Periodic or Generational Actuarial Tables: Which One to Choose?

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Joint work with
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Definitions of periodic and generational life tables

	age	0	1	2	3	4	5	6
année								
1950		0.02649	0.00244	0.00146	0.00114	0.00094	0.00077	0.00065
1951		0.02743	0.00253	0.00152	0.00118	0.00098	0.00080	0.00067
1952		0.02455	0.00227	0.00135	0.00106	0.00088	0.00072	0.00061
1953		0.02486	0.00230	0.00137	0.00107	0.00089	0.00073	0.00062
1954		0.02333	0.00216	0.00129	0.00101	0.00083	0.00069	0.00059
1955		0.02348	0.00217	0.00129	0.00101	0.00084	0.00069	0.00059
1956		0.02332	0.00216	0.00129	0.00101	0.00083	0.00069	0.00059
1957		0.02130	0.00197	0.00117	0.00092	0.00076	0.00063	0.00055
1958		0.01913	0.00177	0.00105	0.00083	0.00068	0.00057	0.00050
1959		0.01856	0.00172	0.00102	0.00080	0.00066	0.00056	0.00049
1960		0.01902	0.00176	0.00104	0.00082	0.00068	0.00057	0.00050
1961		0.01710	0.00159	0.00094	0.00074	0.00061	0.00052	0.00046
1962		0.01882	0.00175	0.00103	0.00081	0.00067	0.00056	0.00049
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1964		0.01620	0.00151	0.00089	0.00070	0.00058	0.00049	0.00044
1965		0.01652	0.00154	0.00090	0.00072	0.00059	0.00050	0.00044
1966		0.01610	0.00150	0.00088	0.00070	0.00058	0.00049	0.00043

Figure: Mortality table

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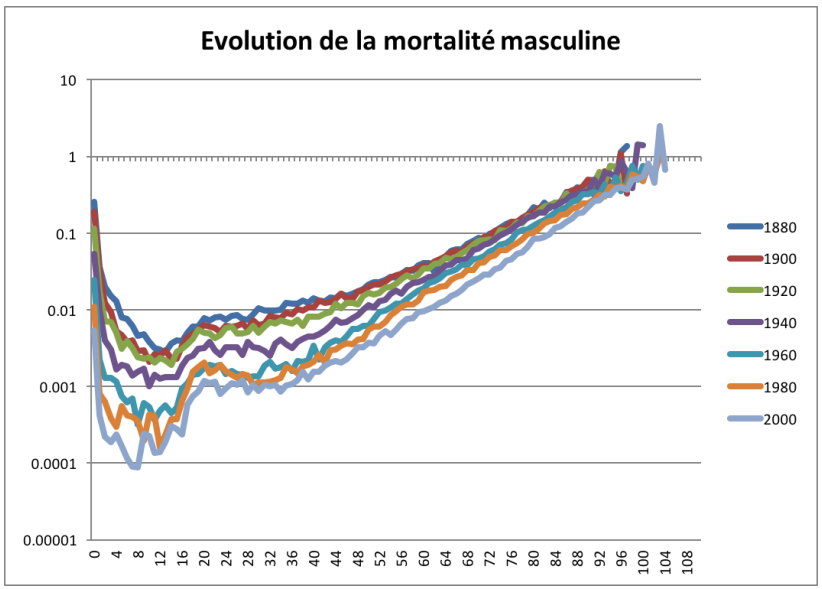
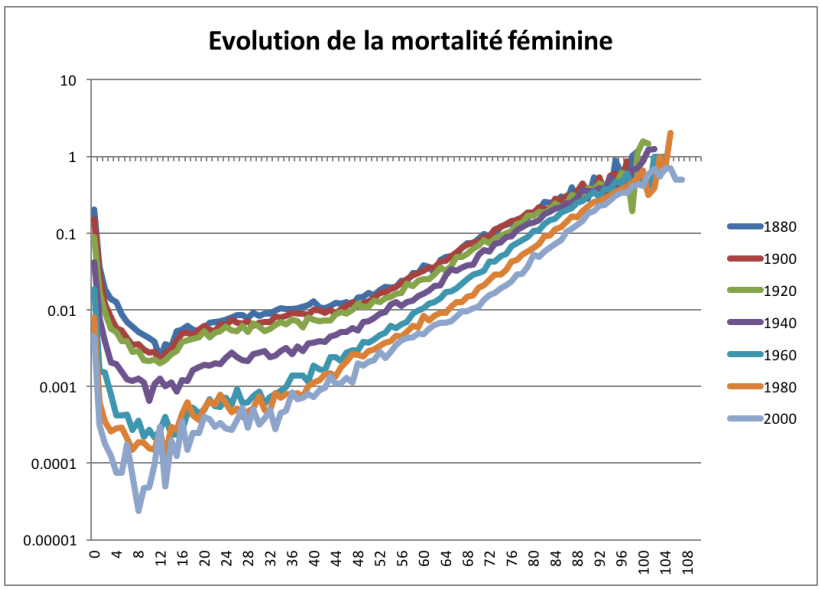
Mortality improvements



