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The New Demographic Transition: Most Gains in Life Expectancy Now Realized Late in Life

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Abstract. The share of increases in life expectancy realized after age 65 was only about 20 percent at the beginning of the 20th century for the US and 16 other countries at comparable stages of development; but that share was close to 80 percent by the dawn of the 21st century, and is almost certainly approaching 100 percent asymptotically. This new demographic transition portends a diminished survival effect on working life. For high-income countries at the forefront of the longevity transition, expected lifetime labor force participation as a percent of life expectancy is declining. Innovative policies are needed if societies wish to preserve a positive relationship running from increasing longevity to greater prosperity.

The original "demographic transition" describes a process that began in Europe by the early 1800s with decreases in mortality followed, usually after a lag, by decreases in fertility (Davis 1945; for an overview in this journal, see Lee 2003). According to Lee and Reher (2011, p.1), "this historical process ranks as one of the most important changes affecting human society in the past half millennium." The increase in life expectancy associated with this demographic transition has been accompanied by rising levels of per capita output, which have in turn spurred further improvements in population health through better nutrition and living standards (Fogel 1994; Barker 1990) and, especially since World War II, through advances in medical care (in this journal, Cutler, Deaton, and Lleras-Muney 2006). At the same time, increases in life expectancy have resulted in a higher proportion of each cohort living long enough to participate in the production of goods and services. Reductions in fertility are also closely linked to higher labor force participation rates among women (Galor and Weil 1996; Costa 2000; Guinnane 2011).

During the original demographic transition, mortality decline prior to fertility decline often led to larger cohorts concentrated in working ages; this transitional change in the age structure of the population provided a boost to income that has been called a "demographic dividend" (Bloom, Canning, and Sevilla, 2003). Swift (2011) documents a significant two-way

positive relationship between life expectancy and GDP per capita between 1820 and 2001 for 13 high-income countries.

Now, the United States and many other countries are experiencing a new kind of demographic transition. Instead of additional years of life being realized early in the lifecycle, they are now being realized late in life. At the beginning of the twentieth century, in the United States and other countries at comparable stages of development, most of the additional years of life were realized in youth and working ages; and less than 20 percent was realized after age 65. Now, more than 75 percent of the gains in life expectancy are realized after 65—and that share is approaching 100 percent asymptotically. The choice of age 65 to illustrate this new demographic transition is somewhat arbitrary, but if we used 60 or 70 instead, the results would be qualitatively similar.

The new demographic transition is a *longevity* transition: how will individuals and societies respond to mortality decline when almost all of the decline will occur late in life? This issue is broader and more far-reaching than the issue of cohort size in each age group, with its focus on the prospective retirement of the unusually large "baby boomer" cohort, and has important socio-economic implications independent of patterns of fertility.

When the gains in life expectancy occur mainly towards the end of life, they contribute more to the age bracket that is traditionally mostly retired rather than to the age bracket in prime working years. Retirees are highly dependent on transfers from the working population for living expenses, including large consumption of medical care. Thus, gains in life expectancy concentrated at the end of life can unsettle an economy's balance between production and consumption in ways that pose a long-run challenge for public policy. The obvious changes that are needed (at least "obvious" to many economists") would be to raise productivity, to raise the

savings rate, and to raise the age of retirement, but how to accomplish such goals is controversial and uncertain.

This paper covers the years 1900-2007 for the United States and 16 other "developed countries," chosen for the continuity of their mortality data: Australia, Belgium, Canada, Denmark, England and Wales, Finland, France, Iceland, Italy, Netherlands, Northern Ireland, Norway, Scotland, Spain, Sweden, and Switzerland. We focus on demographic statistics including life expectancy at birth and at age 65, the percent of each birth cohort expected to survive to age 65, and the share of the increase in life expectancy at birth realized after age 65. For the U.S. economy, we also calculate expected labor force participation for each birth cohort, which allows us to investigate how changes in mortality affect labor force participation and worklife as a share of life expectancy.

Results on the longevity transition and expected labor force participation for the United States and other high-income countries are followed by consideration of economic and social changes in China and other countries that are experiencing an earlier stage of the original demographic transition. The paper concludes with a brief discussion of the long-run implications of the new demographic transition.

The Longevity Transition

To examine long-term trends in life expectancy at birth, we draw upon the life tables in the Human Mortality Database, which offers high quality demographic data for selected countries and regions compiled by a respected group of demographers at <http://www.mortality.org>. We first extract data on life expectancy at birth; in particular, we calculate "period" life

expectancy, which is the projected average age of death for a cohort if it experienced the age-specific death rates prevailing at the year of birth. We also look at rates of survival from birth to age 65, and life expectancy at age 65. We use the five-year period life tables since 1900 (or earliest available year) for each of the 17 countries or regions in the Human Mortality Database that have data extending back at least 70 years. The five-year intervals help to smooth annual fluctuations in demographic trends.

We calculate changes for nine overlapping 20-year intervals: 1907-1927, 1917-1937, and so on up to 1987-2007.[1] (The years ending in "7" are chosen to represent mid-points of each of our five-year intervals.) To calculate the change in years lived past 65, we first multiply survival to 65 by life expectancy at age 65 for each five-year period, and then take differences across 20-year intervals. Finally, we calculate the change in years lived past 65 as a percentage of change in life expectancy at birth for each country for each of the nine 20-year intervals.

Figure 1A shows that life expectancy at birth has increased almost continuously for well over a century in high-income countries. Figure 1B illustrates that much of this rise in life expectancy was due to a particularly large fall in death rates for infants, children, and young adults, resulting in a sharp rise in the percentage of a cohort surviving to age 65. Survival rates from birth to age 65 more than doubled over the twentieth century from 40.9 percent in 1900-04 to 83.3 percent in 2005-09 in the United States. Similarly, survival rates from birth to age 65 in 16 high-income comparators increased from 42.0 to 87.8 percent over the same period.

[1] For our detailed underlying data on the five-year averages for each country, see the on-line appendix with this paper at <http://e-jep.org>. Appendix tables 1-3 show the decreases in the coefficient of variation across the 17 high income countries for the demographic variables portrayed in Figures 1 and 2. To include data for the United States prior to 1933 (when the Human Mortality Database series begins for the United States), we use life table data from U.S. National Vital Statistics Reports, derived from death registration states for the period 1900 to 1928, and for the whole United States thereafter (all races combined). For a small share of observations at the beginning of the century -- Australia, Canada, UK Northern Ireland in 1900-19; Spain in 1900; and the United States in 1905, 1915, and 1925 -- we use imputed values from regressions with year and country fixed effects and country-specific linear time trends.

The other major demographic change that contributes to the longevity transition is an increase in life expectancy at age 65, an increase which has become larger in recent decades as shown in Figure 2A. The interaction between the increase in life expectancy at age 65 and the increase in the percentage of the cohort that survives to age 65 has resulted in an exceptionally large increase in the share of the gain in life expectancy that is realized after age 65. As can be seen in Figure 2B, that share was only about 20 percent during each 20-year period at the beginning of the twentieth century, but it was 76 percent in the United States and 78 percent for the 16-country mean by the end of the century, and is approaching 100 percent asymptotically. Our results here are quite similar to, and extend over time, those of Lee and Tuljapurkar (1997) based on the 1995 survival profile of the United States.

We can illustrate the shift in survival improvement toward older ages by comparing the age distribution of mortality decline between the first half and second half of the twentieth century for a region with particularly reliable long-run data, such as England and Wales. Figure 3 shows that between 1900-04 and 1950-54, declines in death rates were largest for infants and children, whereas between 1950-54 and 2000-04, declines were most salient for those over age 70. (In the on-line Appendix, Figure 1 shows that this pattern of age-specific mortality decline across the twentieth century was similar for Sweden. Figure 3 shows a slight increase in death rates for the oldest [90+] age groups between 1900-04 and 1950-54, perhaps because of small numbers, less reliable data, and/or survival of a less healthy cohort to those ages.)

The actual survival of a given birth cohort will differ from the estimates of life expectancy at birth when survival is changing over time. Remember, estimates of life expectancy at birth (what we earlier called “period” life expectancy) are based on the age-specific death rates prevailing at that year of birth. For example, in 1900-04, life expectancy at birth in England and

Wales was 48.6 years. In contrast, the cohort born in 1900-04 had a cohort life expectancy (actual mean age of death) of 53.8 years, since they experienced part of the increase in survival shown in Figures 1-3. The cohort born only 17 years later experienced a cohort life expectancy of 62.4 years, whereas "period" life expectancy at birth did not reach that level until 1935-1939.[2]

Nevertheless, we find that estimates based on cohort life tables prepared by the Social Security Administration (Bell and Miller 2005) exhibit a similar trend towards survival gains realized late in life: for men, the share of life expectancy increases realized after age 65 was 28 percent between the 1900 and 1920 birth cohorts, rising to a projected 62 percent between the 1980 and 2000 birth cohorts. For women, the share of life expectancy gains realized after age 65 increased from 30 percent (between the 1900 and 1920 birth cohorts) to an estimated 69 percent (between the 1980 and 2000 birth cohorts).

The century-long demographic trends shown in Figures 1 and 2 have been similar in all 17 countries with available data. From a U.S. perspective, the main difference is lagging survival to 65 compared to the other 16 countries (the U.S. line is below the 16-country average in Figure 1B); also, the United States experienced a larger rise in female life expectancy at age 65 between the 1940s and 1970s than the other countries. The relative differences among countries have decreased over time, especially for life expectancy at birth and survival to age 65.

The Longevity Transition and Expected Labor Force Participation

One of the most significant economic effects of the longevity transition is on expected

[2] Survival gains have been so dramatic that period and cohort survival significantly differs. For example, age-specific death rates for England and Wales in 1900-04 would have led to only 43.7 percent of women and 36.4 percent of men surviving to 65. But of the cohort born in 1900-04, 61.3 percent of women and 49.6 percent of men actually survived to age 65.

lifetime labor force participation, partly in terms of total years in the workforce and especially in terms of years in the workforce as a fraction of expected years of life. Two factors affecting the connection from life expectancy to years of work are whether the growing numbers of elderly are healthy enough to work, and the economic, social, and political pressures for a period of retirement at the end of life.

Greater longevity can have opposing effects on age-specific health status. If improved survival is correlated with reductions in morbidity for the elderly, then illness may be compressed into the end of life, as posited by the "compression of morbidity" hypothesis (Fries 1980). On the other side, it is also true that medical interventions tend to keep alive those who are in worse health (Zeckhauser, Sato, and Rizzo 1985), which suggests the possibility that the longer-lived elderly could be sicker for a longer period. The net effect of rising longevity on age-specific morbidity is an empirical question. According to the National Long Term Care Survey, the share of Americans with severe disabilities decreased from 26.2 to 19.7 percent between 1982 and 1999 (Manton and Gu 2001). Milligan and Wise (2011) find a strong within-country correlation between declining mortality and improved self-assessed health for several European countries. Thus, the empirical record suggests that better health in terms of both improved survival and reduced morbidity could tend to raise age-specific rates of labor force participation. Changes in occupational structure which lower the physical demands of work also can increase participation.

Higher incomes tend to increase the demand for leisure, in the form of fewer hours per week and, especially recently, as a block at the end of life (Costa 1998; Murphy and Topel 2006). Furthermore, several factors might give rise to a negative interaction between improved survival and employment, at least for some sub-groups. For example, the reduced selection effect

of mortality might also increase the proportion of the cohort that is less valued in employment (because of less stamina, ambition, education, and the like), reducing age-specific labor force participation. Alternatively, if firms have pyramid-like organizational structures with many jobs at entry and fewer at higher levels in the hierarchy—such as the military's "up or out" policy regarding age and promotion of officers—then increases in survival will lead to crowding at higher levels of the pyramid and lower rates of participation. Moreover, a sharp rise in employment rates for women, at wages that were often below those paid to men, might have led to some decrease in the demand for men's labor.

On net, which of these forces has predominated over the past century, and which are likely to predominate in the future? Estimates of what we call "expected labor force participation" can help answer this question.

Calculating Expected Labor Force Participation

We define "expected labor force participation" (XLFP) as the total years an individual is expected to participate in the labor force, based on period estimates of survival, and labor force participation by gender and age. That is

$$XLFP_{jt} = \sum_{i=1}^{100} \pi_{ijt} L_{ijt},$$

where L_{ijt} is the LFP rate for age i and gender j in year t, weighted by probability of survival to age i (π_{ijt}). It is necessary to examine men and women separately because of the large upsurge in female labor force participation between the 1950s and 2000 (Goldin 1986, 1990; Costa 2000). Our calculations rely on labor force participation rates from decennial censuses (1900-1930) and the Current Population Survey (1942-2007). As in the earlier estimates of life

expectancy, we can calculate both "period" expected labor force participation, which is based on the age-specific labor force participation rates prevailing at a certain point of time, or the actual realized labor force participation rates for a birth cohort; these estimates will differ when age-specific labor force participation rates are changing over time.

Changes in lifetime expected labor force participation can be decomposed into two factors: changes in survival to given ages and changes in age-sex-specific rates of labor force participation. For example, we calculate the effect of improving survival, holding age-specific labor force participation rates constant at their 2007 values. We also calculate the effect of changing rates of labor force participation, holding survival rates constant.[3]

Our work is related to the literature on expected lifetime work hours (Hazan 2009) and worklife expectancy (Smith 1982), including the Bureau of Labor Statistics' worklife estimates for the U.S. population from the 1950s through the early 1980s.[4] As far as we are aware, this paper is the first to produce worklife estimates for the United States covering the period 1900 to 2007, decompose those changes into survival and age-sex-specific labor force participation effects, and to estimate worklife expectancy relative to life expectancy at birth for a broader range of countries in recent decades.

U.S. Expected Labor Force Participation Since 1900

In the early twentieth century most of the increase in life expectancy arose from the dramatic decrease in mortality at young ages. This change first increased the years of youth

[3] These are decompositions 1B and 2B, respectively, in Appendix table 7. Alternative calculations, using 1900 as the base year (decompositions 1A and 2A), show similar results.

[4] In other pre-existing work in this area, Hunt and colleagues (1997) update worklife estimates for the U.S. based on 1992-1993 labor force participation rates. Millimet and colleagues (2003) use a regression framework. In related research, Hazan (2009) estimates lifetime working hours for U.S. men born between 1840 and 1970 and for the U.S. population born between 1890 and 1970.

dependency for these cohorts, and then increased expected labor force participation—the expected number of years that an individual will be in the labor force if he or she participates at the average LFP rate for each sex and age in a given year.

Figure 4A shows that years of expected labor force participation at birth for U.S. males increased by a third—from about 30 to 40 years—between 1900 and 1950. For the most recent half century, however, increases in survival have been offset by decreasing age-specific labor force participation rates for men, causing expected lifetime labor force participation to be relatively constant at about 40 years. Because life expectancy at birth has continued to increase, male expected labor force participation as a fraction of expected years of life has declined, as shown in Figure 4B. Table 1 shows that in the United States between 1900 and 2000, male participation increased from 30 to 40.5 years, female participation from 6.4 years to 34.4 years, and for the total population from 18.5 to 37.4 years. This increase in years of expected labor participation is two-thirds of the total gain in life expectancy at birth of 28.2 years over the twentieth century.

How much of this change is attributable just to longer life expectancies? If we hold age-specific rates of labor force participation constant, but allow survival rates to grow at the actually observed pace, the rise in life expectancy alone would have increased expected labor force participation by 13.3 years for males and by 10.8 years for females since 1900. (See Table 1.) The effect of mortality decline was concentrated in the first half of the twentieth century. Indeed, for men, the ratio of years of expected labor force participation to life expectancy at birth—holding age-specific labor force participation rates constant but allowing survival rates to vary—was relatively constant at 54 percent from early in the twentieth century until about 1970. At that point, it began a slow but seemingly inexorable decline, now falling to about 50 percent.

Actual years of expected labor force participation, reflecting both survival effects and changes in age-specific labor force participation rates, have also begun to decline. The ratio of years of expected labor force participation to life expectancy at birth ($XLFP/LE_0$) has declined for U.S. men from 62.6 percent in 1900 to 51.6 percent in 2007. That same ratio for women increased from 12.7 percent in 1900 to 43.2 percent in 2000, before declining slightly to 41.5 percent by 2007. For the overall U.S. population, years of expected labor force participation divided by life expectancy at birth peaked at 48.6 percent in 2000 and declined slightly to 46.3 percent by 2007 (as shown in Table 1 and earlier in Figure 4B).

Since 1950, increases in survival and declines in age-specific participation rates of men tended to offset one another. For example, between 1950 and 2007, labor force participation rates of men ages 45-54 declined from 95.8 percent to 88.2 percent, but survival to age 50 increased from 84.1 to 92.2 percent, so the total expected years in the labor force between ages 45 and 55 remained eight years.[5]

For women, increases in years of expected labor force participation mostly reflect increases in age-specific rates of labor force participation, especially after 1950. Accordingly, for women the ratio of years of expected labor force participation to life expectancy at birth—holding age-specific labor force participation rates constant but allowing survival rates to vary—has declined slowly but steadily from about 45 percent in the first few decades of the twentieth century to about 40 percent. The increase in female labor force participation since the late 1950s could be considered primarily a one-time substitution from unpaid home production to paid work

[5] For the detailed data behind these calculations across the range of ages, for both men and women, see Appendix Figure 2A and Appendix Table 7, which offer alternative decompositions of changes in both male and female labor force participation. Appendix Table 7 also shows that holding age-specific labor force participation rates constant (at either their 1900 or 2007 values) would have led to a larger increase in male expected labor force participation than actually observed. Appendix Figure 2B shows how closely the actual expected labor force participation rates for women tracks the rate that would have prevailed if survival had been at 2007 levels, but age-specific labor force participation rates had increased as they actually did from 1900 to 2007.

outside the home (Goldin 1990; Costa 2000). If so, then the decrease in years of expected labor force participation for women in the United States since 2000 would reflect relative completion of the one-off change and the beginning of a similar trend as seen for men—that is, a decline of years in the labor force as a share of life expectancy at birth.

Taking into account the decrease in the intensive margin—annual hours worked per full-time worker—tends to reinforce the conclusion that expected work life has declined as a fraction of life expectancy at birth. Hazan (2009) estimated lifetime work hours over the past century conditional on survival to age 5. We adapt Hazan's data to life expectancy at birth to calculate years of expected labor force participation adjusted for hours worked. (See Table 1 for results and Appendix for details of our calculations.)

Calculation of a century-long trend in expected years of labor force participation in other high-income countries is not possible because there is no reliable source for internationally comparable labor force participation rates before 1980. Given the similarities in trends of both survival and labor force participation across these 15 countries for the available years, we suspect the trend of declining expected labor force participation as a share of life expectancy at birth that we found for the United states reflects a broad and robust trend that countries experience as they reach high life expectancy levels. Indeed, with the sole exception of the Netherlands, the ratio of years of expected labor force participation to life expectancy at birth has declined since 1980 for males in all 15 other high-income countries in our analyses.[6] Adjusting for a decline in work hours would reinforce this trend.

[6] The appendix tables provide calculations of expected labor force participation across 15 countries since 1980; see Table 8 in the on-line appendix available with this paper at <http://e-jep.org>. Milligen and Wise (2011, p. 17) examine the age at which male mortality was 1.5 percent in 1977 and 2007, finding that at that age almost 90 percent of UK men were employed in 1977, but by 2007, only 30 percent were.

Demographic Transition across Stages of Economic Development

The demographic transition traces out a pathway, with many societies arrayed along earlier phases of the transition roughly and imperfectly in accordance with their per capita incomes. Many developing countries are currently experiencing the original demographic transition. For example, Table 2 shows that between 1990 and 2010, the share of years lived past 65 as a percentage of increase in life expectancy at birth was only a little over a third in Vietnam and Brazil, and less than a quarter in Bangladesh – comparable to levels a century earlier in today's high-income countries.

Improving health and increasing life expectancy at birth clearly can contribute to better living standards for the world's poor (World Health Organization 2002). Data on labor force participation for developing countries is not always reliably comparable across countries and over time. Nevertheless, the importance of improved survival for gains in expected labor force participation at early stages of the longevity transition can be illustrated with extant data. For example, in 1980 only 70 percent of Indonesian men survived to age 45; by 2007, 90 percent did. This improved survival added 10 years to expected labor force participation rates for Indonesian males between 1980 and 2007. As a result, expected labor force participation rates for Indonesian males rose to 43.7 years, which was 64.5 percent of life expectancy at birth in 2007.

