

Chad

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

## # A tibble: 86 x 2
##   age `2009`
##   <dbl> <dbl>
## 1     0 202275.
## 2     1 203863.
## 3     2 220704.
## 4     3 221070.
## 5     4 223311.
## 6     5 220975.
## 7     6 210641.
## 8     7 198942.
## 9     8 184859.
## 10    9 170112.
## # ... with 76 more rows

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

## # A tibble: 18 x 2
##   age `1993`
##   <dbl> <dbl>
## 1     0 562409.
## 2     5 500500.
## 3    10 401707.
## 4    15 317016.
## 5    20 269428.
## 6    25 239247.
## 7    30 199817.
## 8    35 162208.
## 9    40 132464.
## 10   45 104416.
## 11   50  82104.
## 12   55  63802.
## 13   60  52006.
## 14   65  39956.
## 15   70  38176.
## 16   75  37582.
## 17   80    NA
## 18   85    NA

## [1] "Census Males"

## # A tibble: 86 x 2
##   age `2009`
##   <dbl> <dbl>
## 1     0 206187.
## 2     1 210077.
## 3     2 226819.
## 4     3 227081.
## 5     4 229282.
## 6     5 226472.
```

```
## 7      6 215783.
## 8      7 204745.
## 9      8 191454.
## 10     9 177825.
## # ... with 76 more rows
```

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

```
## # A tibble: 18 x 2
```

```
##   age `1993`
##   <dbl>   <dbl>
```

```
## 1      0 567470.
## 2      5 510473.
## 3     10 408514.
## 4     15 298617.
