List of Figures

3.1a Satellite image prior to blackout 39
3.1b Satellite image during blackout 40
3.2 Internet routing outages during the 2003 blackout 41
3.3 Visual difference of exponential and scale-free networks 45
3.4 Connectivity distribution for the IP backbone network 48
3.5 Connectivity distribution for the electric power grid control area network 49
3.6 Power grid and IP network diameter 50
3.7 A fibre density analysis of North America 52
3.8 A power transmission line density analysis of North America 52
3.9 Transmission line density analysis illustrating the prominence of Ohio 53
3.10 Transmission line and fibre spatial interdependency density analysis 53
4.1 Employment growth rates for West German districts, aggregated into nine types of economic regions, 1988–2003 64
4.2 Employment growth rates for East German districts, aggregated into nine types of economic regions, 1994–2003 65
4.4 The empirical distribution of clusters in the West German labour market 68
4.5 The empirical distribution of clusters in the West German labour market 71
4.6 Employment growth rates for the combined West and East Germany, 1994–2003 74
4.7 The empirical distribution of clusters in the combined West and East German labour market 75
4.8 The evolution of the mean growth rate – of employment – within the biggest avalanches compared with the general mean growth rate – of employment – in Germany, 1994–2003 78
4.A1a Map of the greatest avalanches in the combined West and East German labour market in 2000 (168 districts) 84
List of Figures

4.A1b Map of the greatest avalanches in the combined West and East German labour market in 2001 (162 districts) 85
4.A2a Map of the greatest avalanches in the combined West and East German labour market in 2002 (135 districts) 86
4.A2b Map of the greatest avalanches in the combined West and East German labour market in 2003 (80 districts) 87
4.A3a Map of the districts common to the two greatest avalanches in the combined West and East German labour market in 2000 and 2001 (102 districts) 88
4.A3b Map of the districts common to the two greatest avalanches in the combined West and East German labour market in 2000, 2001 and 2002 (47 districts) 89
5.1 Relation between the size of the BDS test, the length of the $m$-surroundings, and the value of the error margins for a queen matrix 102
5.2 Relation between the size of the BDS test and the length of the $m$-surroundings 103
5.3 Rejection probabilities of several misspecification tests for a SARMA model, a normal error distribution, and a queen matrix with size $15 \times 15$ 106
5.4 Rejection probabilities of several misspecification tests for a non-linear model, a normal error distribution, and a queen matrix with size $15 \times 15$ 107
5.5 Rejection probabilities of several misspecification tests for a spatial error model, a lognormal error distribution, and a queen matrix with size $15 \times 15$ 107
5.6 Rejection probabilities of several misspecification tests for a spatial error model, a normal error distribution, and a full distance matrix with size $15 \times 15$ 108
5.7 Rejection probabilities of several misspecification tests for a non-linear model, a normal error distribution, and a distance matrix with size $15 \times 15$ 109
6.1 Vehicle inventory in the US 123
6.2 Highway VMT and fatalities per VMT 123
6.3 Input data on traffic flow on road links 125
6.4 A Traffic Management Centre (TMC) flow chart 126
6.5 Schematic representation of a freeway network 129
6.6 Schematic representation of an entry ramp as a Boolean gate 129
6.7 Schematic representation of an exit ramp as a Boolean gate 130
6.8 Random Boolean networks and attractor basin configurations 131
6.9 Non-canalizing gates 133
6.10 Semi-canalizing gates 134
<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.11</td>
<td>Canalizing gates are also called ‘forcing gates’</td>
<td>134</td>
</tr>
<tr>
<td>6.12</td>
<td>Schematic representation of a freeway network</td>
<td>135</td>
</tr>
<tr>
<td>7.1</td>
<td>Two routes in parallel</td>
<td>143</td>
</tr>
<tr>
<td>7.2</td>
<td>Distributions of travel time on route $R$</td>
<td>143</td>
</tr>
<tr>
<td>7.3</td>
<td>Expected utility as a function of $p$ in the mean-variance case</td>
<td>150</td>
</tr>
<tr>
<td>7.4</td>
<td>Adding a fixed travel-time segment</td>
<td>162</td>
</tr>
<tr>
<td>7.5</td>
<td>Relative attractiveness of the risky route as a function of the additive parameter $\mu$</td>
<td>164</td>
</tr>
<tr>
<td>7.6</td>
<td>Proportion of users on the risky route as a function of travel time on the safe route</td>
<td>167</td>
</tr>
<tr>
<td>7.7</td>
<td>Aggregate compensatory variation for the mean-variance and mean-standard deviation expected utility functions</td>
<td>170</td>
</tr>
<tr>
<td>8.1</td>
<td>Real and virtual network</td>
<td>184</td>
</tr>
<tr>
<td>9.1a</td>
<td>Marginal 1-digit entropy values for Dutch regions</td>
<td>223</td>
</tr>
<tr>
<td>9.1b</td>
<td>Marginal 2-digit entropy values for Dutch regions</td>
<td>224</td>
</tr>
<tr>
<td>9.1c</td>
<td>Marginal 3-digit entropy values for Dutch regions</td>
<td>224</td>
</tr>
<tr>
<td>9.1d</td>
<td>Marginal 4-digit entropy values for Dutch regions</td>
<td>225</td>
</tr>
<tr>
<td>9.1e</td>
<td>Marginal 5-digit entropy values for Dutch regions</td>
<td>225</td>
</tr>
<tr>
<td>11.1</td>
<td>The number of automobile manufacturers in Great Britain, entrants and exits, 1895–1968</td>
<td>277</td>
</tr>
<tr>
<td>11.2</td>
<td>The share of the Coventry area in the total number of automobile firms in Great Britain, 1895–1968</td>
<td>279</td>
</tr>
<tr>
<td>11.3</td>
<td>Survival rates for three birth cohorts</td>
<td>281</td>
</tr>
<tr>
<td>11.4</td>
<td>Survival rates for three types of pre-entry entrepreneurial backgrounds</td>
<td>281</td>
</tr>
<tr>
<td>11.5</td>
<td>Survival curves for spin-offs located in and outside the Coventry area</td>
<td>283</td>
</tr>
<tr>
<td>11.6</td>
<td>Survival curves for inexperienced firms located in and outside the Coventry area</td>
<td>283</td>
</tr>
<tr>
<td>11.7</td>
<td>Survival curves for firms located in and outside regions specialized in vehicle production</td>
<td>284</td>
</tr>
<tr>
<td>12.1</td>
<td>Relative change of employment in Dortmund, 1976–2010</td>
<td>299</td>
</tr>
<tr>
<td>12.2</td>
<td>Univariate forecasts of the relative change of employment in Dortmund, 1970–2010</td>
<td>304</td>
</tr>
<tr>
<td>12.3</td>
<td>Influence of selected industrial sectors on the change of employment in Dortmund, 1983–2001</td>
<td>307</td>
</tr>
<tr>
<td>12.4</td>
<td>Change of employment in selected industrial sectors in Dortmund, 1984–2001</td>
<td>307</td>
</tr>
<tr>
<td>12.5</td>
<td>Consistency check of forecasts at different regional levels</td>
<td>309</td>
</tr>
<tr>
<td>12.6</td>
<td>Forecast of employment change, 2001–10: planning regions</td>
<td>311</td>
</tr>
<tr>
<td>12.7</td>
<td>Regional employment development, 1976–2010</td>
<td>314</td>
</tr>
</tbody>
</table>
List of Figures

