Socioeconomic disparities in mortality in the US

May 20, 2021

ACTUARIES' CLUB OF BOSTON

ACHS ACTUARIES' CLUB OF HARTFORD & SPRINGFIELD
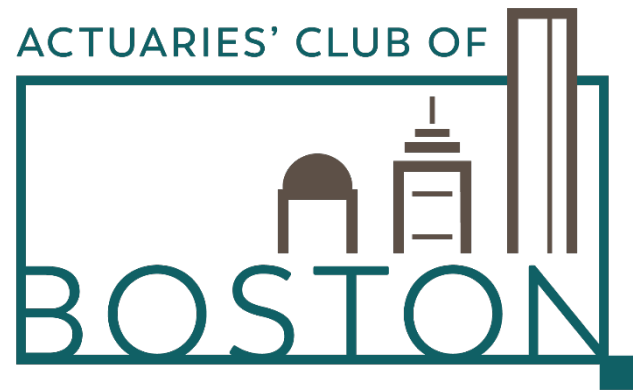
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MassMutual   John Hancock

Mortality by Socioeconomic Category in the United States
An SOA funded project

Magali Barbieri
UC Berkeley/INED

This work would not have been possible without the help of Anneliese Luck (UCB), Carl Boe (UCB), Celeste Winant (UCB) , Ryan Edwards (UCB) and Bénédicte Garnier (INED)

Main project goal

To study trends in **mortality by socioeconomic category** in the United States since the 1980s

Methodological approach

Construction of **lifetable series** for years **1982-2019** for all US counties grouped into **10 categories** based on their population-level socioeconomic characteristics

Why population-level socioeconomic status and not individual-level?

=> Mostly for reasons of data limitations

- Education
  - U.S. death certificates (mostly) measure education since the 1989 CDC/NCHS revision
  - known to be reported with error by decedents or others, and it is differentially poor by race/ethnicity
  - How to deal with those still in school?
  - Known weaker link for women
- No information on income on death certificates
- No other large-scale data options

Concept of « deprivation »

- Initially developped in the UK

  « Deprivation may be defined as a state of observable and demonstrable **disadvantage relative to** the local community or **the wider society or nation to which an individual**, family or group **belongs** » (Townsend, 1987)

  • More specifically: **multidimensional** measure of **local socioeconomic characteristics** (access to material resources)

Overview of methods

1. Construct a single socioeconomic score (SES) for each US county (Singh and Siahpush, 2002, 2006)

2. Rank counties, weight by population, and group into deciles of approx. equal size (~10% total US population)

3. Compute lifetable series for each SES decile for 1982-2019

Data and sources

1. Socioeconomic variables (by county)

   • 1980, 1990 and 2000 Census

   • American Community Survey (5yr) 2005-2009 to 2015-2019

2. Mortality (1982-2019)

   • Individual death records (NCHS)

   With dates of birth and deaths, sex, age at death and county/State of residence

   • July 1st population estimates(Census Bureau)

   By sex, age and county/State

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Socioeconomic score

- Socioeconomic variables used to construct the SES score:
  1. % pop. 25+ with <9 years of education
  2. % pop. 25+ with 4+ years of college
  3. % pop. 16+ in white collar occupations
  4. Unemployment rate
  5. Median household income adj. for state median housing costs
  6. Ratio of median income in 1st and 5th quintiles
  7. % pop. < Federal poverty threshold
  8. Median home value (owner occupied units)
  9. Median gross rent
  10. % housing with no telephone
  11. % housing with no or incomplete plumbing

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Construction of deciles

- Extraction of socioeconomic variables for each county from census/ACS

- Principal Component Analysis
  1. Standardization
  2. Correlation matrix
  3. Extraction of principal components

- Correlations with 1st component applied to each variable for each county and summed up to yield a single score

- Counties ranked on their scores and weighted by their population

- Grouping of counties in 10 categories (deciles)

Example of calculations for one county

Variable	Initial variable value	Mean	Standard deviation	Normalized value	Correlation	Product
% pop. 25+ <9 years educ.	0.026	0.050	0.033	-0.720	-0.630	0.454
% pop. 25+ w. college degree	0.187	0.166	0.029	0.702	0.817	0.573
% pop. 16+ in White Collar occup.	0.608	0.526	0.071	1.142	0.751	0.858
Unemployment rate	0.042	0.059	0.024	-0.706	-0.606	0.428
Median adj. household income	73530	64763	15883	0.552	0.917	0.506
Income inequality	15.726	13.659	3.740	0.553	-0.335	-0.185
% pop. < Fed. Poverty threshold	0.154	0.157	0.060	-0.046	-0.845	0.039
Median housing value (owner occupied)	147900	153617	90734	-0.063	0.709	-0.045
Median gross rent	966	781	215	0.860	0.713	0.614
% housing without telephone	0.021	0.025	0.014	-0.324	-0.447	0.145
% housing no/defective plumbing	0.006	0.006	0.010	0.074	-0.220	-0.016
Socioeconomic score						3.370
Standardized score						112.520

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Map of counties by socioeconomic decile in 2000
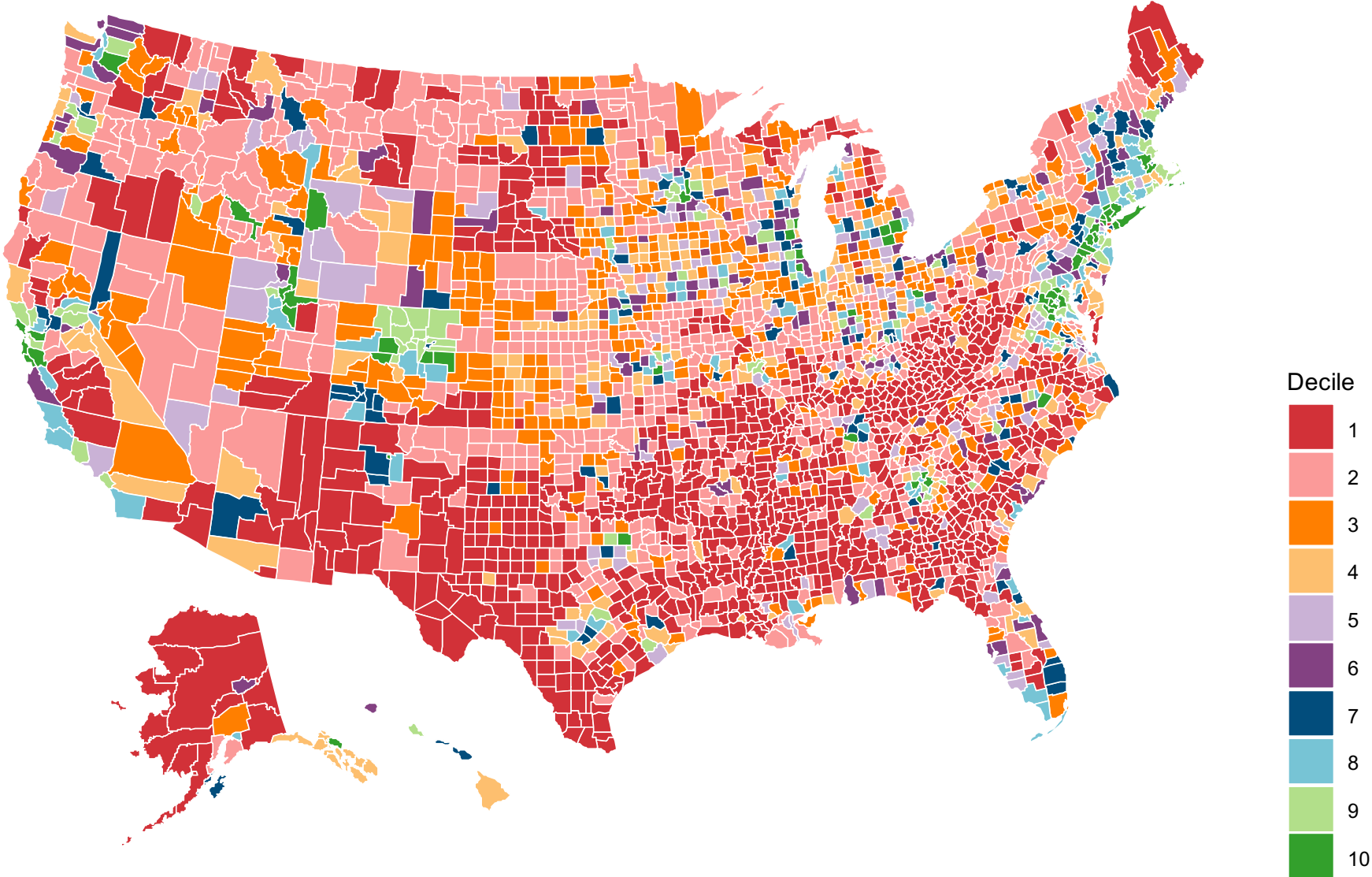
Mortality by decile, 1982-2019
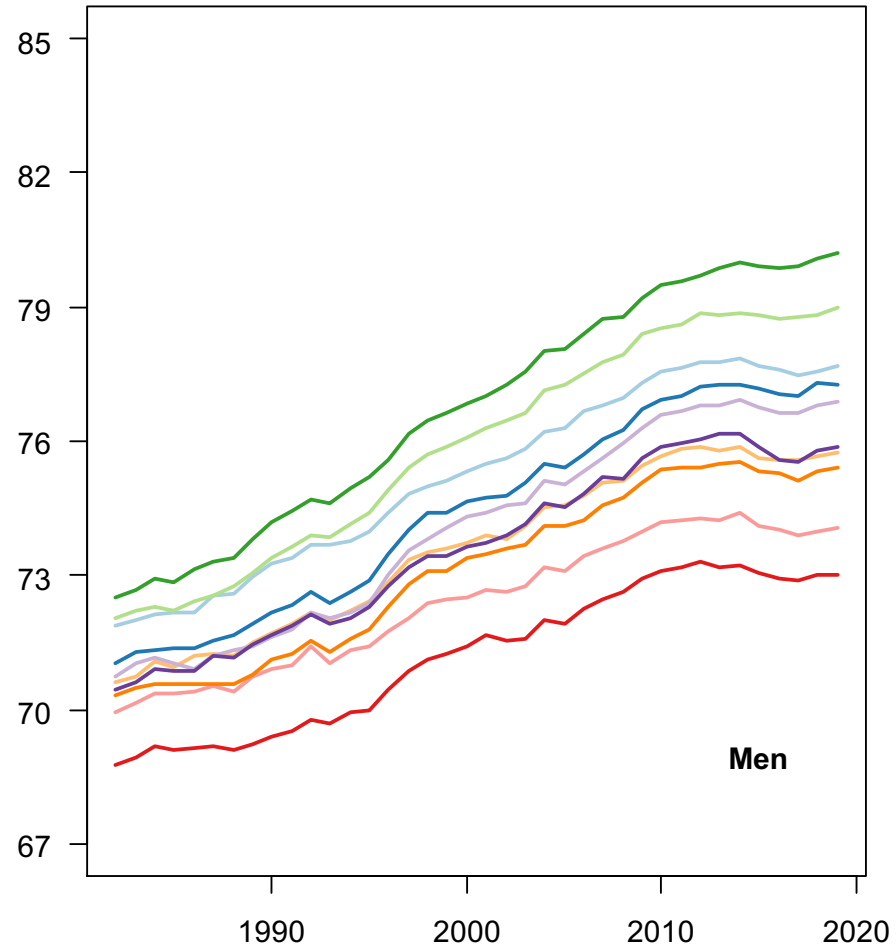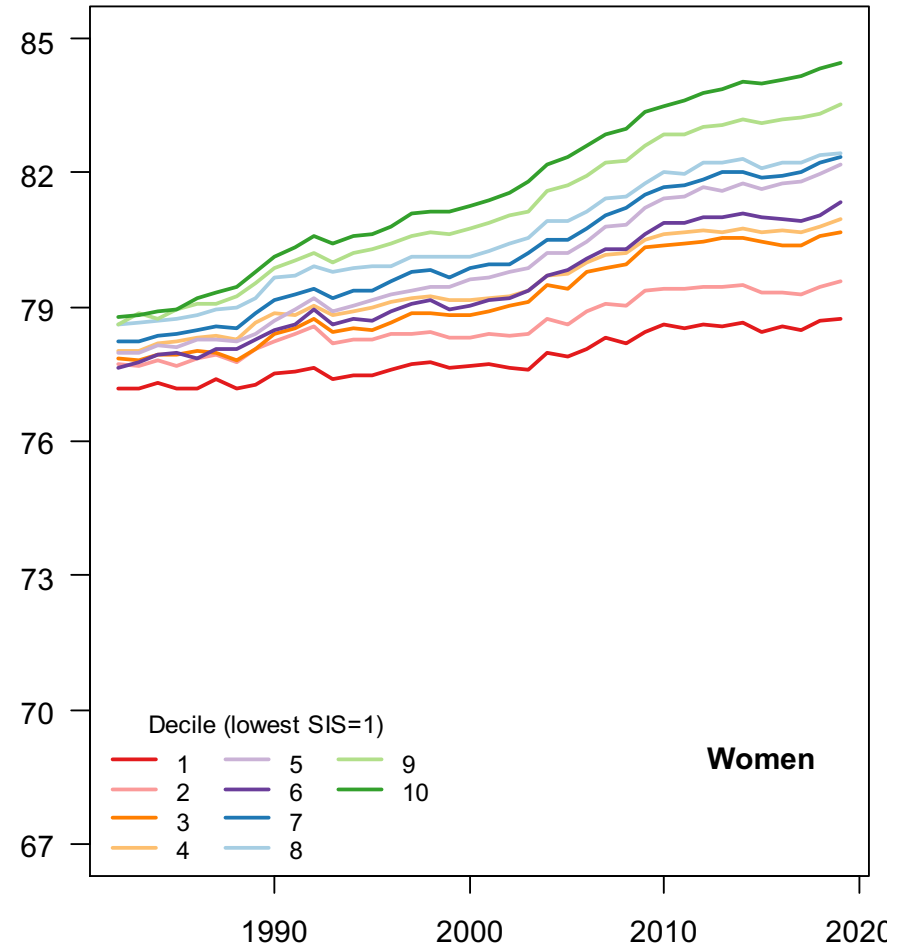
Ratio of qx in each decile to US average, each sex, 1982 (%)