## 5     20 225577.
## 6     25 191518.
## 7     30 166186.
## 8     35 139564.
## 9     40 114484.
## 10    45  91839.
## 11    50  73183.
## 12    55  58250.
## 13    60  48631.
## 14    65  38604.
## 15    70  37058.
## 16    75  41378.
## 17    80    NA
## 18    85    NA
```

Thiele log-Normal Hump Spline

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

##	log_tau2_logpop	log_tau2_logpop	log_tau2_logpop	log_tau2_logpop	log_lambda_fx	log
##	3.25504044	4.95753140	2.84038087	4.71900288	2.39107518	1
##	log_lambda_tp	tp_slope	tp_params_5	tp_params_10	log_lambda_phi	log
##	3.48922673	-0.02909328	0.14214882	0.64971711	12.61074176	1
##	log_lambda_lambda	log_lambda_delta	log_lambda_epsilon			
##	6.07040907	8.13946223	5.48788576			

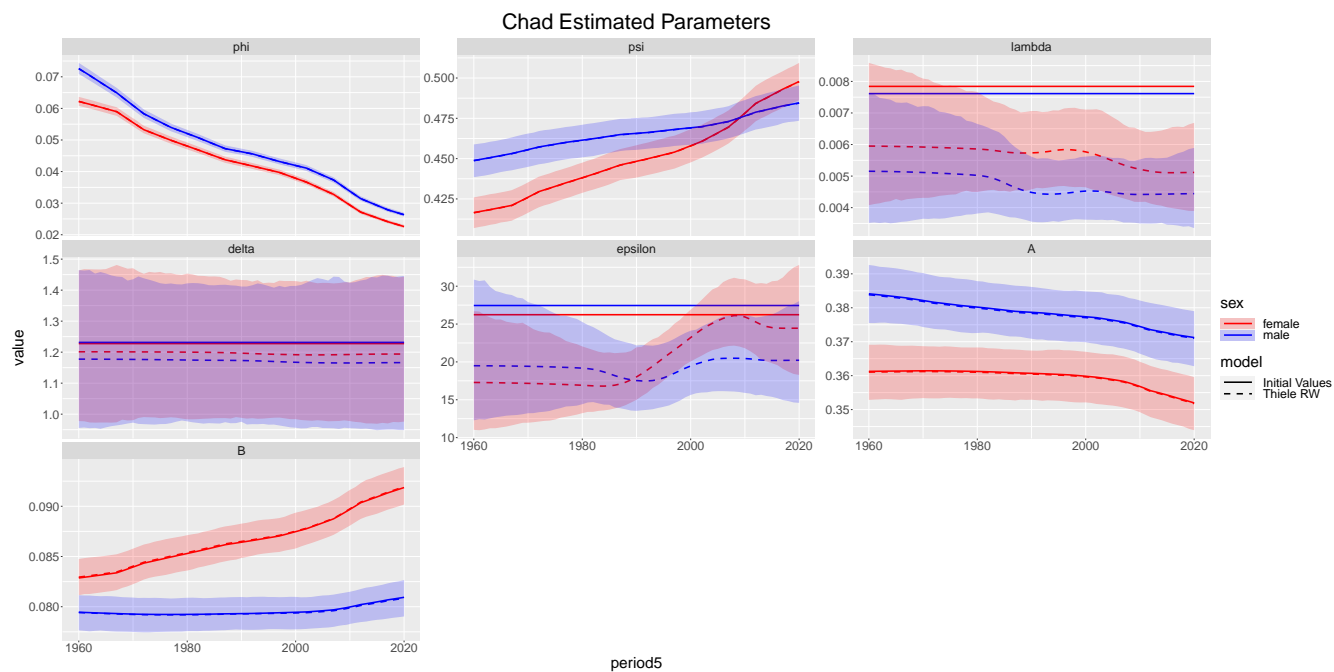


Figure 1: Estimated parameters

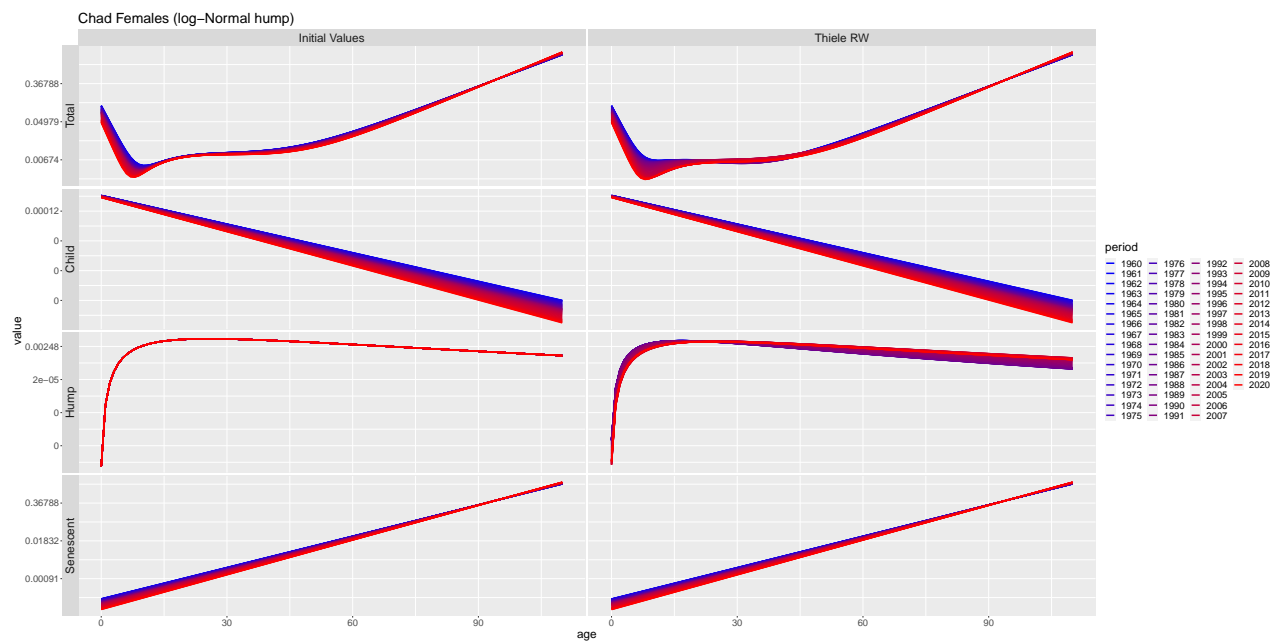


Figure 2: Thiele Decomposed

