

## Index

Numbers in *italics* refer to pages with figures and tables.

- Ackerman's pole placement, 72, 73
- aggregative analysis, 16, 161
- Appleby, plague, 329, 329
- autoregressive effects
  - burials, 142–3
  - wheat series, 105–6, 109
- Aynho, 291, 292, 301
- baptisms
  - England and Wales, 325
- Barker, D. J. P., 6, 7, 12, 113, 125, 129, 135, 313–14
- barley, 37, 93, 96
  - cycles, 92–6, 93, 95, 105
  - prices, 90, 96, 114, 146
- Barnstaple, 292, 294, 296–7, 301
  - baptisms, 296
  - burials, 296, 296
  - economy, 296
  - mortality crisis, 296
  - smallpox epidemics, 296, 296
- beef prices, 156
- bigg, 37
- Bills of Mortality, 171, 172, 187, *187*, 188, 196, 197, 223, 231, 232, 239, 242, 264, 267, 282, 321
- births loop, 49–51, 77, 81, 140
  - delay, 82
  - gain, 49–51, 50
- birthweight, 6, 125, 231
- Bode diagrams, 204, 205, 218, 237,
- boom, 45, 46, 47, 114, 140, *141*, 299, 300, 301, 324, 327, 333
- boom and bust
  - fertility in the USA, 4–5
  - rust cycles, 108, *108*
- Bridekirk, 157, 158
- Brough, 157, 158, 328, 329
- Burford, 281
- burial rates, *120*, 136
- Carlisle, 37, 282
  - plague, 328, 329, 329, 330,
- Cartmel, 157, *158*, 161, *162*
- Caton, *158*
- cattle prices, 146, 153, 156, 161
- chaos, 178, 202, 208, *211*, 214
  - and epidemics, 214–18, 223
- Chester, smallpox, 189, 190–7, 270, 271, 301, 302
  - child burials, 191–5, *192*, 193, 194, 196–7
  - correspondence with London, 196–7, *196*
  - drivers, 195–7
- chickenpox, 216, 217
- cholera, 304
- Cliburn, 157, *158*
- Cockerton, *158*
- control cycles, 4, 64
- crisis mortality, 70, 76, *154*
  - Cheshire, 157
  - Cumbria, 145, 154, 157–63, *158*
  - Lancashire, 157, 158, 159, 160, 161, *162*, 163
  - Lancaster, 164
  - northwest England, 146, 147, *147*, 150, 154, 155, 157–63, *158*
  - Penrith, 48, 70, 125, 127–9, 150, 157
  - Scotland, 157
  - York, 165, 168
  - Yorkshire, 157, *158*, 160
- crisis mortality ratio (CMR), 157, *158*, 160
- Crosby Ravensworth, *158*, 161, *162*, 292, 294
  - adult burials, *162*, 293
  - child burials, *162*, 293
  - economy, 293
  - mortality crises, 293
- Crosthwaite, *158*, 160, 161, *162*, 292, 294
  - baptisms, 293
  - economy, 293
  - mortality crises, 161