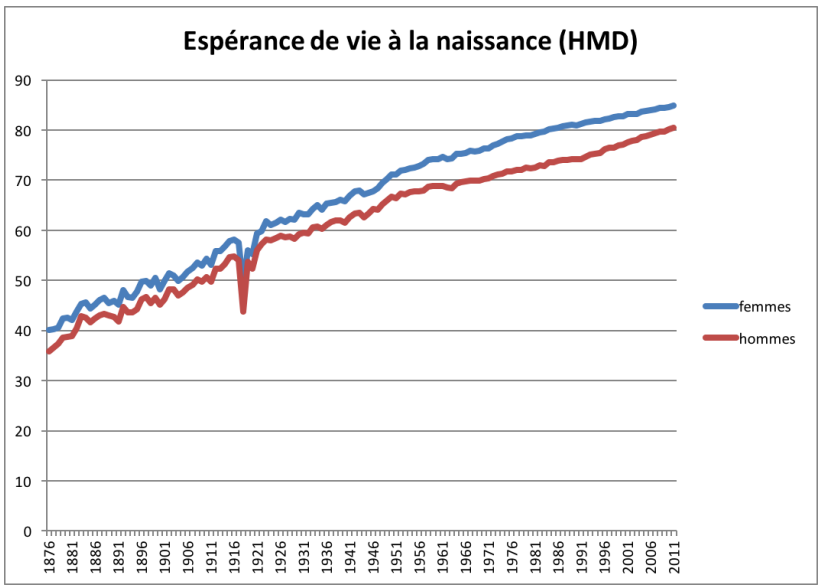
(a) Men



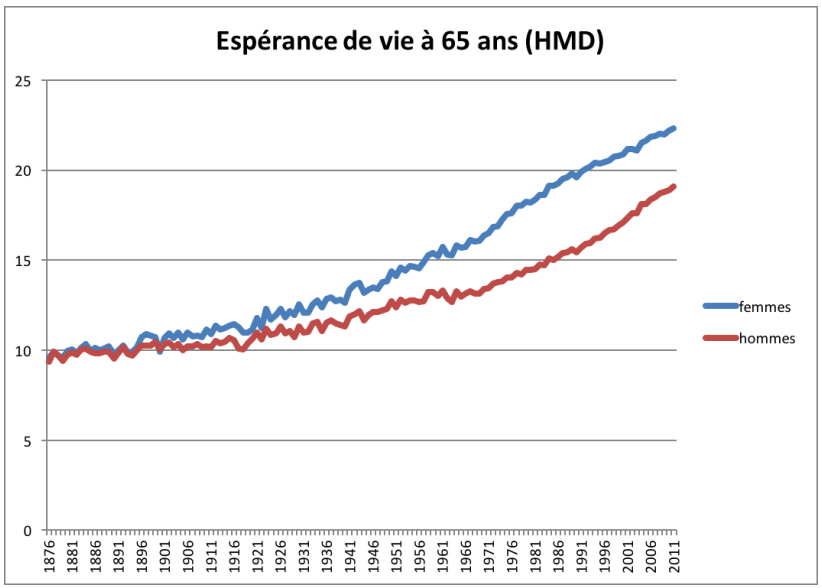
(b) Women

Figure: Past mortality, Switzerland

Mortality improvements - cont'n



(a) At birth



(b) At age 65

Figure: Past life expectancy, Switzerland

Introduction

Mortality improvements over the past decades have been impressive.

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→ Key question: How will mortality evolve in the future?

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→ The answer considerably depends on the model used and the expert's opinion.

Aim of this work

Investigate what would be the impact of using different mortality models on periodic and generational life tables.

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Investigate what would be the impact of using different mortality models on periodic and generational life tables.

→ Why is it such an important question?