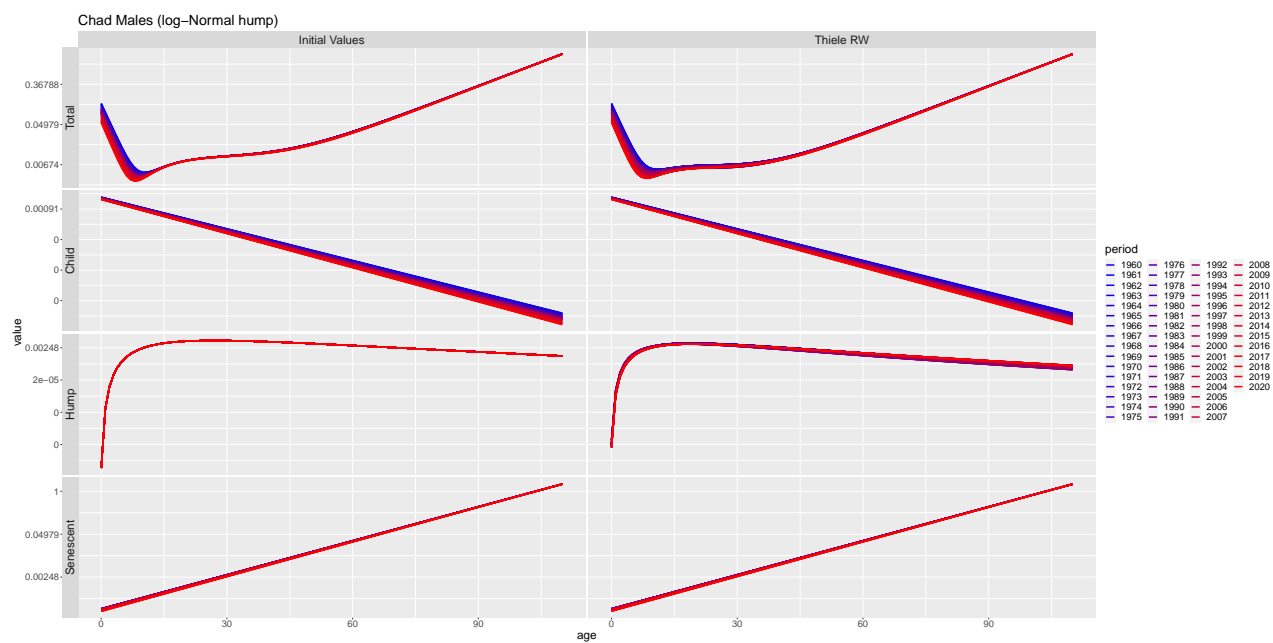


Figure 3: Thiele Decomposed

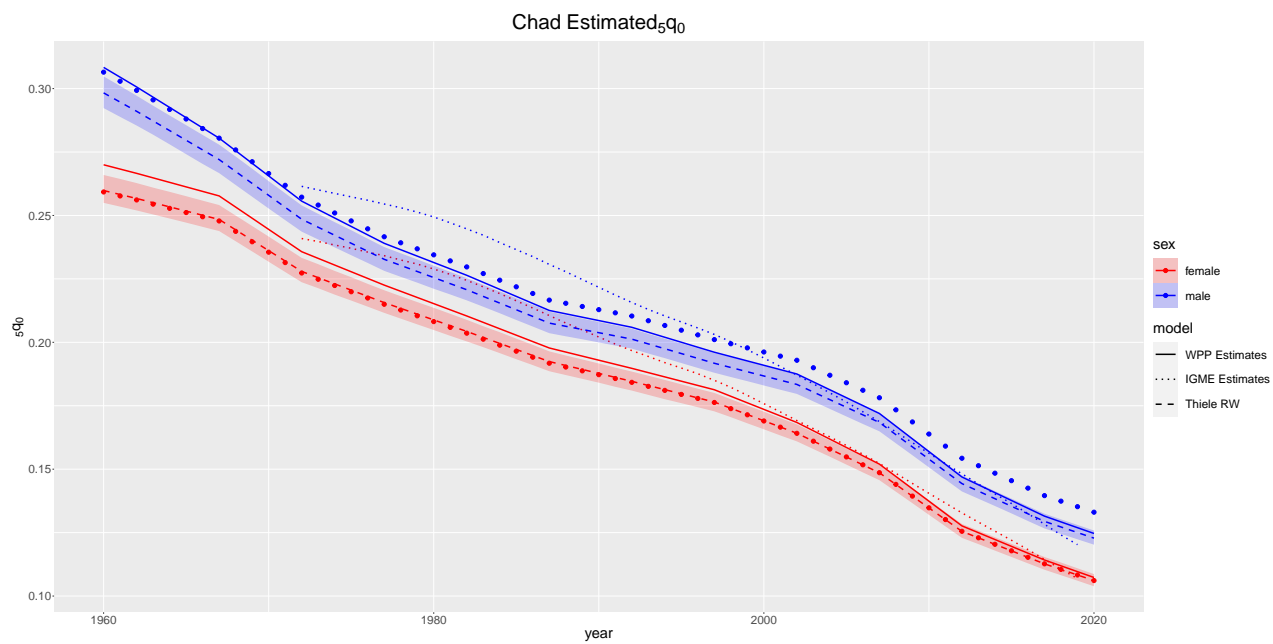


Figure 4: Estimated $5q_0$

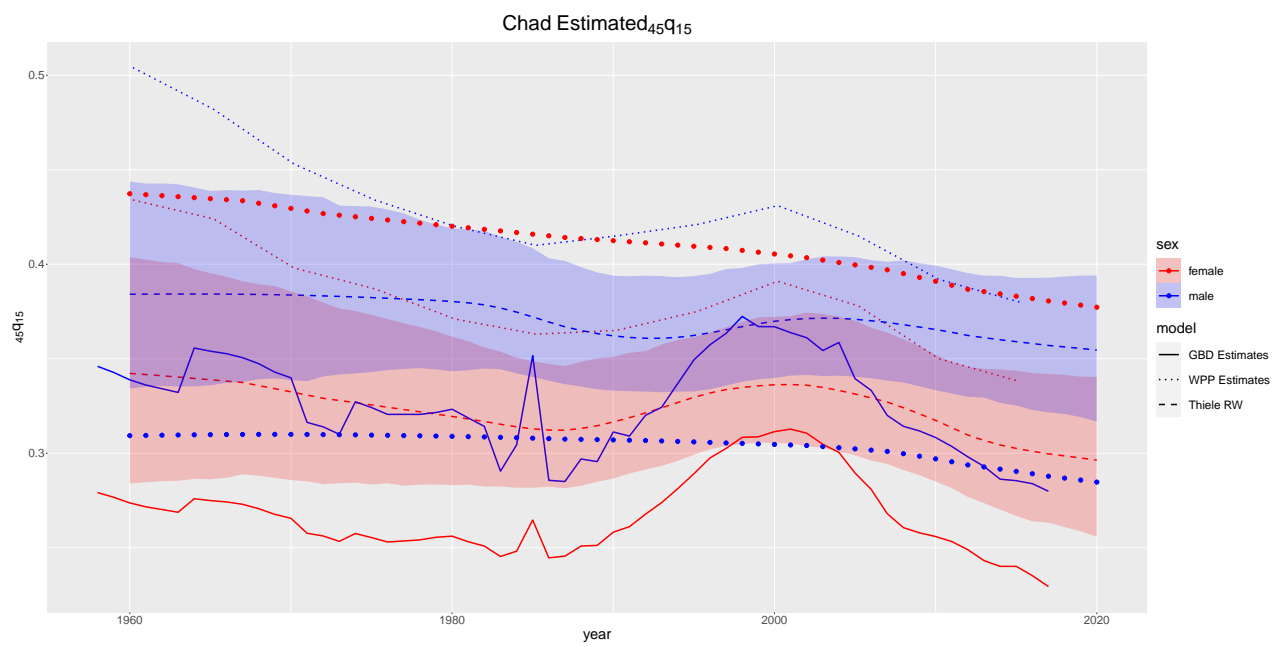


Figure 5: Estimated $_{45}q_{15}$

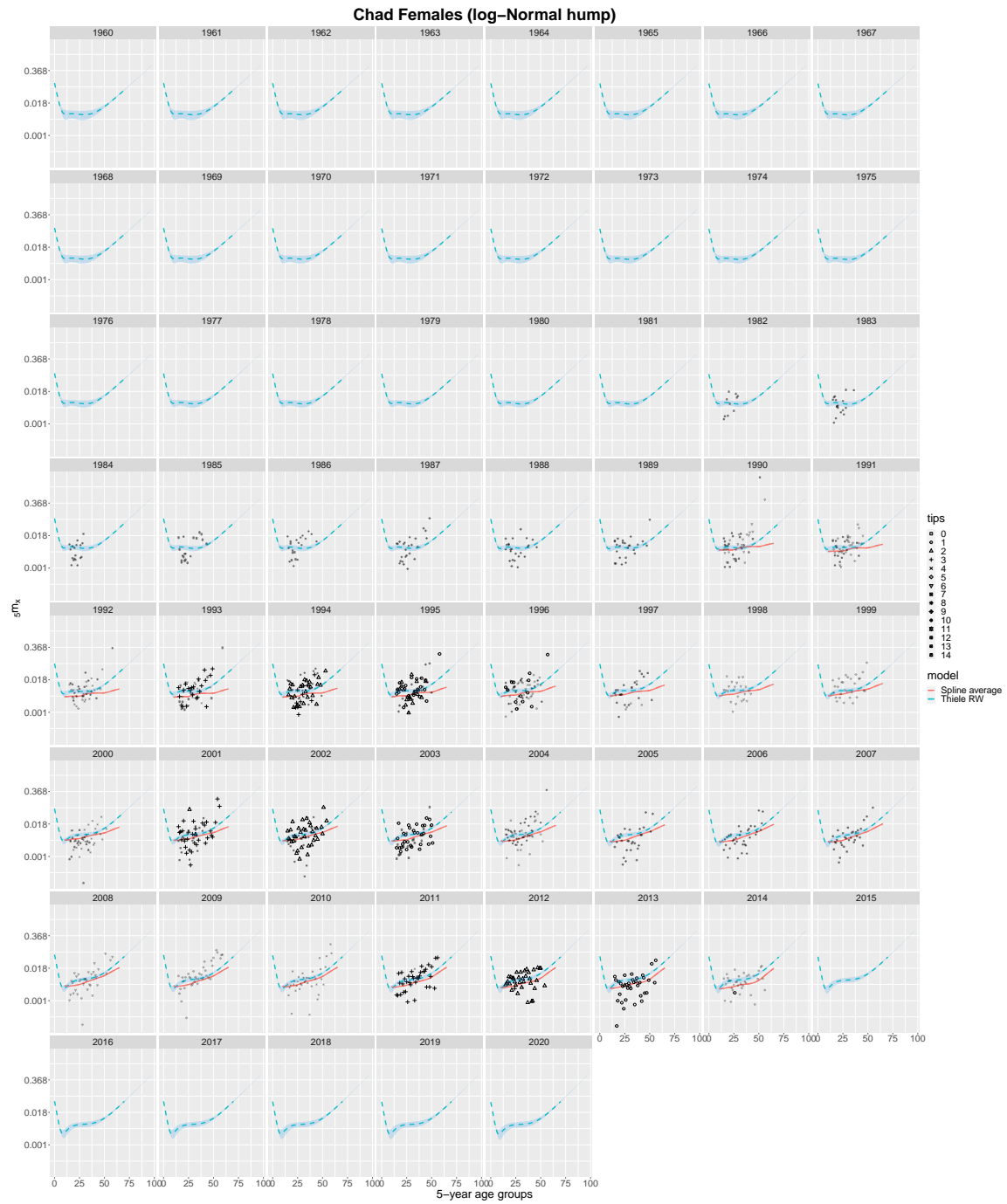


Figure 6: Mortality Schedules

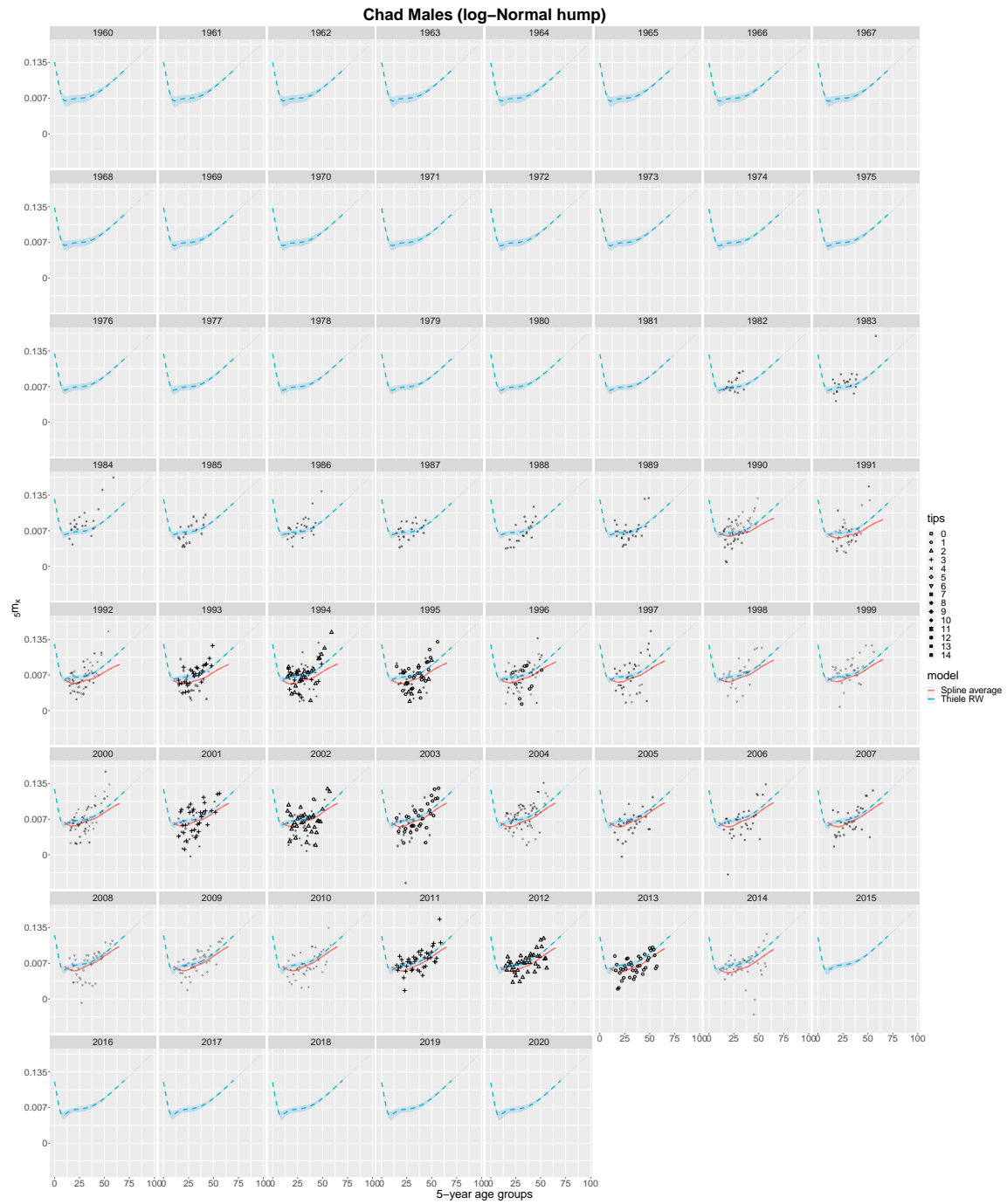


Figure 7: Mortality Schedules

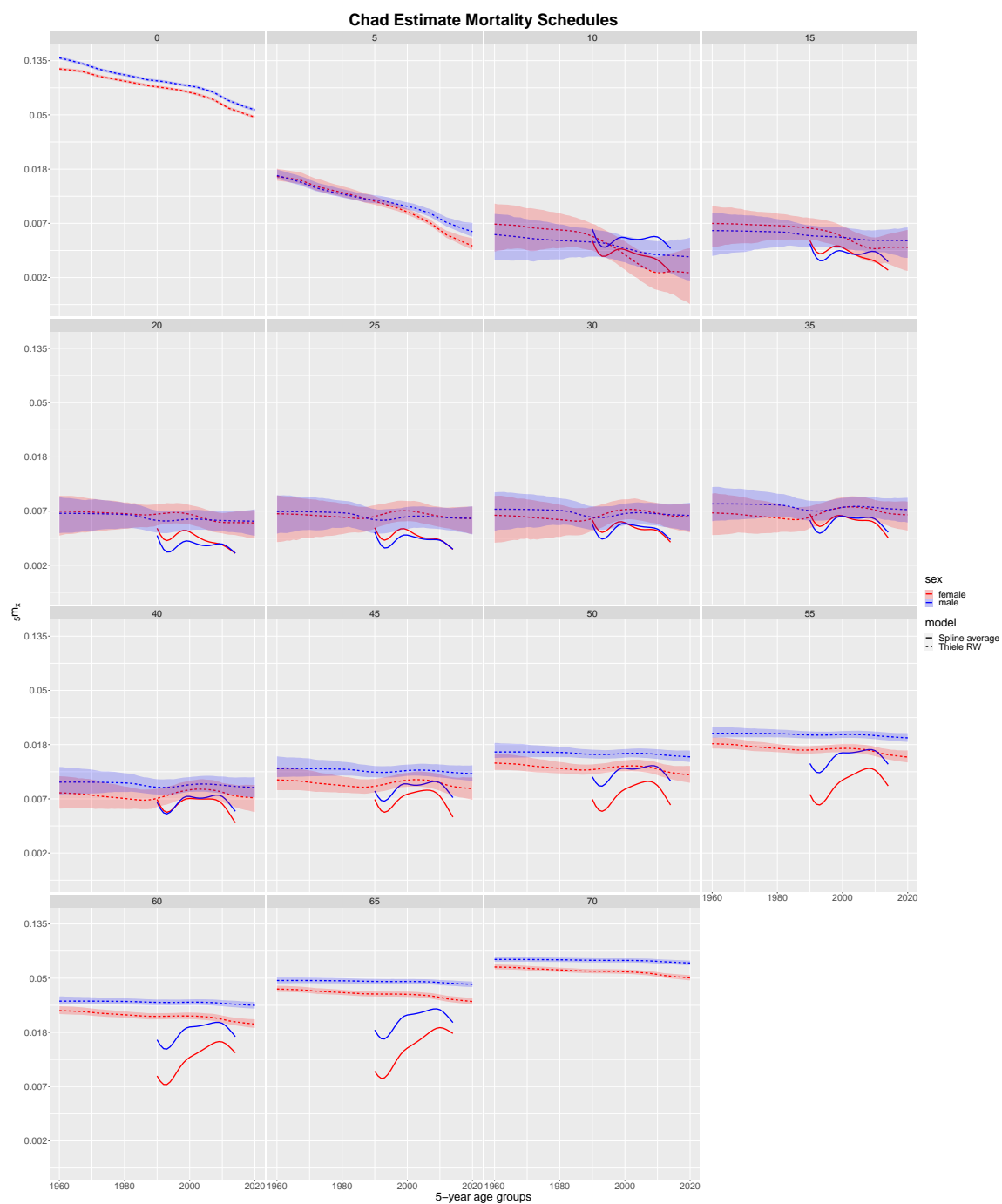


Figure 8: Mortality Schedules