12.8 Regional employment development in former West Germany, 1976–2010 314
12.9 Forecast and actual change rates, 1997 to 2001 317
12.10 Frequency of forecast errors 318
12.11 Employment change, 1994 to 2001: planning regions 323
13.1 Urban per capita GDP in 1985 333
13.2 Moran scatterplots (left) and maps (right) of urban per capita GDP 335
13.3 LISA cluster map for per capita GDP, 1985 and 2001 337
13.4 Spatial regimes of per capita GDP 338
13.5 Accessibility index 343
14.1 The SimBritain data and procedures 369
14.2 Car ownership in Great Britain, 1971–2021 377
14.3 Simulated versus actual average age of residents 378
14.4 Simulated versus actual rate of working population travelling to work by public transport 379
14.5 Very poor households, sources of income, 1991–2021 382
14.6 Estimated spatial distribution of additional income per household in 1991 394
14.7 Spatial distribution of additional income per household as a proportion of average household income by district in 1991 395
14.8 Estimated spatial distribution of additional income per household in 1991, after the implementation of the April 2003 tax credits 396
14.9 Spatial distribution of additional income per household as a proportion of average household income by local authority, after the implementation of the April 2003 tax credits 396
15.1 Urban districts on the city boundary 407
15.2 Movement of people along the city boundary due to the transport costs interactions 409
15.3 Urban pattern formation 411
15.4 Stable pattern condition 411
15.5 Urban shape formation, case 1 – urban shape change 411
15.6 Urban shape formation, case 2 – urban pattern formation 413
15.7 Stable pattern condition 413
15.8 Urban shape formation, case 2 – urban shape change 413
16.1 Schematic representation of city layout 423
16.2 Market share (a) and profit (b) versus rank for asymmetries in h 433
16.3 Short-term equilibrium results for asymmetries in h, β and t 434
16.4 Differences in welfare compared with the symmetric case for asymmetries in β and s 441
17.1 The city of Trento 446
17.2 The supply function and the WTP function 452
List of Figures

17.3 Map of the homogeneous subareas 466
17.4 Increase of property values as a percentage of the property value of the whole city of Trento 473
17.5 Increase of property values as a percentage of total property value of the area involved in the project 474
17.6 Accessibility effect 475
17.7 Urban quality effect 476
17.8 Property value trends in Trento between 1963 and 2001 478