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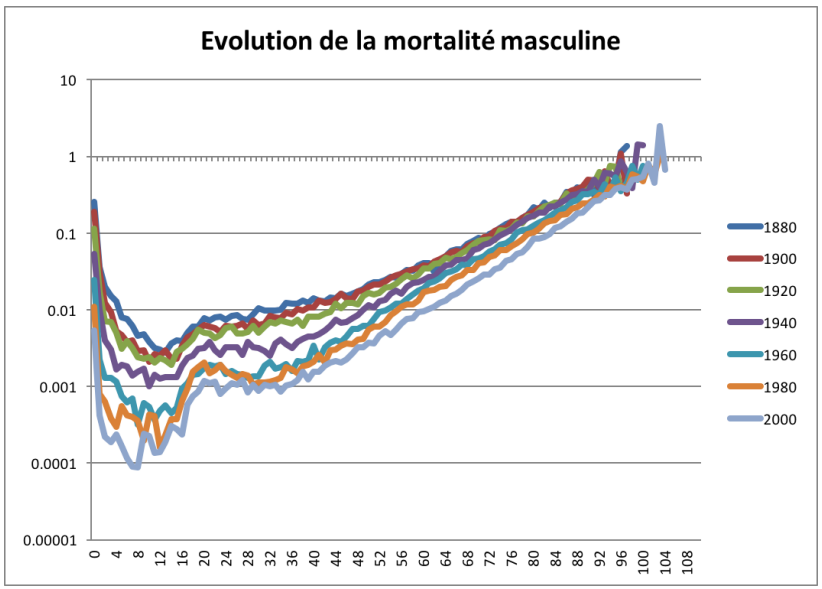
Mortality improvements



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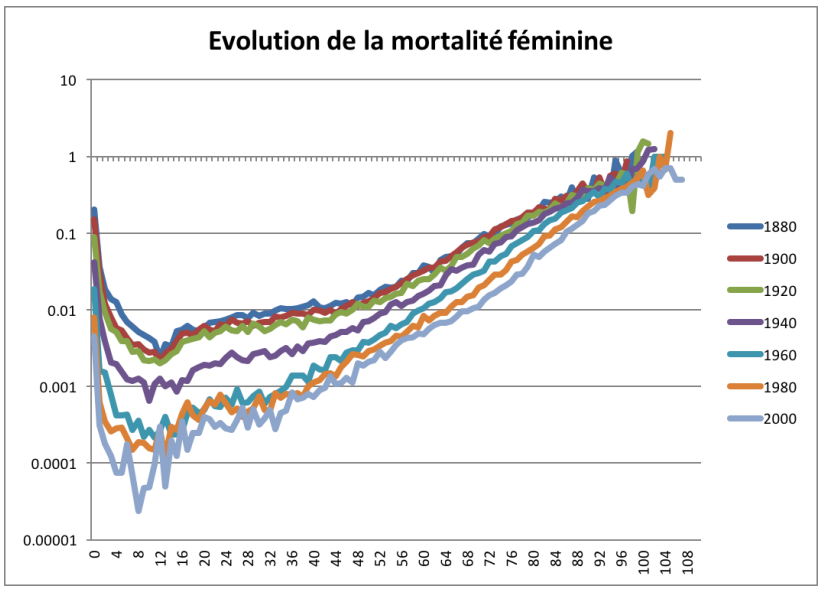
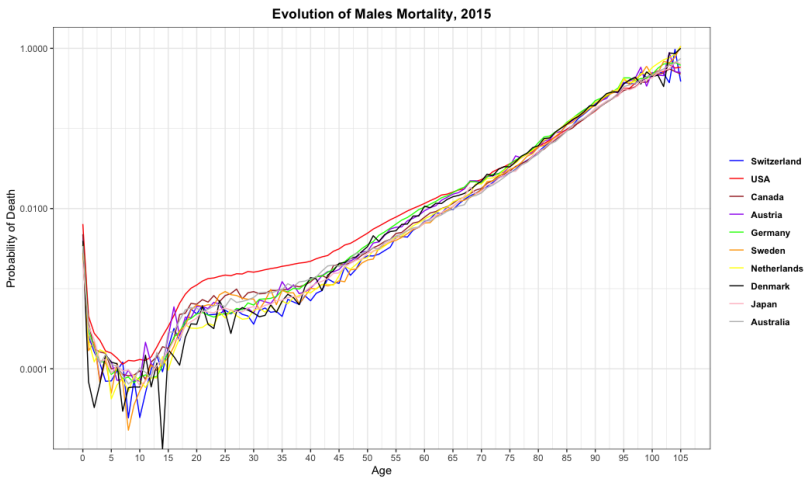