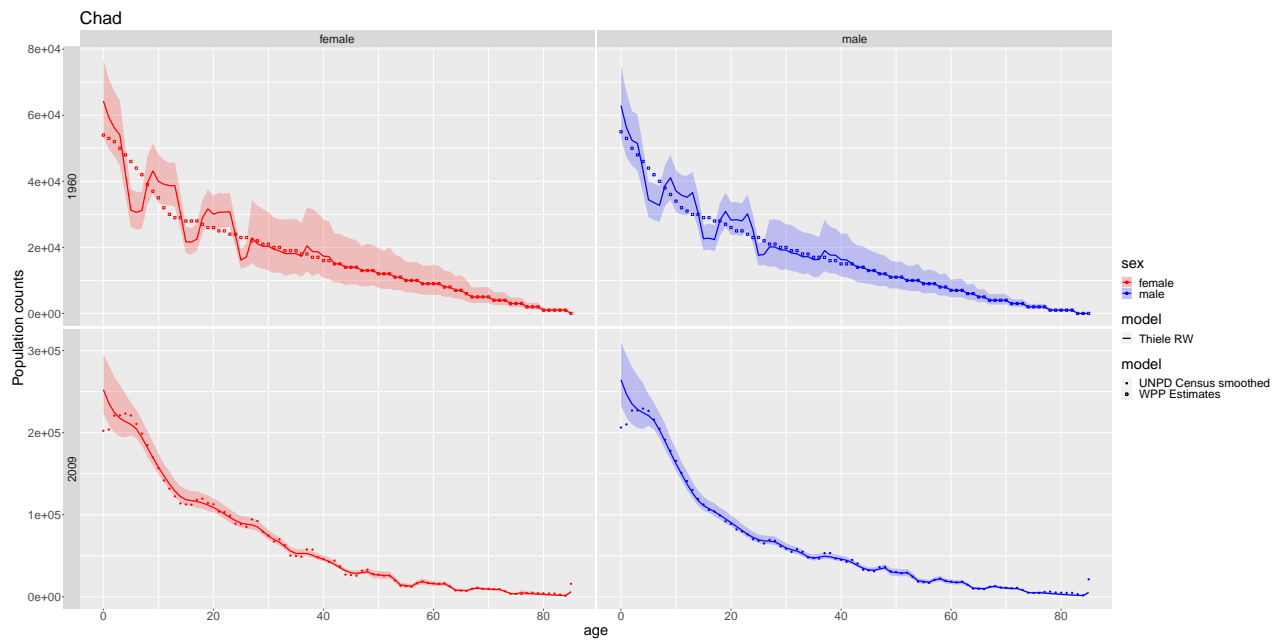


Figure 9: Population

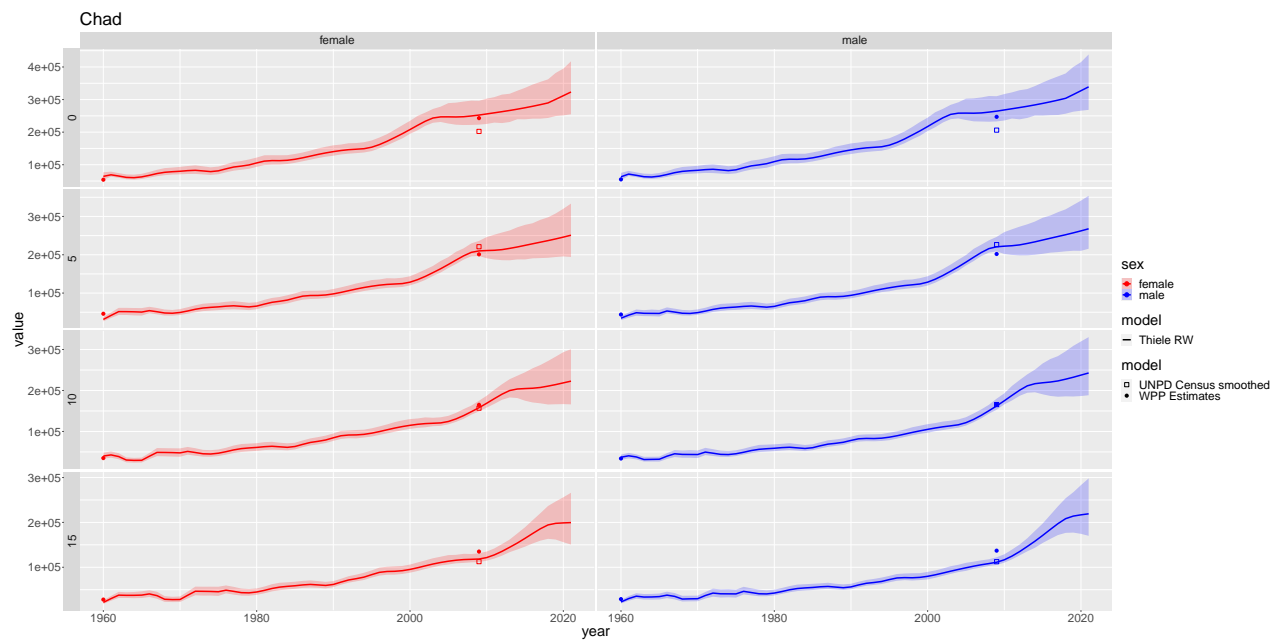


Figure 10: Population

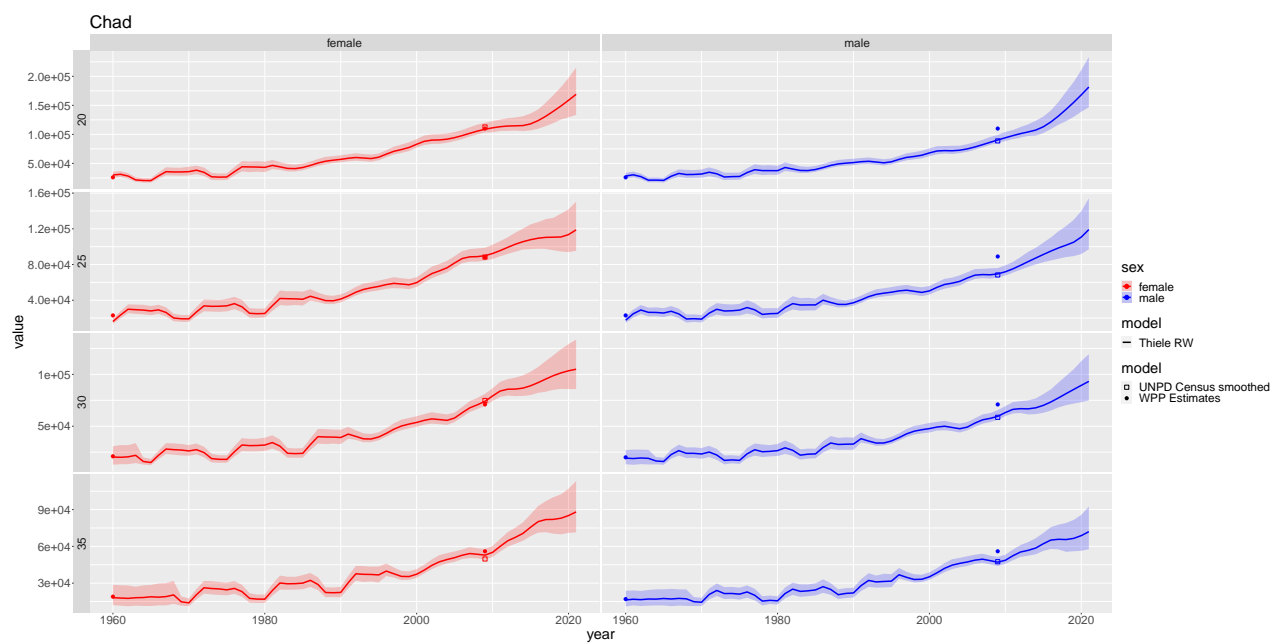


Figure 11: Population

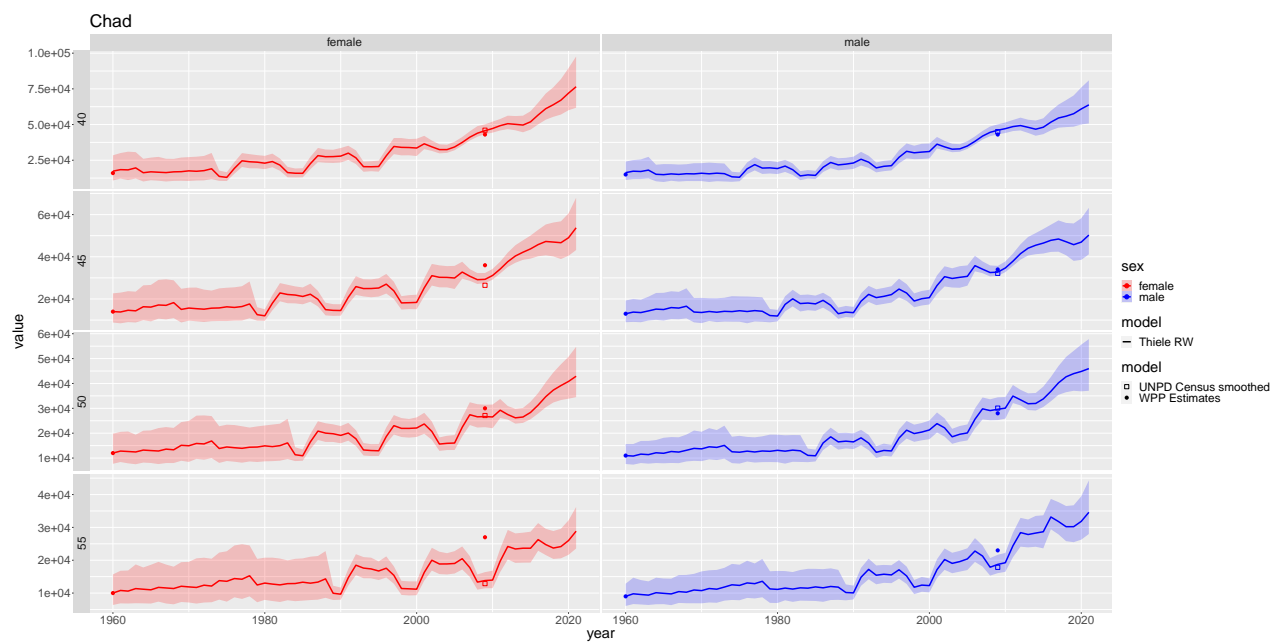


Figure 12: Population

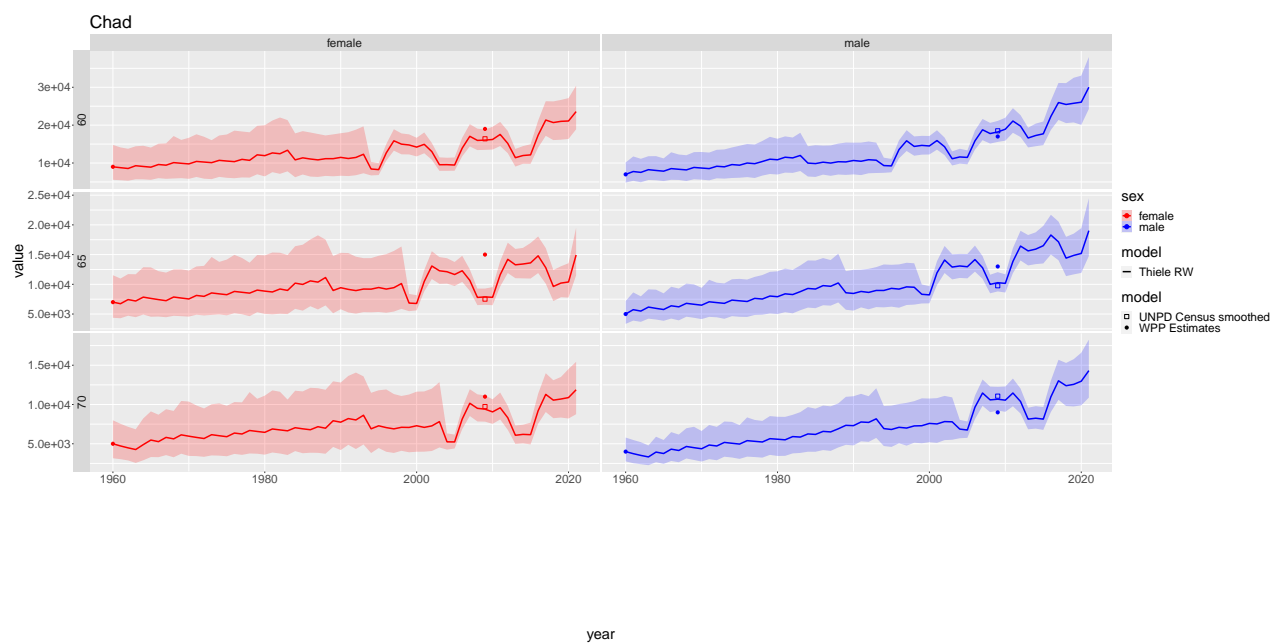


Figure 13: Population

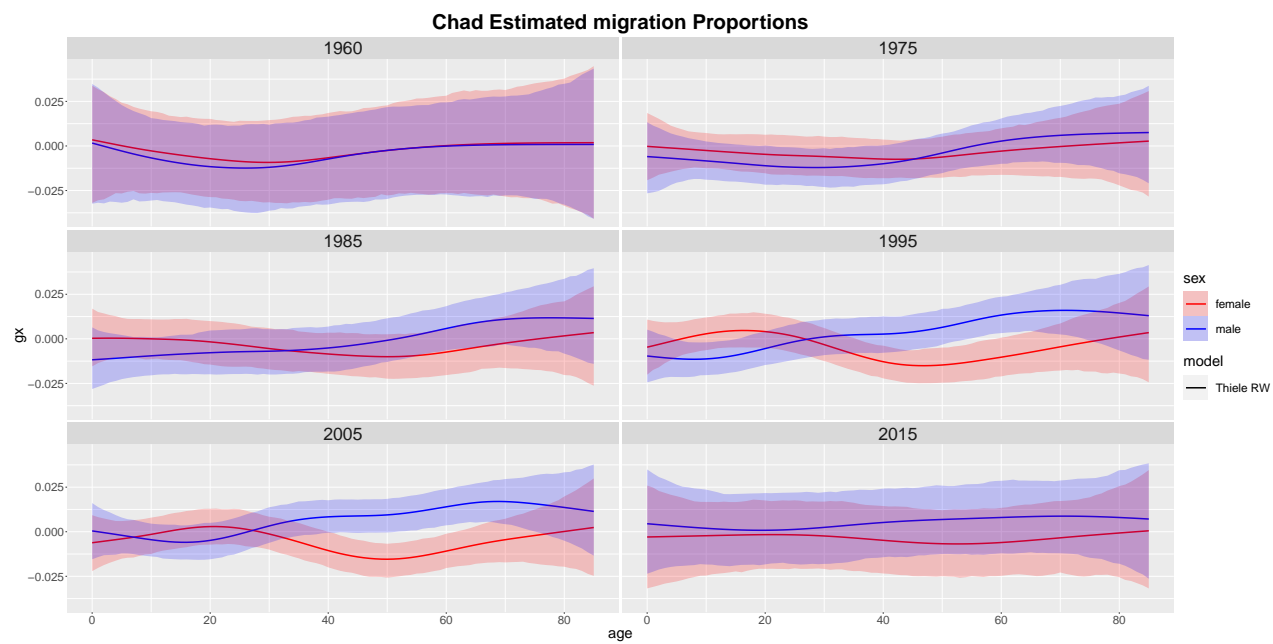


Figure 14: Migration

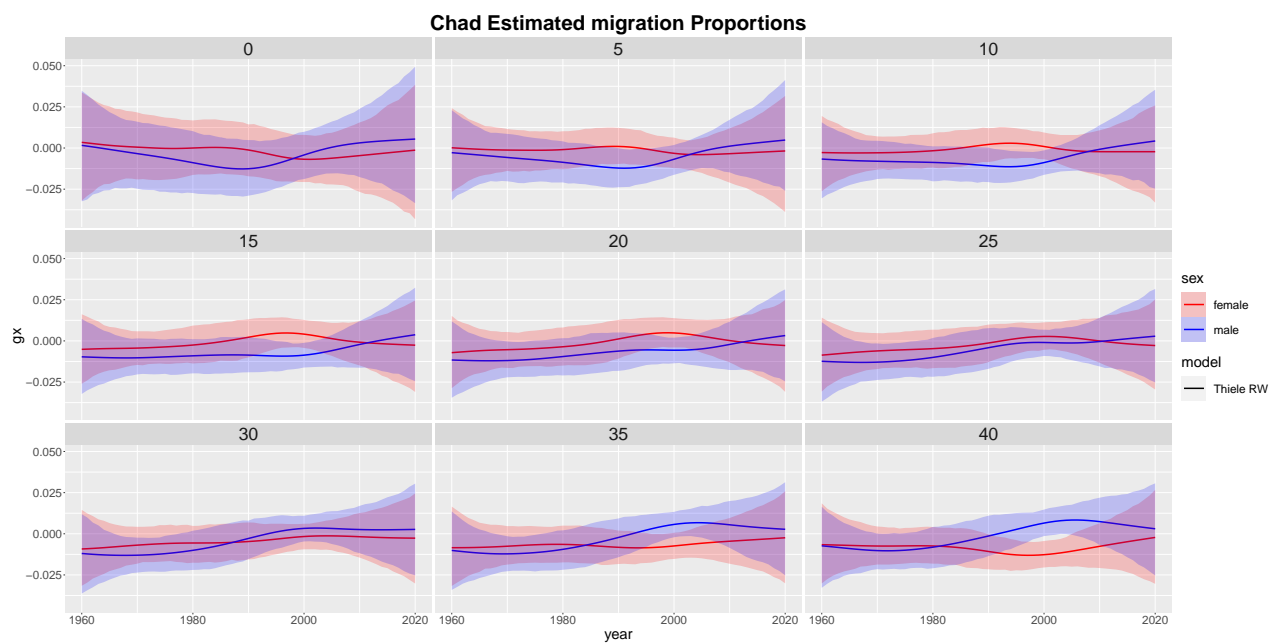


