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RESEARCH





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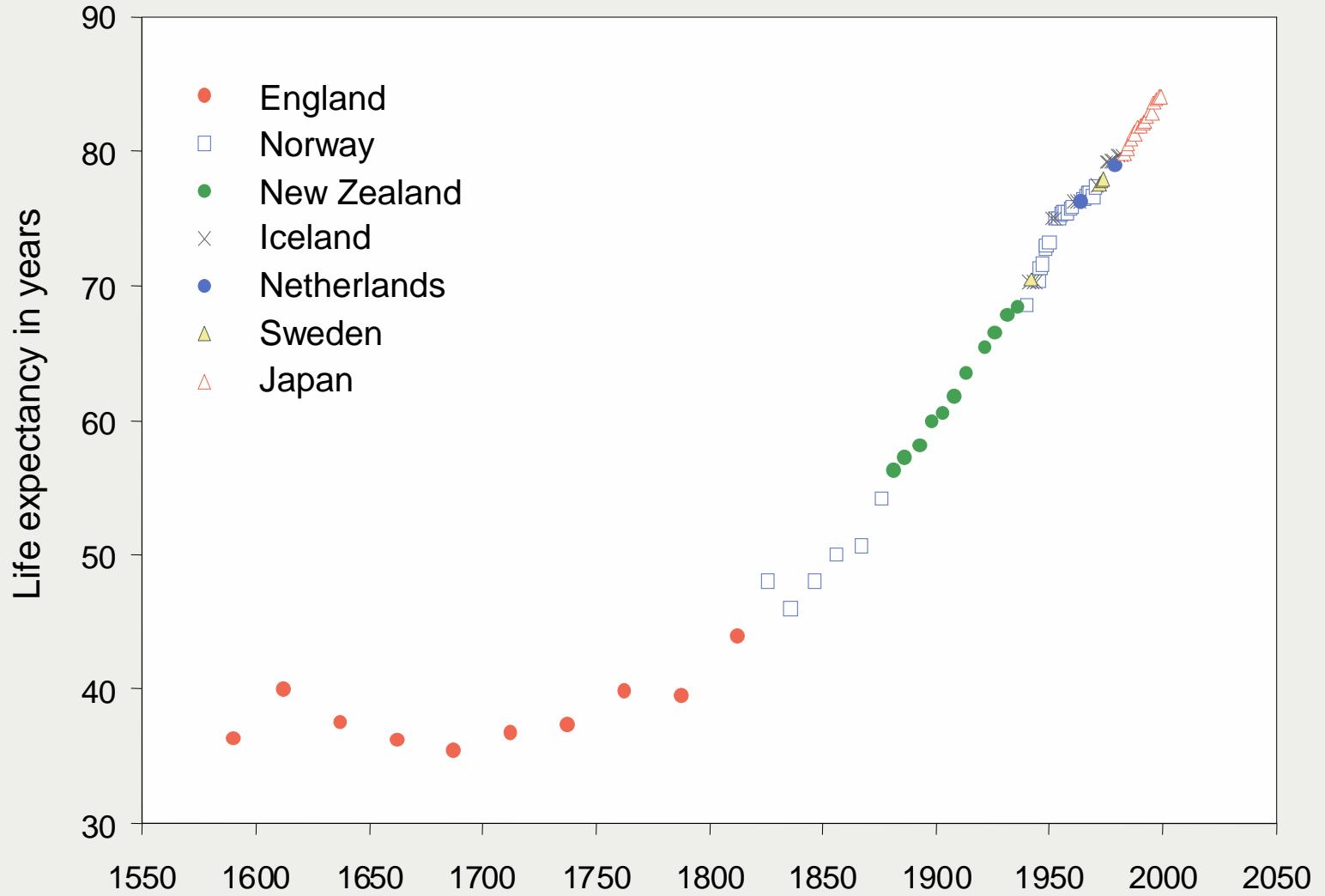
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Longer and longer lives: Some remarkable new research findings

James W. Vaupel

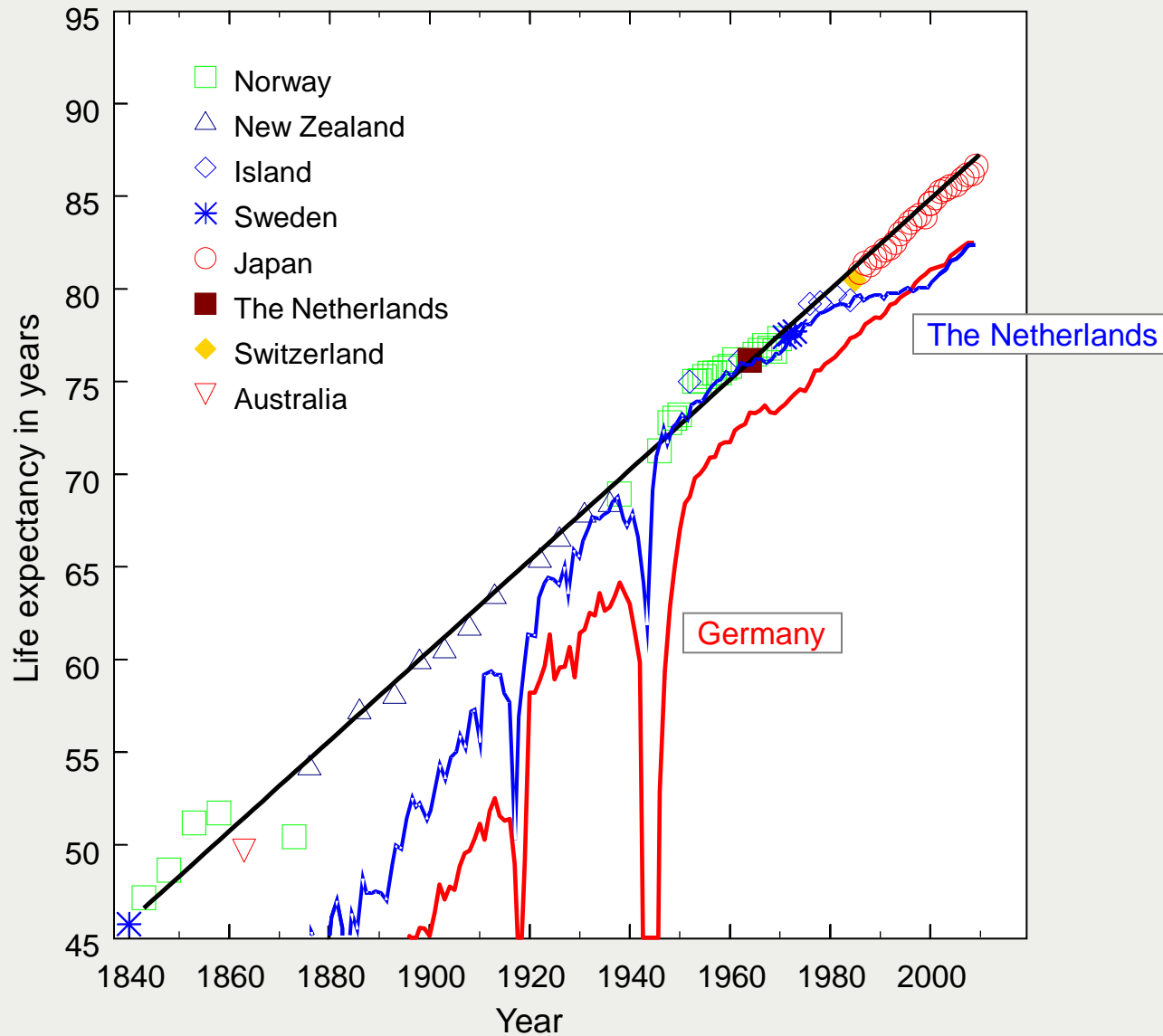
*Longevity 7, Frankfurt,
8 September 2011*

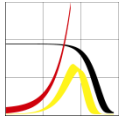






The linear rise of best-practice life expectancy





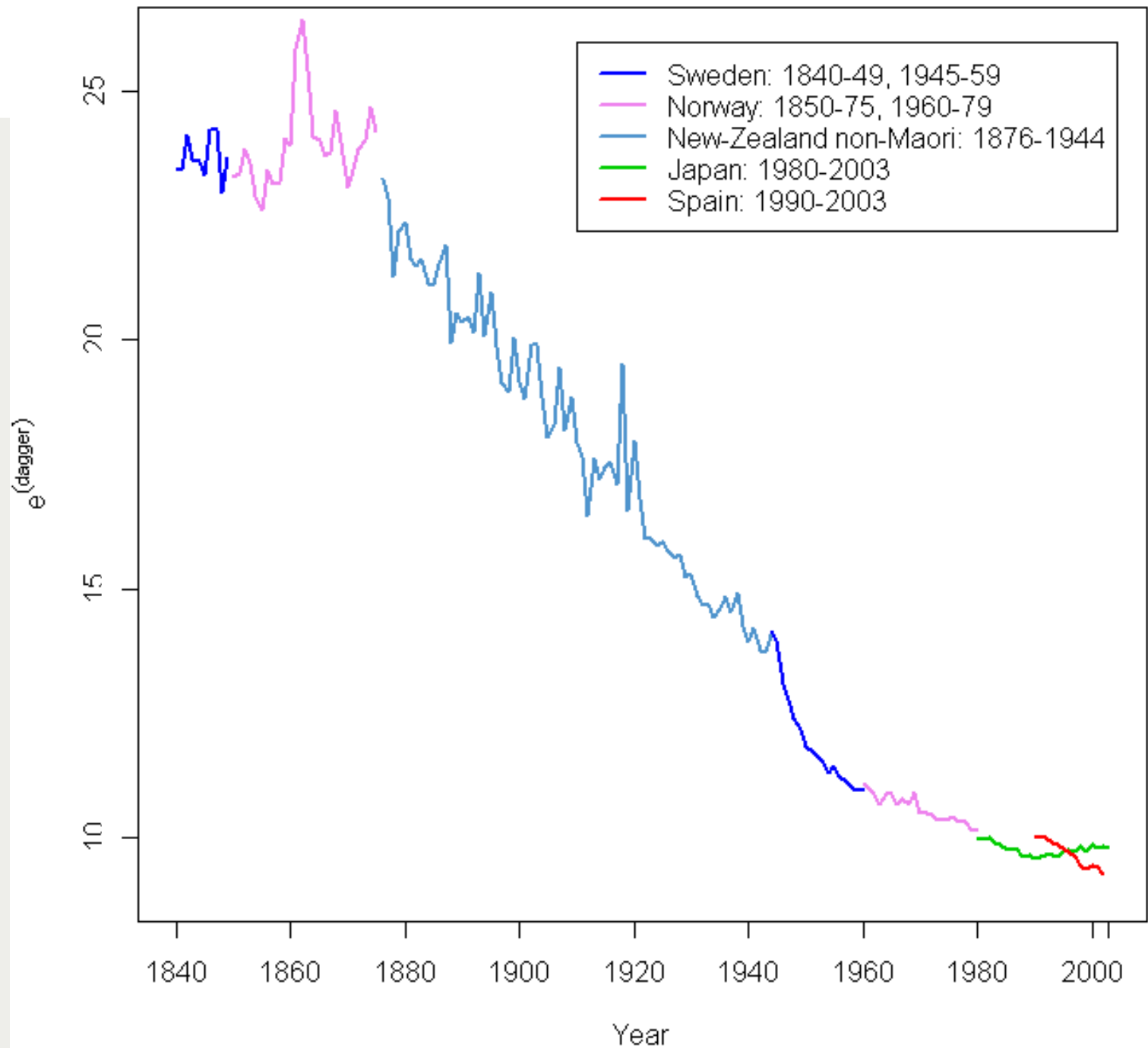
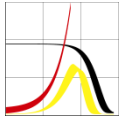
Decomposing Change in Life Expectancy

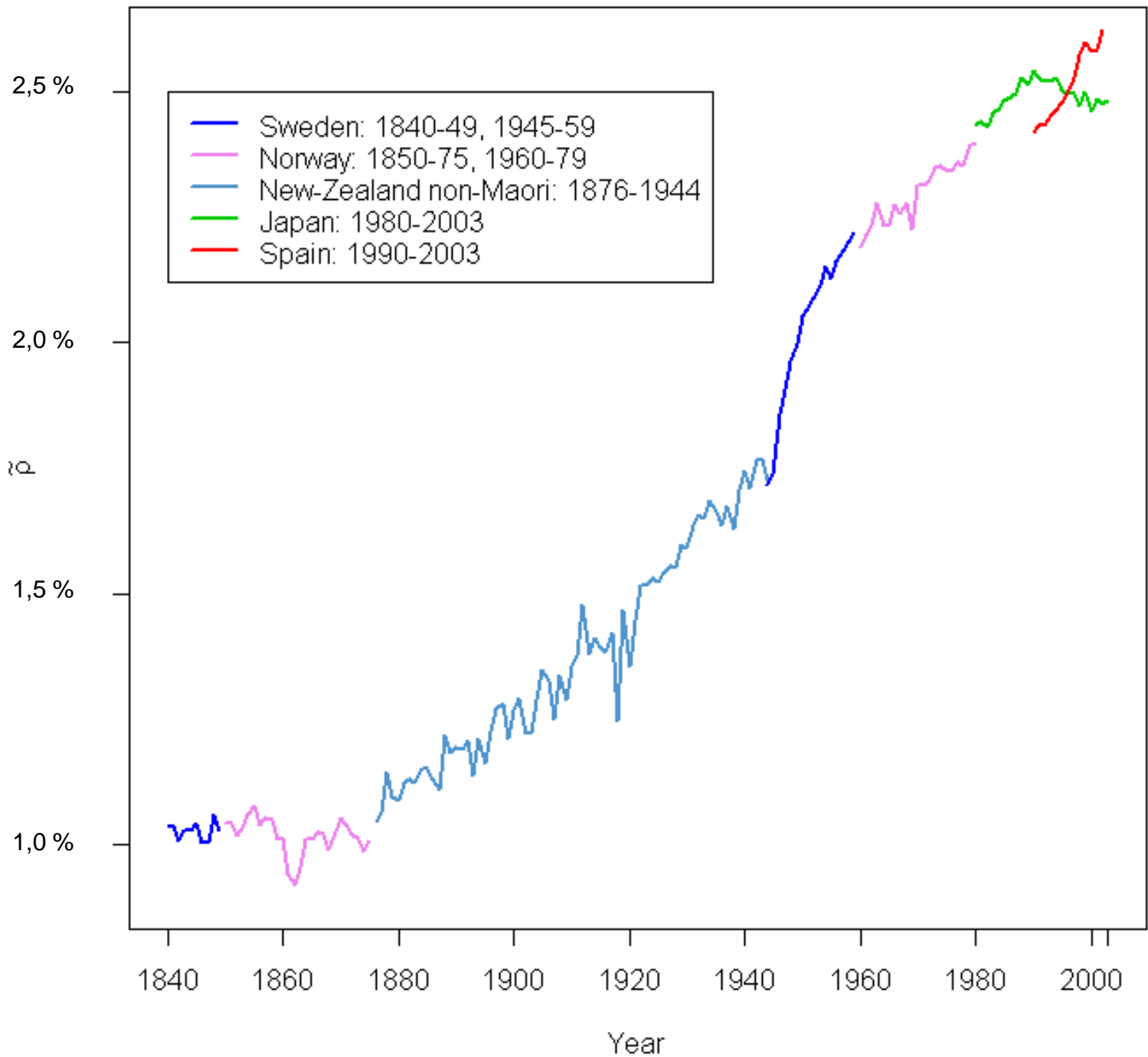
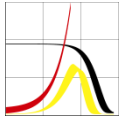
Why?