(b) Women

Figure: Past mortality, Switzerland

Mortality across the globe



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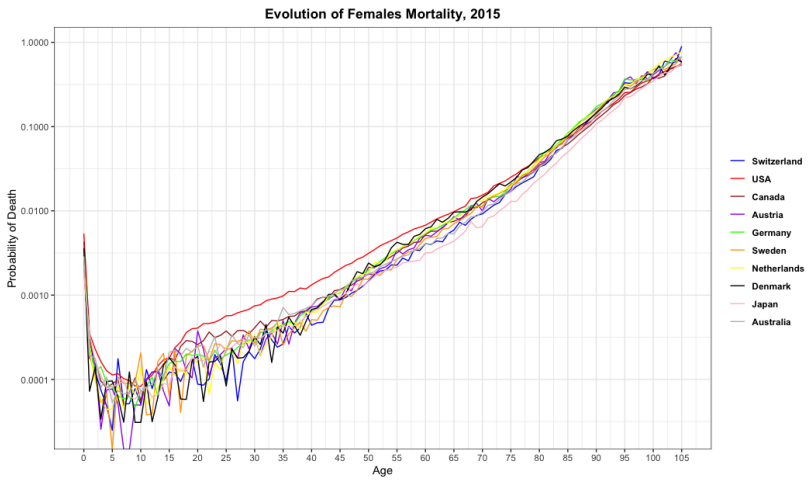

(b) Women

Figure: Mortality in 2015

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Comparing Menthonnex [2009] and Menthonnex [2015] - cont'n

	Menthonnex (2009)	Menthonnex (2015)
Espérance de vie à la naissance		
Femmes, 2010	84.8	84.5
Hommes, 2010	80.1	80.1
Femmes, 2030	87.4	87.6
Hommes, 2030	83.1	84.1
Femmes, 2050	89.3	89.8
Hommes, 2050	85.3	86.6
Espérance de vie à 65 ans		
Femmes, 2010	22.2	22.1
Hommes, 2010	18.9	18.8
Femmes, 2030	24.3	24.3
Hommes, 2030	21.2	21.7
Femmes, 2050	26.0	26.1
Hommes, 2050	22.9	23.6

Figure: Life expectancy using periodic life tables

Comparing Menthonnex [2009] and Menthonnex [2015] - cont'n

	Menthonnex (2009)	Menthonnex (2015)
Espérance de vie à la naissance		
Femmes nées en 1950	83.5	83.4
Hommes nés en 1950	77.2	77.5
Femmes nées en 2015	92.0	92.4
Hommes nés en 2015	88.2	89.6
Femmes nées en 2030	92.8	93.2
Hommes nés en 2030	89.2	90.6
Espérance de vie à 65 ans		
Femmes nées en 1950	24.5	24.4
Hommes nés en 1950	21.1	21.6
Femmes nées en 2030	29.4	29.5
Hommes nés en 2030	26.6	27.5

Figure: Life expectancy using generational life tables

Comparing Menthonnex [2009] and Menthonnex [2015] - cont'n

	Proportion atteignant 100 ans			
	Menthonnex (2009)		Menthonnex (2015)	
	Hommes	Femmes	Hommes	Femmes
Génération 1900	0.20%	0.90%	0.20%	0.90%
Génération 1950	4.40%	9.20%	5.60%	9.70%
Génération 2000	12.80%	20.50%	17.00%	21.00%

Figure: Proportion of people reaching age 100

Comparing Menthonnex [2009] and Menthonnex [2015] - cont'n

- According to Menthonnex [2009]:
  On constate que la mortalité calculée pour les hommes nés en 2000 est du même ordre de grandeur que celle des femmes nées en 1950.

- According to Menthonnex [2015]:
  On constate que la mortalité calculée pour les hommes nés en 2000 est du même ordre de grandeur que celle des femmes nées vers 1970.

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  On constate que la mortalité calculée pour les hommes nés en 2000 est du même ordre de grandeur que celle des femmes nées vers 1970.

$\rightarrow$ The same model applied on slightly different timeframes can produce important differences in terms of results.

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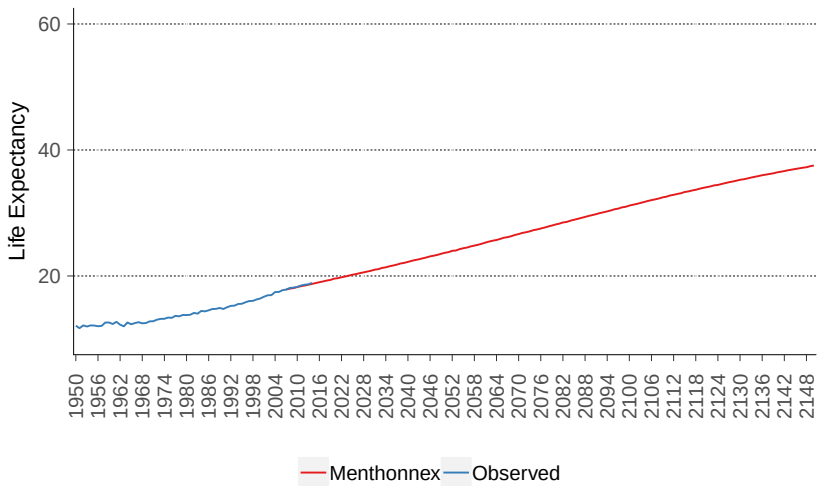
Comparing Menthonnex with other models



