- Estimated gx seems crazy after age 75 in the early years (e.g. in 1960-1964 for females aged 75-79 estimated gx is ≈ -0.7)
- Currently assumed RW on h_t and k_t of the LogQuad Model for males and females independently, will try to introduction some correlation between the two sexes.
- the huge difference in estimated ${}_{45}q_{15}$ at the earliest years is due to the much higher estimated RW penalty on female k_t, while for males k_t are allowed more flexibility hence closer to the empirical sx

  magnitude of the estimated gx of both sexes in these years are similar, but estimated gx are $+ve$ at age 40-59 for males and $-ve$ for females

  gx over-compensated for males to allow for higher mx to match empirical sx for males, or gx under-compensated for mx to be more similar across years for females

  assume common RW penalties in h_t and k_t across sexes?

- Compared estimated mx in 1990-2015 to those from only using DHS-Spline, estimates from the CCMPP-LogQuad Model with DHS deaths are generally higher
- Only 5x5 age-period grid have been considered so far, will try to interpolate the LQ Model to single year of age.
- Simple MVN on migration rates at the moment, will try to introduce correlation soon (age and time direction or time and cohort direction?). Penalty on gx such as tensor P-spline penalties?
- RW on tips, will add spikes at tips=5 and tips=10

LogQuad Model

$$\log(m_{x,t}) = a_x + b_x h_t + c_x h_t^2 + v_x k_t$$

where a_x, b_x, c_x and v_x are fixed coefficients.

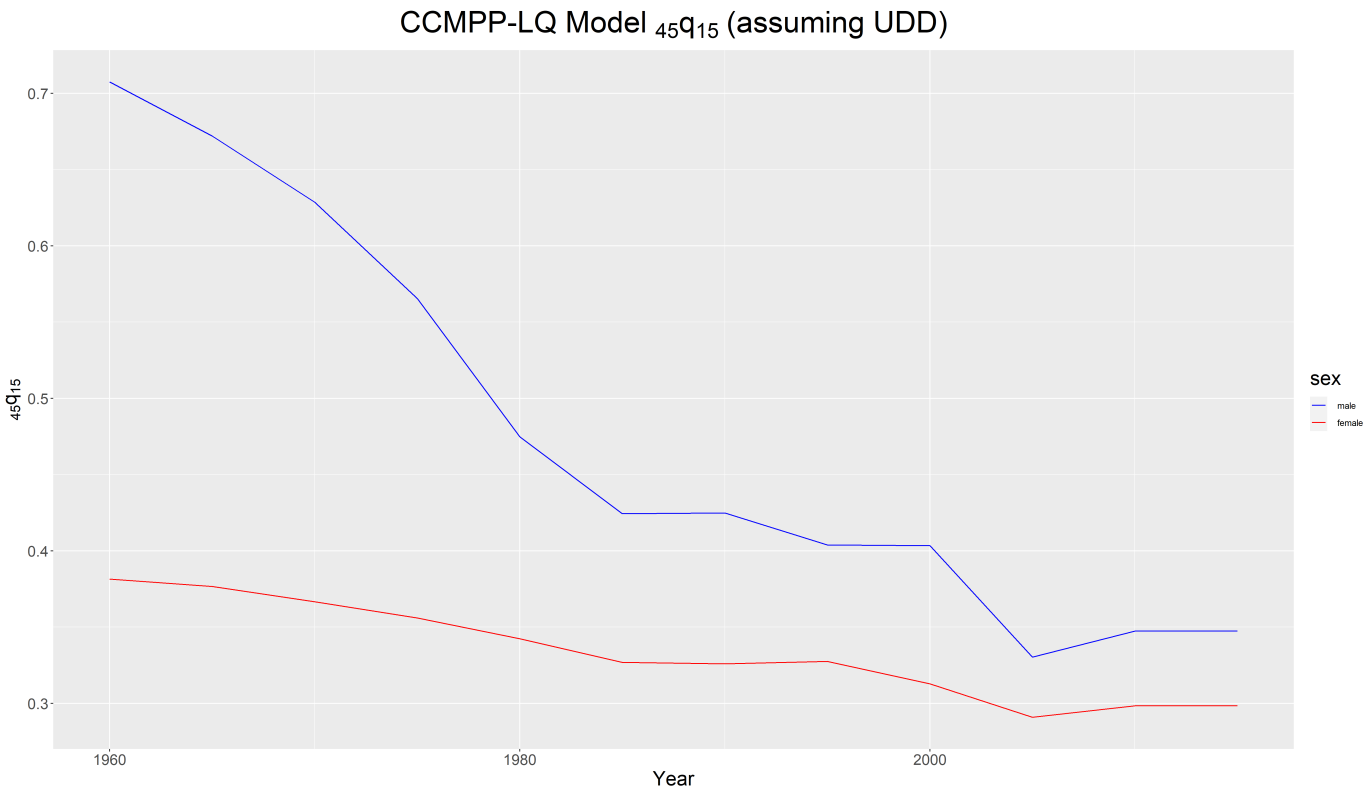
Obtained coefficients from the package *MortCast* which contains the coefficients of the LogQuad Model at age groups $0, 5\text{-}9, 10\text{-}14, \ldots, 110+$. Age group $1\text{-}4$ are left out as in the original LQ Model the ${}_4q_1$ are calibrated such that the modelled $p_0\,{}_4p_1$ match the input ${}_5q_0$.

