Zimbabwe

```
## [1] "Census Females"
```

```
## # A tibble: 86 x 6
##      age `1969`  `1982`  `1992`  `2002`  `2012`
##    <dbl>  <dbl>   <dbl>   <dbl>   <dbl>   <dbl>
##  1     0   215. 137199. 169638. 170997. 215623.
##  2     1   200. 134655. 159190. 172117. 211071.
##  3     2   219. 133815. 158420. 168708. 198666.
##  4     3   229. 131120. 158291. 164925. 190736.
##  5     4   240. 128619. 160494. 162274. 183611.
##  6     5   251. 126617. 162425. 159507. 177197.
##  7     6   258. 125956. 164145. 156778. 173472.
##  8     7   261. 125351. 166412. 155377. 171651.
##  9     8   262. 124105. 167841. 153895. 169450.
## 10     9   259. 118378. 165018. 153789. 171475.
## # ... with 76 more rows
```

```
## [1] "Census Females 5-year"
```

```
## # A tibble: 18 x 2
##      age  `1969`
##    <dbl>   <dbl>
##  1     0 1100.
##  2     5 1252.
##  3    10 1181.
##  4    15  935.
##  5    20  709.
##  6    25  541.
##  7    30  437.
##  8    35  379.
##  9    40  303.
## 10    45  227.
## 11    50  168.
## 12    55  124.
## 13    60   95.4
## 14    65   67.1
## 15    70   35.5
## 16    75   17.0
## 17    80    9.26
## 18    85   13.4
```

```
## [1] "Census Males"
```

```
## # A tibble: 86 x 6
##      age `1969`  `1982`  `1992`  `2002`  `2012`
##    <dbl>  <dbl>   <dbl>   <dbl>   <dbl>   <dbl>
##  1     0   238. 133357. 168079. 170637. 213895.
##  2     1   232. 129754. 158096. 172216. 210140.
##  3     2   231. 129163. 156962. 168433. 197420.
##  4     3   235. 127343. 157057. 164960. 189835.
##  5     4   242. 125798. 159247. 162197. 182613.
##  6     5   248. 124587. 161170. 159217. 176094.
```

```
##  7     6   255. 124714. 162716. 156209. 172218.
##  8     7   265. 124146. 164082. 154419. 170262.
##  9     8   271. 122838. 164791. 152264. 167883.
## 10     9   271. 117620. 161620. 152041. 170380.
## # ... with 76 more rows
```

```
## [1] "Census Males 5-year"
```

```
## # A tibble: 18 x 2
##      age  `1969`
##    <dbl>   <dbl>
##  1     0 1156.
##  2     5 1278.
##  3    10 1207.
##  4    15  931.
##  5    20  636.
##  6    25  459.
##  7    30  389.
##  8    35  341.
##  9    40  280.
## 10    45  229.
## 11    50  186.
## 12    55  142.
## 13    60   97.1
## 14    65   60.0
## 15    70   32.4
## 16    75   15.2
## 17    80    8.24
## 18    85    7.21
```

Thiele log-Normal Hump Spline

```
## [1] "relative convergence (4)"
```

```
##           log_tau2_logpop_f           log_tau2_logpop_f
##                   6.3432175                   4.6662431
##           log_tau2_logpop_m           log_tau2_logpop_m
##                   6.3889944                   4.3377384
##                log_tau2_fx                log_tau2_gx_f
##                   5.2061307                   3.7182017
##               log_tau2_gx_m         log_lambda_gx_age_f
##                   2.6055114                   4.5705622
##         log_lambda_gx_age_m        log_lambda_gx_time_f
##                   6.1570900                   7.4245608
##         log_lambda_gx_time_m     log_lambda_gx_agetime_f
##                   8.2309816                   6.3853650
##     log_lambda_gx_agetime_m                log_lambda_tp
##                   6.9077797                   2.8462823
## log_lambda_tp_0_inflated_sd            log_dispersion_f
##                   0.3835911                   1.1900086
##            log_dispersion_m     log_marginal_prec_phi_f
##                   1.2435459                   6.8096094
##     log_marginal_prec_psi_f       log_marginal_prec_A_f
##                   6.8045529                   6.7713805
##       log_marginal_prec_B_f     log_marginal_prec_phi_m
##                   6.1625055                   6.8096476
##     log_marginal_prec_psi_m       log_marginal_prec_A_m
##                   6.8070532                   6.7888713
##       log_marginal_prec_B_m             log_lambda_phi_f
```

```
##                   2.4707927                   4.3078766
##            log_lambda_psi_f        log_lambda_lambda_f
##                   4.3073177                   2.3485868
##          log_lambda_delta_f       log_lambda_epsilon_f
##                   4.4896663                   4.9124804
##              log_lambda_A_f              log_lambda_B_f
##                   4.3050638                   4.2221216
##            log_lambda_phi_m            log_lambda_psi_m
##                   4.3083311                   4.3077847
##         log_lambda_lambda_m         log_lambda_delta_m
##                   2.3430678                   3.4011507
##        log_lambda_epsilon_m              log_lambda_A_m
##                   4.5892168                   4.3002933
##              log_lambda_B_m    logit_lambda_slope_rho_f
##                   3.8530151                   1.4588849
##     logit_delta_slope_rho_f   logit_epsilon_slope_rho_f
##                   2.0697374                   3.7727928
##    logit_lambda_slope_rho_m    logit_delta_slope_rho_m
##                   1.5400087                   2.2278885
##   logit_epsilon_slope_rho_m
##                  -3.7581311
```