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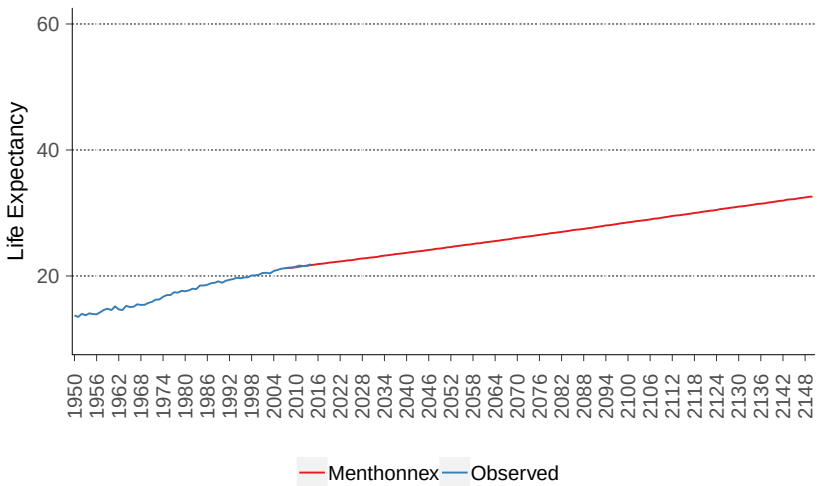

(b) Women

Figure: Comparison of life expectancies at age 65

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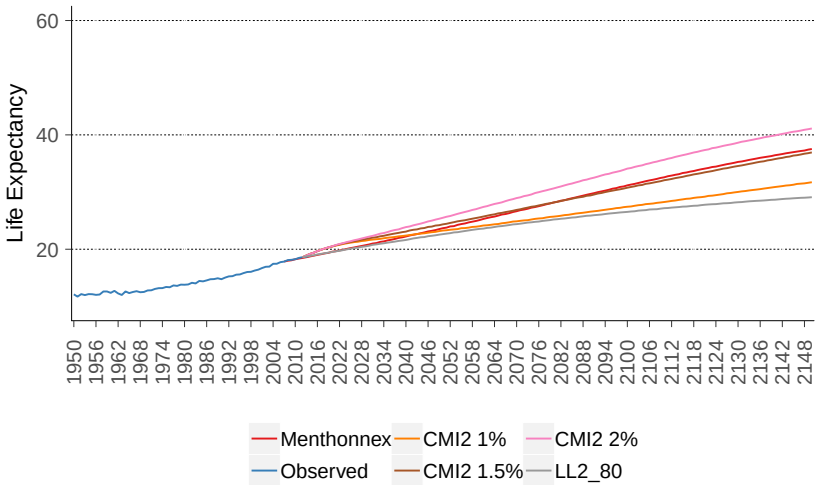

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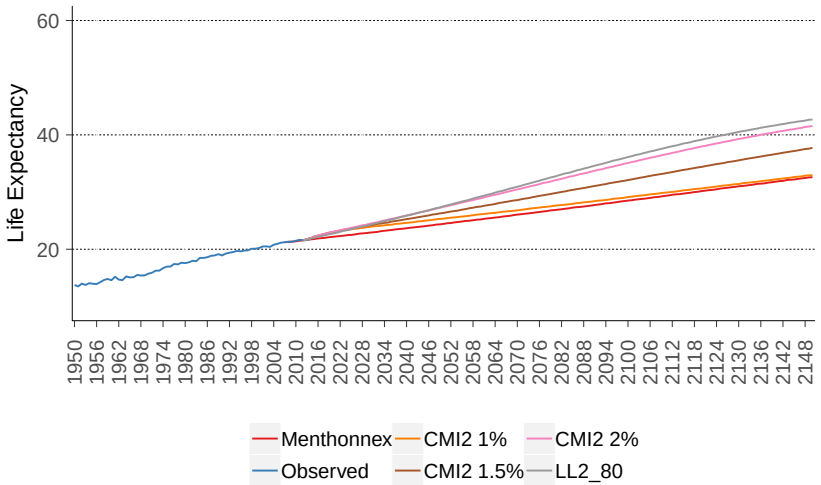

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Background

- Swiss official mortality tables for private pension funds.
- First tables were published in 2002 (LPP 2000).
- Provide an option to forecast mortality: the Menthonnex model.