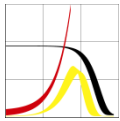
$$\frac{de_0}{dt} = \dot{e}_0 = \bar{\rho} e^{\dagger}$$

Year	\dot{e}_0	$\bar{\rho}$	e^{\dagger}
1840	0.25	1.0 %	25
2000	0.25	2.5%	10

*Vaupel+Canudas Romo,
Demography 2004*

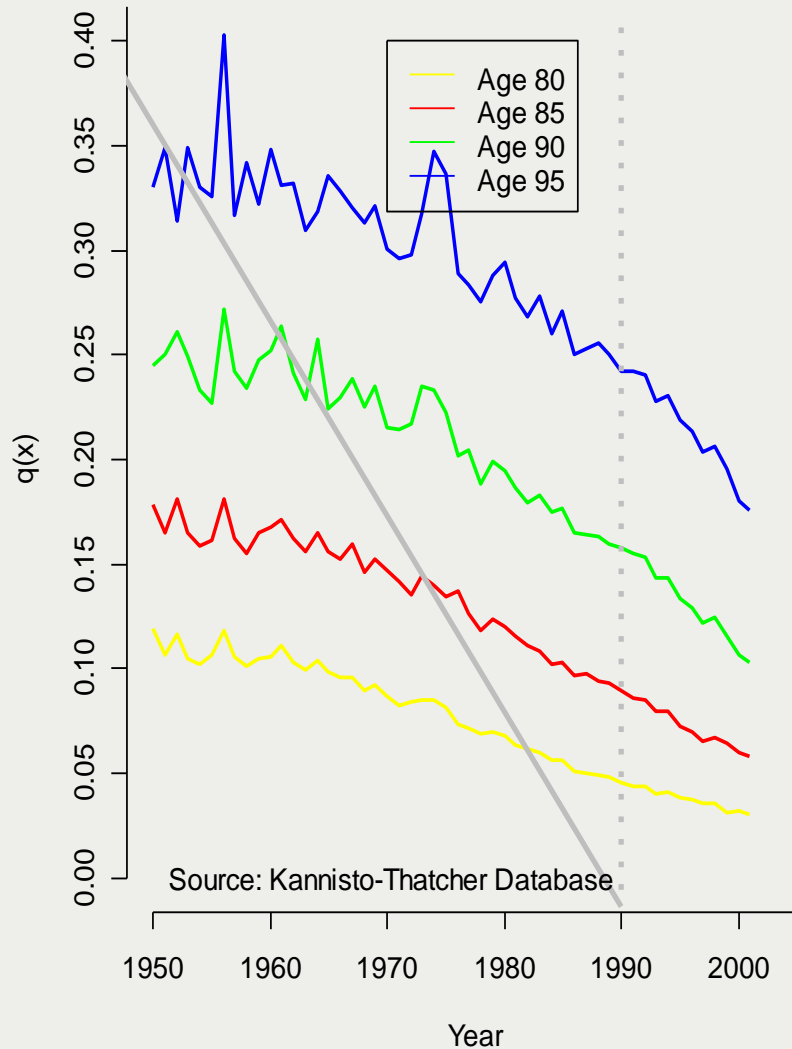




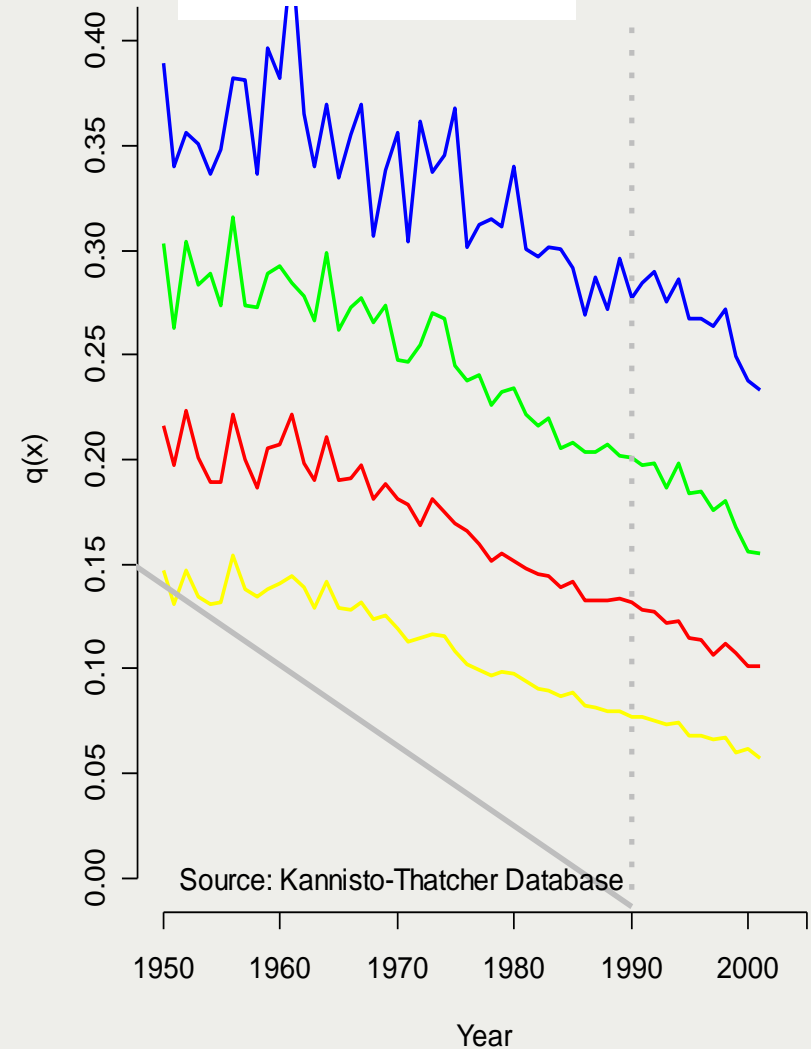


The decline in chances of death in Japan at ages 80, 85, 90 and 95

q(x), Japan, Women



q(x), Japan, Men

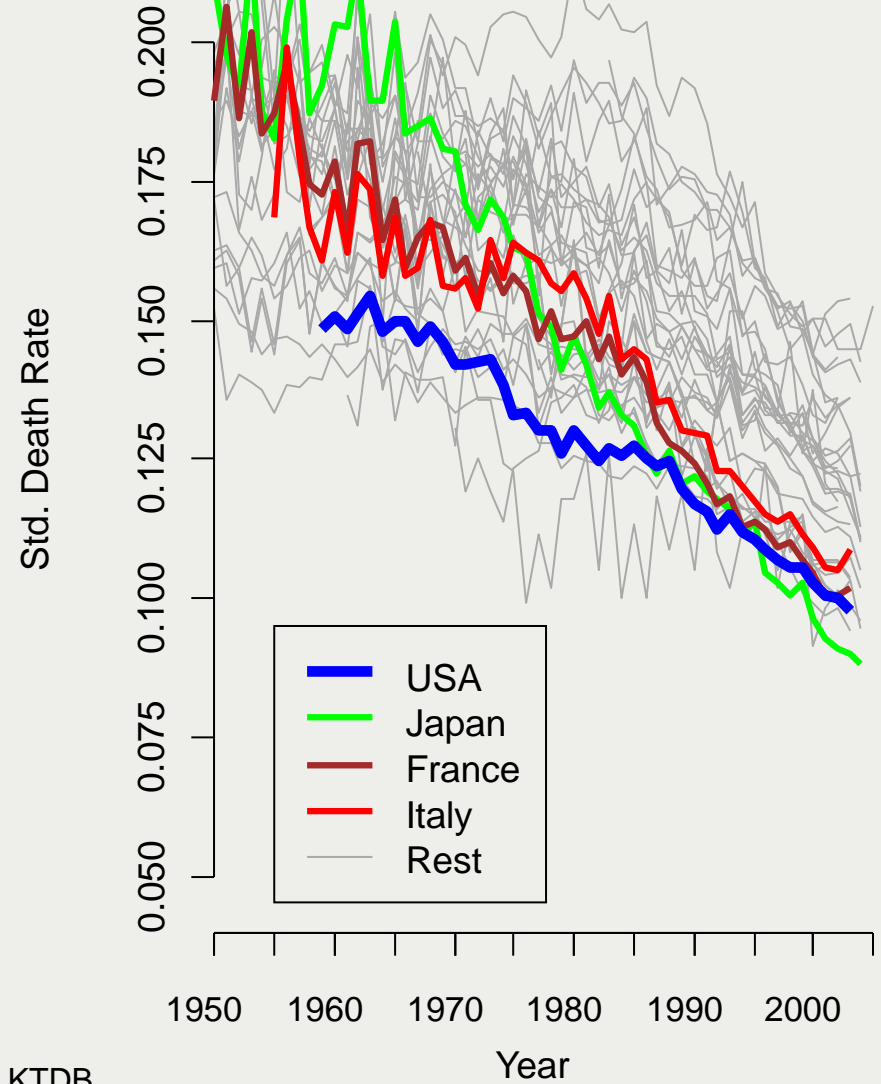
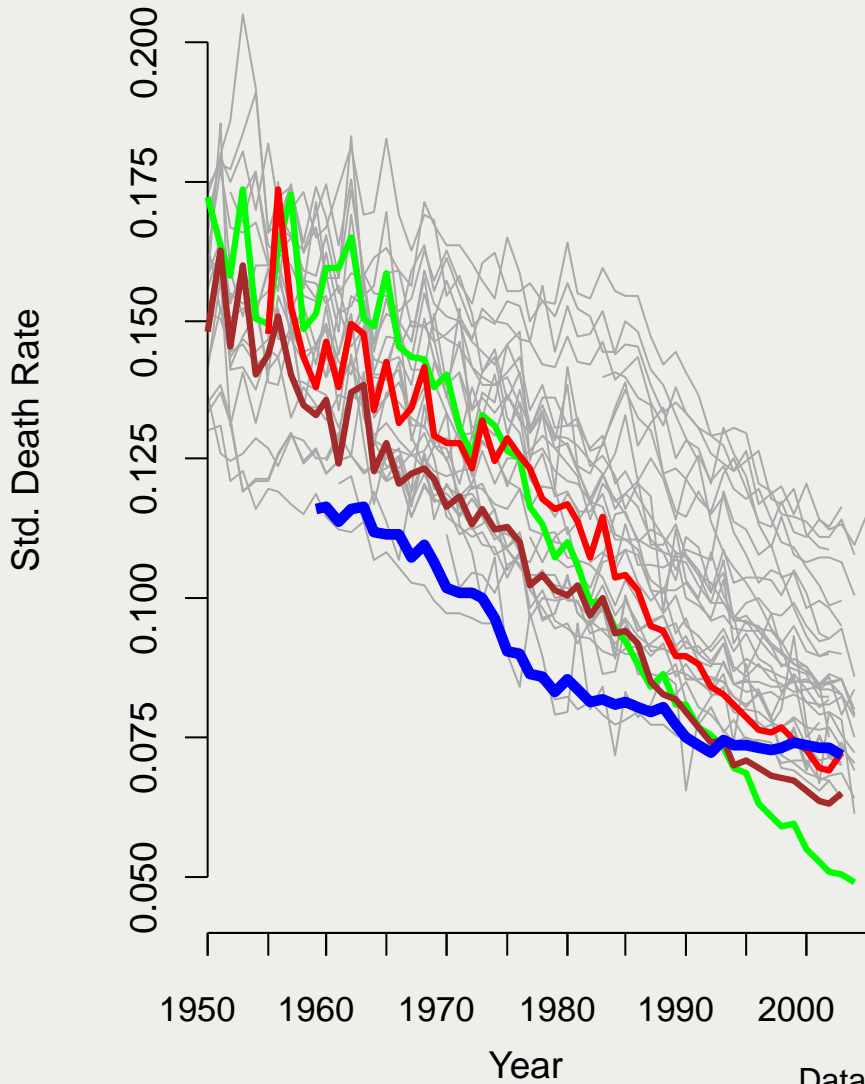




