MortalityLaws R Package

A History of Mortality Modeling from Gompertz to Lee-Carter

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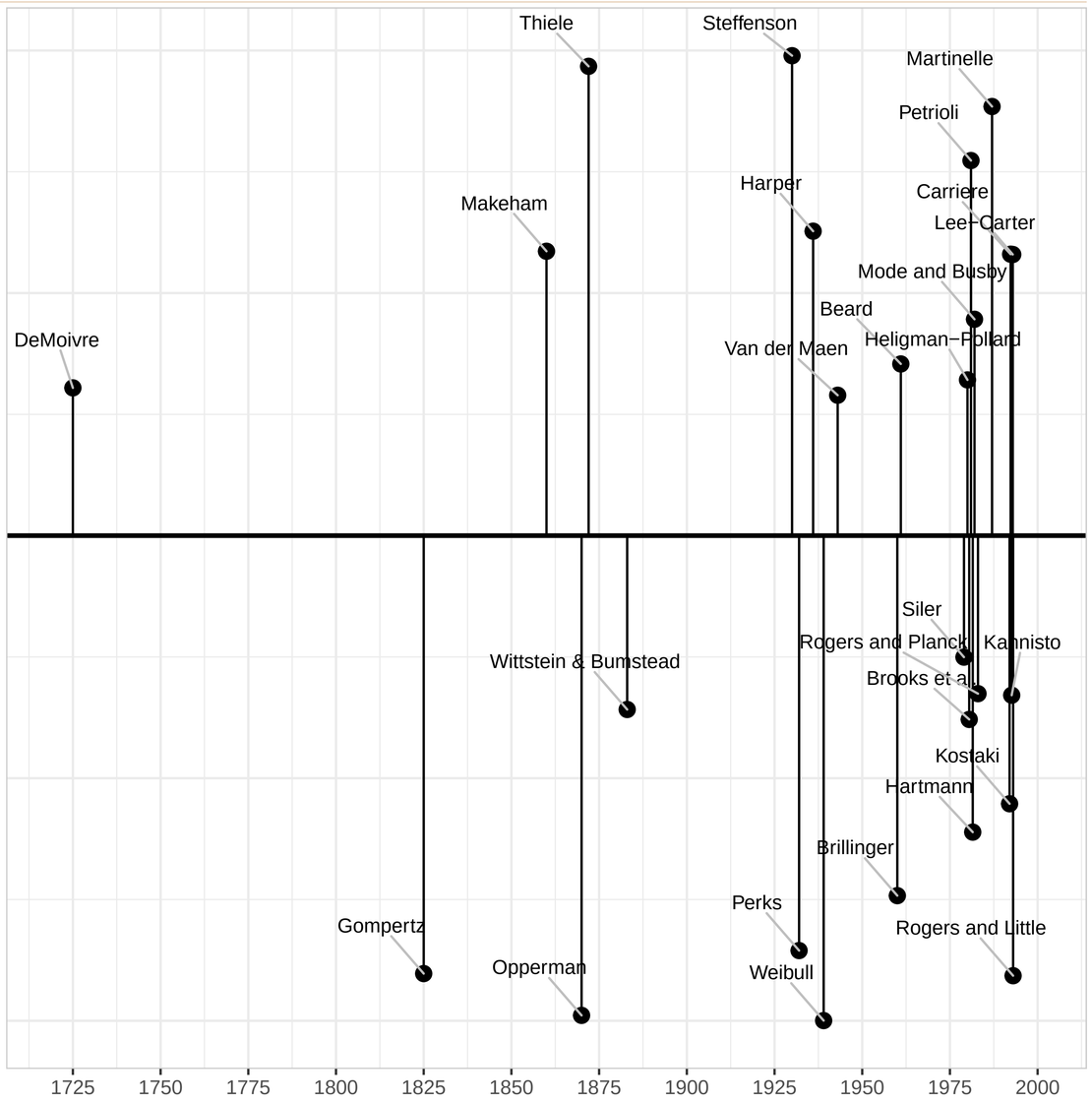
Mortality modelling timeline