China and India are especially important cases to consider, given their large populations and relatively rapid economic development. In India, the share of years lived past 65 as a percentage of increase in life expectancy at birth was barely one-quarter (as shown in Table 2) in the most recent 20 year period. For China, that share was 52 percent for men and 41 percent for women in the 1990-2010 period.

China's position reflects the rapidity of its demographic transition since the early 1970s and its achievement of relatively high levels of health despite low per capita income by the end of the Mao era (Banister 1987; Wang 2011). Indeed, despite the higher death rates associated with the Great Leap Famine of 1959-1961, China's growth in life expectancy from 35~40 in 1949 to 65.5 in 1980 ranks as the most rapid sustained increase in documented global history.[7] These earlier health improvements and growth of the working-age population contributed to China's unprecedented economic growth for the past quarter century. Wang and Mason (2008) estimate that between 1982 and 2000, about 15 percent of China's rapid growth in output per capita stemmed from the demographic dividend. (Bloom and Williamson [1998] estimate that one-quarter to one-third of the growth rates in the "East Asian miracle" stemmed from the demographic dividend.) Although the pace of mortality decline in China has slowed, it continues: Chinese life expectancy increased between 1990 and 2010 from 69.9 to 76.8 for women and from 66.9 to 72.5 for men.

With a rapid demographic transition to relatively low mortality and low fertility, China's population is now aging (Peng 2011). Many policy challenges loom as China establishes social and economic institutions commensurate with its transition to a middle-income, market-based economy with a large elderly population (Eggleston and Tuljapurkar 2010; Chen, Eggleston, and Li 2011). One additional challenge for China in reducing the growth-slowing potential of the new demographic transition is China's increasing burden of chronic disease. Fueled by rapid urbanization, increases in high-fat and calorie-rich diets, reductions in physical activity, unabated male smoking and other factors, prevalence of chronic disease has quickly caught up in China

[7] Miller, Eggleston and Zhang (2011) assess the relative importance of various explanations proposed for these gains, including better nutrition, widespread public health interventions, improved access to medical care, and increases in educational levels. They find that gains in education and public health campaigns jointly explain 25-32 percent of the crude death rate decline under Mao, and similar proportions of the dramatic reductions in infant and under-five mortality in that period.

with that of high-income countries. For example, the age-standardized prevalence of diabetes among adults in China was 9.7 percent in 2007-2008, more than 3 times reported prevalence in 1994 (Yang et al. 2010), comparable to prevalence in the US (8.3 percent overall in 2010, and 11.3 percent among adults; CDC 2011), and higher than the OECD average (OECD 2011).

The timing and the rapidity of the longevity transition has varied across countries and regions. For example, in Japan between 1950 and 1970, only 13.1 percent of increase in male life expectancy at birth was realized after age 65; for women, that figure was 17.3 percent. During the 1990 to 2009 period, Japan led the world in the new demographic transition, with the share of gains in life expectancy at birth realized after age 65 reaching 72.7 percent for men and 87 percent for women (again, as shown in Table 2).

The original and the new demographic transitions are inextricably intertwined with the evolution of social and economic institutions (Aoki 2011). Evidence is mounting that no society at an advanced stage of economic development can presume that further gains in longevity will contribute to growth of per capita income under currently prevailing institutions. For example, Lee and Mason (2011) compare the average age of consumption to the average age of labor income across a large group of countries for which they and their international collaborators have collected detailed generational accounts, including the value of assets and transfer wealth from social support programs (but not including bequests or value of non-market labor). They find that for developing countries, net transfers flow strongly downward from older to younger ages. However, in a "sea change" analogous to what we call the new demographic transition, "the direction of intergenerational transfers in the population has shifted from downward to upward, at least in a few leading rich nations" including Germany, Austria, and Japan (Lee and Mason 2011, p. 116). Although the Lee-Mason estimates are cross-sectional, the link to the longevity

transition is clear: for the 13 countries that overlap between their dataset and ours, there is a strong negative correlation (-0.89) between the share of gains in life expectancy over the past 20 years that were realized after age 65, and the current number of years by which the average age of income exceeds the average age of consumption. In other words, the more the gains in life expectancy are concentrated in traditional retirement years, the closer the intergenerational transfers are to being upward rather than downward.

For a broader group of 107 countries, Bloom, Canning, and Fink (2010) calculate counterfactual annual growth rates of per capita income between 1960 and 2005, using 2005-50 projections of demographics. The results vary depending on the level of economic development. They find that in most non-OECD countries, declining youth dependency would more than offset increasing old-age dependency. However, about half of countries would have grown more slowly using 2005-50 projections of demographics. Among 26 OECD countries analyzed, 25 of them (Turkey is the exception) would have had lower economic growth—averaging 2.1 rather than 2.8 percent per year—under the counterfactual of 2005-50 demographic change.

Policy Implications of the New Demographic Transition

Historically, adults produced more than they consumed and supported children. With such a pattern in place, the increase in proportion of the population in older years implied by the demographic transition might have been thought to shift out the social budget constraint as people expanded their number of years worked. However, “a funny thing happened along the way: societies invented retirement…and the economic consequences of population aging are now viewed with alarm” (Lee and Mason 2011, p.115).

Retirement, a relatively new phenomenon in human history, can be viewed as a response to many economic and social changes. Contributing factors include the shift from self-employment on farms or small businesses to wage and salary status; more rapid technological change, resulting in more rapid obsolescence of human capital (alongside compensation packages that often under-pay at the beginning and over-pay at the end of a career [Lazear 1981]); the introduction of a variety of health and welfare programs for the elderly which discourage work; an income-driven increase in the demand for leisure, with the diminished marginal value of an even shorter work week overtaken by the efficiency gains of a block of leisure at the end of life; and, in times of high unemployment, public concern about job opportunities for younger workers.

Will the new demographic transition inevitably lead to slower economic growth? As people foresee longer lives, they might choose to work longer, save more, and/or invest in human capital in sufficient amounts and innovative enough ways that longer lives continue to contribute to increased prosperity. In this spirit, Bloom, Canning, and Fink (2010) assert that "the problem of population ageing is more a function of rigid and outmoded policies and institutions than a problem of demographic change per se" (p. 607).

It is not clear, however, that the United States or other high-income countries even further along in the new demographic transition are reshaping their policies and institutions sufficiently in response to the longevity transition. Although both the United States and France have increased the age of retirement or age to qualify for early retirement, social welfare systems across the high-income countries of the world continue to give strong incentives for earlier, rather than later, retirement (Gruber and Wise 1998). Between 1965 and 2005, the correlation between change in male life expectancy at birth and change in retirement age is actually

negative: -0.21 (Bloom, Canning, and Fink 2010, p.591). This trend cannot continue indefinitely: longer and longer retirement lives are not consistent with continued increases in per capita income unless there are significant increases in savings, investment, and productivity. It is ironic that the same phenomenon that led to higher GDP per capita—namely higher life expectancy—can now decrease GDP per capita.

Successful navigation of the new demographic transition calls for a combination of policies to change the incentives for savings and investment (including in human capital) earlier in the lifecycle and working later in the lifecycle. Two forces in particular might move the society in that direction: improvement in health, and reductions in the transfers that the elderly can expect to receive from the young.

Public policy should encourage higher labor force participation for the elderly, both by reducing the disadvantages that employers face when employing older workers and by providing enhanced incentives to individuals to continue to work. “People cannot expect to finance 20-25 year retirements with 35-year careers,” John B. Shoven noted. “It just won’t work. Not in Greece [or] the United States ... Eventually, we are going to have to increase retirement ages” (as quoted in Haven 2011). However, increasing labor force participation for the 65-plus age group alone probably won’t make a big difference: even a doubling of those rates from their 2007 levels of 12.6 for women and 20.5 for men would not bring the US ratio of expected labor force participation to life expectancy at birth back to its 2000 level. Increased participation by men 50-64 is needed.

Public policy might also seek to improve productivity, with an emphasis on education and building human capital early in the life-cycle, and on investment to reduce morbidity and improve the physical ability to work later in life. Whether compression of morbidity later in life

will continue depends on whether improvements in medical technology and in the socio-economic determinants of health are offset by adverse trends such as increasing obesity. A potentially promising focus here would be to consider investments in public health and medical technologies that reduce morbidity and improve quality of life, as well as more focus on medical innovations that reduce costs of care. (One example of a policy consistent with both objectives would be expansion of palliative care as a substitute for what can otherwise be extremely expensive end-of-life care in a hospital—especially in countries where the concept of hospice services is relatively new, such as China.)

Finally, increased savings, investment, and capital formation could help in fueling endogenous growth (Lucas 1988; Romer 1990). U.S. personal savings rates have been low for many decades. Increasing the savings rate of individuals before they retire would ameliorate the potential adverse impact of longevity on economic growth. Countries will need to make fiscally realistic structural changes to entitlement programs – such as Medicare and Social Security in the United States – to support acceptable living standards and improvements in health.

High-income societies are now facing a new demographic transition: the longevity transition. They must decide how to respond to mortality decline when almost all of the decline will occur late in life. Additional increases in life expectancy will result in further declines in expected labor force participation as a percentage of life expectancy at birth, unless there is a significant rise in labor force participation rates across both middle and older ages. Of course, increased life expectancy has great value independent of its relationship to per capita income (Murphy and Topel 2006). The original demographic transition gave society a “demographic gift” of higher per capita incomes (Bloom and Williamson 1998) without much need for a policy

response, but the new demographic transition requires politically difficult policies if societies wish to preserve a positive relationship running from increased longevity to greater prosperity.

References

Aoki, Masahiko. 2011. *The Five-Phases of Economic Development and Institutional Evolution in China and Japan* (Presidential Lecture at the XVIth World Congress of the International Economic Association).

Banister, Judith. 1987. *China's Changing Population*: Stanford University Press.

Barker, David J. 1990. "The Fetal and Infant Origins of Adult Disease." *British Medical Journal*, 301(6761): 1111.

Bell, Felicitie C., and Michael L. Miller. 2005. "Life Tables for the United States Social Security Asia 1900-2100" Actuarial Study No. 120, Social Security Administration Office of the Chief Actuary, SSA Pub. No. 11-11536. Available from: http://www.socialsecurity.gov/OACT/NOTES/s2000s.html [downloaded 12 March 2012].

Bloom, David E., D. Canning, and G. Fink. 2010. "Implications of Population Ageing for Economic Growth" *Oxford Review of Economic Policy*, 26(4): 583–612.

Bloom, David E., D. Canning, and J. Sevilla. 2003. *The Demographic Dividend: A New Perspective on the Economic Consequences of Population Change*. Vol. 5: Rand Corporation.

Bloom, David E. and J. G. Williamson. 1998. "Demographic Transitions and Economic Miracles in Emerging Asia" *The World Bank Economic Review*, 12(3): 419–455.

Chen, Qiulin, Karen N. Eggleston, and Ling Li. 2011. "Demographic Change, Intergenerational Transfers, and the Challenges to Social Protection Systems in China," forthcoming in *Demographic Transition and Inclusive Growth in Asia.*

Centers for Disease Control and Prevention (CDC). 2011. "2011 National Diabetes Fact Sheet." Atlanta, GA: CDC. Available from http://www.cdc.gov/diabetes/pubs/pdf/ndfs_2011.pdf [downloaded 12 March 2012].

Costa, Dora L. 1998. *The Evolution of Retirement: An American Economic History, 1880-1990*. University of Chicago Press: Chicago, IL, USA.

Costa, Dora L. 2000. "From Mill Town to Board Room: The Rise of Women's Paid Labor." *Journal of Economic Perspectives*, 14(4): 101–122.

Cutler, David, Angus Deaton and Adriana Lleras-Muney. 2006. "The Determinants of Mortality," *Journal of Economic Perspectives*, 20(3): 97–120.

Davis, Kingsley. 1945. "The World Demographic Transition." *Annals of the American Academy of Political and Social Science*, 237: 1–11.

Eggleston, Karen N., and Shripad Tuljapurkar, editors. 2010. *Aging Asia: Economic and Social Implications of Rapid Demographic Change in China, Japan, and South Korea.* Stanford University Walter H. Shorenstein Asia-Pacific Research Center series with Brookings Institution Press.

Fogel, Robert W. 1994. "Economic Growth, Population Theory, and Physiology: The Bearing of Long-term Processes on the Making of Economic Policy." *American Economic Review*, 84(3): 369–395.

Fries, James F. 1980. "Aging, Natural Death, and the Compression of Morbidity." *New England Journal of Medicine*, 303(3): 130–135.

Fuchs, Victor R. 1999. "'Provide, Provide': The Economics of Aging." In *Medicare Reform: Issues and Answers*, edited by Andrew J. Rettenmaier and Thomas R. Saving (The University of Chicago Press, 1999), pp. 15–36.

Galor, Oded, and David N. Weil. 1996. "The Gender Gap, Fertility, and Growth." *American Economic Review*, 86(3): 374–387.

Gruber, Jonathan and David A. Wise. 1998. *Social Security Programs and Retirement around the World*. University of Chicago Press: Chicago, IL, USA.

Guinnane, Timothy W. 2011. "The Historical Fertility Transition: A Guide for Economists." *Journal of Economic Literature*, 49(3): 589–614.

Goldin, Claudia. 1986. "The Female Labor Force and American Economic Growth: 1890 to 1980," in *Long-Term Factors in American Economic Growth*, Conference on Income and Wealth, Volume 51. Stanley Engerman and Robert Gallman, eds. Chicago: University of Chicago Press, pp. 557–604.

Goldin, Claudia. 1990. *Understanding the Gender Gap: An Economic History of American Women*. New York-Oxford: Oxford University Press.

Haven, Cynthia. "Stanford economist: How do we 'get off this path of deficits as far as the eye can see?'" *Stanford Report*, August 2, 2011. Available at http://news.stanford.edu/news/2011/august/shoven-debt-qanda-080211.html.

Hazan, Moshe. 2009. "Longevity and Lifetime Labor Supply: Evidence and Implications," *Econometrica*, 77(6): 1829–1863.

Human Mortality Database. University of California, Berkeley (USA), and Max Planck Institute for Demographic Research (Germany). Available at www.mortality.org.

Hunt, Tamorah, Joyce Pickersgill and Herbert Rutemiller. 2001. "Recent Trends in Median Years to Retirement and Worklife Expectancy for the Civilian U.S. Population (Prepared Using 1998/99 BLS Labor Force Participation Rates)." *Journal of Forensic Economics*, 14(3): 203–227.

Lazear, Edward P. 1981. "Agency, Earnings Profiles, Productivity, and Hours Restrictions." *American Economic Review*, 71(4): 606–620.

Lee, Ronald D. 2003. "The Demographic Transition: Three Centuries of Fundamental Change." *Journal of Economic Perspectives*, 17(4): 167–190.

Lee, Ronald D. and David S. Reher. 2011. "Introduction: The Landscape of Demographic Transition and its Aftermath" *Population and Development Review*, 37: 1–7.

Lee, Ronald D. and Andrew Mason. 2011. "Generational Economics in a Changing World" *Population and Development Review*, 37: 115–142.

Lee, Ronald D. and Shripad Tuljapurkar. 1997. "Death and Taxes: Longer Life, Consumption, and Social Security" *Demography*, 34(1): 67–81.

Lucas, Robert E. 1988. "On the Mechanics of Economic Development" *Journal of Monetary Economics*, 22(1): 3–42.

Manton, Kenneth G. and Xiliang Gu. 2001. "Changes in the Prevalence of Chronic Disability in the United States Black and Nonblack Population Above Age 65 from 1982 to 1999" *Proceedings of the National Academy of Sciences*, 98(11): 6354–6359.

Miller, N. Grant, Karen N. Eggleston, and Qiong Zhang. "Understanding China's Mortality Decline under Mao: A Provincial Analysis, 1950–1980," Stanford University Asia Health Policy Program working paper, September 2011.

Milligan, Kevin and David A. Wise. 2011. *Introduction to "Social Security and Retirement around the World: Historical Trends in Mortality and Health, Employment, and Disability Insurance Participation and Reforms"*. National Bureau of Economic Research working paper 16719.

Millimet, Daniel L., Michael Nieswiadomy, Hang Ryu, and Daniel Slottje. 2003. "Estimating Worklife Expectancy: An Econometric Approach." *Journal of Econometrics*, 113(1): 83–113.

Murphy, Kevin M. and Robert H. Topel. 2006. "The Value of Health and Longevity." *Journal of Political Economy*, 114(4): 871-904.

OECD. 2011. *Health at a glance 2011: OECD Indicators*. Organization for Economic Cooperation and Development. Available from: http://www.oecd.org/dataoecd/6/28/49105858.pdf [downloaded 12 March 2012].

Peng, Xizhe. 2011. "China's Demographic History and Future Challenges." *Science*, 333(6042): 581–587.

Romer, Paul M. 1990. "Endogenous Technological Change." *Journal of Political Economy*, 98(5), Part 2: The Problem of Development: A Conference of the Institute for the Study of Free Enterprise Systems. (Oct., 1990): S71–S102.

Smith, Shirley J. 1982. "New Worklife Estimates Reflect Changing Profile of Labor Force." *Monthly Labor Review*, 105: 15.

Swift, Robyn. 2011. "The Relationship between Health and GDP in OECD Countries in the Very Long Run" *Health Economics*, 20(3): 306–322.

Wang, Feng. 2011. "The Future of a Demographic Overachiever: Long-Term Implications of the Demographic Transition in China" *Population and Development Review*, 37: 173–190.

Wang, Feng, and Andrew Mason. 2008. "The Demographic Factor in China's Transition." Chapter 5 in *China's Great Economic Transformation*. Loren Brandt and Thomas G. Rawski, editors. (Cambridge: Cambridge University Press): 136–166.

World Health Organization. 2002. *Macroeconomics and Health: Investing in Health for Economic Development: Report of the Commission on Macroeconomics and Health*: World Health Organization (WHO).

Yang, W., Lu, J., Weng, i., Jia, W., Ji, L., Xiao, J., Shan, Z., Liu, J., Tian, H., Ji, Q., Zhu, D., Ge, J., Lin, L., Chen, L., Guo, X., Zhao, Z., Li, Q., Zhou, Z., Shan, G. and He, J. 2010. Prevalence of Diabetes among Men and Women in China, *New England Journal of Medicine* 362(12): 1090–1101.

Zeckhauser, Richard J., Ryuzo Sato, and John Rizzo. 1985. "Hidden Heterogeneity in Risk: Evidence from Japanese Mortality," in *Health Intervention and Population Heterogeneity: Evidence from Japan and the United States*, National Institute for Research Advancement, December 1985, pp. 23–131.