Table	Period of observation	Year of observation
LPP 2010	2005-2009	2007
LPP 2015	2010-2014	2012

Table: Period of observation

Concept

We focus the analysis on the impact the change from the LPP 2010 to the LPP 2015 table has on the mathematical reserves of current pensioners. Therefore, for each year (e.g. 2015), these mathematical reserves can be computed using different techniques:

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Concept - cont'n

- Use the LPP 2015 table (centred in 2012) + a longevity reserve;
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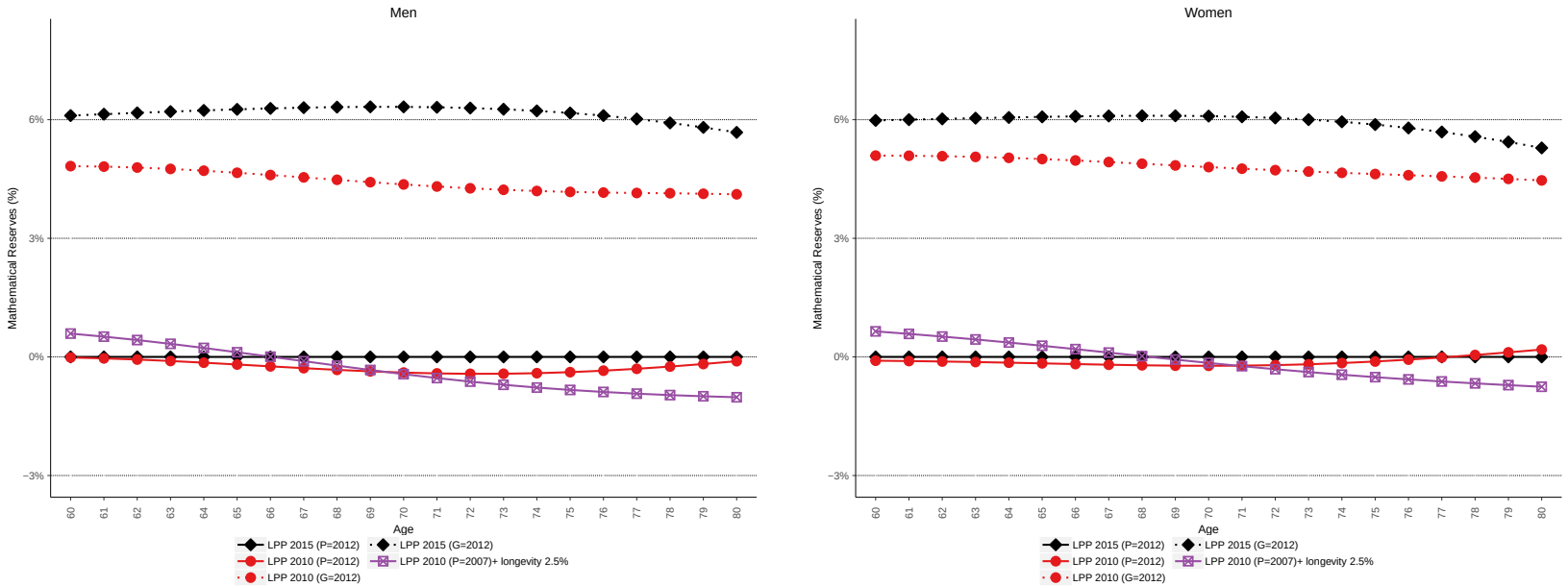
Mathematical reserves in 2012