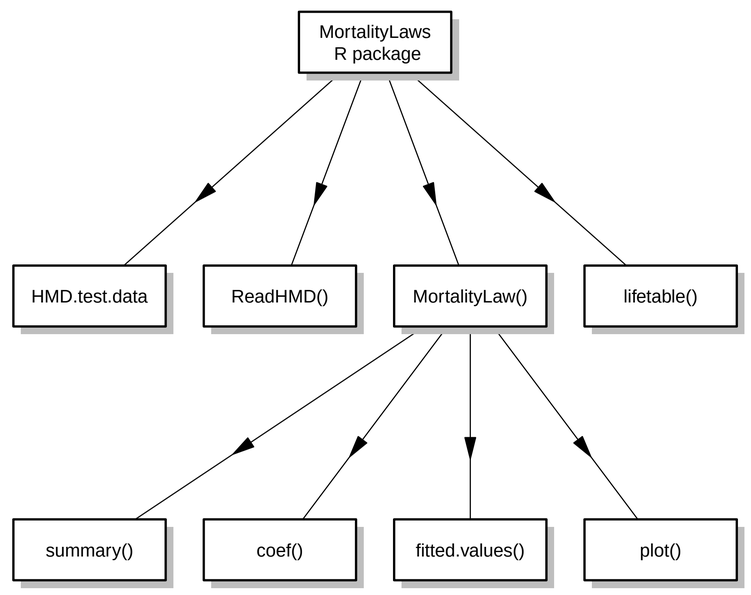


Main Objective

Build an R package that is capable of performing multiple tasks in a matter of seconds. For example:

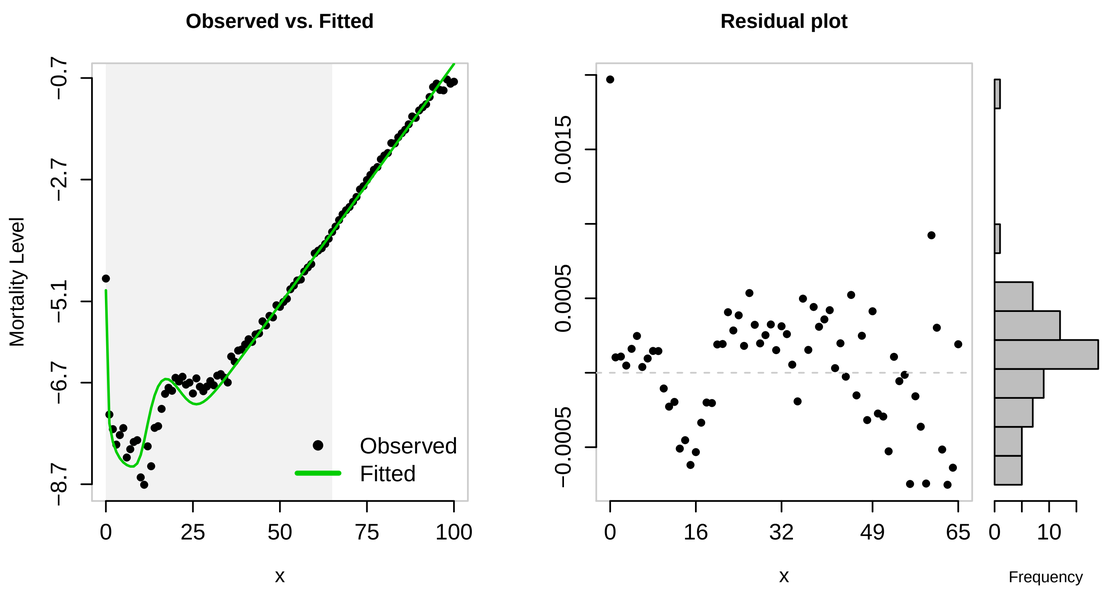
- Download and save HMD data;
- Fit mortality laws over different age intervals;
- Provide multiple fitting procedures for the same model (MLEs, loss functions etc.);
- Smooth data;
- Construct life tables given different type of input data (q_x, m_x, D_x, E_x etc.);
- Facilitate comparisons of mortality improvements accros time and ages;
- Generate instant plots and goodness of fit measures.

