Niger

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

```
## # A tibble: 87 x 3
##      age  `2001`  `2012`
##    <dbl>   <dbl>   <dbl>
## 1      0 231875. 387116
## 2      1 236358. 366174.
## 3      2 234116. 360924.
## 4      3 225152. 351735.
## 5      4 209465. 342057.
## 6      5 191664. 326933
## 7      6 178345. 311417.
## 8      7 168196. 294092.
## 9      8 161218. 275644.
## 10     9 157409. 257784.
## # ... with 77 more rows
```

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

```
## # A tibble: 87 x 3
##      age  `2001`  `2012`
##    <dbl>   <dbl>   <dbl>
## 1      0 239556. 411310.
## 2      1 243901. 386764.
## 3      2 241728. 378032.
## 4      3 233038. 365233.
## 5      4 217830. 352854.
## 6      5 201432. 337766.
## 7      6 189379. 322500.
## 8      7 179111. 305723.
## 9      8 170629. 287739.
## 10     9 163931. 268156.
## # ... with 77 more rows
```

Thiele log-Normal Hump Spline

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

```
##            log_tau2_logpop_f             log_tau2_logpop_f             log_tau2_logpop_m              log_tau2_
##                   6.07470804                    4.88245243                    6.08083344                     4.
##                 log_tau2_gx_m            log_lambda_gx_age_f           log_lambda_gx_age_m               log_lambda_g
##                   3.33149477                    7.52417637                    7.09001843                     7.8
##         log_lambda_gx_agetime_m              log_lambda_tp  log_lambda_tp_0_inflated_sd               log_disp
##                   6.90770387                    1.63622415                   -1.54734476                     0.
##         log_marginal_prec_psi_f          log_marginal_prec_A_f         log_marginal_prec_B_f           log_marginal_pr
##                   4.34596953                    6.79317461                    3.56061485                     4.
##            log_marginal_prec_B_m               log_lambda_phi_f              log_lambda_psi_f               log_lambda_
##                   3.22976785                    4.44226351                    4.37656587                     4.5
##                 log_lambda_A_f               log_lambda_B_f              log_lambda_phi_m                 log_lambd
##                   4.30581523                    3.19698461                    4.47217454                     4.
##            log_lambda_epsilon_m               log_lambda_A_m                log_lambda_B_m
##                   4.54668284                    4.30913278                    5.04752800
```
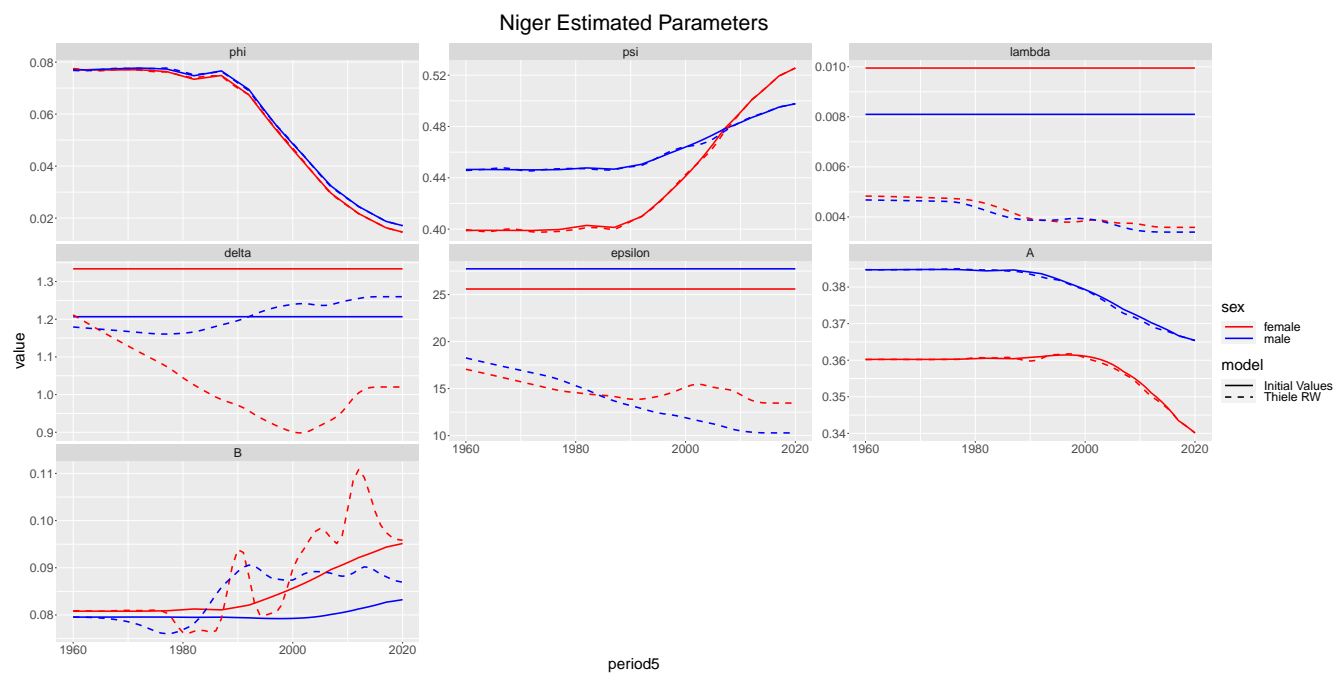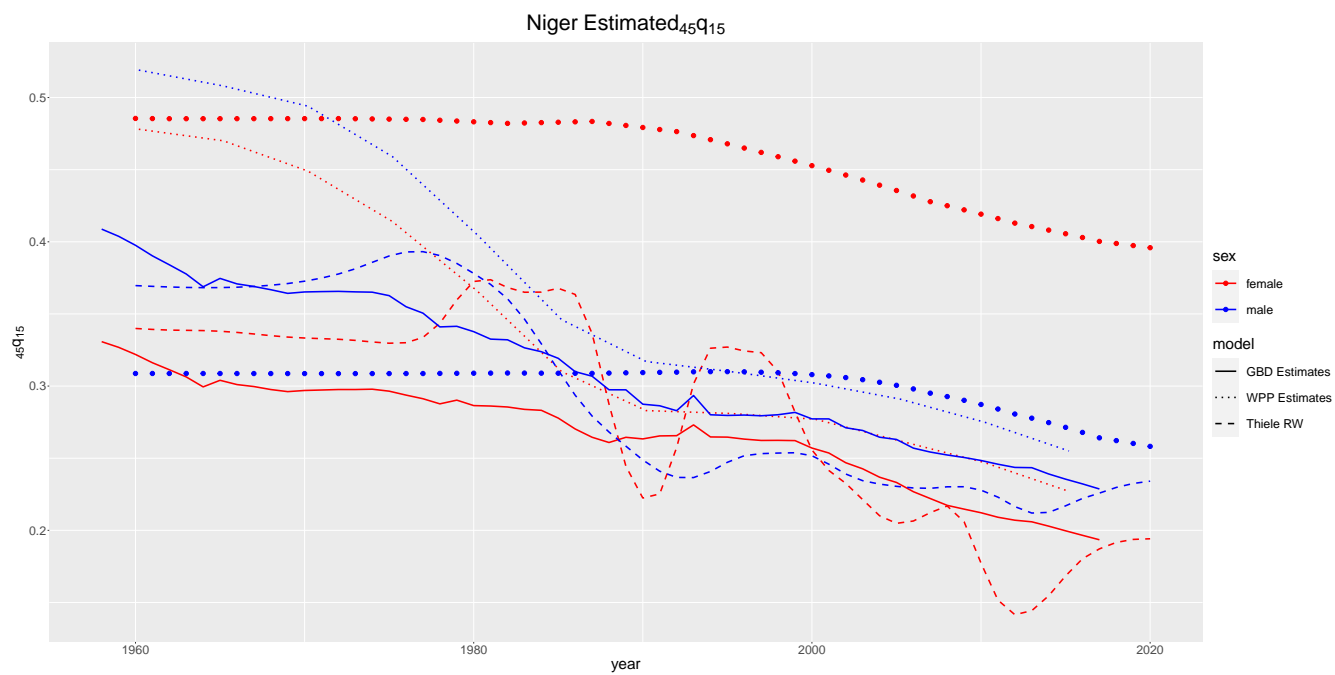
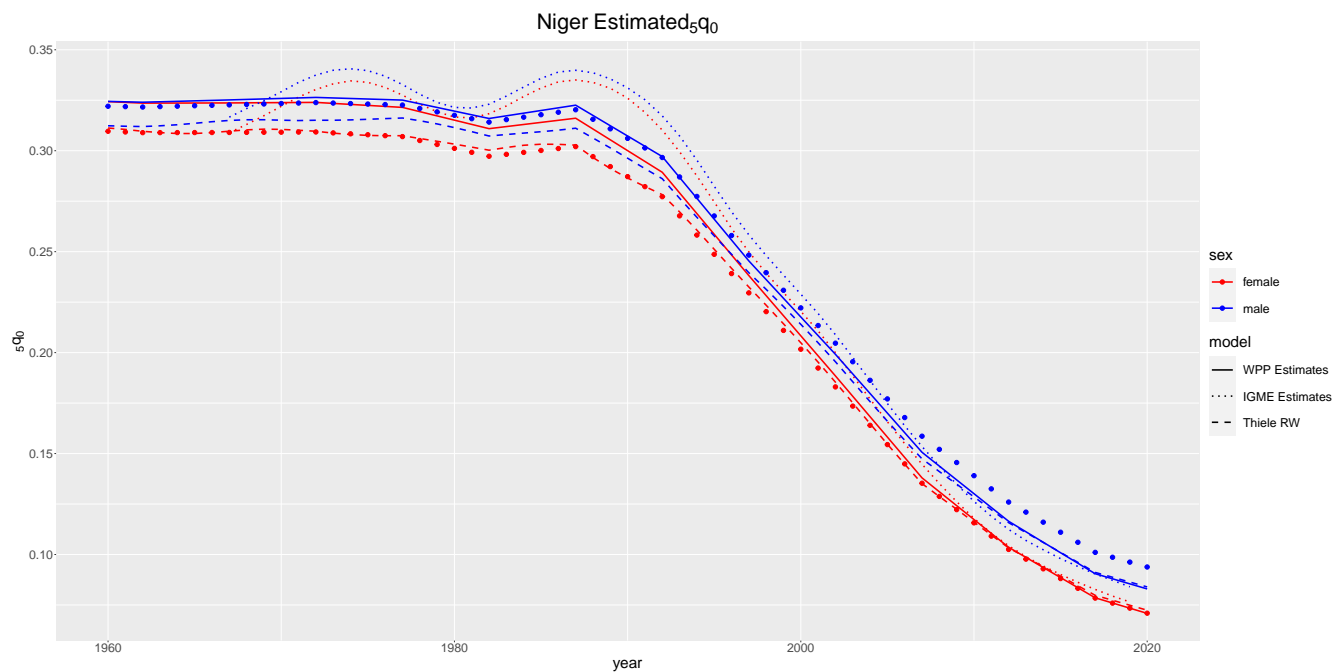Figure 1: Estimated parameters