Ratio of qx to U.S. total (3 year moving average)

Men

Women

Decile (lowest SIS=1)

1	5	9
2	6	10
3	7	
4	8	
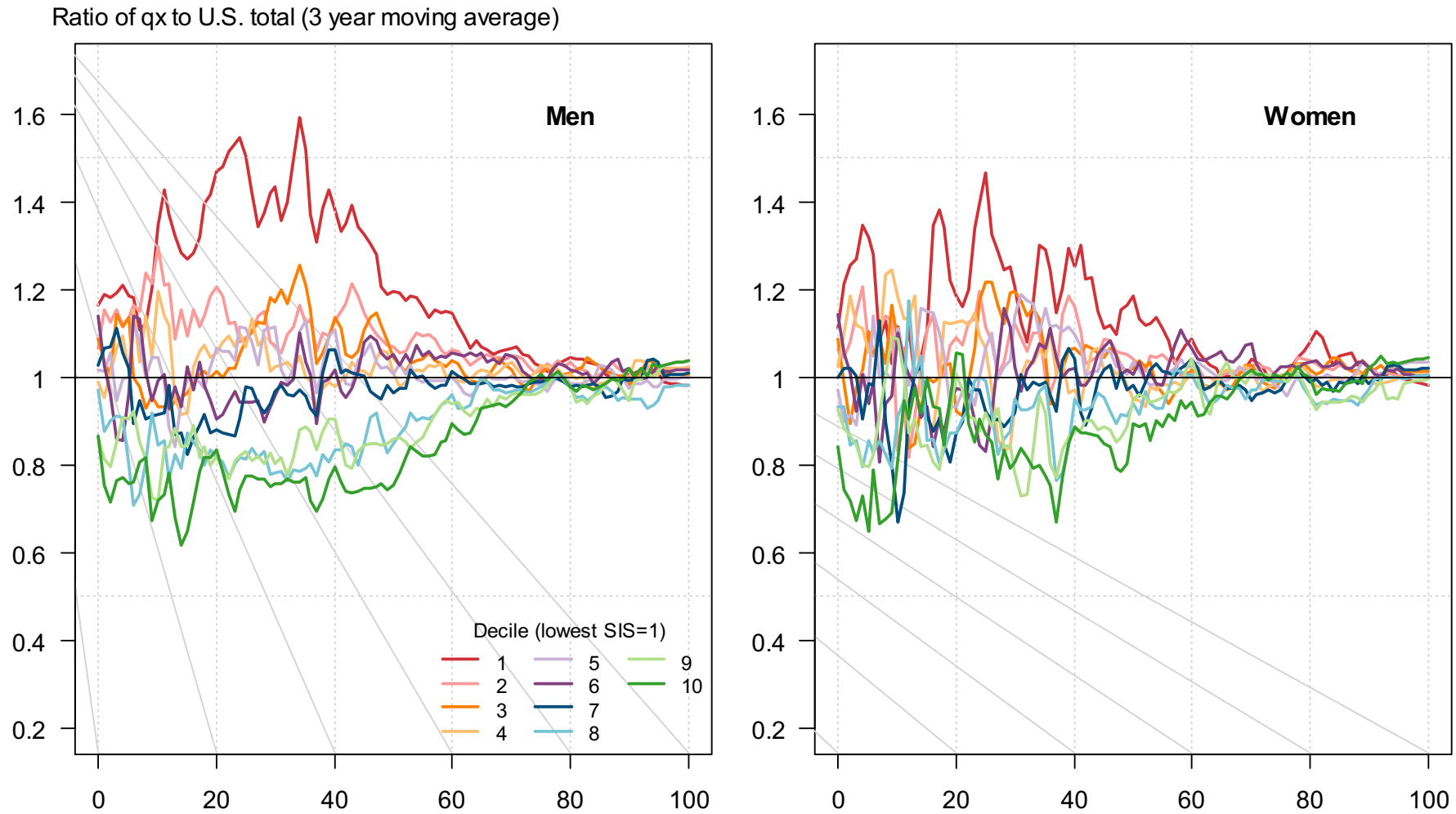
Ratio of qx in each decile to US average, each sex, 2019 (%)