The structure of the MoralityLaws R package



Implemented Parametric Functions & Generic Plots

Mortality laws	**Predictor**	Code
Gompertz	ae^{bx}	`gompertz0`
Gompertz	$\frac{1}{\sigma}exp\left\{\frac{x-m}{\sigma}\right\}$	`gompertz`
Inverse-Gompertz	$\frac{1}{\sigma}exp\left\{\frac{x-m}{\sigma}\right\}/\left(exp\left\{e^{\frac{-(x-m)}{\sigma}}\right\}-1\right)$	`invgompertz`
Makeham	$ae^{bx}+c$	`makeham0`
Makeham	$\frac{1}{\sigma}exp\left\{\frac{x-m}{\sigma}\right\}+c$	`makeham`
Inverse-Makeham	$\frac{1}{\sigma}exp\left\{\frac{x-m}{\sigma}\right\}/\left(exp\left\{e^{\frac{-(x-m)}{\sigma}}\right\}-1\right)+c$	`invmakeham`
Opperman	$\frac{a}{\sqrt{x}}+b+c\sqrt[3]{x}$	`opperman`
Thiele	$a_1e^{-b_1x}+\ a_2e^{-\frac{1}{2}b_2(x-c)^2}+a_3e^{b_3x}$	`thiele`
Wittstein & Bumstead	$\frac{1}{m}a^{-(mx)^n}+a^{-(M-x)^n}$	`wittstein`
Weibull	$\frac{1}{\sigma}\left(\frac{x}{m}\right)^{\frac{m}{\sigma}-1}$	`weibull`
Inverse-Weibull	$\frac{1}{\sigma}\left(\frac{x}{m}\right)^{-\frac{m}{\sigma}-1}/\left(exp\left\{\left(\frac{x}{m}\right)^{-\frac{m}{\sigma}}\right\}-1\right)$	`invweibull`
Siler	$a_1e^{-b_1t}+a_2+a_3e^{b_3t}$	`siler`
Heligman - Pollard	$A^{(x+B)^C}+De^{-E(\ln x\ -\ln F\ )^2}+GH^x$	`HP`
Kannisto	$\frac{ae^{bx}}{1+ae^{bx}}+c$	`kannisto`
Carriere	$s\left(x\right)=\psi_1s_1\left(x\right)+\ \psi_2s_2\left(x\right)+\ \psi_3s_3\left(x\right)$	`carriere1`



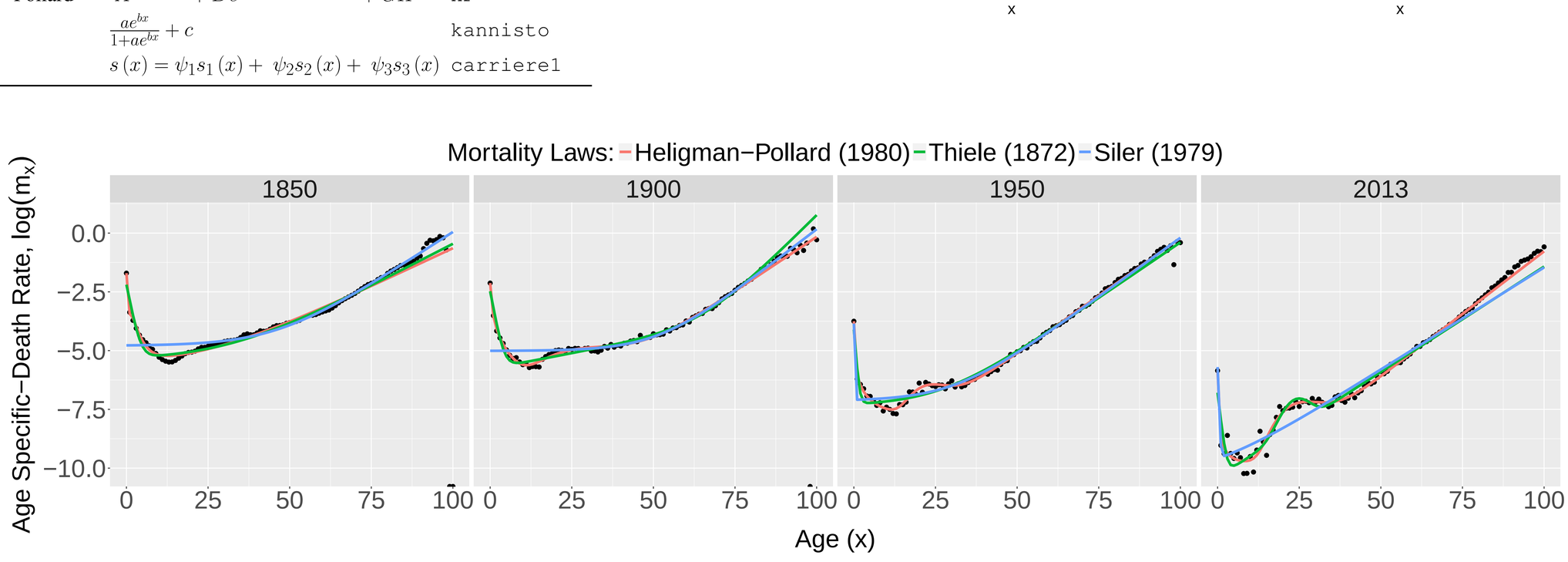


Figure 1: Observed and fitted death rates between age 0 and 80 for male population in Sweden. The mortality is extrapolated up to age 100.