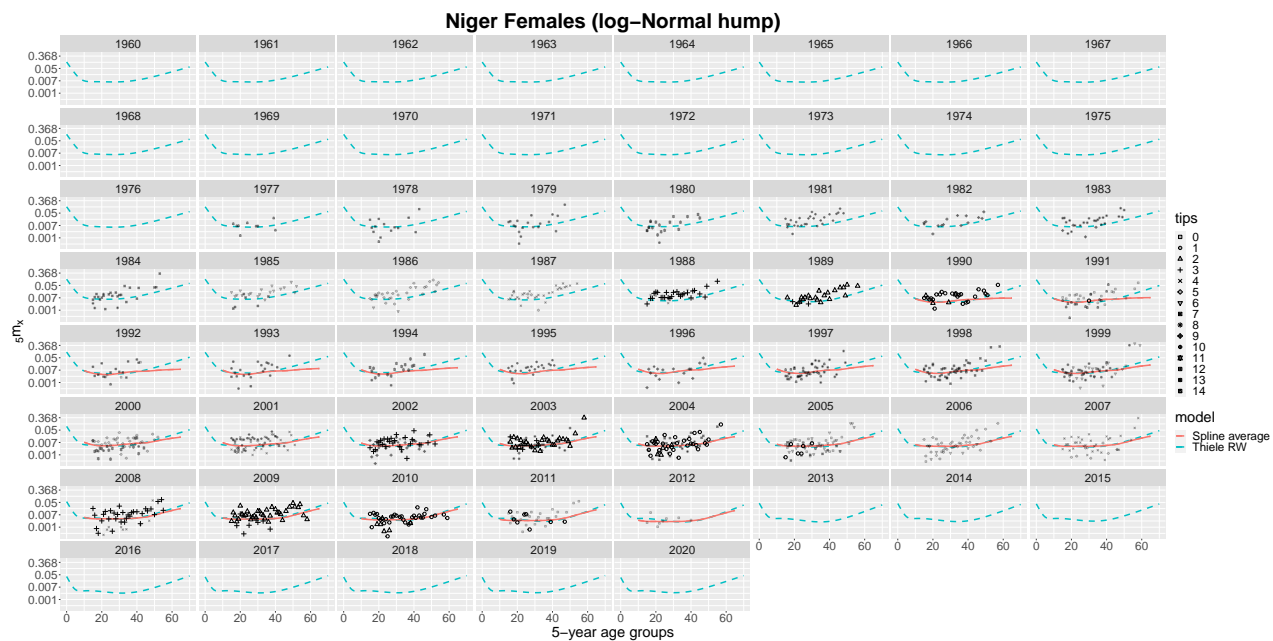Figure 2: Estimated $_{45}q_{15}$

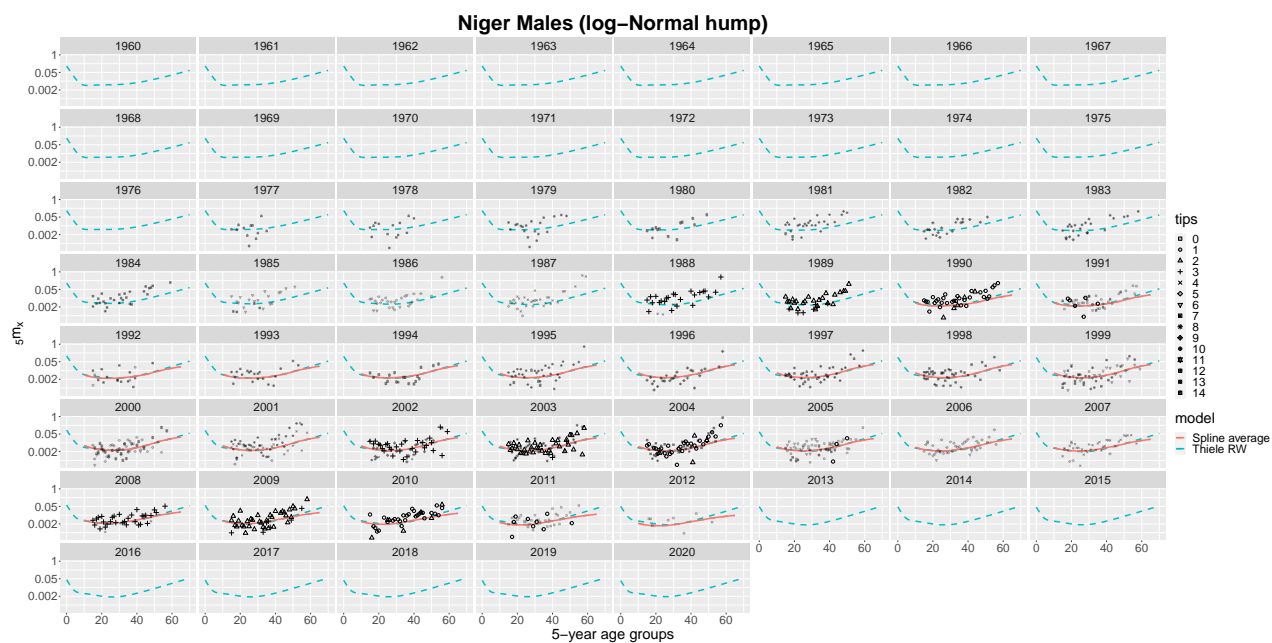Figure 3: Estimated $_5q_0$

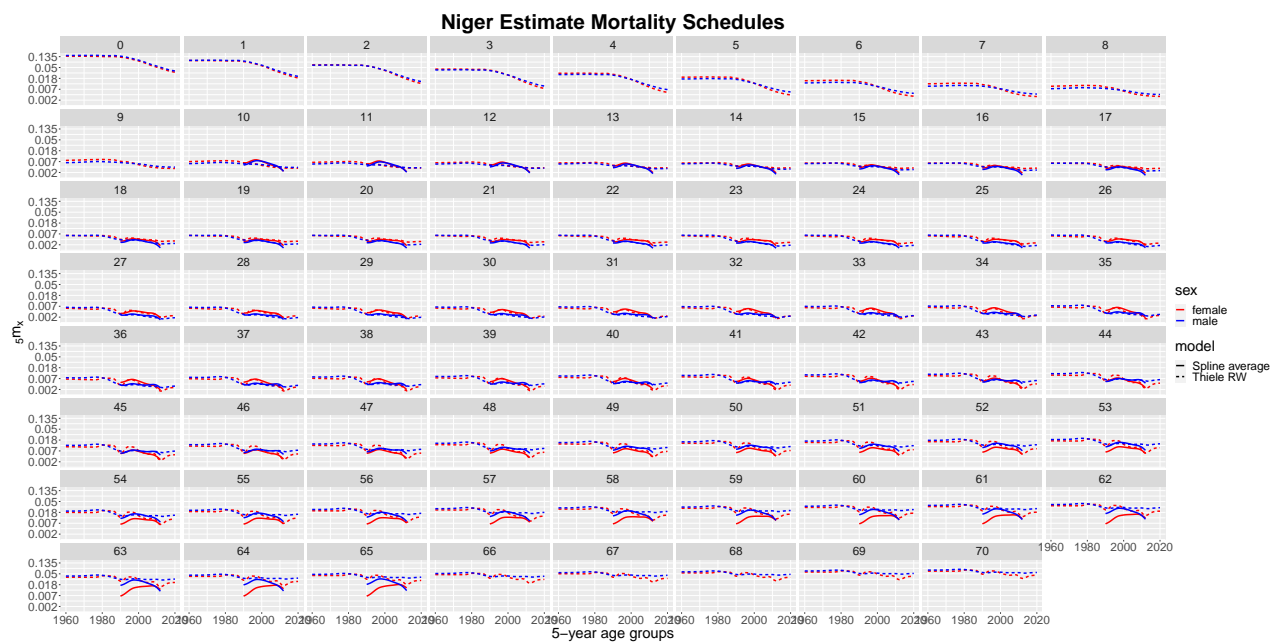Figure 4: Mortality Schedules