Figure 15: Migration

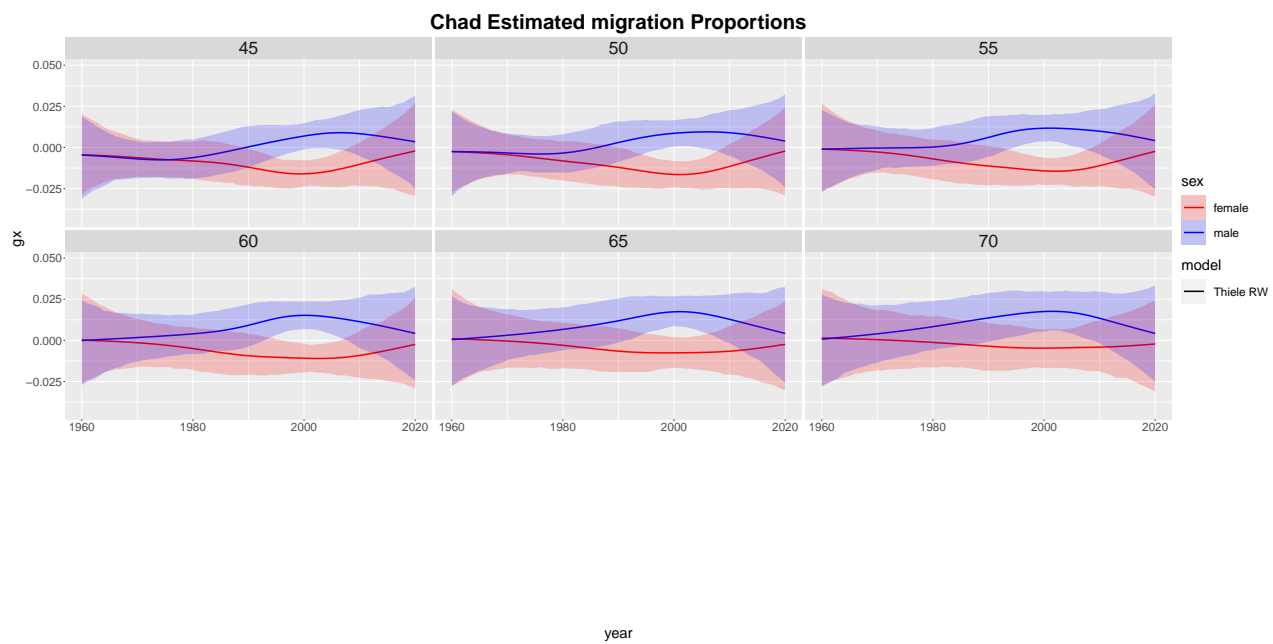


Figure 16: Migration

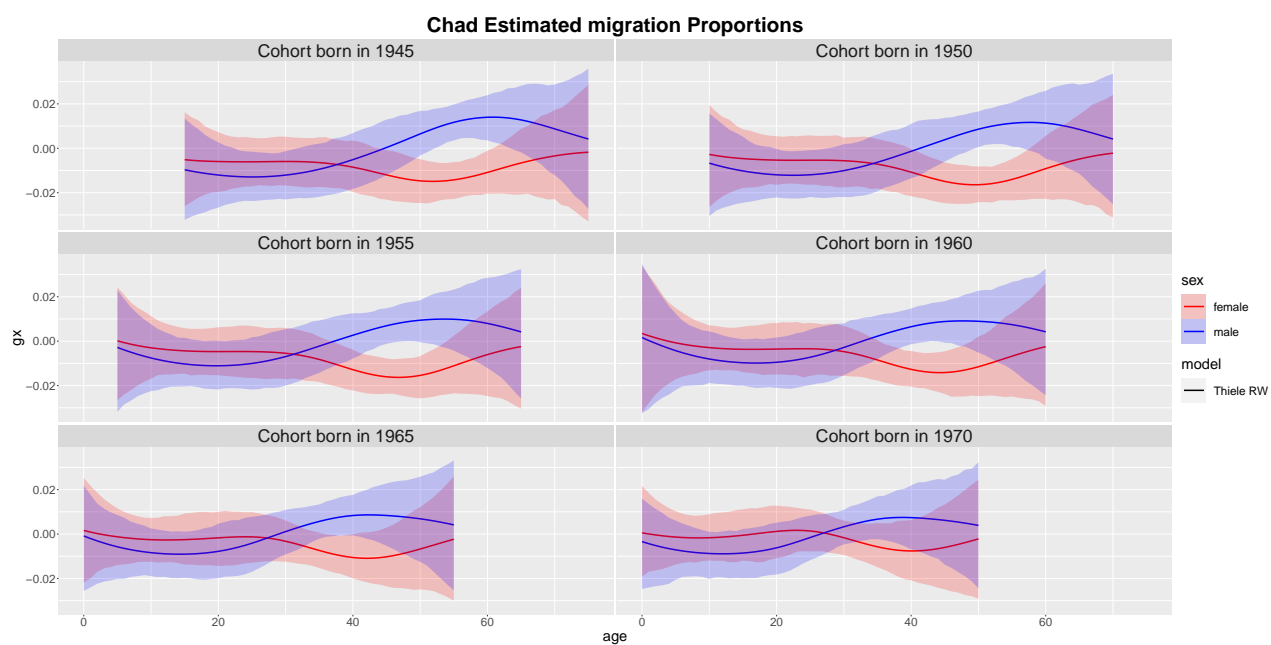


Figure 17: Migration

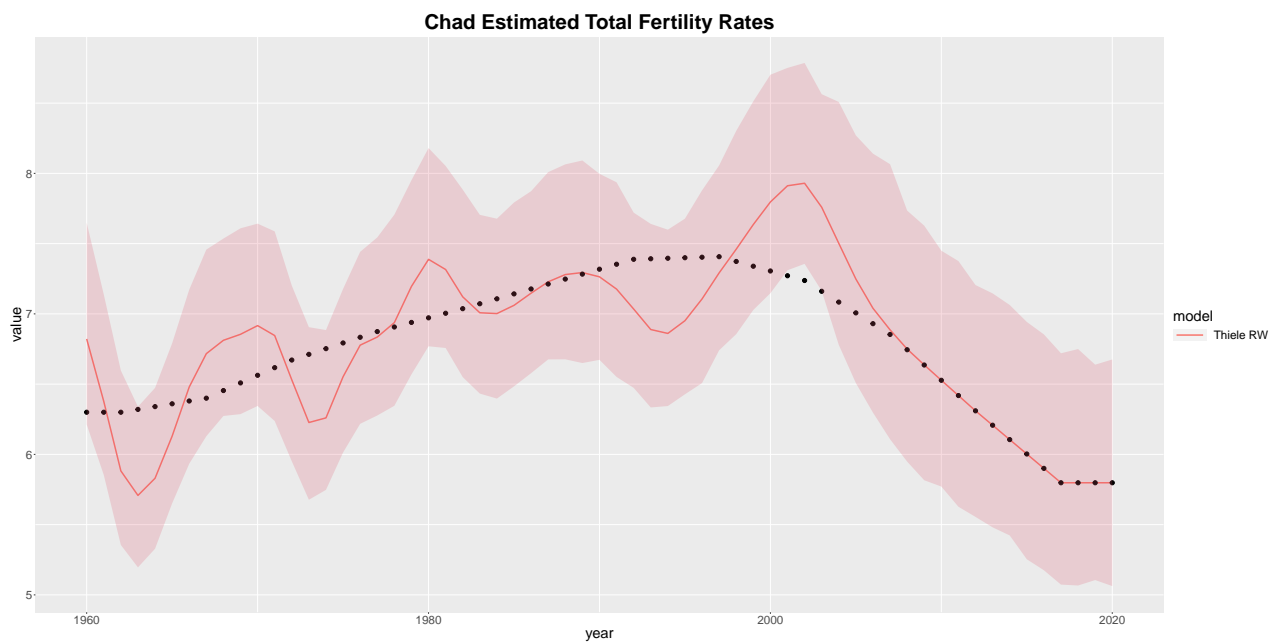


Figure 18: Total Fertility

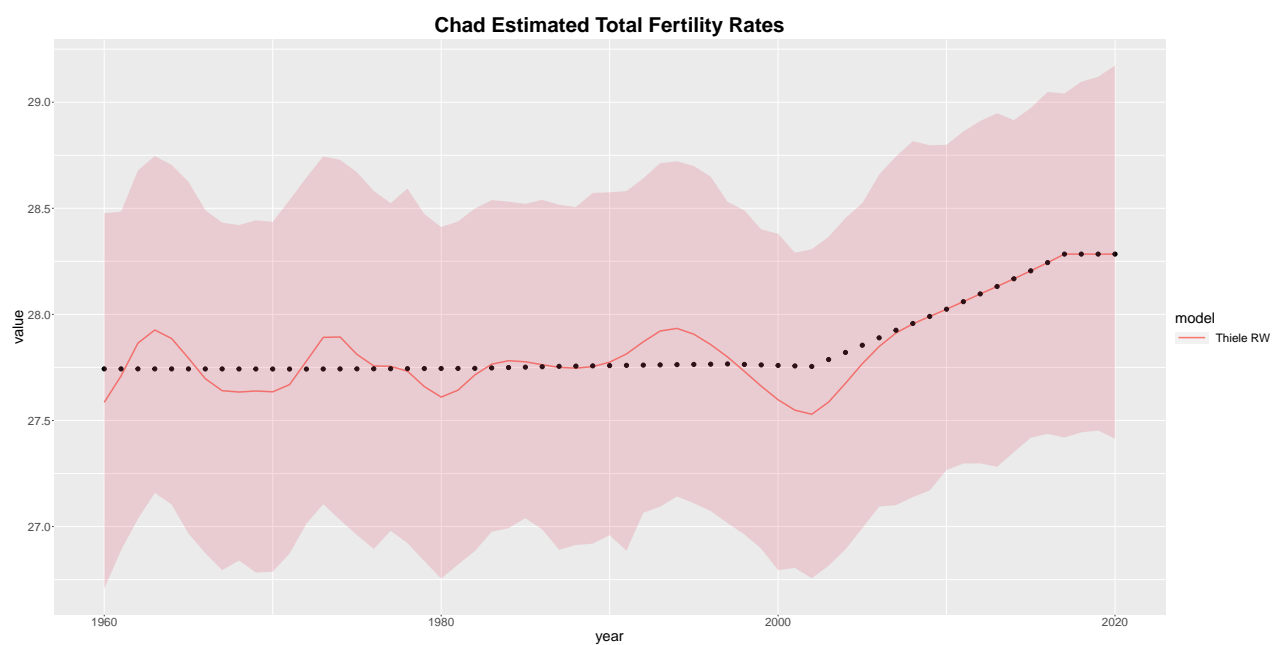


Figure 19: Mean age at births

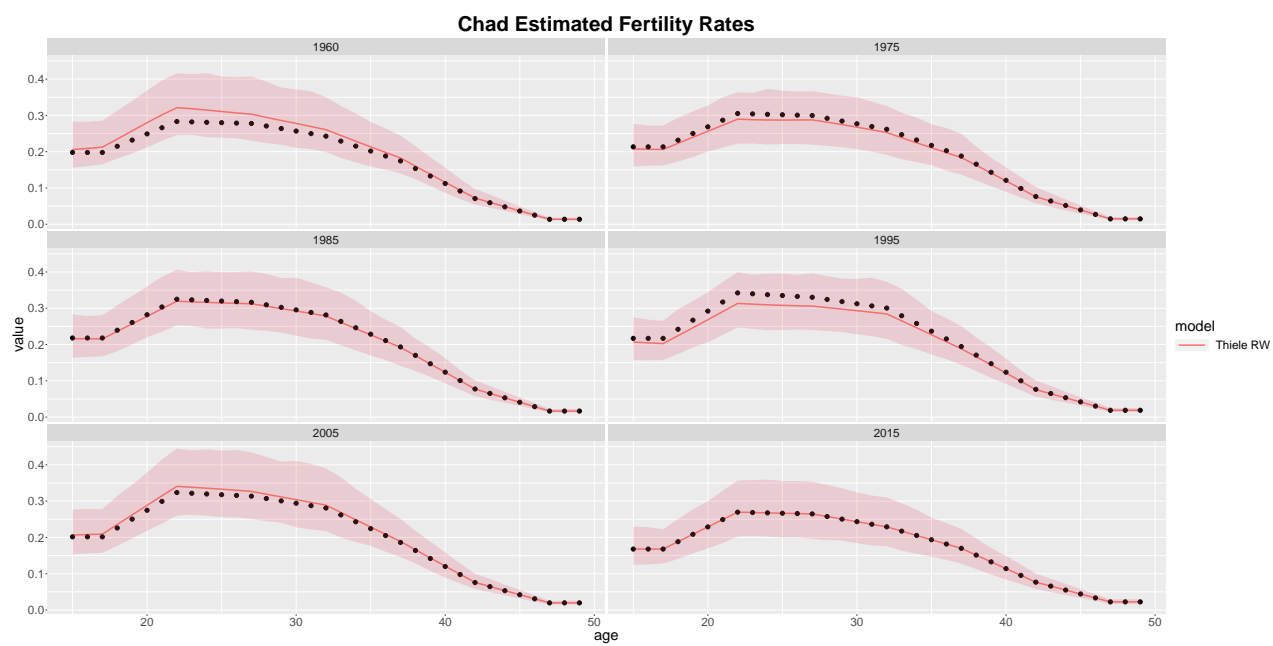


Figure 20: Fertility

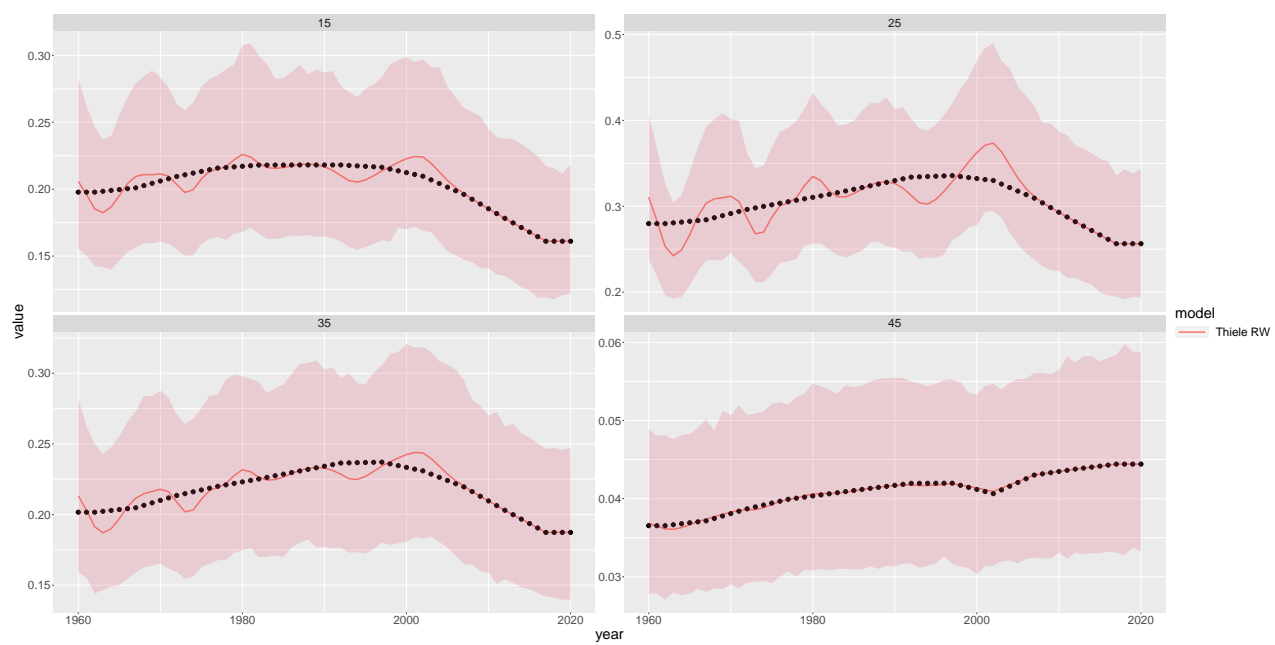


Figure 21: Fertility