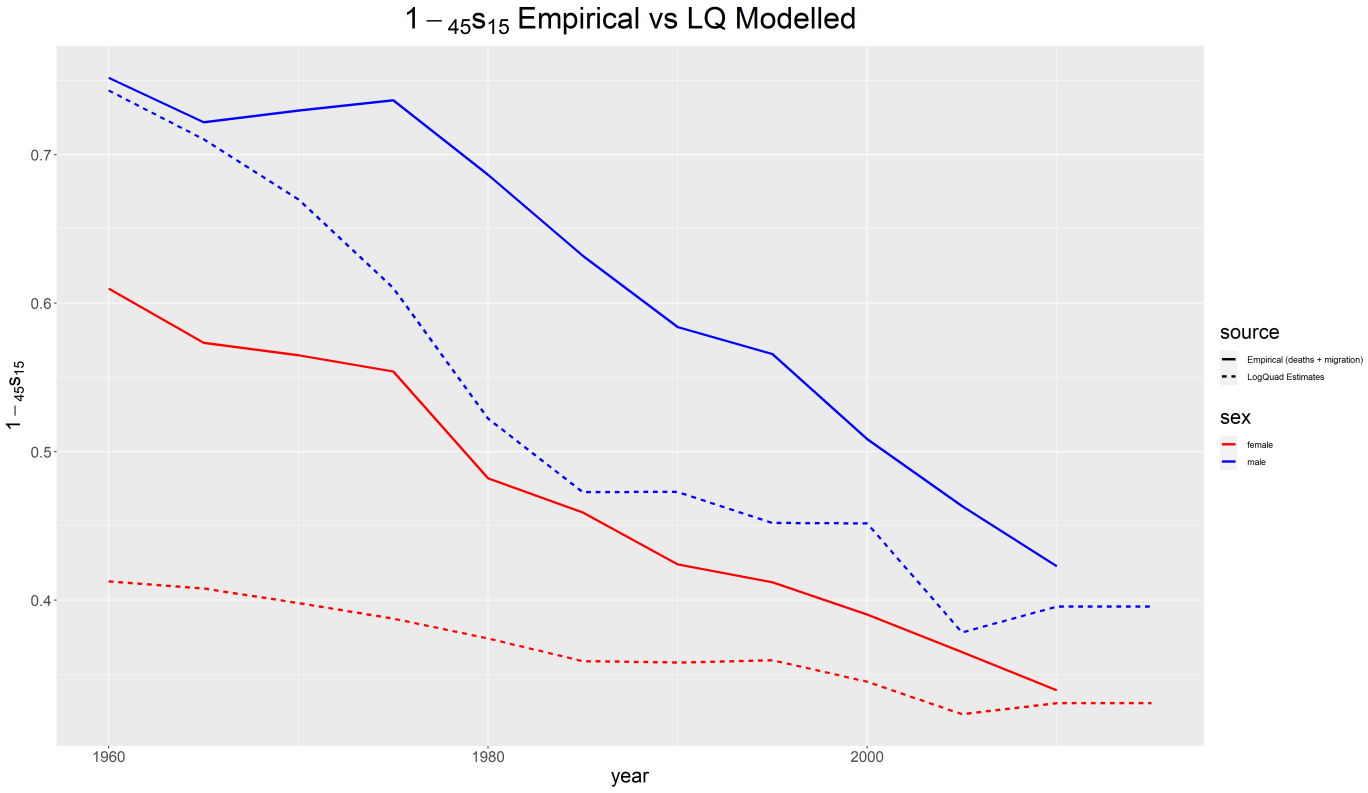
Coefficients starting at age group $5\text{-}9$ were extracted and the log mortality of the first age group $0\text{-}4$ was set to be the estimated h_t.