Figure 5: Mortality Schedules

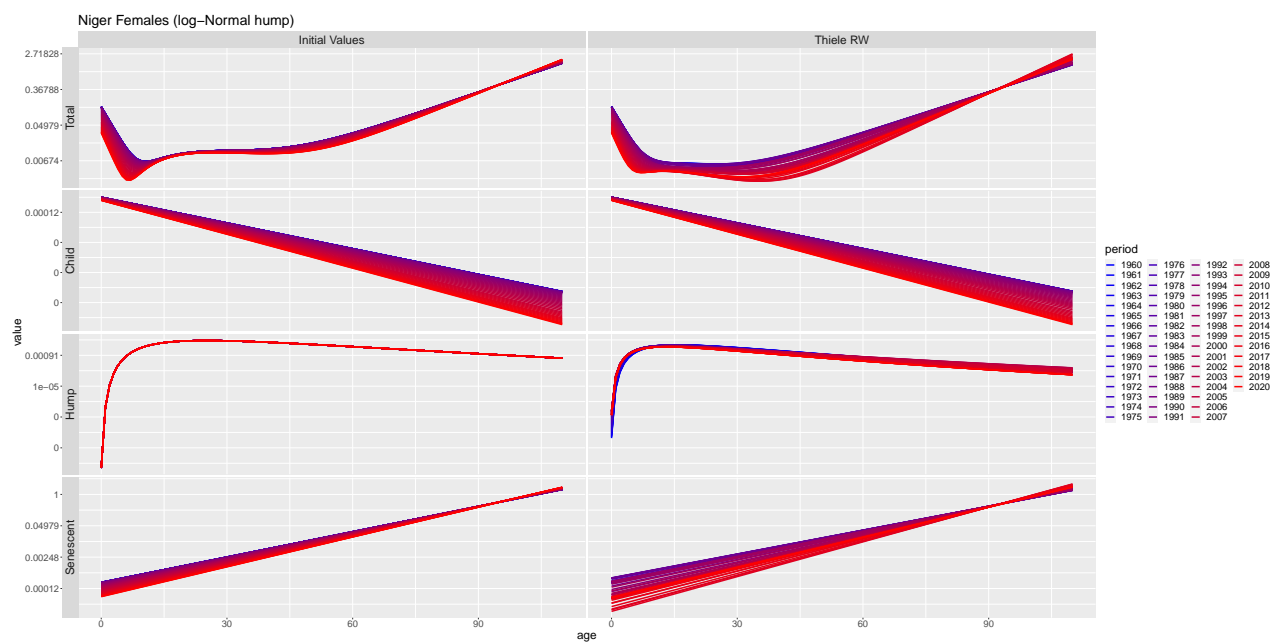Figure 6: Mortality Schedules

5
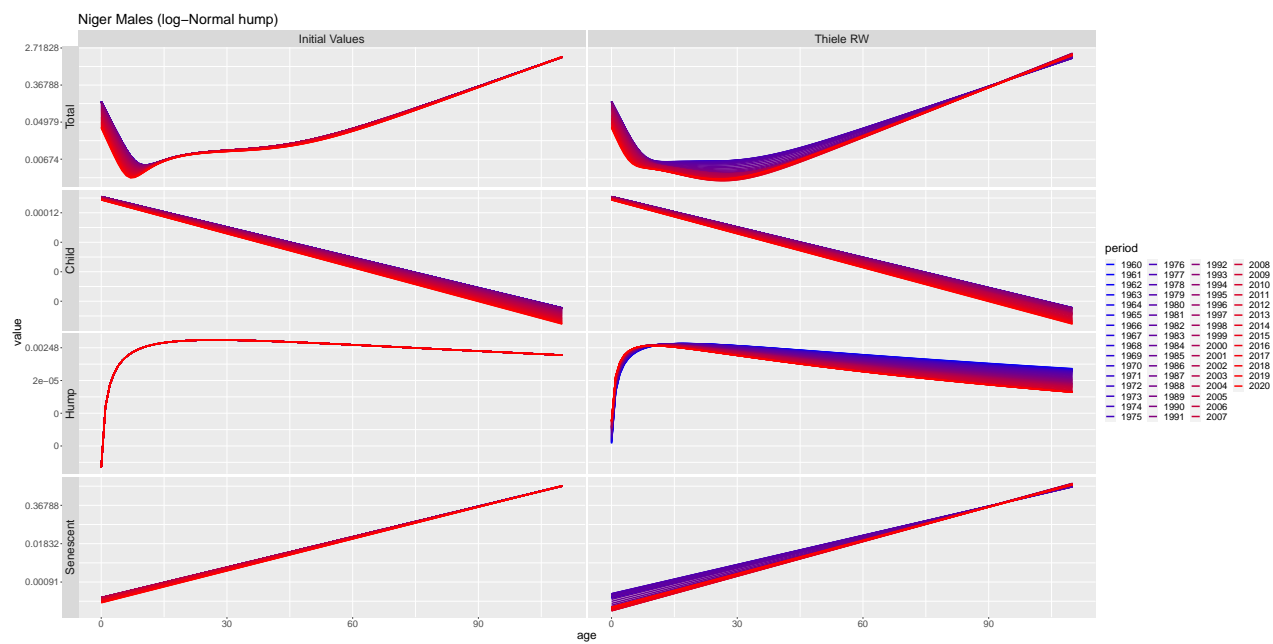
Figure 7: Thiele Decomposed