Figure 1A: Life Expectancy at Birth Since 1900
US and 16 Other High Income Countries

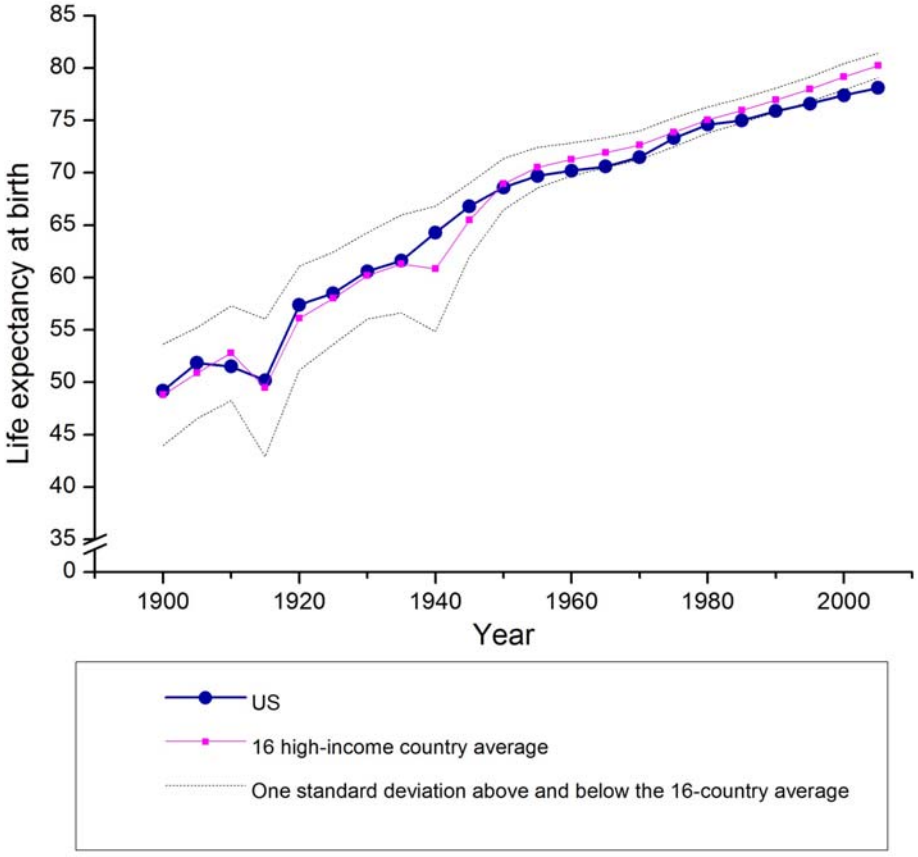


Figure 1B: Percent of Birth Cohort Expected to Survive to Age 65 Since 1900
US and 16 Other High Income Countries

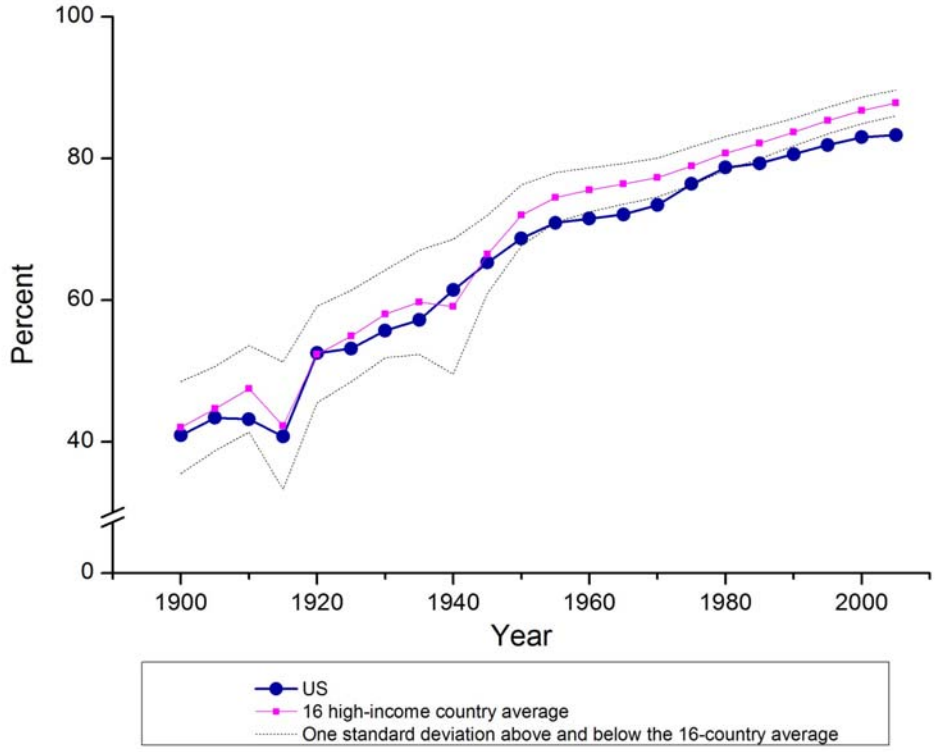


Figure 2A: Life Expectancy at Age 65 Since 1900
US and 16 Other High Income Countries

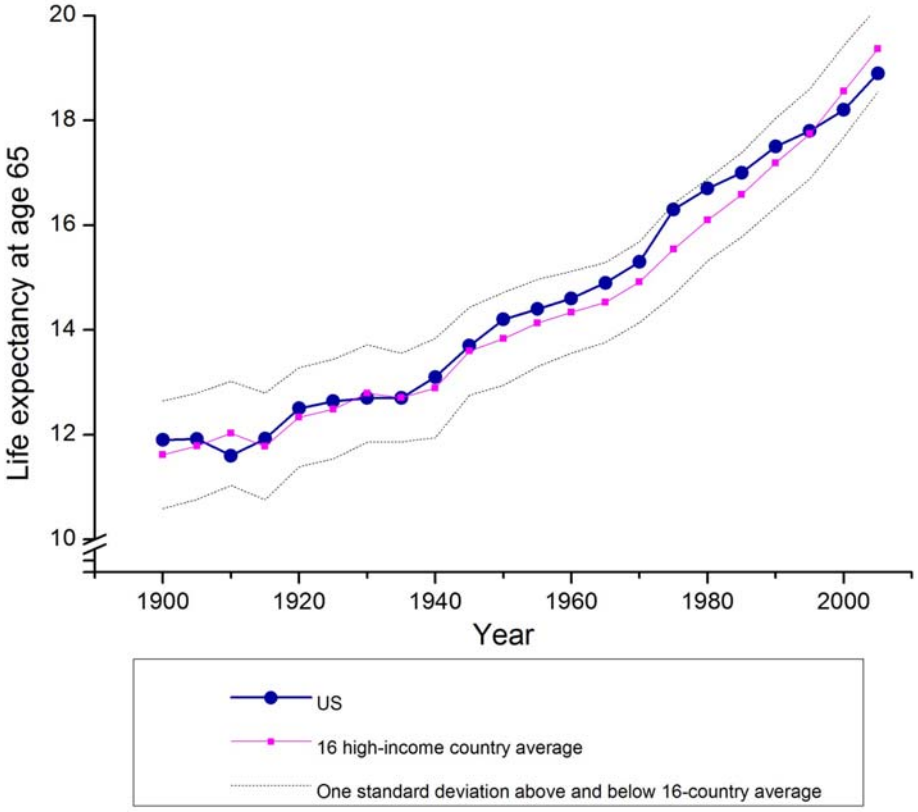


Figure 2B: Share of Gains in Life Expectancy at Birth Realized after Age 65 Since 1900
US and 16 Other High Income Countries

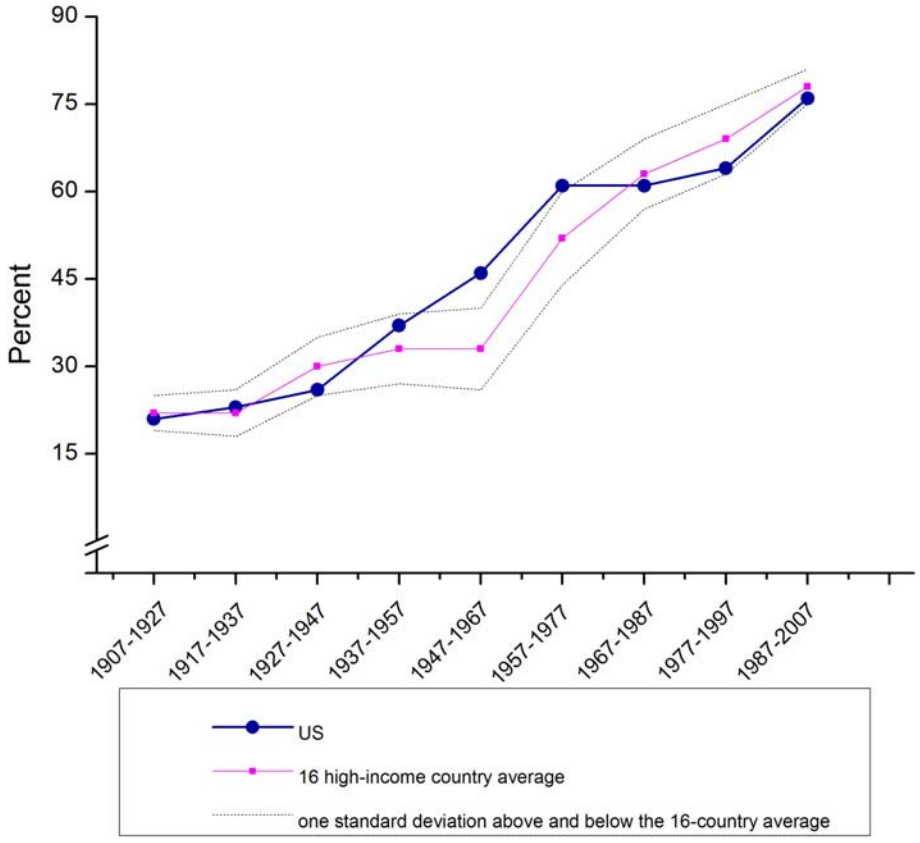
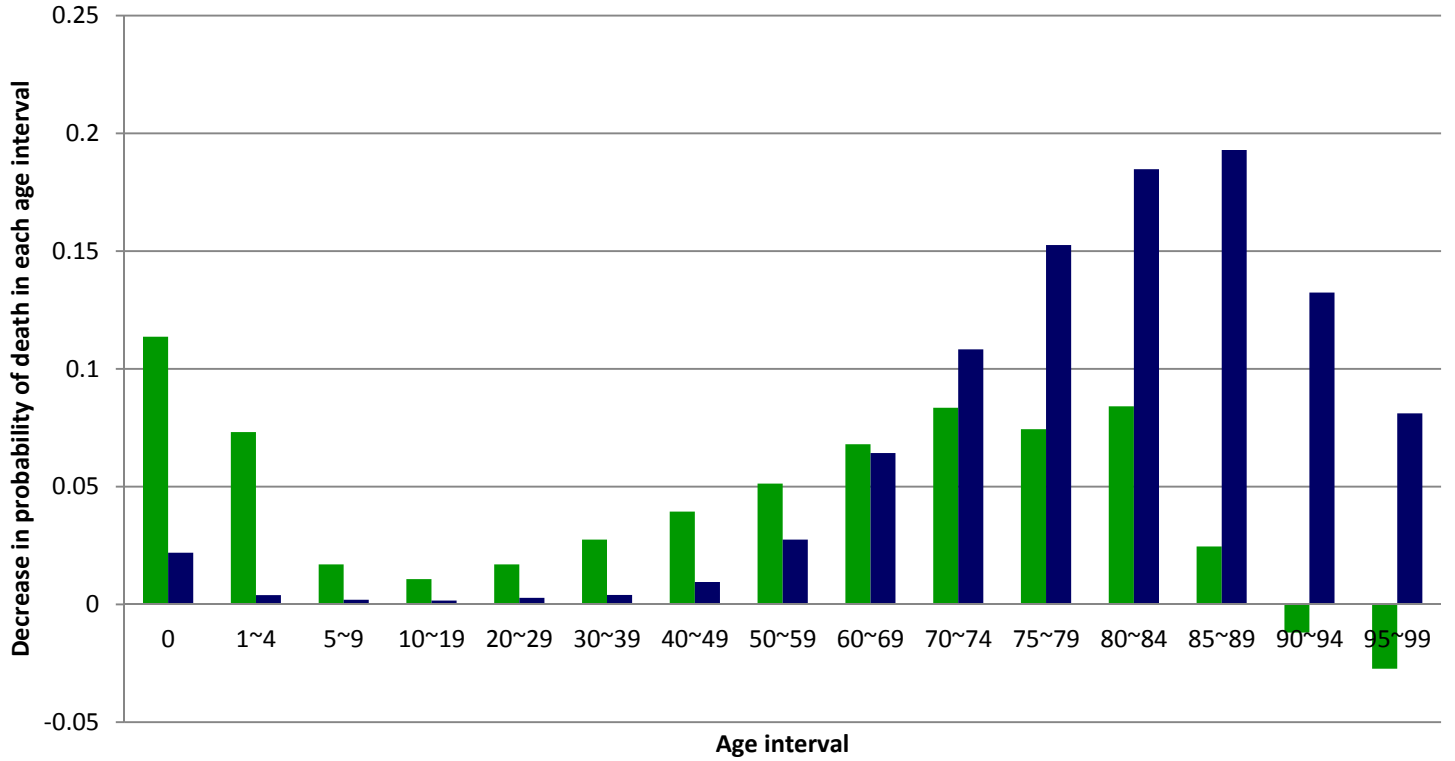


Figure 3. Decrease in Death Rates by Age Group in England and Wales, 1900-04 to 1950-54 and 1950-54 to 2000-04



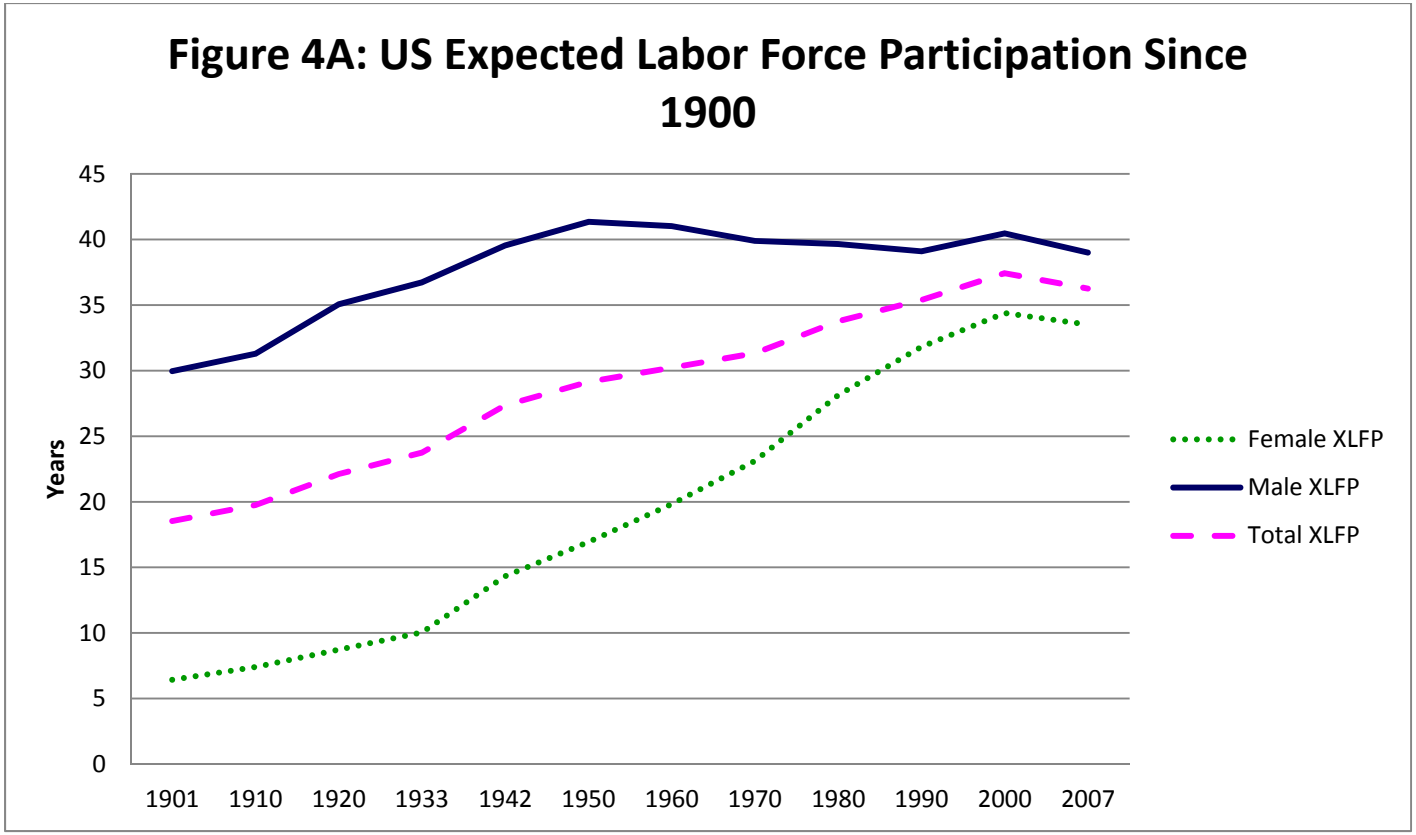


Figure 4A: US Expected Labor Force Participation Since 1900
Years
45
40
35
30
25
20
15
10
5
0
1901
1910
1920
1933
1942
1950
1960
1970
1980
1990
2000
2007
Female XLFP
Male XLFP
Total XLFP

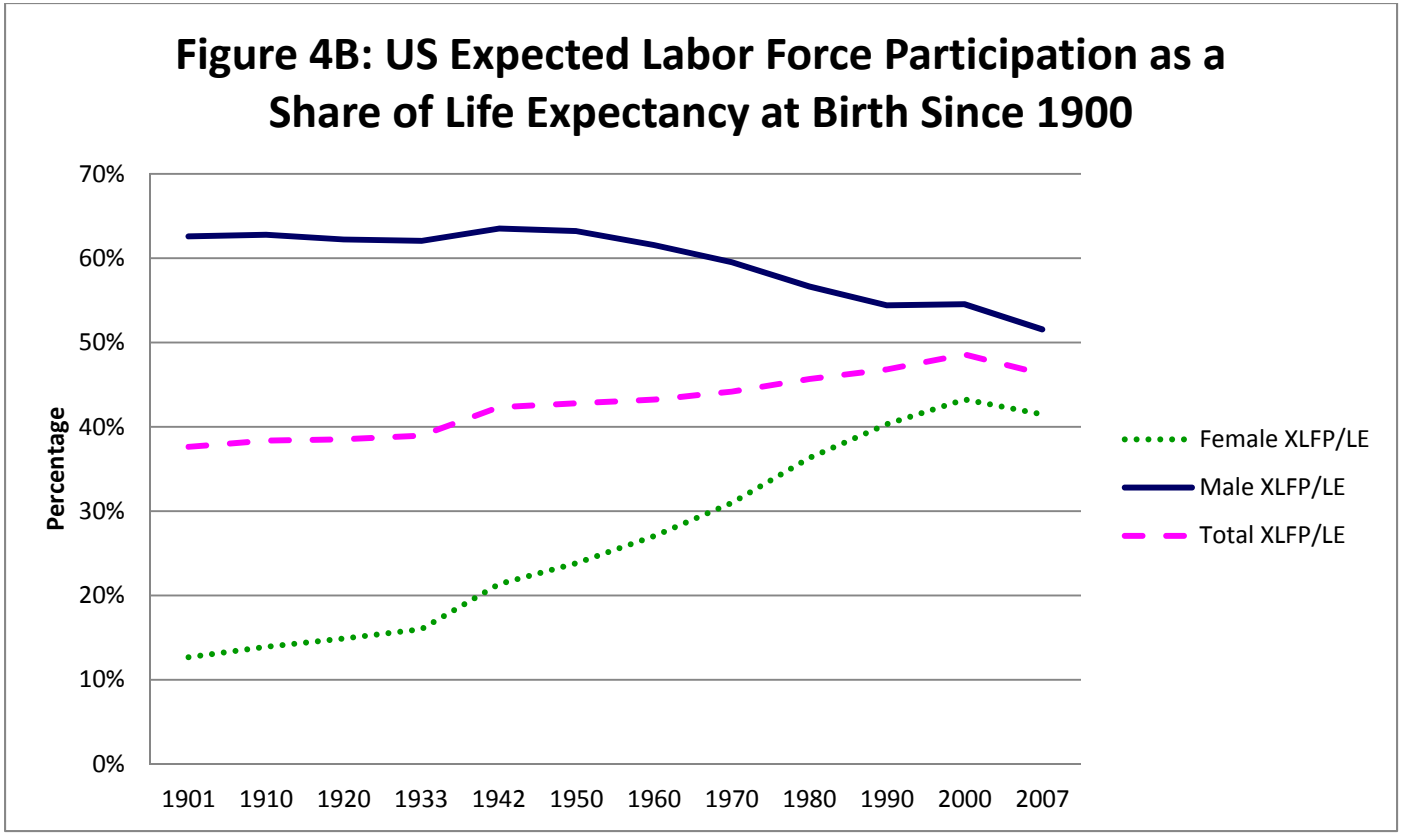


Figure 4B: US Expected Labor Force Participation as a Share of Life Expectancy at Birth Since 1900
Percentage
70%
60%
50%
40%
30%
20%
10%
0%
1901
1910
1920
1933
1942
1950
1960
1970
1980
1990
2000
2007
Female XLFP/LE
Male XLFP/LE
Total XLFP/LE

Table 1. Expected labor force participation in the US, by sex, 1900-2007

	Men					Women			Total (Men and Women)				
Year	Male XLFP	Male XLFP holding LFP constant	Male XLFP adjusted for hours worked	Male $XLFP/LE_0$	Male XLFP adjusted for $hours/LE_0$	Female XLFP	Female XLFP holding LFP constant	Female $XLFP/LE_0$	Total XLFP	Total XLFP holding LFP constant	Total XLFP adjusted for hours worked	Total $XLFP/LE_0$	Total XLFP adjusted for $hours/LE_0$
1900	30.0	25.7	37.28	62.6%	77.9%	6.4	22.7	12.7%	18.5	24.2	n.a.	37.6%	n.a.
1910	31.3	27.1	39.96	62.8%	80.2%	7.4	24.1	13.9%	19.8	25.6	n.a.	38.4%	n.a.
1920	35.1	30.4	37.65	62.2%	66.8%	8.7	26.3	14.9%	22.1	28.4	n.a.	38.5%	n.a.
1933	36.7	32.3	40.40	62.0%	68.2%	10.0	28.3	16.0%	23.7	30.3	29.0	39.0%	47.5%
1942	39.5	34.1	42.66	63.5%	68.5%	14.3	30.1	21.3%	27.4	32.2	29.2	42.3%	45.1%
1950	41.3	35.6	38.22	63.2%	58.4%	16.9	31.3	23.8%	29.1	33.6	29.0	42.8%	42.5%
1960	41.0	36.3	36.79	61.5%	55.2%	19.8	32.0	27.0%	30.2	34.2	28.8	43.2%	41.2%
1970	39.9	36.4	34.67	59.5%	51.7%	23.1	32.2	31.0%	31.3	34.4	28.9	44.2%	40.7%
1980	39.6	37.4	n.a.	56.6%	n.a.	28.1	32.8	36.3%	33.8	35.2	n.a.	45.7%	n.a.
1990	39.1	37.9	n.a.	54.4%	n.a.	31.8	33.1	40.3%	35.4	35.6	n.a.	46.8%	n.a.
2000	40.5	38.7	n.a.	54.5%	n.a.	34.4	33.3	43.2%	37.4	36.0	n.a.	48.6%	n.a.
2007	39.0	39.0	n.a.	51.6%	n.a.	33.5	33.5	41.5%	36.3	36.3	n.a.	46.3%	n.a.
Change, 1900 to most recent	9.0	13.3	-2.6	-11.0%	-26.1%	27.1	10.8	28.8%	17.7	12.0	n.a.	8.7%	n.a.

