Chapter 4

Life course inequality across generations

This chapter examines how inequality which builds up over an entire lifetime from disparities in the length of life, employment rates, earnings and pensions evolves across birth cohorts. It shows that great strides in longevity have been a common phenomenon across countries and genders, but also that marked gaps in the length of life between educational groups and genders exist in all countries for which data are available. It then turns to education- and gender-related gaps in total-career labour earnings by showing how the diverse trends in employment rates, hourly wages and annual hours worked shape their evolution from one generation to the next. The chapter subsequently investigates how inequality during the working life and gaps in life expectancy translate into differences in pension benefits. A pilot dynamic micro-simulation model finally simulates for a limited number of countries the impact of higher life expectancies on the share of healthy life years and on the length of working lives. It also estimates the effect of raising the retirement age on the career length and pension entitlements across socio-economic groups of the late 1960s cohort.

Section 4 building on the pilot Global Future Elderly Model was developed with Barbara Blaylock (Health Division); Vincenzo Atella, Federico Belotti and Andrea Piano Mortari (University of Rome Tor Vergata); and Dana Goldman and Bryan Tysinger (University of Southern California).

Key findings

- Health has improved over time, but health inequalities across socioeconomic groups are striking, fueling unequal ageing. New mortality data at older ages show higher inequality in longevity than previously reported. At age 65, men with high education can expect to live about 3½ years longer than low-educated men on average; for women, the gap is 2½ years.
- The gender gap in lifetime earnings – factoring in employment rates, hourly wages, hours worked and survival rates – has narrowed by about one-third between the cohorts born in 1940-44 and in 1970-74.
- On average across OECD countries, the education premium in lifetime earnings has declined over generations among women, but has risen among men, chiefly driven by employment trends.
- About two-thirds of lifetime earnings inequality passes on to pension inequality – from less than 25% for many Anglo-Saxon countries to more than 85% in about one-third of OECD countries. Entering the labour market late and being unemployed during long periods substantially reduces pensions in most countries, where younger generations might find it harder to earn sufficient pensions.
- A shorter retirement period implied by a shorter life expectancy reduces total pensions received by low earners by about 13% relative to high earners. Raising the retirement age tends to affect low earners proportionally more, but the impact is small.

Introduction

This chapter examines inequality that builds up over an entire lifetime, arguably the most comprehensive measure of inequality. It captures disparities in the length of life as well as in employment rates, earnings and pensions, and digs deeper into the differences between countries, genders, birth cohorts and educational groups.

The great strides in longevity in all cohorts are one of the main driving forces of population ageing and one of the societies' greatest achievements over the past century. At the same time, wide socio-economic gaps in life expectancy persist. Disparities in education are critical determinants of life expectancy inequality.

Gaps in health and life expectancy between different socio-economic groups are perhaps the most shocking and, for many, the most unacceptable manifestations of disadvantage. Life expectancy gaps translate directly into differences in earnings that accumulate over working lives across socio-economic groups. What is more, they also contribute to differences in well-being, as life itself is a non-income component of well-being: it has a non-monetary value that goes beyond income earned. Moreover, earnings inequality translates into pension inequality to greater or less degrees, depending on the progressivity of pension systems, which includes instruments that cushion the impact of labour market shocks on pension entitlements.

Section 1 explores gains in life expectancy from one birth cohort to another by age and gender in a wide range of OECD countries. Drawing on the OECD's Multi-Dimensional Living Standards indicator, it seeks to estimate the contribution of life expectancy to differences in living standards across countries. Section 2 then focuses on education gaps in longevity based on new OECD data and shows that differences in life expectancy, measured as a share of remaining life expectancy across education levels increase with age. The evidence across countries is mixed, however, as to how inequality in life expectancy has evolved over time. Socio-economic differences in life expectancy are major contributory factors in inequality in standards of living.

Section 2 computes education-related disparities in lifetime earnings by cohort and gender in 13 OECD countries, factoring in differences in hourly wages, hours worked, employment and life expectancy. Generally, inequality in lifetime earnings has substantially fallen across cohorts among women, but risen, albeit to a smaller extent, among men. A change in the employment patterns of both genders has been the key driver of those aggregate trends. Overall, the gender gap in lifetime earnings has narrowed by about one-third between the cohorts born in 1940-44 and in 1970-74. How these lifetime developments affect pensions is the focal point of the fourth and last section.