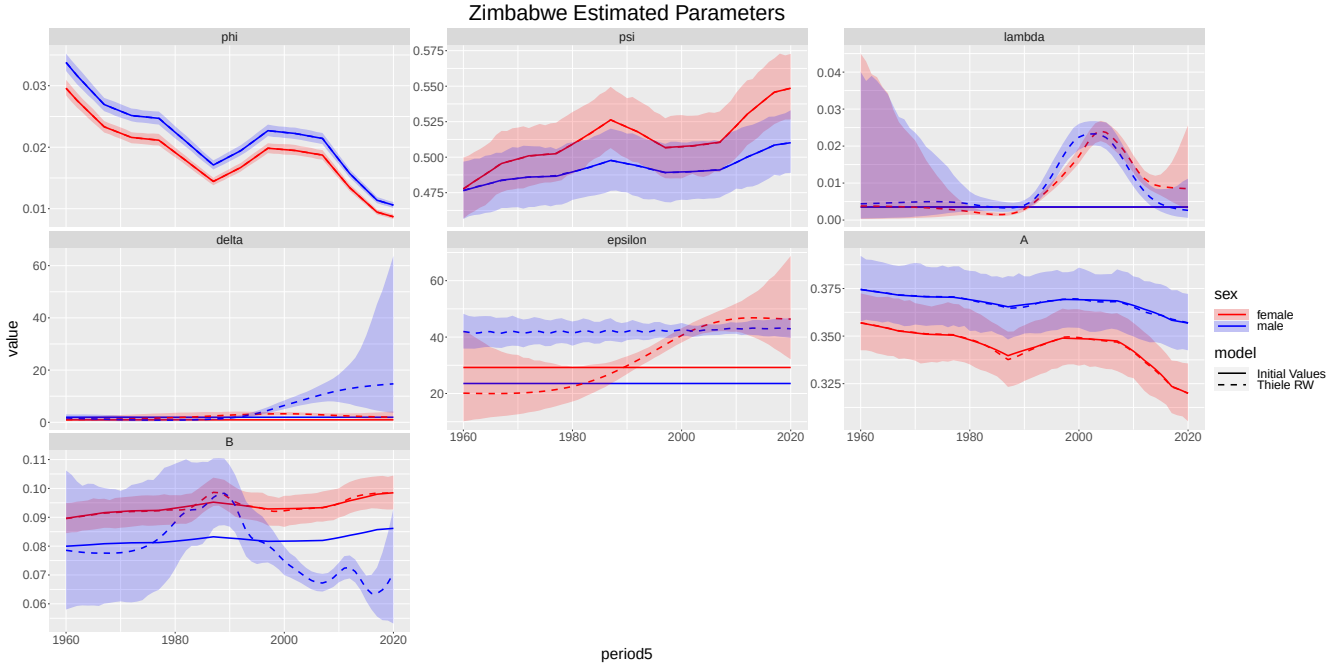


Figure 1: Estimated parameters

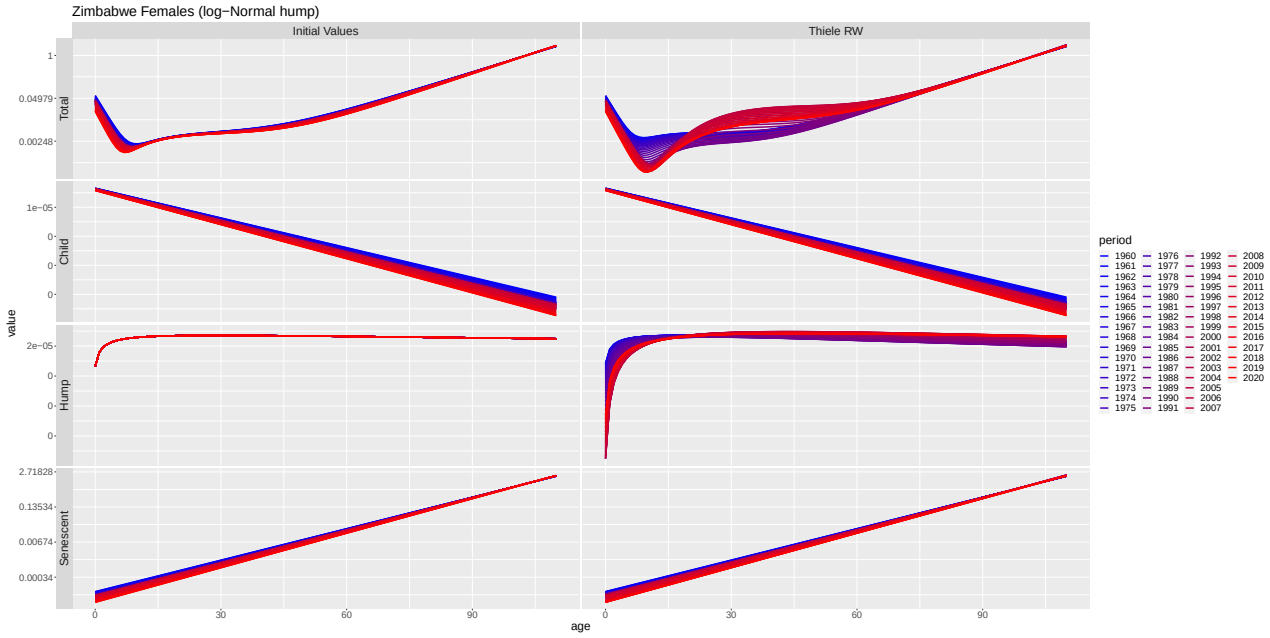


Figure 2: Thiele Decomposed

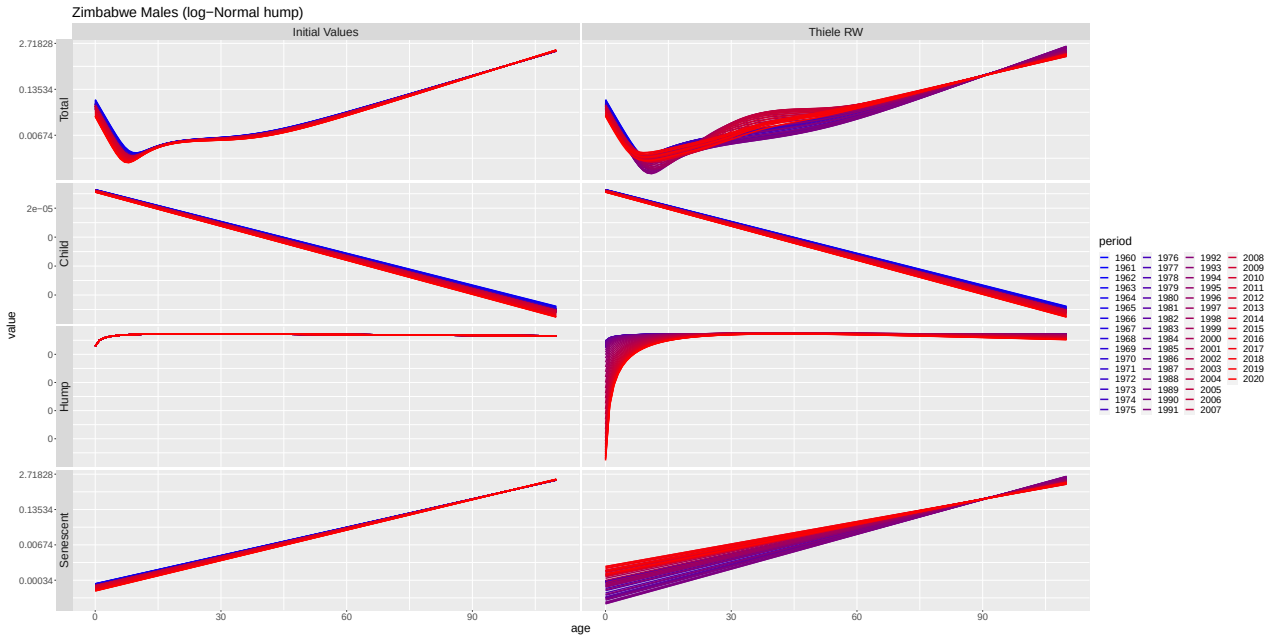


