Index

Accessibility, 493–9
Activity based models, 473–87
\[\text{ABM, 478–9}\]
\[\text{structure, 482–4}\]
\[\text{solving, 484–5}\]
Aggregate
\[\text{data, 344–5}\]
\[\text{model, 18–19, 158–9, 163, 495}\]
Aggregation
\[\text{bias, 334–5}\]
\[\text{of alternatives, 68}\]
Aggregation methods, 338–41
\[\text{artificial sample enumeration method, 339–40}\]
\[\text{classification approach, 340–1}\]
\[\text{naive aggregation method, 338, 345}\]
\[\text{sample enumeration method, 338–9}\]
Alternative-specific constant, 228, 281, 288
Arithmetic progression, 34
Assignment, 349–89
\[\text{all-or-nothing, 359–60, 369, 398–9, 436}\]
\[\text{Burrell, 361–2, 365, 402, 436, 439}\]
\[\text{congested, 367–73, 403}\]
\[\text{Dial, 363–4}\]
\[\text{dynamic, 383, 411–20}\]
\[\text{equilibrium, 392–403}\]
\[\text{hard and soft speed-change methods, 369}\]
\[\text{incremental, 369–70}\]
\[\text{junction interaction, 414–15}\]
\[\text{proportional, 362–4}\]
\[\text{public-transport or transit, 373–80}\]
\[\text{stochastic, 361–6}\]
\[\text{successive averages, 370–2}\]
Box–Cox transformation, 210, 272–3, 438
Box–Tukey transformation, 273
Bid-Choice model, 496–7
Car ownership
\[\text{forecasting, 499–508}\]
\[\text{international comparisons, 507–8}\]
\[\text{stratification, 64, 81, 137, 162}\]
Category analysis, 157–63
\[\text{classical model, 157–62}\]
\[\text{equivalence with linear regression, 159–61}\]
\[\text{person-category approach, 162–3}\]
Central limit theorem, 49, 58, 84, 170
Centroid, 130–1, 358, 387
Centroid connector, 130–1, 201, 380, 444
Choleski decomposition, 50–2
Coefficient of correlation, 48, 68, 163, 514
Cohort
\[\text{study, 91}\]
\[\text{survival method, 491–2}\]
Common lines, 375–6, 379–80
Composite
\[\text{alternative, 240, 325}\]
\[\text{cost, 212–16, 380}\]
Confidence level, 58–9, 80–1, 325
Congestion, 5
\[\text{charging, 8, 169, 177, 369}\]
\[\text{externality, 5–6, 396}\]
\[\text{pricing, 369, 545}\]
Contingent valuation, 95, 521, 525–8
Continuous valuation, 11, 46, 414, 424–5
Continuous
\[\text{model, 131, 251, 304}\]
\[\text{planning, 23–6}\]
\[\text{CONTRAM, 416}\]
Cordon, 85
Corridor models, 453
Cost, \textit{see} Generalised cost
### Index