*Index*

349

- Cumberland, *see* Cumbria
- Cumbria, 6, 34, 327, 333
  - crisis mortality, 145, 154, 157–63, 158
  - crops, 37
  - economy, 138, 139, 140, 155–7
  - farming conditions, 34–8, 334
  - inheritance customs, 333
  - mortality crises, 145–63
  - parishes, 145–63
  - plague, 327, 328–30, 329
  - sheep, 37
  - size of holdings, 35–7, 333
  - tenant right, 35–7
  - wool produced, 37, 146
- cycles
  - births in France, 83
  - deaths in Florence, 83
  - fertility, 83
  - population size, 83
  - real wages, 83
  - 30-year, 77, 80
- damping, 76
- damping, factor, 176, 228, 237, 247, 316
  - definition, 180
- Darlington, 328, 329
- demographic balancing equation, 332
- density-dependent, 55–74, 136, 140, 333
  - grain prices, effect of, 142
- diet, 223, 225, 303, 313, 323, 323
- diphtheria, 302
  - drivers, 318
  - England and Wales, 316–18, 317
  - interactions, 319–20
  - SEIR dynamics, 318
  - wheat prices, 318
- dispersal, 330–3
- driver, for epidemics, 176, 240, 320
- diphtheria, 318
- measles, 217, 226, 228–9, 240
- scarlet fever, 289–90, 311
- smallpox, 179, 185–6, 181–3, 195–7, 196, 203, 206, 211, 216, 217, 219, 220, 221, 230, 240, 266, 272–5, 277, 279, 286–90, 301
  - whooping cough, 234–6, 235, 237, 238, 240
- Dumfries, 157, 329
- Dunfermline, 157
- Durham, plague, 328, 329
- ecological niches, 331, 333
- economic thresholds, 331
- Edenhall, plague, 329, 330
- Eden Valley, 6, 34, 37, 52, 71, 114, 146, 292, 293, 327, 328, 333, 334
- Edinburgh, smallpox, 190, 190, 302
- eigenvalues, 3, 57–8, 59, 78
- endogenous cycles, 51–3
  - definition, 2
  - Kirkoswald, 52–3
  - London, 53
  - matrix modelling, 55–63, 83–6
  - Penrith, 44–7, 51, 75–86
  - York, 51–2, 53, 54
- epidemic/endemic ratio, 252, 253, 254, 255, 256, 257, 258, 258, 260, 262, 262, 263, 264, 265, 268, 315
  - definition, 256
- exogenous cycles
  - definition, 2
  - Penrith, 44–7, 113–44, 133, 141
- family reconstitution, 17
  - methods, 17
  - Penrith, 17, 38, 64, 69, 114, 120, 123, 125, 126, 131, 137, 138, 140, 282
  - validation of matrix model, 64–9
- famine, 5–8, 272
  - Dutch winter, 130, 313
  - Northern Province, 34–5, 145, 146
  - Penrith, 70, 127–9, 128, 137, 150
- feedback, 58, 60–3, 60, 78, 83–6, 133
  - Ackerman's pole placement, 72, 73
- density-dependent, 55–74, 60, 72, 73, 136, 139, 140, 142
- gain, 60–1, 75, 84, 86
- migration (*b*) vector, 71–4, 72
- population dynamics, 136, 139
  - positive, 135, 142
- fertility function, 32, 55–6, 58–9, 77–80, 78, 79, 80
  - estimation, 77–80
  - mean, 84
  - standard deviation, 78–80, 84, 85
- Florence, cycles in deaths, 83
- frequency, definition, 19, 19
- Geneva, smallpox, 275
- Germany, Waldeck parishes, 67
- Glasgow, smallpox, 189–90, 191, 302
- Godalming, 290, 301
- grain prices, 87–112
  - correspondence between, 94–6
  - cycles, 87–9, 90–4
  - predicted price series, 103–4, 111–12
  - rust epidemics, 106–9
  - weather, effect of, 87–9, 97–104
- Great Harwood, 292, 294, 301
  - child burials, 298
  - mortality crises, 298
  - smallpox epidemics, 298
- Greenland, 281
- Greystoke, 34, 157, 158, 300