Age-Standardized Death Rates

Women, Ages 80-89

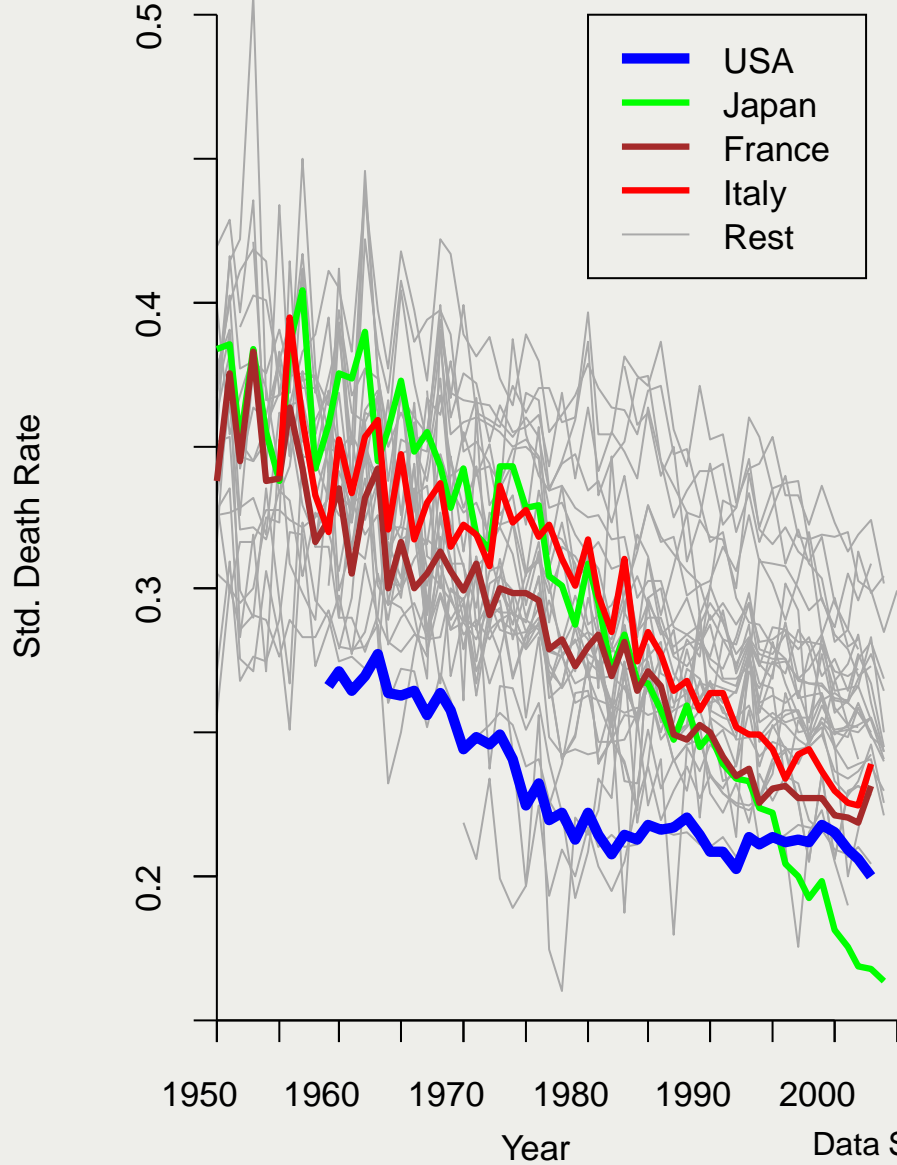
Men, Ages 80-89



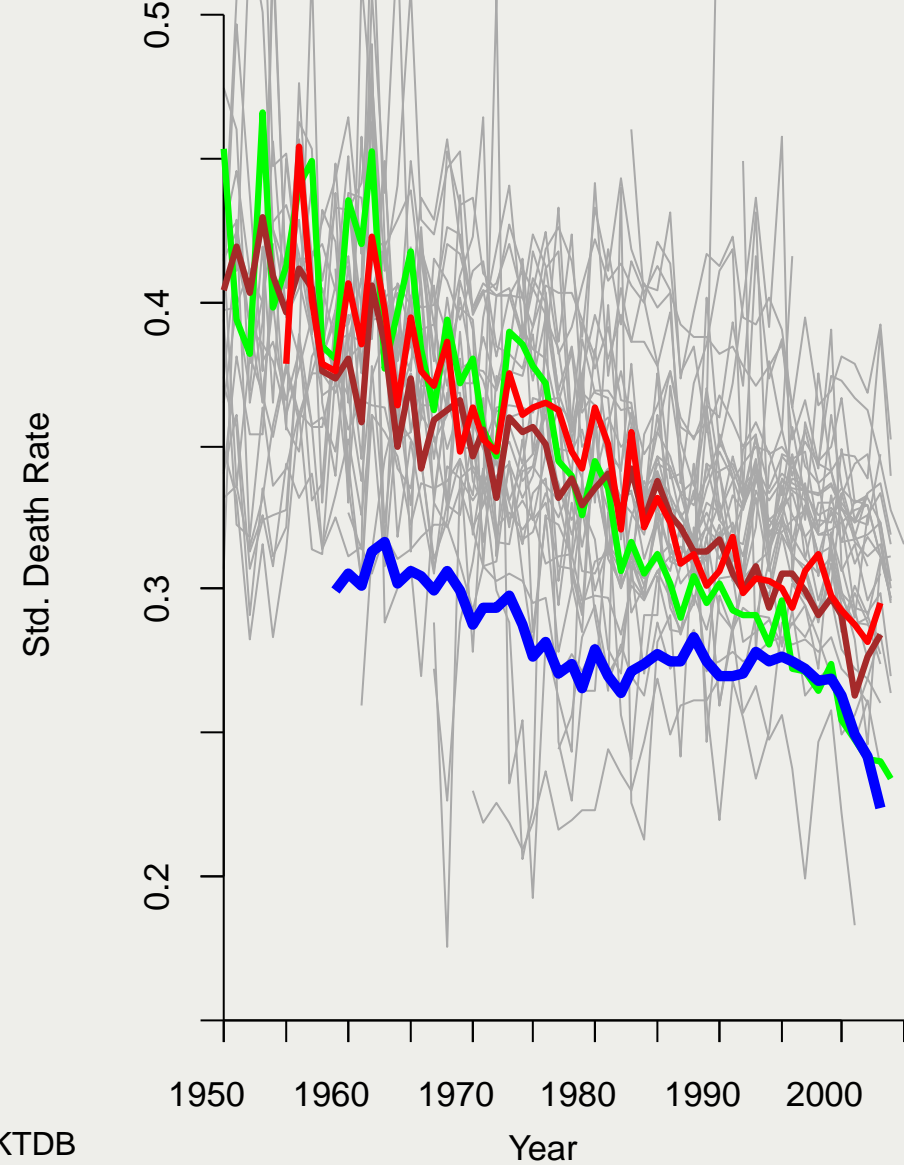


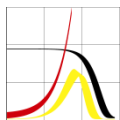
Age-Standardized Death Rates

Women, Ages 90-99



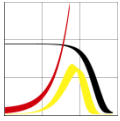
Men, Ages 90-99





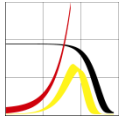
Progress Rates % in Reducing Mortality, Sweden Women

Age	1850- 1900	1900- 1950	1950- 2000	2000- 2008
60-69	0.82	0.61	1.67	1.24
70-79	0.51	0.34	1.82	1.76
80-89	0.23	0.25	1.31	1.23
90-99	0.16	0.24	0.76	0.46
100+	0.00	0.27	0.30	1.11



Progress Rates % in Reducing Mortality, US Women

Age	1933- 1950	1950- 2000	2000- 2006
60-69	1.92	1.10	2.16
70-79	1.23	1.21	1.83
80-89	0.84	0.93	1.53
90-99	0.15	0.42	2.81
100+	-0.37	0.05	2.66

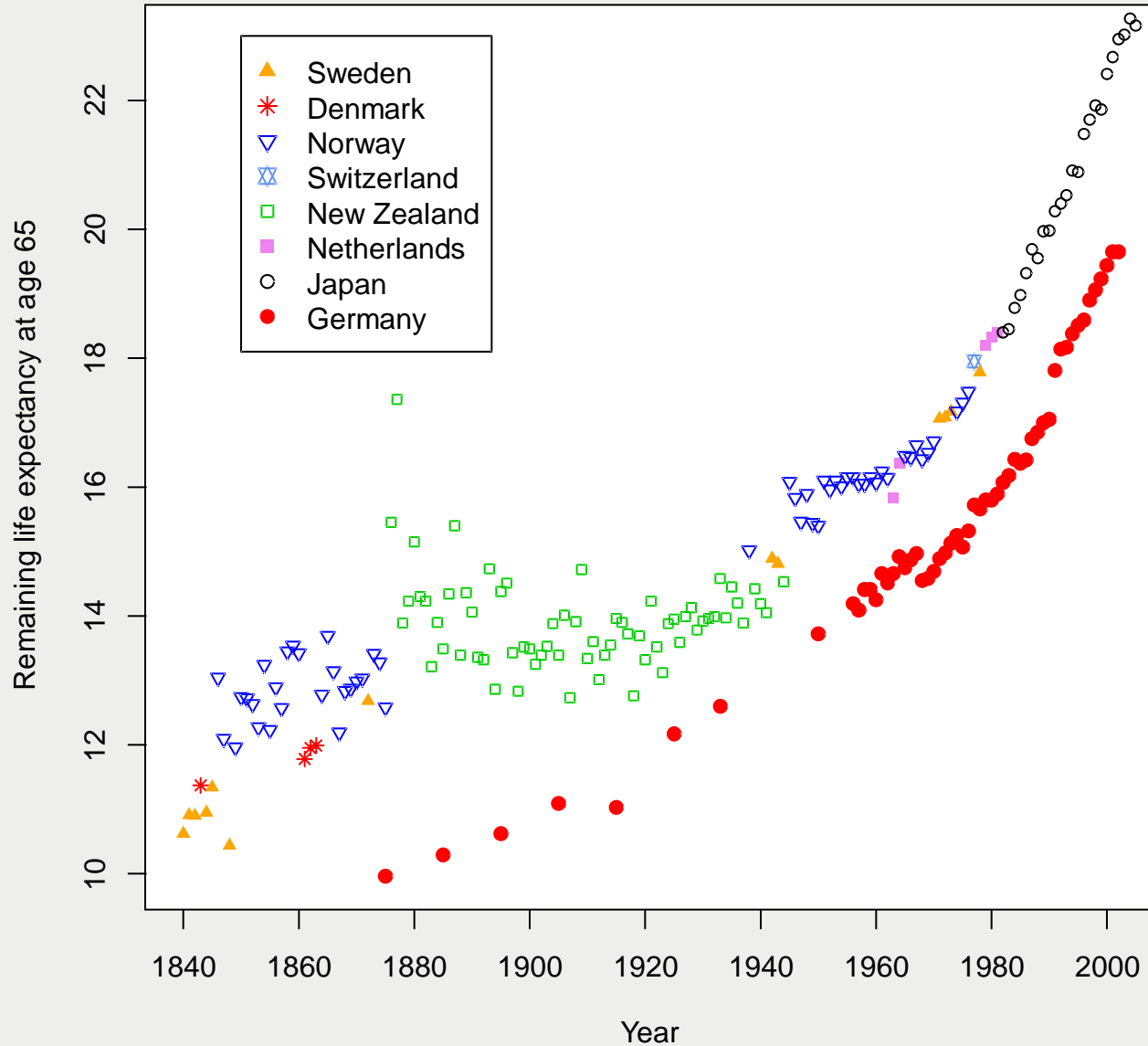


Progress Rates % in Reducing Mortality, Japanese Women

Age	1950-2000	2000-2008
60-69	3.10	2.31
70-79	2.77	2.30
80-89	2.05	1.86
90-99	1.35	1.43
100+	0.74	1.51

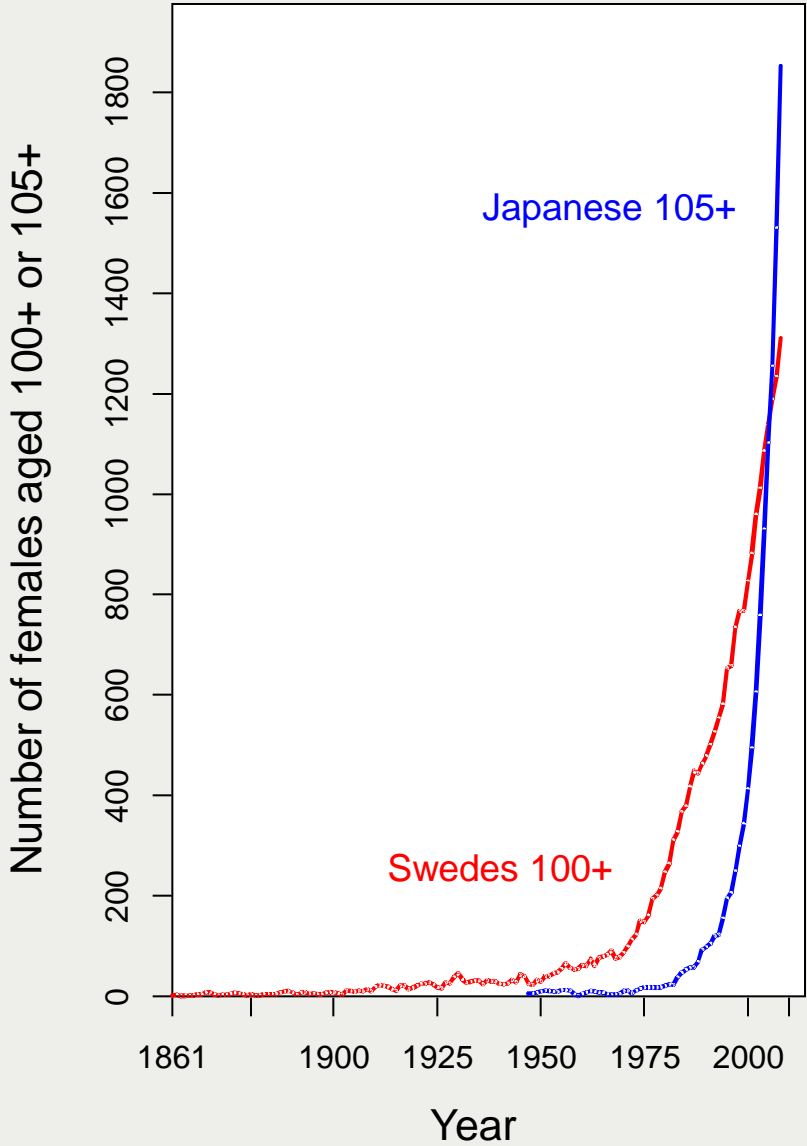


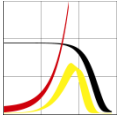
The rise in remaining life expectancy at age 65