<table>
<thead>
<tr>
<th>Term</th>
<th>Page Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost–flow relationship</td>
<td>351–2, 355, 382, 394, 417–18</td>
</tr>
<tr>
<td>Covariance matrix</td>
<td>48, 50, 235, 250–2, 254–5, 293–295, 513</td>
</tr>
<tr>
<td>Convergence</td>
<td>325, 357, 397–9, 402, 410–11</td>
</tr>
<tr>
<td>Cross-sectional data</td>
<td>16, 19–20, 90, 168, 259, 270 survey, 90–3</td>
</tr>
<tr>
<td>Cross-classification analysis</td>
<td>157–63</td>
</tr>
<tr>
<td>Data cross-sectional</td>
<td>16, 19–20, 90, 168, 259, 270 longitudinal or time series, 20, 90–3</td>
</tr>
<tr>
<td>Data collection</td>
<td>23, 55, 71–94, 97, 413, 425, 463–5</td>
</tr>
<tr>
<td>Data correction</td>
<td>86–8</td>
</tr>
<tr>
<td>Decision making context</td>
<td>11, 129</td>
</tr>
<tr>
<td>strategies</td>
<td>23–4</td>
</tr>
<tr>
<td>styles</td>
<td>8–10, 24</td>
</tr>
<tr>
<td>Decision theory</td>
<td>9, 24 choice by elimination, 258 compensatory rule, 257–8 satisficing, 258</td>
</tr>
<tr>
<td>Delay models</td>
<td>412, 414</td>
</tr>
<tr>
<td>Departure time choice</td>
<td>420–5</td>
</tr>
<tr>
<td>Descriptive statistics coefficient of variation</td>
<td>48 mean</td>
</tr>
<tr>
<td>median</td>
<td>47 mode</td>
</tr>
<tr>
<td>Deterrence function</td>
<td>182–3, 187–8, 195–6, 437</td>
</tr>
<tr>
<td>Direct demand models</td>
<td>207, 219–22 abstract mode model, 2 SARC model, 220</td>
</tr>
<tr>
<td>Disaggregate demand models</td>
<td>228–30</td>
</tr>
</tbody>
</table>
Index

Function
asymptote, 33
concavity and convexity, 41
limit, 33, 37
maximum and minimum values, 40–1
point of inflexion, 40–1
Furness method, 180–1, 380

Gaming simulation, 456–8
Geometric progression, 35
Global positioning systems (GPS), 1, 94, 235, 411, 425
Gradient, 33, 37–8
Gravity model, 182–4, 186–8
bi-proportional algorithm, 186–7
calibration, 191–3
generalisations, 198–9
partial matrix techniques, 196
properties, 188–90
tri-proportional calibration method, 193–7
validation, 191–2
Growth-factor methods, 178–82
advantages and limitations, 181–2
doubly constrained methods, 180–1
singly constrained methods, 179–80
uniform method, 178–9
GUTS, 457

Habit and hysteresis, 258–9
Halton sequences, 305–6
Hessian [matrix], 43
Heteroskedasticity, 366, 424
Hierarchical logit model
internal diagnosis, 240
limitations, 241
model structure, 235–7
sequential estimation, 288–9
simultaneous estimation, 289
Human capital approach, 524–5

Imputation methods, 88–9
Incremental elasticity analysis, 431–3
Incremental models, 433–5
Independence of Irrelevant Alternatives (IIA), 234
Inertia, 67, 259, 263–5, 320
Information technology, 1
Input–output, 492
Integration weighting, 87–8
Intervening opportunities model, 199–200
Intra-zonal trips, 201–2