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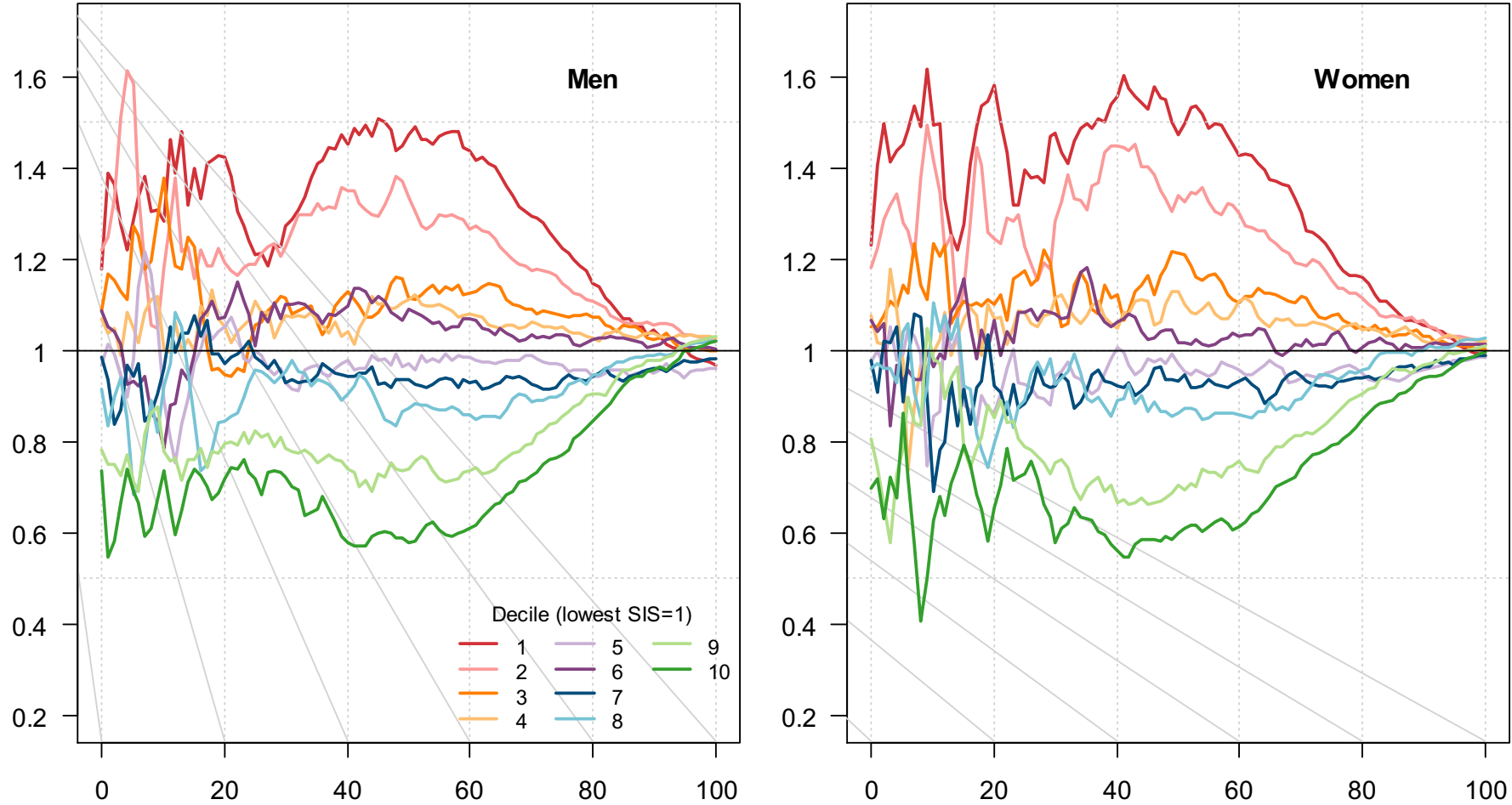
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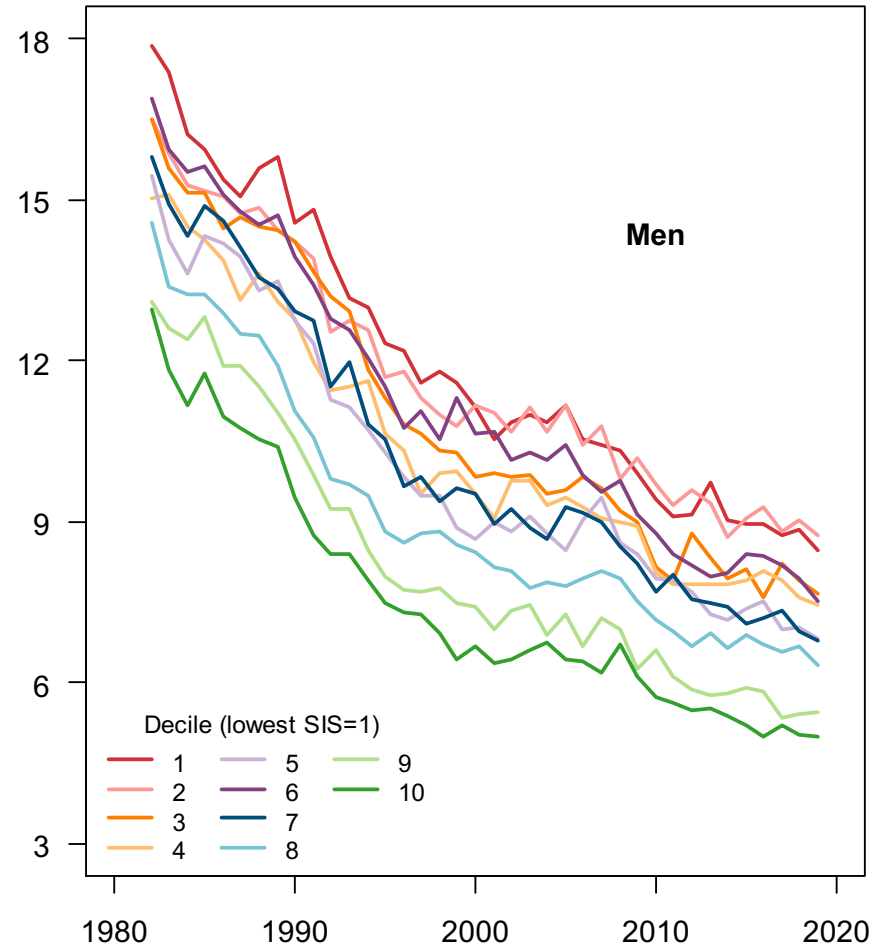
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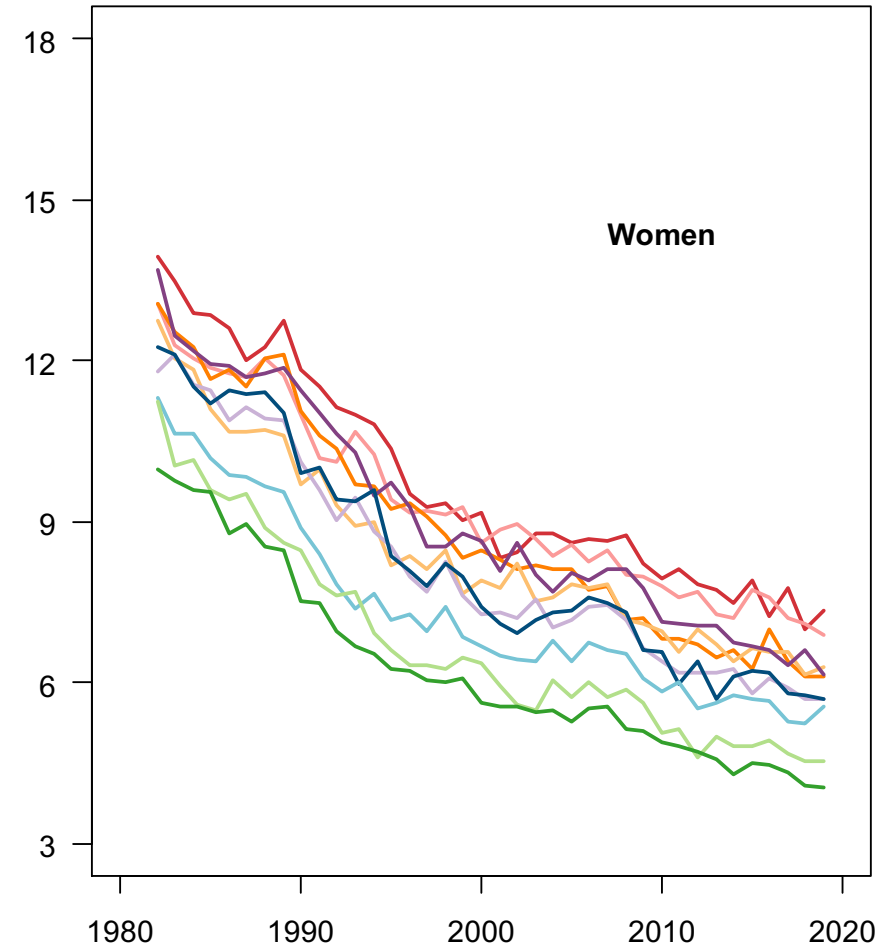
Mortality by decile, 1982-2019

Probability of dying between ages 5 and 25
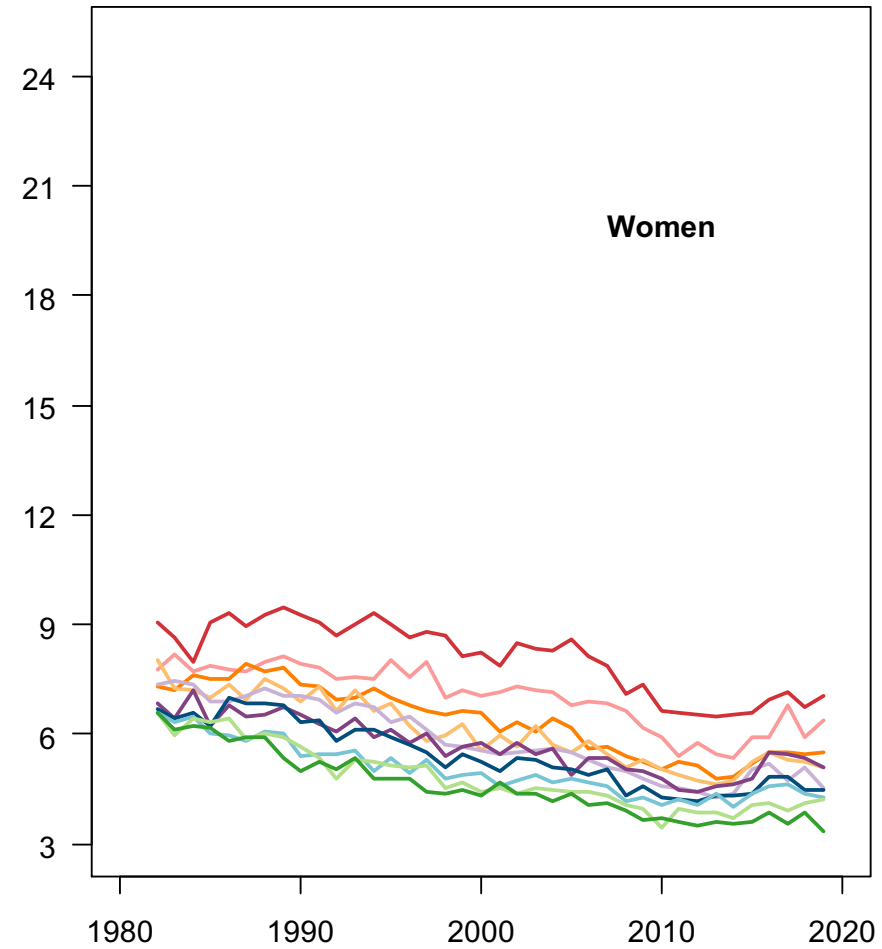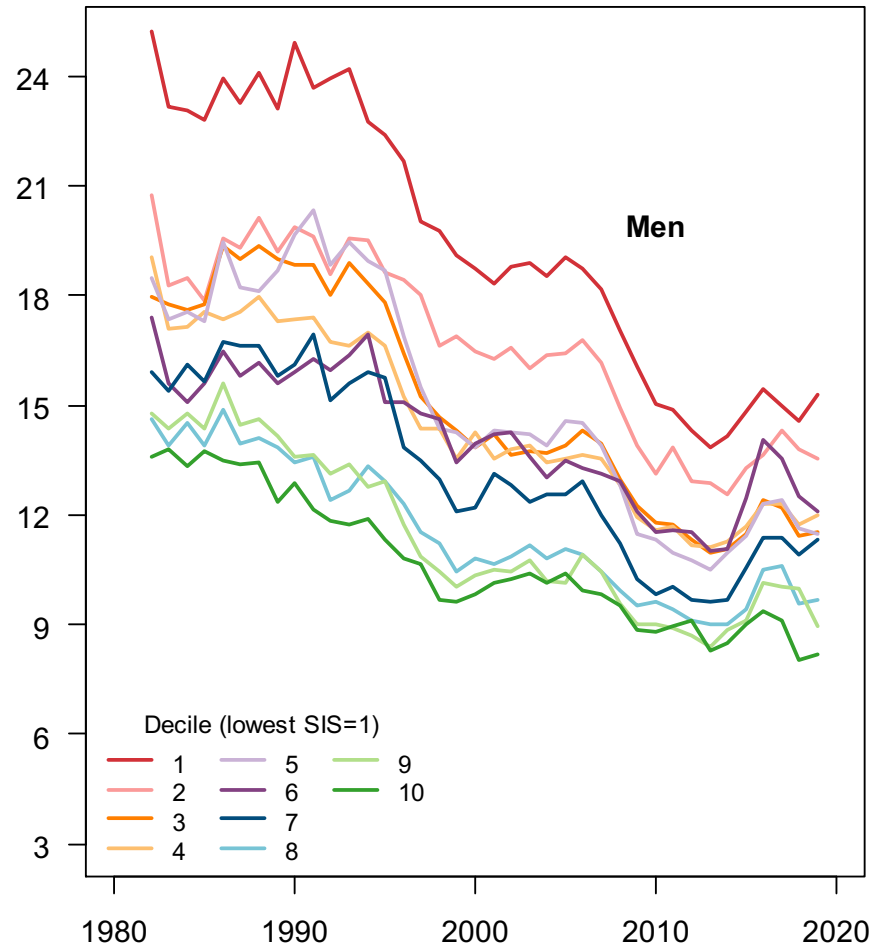
Mortality by decile, 1982-2019