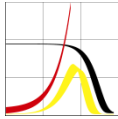
The explosion of centenarians



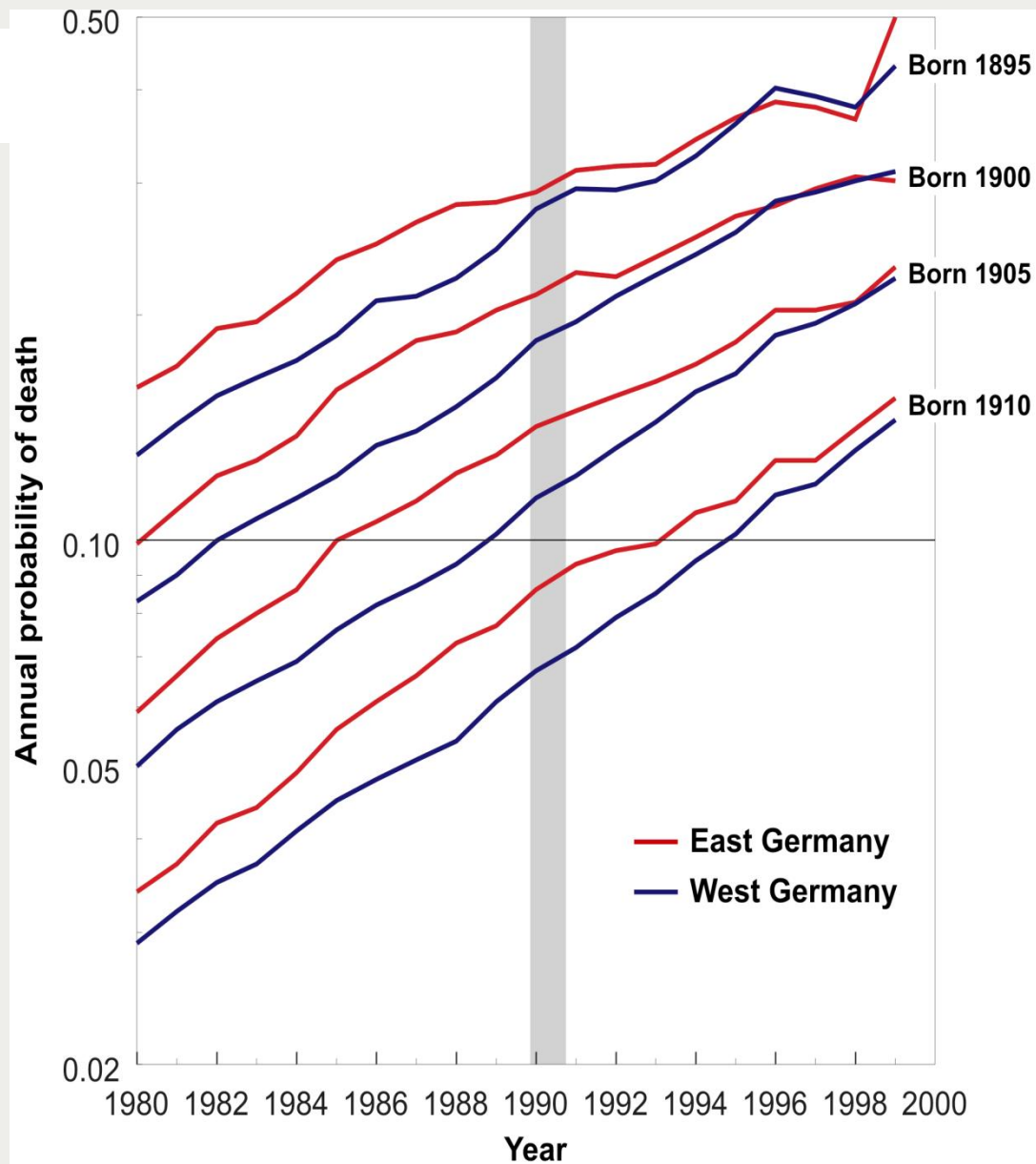


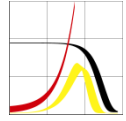
Determinants of Longevity

- **Average** lifespan in a population
 - Biomedical knowledge, health care system, standard of living, education, healthy behavior, environment
- **Variation** in lifespans among individuals
 - Healthy behavior: listen to your mother
 - 25% genetics, 10% childhood, 65% adult life



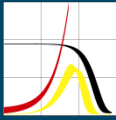
It's never too late



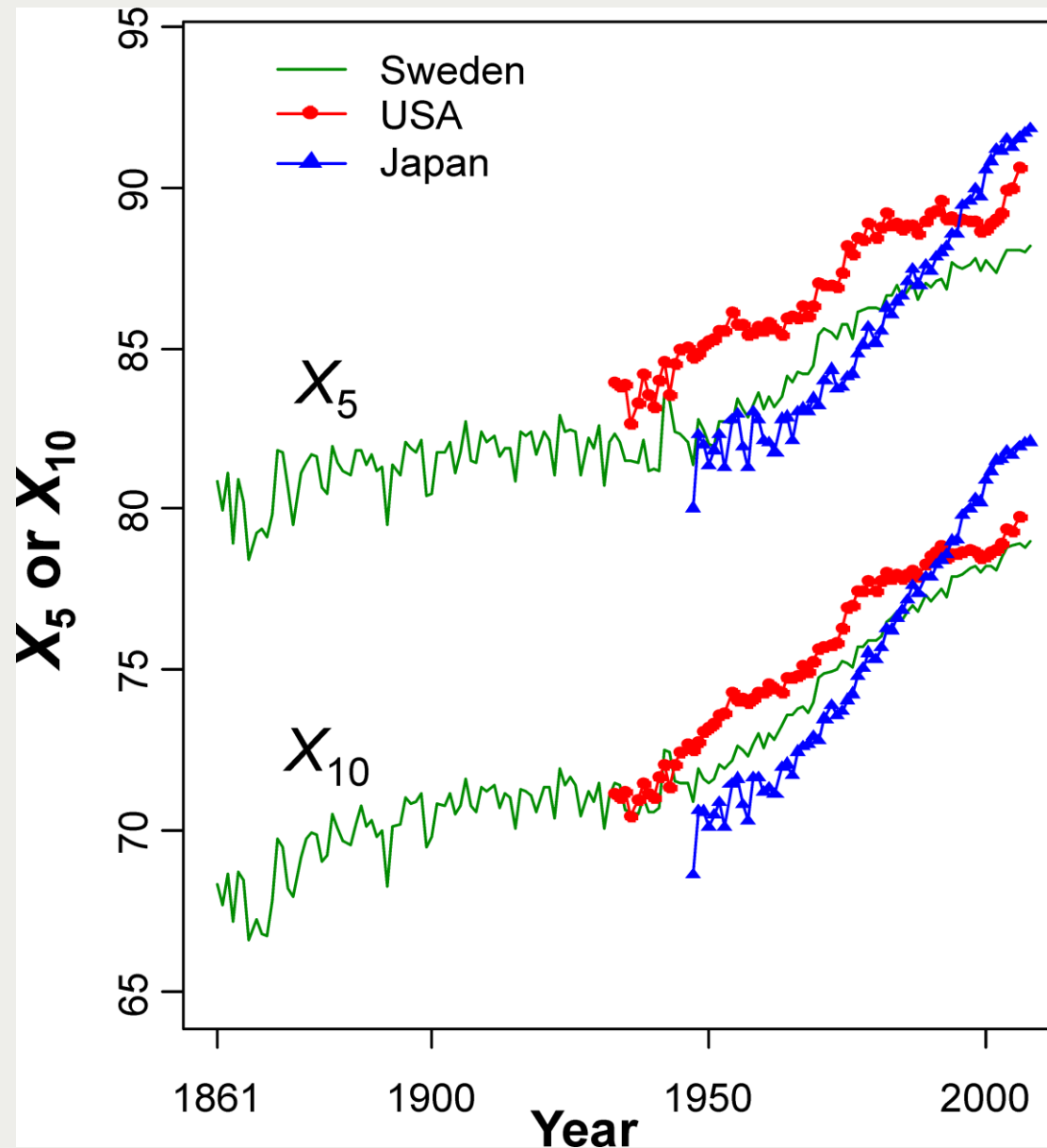


Why?

- Money
- Medicine

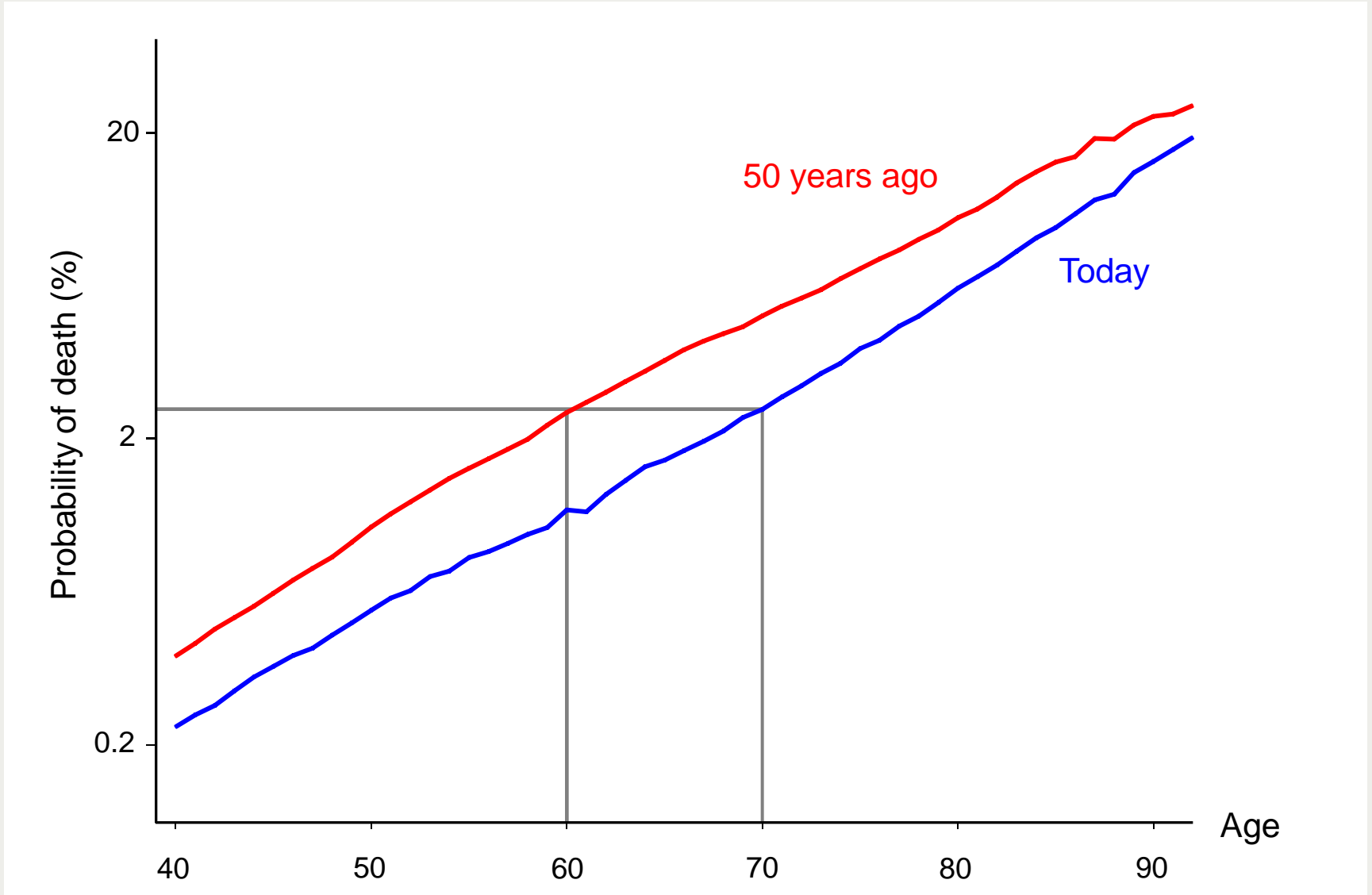


The Postponement of Senescence





Are 70-year-olds today as healthy as 60-year-olds 50 years ago?