Note: Expected Labor Force Participation (XLFP) is calculated as the total years an individual is expected to participate in the labor force based on period estimates of labor force participation and survival by gender and age. XLFP for a given year represents the expected number of years that an individual would be in the labor force if he or she participates at the average LFP rate for each age in that given year. LE_0 is life expectancy at birth. "XLFP holding LFP constant" uses 2007 age- and sex-specific labor force participation rates, but allows survival to each age to vary as it actually did between 1900 and 2007. Sources: Author calculations based on survival data from the Human Mortality Database (1933-2007), supplemented by data for death registration states for 1900-1920; and labor force participation rates from decennial censuses (1900-1930) and the Current Population Survey (1942-2007). Adjustments for hours worked draw from Hazan (2009). See the appendix for details.

Table 2. The Longevity Transition in Asia and Select Developing Countries

Country	Change in years lived past 65 as a percentage of change in life expectancy at birth, 1990-2010	
	Males	Females
Japan	72.7%	87.0%
South Korea	45.4%	57.1%
China	51.9%	40.6%
Philippines	26.2%	36.0%
Indonesia	26.1%	35.7%
Brazil	34.2%	35.0%
Vietnam	32.5%	34.7%
India	23.6%	25.8%
Bangladesh	20.7%	25.4%

Source: Authors' calculations based on the life tables for each country prepared by the International Programs Center of the U.S. Bureau of the Census in its International Data Base.

Appendix for "The New Demographic Transition: Most Gains in Life Expectancy Now Realized Late in Life"

Karen N. Eggleston and Victor R. Fuchs
Stanford University

Data and Methods

For the countries and regions for which the Human Mortality Database offers civilian-only and total population life tables (e.g. France, England and Wales), we choose total population life tables. The initial observation for each country may be based on fewer than 5 years of data. Similarly, for several countries (e.g., Belgium, France, Italy), LE in 2005-09 is based on fewer than 5 years of data. Specifically, the initial years for each country or region are as follows: Australia, 1921; Belgium, 1841; Canada, 1921; Denmark, 1835; Finland, 1878; France, 1816; Iceland, 1838; Italy, 1872; Netherlands, 1850; Norway, 1846; Spain, 1908; Sweden, 1751; Switzerland, 1876; United Kingdom England & Wales, 1841; UK Scotland, 1855; UK Northern Ireland, 1922; U.S.A., 1933. The final year for each country or region is 2007 except as follows: 2006 for Italy and Spain; 2008 for Denmark, Finland, Iceland, Netherlands, Norway, and Sweden; and 2009 for the UK (England & Wales, Scotland, and Northern Ireland).

To smooth annual changes and account for slight differences in starting and ending dates of the data, the changes in life expectancy at birth use average life expectancy over 5-year periods at the beginning and end of each 20-year interval. Thus, the change for the period 1987-2007 is given by subtracting (LE in 1985-1989) from (LE in 2005-2009).

Data for the US prior to 1933 are from US National Vital Statistics Reports, Vol. 58, No. 21, June 28, 2010 "Table 12. Estimated life expectancy at birth in years, by race and sex: Death-registration states, 1900-1928, and United States, 1929-2006."

Our discussion of cohort versus period survival to 65 and life expectancy also draws from the Human Mortality Database, especially the cohort life tables for England and Wales [accessed October 20, 2011].

The survival data we use for developing countries not included in the Human Mortality Database (such as China, India, Indonesia, and Brazil in Table 2) comes from the life tables for each country prepared by the International Programs Center of the U.S. Bureau of the Census, which carries out population estimates and projections for all countries of the world in its International Data Base (IDB). Although key results of the IDB are publicly available on the US Census Bureau website, the detailed life tables by gender and year that we use for this analysis are not publicly available. We thank Dr. Judith Banister for assistance with assembling and validating that data. We extend our appreciation and thanks to Loraine West, Daniel Goodkind, and Andrea Miles at the US Bureau of the Census for graciously providing country life tables from the IDB.

We also calculate XLFP, the expected number of years that an individual will be in the labor force if he or she participates at the average LFP rate for each sex and age. We approximate survival π_{ijt} with sex-specific survival to the mid-point of a given age range, using period life tables for each country as

described above. LFP is generally only available for given age groups, so we approximate L_{ijt} with the average sex-specific LFP rate for a given age group for a given year, assuming LFP before age 15 and after age 75 is zero.

For calculation of XLFP using US Current Population Survey data for 1950-2010, LFP is available for six age ranges: 16-24, 25-34, 35-44, 45-54, 55-64, 65 and older[1]; using ILO data (only available since 1980) for a broader range of countries, LFP is available for five age ranges: 15-24, 25-34, 35-54, 55-64 and 65+. For Table 1, 1900 XLFP calculations use survival data from the 1901 lifetable for the original death registration states (Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Indiana, Michigan and the District of Columbia) and LFP data from the 1900 census, as reported in Historical Statistics of the US "Series D 29-41: Labor force by age and sex, 1890 to 1970." Because there is no LFP data for 1910, we use a simple average, by gender, of LFP rates in 1901 and 1920. Survival data come from 1910 lifetable for the original death registration states (all races). XLFP calculations for 1920 use LFP data from the 1920 census and survival data from the 1920 death registration states (Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Missouri, Nebraska, Delaware, Maryland, Virginia, North Carolina, South Carolina, Florida, Kentucky, Tennessee, Mississippi, Louisiana, Montana, Colorado, Utah, Washington, Oregon, California and the District of Columbia, white race only). Calculations for XLFP for 1933 use 1930 census LFP age ranges and 1933 survival from the HMD lifetable; for 1942, we use the 1942 CPS survey LFP rates and 1942 survival from HMD lifetable (because the 1940 census data methods and age ranges are not comparable to the 1942 and after CPS data).

For the adjustment of US XLFP for work hours, we draw upon the estimates of Hazan (2009), which are conditional on survival to age 5 (and in some cases, older ages). Given our focus on societal expectations about overall worklife, we need to incorporate the dramatic improvements in infant and child survival over the century. Thus, to adjust expected lifetime labor force participation for hours of work, we first multiply Hazan's estimates of expected lifetime work hours by survival to age 5 for the appropriate year or birth cohort. Then we report lifetime work hours as the number of years of full-time work, where full time is 2080 hours per year (40 hours per week, 52 weeks per year). The resulting time series of years of male expected labor force participation, adjusted for the intensive margin of hours worked, shows a 5-year increase between 1900 and 1940, followed by an 8-year decrease by 1970. Adjusting for hours worked therefore leads to an even more dramatic, and earlier, reduction in male expected labor force participation relative to life expectancy.

Data limitations preclude similar calculations for women, but Hazan (2009) does report expected lifetime work hours for the total population up to 1970. Using these numbers, adjusted for survival using the Human Mortality Database (available for the total US population since 1933), yields an estimate of about 29 years of expected labor force participation for the average American, adjusted for hours worked, relatively constant between 1933 and 1970. In other words, for much of the last century, survival gains

[1] Sources for the US LFP data are Fullerton (1999) [Howard N Fullerton, Jr., 1999. "Labor force participation: 75 years of change, 1950–98 and 1998–2025," Monthly Labor Review December 1999: 3-12] summarizing LFP through 1998 based on historical Current Population Survey data, and subsequent data from the Current Population Survey 2011 Statistical Abstract, "Table 585. Civilian Labor Force and Participation Rates with Projections."

and increased female labor force participation have been offset by declining work hours and reduced male age-specific labor force participation. As a result, the average American's expected years in the labor force have remained constant. Meanwhile, survival has continued to improve. Accordingly, worklife as a fraction of life expectancy for the overall US population fell from 47.5% in the 1930s to 40.7% by 1970.

Looking at data for birth cohorts, rather than period data, reinforces and compresses this finding of shorter worklives. For example, using the Hazan (2009, figure 8) cohort estimates of expected lifetime work hours, the cohort of men born in 1900 would have expected to be in the labor force for 64.7% of their lives; the cohort of men born only 30 years later would expect to be in the labor force for two additional years, but a much shorter share of their lives (53.1%).

Countries may differ in how they account for self-employment and other factors (such as military service) that impact labor force participation rates by age and sex. The ILO attempts to standardize for such differences. Specifically, according to the ILO, "the labor force participation rate is a measure of the proportion of a country's working-age population that engages actively in the labor market, either by working or looking for work; it provides an indication of the relative size of the supply of labor available to engage in the production of goods and services. The breakdown of the labor force by sex and age group gives a profile of the distribution of the economically active population within a country.… The participation rates are harmonized to account for differences in national data collection and tabulation methodologies as well as for other country-specific factors such as military service requirements. The series includes both nationally reported and imputed data and only estimates that are national, meaning there are no geographic limitations in coverage" [http://kilm.ilo.org/KILMnetBeta/pdf/kilm01EN-2009.pdf, accessed 30 May 2011].

We compared using single-year survival data to 5-year averages when calculating XLFP for the US and several other countries; the resulting XLFP trends are extremely similar.

Appendix Tables and Figures

Appendix Table 1A. Female life expectancy at birth since 1900, US and 16 other high income countries

	1900-1904	1905-1909	1910-1914	1915-1919	1920-1924	1925-1929	1930-1934	1935-1939	1940-1944	1945-1949	1950-1954
Australia	52.5	53.9	59.8	54.4	64.1	65.1	67.2	67.7	68.6	70.9	72.2
Belgium	50.4	51.9	53.1	51.6	57.3	58.5	60.6	62.2	61.7	65.6	70.1
Canada	51.0	53.2	55.3	53.6	58.6	59.7	62.4	64.1	66.3	69.0	71.5
Denmark	55.6	57.3	59.6	58.4	61.3	62.5	63.8	65.3	67.7	69.5	72.2
Finland	46.2	48.5	50.6	47.6	53.2	55.3	57.9	59.6	60.2	64.5	69.3
France	49.0	50.7	52.7	50.1	55.9	56.9	59.9	61.9	58.6	65.4	69.9
Iceland	52.4	53.1	57.8	57.8	58.8	61.2	63.8	65.8	67.5	71.3	74.3
Italy	43.3	44.8	48.1	42.0	50.3	52.8	56.7	57.8	57.6	62.6	68.1
Netherlands	51.5	54.4	57.1	55.1	61.2	63.7	66.1	67.8	66.3	68.9	73.1
Norway	56.7	57.7	59.6	57.5	62.2	64.3	66.3	68.1	68.7	71.9	74.4
Spain	36.7	42.2	43.1	40.7	44.7	49.9	52.6	53.3	55.3	62.1	66.4
Sweden	55.3	57.7	59.4	57.3	62.3	63.4	64.9	66.5	69.2	71.0	73.1
Switzerland	50.6	52.6	55.3	55.4	59.5	61.9	63.7	65.3	67.1	68.6	71.6
UK England & Wales	50.4	53.3	55.4	55.0	60.1	61.3	63.1	65.1	66.3	69.8	72.1
UK Scotland	49.3	51.1	53.0	52.5	56.8	58.5	59.9	61.8	62.9	66.4	69.5
UK Northern Ireland	46.9	49.1	51.3	49.7	55.2	56.2	58.7	59.4	61.3	66.2	69.6
Average Female (SD)	49.9(4.9)	52.0(4.3)	54.4(4.7)	52.4(5.3)	57.6(5.0)	59.4(4.3)	61.7(4.0)	63.2(4.1)	64.1(4.4)	67.7(3.1)	71.1(2.2)
CV	0.10	0.08	0.09	0.10	0.09	0.07	0.06	0.07	0.07	0.05	0.03
United States	50.7	53.4	53.2	53.6	58.5	60.2	62.6	63.8	66.8	69.5	71.7

	1955-1959	1960-1964	1965-1969	1970-1974	1975-1979	1980-1984	1985-1989	1990-1994	1995-1999	2000-2004	2005-2009
Australia	73.5	74.2	74.4	75.1	77.0	78.6	79.3	80.6	81.6	82.8	83.8
Belgium	72.1	73.2	73.8	74.7	75.9	77.2	78.5	79.7	80.5	81.3	82.1
Canada	73.2	74.5	75.6	76.6	78.0	79.3	80.1	80.8	81.3	82.1	82.8
Denmark	73.7	74.4	75.2	76.3	77.2	77.5	77.6	77.9	78.5	79.5	80.6
Finland	71.3	72.5	73.3	75.0	76.9	78.3	78.7	79.5	80.6	81.6	82.8
France	72.4	74.1	75.1	76.2	77.6	78.8	80.1	81.4	82.2	83.1	84.1
Iceland	75.4	76.1	76.4	77.2	79.3	79.9	80.1	80.9	81.1	82.4	83.1
Italy	70.6	72.3	73.7	75.1	76.7	78.0	79.5	80.6	81.7	83.0	83.9
Netherlands	74.6	75.7	76.3	77.0	78.3	79.4	79.9	80.2	80.5	80.9	82.0
Norway	75.5	75.9	76.7	77.6	78.4	79.3	79.4	80.1	81.0	81.7	82.7
Spain	69.8	72.2	73.9	75.3	77.1	79.1	80.1	81.1	82.1	83.1	83.8
Sweden	74.6	75.4	76.4	77.6	78.4	79.4	80.1	80.8	81.7	82.2	82.9
Switzerland	73.2	74.4	75.4	76.8	78.5	79.4	80.6	81.3	82.2	83.1	84.0
UK England & Wales	73.5	74.2	74.9	75.4	76.2	77.2	78.0	79.0	79.7	80.8	81.9
UK Scotland	71.3	72.2	73.1	73.8	74.5	75.5	76.3	77.2	78.0	78.9	79.9
UK Northern Ireland	71.8	72.7	73.6	73.8	74.6	75.9	77.2	78.3	79.2	80.4	81.2
Average Female (SD)	72.9(1.7)	74.0(1.4)	74.9(1.2)	75.8(1.2)	77.2(1.4)	78.3(1.3)	79.1(1.2)	79.9(1.3)	80.8(1.3)	81.7(1.3)	82.6(1.2)
CV	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01
United States	73.0	73.6	74.1	75.2	77.0	77.9	78.4	79.0	79.4	79.8	80.5

CV = Coefficient of variation. Source: Human Mortality Database, and US Vital Statistics for US data before 1933. To fill in a few missing values in the early period (Australia, Canada, and UK Northern Ireland in 1900-19; Spain in 1900; and the US in 1905, 1915, and 1925), we use imputed values from sex-specific regressions with year and country fixed effects and country-specific linear time trends.

Appendix Table 1B. Male life expectancy at birth since 1900, US and 16 other high income countries

	1900-1904	1905-1909	1910-1914	1915-1919	1920-1924	1925-1929	1930-1934	1935-1939	1940-1944	1945-1949	1950-1954
Australia	49.4	54.5	55.8	51.3	60.2	61.2	63.4	63.6	64.6	66.4	66.7
Belgium	47.0	48.6	49.5	48.1	53.7	54.9	56.6	57.9	55.1	60.2	65.1
Canada	49.3	51.3	52.8	48.5	56.4	57.2	59.9	61.4	62.8	65.1	66.6
Denmark	52.2	54.4	56.5	55.8	59.6	60.9	62.0	63.2	65.6	67.2	69.6
Finland	43.5	45.4	47.4	39.3	48.5	50.3	52.8	53.5	42.0	56.3	62.7
France	45.5	46.8	43.8	32.1	51.8	52.5	54.8	56.0	47.6	59.5	64.1
Iceland	48.0	47.1	52.1	52.6	52.3	58.4	59.9	60.7	62.6	67.6	69.9
Italy	42.9	44.1	47.3	32.5	48.9	51.0	54.4	55.0	48.9	58.4	64.4
Netherlands	48.6	52.0	54.9	53.2	59.7	62.2	64.7	66.3	62.6	64.2	70.6
Norway	53.5	55.1	56.3	54.2	59.8	61.5	63.5	64.8	63.2	68.3	70.8
Spain	35.0	40.2	41.1	38.9	42.2	46.8	49.0	45.3	48.5	56.6	61.8
Sweden	52.7	55.4	56.7	54.6	60.0	61.2	62.9	63.9	66.4	68.5	70.3
Switzerland	47.9	49.6	52.0	51.9	56.5	58.6	59.9	61.3	62.8	64.5	67.0
UK England & Wales	46.6	49.5	50.8	40.3	56.1	57.3	59.0	60.8	58.2	63.3	66.9
UK Scotland	46.2	48.3	49.9	49.0	53.4	54.7	56.3	57.8	55.7	61.9	64.9
UK Northern Ireland	47.0	49.0	50.5	46.2	54.3	55.3	57.2	57.7	58.7	63.5	66.0
Average Male(SD)	47.2(4.4)	49.5(4.3)	51.1(4.6)	46.8(7.8)	54.6(5.1)	56.5(4.6)	58.5(4.4)	59.3(5.3)	57.8(7.5)	63.2(4.0)	66.7(2.9)
CV	0.09	0.09	0.09	0.17	0.09	0.08	0.08	0.09	0.13	0.06	0.04
United States	47.9	50.5	49.9	47.5	56.3	56.9	58.8	59.6	61.9	64.2	65.8

	1955-1959	1960-1964	1965-1969	1970-1974	1975-1979	1980-1984	1985-1989	1990-1994	1995-1999	2000-2004	2005-2009
Australia	67.5	67.8	67.7	68.3	70.0	71.7	72.9	74.5	76.0	77.8	79.1
Belgium	66.7	67.3	67.6	68.2	69.3	70.5	71.8	73.0	74.0	75.2	76.5
Canada	67.7	68.4	68.9	69.6	70.7	72.3	73.5	74.6	75.6	77.2	78.2
Denmark	70.4	70.4	70.5	70.9	71.3	71.4	71.8	72.5	73.5	74.9	76.1
Finland	64.6	65.5	65.7	66.5	68.1	70.0	70.6	71.8	73.3	74.8	75.9
France	65.9	67.2	67.6	68.6	69.5	70.6	71.9	73.1	74.4	75.8	77.1
Iceland	71.0	71.1	71.1	71.2	73.4	73.8	75.1	76.2	76.8	78.6	79.5
Italy	66.1	66.9	67.9	69.1	70.1	71.4	72.9	74.0	75.4	77.2	78.5
Netherlands	71.2	71.2	71.0	71.1	71.9	72.8	73.4	74.1	75.0	76.1	77.8
Norway	71.4	71.1	71.2	71.3	72.1	72.6	72.7	74.1	75.4	76.6	78.1
Spain	65.1	67.2	68.5	69.7	71.1	72.8	73.3	73.8	74.9	76.3	77.2
Sweden	71.2	71.5	71.8	72.1	72.3	73.4	74.2	75.3	76.7	77.8	78.8
Switzerland	68.1	68.7	69.6	70.6	71.9	72.7	73.8	74.5	76.1	77.7	79.0
UK England & Wales	67.9	68.2	68.7	69.2	70.0	71.3	72.3	73.6	74.7	76.2	77.7
UK Scotland	65.9	66.2	67.0	67.4	68.2	69.4	70.3	71.5	72.4	73.6	75.1
UK Northern Ireland	67.6	67.8	68.2	67.3	68.0	69.6	71.1	72.6	73.9	75.5	76.4
Average Male(SD)	68.0(2.3)	68.5(1.9)	68.9(1.8)	69.4(1.7)	70.5(1.6)	71.6(1.4)	72.6(1.3)	73.7(1.2)	74.9(1.2)	76.3(1.3)	77.6(1.3)
CV	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
United States	66.6	66.8	66.8	67.5	69.4	70.7	71.3	72.2	73.4	74.5	75.4

CV = Coefficient of variation. Source: Human Mortality Database, and US Vital Statistics for US data before 1933. To fill in a few missing values in the early period (Australia, Canada, and UK Northern Ireland in 1900-19; Spain in 1900; and the US in 1905, 1915, and 1925), we use imputed values from sex-specific regressions with year and country fixed effects and country-specific linear time trends.