Probability of dying between ages 25 and 45
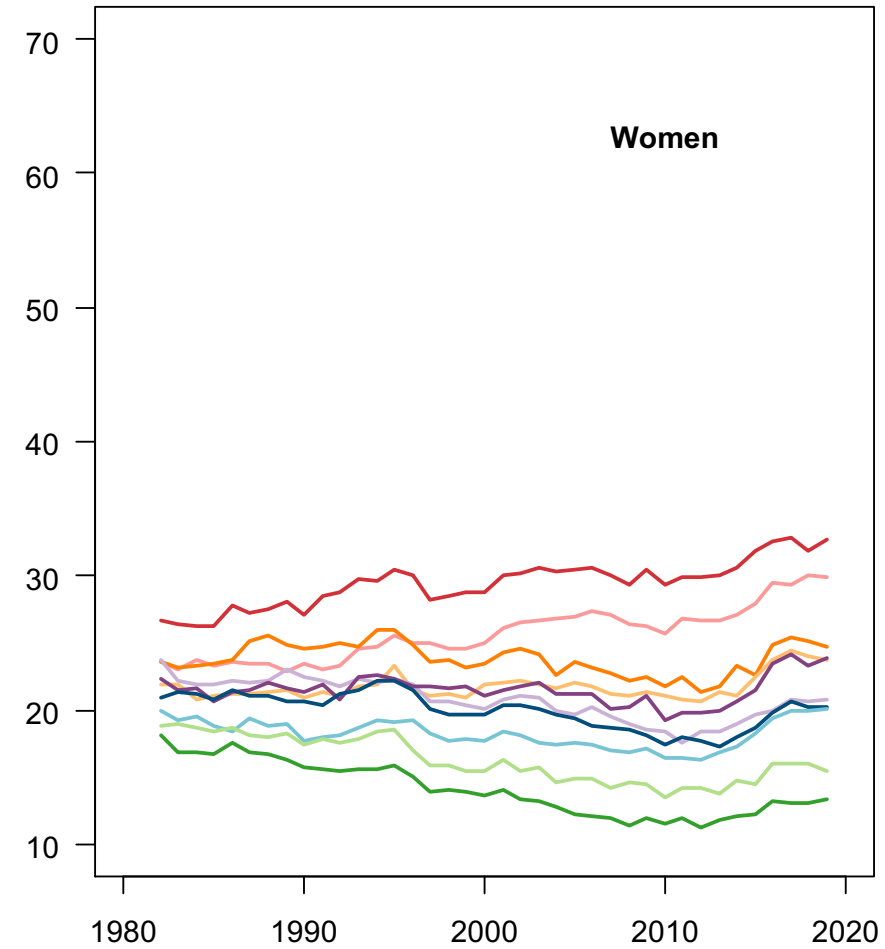
Mortality by decile, 1982-2019

Probability of dying between ages 45 and 65

Mortality by decile, 1982-2019

Probability of dying between ages 65 and 85

Mortality by decile, 1982-2019

Expectation of life at age 65

Men

Women

Decile (lowest SIS=1)
1 5 9
2 6 10
3 7
4 8

Mortality by decile, 1982-2019

Expectation of life at age 85

Ratio of selected mortality indicators of 10th to 1st deciles
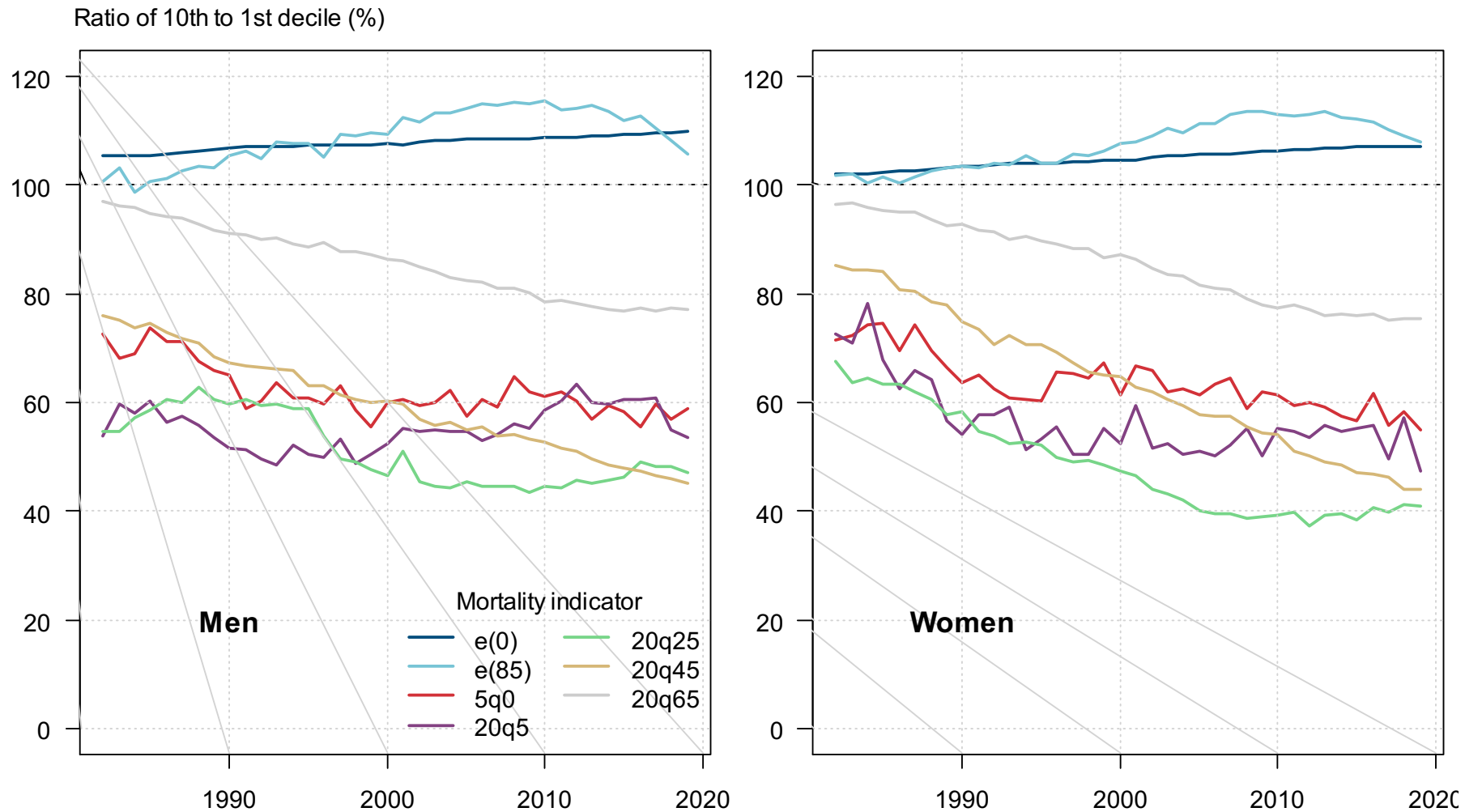
Age contributions to the difference in e(0) between first and tenth deciles by sex, 1982