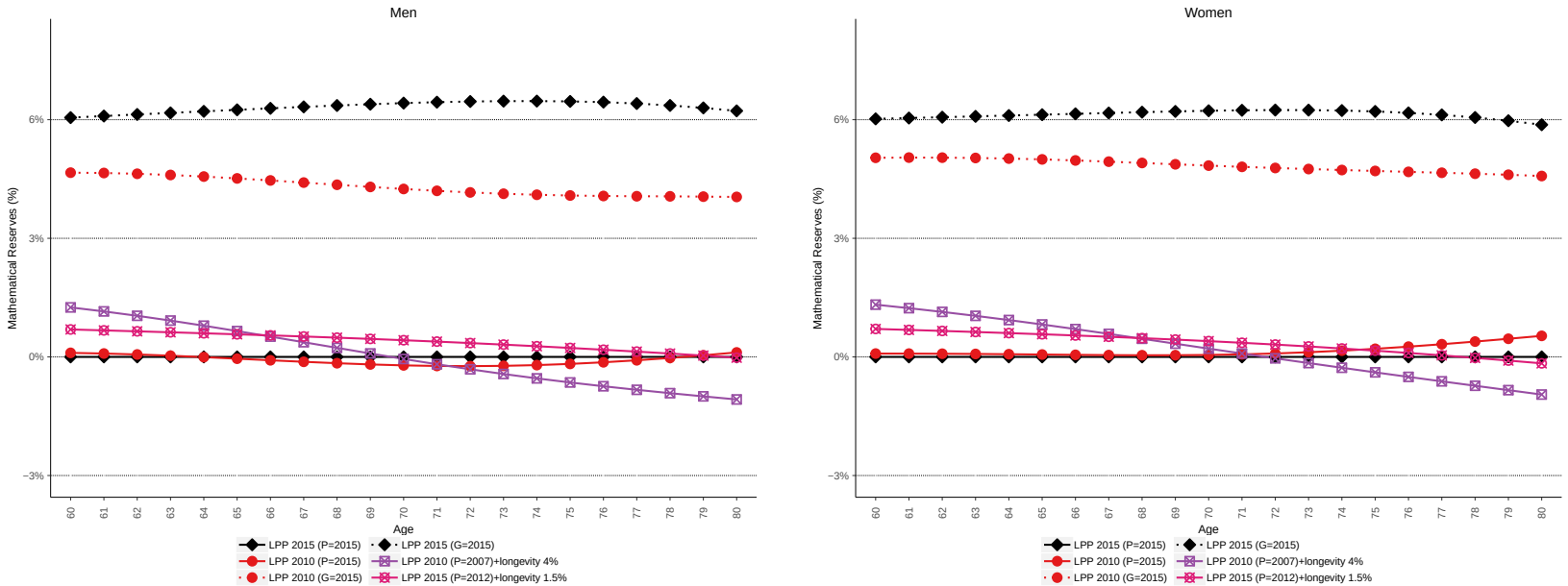


(a) Men

(b) Women

Figure: Relative value - Difference with the LPP 2015 table, P=2012

Mathematical reserves in 2015



(a) Men

(b) Women

Figure: Relative value - Difference with the LPP 2015 table, P=2015

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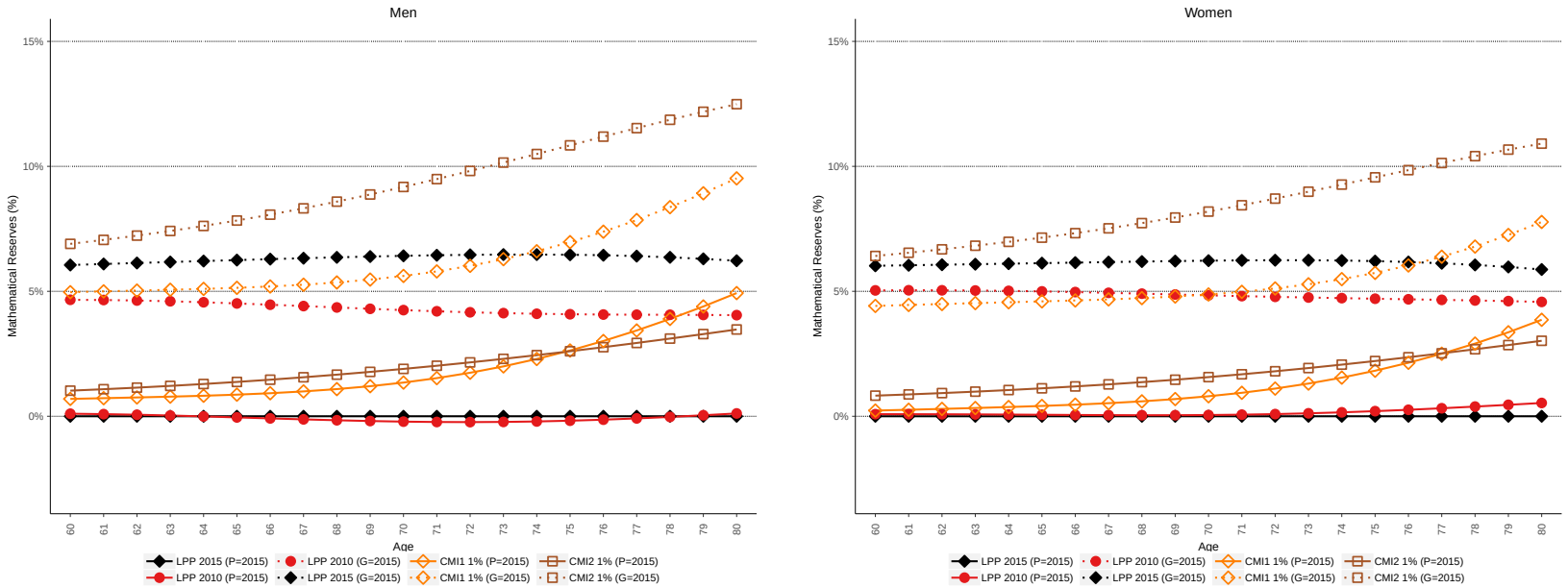
Mathematical reserves in 2015 - CMI 1%