Figure 3: Thiele Decomposed

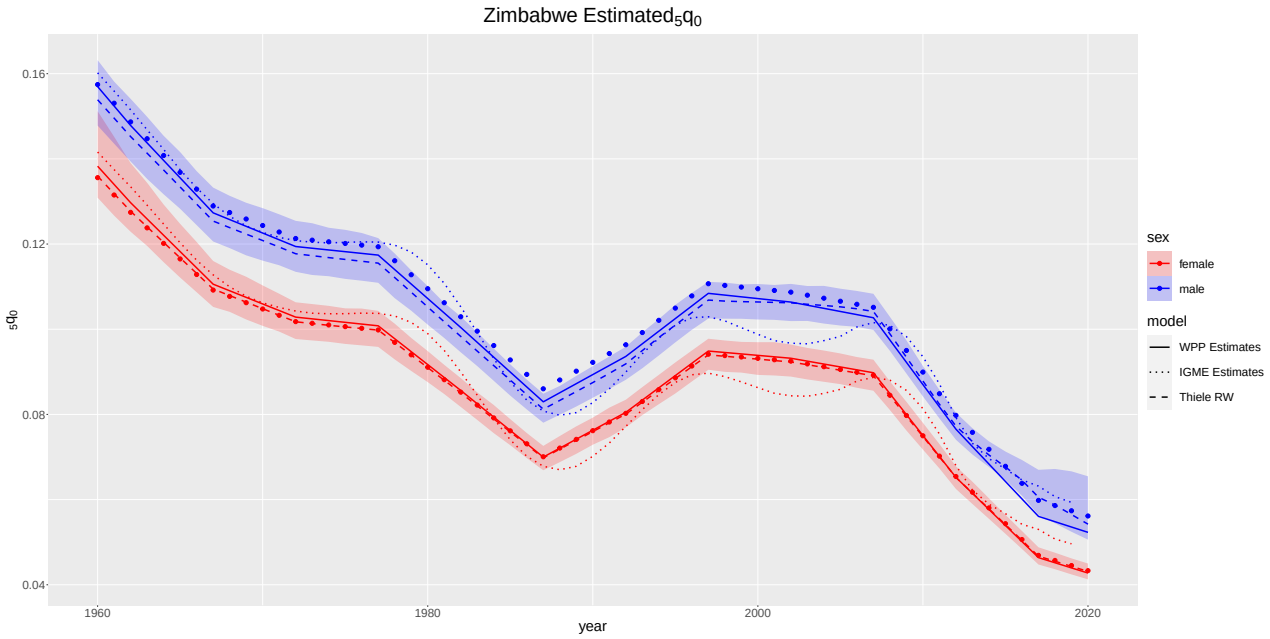


Figure 4: Estimated $_5q_0$

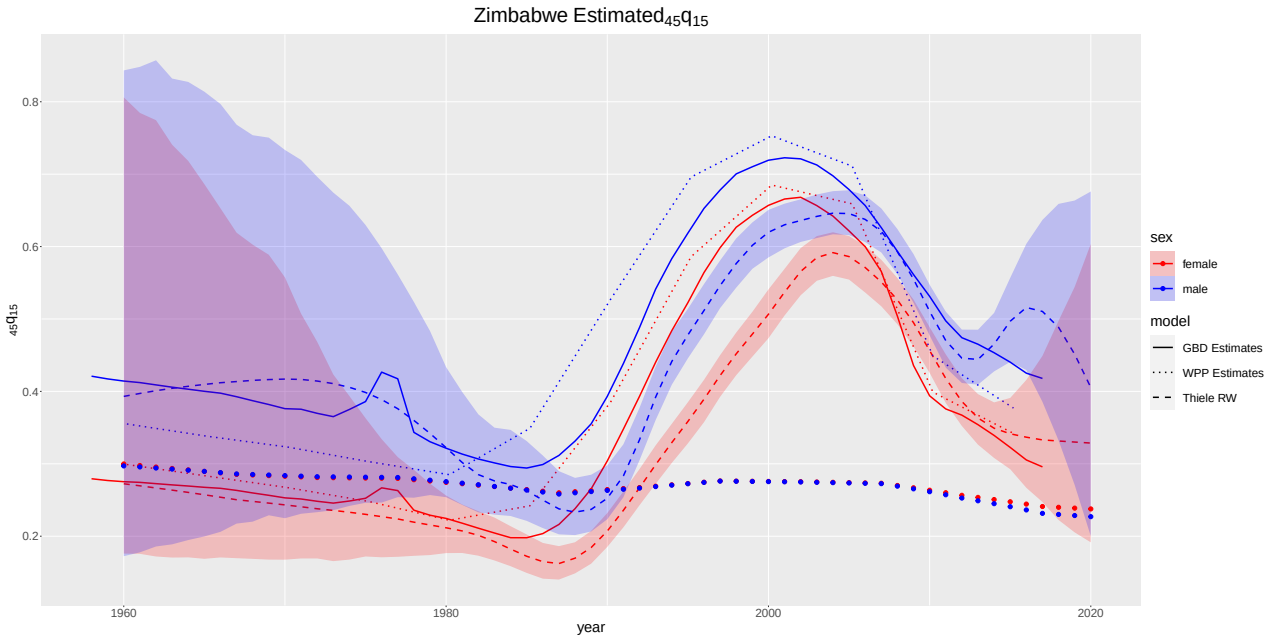
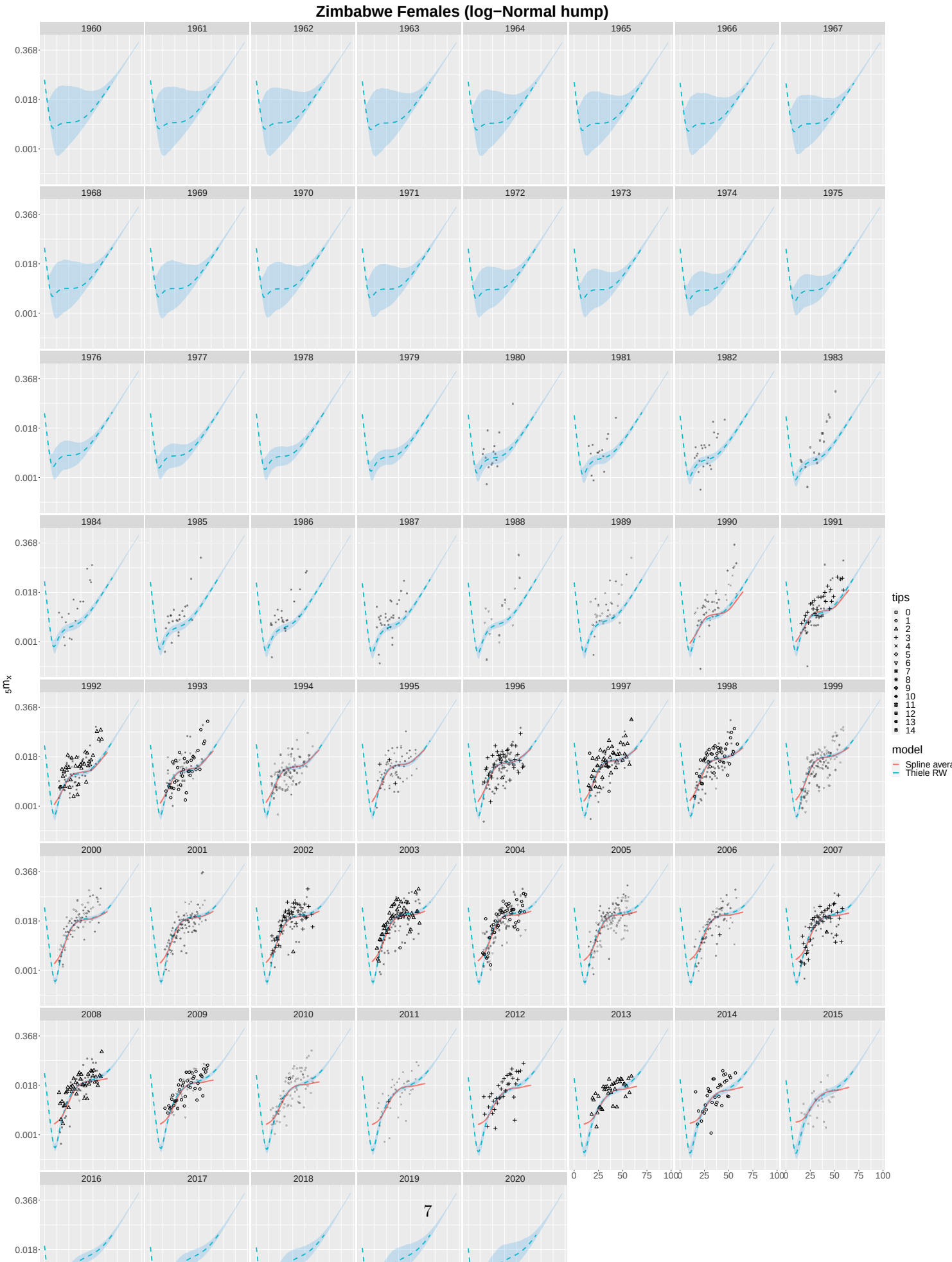


