Mortality Improvement and Socioeconomic Status

Summarizing Waldron (2007)

Overview

- This paper fits in nicely with our discussion of heterogeneity and different rates of improvement across groups
- Analyzes trends in mortality differentials and life expectancy by average relative earnings for male Social Security-covered workers aged 60 or older
- Finds differences in level and rate of change in mortality improvement over time by SES
    - “...male Social-Security covered workers born in 1941 who had average relative earnings in the top half of the earnings distribution and who lived to age 60 would be expected to live 5.8 more years than their counterparts in the bottom half. In contrast, among male Social Security-covered workers born in 1912 who survived to age 60, those in the top half of the earnings distribution would be expected to live only 1.2 years more than those in the bottom half.”
- Warns that these projections are very much only one possible outcome, since the causes of the widening differentials observed are still not understood

Context

- Historically, mortality inequalities by class that emerged between 1650-1850 began to narrow by the 1930s and 1940s (eg. Antonovsky 1967)
- Evidence that the gap has widened due to differential rates of decline in deaths due to heart disease (Feldman 1989)
- This paper adds to the literature by using a large longitudinal data set in which deaths are observed over 29 years
- This allows for disaggregation by age and year-of-birth, avoiding linearity assumptions with regard to interaction terms

Data

- Wage data comes from the SSA Continuous Work History Sample, combined with the Numident (master death) file and the Master Beneficiary Record file
- Earnings are measured relative to the national average wage in the year, then averaged
- Earnings are only used post 1957 to account for expansion of Social Security coverage--some issues still exist due to subsequent expansions, but Waldron suggests that these should not have an important
- Important caveat: this is **not a representative sample**, as it excludes men not participating in the labor force and does not account for the possibility of low covered earnings combined with high non-covered earnings