Section 3 finds that, on average, about two-thirds of lifetime earnings inequality passes on to pension inequality across OECD countries. However, the pass-through from labour earnings to pension inequality differs substantially from one country to another – it is low in countries where the pension system relies primarily on universal basic pensions and high in those where earnings and pensions are closely tied. Section 4 also shows that differences in life expectancy between education levels have a substantial impact on inequality in total pension benefits, which makes the raising of the retirement age a regressive measure, even though only to a quantitatively small extent.

Finally, Section 4 presents results from the pilot Global Future Elderly Model (Global FEM)[1] which projects health and economic circumstances of representative cohorts of individuals born in the late 1940s, the mid-1950s and the late 1960s in Belgium, Italy and the United States. A policy scenario simulates the effect of raising early and normal retirement ages for the late 1960s cohort on the length of working lives and pension entitlements across socio-economic groups.

1. Gains and differences in life expectancy

Gains in life expectancy

Tremendous progress in longevity over the last 100 years has been driven by falls in mortality in all birth cohorts at all ages, particularly very early in life. Historical data (United Nations, 2015) covering 15 OECD countries show that male infant mortality (up to 1 year old) fell from an average of 150 deaths per 1 000 live births between 1900 and 1904 to 3.5 in 2010-14. At the same time, average mortality between the ages of 70 and 71 dropped from 56 to 25 deaths per 1 000 people.

By combining historical mortality data from the same United Nations source with a birth cohort's projected mortality rates to the year 2100, it is possible to work out the cohort's life expectancy at a given age in any OECD country. This *cohort* life expectancy by age is the length of time people from a cohort may, in a given year, be expected to live. It differs from *period* life expectancy which is typically used in most comparative analyses of longevity (and later in this section to describe education-related inequalities in longevity).[2]

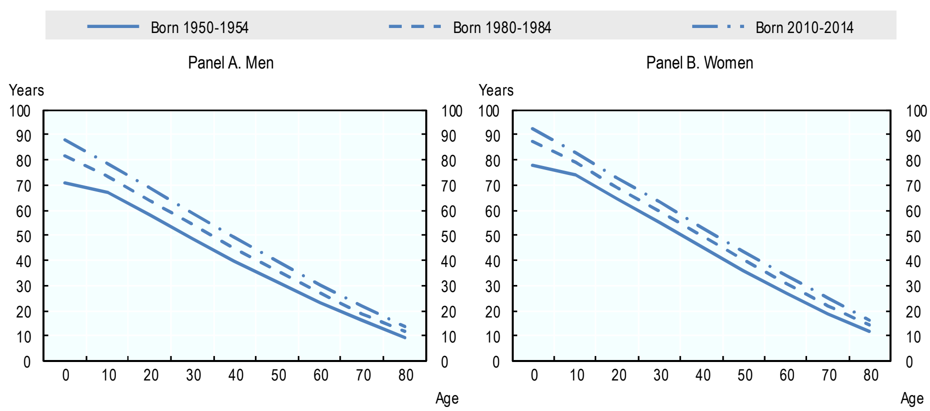
All birth cohorts are expected to enjoy longer remaining life spans at each age than earlier cohorts. Projections pertaining to OECD countries show that, on average, the male cohort born between 2010 and 2014 is expected to live 88.0 years and the female 92.3 (Figure 4.1). Those figures translate into gains of 17.3 and 14.3 years, respectively, over the baby-boomer cohort born between 1950 and 1954. At the age of 60, men are expected to live 7.3 and women 6.7 years longer: slightly less than half of the gains in longevity at birth will come after the age of 60.

Improvements in cohort longevity at birth are expected to slow down, since physiological limits make it more difficult to reduce mortality at older ages and given that infant as well as prime-age mortality have already fallen to very low levels. Men and women born in 2010-14 are expected to live, respectively, 6.5 and 5.0 years longer than those born in 1980-84 who are, in turn, projected to live 10.8 and 9.3 years longer than those born in 1950-54 (Figure 4.1).

Previous studies have highlighted the relationship, at the national level, between health and well-being. Period life expectancy at birth increased by an average of 4.2 years in 26 OECD countries between 1995 and 2013, which accounts for about half of the growth in the OECD's well-being measure – the Multi-dimensional Living Standards (MDLS) (Boarini et al., 2016) – over the same period (Box 4.1). This indicates that life expectancy gains have largely contributed to progress in well-being among OECD countries in recent decades.