Appendix Table 1C. Total life expectancy at birth since 1900, US and 16 other high income countries

	1900-1904	1905-1909	1910-1914	1915-1919	1920-1924	1925-1929	1930-1934	1935-1939	1940-1944	1945-1949	1950-1954
Australia	50.9	56.2	57.6	54.1	62.0	63.0	65.3	65.6	66.6	68.5	69.3
Belgium	48.8	50.3	51.3	49.9	55.6	56.8	58.7	60.0	58.2	62.9	67.6
Canada	50.2	52.3	54.0	50.7	57.5	58.5	61.2	62.8	64.5	66.9	69.0
Denmark	54.0	55.9	58.1	57.2	60.5	61.8	63.0	64.3	66.7	68.4	70.9
Finland	44.9	47.0	49.0	43.2	50.9	52.8	55.3	56.5	50.0	60.4	66.1
France	47.3	48.7	47.9	39.5	53.9	54.8	57.4	59.0	52.8	62.5	67.1
Iceland	50.3	50.1	55.0	55.2	55.5	59.9	61.9	63.3	65.0	69.5	72.1
Italy	43.1	44.5	47.8	36.6	49.6	52.0	55.6	56.5	53.0	60.5	66.3
Netherlands	50.0	53.2	56.0	54.2	60.5	62.9	65.4	67.1	64.4	66.5	71.8
Norway	55.1	56.5	58.0	55.9	61.1	62.9	64.9	66.4	65.9	70.1	72.6
Spain	36.0	41.3	42.2	39.8	43.5	48.4	50.8	49.1	51.8	59.4	64.2
Sweden	54.1	56.6	58.1	56.0	61.2	62.3	63.9	65.2	67.8	69.8	71.7
Switzerland	49.2	51.1	53.7	53.7	58.0	60.3	61.8	63.3	65.0	66.6	69.4
UK England & Wales	48.6	51.5	53.2	46.9	58.2	59.4	61.2	63.1	62.2	66.6	69.6
UK Scotland	47.8	49.8	51.6	50.8	55.3	56.7	58.3	59.9	59.5	64.3	67.3
UK Northern Ireland	47.0	49.1	50.9	47.8	54.7	55.8	58.0	58.6	60.0	64.9	67.9
Average Total(SD)	48.6(4.6)	50.9(4.3)	52.8(4.5)	49.5(6.6)	56.1(5.0)	58.0(4.4)	60.2(4.1)	61.3(4.7)	60.8(6.0)	65.5(3.5)	68.9(2.5)
CV	0.10	0.09	0.09	0.13	0.09	0.08	0.07	0.08	0.10	0.05	0.04
United States	49.2	51.9	51.5	50.2	57.4	58.5	60.6	61.6	64.3	66.8	68.6

	1955-1959	1960-1964	1965-1969	1970-1974	1975-1979	1980-1984	1985-1989	1990-1994	1995-1999	2000-2004	2005-2009
Australia	70.4	70.9	71.0	71.6	73.5	75.2	76.2	77.7	78.9	80.5	81.6
Belgium	69.4	70.2	70.7	71.4	72.6	73.8	75.2	76.4	77.4	78.4	79.5
Canada	70.3	71.3	72.1	73.0	74.2	75.8	76.8	77.8	78.6	79.8	80.7
Denmark	72.1	72.4	72.9	73.6	74.3	74.5	74.8	75.3	76.1	77.3	78.5
Finland	68.0	69.1	69.6	70.8	72.6	74.3	74.8	75.7	77.1	78.4	79.5
France	69.3	70.7	71.4	72.4	73.6	74.8	76.2	77.4	78.6	79.7	80.8
Iceland	73.2	73.6	73.7	74.1	76.3	76.8	77.6	78.6	79.0	80.6	81.3
Italy	68.4	69.6	70.8	72.1	73.5	74.8	76.3	77.4	78.8	80.3	81.5
Netherlands	72.9	73.4	73.6	74.0	75.0	76.1	76.7	77.3	77.9	78.7	80.1
Norway	73.5	73.5	73.9	74.4	75.2	75.9	76.0	77.2	78.3	79.3	80.6
Spain	67.6	69.8	71.3	72.6	74.3	76.1	76.8	77.5	78.6	79.8	80.6
Sweden	72.9	73.4	74.1	74.8	75.3	76.4	77.2	78.1	79.3	80.2	81.0
Switzerland	70.7	71.6	72.6	73.7	75.2	76.2	77.3	78.0	79.4	80.6	81.7
UK England & Wales	70.8	71.3	72.0	72.5	73.3	74.5	75.4	76.5	77.4	78.7	80.0
UK Scotland	68.7	69.3	70.1	70.7	71.5	72.6	73.5	74.6	75.4	76.4	77.7
UK Northern Ireland	69.8	70.3	70.9	70.6	71.4	72.9	74.3	75.7	76.8	78.1	78.8
Average Total(SD)	70.5(1.9)	71.3(1.6)	71.9(1.4)	72.6(1.4)	73.9(1.4)	75.0(1.2)	75.9(1.2)	76.9(1.1)	78.0(1.2)	79.2(1.2)	80.2(1.2)
CV	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.02	0.01
United States	69.7	70.2	70.6	71.5	73.3	74.6	75.0	75.9	76.6	77.4	78.1

CV = Coefficient of variation. Source: Human Mortality Database, and US Vital Statistics for US data before 1933. To fill in a few missing values in the early period (Australia, Canada, and UK Northern Ireland in 1900-19; Spain in 1900; and the US in 1905, 1915, and 1925), we use imputed values from sex-specific regressions with year and country fixed effects and country-specific linear time trends.

Appendix Table 2A. Female life expectancy at age 65 since 1900, US and 16 other high income countries

	1900-1904	1905-1909	1910-1914	1915-1919	1920-1924	1925-1929	1930-1934	1935-1939	1940-1944	1945-1949	1950-1954
Australia	12.9	13.0	13.2	13.0	14.0	14.0	14.3	14.2	14.3	14.7	14.9
Belgium	11.9	11.8	12.1	11.7	12.5	12.5	12.9	13.1	13.0	13.8	14.2
Canada	12.8	13.0	13.2	13.0	13.7	13.5	14.0	14.1	14.2	14.9	15.3
Denmark	12.9	12.9	13.2	13.0	12.9	12.9	13.0	13.1	13.4	14.1	14.4
Finland	11.7	12.0	12.2	11.4	12.3	12.5	12.7	12.4	12.7	13.2	13.2
France	11.5	11.5	11.8	11.7	12.4	12.4	12.9	13.1	12.6	14.1	14.6
Iceland	13.1	13.1	13.7	13.4	13.4	15.0	15.6	14.9	15.2	16.0	16.5
Italy	10.8	11.0	11.4	10.9	11.8	12.0	12.8	12.6	12.4	13.6	14.1
Netherlands	12.2	12.3	12.7	12.3	12.8	12.9	13.3	13.4	13.1	14.0	14.8
Norway	14.3	14.3	14.5	14.1	14.6	14.7	14.8	14.8	15.3	15.7	15.9
Spain	10.2	10.5	10.7	10.7	11.2	11.9	12.3	12.2	12.8	14.2	14.4
Sweden	13.5	13.7	13.8	13.6	13.9	13.8	13.8	13.6	14.2	14.3	14.6
Switzerland	10.5	10.6	11.0	11.0	11.5	11.9	12.3	12.6	13.2	13.5	14.3
UK England & Wales	11.7	11.9	12.4	12.2	13.0	12.8	13.2	13.4	13.9	14.5	14.6
UK Scotland	11.7	12.1	12.2	12.1	12.5	12.4	12.7	12.7	13.2	13.6	13.6
UK Northern Ireland	11.5	11.7	11.9	11.6	12.1	12.3	12.4	12.4	12.9	13.6	13.8
Average Female	12.1(1.1)	12.2(1.1)	12.5(1.0)	12.2(1.0)	12.8(0.9)	13.0(1.0)	13.3(1.0)	13.3(0.8)	13.5(0.9)	14.2(0.8)	14.6(0.8)
CV	0.09	0.09	0.08	0.08	0.07	0.07	0.07	0.06	0.07	0.05	0.06
United States	12.2	12.5	12.0	12.5	12.8	13.3	13.4	13.4	13.9	14.7	15.4

	1955-1959	1960-1964	1965-1969	1970-1974	1975-1979	1980-1984	1985-1989	1990-1994	1995-1999	2000-2004	2005-2009
Australia	15.4	15.8	15.9	16.3	17.4	18.2	18.5	19.3	20.1	20.9	21.7
Belgium	14.7	14.9	15.1	15.6	16.2	17.0	17.9	18.7	19.3	19.8	20.5
Canada	15.9	16.4	17.1	17.6	18.4	19.0	19.3	19.8	20.0	20.6	21.2
Denmark	15.1	15.3	15.9	16.8	17.4	17.7	17.9	17.8	17.9	18.4	19.2
Finland	13.6	13.8	14.0	15.1	16.3	17.2	17.5	18.1	18.9	19.8	20.9
France	15.3	15.9	16.4	16.9	17.7	18.4	19.3	20.3	20.8	21.5	22.3
Iceland	16.6	16.6	16.7	17.4	18.9	18.7	19.0	19.5	19.5	20.4	20.6
Italy	14.7	15.2	15.6	16.3	16.8	17.4	18.4	19.2	20.0	20.8	21.4
Netherlands	15.3	15.9	16.4	16.8	17.7	18.5	18.8	19.0	19.1	19.4	20.3
Norway	16.1	16.0	16.5	16.9	17.6	18.2	18.5	18.8	19.4	20.0	20.7
Spain	14.7	15.5	15.9	16.2	17.1	18.2	18.8	19.6	20.2	20.9	21.4
Sweden	15.2	15.6	16.2	17.1	17.6	18.3	18.8	19.3	19.8	20.2	20.7
Switzerland	14.8	15.4	15.8	16.7	17.8	18.4	19.3	19.9	20.4	21.1	21.7
UK England & Wales	15.1	15.4	15.9	16.2	16.6	17.1	17.5	18.1	18.5	19.3	20.2
UK Scotland	14.0	14.4	14.9	15.4	15.8	16.2	16.4	16.9	17.4	18.1	18.9
UK Northern Ireland	14.3	14.7	15.2	15.3	15.9	16.4	16.9	17.7	18.1	18.9	19.8
Average Female	15.0(0.8)	15.4(0.7)	15.8(0.8)	16.4(0.8)	17.2(0.9)	17.8(0.8)	18.3(0.9)	18.9(0.9)	19.3(1.0)	20.0(1.0)	20.7(0.9)
CV	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.04
United States	15.8	16.2	16.5	17.1	18.2	18.6	18.7	19.1	19.2	19.4	20.1

CV = Coefficient of variation. Source: Human Mortality Database, and US Vital Statistics for US data before 1933. To fill in a few missing values in the early period (Australia, Canada, and UK Northern Ireland in 1900-19; Spain in 1900; and the US in 1905, 1915, and 1925), we use imputed values from sex-specific regressions with year and country fixed effects and country-specific linear time trends.

Appendix Table 2B. Male life expectancy at age 65 since 1900, US and 16 other high income countries

	1900-1904	1905-1909	1910-1914	1915-1919	1920-1924	1925-1929	1930-1934	1935-1939	1940-1944	1945-1949	1950-1954
Australia	10.8	11.0	11.2	11.0	12.3	12.3	12.6	12.4	12.3	12.4	12.3
Belgium	10.8	10.7	10.8	10.9	11.4	11.3	11.7	11.7	11.3	12.3	12.4
Canada	12.1	12.2	12.4	12.2	13.0	12.7	13.1	13.1	12.9	13.3	13.5
Denmark	11.7	12.0	12.3	12.5	12.7	12.6	12.7	12.6	13.0	13.6	13.8
Finland	10.8	10.9	11.0	9.9	10.9	10.8	11.1	10.9	10.7	11.1	11.1
France	10.5	10.3	10.5	10.4	11.0	10.8	11.1	11.0	10.4	12.0	12.1
Iceland	10.9	11.3	12.2	12.0	11.5	13.3	13.5	12.9	13.8	14.8	14.7
Italy	10.7	10.8	11.2	10.7	11.5	11.4	12.0	11.9	11.4	12.8	13.0
Netherlands	11.6	11.7	12.1	11.7	12.4	12.5	12.9	12.9	12.5	13.2	14.1
Norway	13.4	13.5	13.5	13.3	13.7	13.8	13.9	13.8	14.3	14.8	14.8
Spain	9.2	10.0	10.0	9.7	10.1	10.4	10.8	10.2	10.7	12.0	12.4
Sweden	12.6	12.9	12.9	12.8	13.3	13.2	13.2	13.0	13.5	13.6	13.7
Switzerland	10.1	10.0	10.2	10.2	10.7	10.9	11.2	11.3	11.7	12.0	12.5
UK England & Wales	10.6	10.7	11.0	10.6	11.4	11.2	11.4	11.5	11.8	12.2	11.8
UK Scotland	10.5	10.8	10.8	10.4	10.9	10.8	11.1	11.0	11.4	11.9	11.5
UK Northern Ireland	11.0	11.0	11.2	10.9	11.5	11.6	11.6	11.5	11.9	12.4	12.3
Average Male(SD)	11.1(1.0)	11.2(1.0)	11.5(1.0)	11.2(1.1)	11.8(1.0)	11.8(1.1)	12.1(1.0)	12.0(1.0)	12.1(1.2)	12.8(1.1)	12.9(1.1)
CV	0.09	0.09	0.09	0.10	0.09	0.09	0.08	0.08	0.10	0.08	0.09
United States	11.5	11.3	11.2	11.3	12.2	11.9	12.0	11.9	12.2	12.7	12.9

	1955-1959	1960-1964	1965-1969	1970-1974	1975-1979	1980-1984	1985-1989	1990-1994	1995-1999	2000-2004	2005-2009
Australia	12.4	12.4	12.2	12.5	13.3	14.0	14.6	15.5	16.4	17.6	18.6
Belgium	12.6	12.5	12.2	12.3	12.5	13.1	13.7	14.5	15.1	15.9	16.8
Canada	13.5	13.6	13.7	13.8	14.2	14.7	15.1	15.7	16.1	17.2	18.0
Denmark	13.9	13.6	13.5	13.7	13.8	13.8	14.1	14.2	14.6	15.4	16.3
Finland	11.4	11.5	11.3	11.7	12.3	13.0	13.4	14.1	14.8	15.9	16.9
France	12.4	12.7	12.7	13.1	13.5	14.2	14.9	15.8	16.2	17.1	17.9
Iceland	14.9	15.1	14.8	14.8	16.1	15.5	15.9	16.4	16.5	17.8	18.2
Italy	13.1	13.1	13.0	13.3	13.3	13.8	14.6	15.3	15.9	16.9	17.7
Netherlands	14.1	14.1	13.8	13.6	13.7	14.0	14.2	14.5	14.9	15.7	16.8
Norway	14.7	14.2	14.0	13.9	14.2	14.3	14.4	14.9	15.5	16.4	17.4
Spain	12.6	13.0	13.2	13.4	14.0	14.8	15.3	15.8	16.2	16.9	17.4
Sweden	13.9	13.8	13.9	14.1	14.1	14.5	15.0	15.6	16.2	17.0	17.7
Switzerland	12.8	12.9	13.0	13.5	14.1	14.6	15.2	15.7	16.5	17.5	18.3
UK England & Wales	11.9	12.0	12.1	12.3	12.6	13.1	13.6	14.3	15.1	16.3	17.5
UK Scotland	11.5	11.4	11.6	11.6	11.9	12.4	12.7	13.3	14.0	15.1	16.2
UK Northern Ireland	12.3	12.3	12.3	12.0	12.3	12.6	13.1	13.9	14.6	15.8	16.9
Average Male(SD)	13.0(1.1)	13.0(1.0)	13.0(1.0)	13.1(0.9)	13.5(1.0)	13.9(0.9)	14.4(0.9)	15.0(0.9)	15.5(0.8)	16.5(0.8)	17.4(0.7)
CV	0.08	0.08	0.07	0.07	0.08	0.06	0.06	0.06	0.05	0.05	0.04
United States	13.0	12.9	12.9	13.1	13.9	14.3	14.7	15.3	15.8	16.5	17.3

CV = Coefficient of variation. Source: Human Mortality Database, and US Vital Statistics for US data before 1933. To fill in a few missing values in the early period (Australia, Canada, and UK Northern Ireland in 1900-19; Spain in 1900; and the US in 1905, 1915, and 1925), we use imputed values from sex-specific regressions with year and country fixed effects and country-specific linear time trends.