350

*Index*

- Hanbury, 281
- hardship index, 151–3, 151, 152, 153, 155–6, 156
- hare, 22, 23, 24, 25
  - population cycles, 21–5
- hide prices, 161
- homeostasis, *see* steady-state population
- Hutterites, 65–6, 67
- i*-state, 327
- illegitimacy, 333
- inbreeding, 331
- infectious diseases, 8–10, 113
  - interactions, 224–8, 267–9, 319–20
  - theory of, 173, 175–80, 244–8
- infectious period
  - measles, 307
  - scarlet fever, 314
  - smallpox, 175, 177, 249, 252, 255, 256, 261, 263
- influenza, 145, 197
- Ingleton, 157, 158, 160
- inoculation (variolation), smallpox, 172, 183, 270, 275, 285, 291, 300, 301, 302
  - definition, 183
- interepidemic interval (*T*)
  - interactions, 239, 240
  - measles, 223, 225, 227, 228, 240, 264, 304, 305, 306, 307
  - scarlet fever, 310, 315
  - smallpox, 172–3, 177, 178, 180, 181, 184–5, 188, 195, 196, 204, 208, 218, 240, 249, 252, 271, 275, 277, 278, 282, 285, 289, 291, 296, 297, 298, 299, 301
  - whooping cough, 231, 233, 236, 237, 240
- Kalman filtering, 83
- Kendal, 45, 157, 158, 328, 329, 329, 330
- Keswick, *see* Crosthwaite
- Kirkoswald, 52–3, 292, 294, 301
  - adult burials, 293
  - child burials, 293
  - mortality crises, 293
  - smallpox, 293
- Kondratieff cycle, 4
- Kuznets cycle, 4
- Lancashire
  - economy, 163
  - parishes, 157, 158, 159, 160, 161, 162, 163
- Lancaster, 157, 158, 163–5, 164, 292, 294, 298–9, 300
  - adult burials, 164–5, 164
  - baptisms, 163, 298
  - boom, 298, 299
- child burials, 163, 164, 164, 165, 299, 299
- economic factors, 164–5
- mortality crises, 164
- population dynamics, 163–5
- smallpox epidemics, 299, 301
- wool and wheat, effect of, 164–5
- latitude, effect on infant mortality, 160
- Leslie Matrix, *see* matrix modelling
- life expectancy, 4, 175, 201, 245, 247, 248, 249, 252, 253, 254, 255, 256, 258–9, 258, 263, 268, 314
- limit cycles, *see* control cycles, 4
- linearised model, 174, 175, 177, 188, 218, 219–20, 220, 276, 277
- London
  - deaths, 187, 243
  - endogenous cycles, 53
  - interaction of diseases, 238–43, 241, 319–20
  - long wavelength cycles, 76, 187
  - measles, 222–31, 224, 226, 227, 240, 263–4, 265
  - migration, 185, 186, 187, 269
  - modelling smallpox, 207, 209, 210, 212, 213, 248–54, 250, 251, 254
  - plague, 53, 172, 172, 173, 186, 187
  - population dynamics, 244–69
  - Quakers, 306
  - smallpox, 113, 171–3, 172, 173, 177, 179, 180–1, 184–7, 186, 239, 240, 240, 241, 242, 242, 243, 248, 253, 289, 300, 301, 302
    - correspondence with Chester, 196–7, 196
  - typhus, 113
  - whooping cough, 231–7, 232, 233, 235, 240, 242
- Lowther, 158
- lynx, 22, 23, 25
  - population cycles, 21–5
- Maidstone, 290, 291, 301
- malnutrition, 5–8, 322–4
  - birthweight, effect on, 6
  - child mortality, 125–31, 145, 243
  - infant mortality, 125–31, 145, 243
  - population dynamics, effect on, 268
  - population growth, effect on, 7
  - in pregnancy, 6, 8, 113, 125–31, 142, 229–30, 243, 313, 316, 318, 320
  - and susceptibility to disease, 181, 185, 186, 188, 229–31, 237, 238, 267–9, 268, 272–5, 276, 286, 309, 311–14, 316, 319–20
- Manchester, 270, 283, 330, 329
- marital fertility, 64–6, 65, 67
- market towns, 271, 275, 300