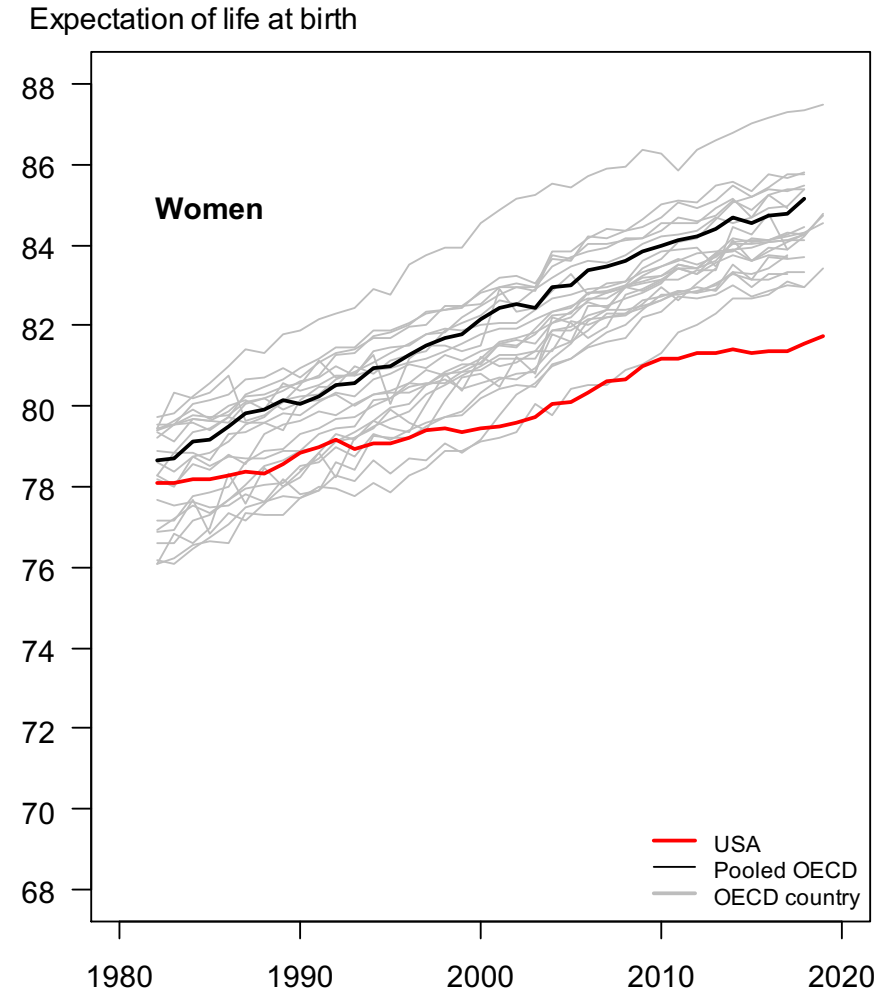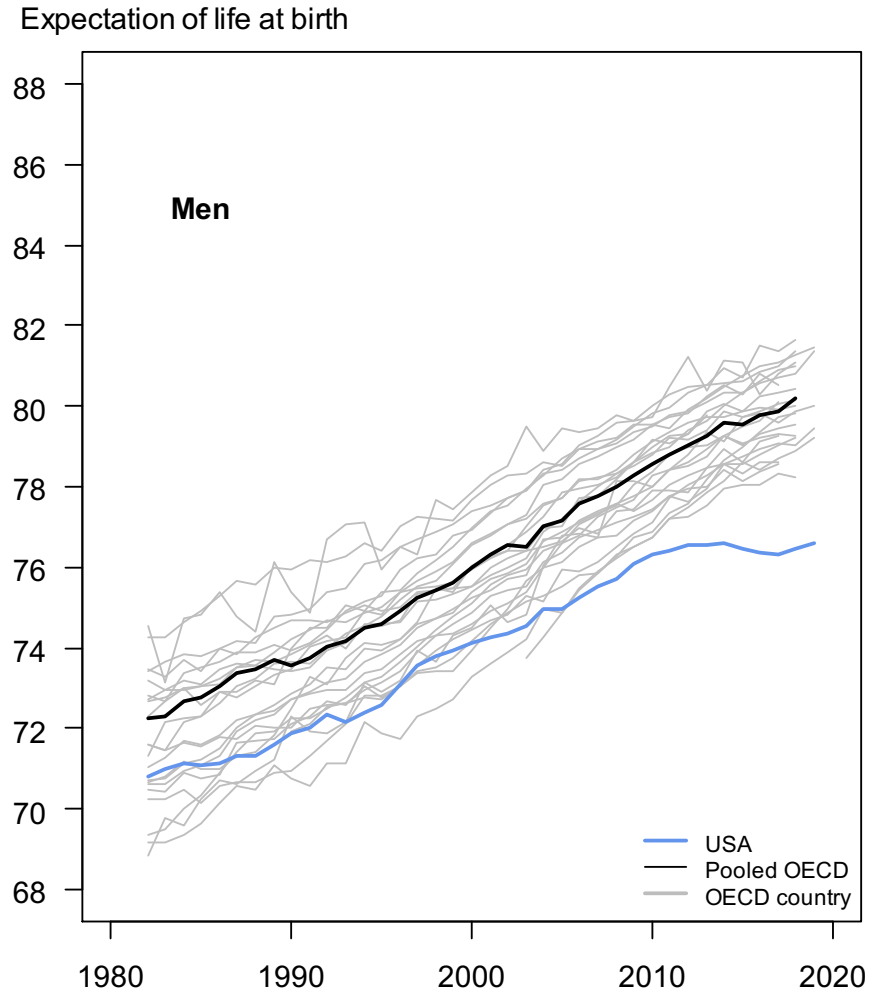Men   e(0) d1 = 68.8 years – d10 = 72.5 years – Diff. = 3.7 years
Women e(0) d1 = 77.2 years – d10 = 78.8 years – Diff. = 1.6 years

Age contributions (in years)
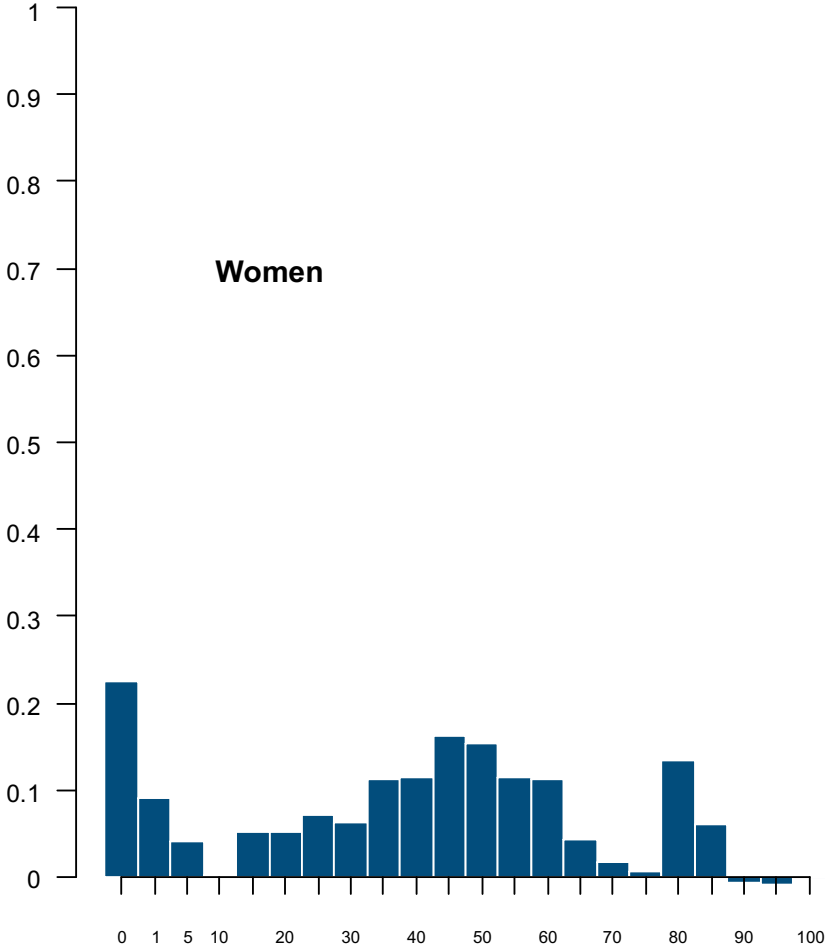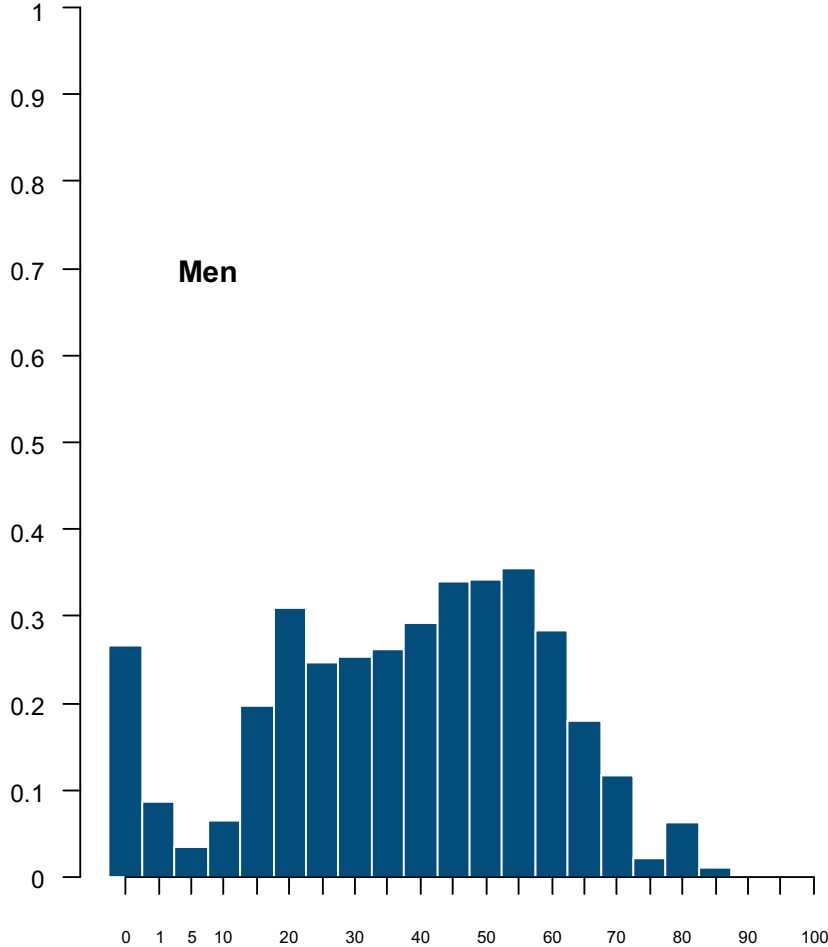
Age contributions to the difference in e(0) between first and tenth deciles by sex, 2019