Appendix Table 2C. Total life expectancy at age 65 since 1900, US and 16 other high income countries

	1900-1904	1905-1909	1910-1914	1915-1919	1920-1924	1925-1929	1930-1934	1935-1939	1940-1944	1945-1949	1950-1954
Australia	11.8	12.0	12.2	12.0	13.1	13.1	13.5	13.4	13.3	13.6	13.6
Belgium	11.4	11.3	11.5	11.3	12.0	12.0	12.4	12.4	12.2	13.1	13.4
Canada	12.4	12.6	12.8	12.6	13.4	13.1	13.6	13.6	13.5	14.1	14.4
Denmark	12.4	12.5	12.8	12.8	12.8	12.8	12.8	12.9	13.2	13.9	14.1
Finland	11.3	11.5	11.7	10.8	11.7	11.8	12.0	11.8	11.8	12.3	12.4
France	11.0	10.9	11.3	11.1	11.8	11.7	12.1	12.2	11.7	13.3	13.5
Iceland	12.1	12.4	13.1	12.8	12.6	14.3	14.7	14.0	14.6	15.5	15.8
Italy	10.8	10.9	11.3	10.8	11.6	11.8	12.5	12.3	12.0	13.2	13.6
Netherlands	11.9	12.0	12.4	12.0	12.6	12.7	13.1	13.1	12.8	13.6	14.5
Norway	13.9	14.0	14.0	13.8	14.2	14.3	14.4	14.3	14.8	15.3	15.4
Spain	9.8	10.3	10.4	10.3	10.7	11.3	11.6	11.3	11.9	13.3	13.5
Sweden	13.1	13.4	13.4	13.3	13.7	13.5	13.5	13.3	13.9	13.9	14.2
Switzerland	10.3	10.4	10.6	10.7	11.1	11.5	11.8	12.1	12.6	12.8	13.5
UK England & Wales	11.2	11.4	11.8	11.5	12.3	12.1	12.5	12.6	13.0	13.6	13.5
UK Scotland	11.2	11.6	11.6	11.4	11.9	11.8	12.1	12.0	12.5	12.9	12.7
UK Northern Ireland	11.2	11.4	11.5	11.3	11.8	12.0	12.0	12.0	12.4	13.1	13.2
Average Total(SD)	11.6(1.0)	11.8(1.0)	12.0(1.0)	11.8(1.0)	12.3(0.9)	12.5(1.0)	12.8(0.9)	12.7(0.8)	12.9(1.0)	13.6(0.8)	13.8(0.9)
CV	0.09	0.09	0.08	0.09	0.08	0.08	0.07	0.07	0.08	0.06	0.06
United States	11.9	11.9	11.6	11.9	12.5	12.6	12.7	12.7	13.1	13.7	14.2

	1955-1959	1960-1964	1965-1969	1970-1974	1975-1979	1980-1984	1985-1989	1990-1994	1995-1999	2000-2004	2005-2009
Australia	13.9	14.2	14.1	14.5	15.6	16.4	16.8	17.6	18.5	19.6	20.4
Belgium	13.7	13.8	13.8	14.0	14.6	15.3	16.0	16.9	17.6	18.2	19.0
Canada	14.7	15.0	15.3	15.7	16.4	17.0	17.4	18.0	18.3	19.2	19.9
Denmark	14.5	14.5	14.7	15.3	15.7	15.9	16.1	16.2	16.4	17.2	18.0
Finland	12.7	12.8	12.9	13.6	14.7	15.5	15.9	16.4	17.3	18.2	19.2
France	14.1	14.5	14.8	15.3	15.9	16.6	17.5	18.5	18.9	19.7	20.6
Iceland	15.8	15.9	15.9	16.2	17.6	17.2	17.5	18.0	18.1	19.2	19.6
Italy	14.0	14.3	14.4	14.9	15.2	15.8	16.7	17.5	18.3	19.2	20.0
Netherlands	14.8	15.1	15.1	15.3	15.8	16.4	16.7	17.0	17.3	17.8	18.9
Norway	15.5	15.1	15.3	15.5	15.9	16.4	16.6	17.1	17.7	18.4	19.3
Spain	13.8	14.4	14.7	15.0	15.7	16.8	17.3	17.9	18.5	19.1	19.6
Sweden	14.6	14.8	15.1	15.7	16.0	16.6	17.1	17.6	18.3	18.8	19.4
Switzerland	13.9	14.3	14.6	15.3	16.1	16.8	17.5	18.1	18.8	19.6	20.4
UK England & Wales	13.8	14.0	14.3	14.6	14.9	15.5	15.9	16.6	17.1	18.1	19.2
UK Scotland	12.9	13.1	13.5	13.8	14.2	14.6	15.0	15.5	16.1	16.9	17.8
UK Northern Ireland	13.4	13.6	13.9	13.9	14.3	14.8	15.3	16.1	16.7	17.7	18.5
Average Total(SD)	14.1(0.8)	14.3(0.8)	14.5(0.8)	14.9(0.8)	15.5(0.9)	16.1(0.8)	16.6(0.8)	17.2(0.8)	17.7(0.8)	18.6(0.9)	19.4(0.8)
CV	0.06	0.05	0.05	0.05	0.06	0.05	0.05	0.05	0.05	0.05	0.04
United States	14.4	14.6	14.9	15.3	16.3	16.7	17.0	17.5	17.8	18.2	18.9

CV = Coefficient of variation. Source: Human Mortality Database, and US Vital Statistics for US data before 1933. To fill in a few missing values in the early period (Australia, Canada, and UK Northern Ireland in 1900-19; Spain in 1900; and the US in 1905, 1915, and 1925), we use imputed values from sex-specific regressions with year and country fixed effects and country-specific linear time trends.

Appendix Table 3A. Percent of female cohort surviving to age 65 since 1900, US and 16 other high income countries

	1900-1904	1905-1909	1910-1914	1915-1919	1920-1924	1925-1929	1930-1934	1935-1939	1940-1944	1945-1949	1950-1954
Australia	52.8%	55.3%	57.9%	54.6%	64.2%	65.7%	69.1%	69.9%	71.6%	75.0%	77.3%
Belgium	46.1%	48.2%	50.1%	47.2%	55.5%	57.1%	60.1%	62.5%	61.8%	68.3%	75.7%
Canada	46.1%	48.9%	51.9%	49.0%	57.0%	58.7%	62.1%	64.7%	68.3%	72.3%	76.4%
Denmark	53.0%	55.6%	58.5%	56.1%	60.7%	62.7%	64.5%	67.1%	71.1%	73.9%	78.9%
Finland	41.4%	44.0%	46.3%	41.8%	49.6%	51.6%	55.1%	57.8%	59.3%	66.6%	74.3%
France	43.2%	44.9%	48.2%	44.4%	52.4%	54.0%	58.1%	60.9%	56.3%	68.3%	74.7%
Iceland	46.8%	49.2%	55.3%	54.8%	57.5%	58.8%	62.2%	67.7%	69.6%	74.8%	80.5%
Italy	38.3%	40.1%	44.8%	35.7%	47.6%	51.2%	56.4%	58.2%	58.3%	65.7%	74.0%
Netherlands	48.2%	51.8%	55.8%	52.1%	60.7%	64.3%	67.8%	70.7%	69.1%	73.7%	80.7%
Norway	53.2%	54.6%	57.0%	53.8%	61.0%	64.0%	67.6%	70.8%	72.3%	77.8%	82.2%
Spain	27.8%	34.9%	37.3%	32.8%	39.7%	46.0%	50.1%	50.7%	54.1%	63.6%	70.5%
Sweden	52.7%	55.6%	57.9%	54.2%	62.1%	63.5%	65.9%	68.6%	73.2%	76.3%	80.3%
Switzerland	43.4%	46.0%	50.4%	49.7%	56.4%	60.2%	63.6%	66.6%	70.2%	72.8%	77.8%
UK England & Wales	43.7%	47.7%	51.2%	50.8%	58.8%	60.8%	63.3%	66.5%	68.6%	74.3%	78.1%
UK Scotland	40.1%	42.7%	46.7%	46.6%	53.0%	55.6%	58.2%	61.0%	63.1%	68.5%	73.3%
UK Northern Ireland	35.7%	39.0%	42.5%	40.1%	47.3%	49.5%	54.3%	55.7%	59.7%	67.6%	73.5%
Average Female(SD)	44.5(7.0)%	47.4(6.3)%	50.7(6.2)%	47.7(7.1)%	55.2(6.6)%	57.7(5.9)%	61.1(5.4)%	63.7(5.9)%	65.4(6.3)%	71.2(4.2)%	76.8(3.3)%
CV	0.16	0.13	0.12	0.15	0.12	0.10	0.09	0.09	0.10	0.06	0.04
United States	43.25%	46.4%	46.44%	46.5%	54.30%	56.3%	59.9%	62.0%	67.1%	71.6%	75.4%

	1955-1959	1960-1964	1965-1969	1970-1974	1975-1979	1980-1984	1985-1989	1990-1994	1995-1999	2000-2004	2005-2009
Australia	79.9%	80.7%	80.7%	81.8%	84.2%	86.5%	87.6%	89.2%	90.4%	91.5%	92.3%
Belgium	79.0%	80.8%	81.5%	82.5%	84.0%	85.5%	87.2%	88.3%	89.1%	89.7%	90.3%
Canada	79.2%	81.1%	82.2%	83.4%	84.9%	86.6%	87.7%	88.7%	89.4%	90.2%	90.8%
Denmark	81.2%	82.4%	82.9%	83.4%	84.1%	83.8%	83.7%	84.4%	85.6%	87.6%	88.8%
Finland	77.9%	80.0%	81.6%	83.8%	86.0%	87.9%	88.3%	89.2%	90.3%	90.7%	91.0%
France	78.7%	81.2%	82.4%	84.0%	85.7%	87.2%	88.5%	89.5%	90.3%	90.9%	91.5%
Iceland	82.7%	84.4%	84.2%	84.5%	86.8%	88.6%	88.6%	89.2%	90.2%	91.1%	92.3%
Italy	77.6%	79.8%	81.7%	83.6%	85.7%	87.3%	88.8%	89.9%	91.0%	92.1%	92.9%
Netherlands	83.3%	84.8%	85.2%	85.9%	87.1%	88.1%	88.5%	88.8%	89.1%	89.5%	90.5%
Norway	84.4%	85.3%	86.0%	87.2%	87.8%	88.5%	88.1%	89.0%	90.0%	90.5%	91.4%
Spain	76.0%	79.4%	81.9%	84.0%	86.3%	88.6%	89.7%	90.5%	91.6%	92.5%	93.0%
Sweden	82.9%	84.4%	85.6%	86.5%	87.3%	88.3%	89.1%	89.7%	90.7%	91.2%	91.9%
Switzerland	80.7%	82.7%	84.2%	85.8%	87.6%	88.5%	89.6%	90.1%	91.0%	91.8%	92.4%
UK England & Wales	80.5%	81.4%	82.1%	82.6%	83.4%	84.7%	85.8%	87.4%	88.5%	89.5%	90.4%
UK Scotland	76.4%	77.7%	78.9%	79.2%	79.8%	81.4%	82.9%	84.4%	85.8%	86.9%	87.9%
UK Northern Ireland	77.5%	79.2%	80.2%	80.3%	80.9%	82.7%	84.6%	86.2%	87.9%	89.2%	89.7%
Average Female(SD)	79.9(2.5) %	81.6(2.2)%	82.6(2.0)%	83.6(2.1)%	85.1(2.3)%	86.5(2.3)%	87.4(2.1)%	88.4(1.9)%	89.4(1.7)%	90.3(1.5)%	91.1(1.4)%
CV	0.03	0.03	0.02	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02
United States	77.8%	78.6%	79.2%	80.4%	82.7%	83.9%	84.6%	85.4%	86.1%	86.7%	87.3%

CV = Coefficient of variation. Source: Human Mortality Database, and US Vital Statistics for US data before 1933. See Appendix Table 1.

Appendix Table 3B. Percent of male cohort surviving to age 65 since 1900, US and 16 other high income countries

	1900-1904	1905-1909	1910-1914	1915-1919	1920-1924	1925-1929	1930-1934	1935-1939	1940-1944	1945-1949	1950-1954
Australia	45.3%	47.5%	49.3%	42.7%	56.0%	57.6%	61.4%	61.0%	62.6%	65.2%	65.5%
Belgium	39.0%	41.3%	42.6%	41.2%	49.3%	50.4%	52.5%	53.9%	48.3%	56.3%	63.8%
Canada	44.5%	46.7%	48.5%	42.0%	54.7%	55.6%	58.8%	60.1%	61.9%	64.5%	66.3%
Denmark	46.4%	49.2%	52.4%	52.0%	58.7%	60.8%	62.1%	63.8%	67.7%	69.8%	73.3%
Finland	35.8%	36.6%	38.1%	24.8%	38.1%	39.1%	41.8%	42.5%	26.3%	46.3%	56.8%
France	36.1%	36.5%	32.1%	16.0%	43.5%	43.9%	46.5%	47.2%	34.9%	55.9%	61.6%
Iceland	38.2%	37.9%	43.8%	43.8%	42.5%	54.7%	56.0%	58.2%	60.7%	69.0%	73.0%
Italy	36.7%	38.0%	42.7%	20.8%	44.5%	47.1%	51.4%	52.3%	42.0%	56.8%	65.2%
Netherlands	43.5%	47.8%	52.2%	48.8%	58.9%	62.8%	66.4%	68.7%	62.4%	64.8%	75.3%
Norway	48.1%	50.3%	51.5%	48.3%	56.7%	59.1%	62.7%	65.0%	61.8%	71.2%	75.4%
Spain	23.6%	31.1%	32.9%	28.5%	33.8%	38.5%	42.0%	34.1%	38.8%	51.6%	60.5%
Sweden	47.9%	51.0%	52.7%	49.5%	58.1%	59.8%	62.3%	63.8%	67.8%	71.3%	74.5%
Switzerland	36.9%	38.6%	42.1%	41.7%	48.8%	51.9%	54.0%	57.1%	60.3%	63.6%	67.7%
UK England & Wales	36.4%	40.3%	42.5%	27.4%	51.0%	52.7%	55.2%	57.3%	52.9%	60.9%	66.4%
UK Scotland	34.2%	37.6%	41.0%	40.1%	47.1%	49.2%	51.7%	53.3%	49.2%	57.9%	61.6%
UK Northern Ireland	37.9%	40.4%	42.5%	36.1%	47.5%	49.4%	52.5%	53.4%	55.0%	62.0%	65.3%
Average Male(SD)	39.4(6.3)%	41.9(6.0)%	44.2(6.5)%	37.7(11.0)%	49.3(7.6)%	52.0(7.4)%	54.8(7.3)%	55.7(8.9)%	53.3(12.4)%	61.7(7.2)%	67.0(5.7)%
CV	0.16	0.14	0.15	0.29	0.15	0.14	0.13	0.16	0.23	0.12	0.09
United States	38.7%	40.8%	40.3%	36.2%	50.66%	0.50075	52.0%	53.0%	56.3%	59.5%	62.2%

	1955-1959	1960-1964	1965-1969	1970-1974	1975-1979	1980-1984	1985-1989	1990-1994	1995-1999	2000-2004	2005-2009
Australia	67.2%	67.3%	67.0%	68.4%	71.7%	75.3%	77.9%	80.9%	83.4%	85.8%	87.1%
Belgium	66.4%	66.6%	67.2%	68.7%	70.9%	73.2%	75.9%	78.3%	79.8%	81.2%	82.8%
Canada	67.8%	68.7%	69.4%	70.4%	72.2%	75.7%	78.2%	80.3%	82.5%	84.4%	85.4%
Denmark	74.2%	73.8%	73.6%	73.7%	74.2%	73.9%	74.6%	76.4%	78.5%	80.9%	82.5%
Finland	60.1%	60.9%	61.0%	62.6%	65.8%	70.1%	71.7%	74.6%	77.7%	79.9%	80.5%
France	64.1%	65.9%	66.6%	68.5%	69.9%	71.7%	73.8%	75.8%	78.3%	80.4%	81.9%
Iceland	74.7%	74.0%	74.1%	73.5%	76.6%	78.6%	81.5%	83.6%	84.8%	87.2%	88.4%
Italy	66.8%	67.6%	69.2%	71.2%	72.5%	74.6%	77.3%	79.4%	82.2%	84.9%	86.8%
Netherlands	75.6%	74.8%	74.0%	74.2%	75.9%	77.7%	79.2%	80.9%	82.6%	84.4%	86.6%
Norway	75.7%	75.0%	74.8%	75.0%	76.1%	77.0%	77.0%	80.1%	82.8%	84.7%	86.6%
Spain	66.1%	69.3%	71.2%	72.9%	74.8%	77.3%	77.9%	78.4%	80.2%	82.3%	83.6%
Sweden	75.9%	76.4%	76.7%	76.9%	77.0%	78.6%	80.4%	82.4%	84.8%	86.4%	87.5%
Switzerland	69.5%	70.2%	72.3%	74.1%	76.1%	77.4%	79.4%	80.8%	83.3%	85.5%	87.0%
UK England & Wales	68.1%	68.6%	69.7%	70.8%	72.4%	74.8%	77.1%	79.7%	81.8%	83.7%	85.2%
UK Scotland	63.3%	63.4%	65.2%	66.1%	67.4%	69.7%	72.0%	75.0%	76.5%	78.1%	80.4%
UK Northern Ireland	67.8%	67.5%	68.5%	66.5%	67.5%	70.6%	73.9%	77.5%	80.4%	82.6%	83.1%
Average Male(SD)	69.0(4.9)%	69.4(4.4)%	70.0(4.2)%	70.8(3.8)%	72.6(3.5)%	74.8(3.0)%	76.7(2.9)%	79.0(2.6)%	81.2(2.5)%	83.3(2.6)%	84.7(2.6)%
CV	0.07	0.06	0.06	0.05	0.05	0.04	0.04	0.03	0.03	0.03	0.03
United States	63.8%	64.0%	63.7%	65.3%	69.1%	71.8%	73.1%	74.6%	77.0%	78.7%	79.4%

CV = Coefficient of variation. Source: Human Mortality Database, and US Vital Statistics for US data before 1933. See Appendix Table 1.

Appendix Table 3C. Percent of total cohort surviving to age 65 since 1900, US and 16 other high income countries

	1900-1904	1905-1909	1910-1914	1915-1919	1920-1924	1925-1929	1930-1934	1935-1939	1940-1944	1945-1949	1950-1954
Australia	48.9%	51.2%	53.4%	48.0%	59.9%	61.4%	65.0%	65.2%	67.0%	70.0%	71.4%
Belgium	42.5%	44.7%	46.3%	44.2%	52.4%	53.8%	56.3%	58.2%	54.8%	62.1%	69.7%
Canada	45.3%	47.8%	50.2%	45.0%	55.9%	57.2%	60.4%	62.4%	65.0%	68.3%	71.2%
Denmark	49.8%	52.5%	55.6%	54.1%	59.8%	61.9%	63.4%	65.5%	69.4%	71.8%	76.1%
Finland	38.6%	40.3%	42.3%	32.6%	43.9%	45.4%	48.4%	50.0%	40.4%	56.6%	65.9%
France	39.6%	40.6%	39.5%	27.2%	48.1%	49.0%	52.3%	54.0%	44.8%	62.3%	68.4%
Iceland	42.7%	43.7%	49.6%	49.4%	50.1%	56.8%	59.1%	63.0%	65.1%	71.8%	76.6%
Italy	37.6%	39.1%	43.8%	27.1%	46.1%	49.2%	54.0%	55.3%	49.5%	61.2%	69.6%
Netherlands	45.8%	49.9%	54.0%	50.5%	59.8%	63.6%	67.1%	69.7%	65.7%	69.1%	78.0%
Norway	50.7%	52.5%	54.4%	51.1%	58.9%	61.6%	65.2%	67.9%	66.9%	74.5%	78.8%
Spain	25.7%	33.0%	35.1%	30.7%	36.8%	42.3%	46.1%	41.6%	46.1%	57.7%	65.8%
Sweden	50.4%	53.3%	55.4%	51.9%	60.1%	61.7%	64.2%	66.2%	70.5%	73.8%	77.4%
Switzerland	40.2%	42.3%	46.3%	45.7%	52.7%	56.2%	58.9%	62.0%	65.4%	68.3%	72.9%
UK England & Wales	40.1%	44.0%	46.9%	37.6%	55.0%	56.9%	59.4%	62.1%	60.8%	67.5%	72.4%
UK Scotland	37.2%	40.2%	44.0%	43.5%	50.2%	52.6%	55.1%	57.3%	56.5%	63.4%	67.7%
UK Northern Ireland	37.0%	39.9%	42.6%	37.8%	47.4%	49.5%	53.5%	54.6%	57.4%	64.9%	69.5%
Average Total(SD)	42.0(6.5)%	44.7(5.9)%	47.4(6.1)%	42.3(9.0)%	52.3(6.8)%	54.9(6.4)%	58.0(6.2)%	59.7(7.4)%	59.1(9.5)%	66.5(5.5)%	72.0(4.3)%
CV	0.16	0.13	0.13	0.21	0.13	0.12	0.11	0.12	0.16	0.08	0.06
United States	40.9%	43.4%	43.2%	40.7%	52.5%	53.2%	55.7%	57.2%	61.4%	65.3%	68.7%

	1955-1959	1960-1964	1965-1969	1970-1974	1975-1979	1980-1984	1985-1989	1990-1994	1995-1999	2000-2004	2005-2009
Australia	73.5%	74.0%	73.8%	75.0%	77.9%	80.8%	82.9%	85.2%	86.8%	88.5%	89.6%
Belgium	72.5%	73.6%	74.3%	75.6%	77.5%	79.4%	81.6%	83.3%	84.4%	85.4%	86.5%
Canada	73.3%	74.8%	75.7%	76.9%	78.5%	81.4%	83.1%	84.4%	85.9%	87.3%	88.0%
Denmark	77.7%	78.1%	78.3%	78.5%	79.2%	78.9%	79.2%	80.3%	82.0%	84.2%	85.6%
Finland	69.3%	70.7%	71.5%	73.5%	76.0%	79.1%	80.0%	81.9%	83.9%	85.3%	85.9%
France	71.8%	73.8%	74.5%	76.2%	77.9%	79.7%	81.3%	82.7%	84.7%	85.7%	86.5%
Iceland	78.6%	79.0%	79.0%	78.8%	81.5%	83.4%	84.9%	86.3%	87.5%	89.1%	90.3%
Italy	72.2%	73.8%	75.5%	77.5%	79.2%	81.1%	83.3%	84.8%	86.7%	88.6%	89.8%
Netherlands	79.4%	79.7%	79.5%	80.0%	81.5%	83.0%	83.9%	84.9%	85.9%	87.0%	88.6%
Norway	80.1%	80.1%	80.4%	81.0%	82.0%	82.8%	82.6%	84.5%	86.4%	87.6%	88.9%
Spain	71.3%	74.7%	77.0%	79.0%	81.2%	83.3%	83.9%	84.5%	85.9%	87.5%	88.4%
Sweden	79.3%	80.4%	81.1%	81.6%	82.1%	83.3%	84.6%	86.0%	87.6%	88.8%	89.6%
Switzerland	75.3%	76.7%	78.5%	80.1%	82.0%	83.0%	84.6%	85.5%	87.2%	88.6%	89.7%
UK England & Wales	74.5%	75.1%	76.3%	76.8%	78.0%	79.8%	81.6%	83.6%	85.1%	86.5%	87.7%
UK Scotland	70.0%	70.8%	72.3%	72.9%	73.8%	75.7%	77.5%	79.8%	81.2%	82.5%	84.1%
UK Northern Ireland	72.7%	73.5%	74.6%	73.4%	74.3%	76.8%	79.4%	81.9%	84.1%	85.8%	86.1%
Average Total(SD)	74.5(3.5)%	75.6(3.1)%	76.4(2.9)%	77.3(2.7)%	78.9(2.7)%	80.7(2.4)%	82.2(2.2)%	83.7(1.9)%	85.3(1.9)%	86.8(1.9)%	87.8(1.8)%
CV	0.05	0.04	0.04	0.04	0.03	0.03	0.03	0.02	0.02	0.02	0.02
United States	70.9%	71.5%	72.1%	73.4%	76.4%	78.7%	79.3%	80.6%	81.9%	83.0%	83.3%

CV = Coefficient of variation. Source: Human Mortality Database, and US Vital Statistics for US data before 1933. See Appendix Table 1.