Figure 5: Estimated ${}_{45}q_{15}$


Zimbabwe Females (log−Normal hump)
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2017
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2019
2020
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0.018
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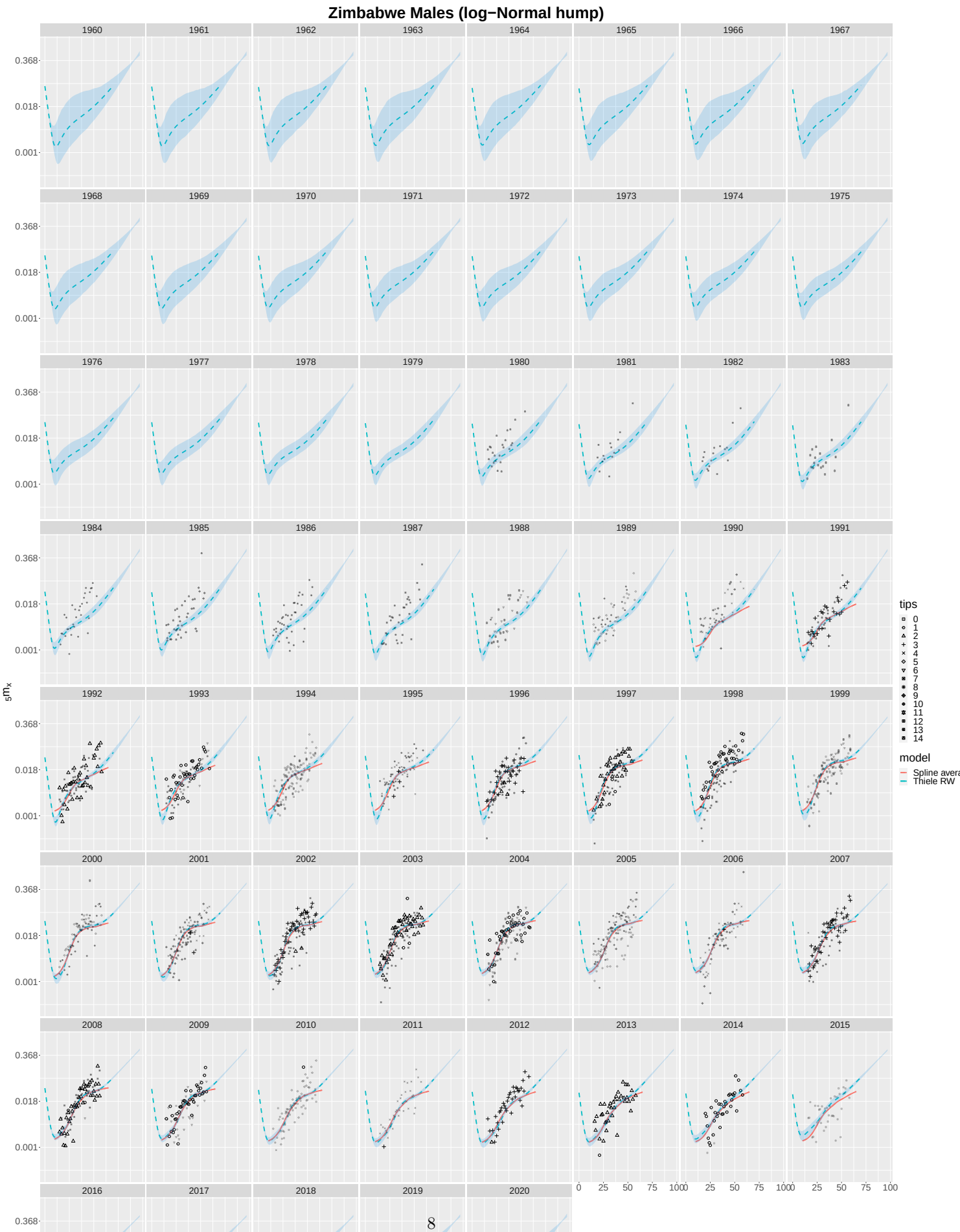
model
Spline
Thiele RW