Men   e(0) d1 = 73.0 years – d10 = 80.2 years – Diff. = 7.2 years
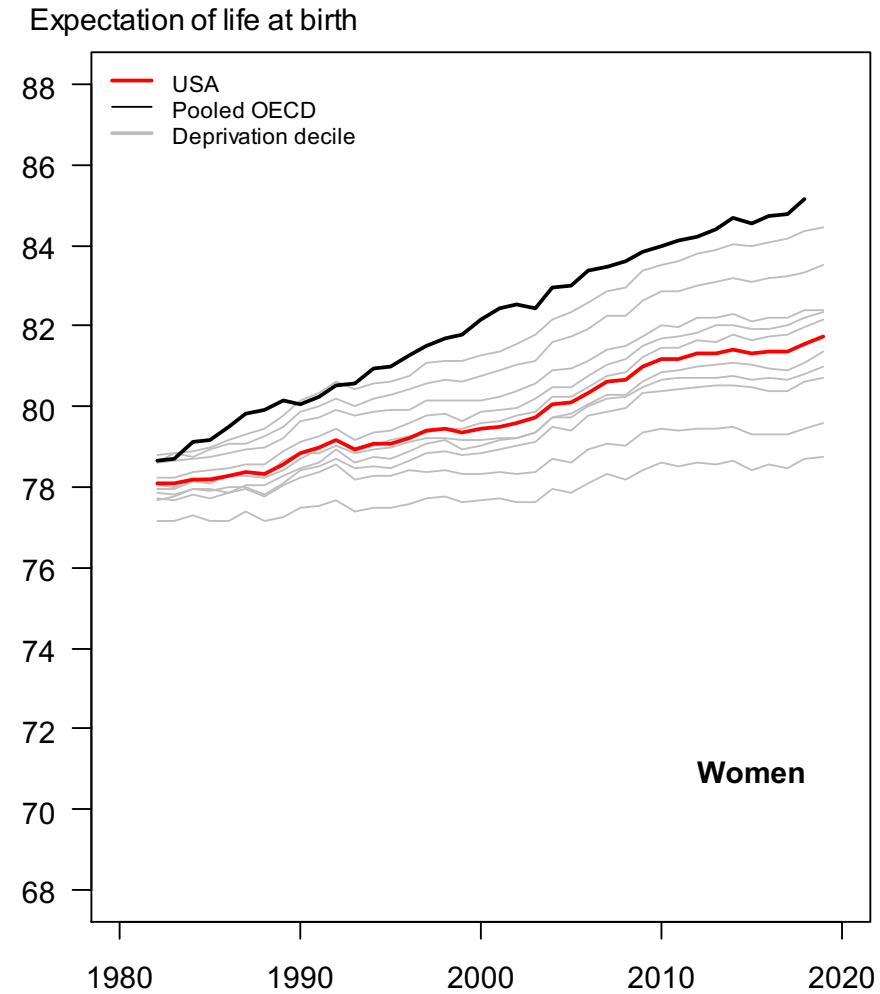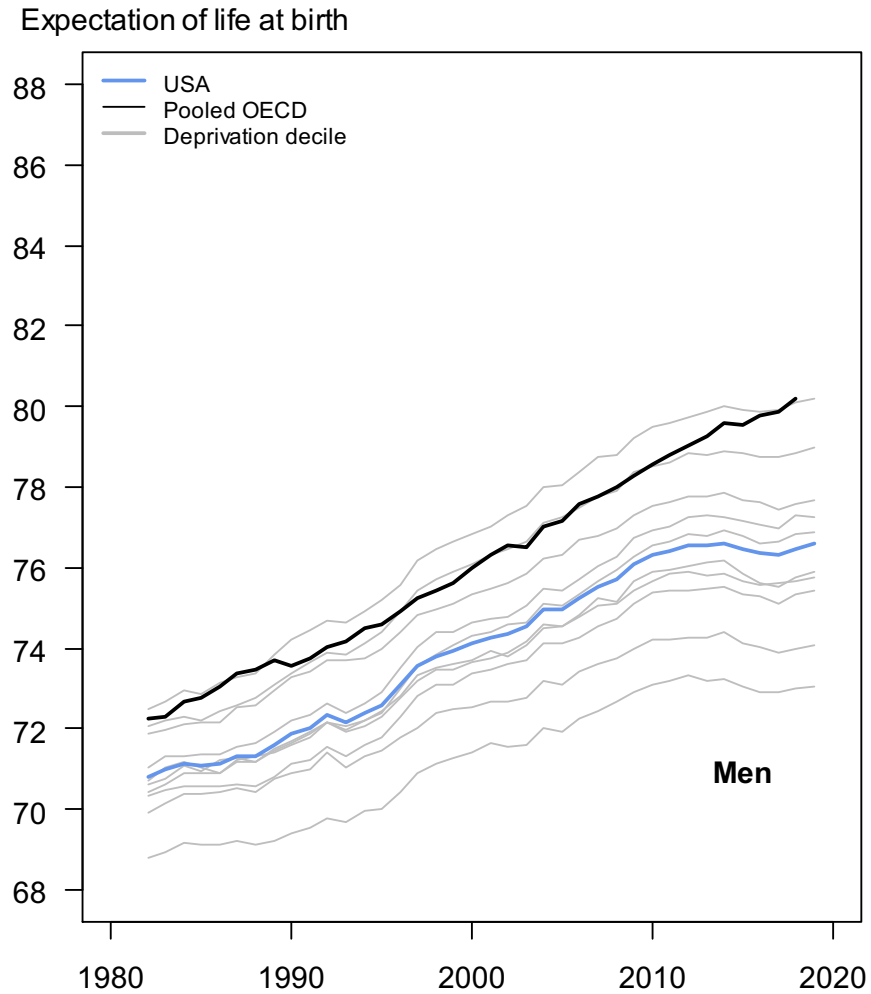Women e(0) d1 = 78.7 years – d10 = 84.5 years – Diff. = 5.7 years