Figure 4.1. Projected remaining cohort life expectancy by age in 35 OECD countries

Life expectancy in years



Source: OECD calculations based on United Nations (2015), *World Population Prospects: The 2015 Revision*, Department of Economic and Social Affairs, Population Division, United Nations, New York.

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Box 4.1. The impact of increases in longevity on well-being

Multi-dimensional living standards (MDLS) is a metric developed as part of the OECD Inclusive Growth Initiative to help assess policies' impact on the income and non-income components of well-being. It draws on a methodology that combines the level and the inequality of disposable household income with the benefits from the non-income components unemployment and longevity by assigning a money value to the latter three components as further described in Annex 4.A1.

Progress in longevity has been a key driver of higher MDLS at all ages

Increases in longevity have contributed half of the increase of MDLS over the period 1995-2013. Each additional year of longevity raises MDLS by an average of 5.9%, so generating an increase of 25% in well-being over the period – an annual growth rate of 1.4%. In comparison, household income growth accounted for 1.5% of the rise in MDLS. The contribution of longevity to the annual improvement in MDLS is expected to decline to 0.5% by 2050, as gains in longevity lessen over time (Murtin, 2015).

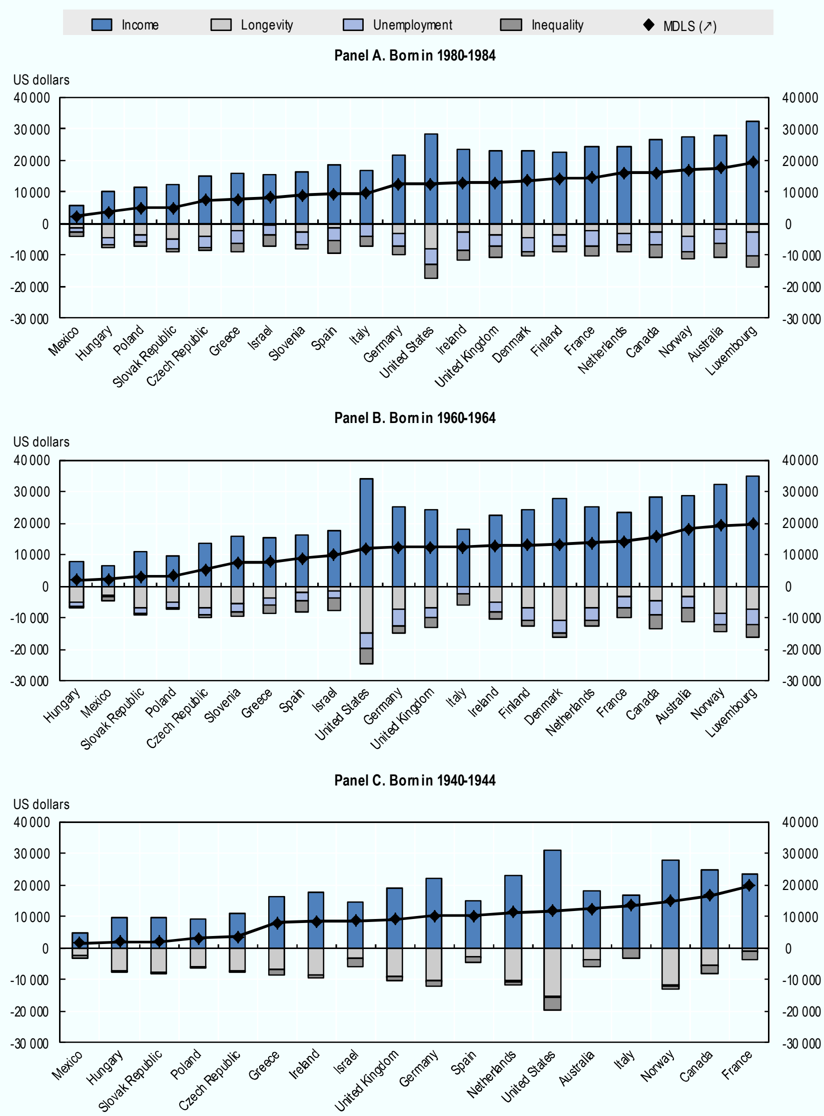
The MDLS of birth cohorts can be compared for different countries. In 2010, the rankings of countries were similar from one cohort to another (in 2010 these cohorts have therefore different ages). There were some exceptions, however (Figure 4.2). France, for instance, came top for MDLS among 66-70 year-olds in 2010 (born 1940-44), but sixth among people aged 26-30 (born 1980-84). In Italy, too, older cohorts were better off than younger ones in 2010, while the opposite was true for Ireland. As for the United States, the wide longevity shortfall in all cohorts – compared to the best-performing country – produced an MDLS ranking that was considerably worse than a ranking on the basis of income alone would have been.