Equivalent ages for females

Table 1: Females

Current Age	Equivalent Age 50 Years Ago			
	Sweden	France	U.S.A	Japan
40	26	26	33	16
50	42	41	44	25
60	52	49	53	43
70	63	59	63	53
80	72	70	74	67
90	84	83	85	79



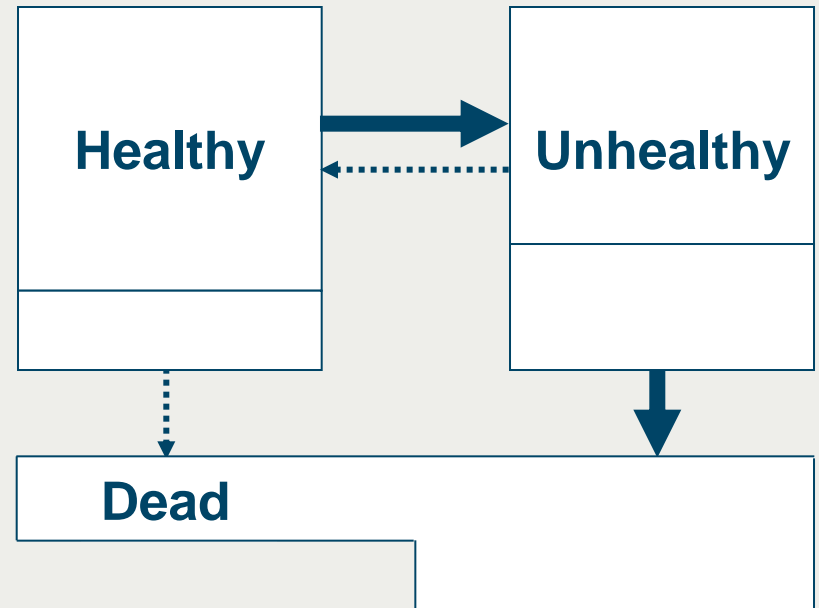
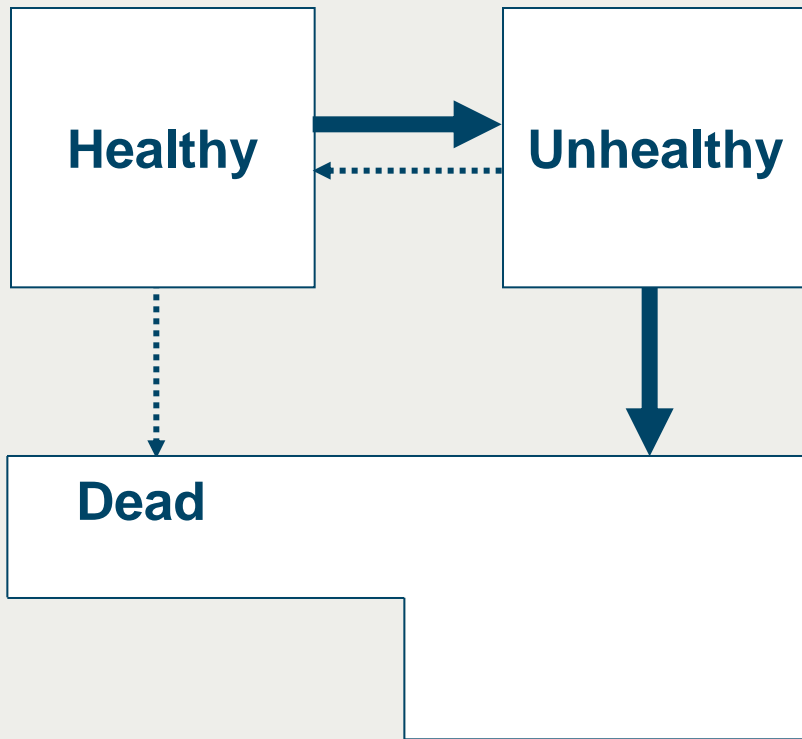
Equivalent ages for males

Table 2: Males

Current Age	Equivalent Age 50 Years Ago			
	Sweden	France	U.S.A	Japan
40	22	23	34	17
50	43	43	44	40
60	54	50	51	50
70	63	59	60	57
80	74	71	73	70
90	86	84	85	81

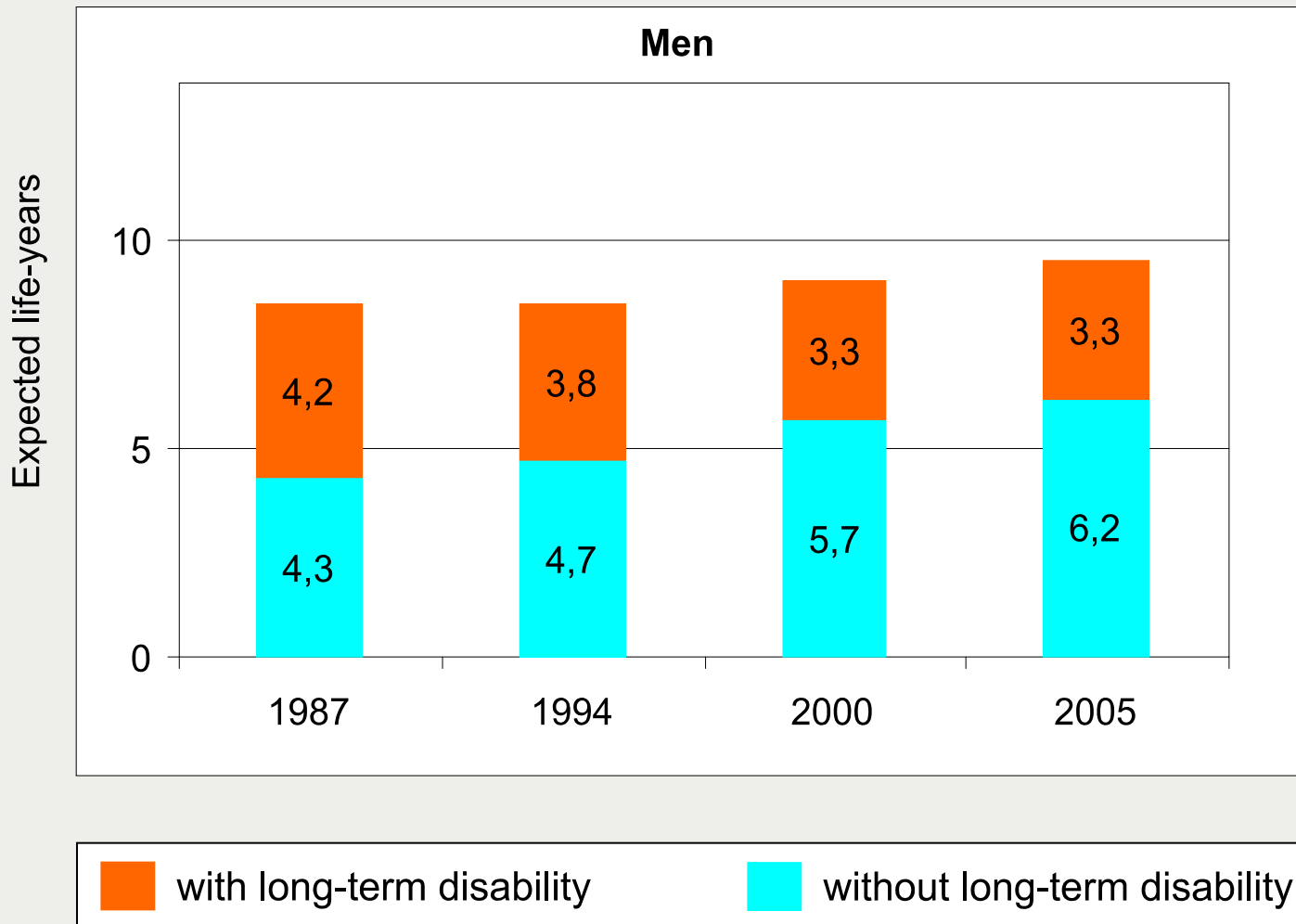


Three states of health



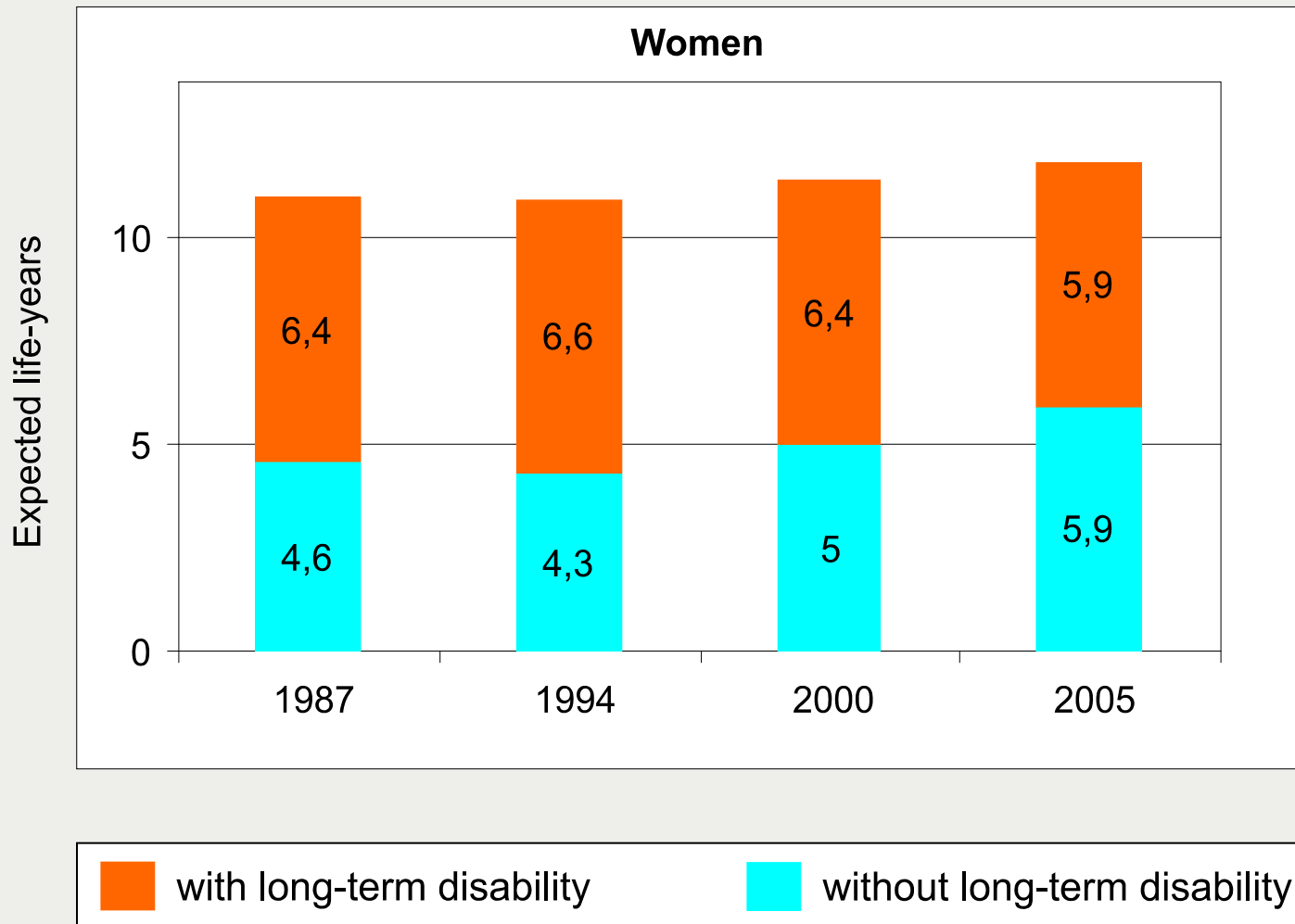


Life expectancy without and with long-term disability at age 75 in Denmark in 1987, 1994, 2000 and 2005.



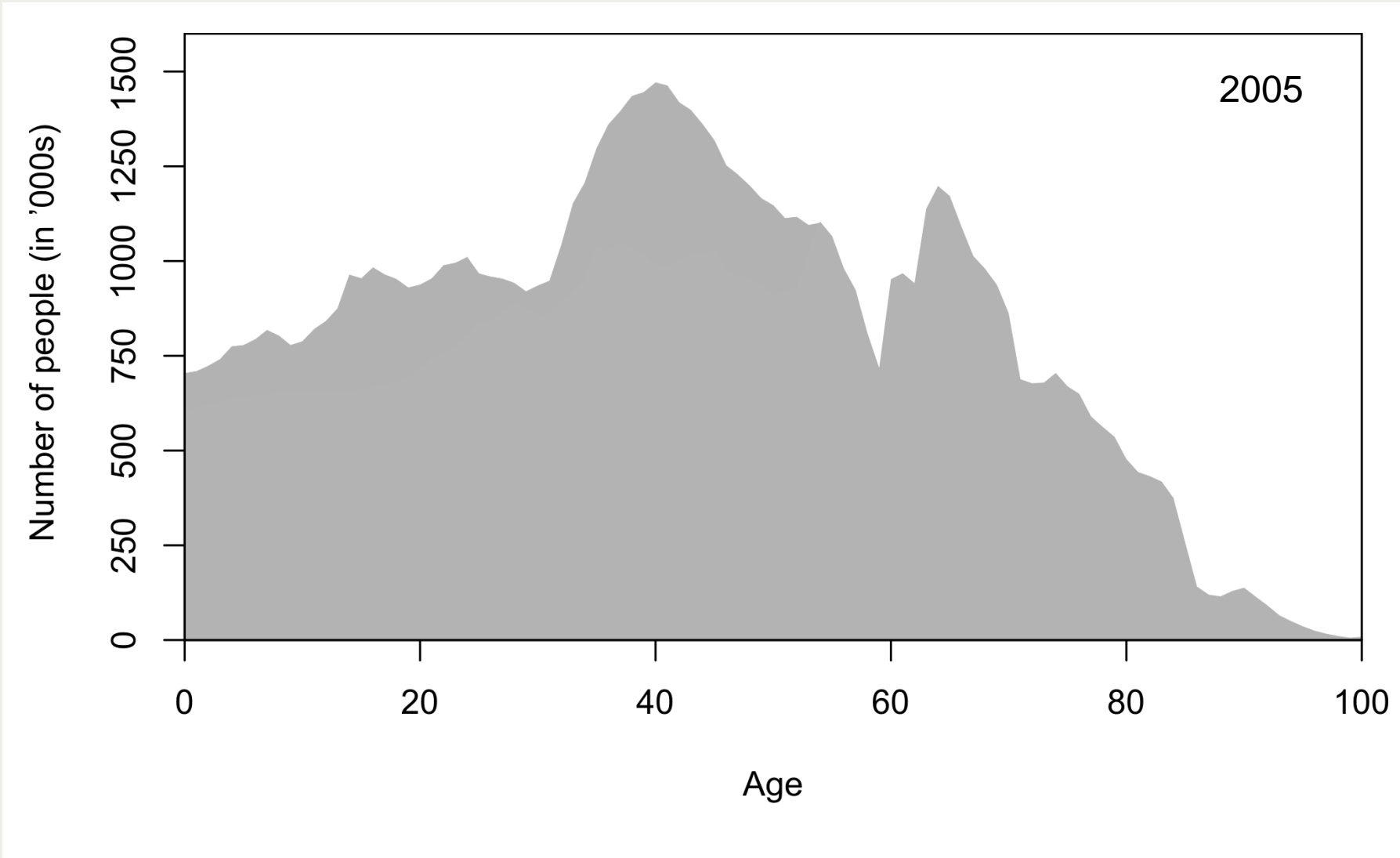


Life expectancy without and with long-term disability at age 75 in Denmark in 1987, 1994, 2000 and 2005.