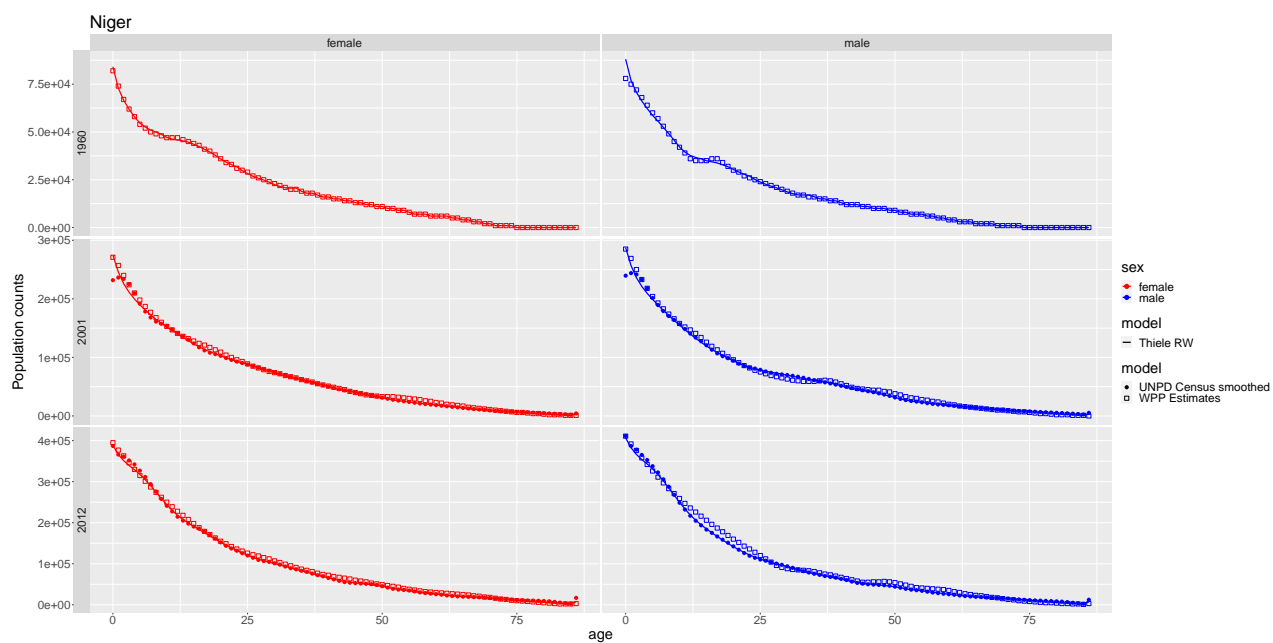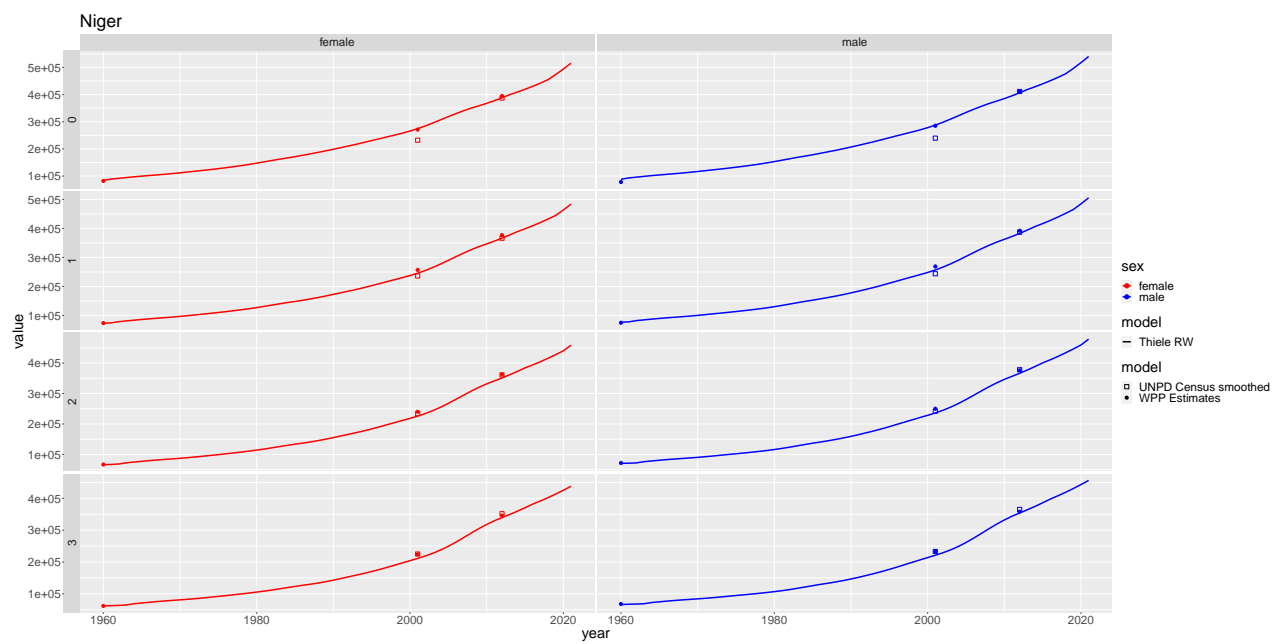

Figure 8: Thiele Decomposed
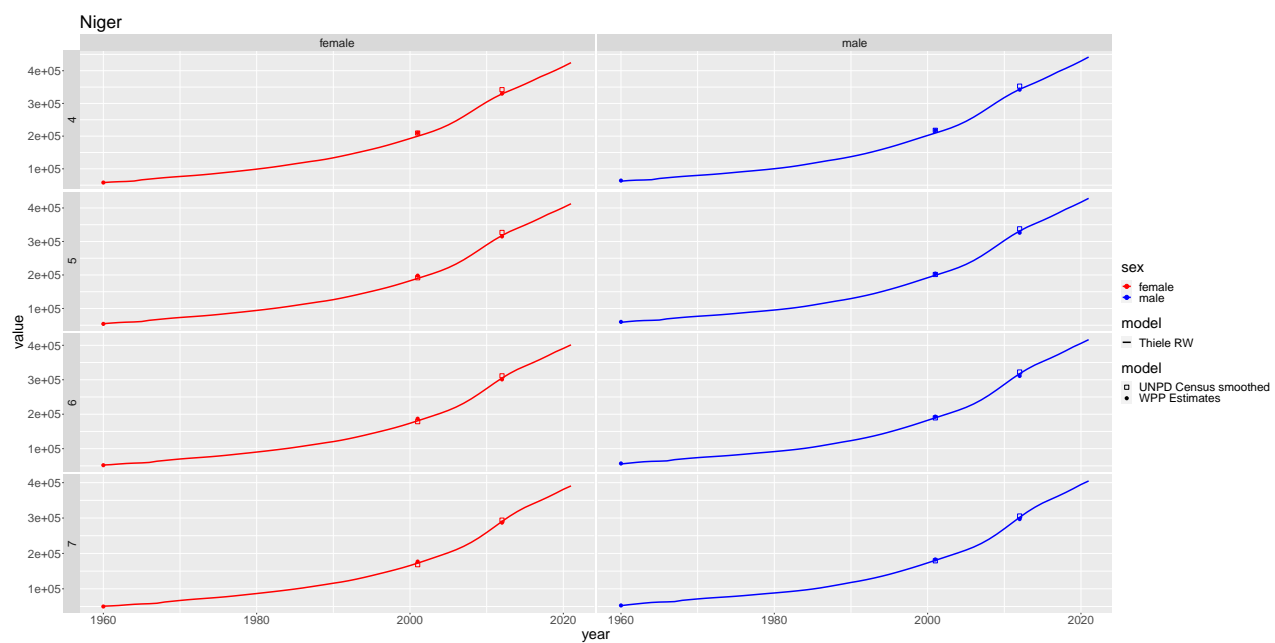
Figure 9: Population