Journey, 140–1, 166, 177, 191, 202, 208, 413–14, 511
Journey purpose, 191, 202
K factors, 202, 435
Lagrangian multipliers, 42
Land-use and transport model, 493–9
Latent variables, 227, 265–6, 288–91
Level of service, 6, 76, 220, 289, 308, 350, 432
Likelihood
function, 52, 275, 298, 324, 514
ratio, 342
ratio test, 279–81
Line section, 376, 380
Linear regression model, 52, 144–51
coefficient of determination, 149–50
estimation, 146–7
F test, 148–9
household-based regression, 153–4
intercept, 146, 152
multicollinearity, 150
multiple regression, 150–1
non-linearity problem, 154–6
t-test, 148
zonal-based regression, 151–3
Link, 133–4
delay, 134
perceived cost, 362
properties, 133–4
transfer link, 374
walk link, 133, 374
Log-likelihood, 255, 261, 281–2, 291, 296–7, 325, 342, 344
Longitudinal
data, 20, 90–3
survey, 91, 93
Logarithmic function, 39–40
Lowry model, 495–6
Marginal demand model, 454–6
Matrix
basic operations, 36–7
diagonal matrix, 36
inverse of a matrix, 36
symmetric matrix, 37
see also Trip matrix
Maximum likelihood, 51–2, 275, 277, 288, 293–4, 448, 512
ME2, 441–2, 446–9
Microsimulation, 11, 387, 484–7, 495, 499
Mixed logit model, 250–6, 295–308
Modal split, 21–2, 77
Modal-split models, 22
  calibration, 217–19
  joint distribution/modal-split, 211–14
  multimodal, 214–16
  pivot point, 433–5
  simplified, 433–5
  trip-end, 209
  trip interchange, 209–11
Model
  calibration, validation and use, 16–17
  complexity, 65, 68–71
  physical model, 414, 456
  specification, 15–16, 157–8, 163, 251–4
  structure, 15, 111, 118, 215, 235–7, 328
  structural model, 8, 430
  updating, 341–7
  variable specification, 16
  with panel data, 259–65
Monitoring function, 24, 26
Monte Carlo methods, 112, 203, 305, 362, 481–2, 484–5
Motorcycle ownership, 505–7
Muddling through, 9
Multinomial logit model, 232–5
  functional form, 238, 243–4
  properties, 234–5
Multinomial probit model, 248–50, 292–5
Nested logit model
  see Hierarchical logit model
Network
  definition, 128, 133
  link, 133–4
  private network, 350
  public-transport network, 133, 350, 374
Node, 130–3, 358–9, 362–3, 376, 378–81, 399–401, 444
Normal distribution, 48–50, 119, 228, 249, 277, 301, 513, 519
Null zones, 152
Ordinal probit, 318,
Origin–destination (O–D) survey
  data correction, 86–8
  questionnaire design, 77–9
  sample size, 80
  survey period, 74, 85
  validation of results, 90
Panel data, 90–3, 259–65, 307
Panel survey, 90–1
  rotary panel, 90
  sources of error, 92–3
  split panel, 90
Parameter, 16, 30
Perception of price, 534
Pivot-point logit, 433–5
Planning variables, 24, 71, 479, 489–93
Policy variables, 15, 278
Population
  forecasting, 491–2
  spatial allocation, 167, 493
  synthesis, 477, 479–81
Private sector projects, 535–8
Public transport
  line, 376
  route, 374, 376–9
Quadratic form, 49–50, 148
Ramp-up, 535
Random utility theory, 230–2
Random variable, 46–8, 512
Representative individual, 477
Revealed preferences, 20, 94, 413, 422, 512–15
Regression analysis, 144–57, 313
Rho squared index, 282
RHTM, 504–5
Risk
  identification, 539, 545
  management, 539
  mitigation, 539
Route
  choice, 117, 356–7, 359, 366, 373–9, 403, 416, 456, 449, 468
  section, 376, 379–80
Sampling method, 56–7
  choice-based, 57
  random, 56
  stratified, 56
Sampling theory, 55–64
  population of interest, 56
  sample design, 56, 81
  sample expansion, 89
  sample size, 57–9
  sample size for continuous survey, 82–3
  sampling bias, 57
  sampling error, 57
SATURN, 416–18, 420, 449
Scalar, 35
Scenarios, 22, 327, 526, 542
### Index