(a) Men

(b) Women

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Mathematical reserves in 2015 - Global comparison

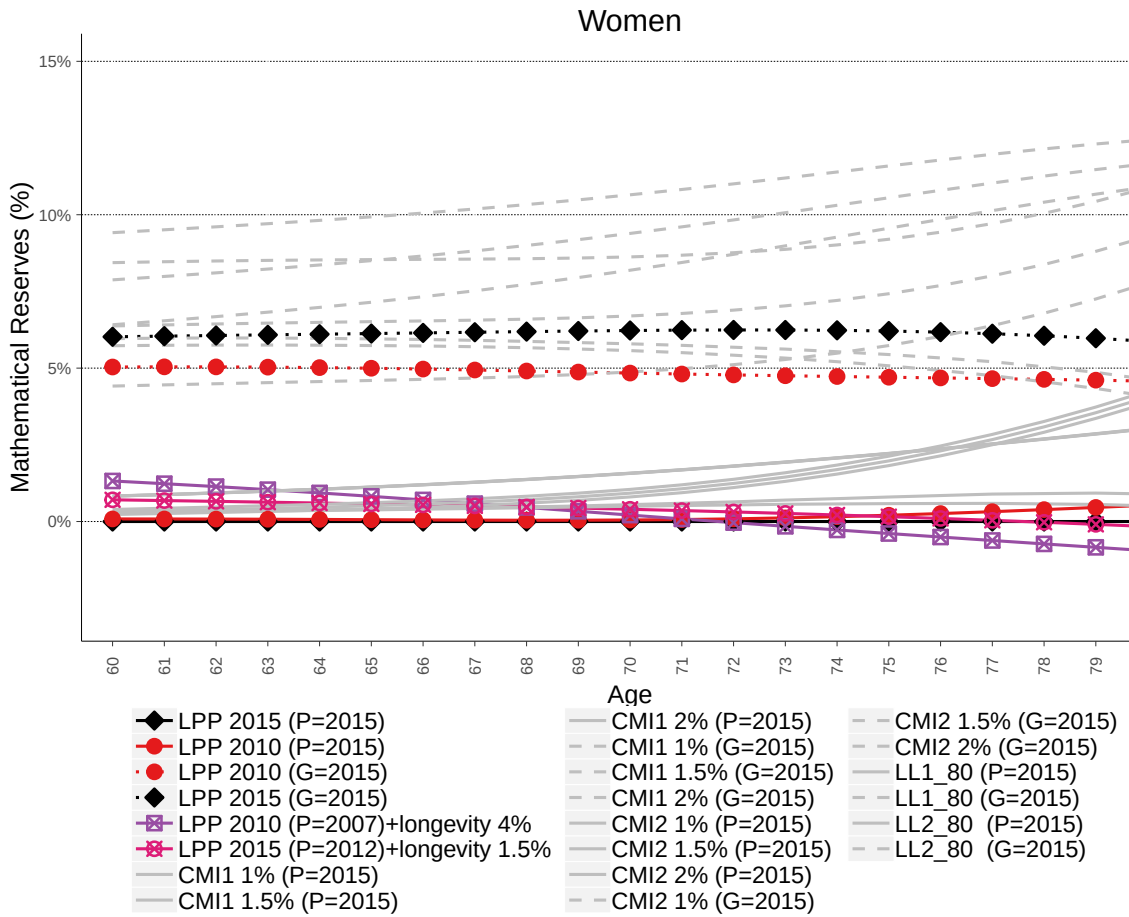

Figure: Relative value - Difference with the LPP 2015 table, P=2015, women

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Additional details: Arnold et al. [2019]

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Thank you very much for your attention!

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