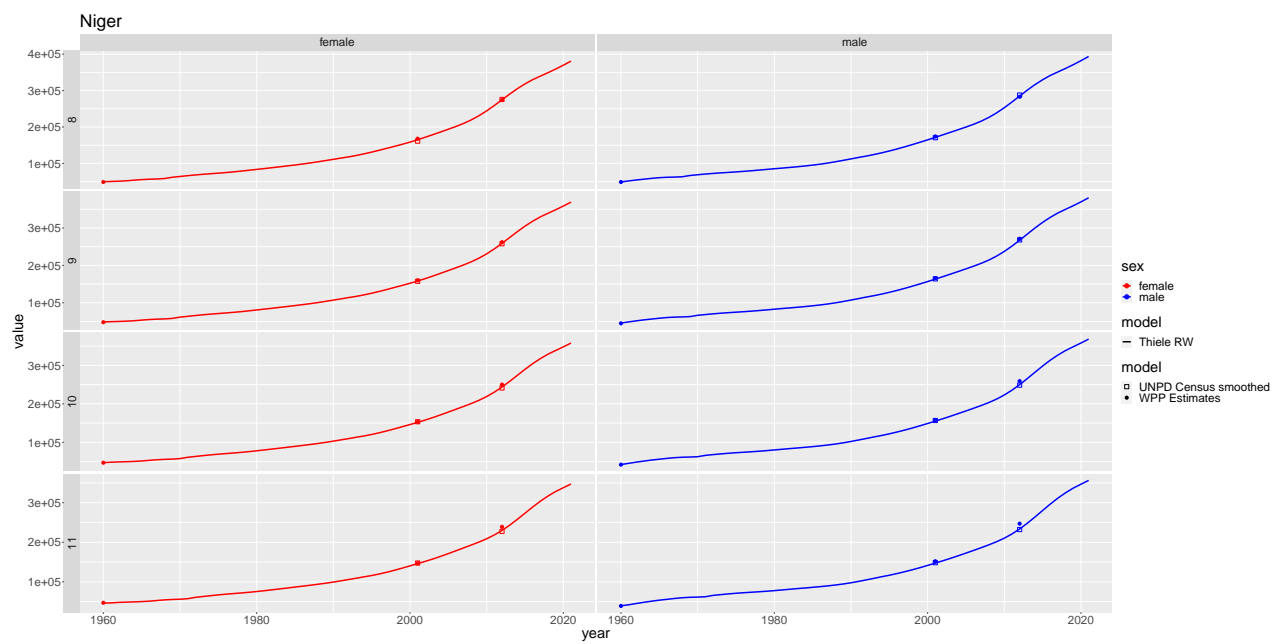Figure 10: Population

Figure 11: Population
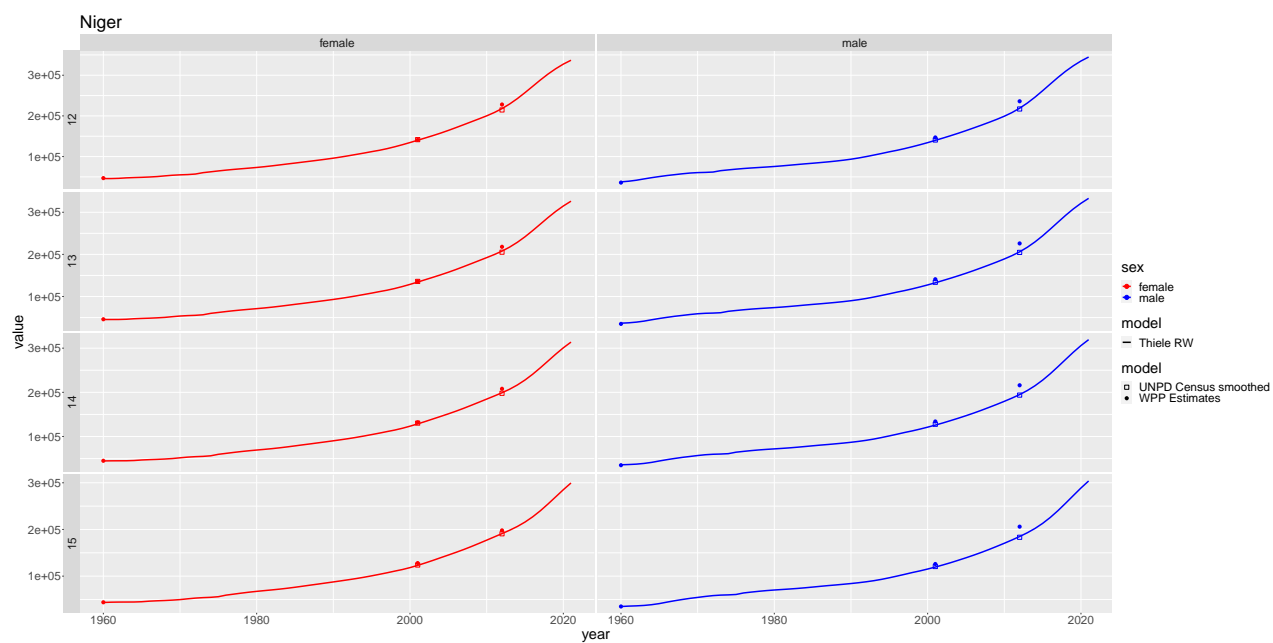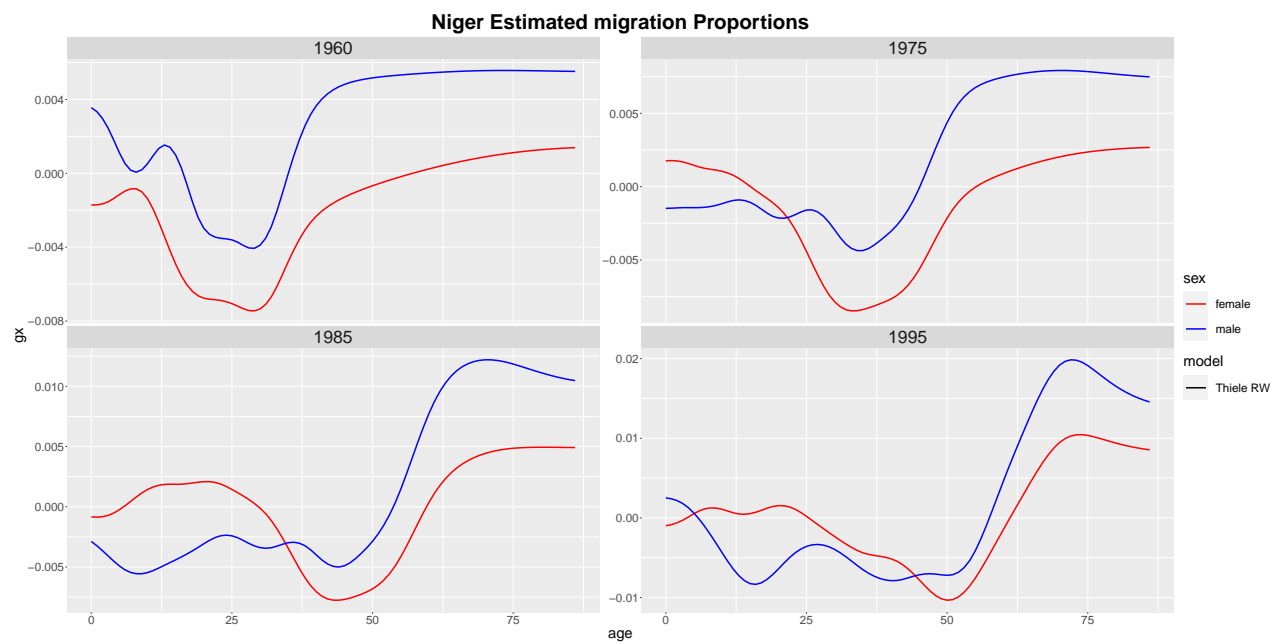