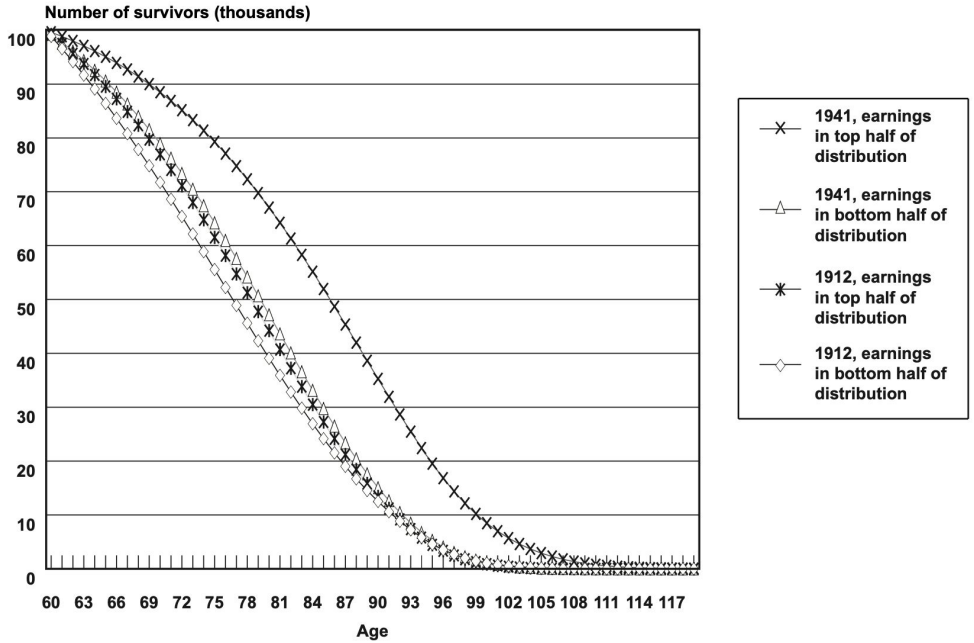
Methods

- Estimates are constructed of mortality differentials and cohort and period life expectancies
- Models:
  - Mortality differentials over time:
    - $1(dead)_{isc} = \alpha + \beta_1 age_{isc} + \beta_2 1(earnings_{isc}) + \epsilon_{isc}$
  - Cohort life expectancy estimates:
    - Uses a discrete-time logistic regression model of the form:
    - $$1(dead)_{isc} = \gamma + \theta_1 age_{isc} + \theta_2 birthyear_{isc} + \theta_3 age_{isc} \times birthyear_{isc} + \theta_4 1(earnings_{isc}) + \theta_5 age_{isc} \times 1(earnings_{isc}) + \theta_6 birthyear_{isc} \times 1(earnings_{isc}) + \theta_7 age_{isc} \times birthyear_{isc} \times 1(earnings_{isc}) + \varepsilon_{isc}$$
- No effort is made to control for changes in sample frailty over time

"Theoretically, if more frail members of lower-earnings groups are making it into the sample at older ages than in the past, then they could push up mortality differentials relative to the past. Hypothetically, it is possible that widening mortality differentials can indicate improvement for the lower-earnings groups, if such widening is an indication of their survival in greater numbers to ages at which previously only the strongest among them survived."

Key Result: Widening Mortality Differentials

Chart 1.
Selected cohort survival curves for male Social Security–covered workers, by age and earnings group



SOURCE: Author's calculations using a matched 2001 Continuous Work History Sample.

Other Key Findings

- These results also hold for cohort life expectancies, though for later birth cohorts the confidence intervals tend to overlap--projected estimates?
- Waldron, using period data, also attempts to compare these numbers to other OECD countries, finding that, at 65, high-earning Social Security-covered men rank close to population averages for multiple other countries like Canada, suggesting they do worse than high-earning men in these countries
    - Men in the bottom quarter of the earning distribution “could expect to live roughly as long as the average Irishman”
    - Differences in medical care and health behaviors?
    - Short discussion of the differences in frailty across countries--Mexico is predicted to have a selectively healthier and more robust population at age 80
- This paper offers insight into the way in which population heterogeneity may lead to very different outcomes--though questions about sample frailty remain

Simulation of mortality differentials over time

Table 1.
Odds ratios (confidence intervals) for the bottom half of the earnings distribution relative to the top half of the distribution, by year of birth and age

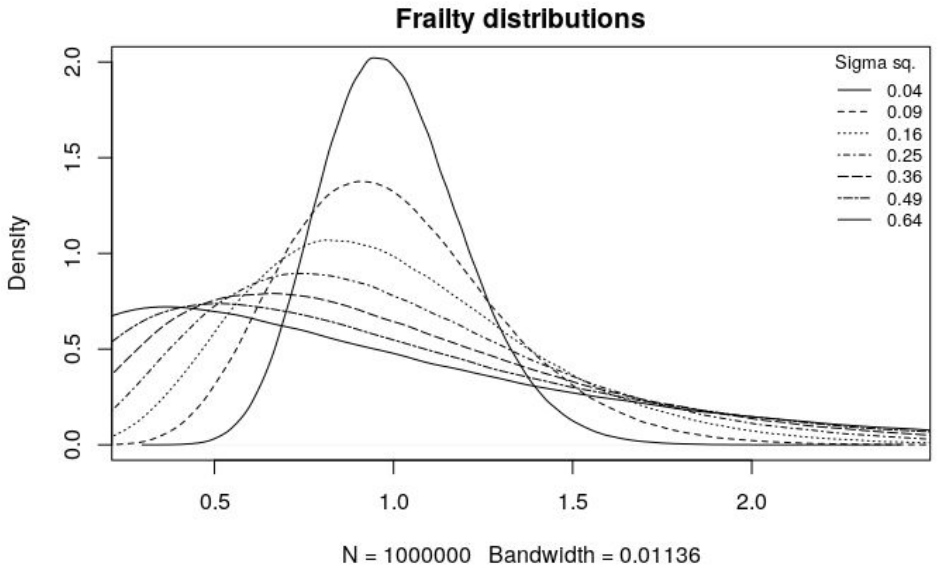
Year of birth	60–64	65–69	70–74	75–79	80–84	85–89
1912–1915	1.27 (1.19–1.35) *	1.24 (1.17–1.31) *	1.20 (1.13–1.26) *	1.13 (1.07–1.19) *	1.09 (1.03–1.15) *	0.94 (0.88–1.00) **
1916–1919	1.51 (1.42–1.62) *	1.36 (1.29–1.44) *	1.34 (1.27–1.41) *	1.20 (1.14–1.27) *	1.05 (0.99–1.11)	. . .
1920–1923	1.50 (1.40–1.60) *	1.40 (1.32–1.48) *	1.34 (1.27–1.41) *	1.31 (1.24–1.38) *	. . .	. . .
1924–1927	1.51 (1.41–1.62) *	1.53 (1.44–1.63) *	1.48 (1.41–1.57) *	. . .	. . .	. . .
1928–1931	1.71 (1.59–1.84) *	1.61 (1.51–1.71) *	. . .	. . .	. . .	. . .
1932–1935	1.75 (1.62–1.89) *	1.73 (1.59–1.88) *	. . .	. . .	. . .	. . .
1936–1938	1.84 (1.68–2.03) *	. . .	. . .	. . .	. . .	. . .