*Index*

351

- marriage
  - mean age, 80–1
  - oscillations, 80–1
- maternity, mean age at, 77
- matrix modelling, 31–3, 59, 60, 62, 63, 71–4, 72, 77–80, 82
  - Ackerman's pole placement, 72, 73
  - baptisms, 58–9
  - eigenvalues, 32–3, 57–8, 59, 78
  - of endogenous oscillations, 55–63, 83–6
  - feedback, 58, 60–3, 60, 72, 78
  - fertility function, 32, 55–6, 58–9, 77–80, 78, 79, 80
  - identity (*I*) matrix, 72
  - loop gain, 50, 50
  - migration (*b*) vector, 71–4, 72, 73
  - mortality function, 61–3
  - survival function, 32
  - validation, 64–9
  - vectors, 55, 56, 72, 73
- measles, 178, 197, 206, 215, 217, 318
  - and chaos, 215, 216, 217, 252
  - death rate, 307
  - driver, 217, 226, 228–9, 240
  - in England and Wales, 304–6, 305, 306–8, 307
- infectious period, 307
- interactions, 238–43, 241, 319–20
  - in London, 222–31, 226, 227, 242, 265
- malnutrition in pregnancy, 229–30
- mean age of infection, 228
- modelling, 263–4, 265, 306–8, 307, 308
  - predicted deaths, 306
- metapopulation, 11, 83, 217, 306, 308, 325–34
  - definition, 2, 325
  - epidemic spread, 326
  - lattice-based simulation, 326
- migration, 327
  - feedback (*b*) vector, 71–4, 72
  - in homeostasis, 69–71
  - immigration index, 71
  - in London, 185, 186, 187, 269
  - in metapopulation, 330–4
  - oscillations at Penrith, 70, 131–2, 141, 142
  - smallpox, effect on, 185, 186, 187, 188, 269, 300
  - wheat prices, effect of, 131–2, 136, 269
- Morland, 158
- mortality
  - child, rate of, 81, 85
  - function, 81–3
  - theory, 3
  - mumps, 217
- Nantwich, 292, 294, 298, 301
  - baptisms, 297
- child burials, 297, 297
- smallpox epidemics, 297, 297, 298
- natural frequency, *see* resonant frequency
- natural immunity, 276, 281
- neonatal mortality, 123–31, 124, 128, 138, 230, 243
- Newbiggin, 157, 158
- Newcastle, 328, 329
- Newton Reigny, 292, 293, 294, 301
  - adult burials, 293
  - child burials, 293
  - economy, 293
- noise
  - white, 19, 110, 142, 143, 206, 207, 207, 208, 220, 280, 281
  - non-white, 110, 143
- non-linear model, 175, 188, 189–221, 220, 278, 286
- North Meols, 157, 158
- Northampton, 270
- Northern Province, 37, 325
- Northumberland, plague, 328
- Norwich, 270
- Nottingham, 270
- oats, 37
  - cycles, 92–4, 93, 94, 95, 96, 105
  - prices, 90, 93, 96, 114, 146
- oscillations
  - overdamped, 75, 76
  - stable, 75, 76
  - underdamped, 75, 76
  - unstable, 75, 76
  - see also* wavelength, cycles
- p-state, 327
- parish registers
  - aggregative analysis, 16
  - as a database, 16
  - family reconstitution, 17
  - underregistration, 31, 121
- Penrith
  - age at marriage, 80–1, 131
  - age at maternity, 77
  - age-specific mortality, 49, 126
  - baptisms, 39–47, 41, 42, 43, 44, 45, 131, 135–6, 138, 140, 282
  - birth loop, 49–51, 50
  - boom, 45, 46, 47, 140
  - burial rates, 120
  - burials, 38–9, 38, 39, 40, 44, 45, 83
  - description, 37–8
  - endogenous cycles, 44–7, 51, 75–86
  - exogenous cycles, 44–7, 113–142, 133, 141
  - family reconstitution, 17, 38, 64, 69, 114, 120, 123, 125, 126, 131, 137, 138, 140, 282