Zimbabwe Males (log−Normal hump)
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2020
0.368
0.018
0.001
0
25
50
75
100
$_5m_x$
tips
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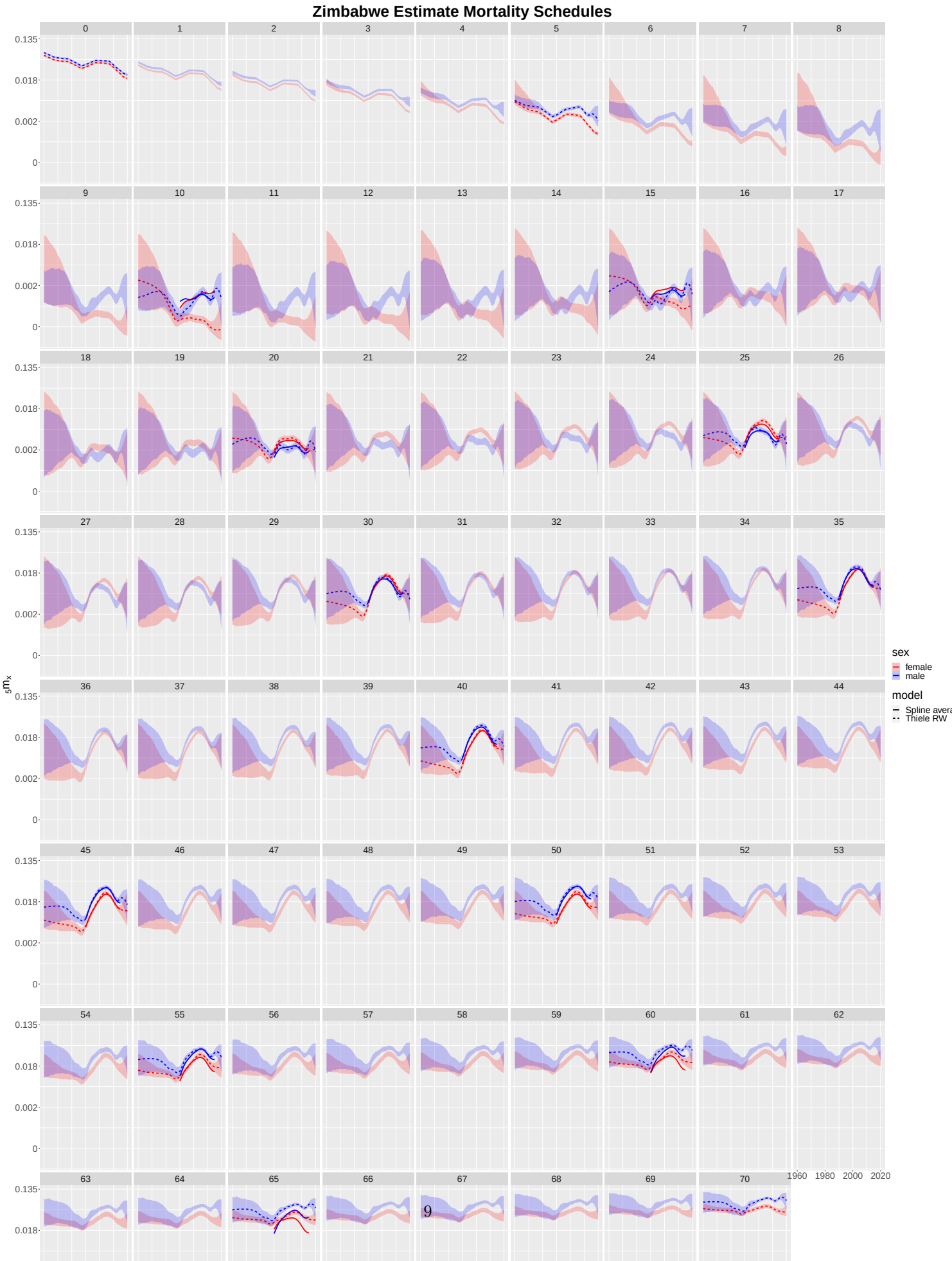
11
12
13
14
model
Spline
Thiele RW


Zimbabwe Estimate Mortality Schedules
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59
60
61
62
63
64
65
66
67
68
69
70
0.135
0.018
0.002
0
1960
1980
2000
2020
sex
female
male
model
Spline avera
Thiele RW