Figure 12: Population
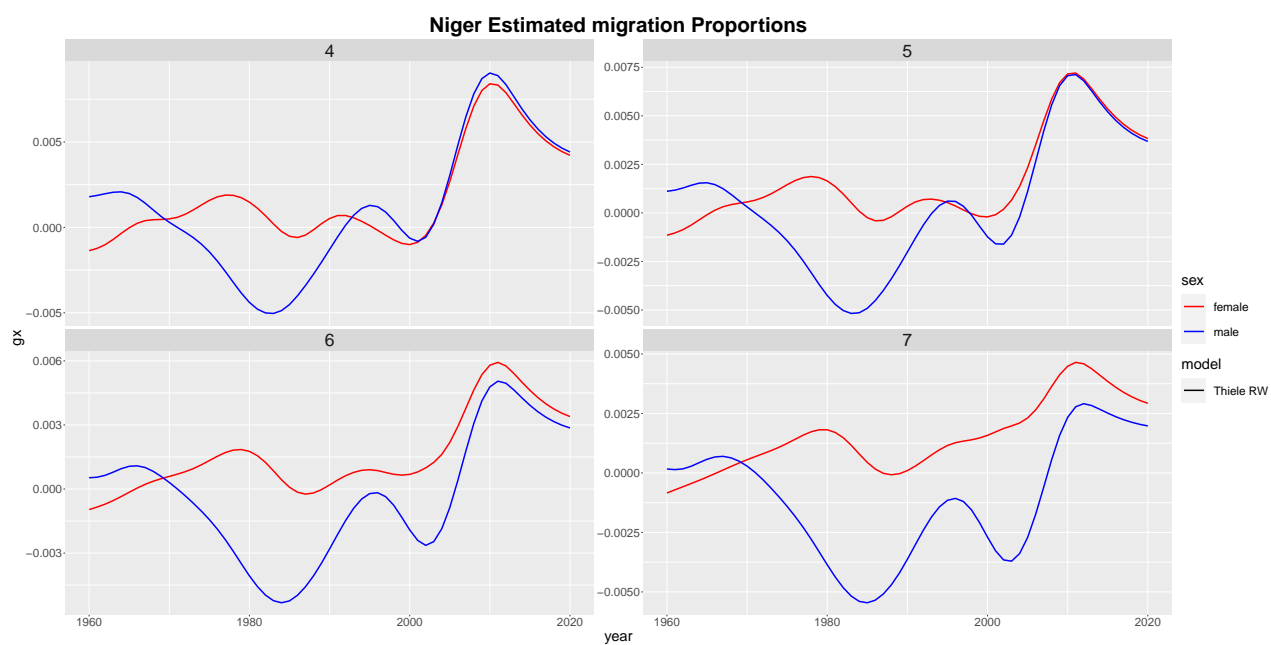
Figure 13: Population