- Penrith (*cont.*)  
 famine, 70, 127–9, 128, 137, 150  
 feedback, 135–6, 142  
 hardship index, 151, 153  
 marital fertility, 64–6, 65, 67, 131, 139,  
     140  
 as a market town, 271, 283  
 marriages, 80  
 matrix modelling, 55–74  
 migration, 69–71, 70, 131–2, 136, 139,  
     141, 142  
 modelling smallpox, 277, 279, 280, 281  
 mortality, adult, 116, 118–20, 119, 132,  
     133–4, 138, 139, 140, 142, 147, 150,  
     156, 157, 158, 162  
 mortality, child, 115–18, 115, 117, 127,  
     138, 139, 142, 147, 150, 156, 157,  
     158, 162, 271–6, 273, 274  
 mortality crises, 48, 70, 125, 127–9, 150,  
     157  
 mortality, infant, 114, 120–31, 121, 122,  
     123, 128, 135, 138, 139, 141, 147,  
     150, 151, 156, 158, 162  
 plague, 38, 45, 47–9, 48, 49, 70, 75, 77,  
     137, 187, 328–30, 329  
 population size, 47–8, 272, 282  
 smallpox, 116, 134, 138, 139, 271–5, 273,  
     276–80, 277, 279, 280, 281, 282, 289,  
     291, 301  
 stationarity of data series, 142–3  
 steady-state, 46–7, 50, 55, 114, 136, 140,  
     141  
 survival curve, 67–9, 68, 83  
 30-year cycle, 82–3  
 underregistration, 44, 121  
 wheat prices, 150, 151  
 wool prices, 147–51, 150, 151, 155–7  
 phase diagrams, 206, 207, 208, 209, 210,  
     210, 212, 213, 215, 216, 277, 278,  
     279, 280, 286, 287, 287, 288  
 phase-shift, 203, 204, 205, 241  
 placenta, 135  
 plague, 4, 145, 327, 328–30  
     Cumbria, 327–30  
     Kendal, 45, 328–30, 329  
     Kirkoswald, 52–3  
     London, 53, 172, 172, 173, 186, 187  
     Penrith, 38, 45, 47–9, 48, 49, 70, 75, 77,  
         137, 187, 328–30, 329  
     spread, 328–30, 329  
     as a trigger, 75, 77, 186–7, 188  
     York, 51–2, 198  
 population growth  
     boom, 45, 46, 47, 114, 140, 141, 299, 300,  
         301, 324, 327, 333  
     fertility, effect of, 3  
     food supply, 6
- Malthusian checks, 3, 34  
 mortality, effect of, 3, 7  
 nuptiality, effect of, 3  
 optimal level, 60  
 positive check, 3  
 preventive check 3  
 population size/density, (*N*)  
     changes, 304–5, 306–8  
     in classification of epidemics, 300–2  
     definition, 174, 175, 178  
     determination of interepidemic interval,  
         177, 183, 196, 201, 285, 289, 291  
     determination of resonant frequency,  
         178, 209, 286, 291  
     effect on dynamics of epidemics, 225–8,  
         230, 233–4, 236–8, 253, 254, 296  
     in modelling, 177, 203, 218–19, 255,  
         257–8, 257, 261–2, 264  
     predicted, 179, 180  
     relative measure of, 180  
 post-neonatal mortality, 123–31, 124, 128,  
     138, 139, 243  
 Poulton-le-Fylde, 157, 158  
 pregnancy, nutrition in, 6, 8, 113, 125–31,  
     142, 229–30, 243, 313, 316, 318, 320  
 Prestwich, 158
- rainfall  
     driver, 179, 181–2, 183, 196, 240, 288,  
         289, 289, 305–6, 311, 318  
     predicted price series, 103–4, 111–12  
     principal component analysis, 110–11  
     seasonal mean, 89  
     soil moisture deficit, 102  
     wheat prices, effect on, 101–2  
 reproductive rate, (*R*), 174, 275  
 resonant frequency, 18, 176, 177, 178, 180,  
     182, 183, 204, 206, 208, 211, 217,  
     219, 220, 221, 228, 229, 230, 234,  
     236, 237, 238, 239, 247, 276, 277,  
     286, 288, 291  
 resources, 331  
 Richmond, plague, 328–30, 329  
 rubella, 217  
 rural towns, smallpox in, 270–302  
     modelling, 276–80  
 rust, 106–9  
     *Berberis vulgaris*, as secondary host, 106  
         eradication, 109  
     epidemics, 106–9  
     life cycle, 107, 108  
     *Puccinia* spp. 106–7  
 rye, 37, 96
- St Bees, 292, 294, 298  
 mortality crises, 298  
 smallpox epidemics, 298, 302