1. Over time, for a given age, the differential has widened.
2. Within the same cohort, across ages, the differential falls.

Odds of dying for male Social Security-covered workers in the bottom half of the average relative earnings distribution relative to their counterparts in the top half of the earnings distribution.

Simulation

Each cohort has a different frailty:



Share of the population that has low earnings can also vary:

	Share of population in earnings distribution	
	Bottom half	Top half
Equal	0.5	0.5
Large bottom	0.8	0.2
Small bottom	0.2	0.8

Higher sigma sq., smaller variance in frailty, more recent cohorts?

Simulation results

Equal earnings distribution

Cohort	60-64	65-69	70-74	75-79	80-84	85-89
1	1.39E+08	1208.0429	35.3219	17.6828	19.2159	-
2	9.88E-01	0.9978	0.9968	0.9973	1.0023	0.9916
3	9.96E-01	1.0028	0.9901	0.9963	1.0014	0.9902
4	1.00E+00	1.0003	1.0054	1.0019	0.9939	1.003
5	9.95E-01	1.0021	0.9991	1.0012	1.0028	0.9894
6	9.95E-01	0.9977	0.9973	0.9964	0.9967	0.9921
7	1.00E+00	1.0044	0.9966	1.0024	0.9964	1.0087

Large bottom half of average earnings

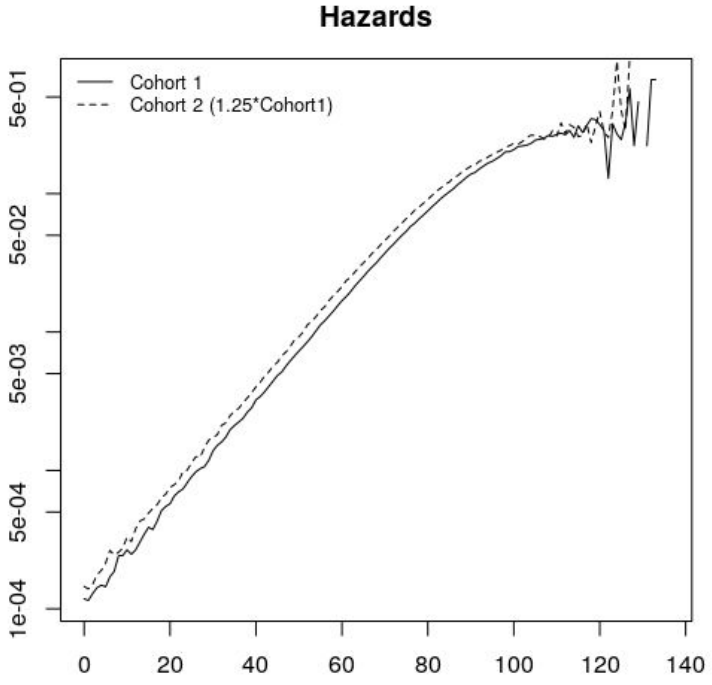
Cohort	60-64	65-69	70-74	75-79	80-84	85-89
1 (smaller variance)	1.013	0.985	1.005	1.009	0.991	1.006
2	1.005	0.99	0.999	1.007	0.999	1.004
3	0.985	0.992	0.995	1.002	1	1.007
4	0.99	0.989	0.998	0.994	1.004	1.001
5	0.996	0.997	1.01	1.003	1	0.994
6	1.001	0.996	0.987	1.004	0.994	0.993
7 (larger variance)	1.005	1.003	0.997	0.997	0.998	1.01