Figure 14: Migration
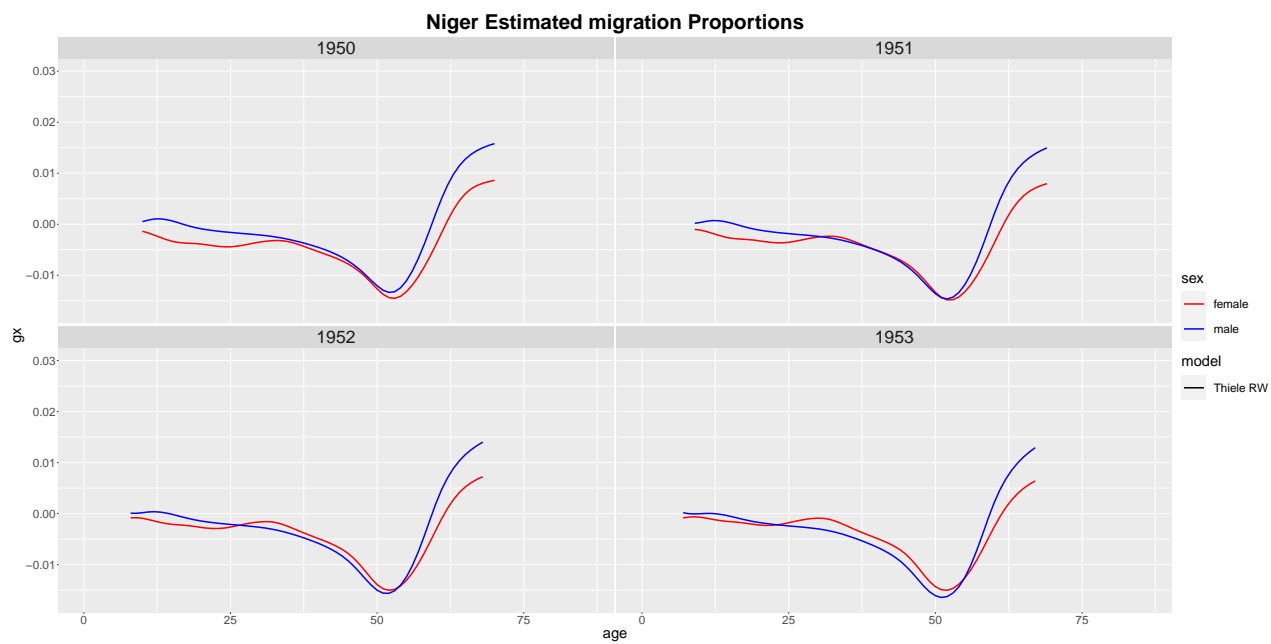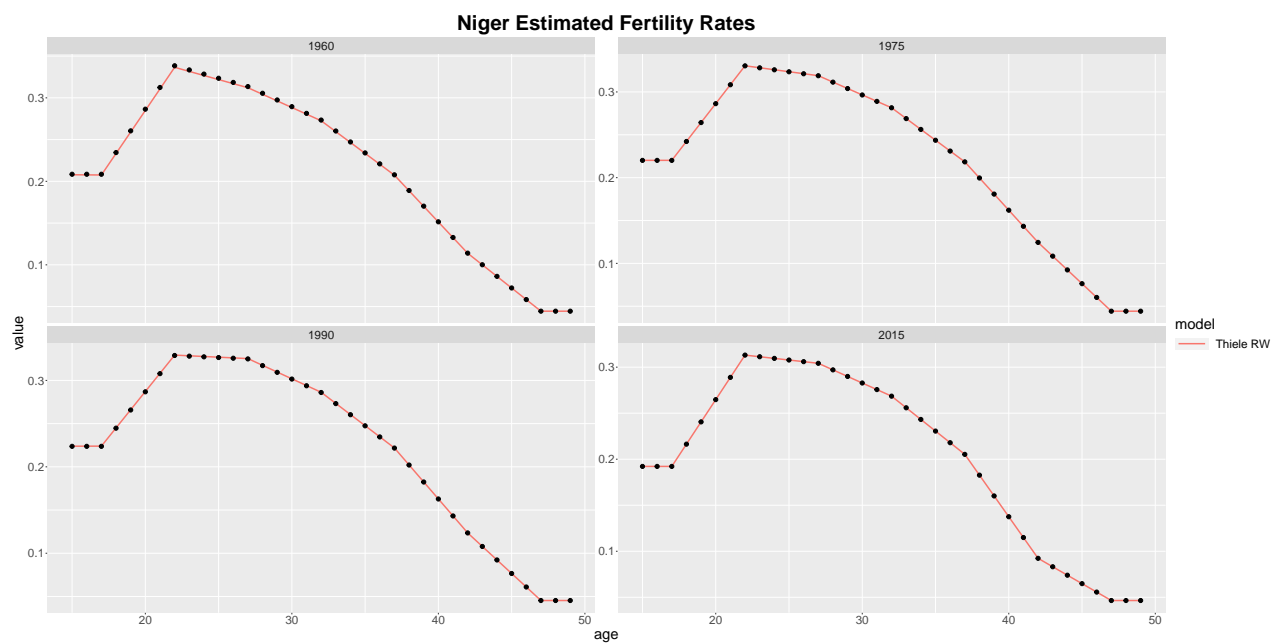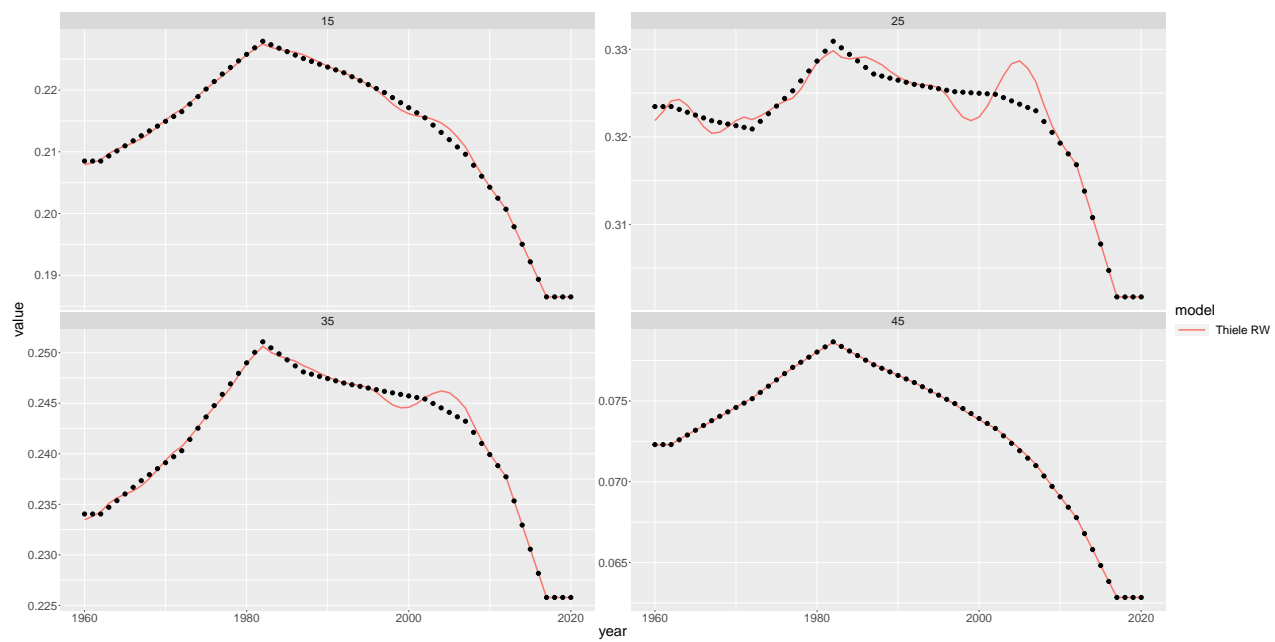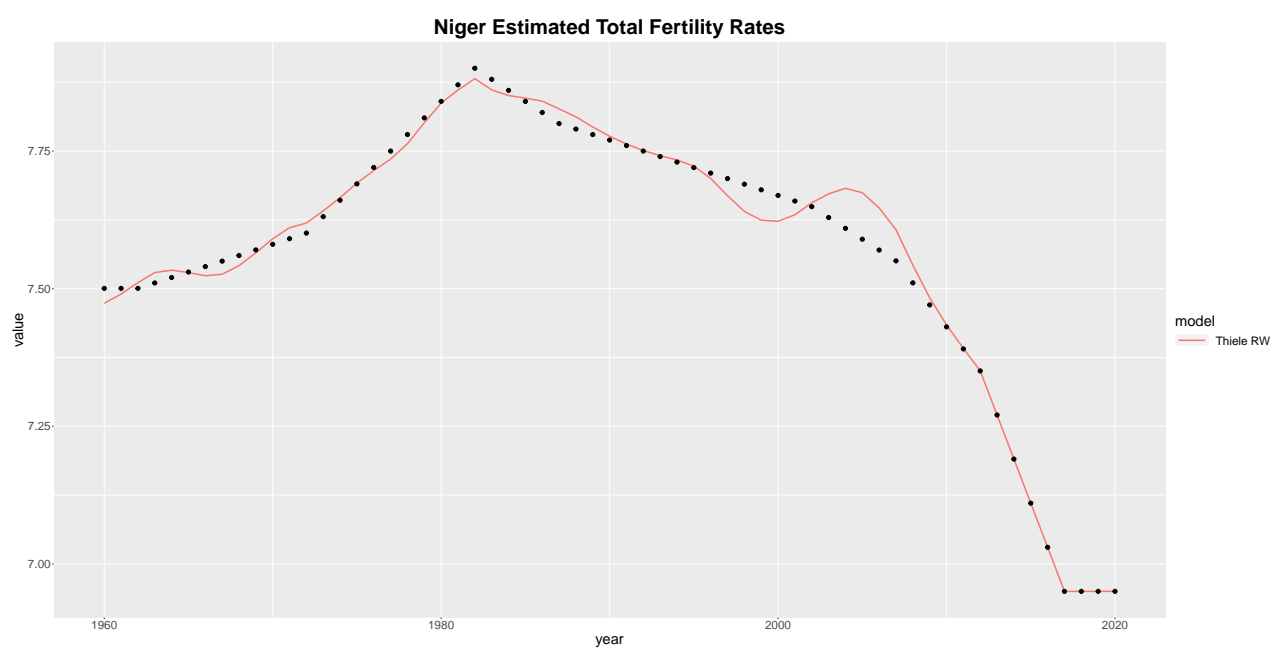
Figure 15: Migration

Figure 16: Migration

Figure 17: Fertility

Figure 18: Fertility

Figure 19: Total Fertility