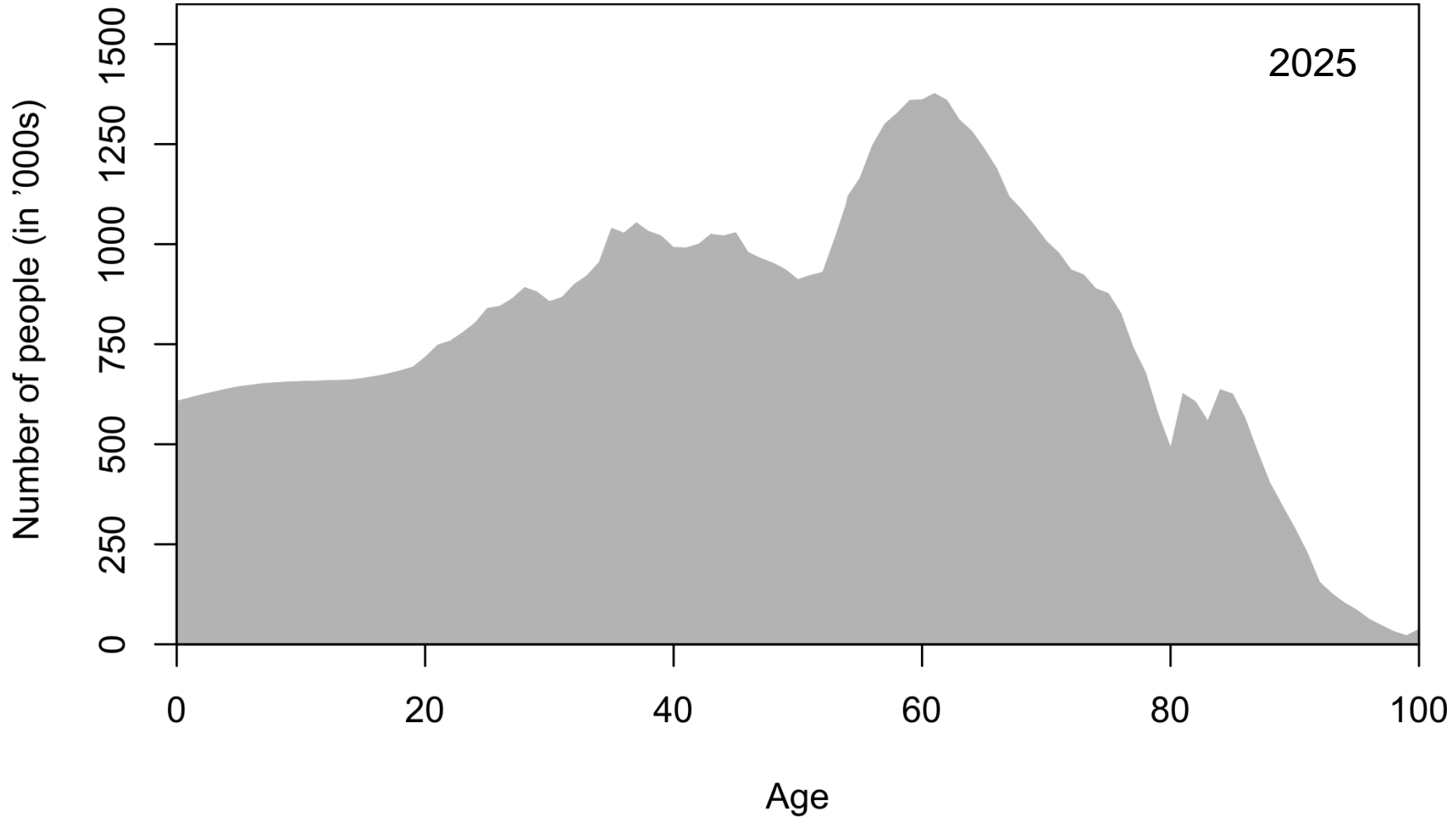


Number of people in Germany in 2005 by age



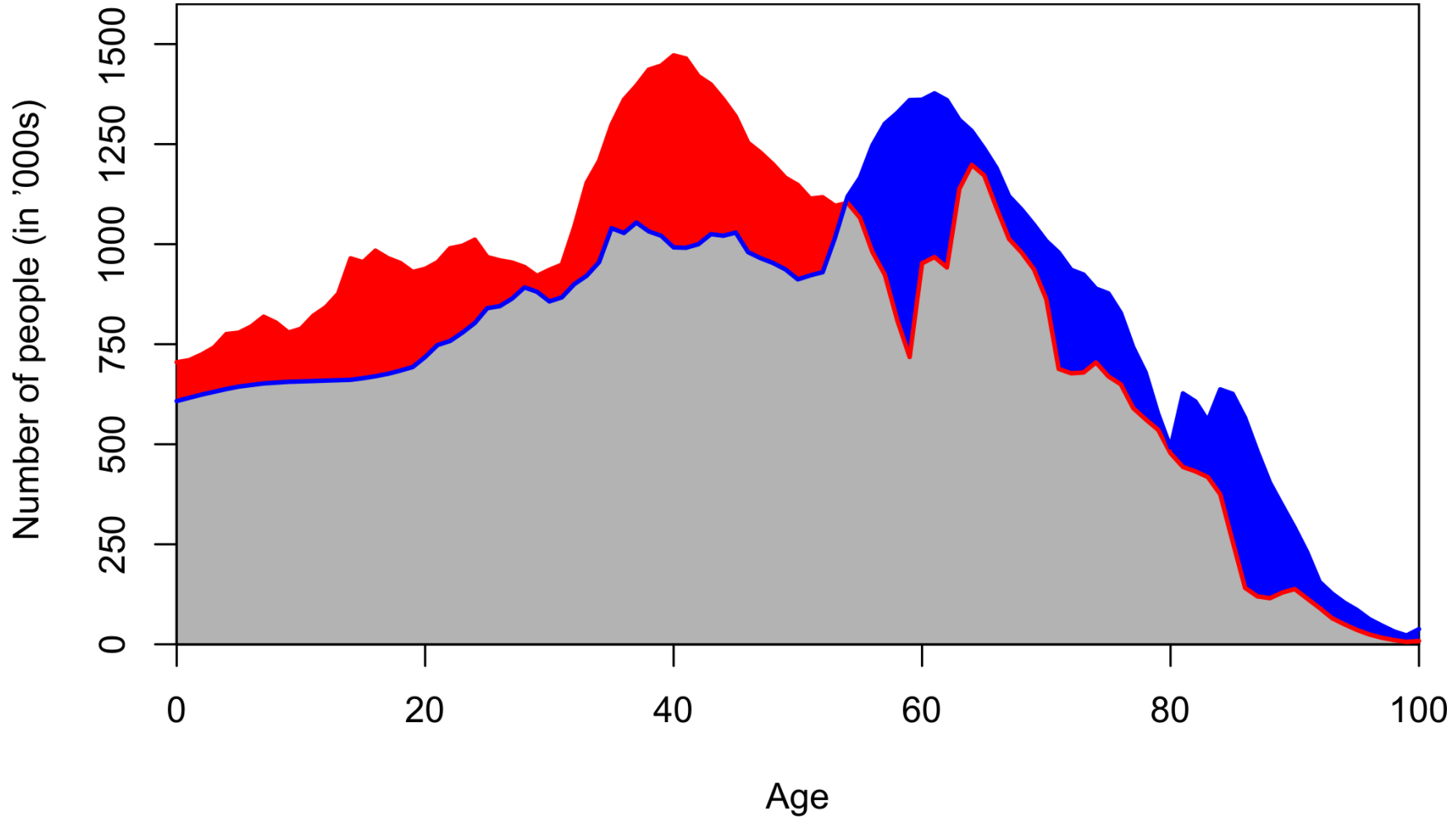


Number of people in Germany in 2025 by age





Population aging

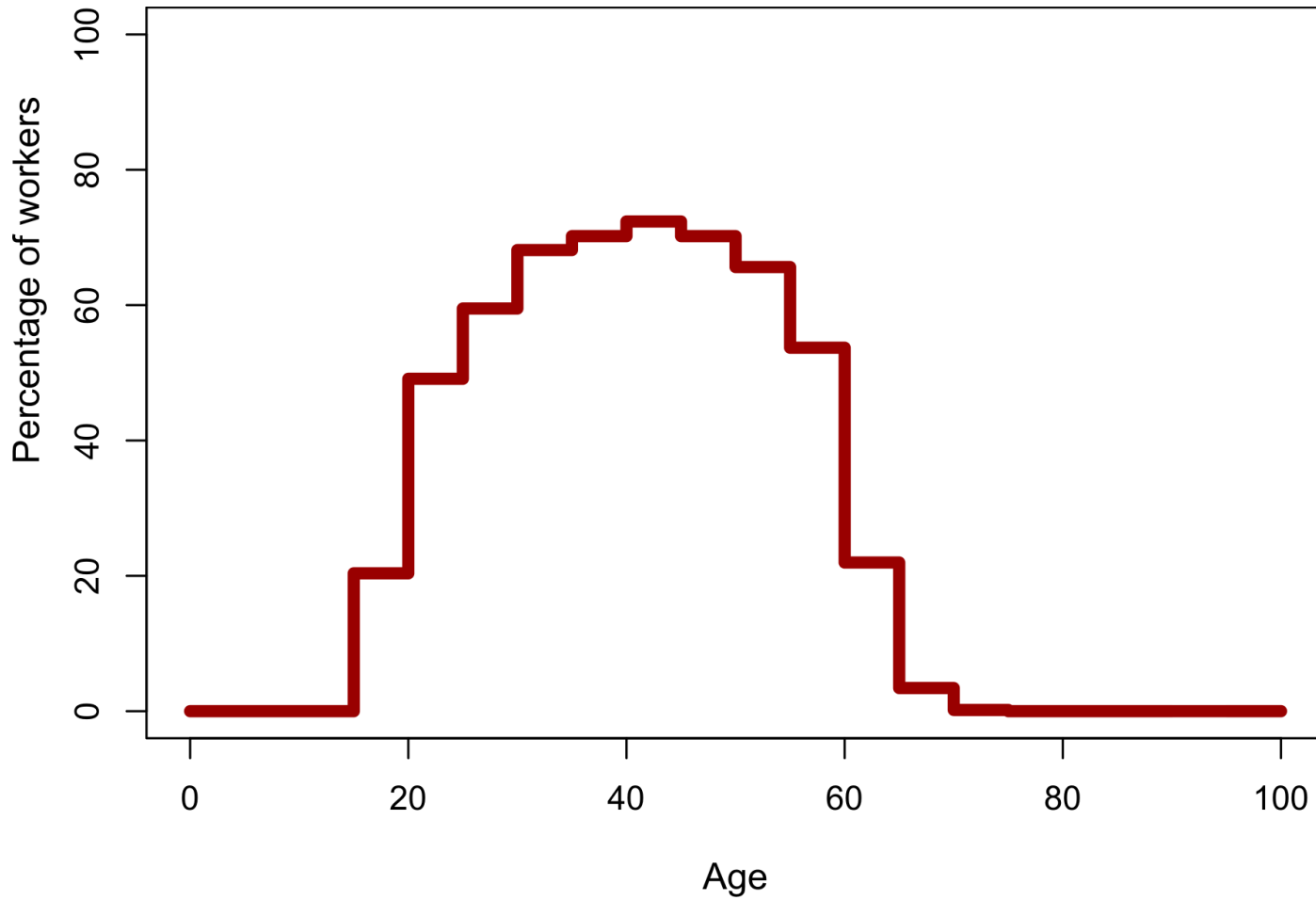




Country	R, nonworkers per worker			H, hours worked per week per capita		
	2009	2025	Change	2009	2025	Change
Germany	1.13	1.47	30%	12.55	11.16	-11%
Denmark	1.01	1.12	11%	14.96	14.13	-6%
France	1.40	1.69	21%	12.45	11.35	-9%
Italy	1.60	1.86	16%	13.14	12.05	-8%
Netherlands	0.91	1.20	32%	13.84	11.97	-14%
UK	1.11	1.19	7%	14.97	14.67	-2%
USA	1.17	0.99	-15%	15.64	16.36	5%