<table>
<thead>
<tr>
<th>Topic</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screen lines</td>
<td>74–5, 85, 386</td>
</tr>
<tr>
<td>Sensitivity analysis</td>
<td>205, 455–6, 546</td>
</tr>
<tr>
<td>Series</td>
<td>34–5, 44</td>
</tr>
<tr>
<td>Taylor’s expansion</td>
<td>44, 336, 398</td>
</tr>
<tr>
<td>Maclaurin’s series</td>
<td>44</td>
</tr>
<tr>
<td>Significance level</td>
<td>148, 161, 278</td>
</tr>
<tr>
<td>Simulated maximum likelihood</td>
<td>289, 293–4, 296, 305</td>
</tr>
<tr>
<td>Sketch planning models</td>
<td>430–1</td>
</tr>
<tr>
<td>Speed–flow relationship</td>
<td>see Cost–flow relationships</td>
</tr>
<tr>
<td>Stated preference</td>
<td>20</td>
</tr>
<tr>
<td>attribute level balance</td>
<td>102</td>
</tr>
<tr>
<td>blocking of designs</td>
<td>110–11</td>
</tr>
<tr>
<td>choice</td>
<td>96–9</td>
</tr>
<tr>
<td>data</td>
<td>310–22</td>
</tr>
<tr>
<td>D-optimal design</td>
<td>108</td>
</tr>
<tr>
<td>D-efficient design</td>
<td>108–9</td>
</tr>
<tr>
<td>dummy coding</td>
<td>105–7</td>
</tr>
<tr>
<td>effects coding</td>
<td>105-7</td>
</tr>
<tr>
<td>experimental design</td>
<td>107–11</td>
</tr>
<tr>
<td>fractional factorial design</td>
<td>103–5</td>
</tr>
<tr>
<td>interactions and independence</td>
<td>103</td>
</tr>
<tr>
<td>labelled experiment</td>
<td>102</td>
</tr>
<tr>
<td>lexicographic responses</td>
<td>101</td>
</tr>
<tr>
<td>modelling</td>
<td>308–9</td>
</tr>
<tr>
<td>non purchase alternative</td>
<td>97–8, 113</td>
</tr>
<tr>
<td>orthogonal coding</td>
<td>105–7</td>
</tr>
<tr>
<td>orthogonal design</td>
<td>107–8</td>
</tr>
<tr>
<td>payment mechanism</td>
<td>95</td>
</tr>
<tr>
<td>pivot design</td>
<td>114</td>
</tr>
<tr>
<td>ranking</td>
<td>95–6</td>
</tr>
<tr>
<td>rating</td>
<td>95–6</td>
</tr>
<tr>
<td>repeated observations</td>
<td>92–3</td>
</tr>
<tr>
<td>sample size</td>
<td>94, 109–10</td>
</tr>
<tr>
<td>survey</td>
<td>94–128</td>
</tr>
<tr>
<td>use of computers</td>
<td>115–16</td>
</tr>
<tr>
<td>mixed RP–SP estimation</td>
<td>322–31</td>
</tr>
<tr>
<td>Study-area definition</td>
<td>72, 74</td>
</tr>
<tr>
<td>external cordon</td>
<td>74</td>
</tr>
<tr>
<td>internal cordons</td>
<td>74</td>
</tr>
<tr>
<td>screen lines</td>
<td>74</td>
</tr>
<tr>
<td>zones</td>
<td>68, 74</td>
</tr>
<tr>
<td>Subjective value of time</td>
<td>100, 312, 509</td>
</tr>
<tr>
<td>Substantive rationality</td>
<td>9–10</td>
</tr>
<tr>
<td>Survey</td>
<td></td>
</tr>
<tr>
<td>cordon</td>
<td>85</td>
</tr>
<tr>
<td>intercept</td>
<td>74</td>
</tr>
<tr>
<td>O–D</td>
<td>73–4, 76, 80–1, 85–90, 172</td>
</tr>
<tr>
<td>panel</td>
<td>90–1</td>
</tr>
<tr>
<td>roadside interviews</td>
<td>83–5</td>
</tr>
<tr>
<td>scope</td>
<td>74</td>
</tr>
<tr>
<td>screen-line</td>
<td>85–6</td>
</tr>
<tr>
<td>stated preference</td>
<td>94–128</td>
</tr>
<tr>
<td>travel diary</td>
<td>483</td>
</tr>
<tr>
<td>travel time</td>
<td>75, 93–4</td>
</tr>
<tr>
<td>workplace interviews</td>
<td>75</td>
</tr>
<tr>