*Index*

353

- scarlet fever, 289, 304
- drivers, 289–90, 311
- England and Wales, 289, 310–16, 312, 315
- epidemics, 219, 252
- infectious period, 314
- interactions, 319–20
- interepidemic period, 310, 315
- malnutrition, 311–14, 316, 318
- mean age of infection, 314
- modelling, 314–15, 315
- mortality, 315–16
- seasonal forcing, 178, 223
- Sefton, 158
- SEIR/SIR dynamics, 173, 174, 177, 184, 188, 206, 215, 271, 275, 289, 302, 310, 318, 319
- sheep, 37
  - wool prices, 146, 154, 156
- Sherbourne, 290, 301
- Shetland Islands, 270, 281
- sine wave, 18, 19
- Skipton, 290, 291, 301
- smallpox, 4
  - at Chester, 189, 190–7, 270, 271, 301, 302
  - classification of epidemics, 299–302
  - drivers, 179, 181–3, 185–6, 195–7, 196, 203, 206, 211, 216, 217, 219, 220, 221, 230, 240, 266, 272–5, 277, 279, 286–90, 301
  - England and Wales, 309–10, 309
  - epidemics, 268, 290, 294, 296, 297
  - fatality rate, 169, 281–3
  - history, 169–71
  - inoculation, 172, 183
  - interactions, 238–43, 241, 319–20
  - lethality, 169, 270
  - London, 113, 171–3, 172, 173, 177, 179, 180–1, 184–7, 186, 239, 240, 240, 241, 242, 242, 243, 248, 253, 289, 300, 301, 302
  - interepidemic interval, 172–3, 180
  - mean age of infection, 177, 179, 184–5, 191, 206
  - long wavelength oscillations, 186–7
  - modelling, 207, 209, 210, 212, 213, 244–69, 250, 251, 254, 255, 277, 279, 280, 281, 283–90, 286, 287, 288
  - natural immunity, 276
  - Penrith, 116, 134, 138, 139, 271–5, 276–80, 273, 277, 279, 280, 281, 282, 289, 291, 301
  - in rural towns, 270–302, 294
  - seasonal weather conditions, 181–3
  - Thornton-in-Lonsdale, 29, 283–90, 286, 287, 288
  - vaccination, 172, 173, 183, 184, 188, 264–6, 266, 270, 300, 302, 304, 318, 319
  - virus, 170
  - York, 197, 198, 200
  - spatial dynamics of infectious diseases, 178, 223, 240, 326
    - in metapopulations, 332
  - stationarity, analysis, 110, 142–4
  - steady-state population, 46–7, 55–74, 277, 327
    - Penrith, 46–7, 50, 55, 114, 136, 140, 141
    - stochastic effects, driving epidemics, 178, 206, 207, 216, 221, 223, 240, 308, 326
  - Stockport, 157
  - survival curve, 67, 68, 72, 83, 84
  - susceptibility, *see* transmission coefficient
  - Taunton, 301, 290
  - temperature, seasonal
    - adult burials, effect on, 132, 133–4, 142
    - average, 98
    - driver, 179, 181, 182, 183, 196, 226, 229, 230, 231, 235, 236, 237, 240, 278, 288, 289, 305–6, 318
    - predicted price series, 103–4, 111–12
    - principal component analysis, 101, 110–11
    - seasonal mean, 89
    - wheat prices, effect on, 97–101, 100
  - Third World countries, 9, 10, 66, 67, 131, 222, 230, 238, 311
  - Thornton-in-Lonsdale, 157, 158, 160, 161, 162, 291, 292, 294, 300, 301
  - baptisms, 283, 284
  - burials, 25–31, 26, 27, 28, 29, 30, 31
    - child burials, 26, 27, 28, 29, 30, 31, 283, 284, 288
    - drivers, 286–90, 289
  - population dynamics, 289
  - smallpox epidemics, 29, 283–90, 286, 287, 288
  - wool prices, 288, 290
  - threshold density, 136, 137, 174, 180, 275, 278, 301
  - time-series analysis, 18–31
    - autocorrelation function (acf), 21, 143
    - coherence (input–output), 20
    - cross-correlation function (ccf), 21
    - delay (lag), 21
    - fast Fourier transform, 18
    - filtering, 20
    - Kalman filtering, 83
    - spectral analysis, 20
    - worked examples, 21–31
  - transmission coefficient ( $\beta$ )
    - measles, 225, 229, 230, 307, 308
    - smallpox, 174, 175, 176, 178, 195, 202, 203, 208, 209, 218, 252, 253, 274, 275, 276, 277, 278, 279, 280, 286, 287, 288, 289, 291, 300, 301