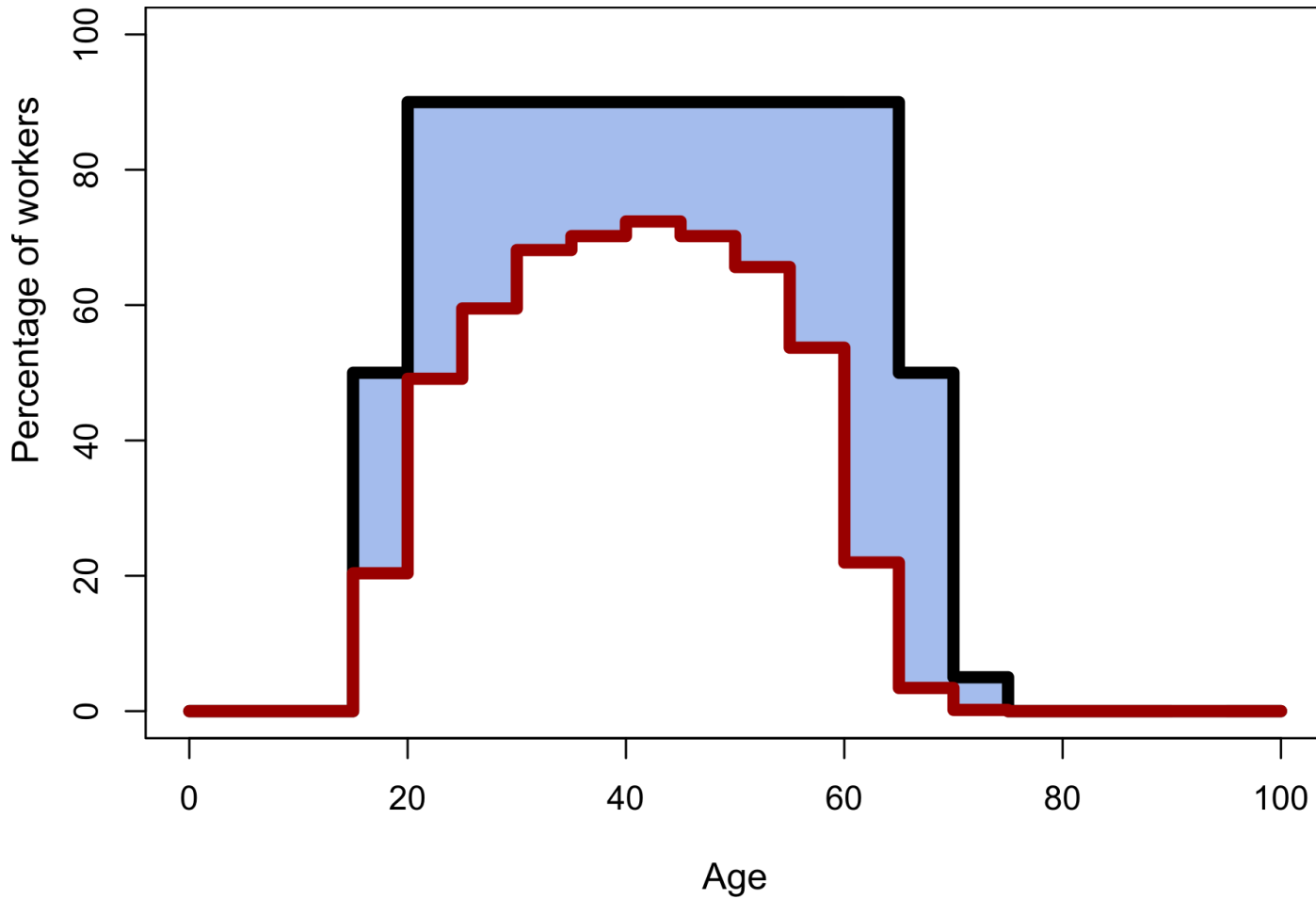


Percentage working by age



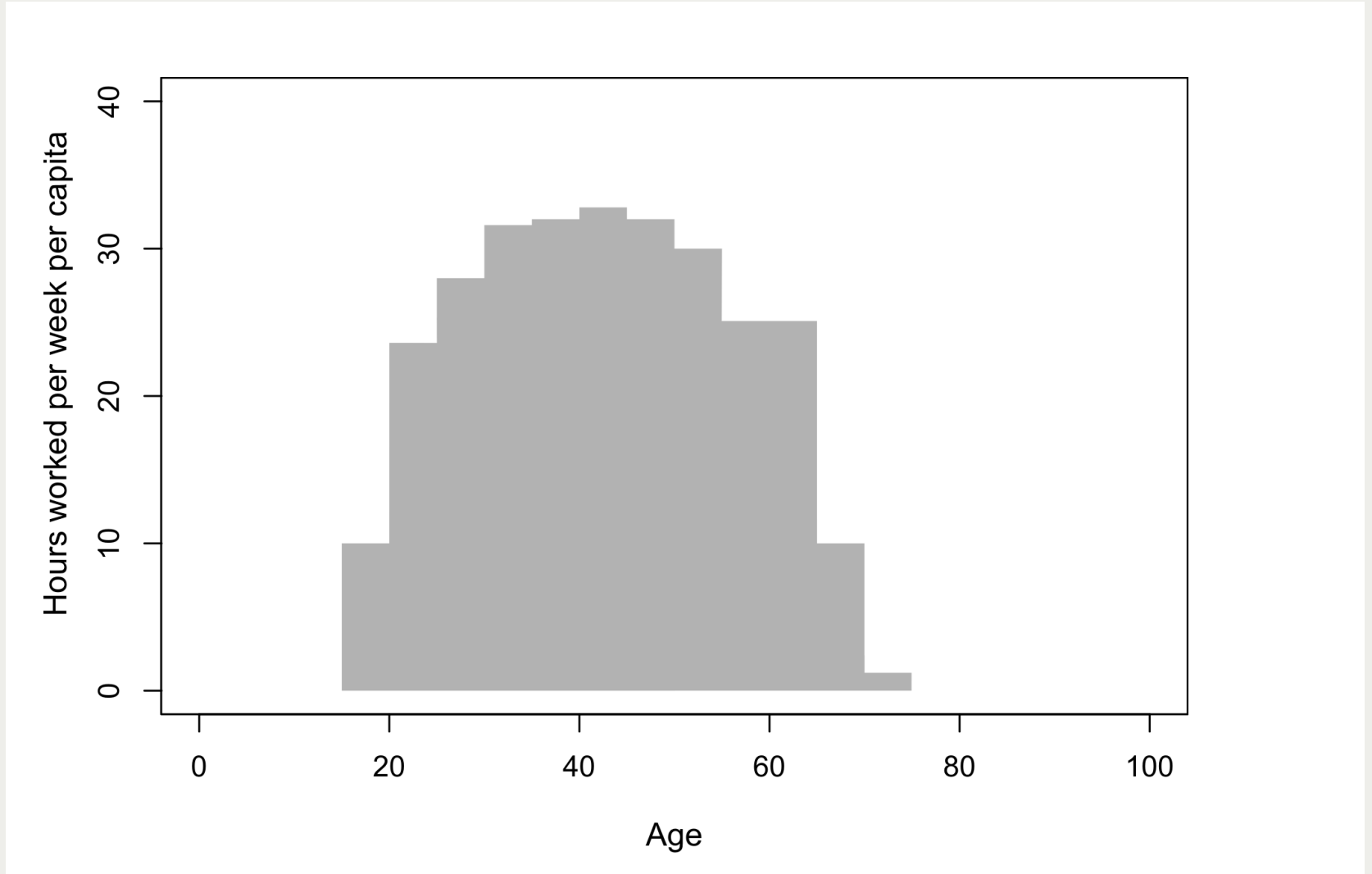


Where the Scandinavian countries are moving



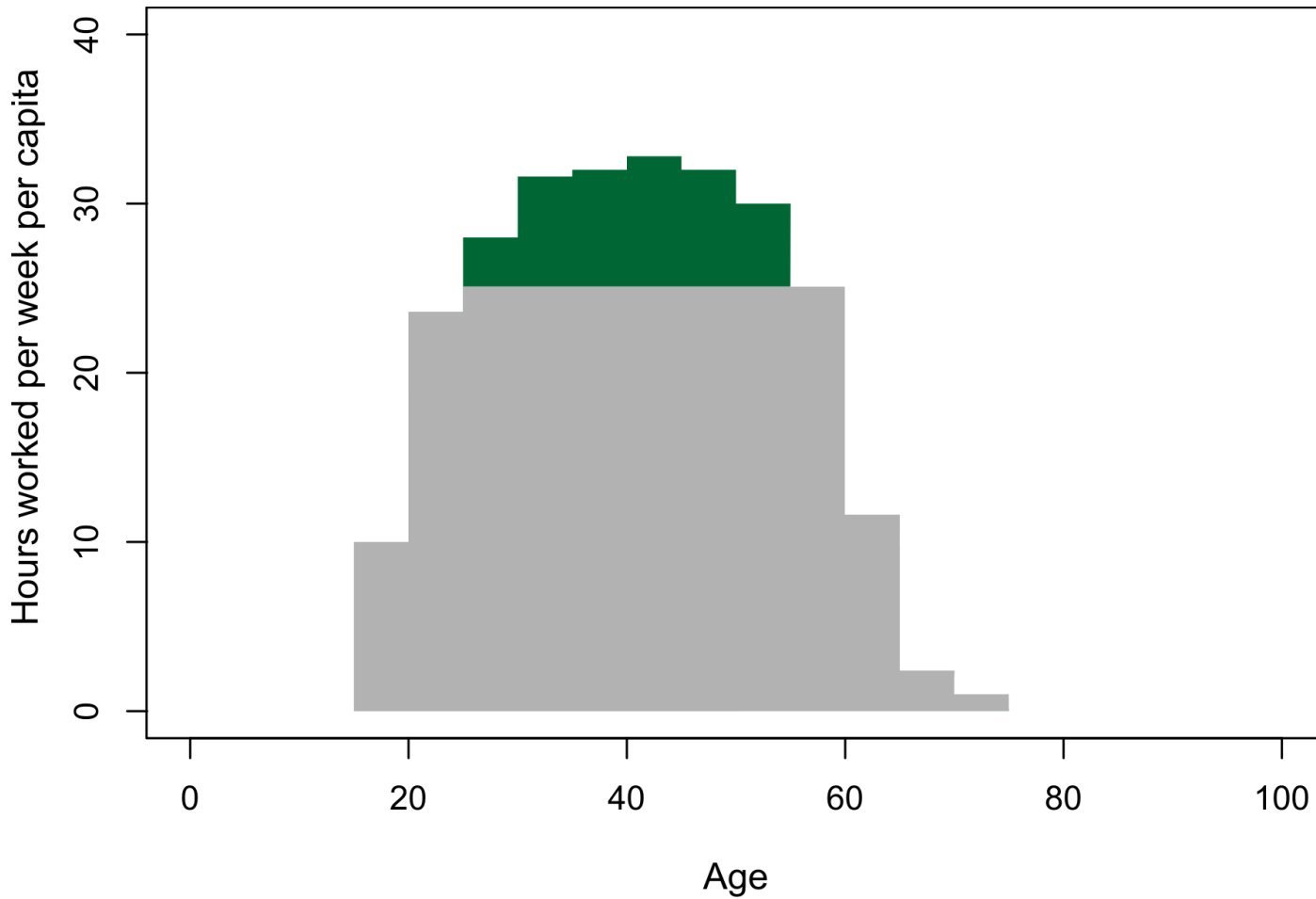


Hours worked per week per capita by age



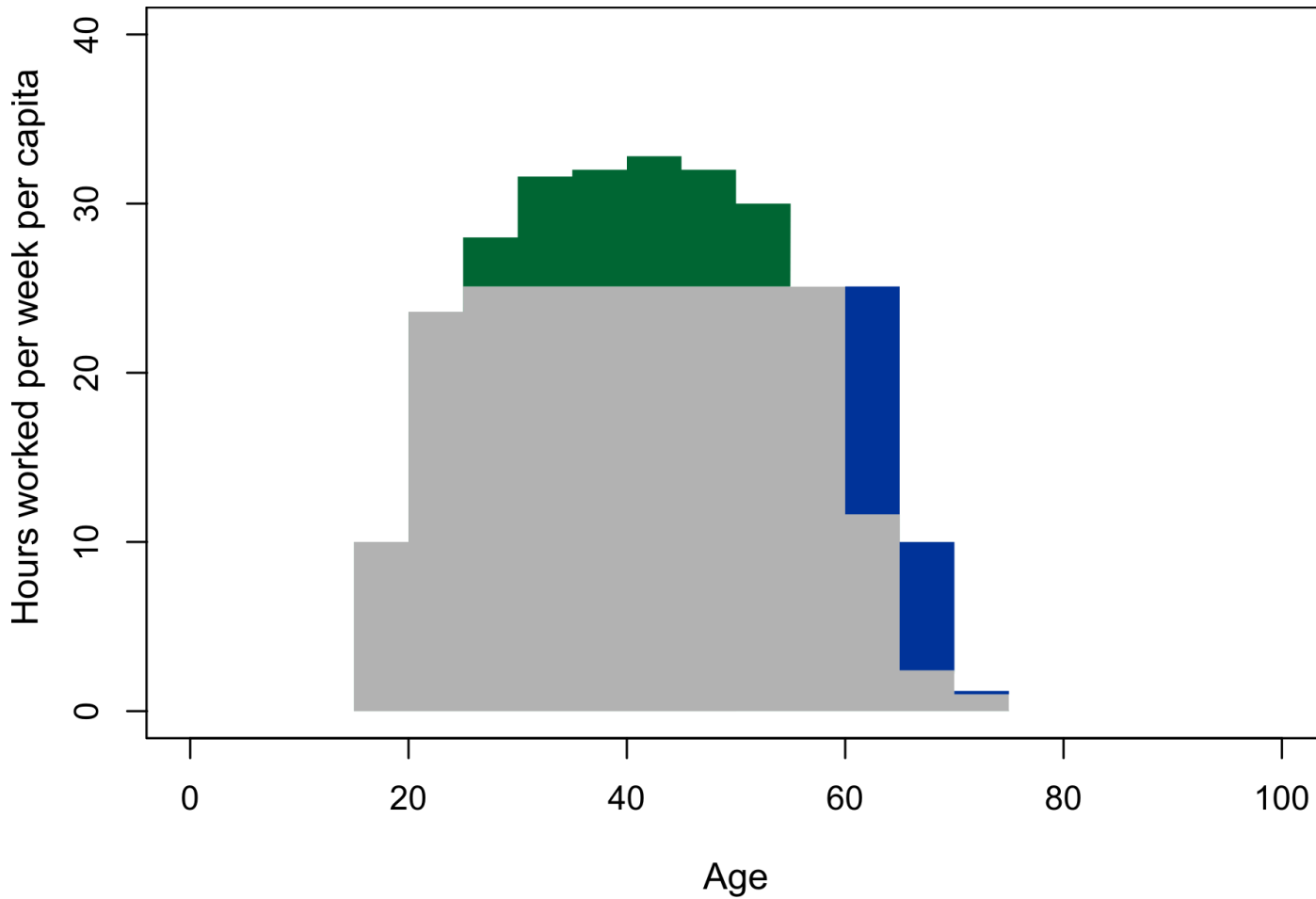


Reducing work effort to an average of 25 hours per week from age 25 to age 55



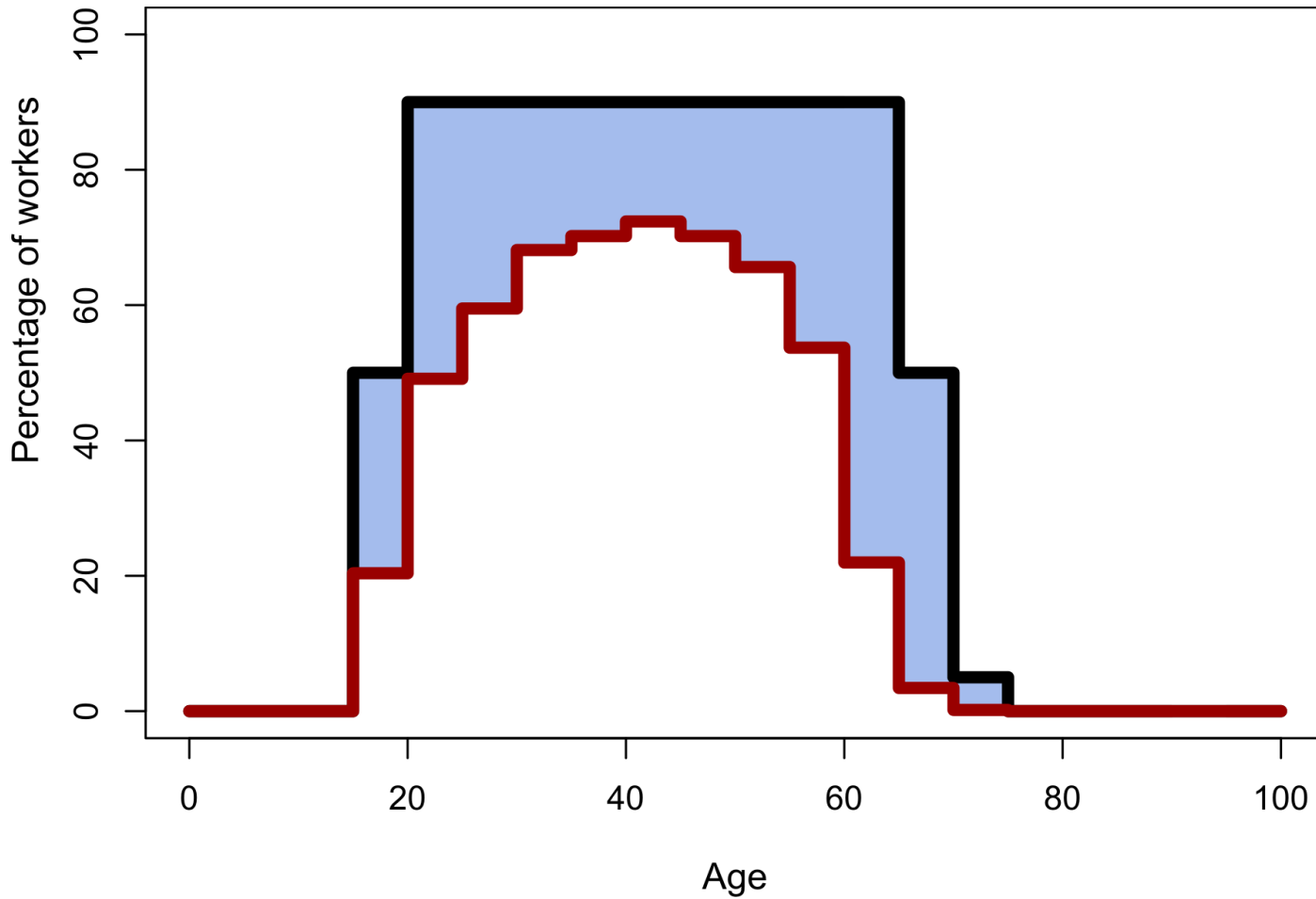


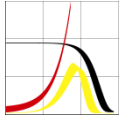
Increasing work effort to 25 hours per week at age 60-64 and to 10 hours per week at ages 65-69





Where the Scandinavian countries are moving



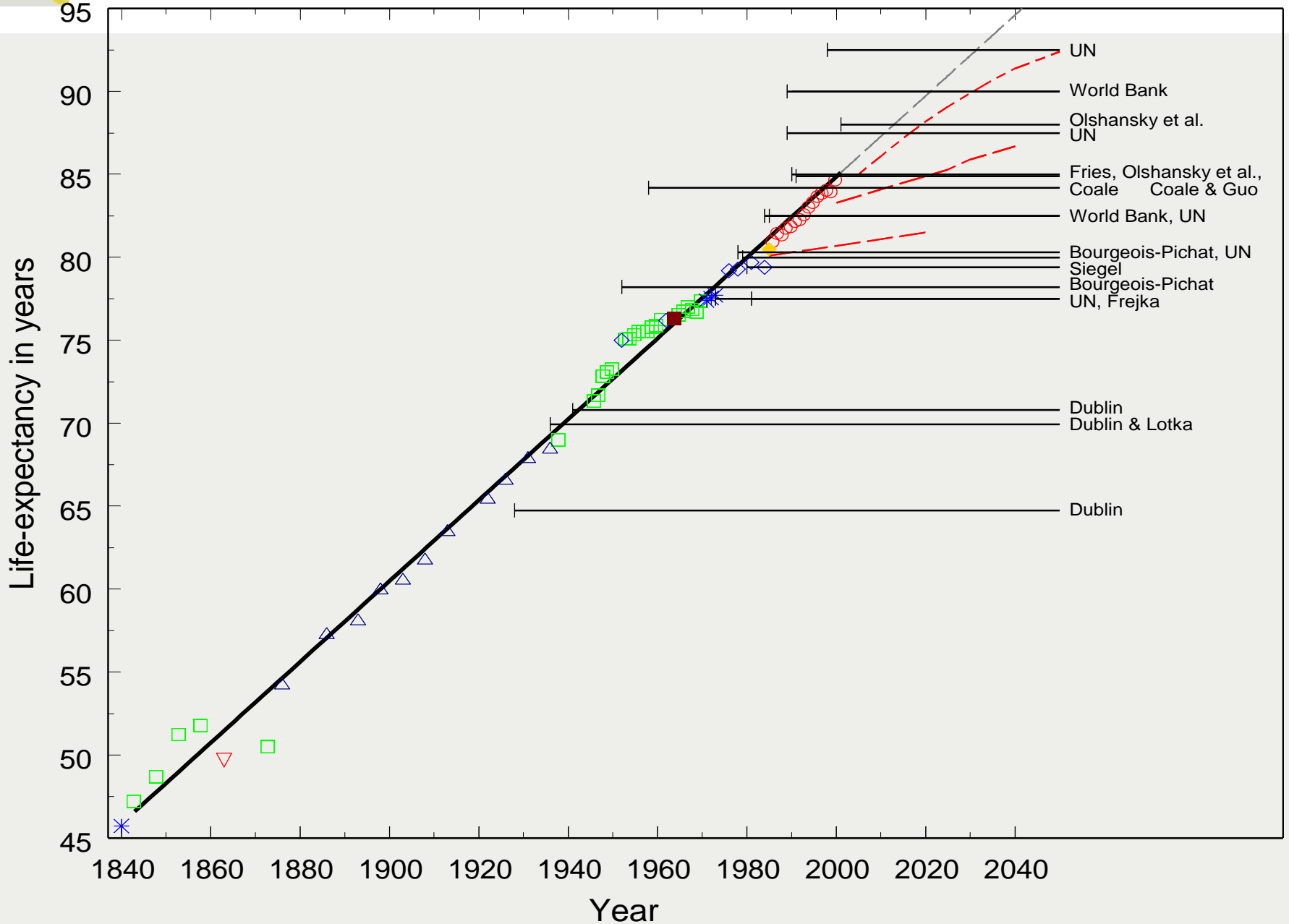


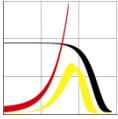
Forecasting Life Expectancy

- Rely on extrapolation using time-series methods
- Be very cautious about using expert judgments about the future