Appendix Table 4A. Change in female life expectancy at birth, US and 16 other high income countries

	1907-1927	1917-1937	1927-1947	1937-1957	1947-1967	1957-1977	1967-1987	1977-1997	1987-2007
Australia	11.2	13.3	5.8	5.8	3.5	3.5	4.9	4.6	4.5
Belgium	6.7	10.7	7.1	9.9	8.2	3.8	4.6	4.7	3.7
Canada	6.5	10.6	9.3	9.1	6.6	4.8	4.5	3.3	2.8
Denmark	5.3	7.0	7.0	8.4	5.7	3.5	2.4	1.2	3.0
Finland	6.8	12.0	9.2	11.7	8.9	5.6	5.4	3.7	4.0
France	6.3	11.8	8.5	10.5	9.7	5.2	5.0	4.6	4.0
Iceland	8.1	8.0	10.1	9.6	5.2	3.9	3.7	1.8	2.9
Italy	8.1	15.8	9.7	12.8	11.1	6.1	5.8	5.1	4.4
Netherlands	9.3	12.7	5.2	6.7	7.4	3.7	3.6	2.2	2.1
Norway	6.6	10.5	7.6	7.5	4.8	2.9	2.7	2.6	3.3
Spain	7.7	12.7	12.2	16.5	11.8	7.3	6.1	5.0	3.7
Sweden	5.6	9.2	7.6	8.1	5.4	3.8	3.6	3.3	2.9
Switzerland	9.3	9.8	6.7	8.0	6.8	5.2	5.1	3.7	3.4
UK England & Wales	8.0	10.1	8.5	8.4	5.1	2.6	3.1	3.6	3.9
UK Scotland	7.4	9.3	8.0	9.5	6.7	3.2	3.2	3.5	3.6
UK Northern Ireland	7.0	9.7	10.0	12.4	7.4	2.8	3.6	4.6	4.1
Average Female	7.5	10.8	8.3	9.7	7.1	4.2	4.2	3.6	3.5
Standard Deviation	1.5	2.2	1.8	2.7	2.3	1.3	1.1	1.2	0.7
CV	0.20	0.20	0.21	0.28	0.32	0.31	0.27	0.32	0.19
	1901-1920	1910-1933	1920-1947						
United States	7.8	9.3	11.0	9.2	4.6	4.1	4.2	2.3	2.2

CV = Coefficient of variation.

Source: Human Mortality Database, and US Vital Statistics for US data before 1933. See Appendix Table 1.

Appendix Table 4B. Change in male life expectancy at birth, US and 16 other high income countries

	1907-1927	1917-1937	1927-1947	1937-1957	1947-1967	1957-1977	1967-1987	1977-1997	1987-2007
Australia	6.6	12.3	5.2	3.9	1.4	2.5	5.2	6.0	6.3
Belgium	6.3	9.8	5.3	8.9	7.5	2.6	4.1	4.8	4.8
Canada	5.9	12.9	7.9	6.3	3.9	3.0	4.5	5.0	4.7
Denmark	6.6	7.3	6.3	7.3	3.3	0.9	1.3	2.2	4.3
Finland	4.9	14.2	6.1	11.1	9.4	3.5	4.8	5.2	5.3
France	5.7	23.8	7.0	10.0	8.1	3.6	4.3	4.9	5.2
Iceland	11.3	8.2	9.2	10.2	3.5	2.4	4.0	3.4	4.4
Italy	7.0	22.6	7.4	11.0	9.5	4.1	5.0	5.3	5.6
Netherlands	10.2	13.2	2.1	4.9	6.8	0.7	2.4	3.1	4.4
Norway	6.3	10.6	6.8	6.6	2.9	0.7	1.5	3.3	5.4
Spain	6.6	6.4	9.8	19.9	11.9	6.0	4.8	3.8	3.9
Sweden	5.9	9.4	7.3	7.2	3.3	1.2	2.4	4.3	4.6
Switzerland	9.0	9.4	6.0	6.8	5.1	3.8	4.2	4.3	5.2
UK England & Wales	7.7	20.5	6.0	7.1	5.4	2.2	3.6	4.7	5.4
UK Scotland	6.4	8.8	7.2	8.2	5.1	2.3	3.4	4.2	4.8
UK Northern Ireland	6.3	11.5	8.2	9.9	4.7	0.4	2.9	5.9	5.4
Average Male	7.0	12.5	6.7	8.7	5.7	2.5	3.7	4.4	5.0
Standard Deviation	1.7	5.3	1.8	3.6	2.9	1.5	1.2	1.0	0.6
CV	0.24	0.42	0.27	0.42	0.50	0.61	0.34	0.24	0.12
	1901-1920	1910-1933	1920-1947						
United States	8.5	8.9	7.8	7.0	2.6	2.8	4.6	4.1	4.1

CV = Coefficient of variation.

Source: Human Mortality Database, and US Vital Statistics for US data before 1933. See Appendix Table 1.

Appendix Table 4C. Change in total life expectancy at birth, US and 16 other high income countries

	1907-1927	1917-1937	1927-1947	1937-1957	1947-1967	1957-1977	1967-1987	1977-1997	1987-2007
Australia	6.9	11.5	5.5	4.8	2.4	3.1	5.2	5.4	5.4
Belgium	6.5	10.2	6.1	9.4	7.8	3.2	4.5	4.9	4.3
Canada	6.2	12.0	8.5	7.5	5.2	3.9	4.7	4.4	3.9
Denmark	5.9	7.1	6.6	7.8	4.5	2.2	1.9	1.8	3.7
Finland	5.8	13.3	7.6	11.6	9.2	4.5	5.2	4.6	4.7
France	6.1	19.4	7.8	10.3	8.9	4.4	4.8	5.0	4.7
Iceland	9.8	8.1	9.6	9.9	4.2	3.1	3.9	2.7	3.7
Italy	7.5	19.9	8.5	11.9	10.3	5.1	5.5	5.3	5.2
Netherlands	9.7	12.9	3.6	5.8	7.1	2.2	3.1	2.9	3.4
Norway	6.4	10.5	7.2	7.0	3.8	1.7	2.2	3.1	4.5
Spain	7.1	9.2	11.0	18.5	11.9	6.7	5.5	4.3	3.8
Sweden	5.7	9.2	7.5	7.6	4.3	2.5	3.1	4.0	3.8
Switzerland	9.2	9.6	6.4	7.4	6.0	4.5	4.7	4.1	4.4
UK England & Wales	7.9	16.2	7.2	7.8	5.4	2.4	3.4	4.2	4.6
UK Scotland	6.9	9.1	7.6	8.8	5.8	2.8	3.4	3.9	4.1
UK Northern Ireland	6.6	10.9	9.1	11.1	6.0	1.6	3.3	5.4	4.5
Average Total	7.1	11.8	7.5	9.2	6.4	3.4	4.0	4.1	4.3
Standard Deviation	1.3	3.8	1.7	3.2	2.6	1.4	1.1	1.0	0.6
CV	0.19	0.32	0.23	0.35	0.40	0.41	0.29	0.25	0.13
	1901-1920	1910-1933	1920-1947						
United States	8.2	9.1	9.3	8.1	3.8	3.6	4.5	3.3	3.1

CV = Coefficient of variation.

Source: Human Mortality Database, and US Vital Statistics for US data before 1933. See Appendix Table 1.

Appendix Table 5A. Change in years lived past 65 for females, US and 16 other high income countries

	1907-1927	1917-1937	1927-1947	1937-1957	1947-1967	1957-1977	1967-1987	1977-1997	1987-2007
Australia	2.0	2.9	1.9	2.3	1.8	2.4	3.5	3.4	3.7
Belgium	1.4	2.6	2.3	3.4	2.9	2.0	3.3	3.6	2.9
Canada	1.6	2.8	2.8	3.4	3.3	3.0	2.9	2.3	2.3
Denmark	0.9	1.5	2.3	3.5	2.8	2.4	1.8	0.6	2.0
Finland	1.2	2.4	2.4	3.5	2.6	3.4	4.0	3.0	3.6
France	1.5	2.8	3.0	4.0	3.8	3.2	3.6	3.6	3.3
Iceland	2.4	2.7	3.1	3.6	2.2	2.7	2.7	1.1	2.2
Italy	1.8	3.5	2.7	4.0	3.8	2.9	3.6	3.8	3.6
Netherlands	1.9	3.0	2.0	3.3	3.6	2.7	2.7	1.6	1.7
Norway	1.6	2.8	2.9	3.2	2.0	1.8	2.0	2.0	2.6
Spain	1.8	2.7	3.5	5.0	4.0	3.5	3.9	3.8	3.0
Sweden	1.1	1.9	2.1	3.3	3.0	2.8	2.8	2.6	2.3
Switzerland	2.3	2.9	2.6	3.5	3.5	3.6	4.0	3.0	2.8
UK England & Wales	2.1	2.7	3.0	3.2	2.3	1.6	2.0	2.5	3.2
UK Scotland	1.7	2.1	2.4	2.9	2.5	1.9	1.8	2.4	3.0
UK Northern Ireland	1.5	2.2	3.1	4.2	3.0	1.7	2.1	3.1	3.4
Average Female	1.7	2.6	2.6	3.5	2.9	2.6	2.9	2.7	2.9
Standard Deviation	0.4	0.5	0.5	0.6	0.7	0.7	0.8	1.0	0.6
	1901-1920	1910-1933	1920-1947						
United States	1.6	2.4	3.6	4.0	2.5	2.7	2.7	1.5	1.7

Source: Human Mortality Database, and US Vital Statistics for US data before 1933. See Appendix tables 2 and 3.

Appendix Table 5B. Change in years lived past 65 for males, US and 16 other high income countries

	1907-1927	1917-1937	1927-1947	1937-1957	1947-1967	1957-1977	1967-1987	1977-1997	1987-2007
Australia	1.8	2.9	1.0	0.8	0.1	1.2	3.2	4.1	4.8
Belgium	1.3	1.8	1.2	2.0	1.3	0.5	2.2	3.2	3.5
Canada	1.3	2.8	1.5	1.3	0.9	1.1	2.3	3.0	3.6
Denmark	1.8	1.6	1.8	2.2	0.4	-0.1	0.6	1.2	3.0
Finland	0.3	2.2	0.9	2.2	1.8	1.2	2.7	3.4	4.0
France	1.0	3.5	2.0	2.8	1.7	1.5	2.6	3.2	3.7
Iceland	3.0	2.3	3.0	3.6	0.7	1.2	1.9	1.6	3.2
Italy	1.3	4.0	1.9	2.6	1.8	0.9	2.3	3.4	4.1
Netherlands	2.2	3.1	0.7	1.8	1.7	-0.3	1.0	1.9	3.3
Norway	1.3	2.5	2.4	2.2	-0.1	-0.4	0.7	2.1	3.9
Spain	0.9	0.7	2.2	4.9	3.2	2.1	2.5	2.6	2.7
Sweden	1.3	2.0	1.8	2.3	1.0	0.3	1.3	2.9	3.5
Switzerland	1.8	2.2	2.0	2.4	1.8	1.8	2.7	3.0	3.9
UK England & Wales	1.5	3.7	1.6	1.5	1.0	1.0	2.1	3.2	4.4
UK Scotland	1.3	1.7	1.5	1.4	0.7	0.8	1.6	2.7	3.9
UK Northern Ireland	1.3	2.2	2.0	2.2	0.8	-0.1	1.3	3.4	4.4
Average Male	1.5	2.4	1.7	2.3	1.2	0.8	1.9	2.8	3.7
Standard Deviation	0.6	0.9	0.6	1.0	0.8	0.7	0.8	0.8	0.6
	1901-1920	1910-1933	1920-1947						
United States	1.7	1.7	1.4	2.0	0.6	1.3	2.5	2.5	3.0

Source: Human Mortality Database, and US Vital Statistics for US data before 1933. See Appendix tables 2 and 3.

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Appendix Table 5C. Change in years lived past 65 for total population, US and 16 other high income countries

	1907-1927	1917-1937	1927-1947	1937-1957	1947-1967	1957-1977	1967-1987	1977-1997	1987-2007
Australia	1.9	3.0	1.5	1.5	0.9	1.9	3.5	3.9	4.4
Belgium	1.4	2.2	1.7	2.7	2.1	1.3	2.9	3.6	3.4
Canada	1.5	2.8	2.1	2.3	2.0	2.1	2.8	2.9	3.1
Denmark	1.3	1.5	2.1	2.9	1.5	1.2	1.2	1.1	2.6
Finland	0.7	2.4	1.6	2.9	2.2	2.3	3.5	3.3	3.8
France	1.3	3.6	2.5	3.5	2.8	2.3	3.2	3.6	3.6
Iceland	2.7	2.5	3.0	3.6	1.4	1.9	2.4	1.5	2.8
Italy	1.5	3.9	2.3	3.3	2.8	1.9	3.0	3.8	4.0
Netherlands	2.1	3.1	1.3	2.6	2.6	1.2	2.0	2.0	2.7
Norway	1.5	2.7	2.6	2.7	0.9	0.7	1.4	2.2	3.4
Spain	1.4	1.6	2.9	5.2	3.7	2.9	3.2	3.1	2.9
Sweden	1.2	1.9	1.9	2.8	2.0	1.5	2.2	2.9	3.0
Switzerland	2.1	2.6	2.3	3.0	2.6	2.7	3.4	3.2	3.4
UK England & Wales	1.9	3.5	2.3	2.4	1.7	1.4	2.1	2.9	3.8
UK Scotland	1.5	1.9	2.0	2.2	1.6	1.4	1.8	2.6	3.4
UK Northern Ireland	1.4	2.3	2.6	3.2	1.9	0.8	1.8	3.5	3.8
Average Total	1.6	2.6	2.2	2.9	2.1	1.7	2.5	2.9	3.4
Standard Deviation	0.5	0.7	0.5	0.8	0.7	0.7	0.7	0.8	0.5
	1901-1920	1910-1933	1920-1947						
United States	1.7	2.1	2.4	3.0	1.7	2.2	2.7	2.1	2.3

Source: Human Mortality Database, and US Vital Statistics for US data before 1933. See Appendix tables 2 and 3.

Appendix Table 6A. Change in years lived past 65 as a percentage of change in life expectancy at birth for females, US and 16 other high income countries

	1907-1927	1917-1937	1927-1947	1937-1957	1947-1967	1957-1977	1967-1987	1977-1997	1987-2007
Australia	17.7%	21.4%	31.9%	40.4%	50.5%	67.2%	71.0%	75.4%	83.0%
Belgium	21.5%	24.5%	31.9%	34.8%	35.5%	54.4%	70.4%	76.7%	80.2%
Canada	24.7%	26.1%	30.1%	37.9%	49.5%	63.3%	65.7%	68.1%	82.0%
Denmark	17.3%	21.1%	33.3%	41.6%	48.5%	68.7%	73.6%	52.5%	69.0%
Finland	17.6%	20.1%	25.7%	29.5%	29.4%	60.9%	75.2%	81.3%	88.3%
France	24.2%	23.6%	35.3%	38.6%	39.5%	60.6%	71.7%	78.6%	82.1%
Iceland	29.3%	34.1%	31.2%	37.9%	41.8%	70.5%	72.3%	60.8%	76.1%
Italy	21.8%	21.9%	28.2%	31.6%	34.5%	48.5%	61.5%	75.8%	81.5%
Netherlands	20.5%	23.7%	38.6%	49.2%	49.0%	72.2%	76.4%	73.8%	78.1%
Norway	23.7%	26.9%	37.6%	42.2%	40.7%	63.1%	76.8%	78.2%	79.3%
Spain	23.6%	21.4%	28.8%	30.3%	33.8%	48.2%	63.2%	76.7%	80.7%
Sweden	20.1%	21.1%	27.6%	40.5%	55.6%	73.5%	78.2%	77.3%	78.9%
Switzerland	24.5%	29.8%	39.0%	44.4%	51.5%	69.4%	78.1%	81.2%	82.0%
UK England & Wales	26.1%	26.8%	35.5%	38.4%	44.1%	63.2%	64.6%	71.2%	83.2%
UK Scotland	23.6%	22.5%	30.6%	31.0%	36.7%	59.3%	56.8%	66.4%	82.9%
UK Northern Ireland	21.8%	23.0%	31.0%	34.0%	40.8%	61.2%	59.4%	67.2%	84.2%
Average Female	22.4%	24.2%	32.3%	37.6%	42.6%	62.8%	69.7%	72.6%	80.7%
Standard Deviation	3.3%	3.7%	4.0%	5.5%	7.5%	7.6%	6.9%	7.8%	4.2%
	1901-1920	1910-1933	1920-1947						
United States	20.9%	26.2%	33.0%	43.4%	54.7%	67.6%	64.9%	62.5%	77.8%

Source: Human Mortality Database, and US Vital Statistics for US data before 1933. See Appendix tables 1-3.