354

*Index*

- transmission coefficient ( $\beta$ ) (*cont.*)
  - whooping cough, 234, 236, 237
- trend, definition, 19
- tuberculosis, 303
- typhoid, 303
- typhus, 4, 48, 113, 137, 145, 303
- Urswick, 158
- vaccination, smallpox, 172, 173, 183, 184, 188, 264–6, 266, 270, 300, 302, 304, 318, 319
  - definition, 183
  - theoretical effects, 264–6, 266
- vitamin A, 223, 231
- Walton-on-the-Hill, 158, 161, 162
- Warcop, 158
  - plague, 329, 330
- wavelength ( $\lambda$ ),
  - definition, 18, 19, 19
  - damping, 75
  - long, 19, 39, 41, 44, 45, 52, 187
  - medium, 19, 43, 47
  - short, 19, 39, 41, 43, 46
- Westmorland, *see* Cumbria
- Whalley, 157, 158
- wheat, 37
  - autoregressive effects, 105–6, 109
  - causes of short wavelength oscillation, 105–12
  - cycles, 90–112, 92, 95, 149, 209
  - medium wavelength oscillation, 90–1, 98–101
  - predicted price series, 103–4, 111–12
  - rust epidemics, 106–9
  - seasonal rainfall, effect of, 101–2
  - seasonal temperatures, effect of, 97–101, 100
  - short wavelength oscillation, 90–1, 97–112
- wheat prices, 90, 90, 91, 92, 94, 96, 97, 100, 114, 145, 162, 164
  - adult mortality, effect on, 118, 150
  - and baptisms, 131
  - child mortality, effect on, 117, 118, 126, 127, 145–55, 150, 201
  - as a driver, 186, 206, 209, 226, 227, 228, 229, 235, 237, 238, 240, 242, 243,
- 272–5, 276, 278, 285, 288, 289, 289, 294, 299, 309, 311, 312, 318, 320, 324–5
- hardship index, 151–3, 151, 152, 153, 155–6, 156
- infant mortality, effect on, 122–31, 123, 124, 145, 150, 151
- and migration, 131–2
- non-stationarity, 110
- and susceptibility, 181, 185–6, 188, 231, 233, 237, 242
- and wool prices, 146–57, 147, 149, 154, 161–3
- whooping cough, 231–7, 319–20
  - in Cape Town, 238
  - drivers, 234–6, 235, 237, 238, 240
  - interactions, 238–43, 241, 306–8
  - interepidemic interval, 231, 233, 236, 237, 240
- in London, 231–7, 232, 233, 235, 240, 242
- mean age of infection, 234
- wool prices, 146–57, 148, 155, 162, 164, 289
  - hardship index, 151–3, 151, 152, 153, 155–6, 156
  - mortality, effect on, 147–57, 150, 161–8
  - and smallpox epidemics, 288, 289, 290
  - and wheat prices, 146–57, 147, 149, 154, 161–3
  - York, 165, 167, 168, 200
- Wrigley & Schofield, 1, 4, 16, 66, 67, 69, 77, 81, 83, 157, 160, 172, 224, 235, 298, 306, 324, 325, 333
- Wybunbury, 292, 294, 301
  - child burials, 298
  - mortality crises, 298
- York
  - baptisms, 52
  - child mortality, 167, 168, 198, 199, 200, 200, 201
  - crisis mortality, 165, 168
  - endogenous oscillations, 51–2, 53, 54
  - infant mortality, 165, 166, 167, 167, 168
  - market centre, 168
  - mortality, effect of wheat prices, 167, 168
  - mortality, effect of wool prices, 165, 167, 168
- plague, 51–2, 198, 198
- smallpox, 167, 197–201, 300
- wool prices, 165, 167, 167, 168, 200