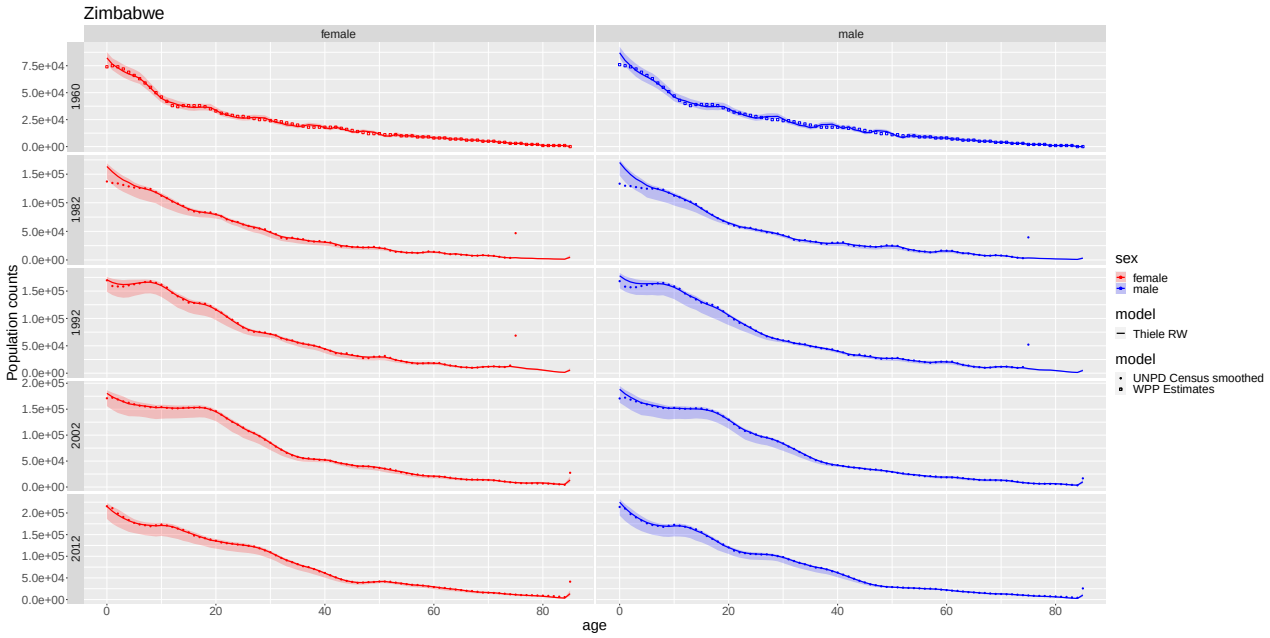

Figure 9: Population

Figure 10: Population

Figure 11: Population

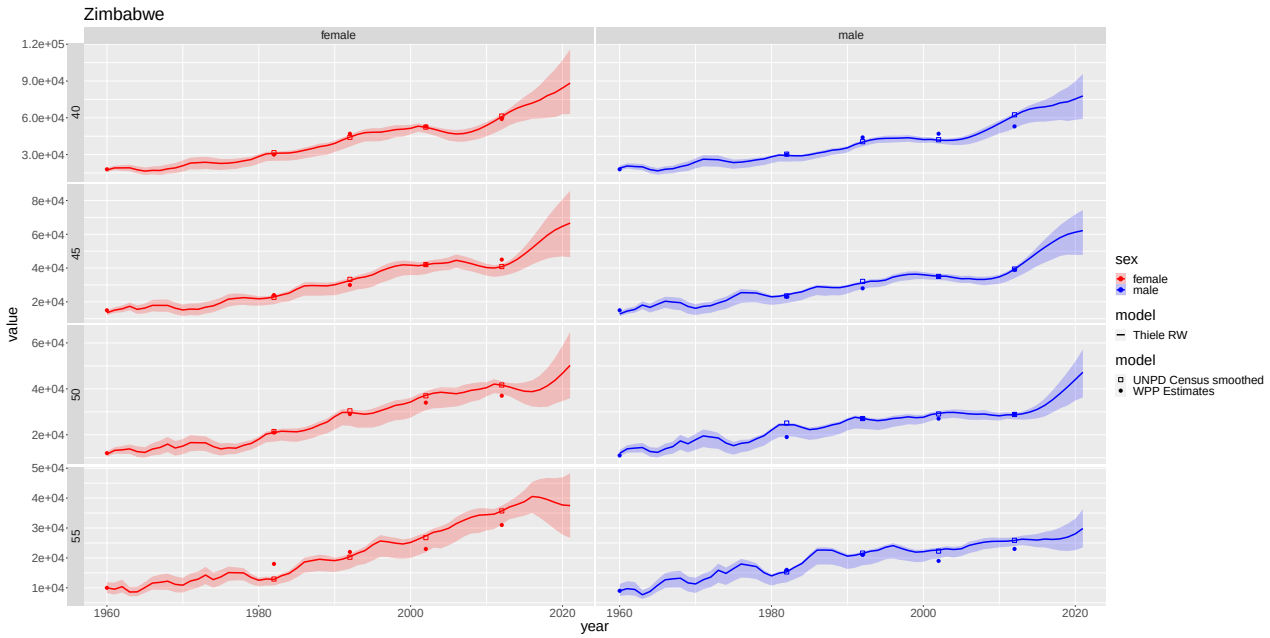

Figure 12: Population

Figure 13: Population

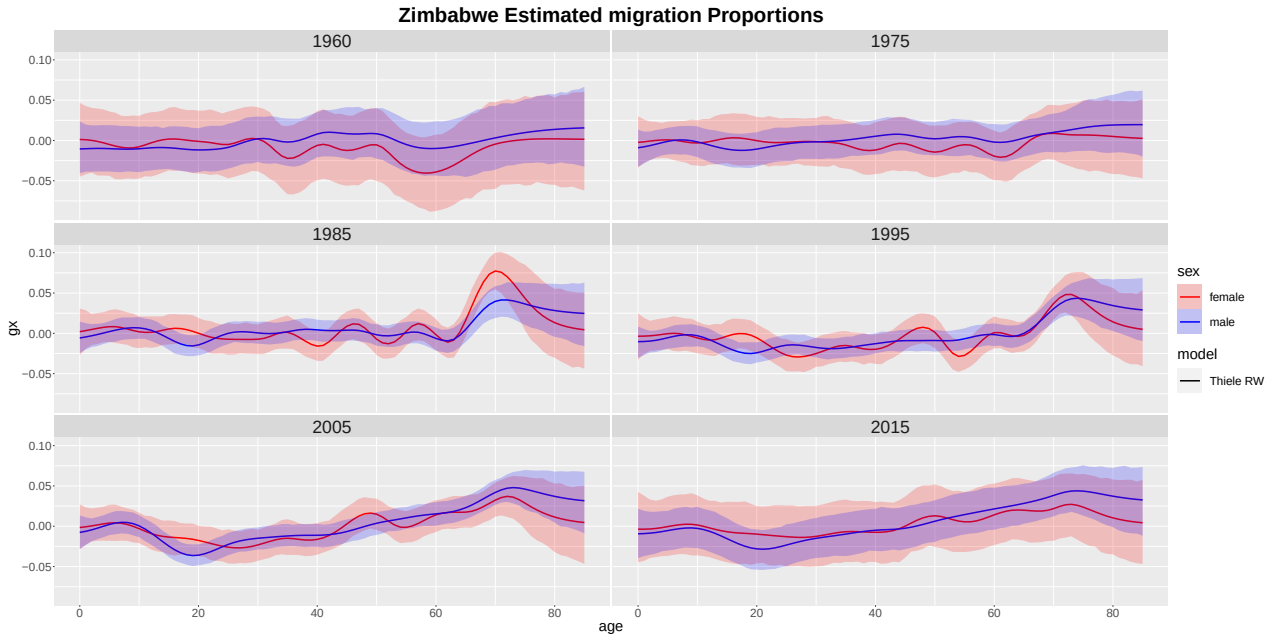