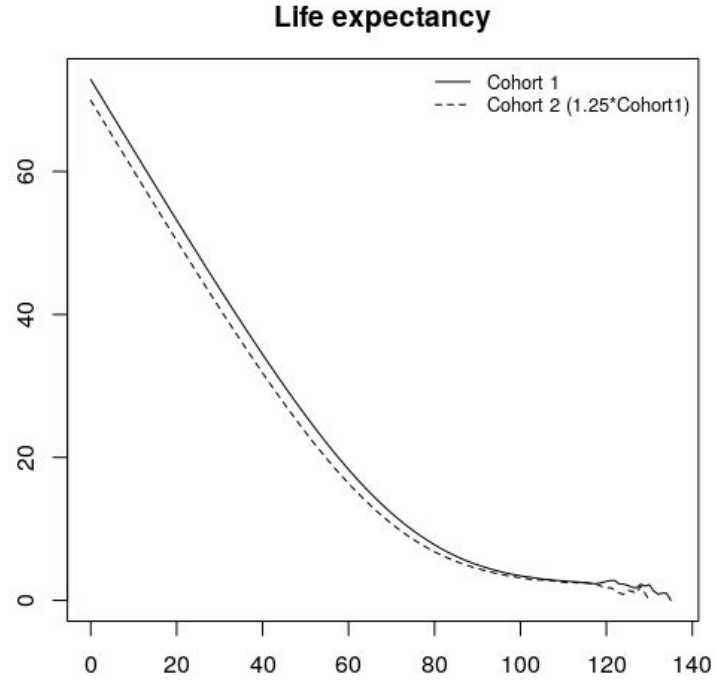
Small bottom half of average earnings

Cohort	60-64	65-69	70-74	75-79	80-84	85-89
1	0.98	1.017	0.996	1.007	0.99	0.992
2	0.997	1.007	0.989	0.989	0.999	0.991
3	1.005	0.99	1.004	1	1.003	1.004
4	1.004	1.001	0.994	0.999	0.994	1.007
5	0.998	1.002	0.991	1.005	1.008	1.006
6	0.991	1.005	1.011	0.993	1	1.006
7	0.994	1.006	1.001	0.996	0.995	1.008

Applications - Gamma-Gompertz frailty

2 cohorts with same frailty but where the hazard of one is 25% larger than the other.