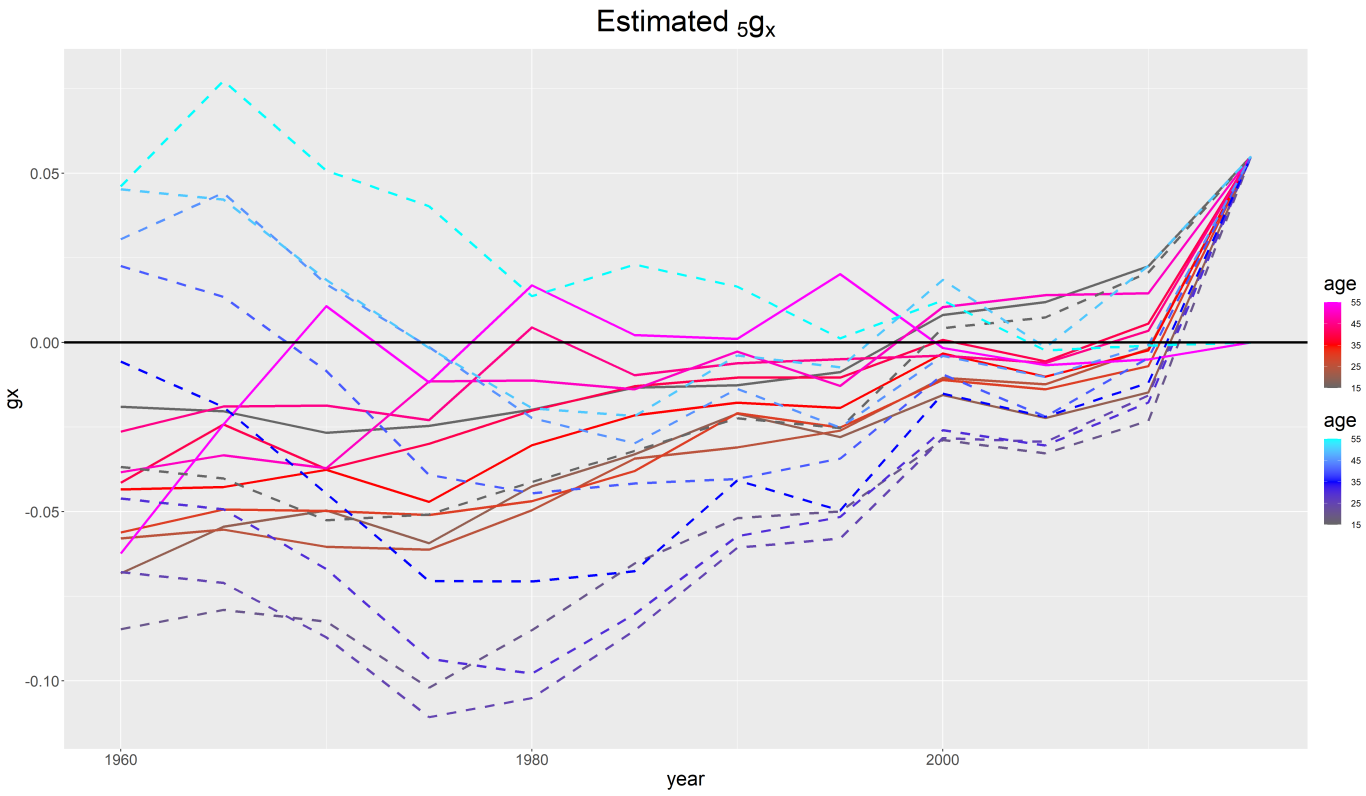
AR(1) is assumed on h_t and k_t for both males and females, independently.