Age contributions (in years)
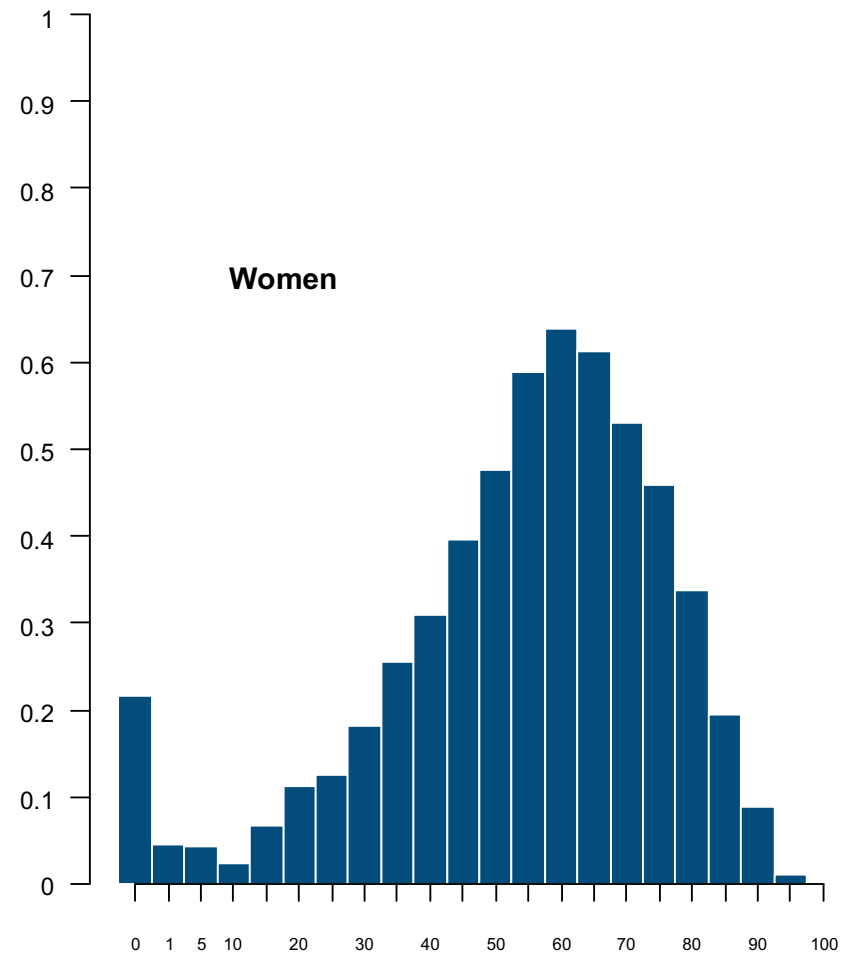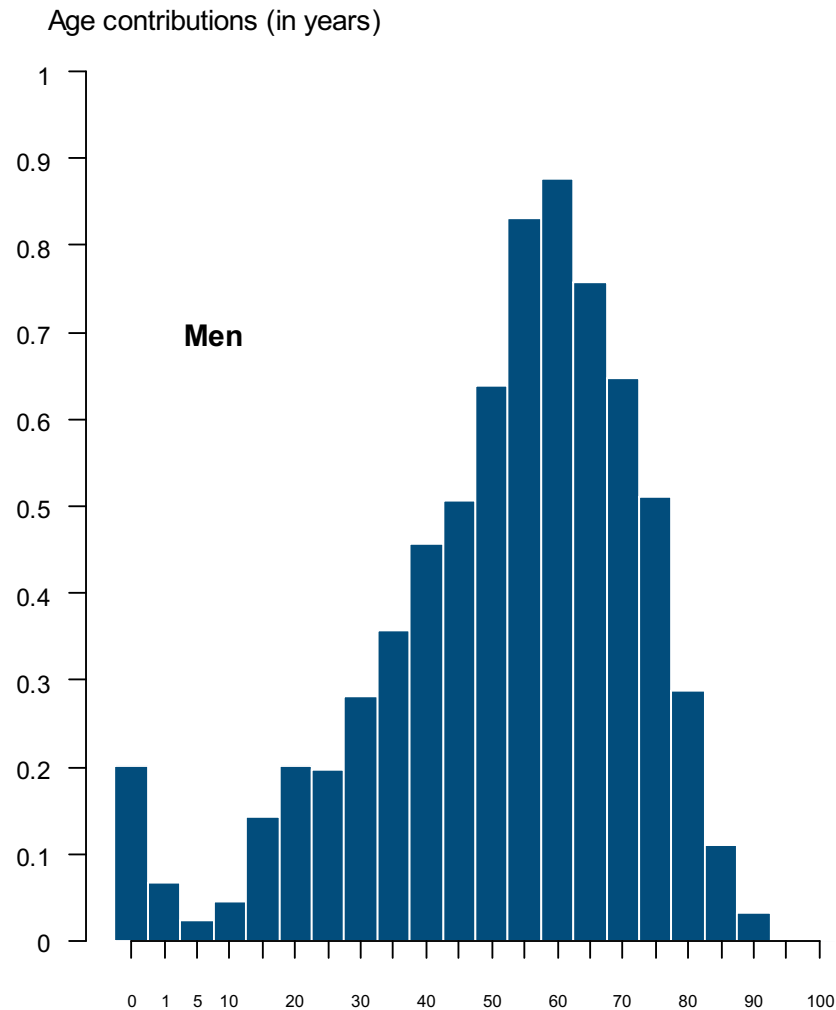
Age contributions to the difference in e(0) between first and tenth deciles by sex, 1982 and 2019
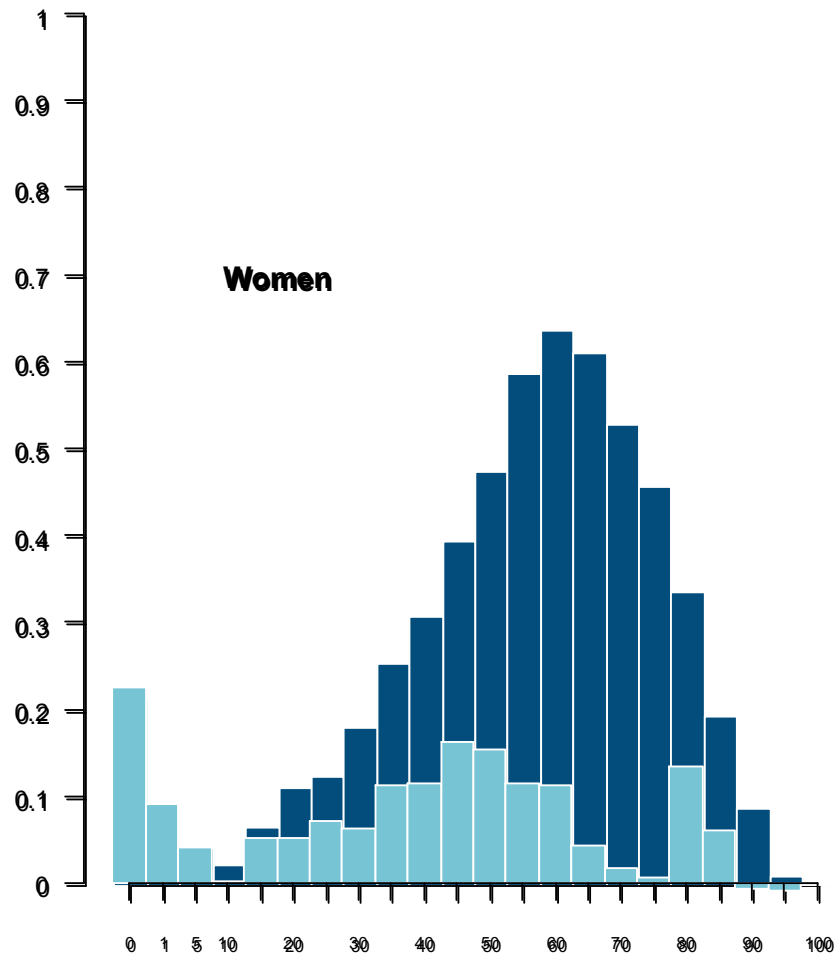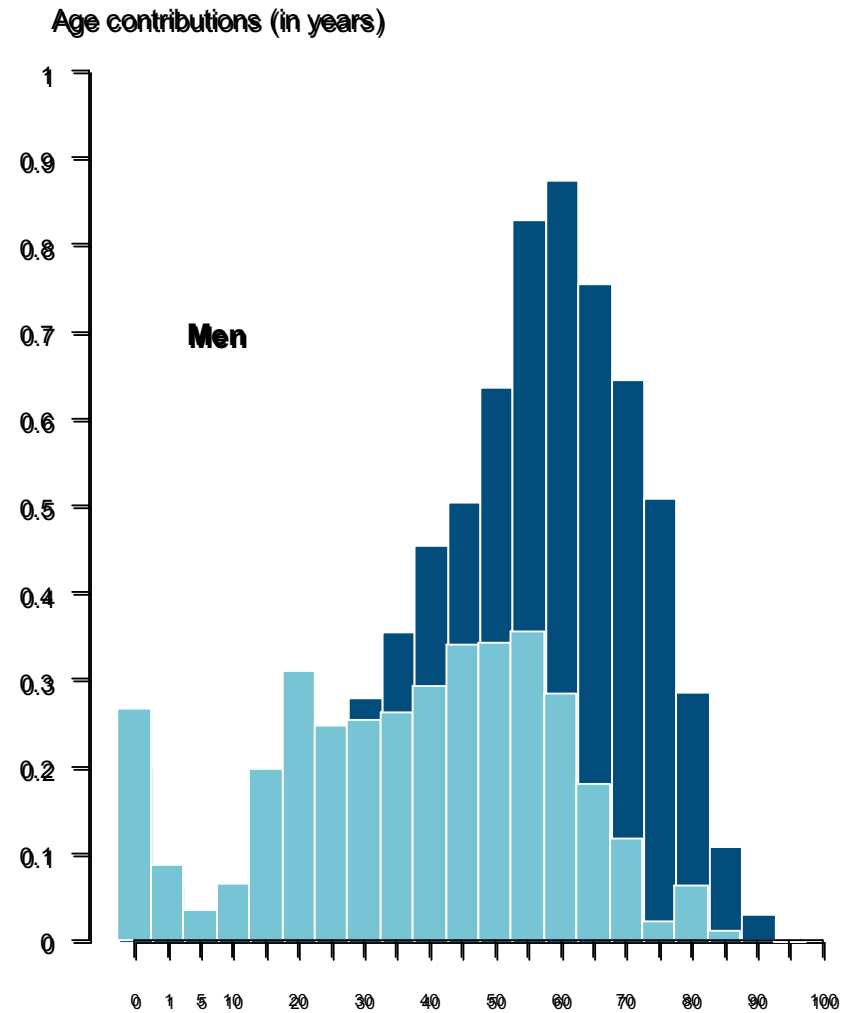
International comparisons:
The US disadvantage in mortality

Expectation of life at birth (Men)

Expectation of life at birth (Women)

County-level socioeconomic inequalities in mortality and the US disadvantage in mortality

Expectation of life at birth

Men

- USA
- Pooled OECD
- Deprivation decile

Expectation of life at birth

Women

- USA
- Pooled OECD
- Deprivation decile

Conclusions

- Clear socioeconomic gradient in life expectancy at birth and other mortality values
- Increasing inequalities over time
- Larger disparities for men than for women
- Larger inequalities below age 45 years than above
- The opioid epidemic has affected all Americans, including those living in the most affluent areas
- Only the least deprived American women have longer lives than the average women in other high-income democracies

Possible extensions

- Compare inter- and intra-decile disparities in mortality using data from the USMDB

- Investigate differences in cause-of-death structure by decile (incl. Covid-19)

- Concentrate on mortality variations across deciles for specific categories (racial/ethnic, foreign born, urban/rural, etc…)

Using fixed versus variable SIS
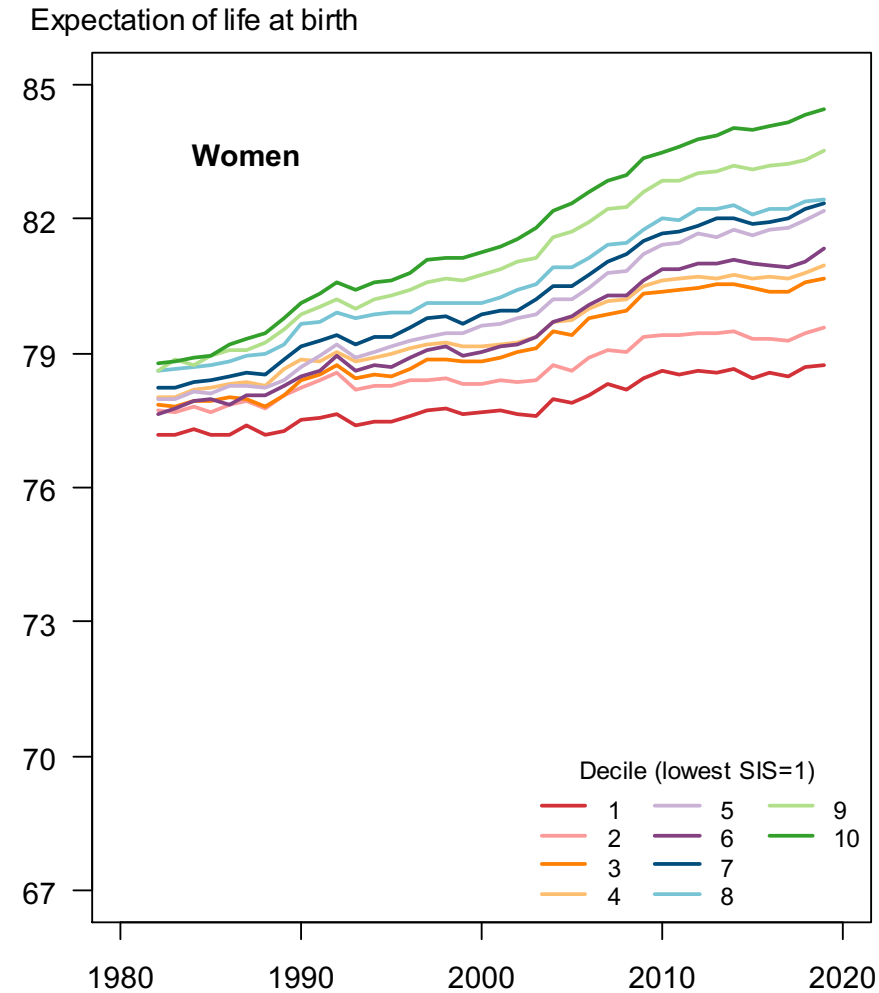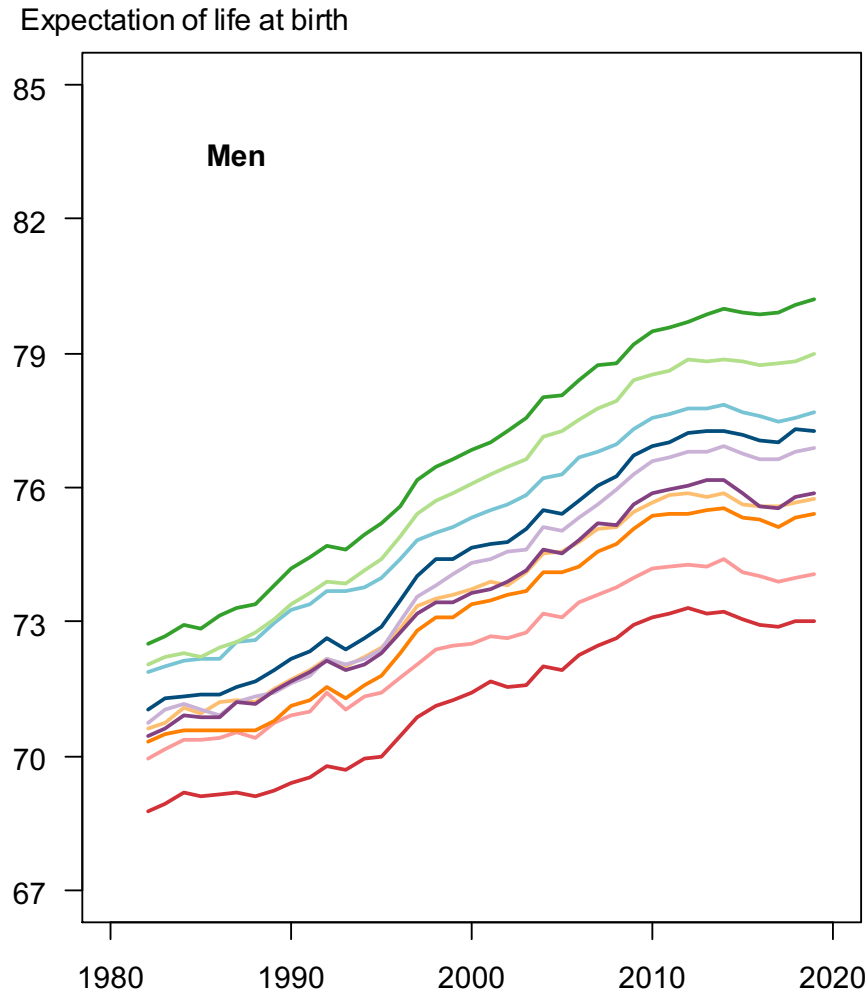
An overall pattern that is very similar...