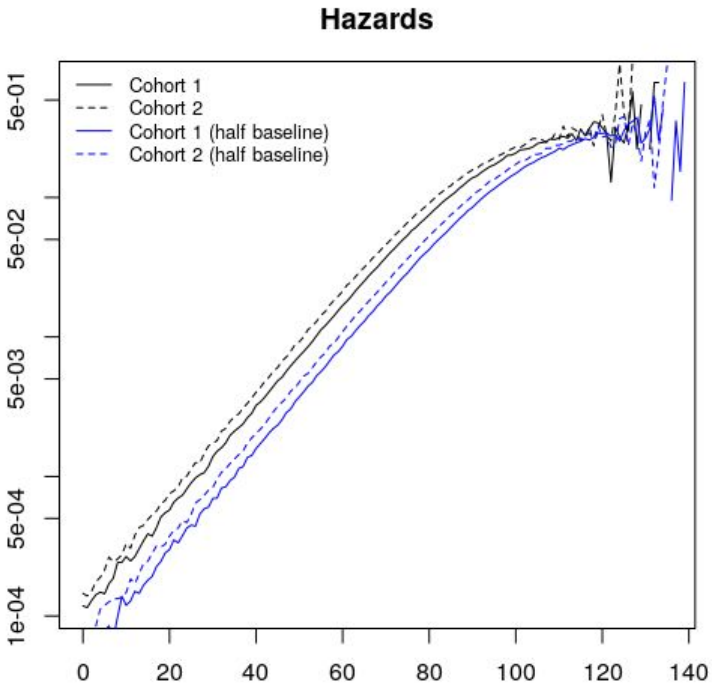


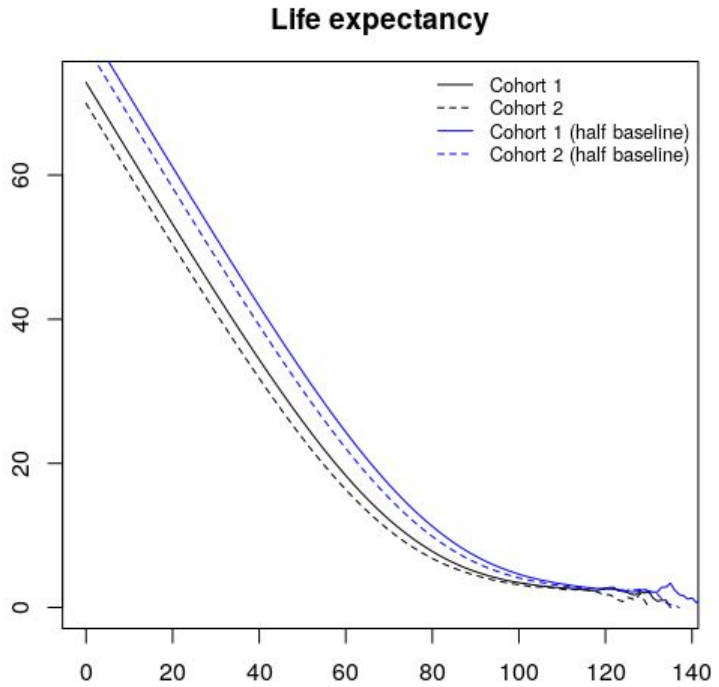
$m_2(65)/m_1(65) = 0.2565$

Cohort 1: e(65) = 15.05
Cohort 2: e(65) = 13.34

Applications - Gamma-Gompertz frailty

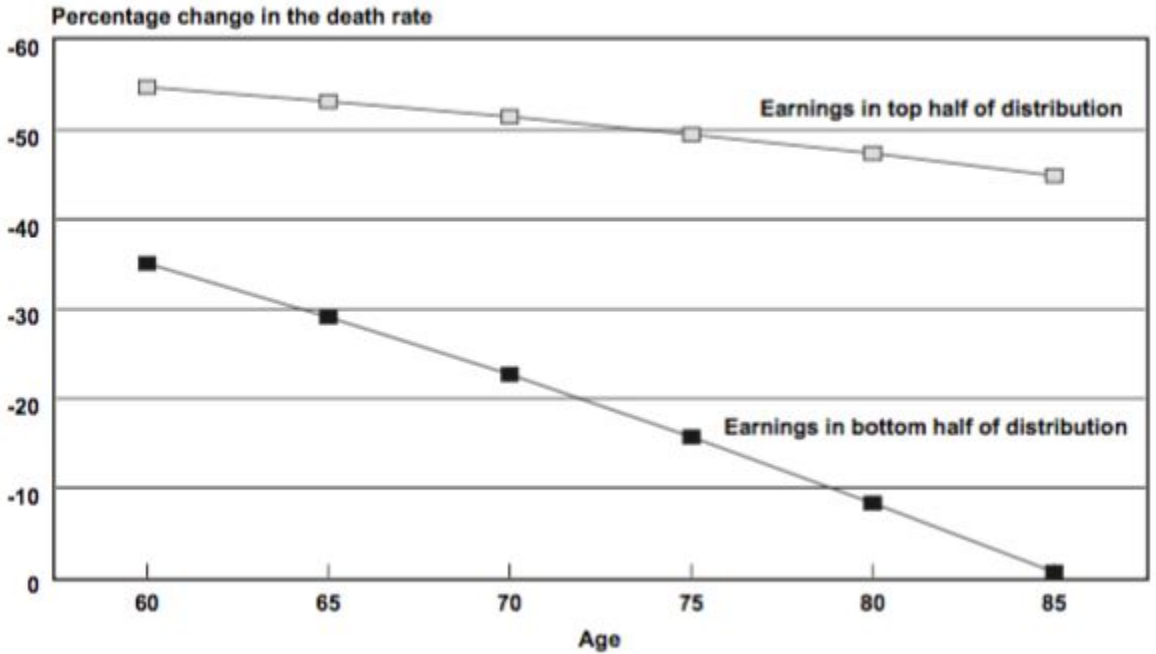
What happens when baseline mortality is halved?





