>
<tr>
<td>2. Ricardo, His Economy, and the Economy of His Day</td>
<td>47</td>
</tr>
<tr>
<td>2.i David Ricardo, Esq.</td>
<td>47</td>
</tr>
<tr>
<td>2.ii Economics Matters, Experimental Farming Matters</td>
<td>51</td>
</tr>
<tr>
<td>3. Constructing Ricardo’s Numerical Model Farm and Questions of Distribution</td>
<td>56</td>
</tr>
<tr>
<td>3.i The Numbers in Ricardo’s <em>Principles</em> and Experimental Accounts</td>
<td>58</td>
</tr>
<tr>
<td>3.ii The Spade-Husbandry Debate</td>
<td>69</td>
</tr>
<tr>
<td>4. Ricardo’s Model Farm and Model Farming</td>
<td>73</td>
</tr>
</tbody>
</table>
Contents

4.i  Three Model Farms in One  74
4.ii  A Model Farm that Worked According to Ricardo’s Economic Ideas  75
4.iii  A Model of an Individual Farm in the Period  76
4.iv  A Model Farm for the Whole Agricultural Sector  78
   5.i  Ingredients  79
   5.ii  Fitting Things Together: Integration and Reasoning Possibilities  81
Appendix 1: Numerical Argument in Ricardo’s 1815 Essay  83

3  Imagining and Imaging: Creating a New Model World  91
  1.  Introduction  91
  2.  Acts of Translation or a New Way of World-Making?  93
  3.  Making the Mathematical Economic World in Models  96
  4.  The Artist’s Space versus the Economist’s Space  98
  5.  The History of the Edgeworth Box Diagram – as Told by Itself  106
     5.i  Edgeworth’s Imagination and Image  107
     5.ii  Pareto’s Imagination and Images  115
     6.i  Visualization  118
     6.ii  Newness  126
  7.  Seeing the World in the Model  129
  8.  Conclusion  131

4  Character Making: Ideal Types, Idealization, and the Art of Caricature  136
  1.  Introduction  136
  2.  Characterizing Economic Man: Classical Economists’ Homo Economicus  138
  3.  Concept Forming: Weber’s Ideal Types and Menger’s Human Economy  141
  4.  Symbolic Abstraction: Jevons’ Calculating Man  145
  5.  Exaggerating Qualities: Knight’s Slot-Machine Man  150
  6.  Making a Cartoon into a Role Model: Rational Economic Man  153
  7.  The Art of Caricature and Processes of Idealization  157
  8.  Model Man’s CV: De-Idealization and the Changing Roles of Economic Man  164

5  Metaphors and Analogies: Choosing the World of the Model  172
  1.  From Metaphors to Analogical Models  172
  2.  The Newlyn-Phillips Machine  176
  3.  The Machine’s Inventors: Walter Newlyn and Bill Phillips  184
4. Inventing the Newlyn-Phillips Machine

Step 1: Phillips chooses the analogy for his supply/demand model (early 1949) 187
Step 2: Newlyn designs the blueprint for a monetary circulation machine (Easter 1949) 189
Step 3: Phillips and Newlyn build the prototype Machine (Summer 1949) 194

5. Analogical Models and New Things 200

6 Questions and Stories: Capturing the Heart of Matters 204

1. Introduction 217

2. Stories to Shape Model Resources: Frisch’s Macro-Dynamic Scheme 218

3. Questions and Stories Capturing Keynes’ General Theory 221
   3.i Modelling Keynes’ General Theory: Meade 222
   3.ii Reasoning with Models: The External and Internal Dynamics 225
   3.iii Modelling Keynes’ General Theory: Samuelson 228

   4.i Modelling Keynes’ General Theory: Hicks 232
   4.ii Demonstrations, Variety, and Fruitfulness 236

5. Capturing the Heart of the Matter with Narratives 239
   5.i Narratives and Identity in the World of the Model 239
   5.ii Model Narratives and Making Sense of the Economic World 242
   5.iii Narrative as a Testing Bed for Models 246

6. Where Next? 251

7 Model Experiments? 256

1. Introduction 256

2. Experiments in the World of the Model 258
   2.i Mangoldt and Jenkin 259
   2.ii Marshall 267
   2.iii Conceptual Work: Defining Generic Categories 270

3. Models in ‘Laboratory’ Experiments 272

4. Comparison: Model Experiments and Laboratory Experiments 277
   4.i Controls and Demonstration 277
   4.ii Experimental Validity and The Inference Gap 282

5. Hybrids 288
   5.i Virtually Experiments 288
   5.ii The Status of Hybrids 292

6. Materials Matter: Surprise versus Confoundment 293
### Contents

8 **Simulation: Bringing a Microscope into Economics**

1. **The Birth of a New Technology**
2. **Simulation: Content and Context**
3. **Shubik and Simulation**
   3.i **Martin Shubik's History**
   3.ii **Models, Simulated Environments, and Simulated Behaviour**
4. **Guy Orcutt's History and “Microsimulation”**
5. **Bringing a Microscope into Economics**
   5.i **Introducing the Analogy**
   5.ii **Matters of Scale and Kind**
   5.iii **Specimens = Models**
6. **How Do Simulations Work as Microscopes?**
7. **The Observation–Inference Problem**
8. **Conclusion**

9 **Model Situations, Typical Cases, and Exemplary Narratives**

1. **Introduction**
2. **War Games**
3. **The Exemplary Narrative**
   3.i **The Prisoners Dilemma: Collaborate or Defect?**
   3.ii **The Economists' Dilemma: Individual Rationality or Invisible Hand?**
4. **The Commentator's Dilemma: Fitting Together Situations, Narratives, and Cases**
   4.i **Reasoning about Situations**
   4.ii **Explanatory Depth: The Roles of Narratives**
   4.iii **Explanatory Breadth: Taxonomies, Kinds, and Cases**
5. **Conclusion**

10 **From the World in the Model to the Model in the World**

1. **Introduction**
2. **Models: The New Working Objects of Economics**
   2.i **Model Worlds and Working Objects**
   2.ii **Small Worlds, Miniature Worlds, Compressed Worlds?**
3. **The Work of Working Objects**
   3.i **Materials for Describing and Theorizing**
   3.ii **“Abstract Typical Representations” and Model Inductions**
4. **Modelling: The New Way of Practising Economics**
   4.i **Assumptions in Practices**
   4.ii **Network of Models**
   4.iii **Community Matters**
Contents

5. Models in the World 400
  5.i Models: New Instruments for Acting in the World 400
  5.ii Seeing Small Worlds in the Big World 405

Index 413

Colour plate section appears between pages 100 and 101