The open age group in the population counts data starts at a younger age than the LQ Model, therefore weighted average of the estimated mortality rates of the last few age groups are calculated, with weights equal to the exposures according to the life table assuming UDD.

Results

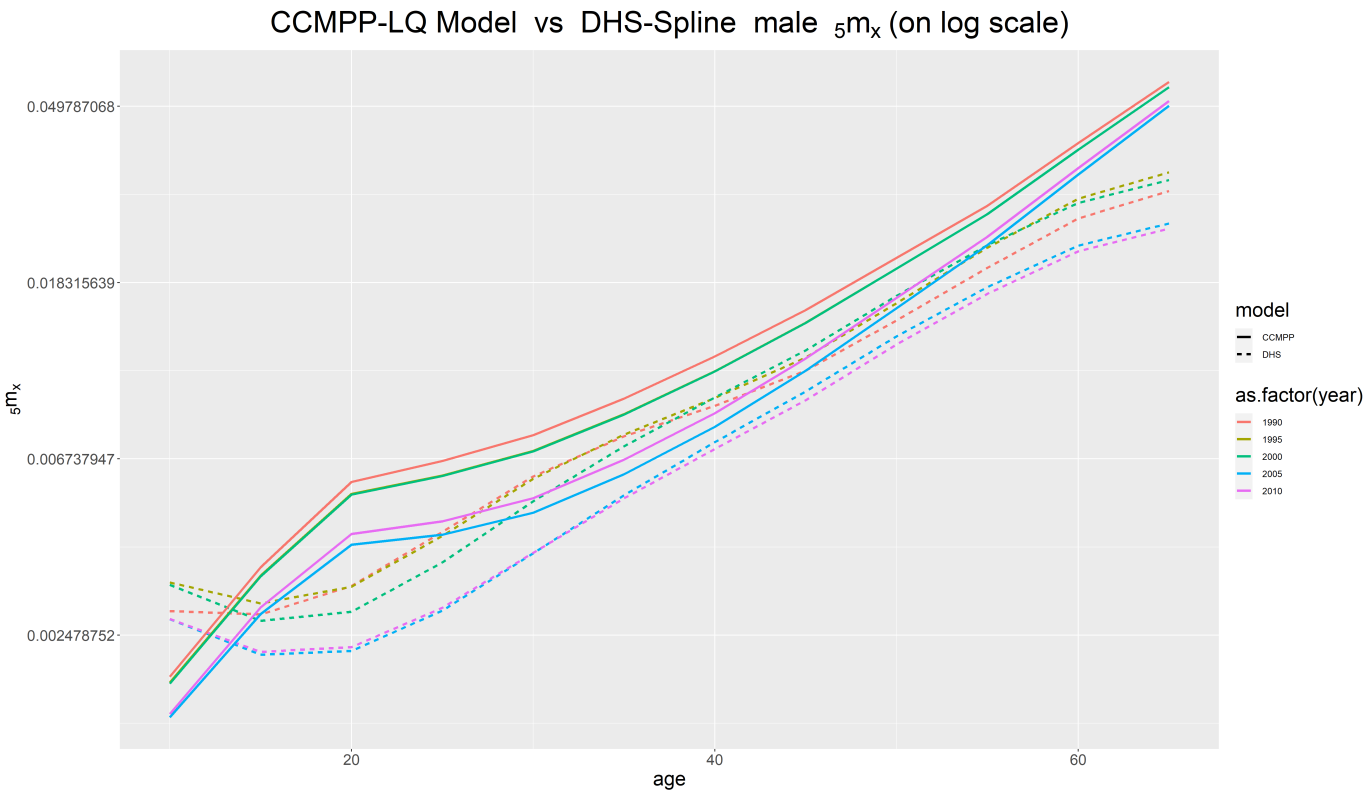

CCMPP-LQ Model $_{45}q_{15}$ (assuming UDD)
0.7
0.6
0.5
0.4
0.3
$_{45}q_{15}$
1960
1980
2000
Year
sex
male
female