Appendix

Chart 2.
Percentage change in the death rate for male Social Security–covered workers, by selected age and earnings group from birth years 1912–1941

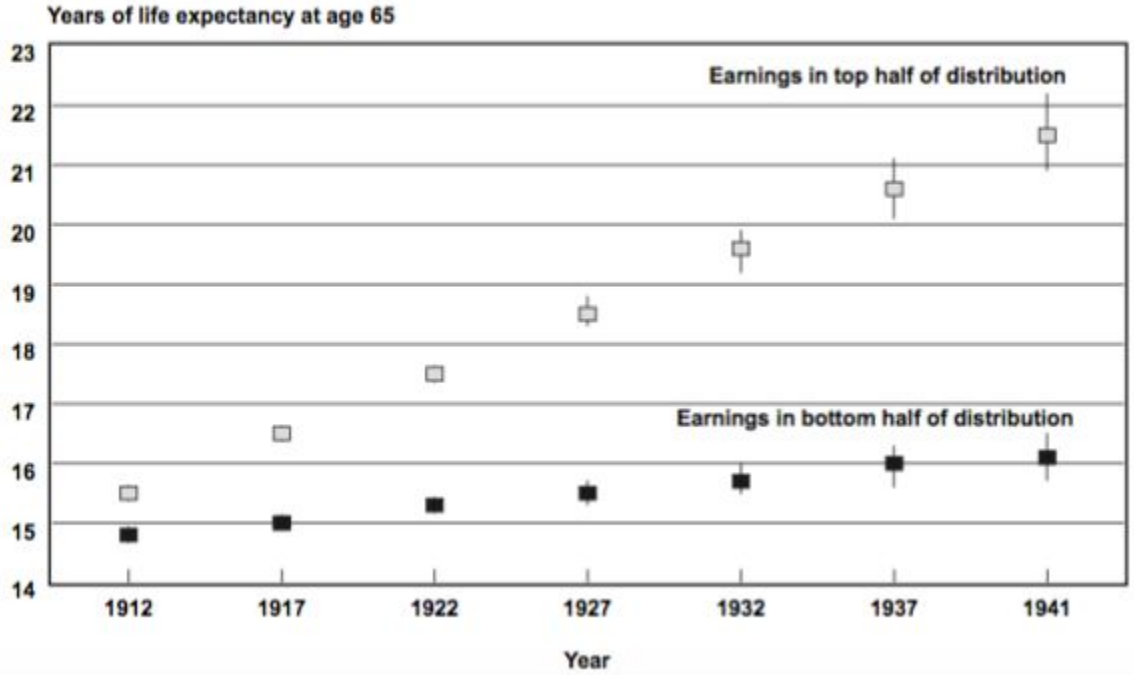


SOURCE: Author's calculations using a matched 2001 Continuous Work History Sample.