Variable SIS
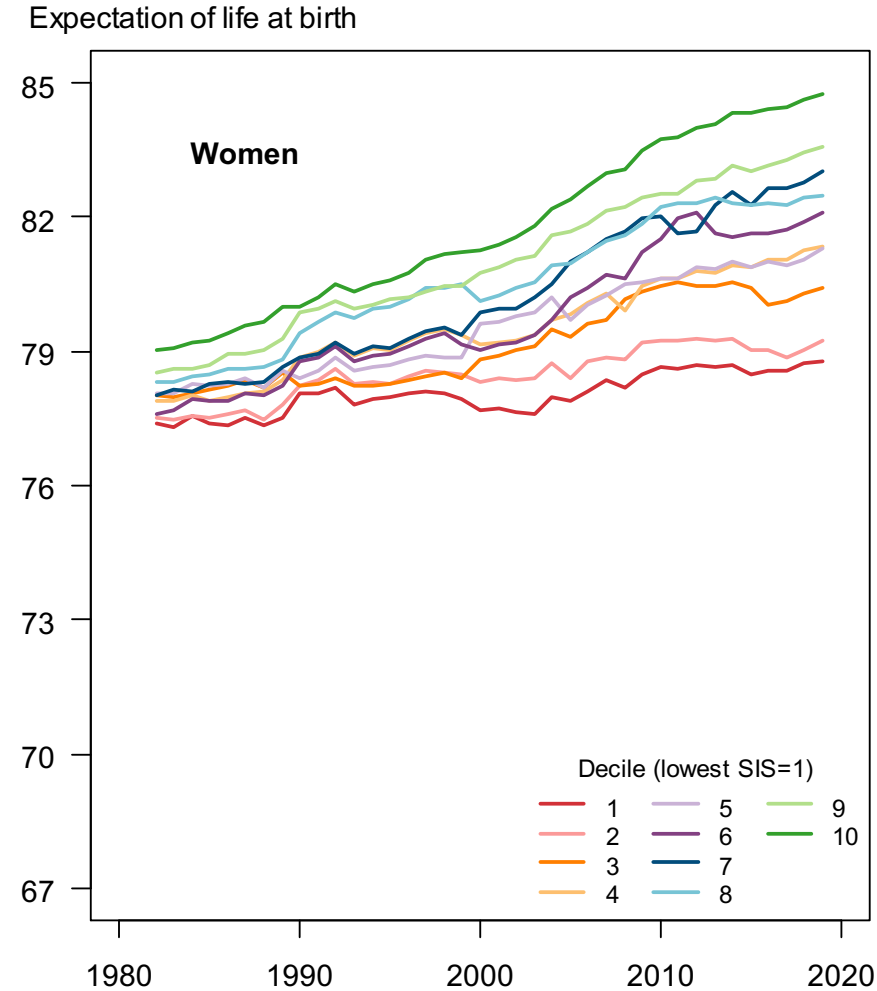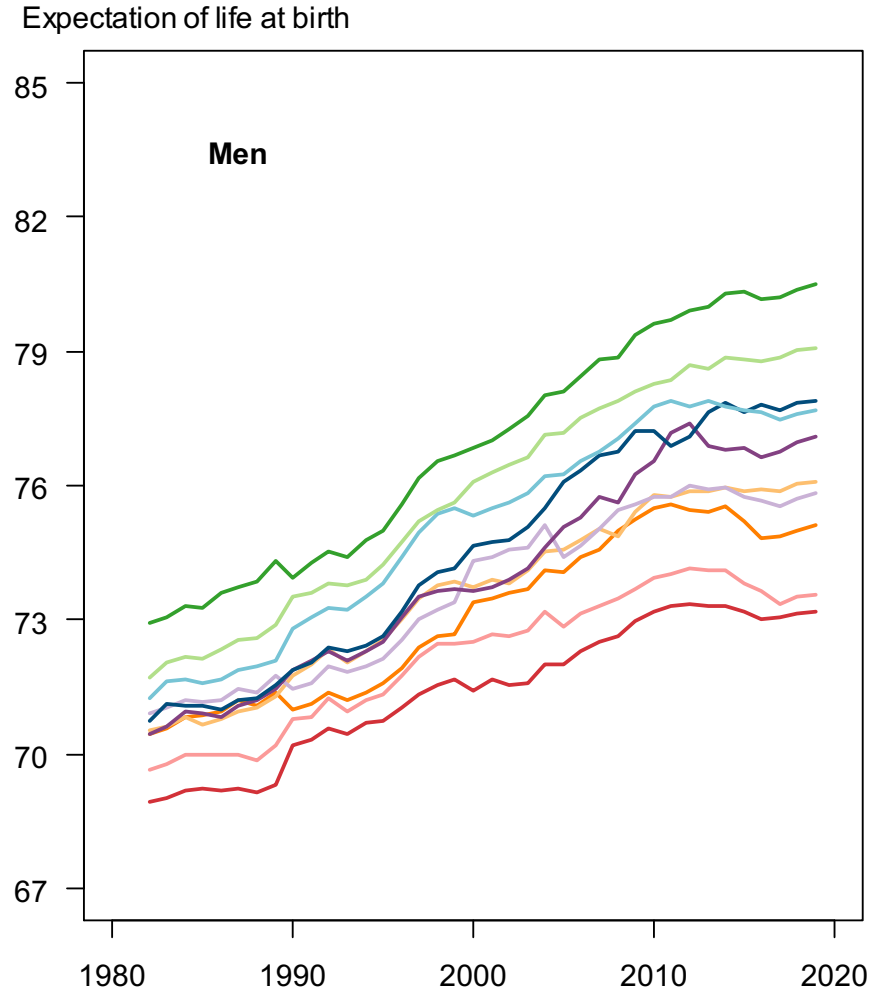
Using fixed versus variable SIS

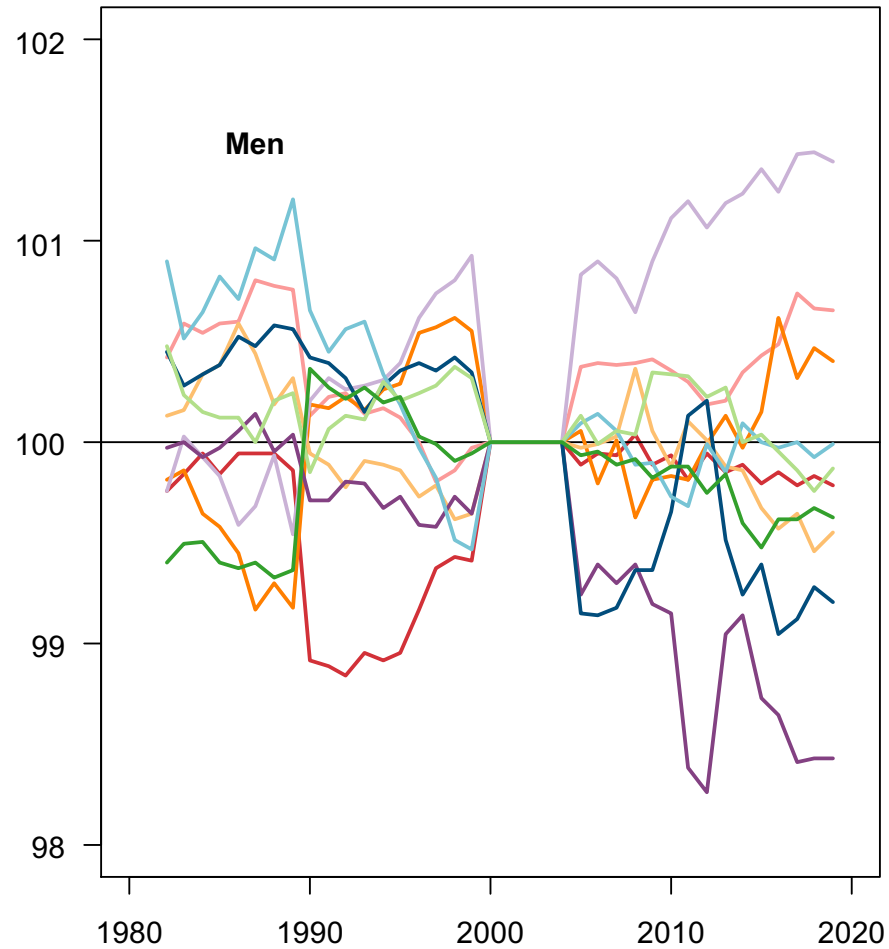An overall pattern that is very similar...

Fixed SIS (to 2000)

Using fixed versus variable SIS

... but with some differences

Ratio of e(0) fixed to variable

Ratio of e(0) fixed to variable