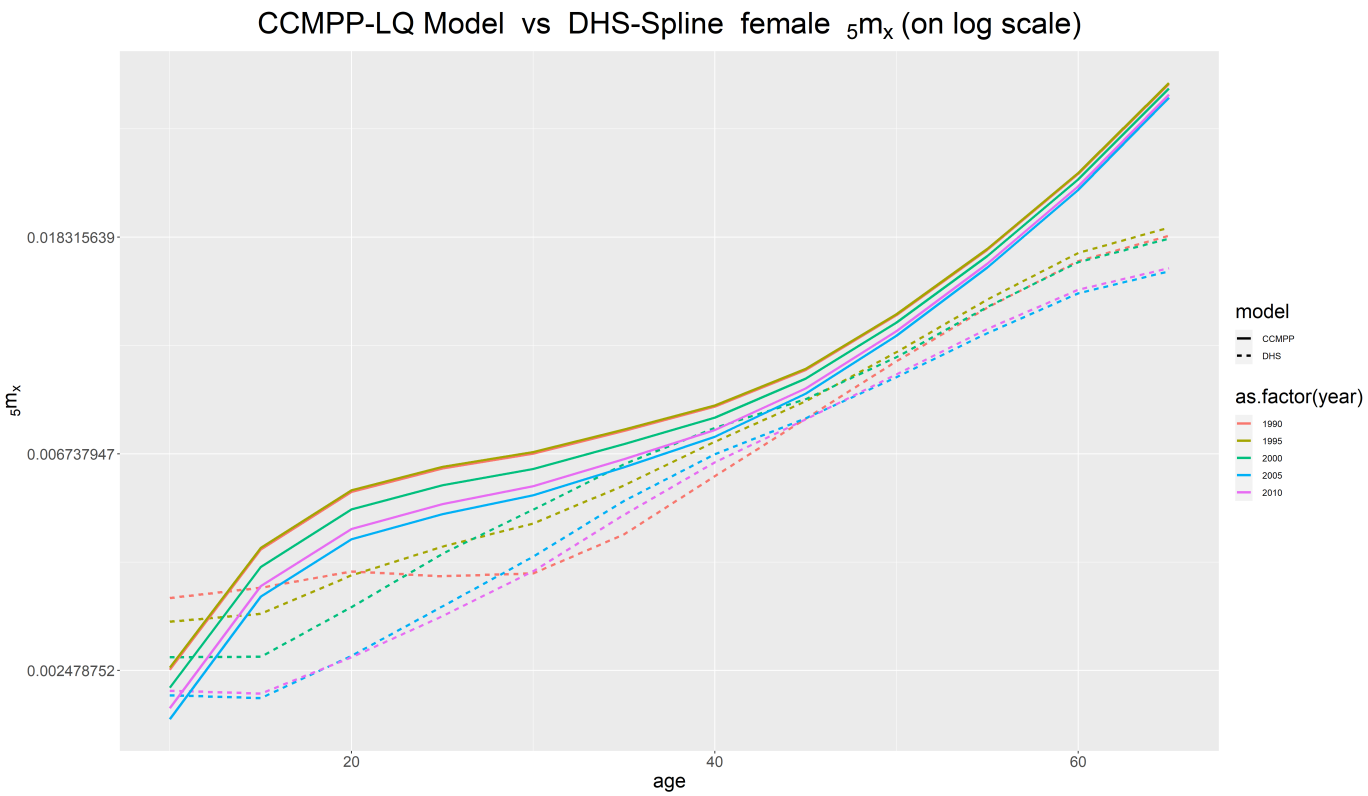

$1-{}_{45}s_{15}$ Empirical vs LQ Modelled
0.7
0.6
0.5
0.4
$1-{}_{45}s_{15}$
1960
1980
2000
year
source
Empirical (deaths + migration)
LogQuad Estimates
sex
female
male