Appendix Table 6B. Change in years lived past 65 as a percentage of change in life expectancy at birth for males, US and 16 other high income countries

	1907-1927	1917-1937	1927-1947	1937-1957	1947-1967	1957-1977	1967-1987	1977-1997	1987-2007
Australia	27.7%	23.2%	20.0%	19.4%	4.4%	49.4%	62.1%	68.8%	77.0%
Belgium	20.1%	18.8%	23.3%	23.0%	17.1%	21.0%	53.9%	66.7%	74.0%
Canada	22.9%	21.4%	19.2%	20.4%	23.2%	37.7%	51.0%	60.5%	76.9%
Denmark	26.9%	21.2%	29.1%	31.0%	12.4%	-6.9%	44.6%	56.0%	69.6%
Finland	5.6%	15.4%	14.6%	19.9%	18.8%	35.8%	56.3%	65.6%	75.6%
France	17.0%	14.9%	28.6%	27.8%	21.4%	41.2%	59.9%	66.4%	70.5%
Iceland	26.2%	27.8%	32.4%	35.2%	21.4%	49.9%	48.6%	48.4%	72.8%
Italy	18.5%	17.6%	25.4%	23.3%	18.5%	22.3%	44.9%	64.7%	73.6%
Netherlands	21.8%	23.8%	35.4%	37.6%	24.6%	-39.5%	43.2%	62.1%	76.2%
Norway	21.2%	24.0%	35.6%	33.1%	-4.3%	-56.8%	44.2%	63.1%	72.4%
Spain	13.7%	11.1%	22.0%	24.5%	27.1%	35.3%	51.8%	66.8%	67.9%
Sweden	22.4%	21.2%	24.6%	31.2%	30.4%	25.6%	56.6%	66.4%	74.7%
Switzerland	19.8%	23.7%	33.7%	35.7%	34.1%	48.5%	63.8%	70.2%	73.8%
UK England & Wales	20.0%	18.0%	26.1%	21.8%	18.5%	45.1%	57.0%	69.1%	81.6%
UK Scotland	19.9%	18.9%	21.6%	17.2%	13.4%	33.7%	47.5%	64.2%	81.4%
UK Northern Ireland	20.2%	19.2%	24.0%	22.0%	16.0%	-16.7%	43.9%	58.2%	81.0%
Average Male	20.3%	20.0%	26.0%	26.4%	18.6%	20.3%	51.8%	63.6%	74.9%
Standard Deviation	5.3%	4.2%	6.1%	6.6%	9.4%	32.9%	6.9%	5.6%	4.1%
	1901-1920	1910-1933	1920-1947						
United States	20.5%	19.5%	17.7%	27.9%	24.9%	47.5%	55.4%	62.7%	73.6%

Source: Human Mortality Database, and US Vital Statistics for US data before 1933. See Appendix tables 1-3.

Appendix Table 6C. Change in years lived past 65 as a percentage of change in life expectancy at birth for total population, US and 16 other high income countries

	1907-1927	1917-1937	1927-1947	1937-1957	1947-1967	1957-1977	1967-1987	1977-1997	1987-2007
Australia	27.7%	25.8%	26.4%	31.4%	38.4%	61.1%	67.1%	72.8%	80.2%
Belgium	21.1%	21.8%	28.1%	29.3%	26.8%	41.2%	63.4%	73.0%	77.8%
Canada	24.0%	23.5%	24.8%	30.3%	38.9%	53.7%	59.8%	65.6%	79.9%
Denmark	22.5%	21.2%	31.6%	36.6%	34.7%	52.5%	65.4%	58.6%	70.0%
Finland	12.4%	17.9%	21.2%	25.4%	24.4%	51.9%	67.7%	72.9%	80.5%
France	21.1%	18.4%	32.7%	33.9%	31.4%	52.8%	66.7%	72.6%	76.7%
Iceland	28.0%	31.0%	31.4%	36.5%	32.6%	61.7%	60.2%	53.8%	74.4%
Italy	20.3%	19.5%	27.1%	27.9%	27.2%	38.2%	54.7%	70.9%	78.1%
Netherlands	21.3%	23.8%	37.6%	44.3%	37.1%	54.1%	63.9%	69.6%	78.5%
Norway	22.6%	25.6%	36.6%	37.8%	22.9%	38.9%	65.9%	71.6%	75.8%
Spain	19.3%	17.0%	26.1%	27.8%	30.9%	42.9%	58.0%	72.7%	74.2%
Sweden	21.2%	21.0%	26.0%	36.1%	46.0%	62.2%	70.5%	72.4%	77.1%
Switzerland	22.4%	27.0%	36.7%	40.5%	44.2%	61.2%	72.9%	76.3%	77.3%
UK England & Wales	23.4%	21.7%	31.8%	31.3%	32.1%	56.9%	61.6%	70.5%	82.4%
UK Scotland	22.1%	21.0%	26.6%	25.0%	27.0%	50.3%	54.1%	66.2%	82.0%
UK Northern Ireland	21.0%	21.0%	28.0%	28.9%	31.2%	53.0%	54.5%	63.9%	82.9%
Average Total	21.9%	22.3%	29.5%	32.7%	32.9%	52.0%	62.9%	69.0%	78.0%
Standard Deviation	3.5%	3.7%	4.7%	5.5%	6.7%	8.0%	5.7%	6.0%	3.4%
	1901-1920	1910-1933	1920-1947						
United States	20.7%	22.7%	26.0%	36.8%	45.8%	60.5%	61.3%	64.3%	76.0%

Source: Human Mortality Database, and US Vital Statistics for US data before 1933. See Appendix tables 1-3.

Appendix Table 7. Decomposition of Changes in U.S. Expected Labor Force Participation, 1900 to 2007

	Decomposition 1A: 1900 LFP Rates			Decomposition 1B: 2007 LFP Rates		
Year	Female XLFP1A	Male XLFP1A	Total LFP1A	Female XLFP1B	Male XLFP1B	Total LFP1B
1900	6.43	29.96	18.53	22.66	25.71	24.23
1910	6.80	31.54	19.59	24.09	27.10	25.64
1920	7.40	35.62	21.77	26.25	30.41	28.37
1933	7.93	37.79	23.26	28.25	32.31	30.34
1942	8.41	39.92	24.69	30.08	34.09	32.16
1950	8.74	41.71	25.79	31.33	35.60	33.56
1960	8.92	42.53	26.34	31.98	35.60	34.22
1970	8.98	42.66	26.48	32.19	36.35	34.38
1980	9.15	44.15	27.22	32.83	37.44	35.23
1990	9.23	44.85	27.56	33.11	37.92	35.60
2000	9.28	45.88	27.58	33.30	38.68	35.99
2007	9.33	46.23	27.78	33.51	39.00	36.25
Change (years)	2.91	16.27	9.26	10.84	13.29	12.02
% of Actual Change	10.73%	179.99%	52.21%	40.05%	146.96%	67.83%

	Decomposition 2A: 1900 Survival			Decomposition 2B: 2007 Survival		
Year	Female XLFP2A	Male XLFP2A	Total LFP2A	Female XLFP2B	Male XLFP2B	Total LFP2B
1900	6.43	29.96	18.53	9.34	46.33	28.15
1910	7.00	29.72	18.68	10.16	45.92	28.35
1920	7.58	29.48	18.84	10.97	45.52	28.54
1933	8.14	29.09	18.91	11.81	44.98	28.69
1942	10.94	29.72	20.59	15.89	45.67	31.03
1950	12.30	29.57	20.88	18.01	45.40	31.49
1960	13.94	28.82	21.20	20.70	44.07	31.97
1970	16.24	28.00	21.95	23.96	42.67	32.94
1980	19.64	27.20	23.33	28.55	41.04	34.55
1990	21.97	26.53	24.20	32.03	39.95	35.85
2000	23.61	27.03	25.32	34.43	40.57	37.50
2007	22.66	25.69	24.17	33.50	38.99	36.24
Change (years)	16.23	-4.27	5.65	24.16	-7.34	8.09
% of Actual Change	59.93%	-47.26%	31.85%	89.22%	-81.18%	45.64%

LFP = Labor force participation. XLFP = Expected Labor Force Participation.

Source: Author calculations based on survival data from the Human Mortality Database (and US Vital Statistics for US data before 1933) and labor force participation data from decennial censuses and the Current Population Survey. The table reports decompositions of the XLFP trend series for the US into two different effects: (1) the effect of improving survival, holding age-specific LFP rates constant at their 1900 or 2007 values (decompositions 1A and 1B, respectively); and (2) the effect of changing LFP, holding survival to each age constant at 1900 or 2007 levels (decompositions 2A and 2B, respectively). Each decomposition is calculated separately for men and women, and then for the total population.

Appendix Table 8A. Expected labor force participation as percentage of life expectancy at birth for females, US and 14 high-income comparators, 1980 to 2007

	1980	1990	2000	2007
Australia	30.81%	35.92%	37.91%	40.69%
Belgium	26.27%	27.37%	32.44%	35.22%
Canada	33.93%	39.96%	40.83%	43.82%
Denmark	44.33%	47.50%	45.60%	46.48%
Finland	43.03%	44.15%	43.43%	43.72%
France	33.71%	34.05%	34.86%	37.58%
Iceland	51.43%	53.62%	53.24%	51.93%
Italy	24.40%	26.16%	26.55%	28.47%
Netherlands	27.33%	30.43%	38.46%	43.18%
Norway	39.68%	43.51%	45.59%	45.97%
Spain	19.90%	24.33%	29.44%	34.49%
Sweden	46.22%	49.00%	44.40%	46.24%
Switzerland	40.39%	41.60%	42.24%	43.98%
UK	35.69%	40.57%	40.59%	41.33%
Average Female	35.51%	38.44%	39.68%	41.65%
Standard Deviation	9.16%	9.04%	7.11%	6.01%
United States	36.06%	40.24%	43.12%	41.61%

Appendix Table 8B. Expected labor force participation as percentage of life expectancy at birth for males, US and 14 high-income comparators, 1980 to 2007

	1980	1990	2000	2007
Australia	57.28%	54.21%	51.05%	51.64%
Belgium	50.48%	45.42%	44.94%	45.36%
Canada	56.95%	54.00%	50.82%	51.54%
Denmark	57.30%	57.21%	53.25%	53.58%
Finland	54.32%	51.98%	49.55%	48.87%
France	54.32%	48.13%	45.27%	46.07%
Iceland	64.27%	61.39%	62.20%	59.64%
Italy	53.58%	50.10%	45.05%	44.45%
Netherlands	51.84%	50.67%	52.00%	53.31%
Norway	58.40%	55.51%	53.50%	52.14%
Spain	56.65%	50.64%	48.61%	49.19%
Sweden	57.29%	55.51%	49.57%	51.76%
Switzerland	61.25%	59.68%	55.91%	54.78%
UK	59.85%	56.86%	52.33%	51.71%
Average Male	56.70%	53.67%	51.00%	51.00%
Standard Deviation	3.67%	4.46%	4.63%	4.03%
United States	56.04%	54.18%	54.34%	51.76%

Appendix Table 8C. Expected labor force participation as percentage of life expectancy at birth for total population, US and 14 high-income comparators, 1980 to 2007

	1980	1990	2000	2007
Australia	43.06%	44.78%	44.10%	45.91%
Belgium	37.93%	36.06%	38.42%	40.05%
Canada	45.03%	46.66%	45.54%	47.43%
Denmark	50.54%	52.09%	49.27%	49.85%
Finland	48.23%	47.71%	46.24%	46.06%
France	43.55%	40.68%	39.76%	41.49%
Iceland	57.22%	57.62%	57.39%	55.81%
Italy	38.15%	37.54%	35.35%	36.08%
Netherlands	39.60%	40.22%	45.00%	47.97%
Norway	48.70%	49.44%	49.33%	48.83%
Spain	37.42%	36.94%	38.64%	41.57%
Sweden	51.73%	52.29%	46.77%	48.79%
Switzerland	50.24%	50.14%	48.65%	49.01%
UK	47.19%	48.25%	46.12%	46.26%
Average Total	45.61%	45.74%	45.04%	46.08%
Standard Deviation	5.98%	6.59%	5.65%	4.93%
United States	45.31%	46.65%	48.32%	46.49%

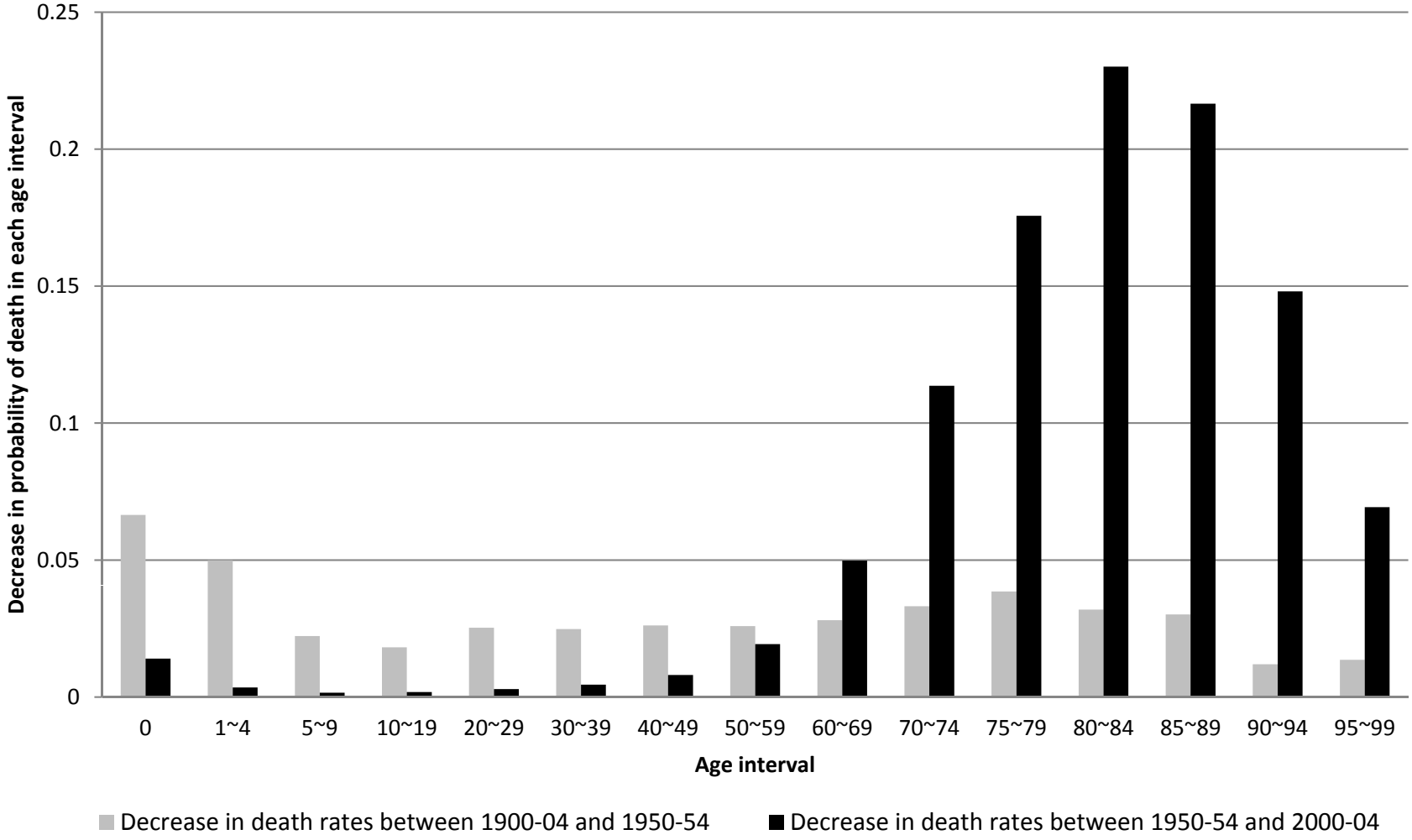
Source: Author calculations based on survival data from the Human Mortality Database and labor force participation data from the International Labor Organization (except for the US; see note to appendix table 7).

Appendix Table 9. Male Expected Labor Force Participation as a Percentage of Life Expectancy at Birth in Asia and Select Developing Countries, 2007

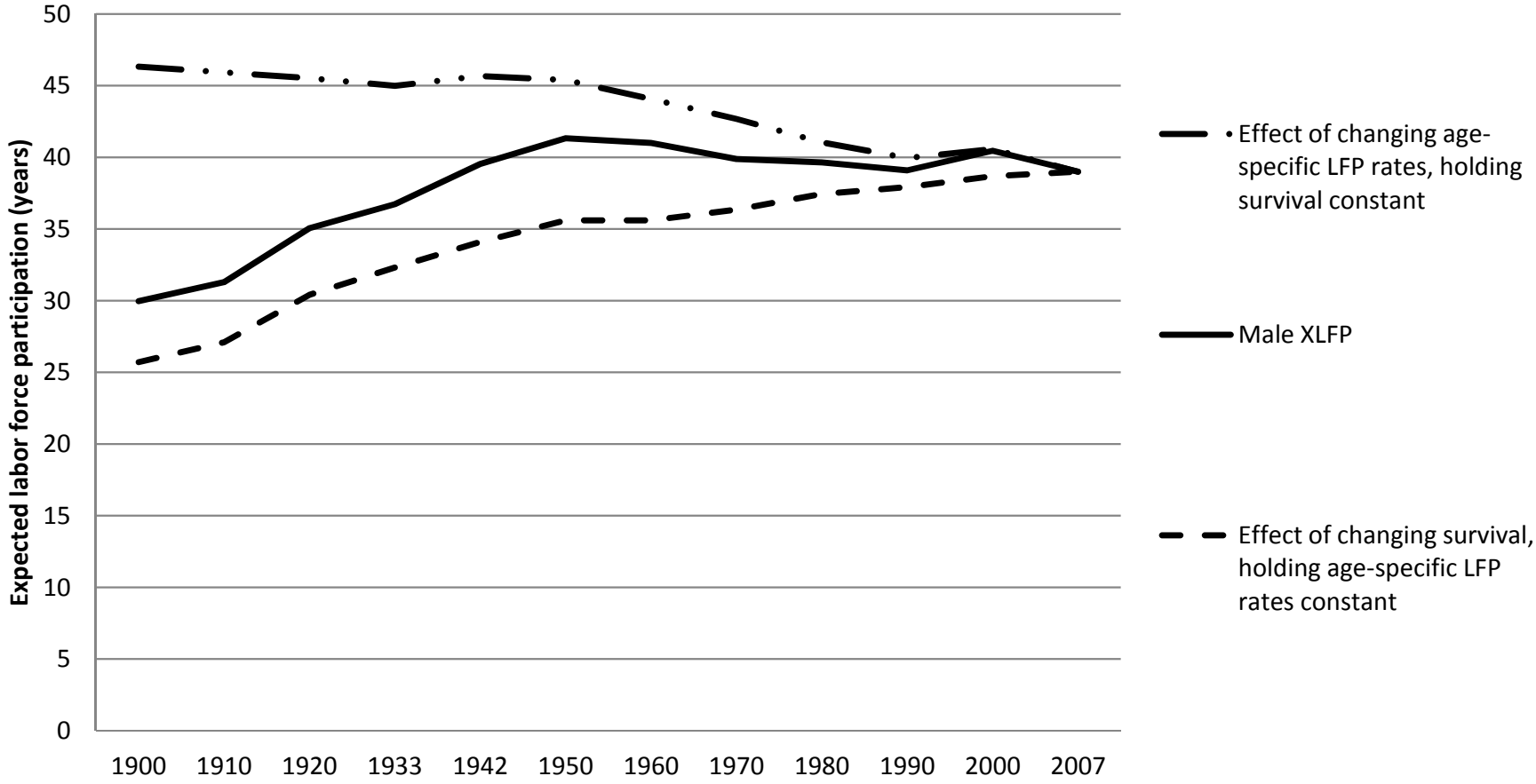
Country	Male XLFP/LE_0 in 2007
Japan	54.1%
South Korea	52.0%
China	57.6%
Philippines	59.6%
Indonesia	64.5%
Brazil	59.1%
Vietnam	54.6%
India	60.0%
Bangladesh	60.9%

Note: The Expected Labor Force Participation (XLFP) estimates should be considered indicative only and interpreted with caution, given questions about comparability of labor force participation data. The estimates are author calculations based on International Labor Organization estimates of age-sex-specific labor force participation for each country. Survival data are from the life tables for each country prepared by the International Programs Center of the U.S. Bureau of the Census in its International Data Base.

Appendix Figure 1. Decrease in death rates by age group in Sweden, 1900-04 to 2000-04



Appendix Figure 2A: Decomposition of Changes in US Male Expected Labor Force Participation, Since 1900



Appendix Figure 2B: Decomposition of Changes in US Female Expected Labor Force Participation, Since 1900