<td>Synthetic model</td>
<td>198–200, 211–19</td>
</tr>
<tr>
<td>see also Gravity model</td>
<td></td>
</tr>
<tr>
<td>System dynamics</td>
<td>497–9</td>
</tr>
<tr>
<td>Taste variation</td>
<td>67, 249–50, 279, 515</td>
</tr>
<tr>
<td>Time of day choice</td>
<td>see Departure time choice</td>
</tr>
<tr>
<td>Time series</td>
<td>data</td>
</tr>
<tr>
<td>extrapolation</td>
<td>500–3</td>
</tr>
<tr>
<td>Tours</td>
<td>140, 164–5, 474–7, 482–4</td>
</tr>
<tr>
<td>Traffic counts</td>
<td>444–6</td>
</tr>
<tr>
<td>inconsistency of</td>
<td>444</td>
</tr>
<tr>
<td>independence of</td>
<td>444</td>
</tr>
<tr>
<td>Traffic and revenue risk</td>
<td>536</td>
</tr>
<tr>
<td>Transfer index</td>
<td>342–3</td>
</tr>
<tr>
<td>Transfer price</td>
<td>521–2</td>
</tr>
<tr>
<td>Transferability</td>
<td>169–70, 341–3, 431</td>
</tr>
<tr>
<td>Transitional probability approach</td>
<td>492</td>
</tr>
<tr>
<td>Transport supply</td>
<td>4–5</td>
</tr>
<tr>
<td>Travel time reliability</td>
<td>413–14</td>
</tr>
<tr>
<td>Tree-building algorithm</td>
<td>358–9, 380</td>
</tr>
<tr>
<td>D’Esopo</td>
<td>358</td>
</tr>
<tr>
<td>Dijkstra</td>
<td>358</td>
</tr>
<tr>
<td>Moore</td>
<td>358</td>
</tr>
<tr>
<td>Trip logit model</td>
<td>see Hierarchical logit model</td>
</tr>
<tr>
<td>Trend extrapolation</td>
<td>491</td>
</tr>
<tr>
<td>Trip</td>
<td>attractions</td>
</tr>
<tr>
<td>classification of</td>
<td>141–2</td>
</tr>
<tr>
<td>generations</td>
<td>22, 151, 157, 161–2, 164–71</td>
</tr>
<tr>
<td>home-based</td>
<td>165</td>
</tr>
<tr>
<td>non-home-based</td>
<td>164–5</td>
</tr>
<tr>
<td>productions</td>
<td>140, 142–3, 158</td>
</tr>
<tr>
<td>Trip distribution modelling</td>
<td>175–206</td>
</tr>
<tr>
<td>Trip generation</td>
<td>22</td>
</tr>
<tr>
<td>Bayesian updating</td>
<td>170–1</td>
</tr>
<tr>
<td>factors affecting</td>
<td>142–3</td>
</tr>
<tr>
<td>forecasting variables</td>
<td>167–8</td>
</tr>
<tr>
<td>frequency choice logit model</td>
<td>165–6</td>
</tr>
<tr>
<td>geographic stability of parameters</td>
<td>169–70</td>
</tr>
<tr>
<td>modelling</td>
<td>139–73</td>
</tr>
<tr>
<td>temporal stability of parameters</td>
<td>168–9</td>
</tr>
<tr>
<td>Trip matrix</td>
<td>estimation from traffic counts</td>
</tr>
<tr>
<td>sparse matrices</td>
<td>201</td>
</tr>
<tr>
<td>Trip length distribution (TLD)</td>
<td>184, 190, 192, 195–6, 441</td>
</tr>
</tbody>
</table>
Index

UDM, 497
UMOT, 430–1
Utility function, 118, 232, 237, 239, 242, 249, 252, 290, 304, 422, 509, 512
Urban simulation, 499

Validation sample, 284–5
Value of time, 178, 243, 509–22
Valuing external effects, 522–31
Variable
  dependent, 31, 43, 69, 154, 326
  endogenous, 15, 26–7, 489
  exogenous, 12, 25
  generic, 233, 244
  independent, 95, 162, 310, 413, 503
  Vector, 35–6
  Wardrop’s equilibrium, 367–9
    first principle, 367
    second principle, 368–9
  Willingness-to-pay, 95, 496, 512, 515–23, 526–9, 539–40
  Zone centroid, 130, 477
Zoning
  criteria, 130–1
  system, 128–35