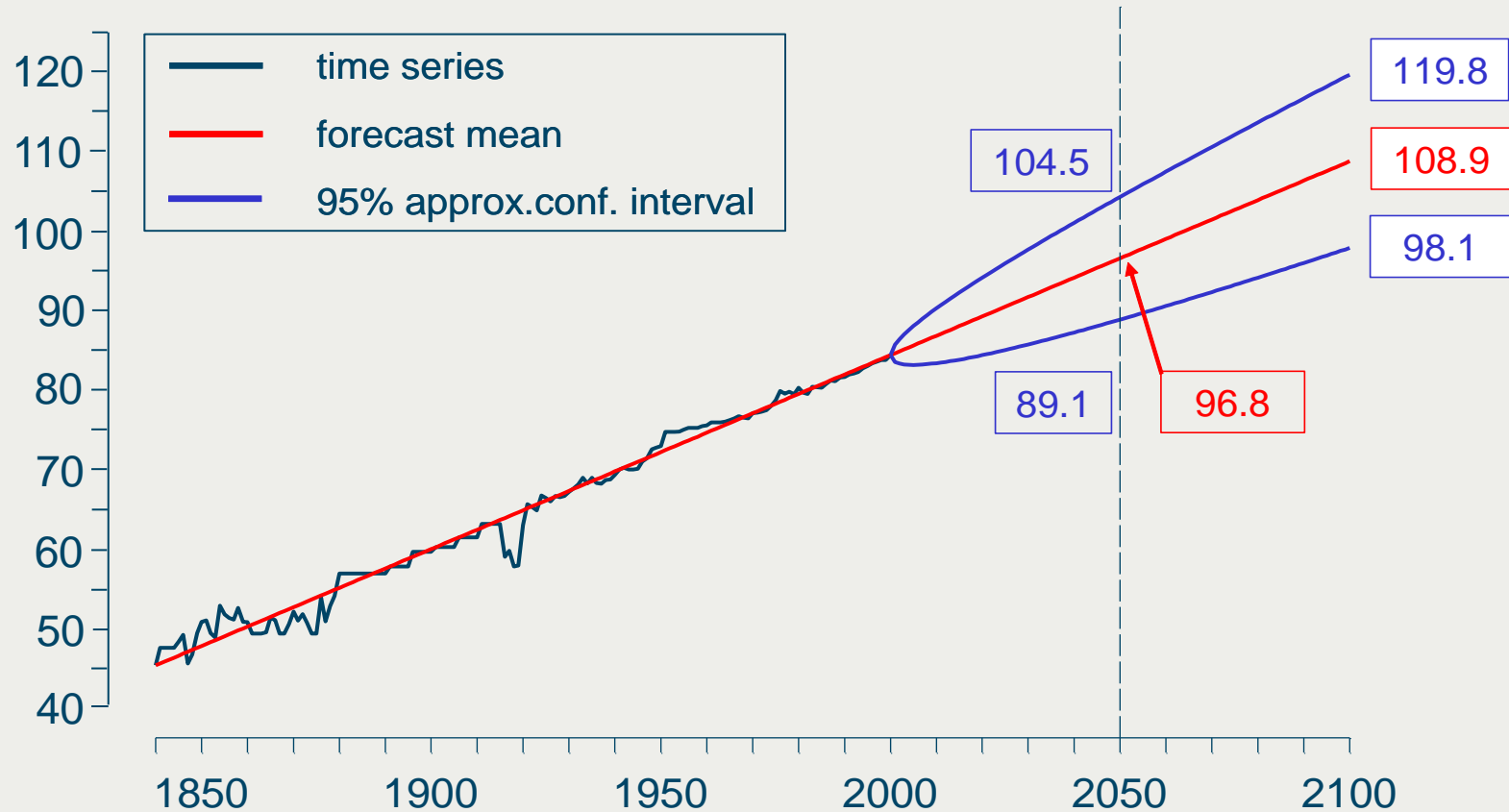


The Sorry Saga of Looming Limits to Life Expectancy





Directly Forecasting Record Life Expectancy



Forecasting female record life expectancy (up to 2100)
using a random walk with drift



Oldest age at which at least 50% of a birth cohort is still alive in eight countries

	2000	2001	2002	2003	2004	2005	2006	2007
Canada	102	102	103	103	103	104	104	104
Denmark	99	99	100	100	101	101	101	101
France	102	102	103	103	103	104	104	104
Germany	99	100	100	100	101	101	101	102
Italy	102	102	102	103	103	103	104	104
Japan	104	105	105	105	106	106	106	107
UK	100	101	101	101	102	102	103	103
USA	101	102	102	103	103	103	104	104

Data are ages in years. Baseline data were obtained from the Human Mortality Database and refer to the total population of the respective countries.



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