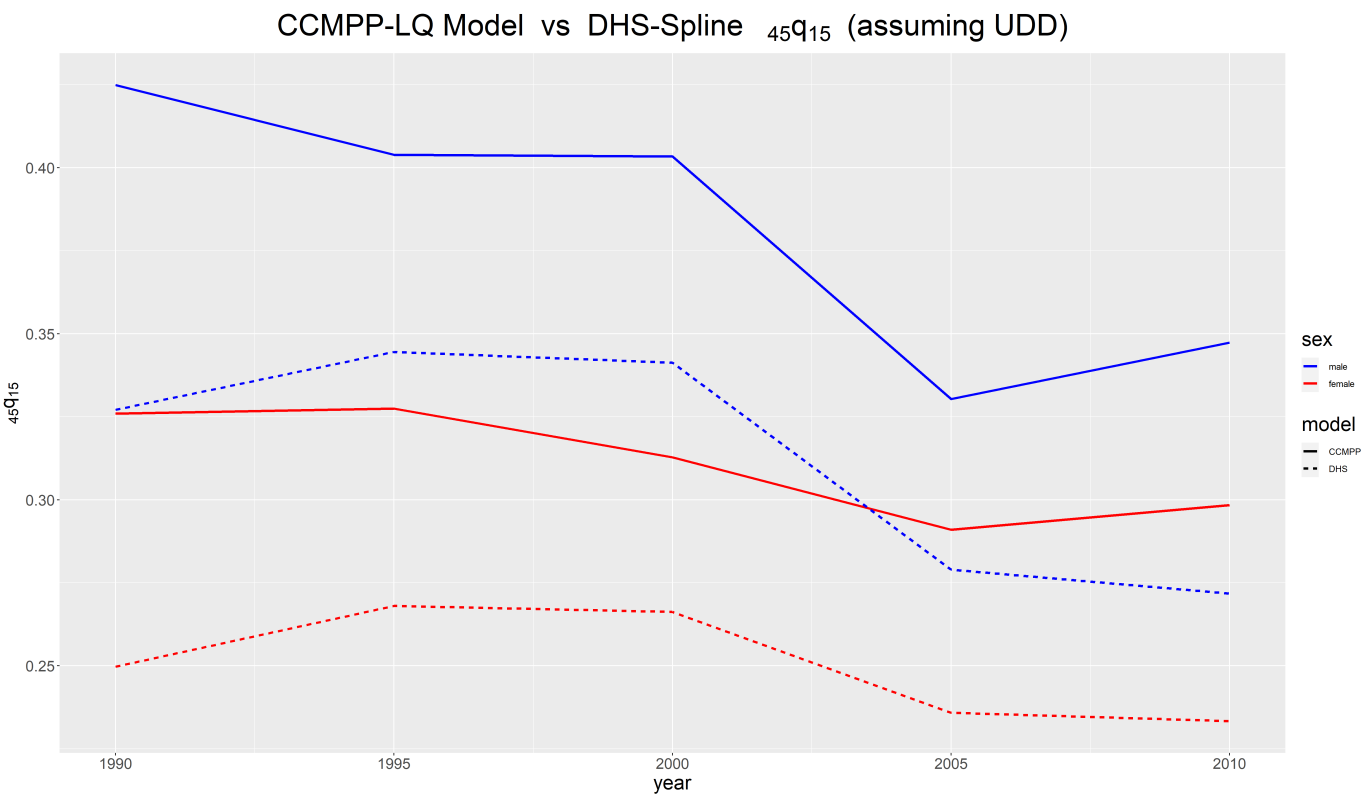


*Prior for gx set to -0.055 at most of these ages

Comparison to DHS-Spline






CCMPP-LQ Model vs DHS-Spline $_{45}q_{15}$ (assuming UDD)
$_{45}q_{15}$
0.40
0.35
0.30
0.25
1990
1995
2000
2005
2010
year
sex
male
female
model
CCMPP
DHS