NOTE: The endpoints (years of birth 1912 and 1941) are used to calculate the percentage change.

Appendix

Chart 3.
Cohort life expectancy at age 65 (and 95 percent confidence intervals) for male Social Security–covered workers, by selected birth years and earnings group



SOURCE: Author's calculations using a matched 2001 Continuous Work History Sample.

Appendix

Table 9.
Male period life expectancy in 2000, by age and country (in years)

Country	Life expectancy	Country	Life expectancy	Country	Life expectancy
Males at age 60		***Males at age 65***		***Males at age 80***	
Iceland	22.2	Iceland	18.1	Mexico	8.7
Japan	21.4	Japan	17.5	Iceland	8.4
U.S. Social Security–covered workers (76th–100th percentile)	21.3	U.S. Social Security–covered workers (76th–100th percentile)	17.0	Japan	8.0
Switzerland	20.9	Australia	16.9	Canada	7.8
Australia	20.8	Canada	16.9	Australia	7.6
Canada	20.7	Switzerland	16.9	France	7.6
Sweden	20.7	Mexico	16.8	United States (OECD)	7.6
U.S. Social Security–covered workers (51st–75th percentile)	20.5	France	16.7	New Zealand	7.4
France	20.4	Sweden	16.7	Switzerland	7.4
Italy	20.4	Italy	16.5	Italy	7.3
New Zealand	20.3	New Zealand	16.5	Spain	7.3
Spain	20.3	Spain	16.5	U.S. Social Security–covered workers (0–25th percentile)	7.2
Mexico	20.2	U.S. Social Security–covered workers (51st–75th percentile)	16.5	United States (OCACT)	7.2
Norway	20.0	United States (OECD)	16.3	Sweden	7.1
United States (OECD)	19.9	Austria	16.0	Austria	7.0
Austria	19.7	Norway	16.0	Germany	7.0
United States (OCACT)	19.4	United States (OCACT)	15.8	U.S. Social Security–covered workers (51st–75th percentile)	7.0
Germany	19.4	Germany	15.7	United Kingdom	6.9
United Kingdom	19.4	United Kingdom	15.7	Denmark	6.8
Belgium	19.3	Belgium	15.5	U.S. Social Security–covered workers (76th–100th percentile)	6.8
Finland	19.2	Finland	15.5	Belgium	6.7
Luxembourg	19.2	Luxembourg	15.5	Norway	6.7
Netherlands	19.1	Netherlands	15.3	Finland	6.6
Portugal	19.0	Portugal	15.3	U.S. Social Security–covered workers (26th–50th percentile)	6.6
Denmark	18.9	Denmark	15.2	Luxembourg	6.5
U.S. Social Security–covered workers (26th–50th percentile)	18.7	U.S. Social Security–covered workers (26th–50th percentile)	15.0	Poland	6.5
Ireland	18.4	U.S. Social Security–covered workers (0–25th percentile)	14.7	Netherlands	6.4
U.S. Social Security–covered workers (0–25th percentile)	18.0	Ireland	14.6	Portugal	6.4
Czech Republic	17.0	Czech Republic	13.7	Czech Republic	6.1
Poland	16.7	Poland	13.6	Ireland	6.1
Slovak Republic	15.9	Slovak Republic	12.9	Slovak Republic	6.1
Turkey	15.9	Hungary	12.7	Hungary	6.0
Hungary	15.5	Turkey	12.6	Turkey	5.3