Figure 14: Migration

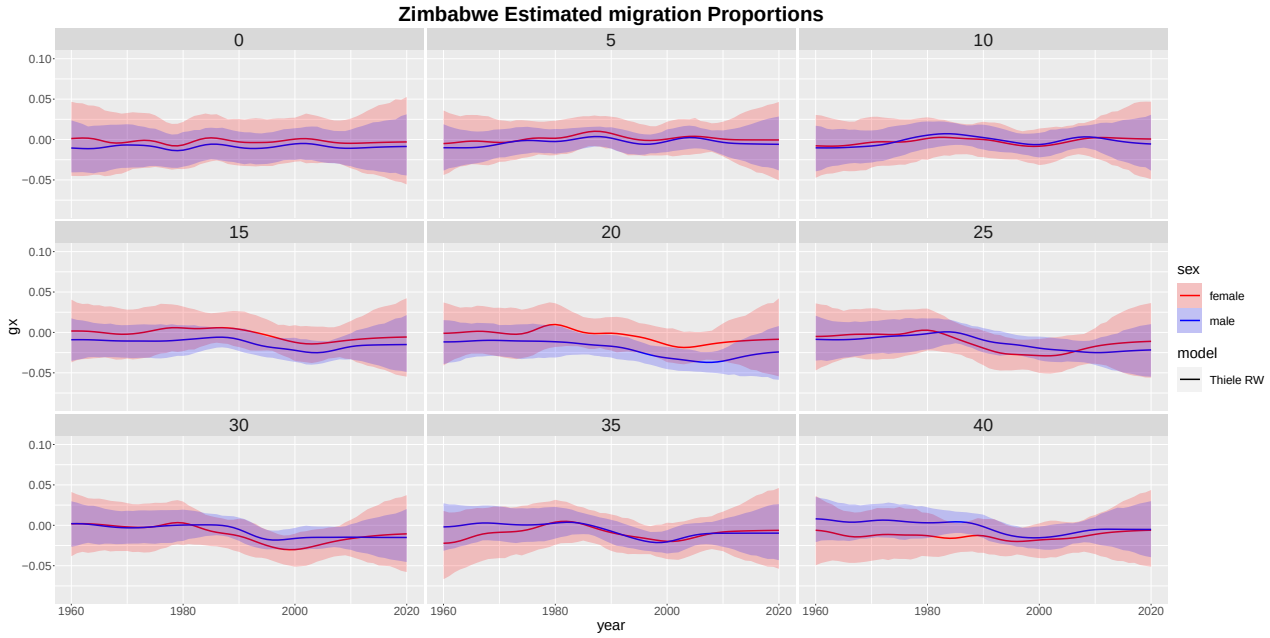

Figure 15: Migration

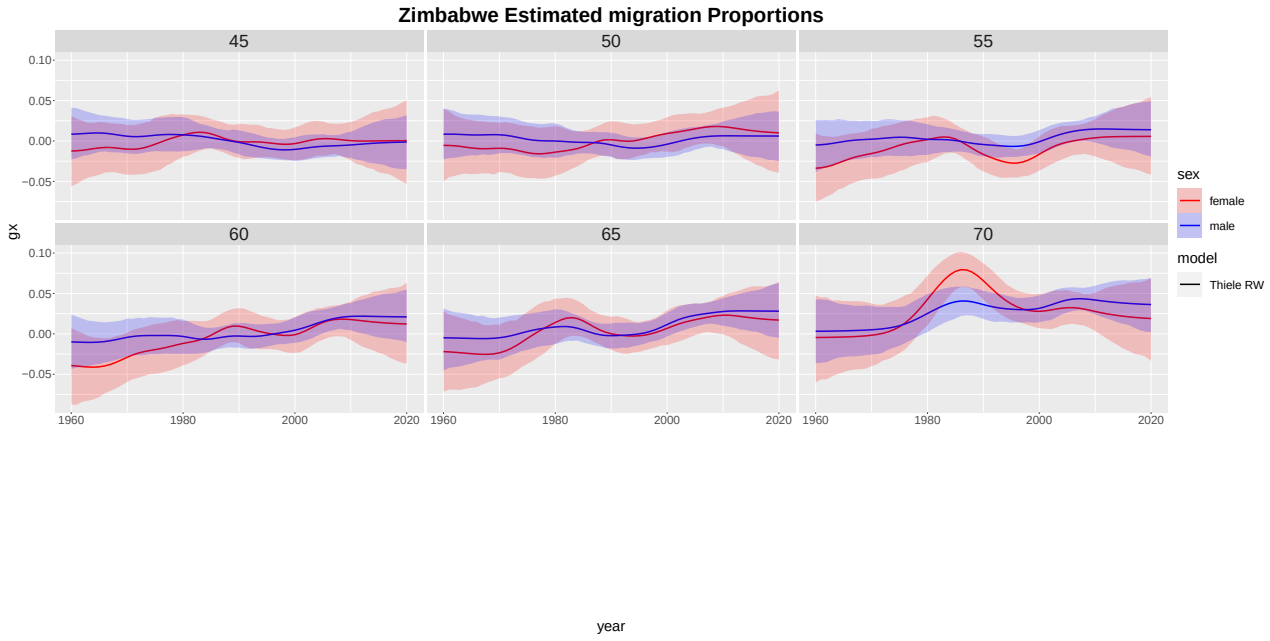

Figure 16: Migration

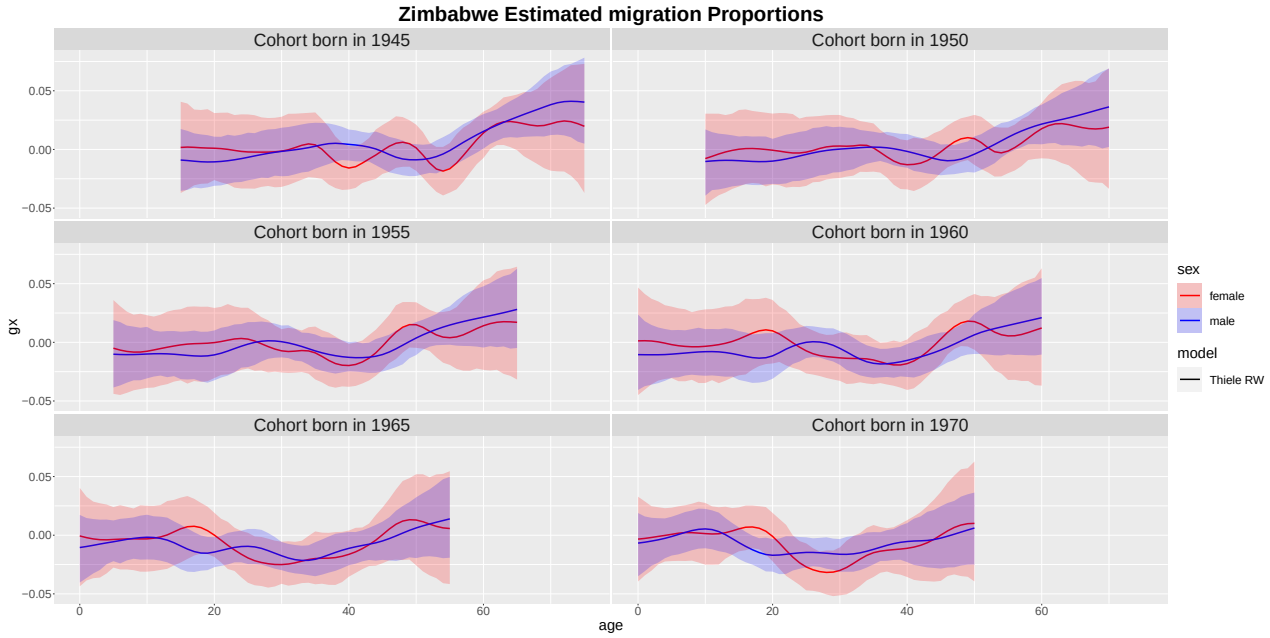

Figure 17: Migration

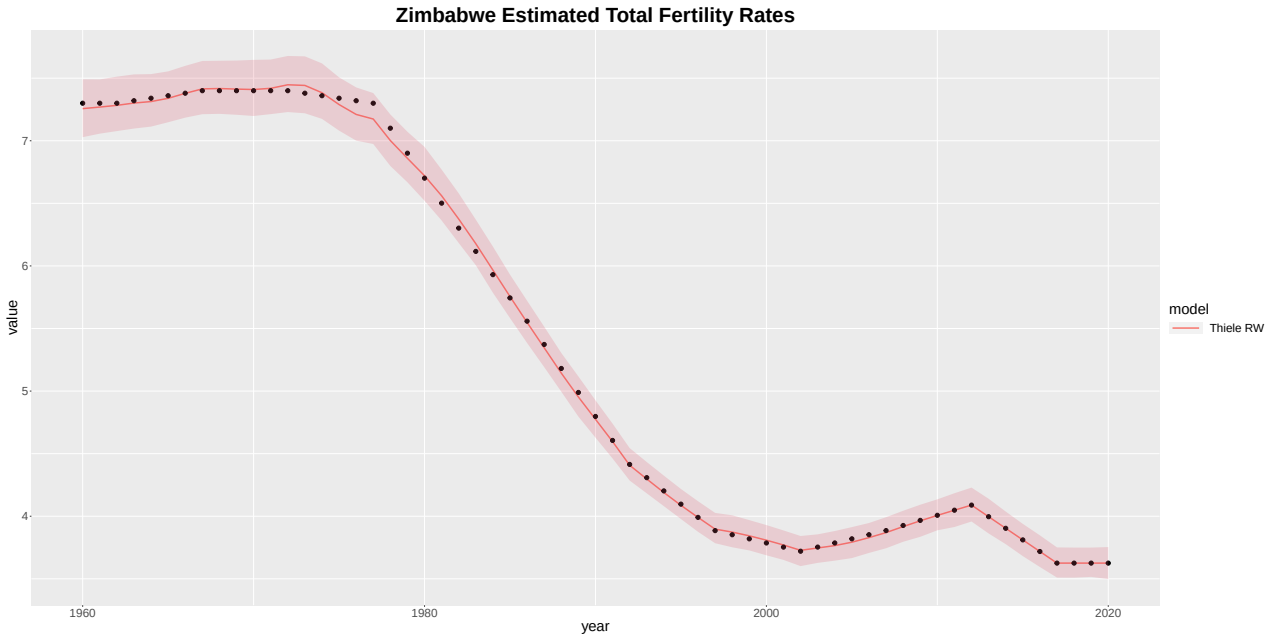

Figure 18: Total Fertility

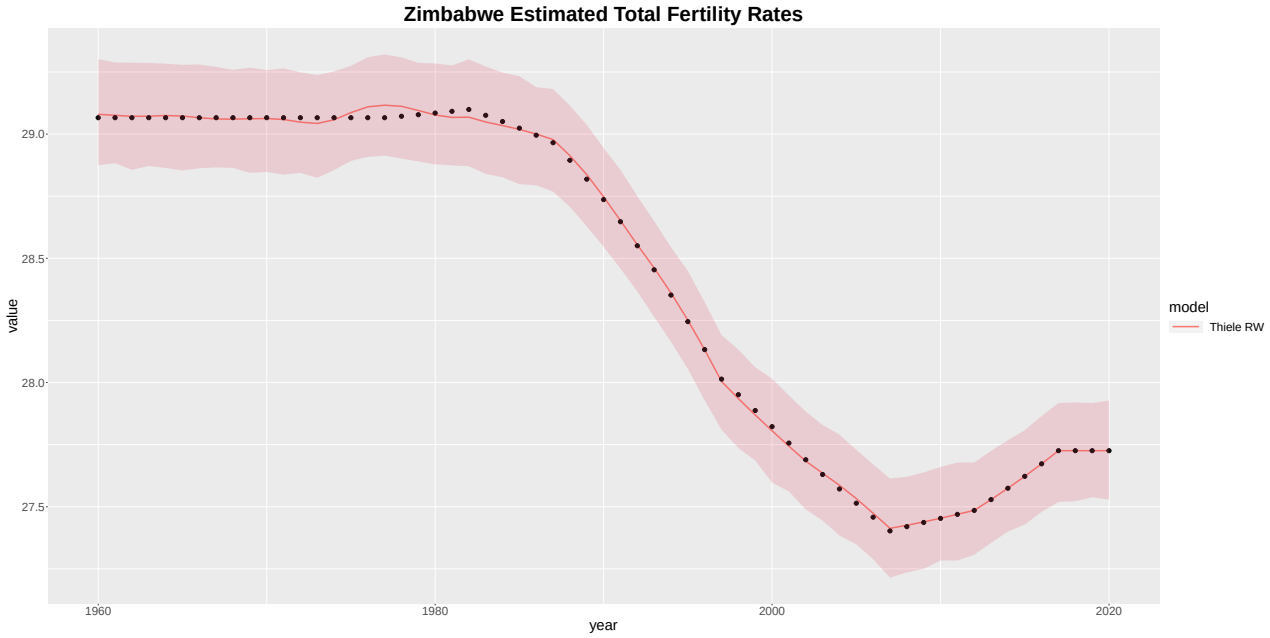

Figure 19: Total Fertility

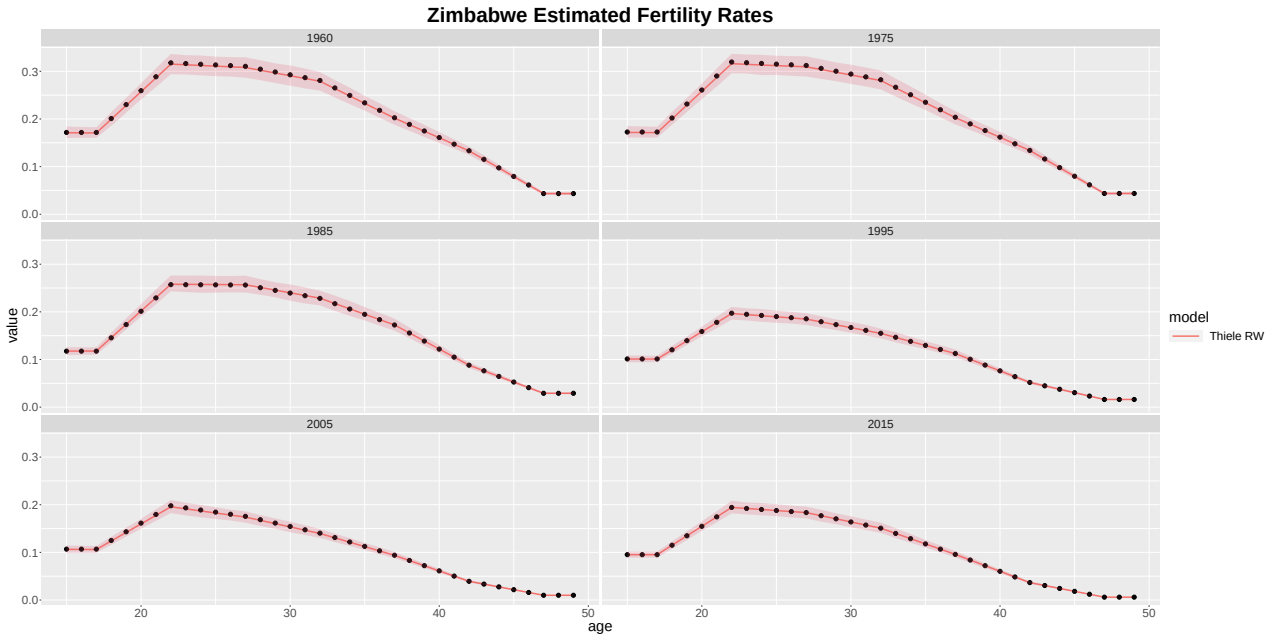

Figure 20: Fertility

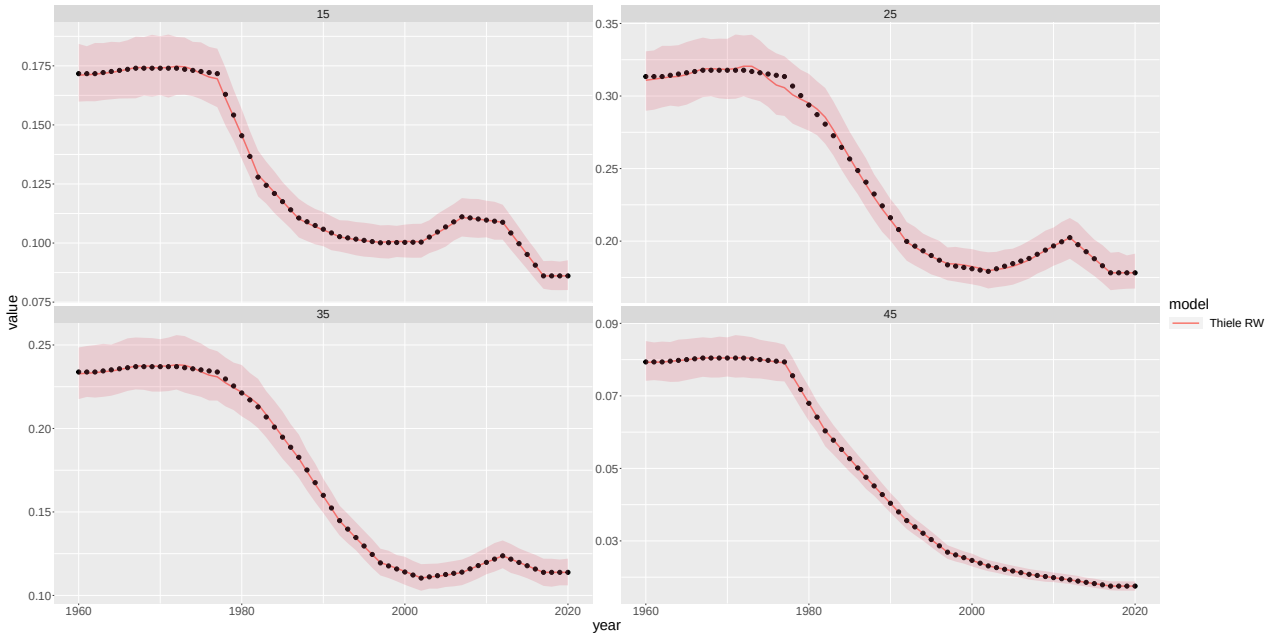

Figure 21: Fertility