Box 4.1. The impact of increases in longevity on well-being *(cont.)*

While additional work shows that MDLS of all age groups are estimated to have risen across cohorts, older people have enjoyed greater gains. Across the 22 OECD countries under study, the MDLS of 70-year-olds grew at an average annual rate of 4.5% between 1980-84 (the 1910-14 birth cohort) and 2010-14 (the cohort born between 1940 and 1944). By contrast, MDLS rose at an annual rate of 1.4% among people in their 30s – that is between the 1950-54 and 1980-84 birth cohorts – a finding attributable in part to the impact of changes in longevity.

Figure 4.2. Multi-dimensional living standards by cohort in 2010

Average of 22 OECD countries



Source: OECD calculations based on *OECD Income Distribution And Poverty Database, OECD Labour Force Statistics Database* and United Nations (2015), *World Population Prospects: The 2015 Revision*, Department of Economic and Social Affairs, Population Division, United Nations, New York.

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Box 4.1. The impact of increases in longevity on well-being *(cont.)*

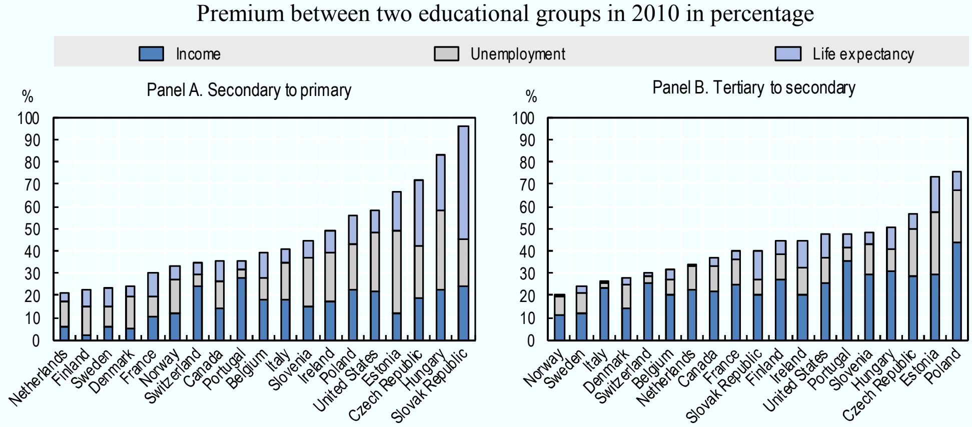
Wide education-related disparities in longevity fuel inequality in well-being

Longevity gaps by level of educational attainment fuel inequality in MDLS. As data on education-related longevity are not available by cohort, disparities in period life expectancy at the ages of 25 and 65 between groups with different educational levels are used here to calculate well-being according to educational attainment. Indeed, new OECD evidence 23 OECD countries around 2011 reveals large education-related differences in life expectancy at those ages (see below), which contribute substantially to inequality in MDLS in OECD countries.

While the income gap between people with medium and low education is, on average, around 15%, Diaz and Murtin (2017a) show that the MDLS gap between the two groups is three times wider (Figure 4.3). The MDLS premium associated with moving from primary to secondary education is attributable chiefly to non-income components, with longevity and unemployment accounting, respectively, for 28% and 38% of the total gap, compared to 34% for income. Here again differences in life expectancy contribute substantially to MDLS gaps, particularly in Central and Eastern European Countries (CEECs). The MLDS gaps between people with medium and high education can be ascribed principally to household income gaps, although inequality of life expectancy is an important factor in CEECs, Ireland and the United States.

Figure 4.3. Differences in components of multi-dimensional living standards between educational groups

Premium between two educational groups in 2010 in percentage



Note: United Kingdom refers to data for England and Wales.

Source: Díaz, M. and F. Murtin (2017), "Socio-economic Inequality in Living Standards", *OECD Statistics Directorate Working Paper*, OECD Publishing, Paris, forthcoming.

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Premature mortality impacts strongly on inequality in well-being measured over a lifetime

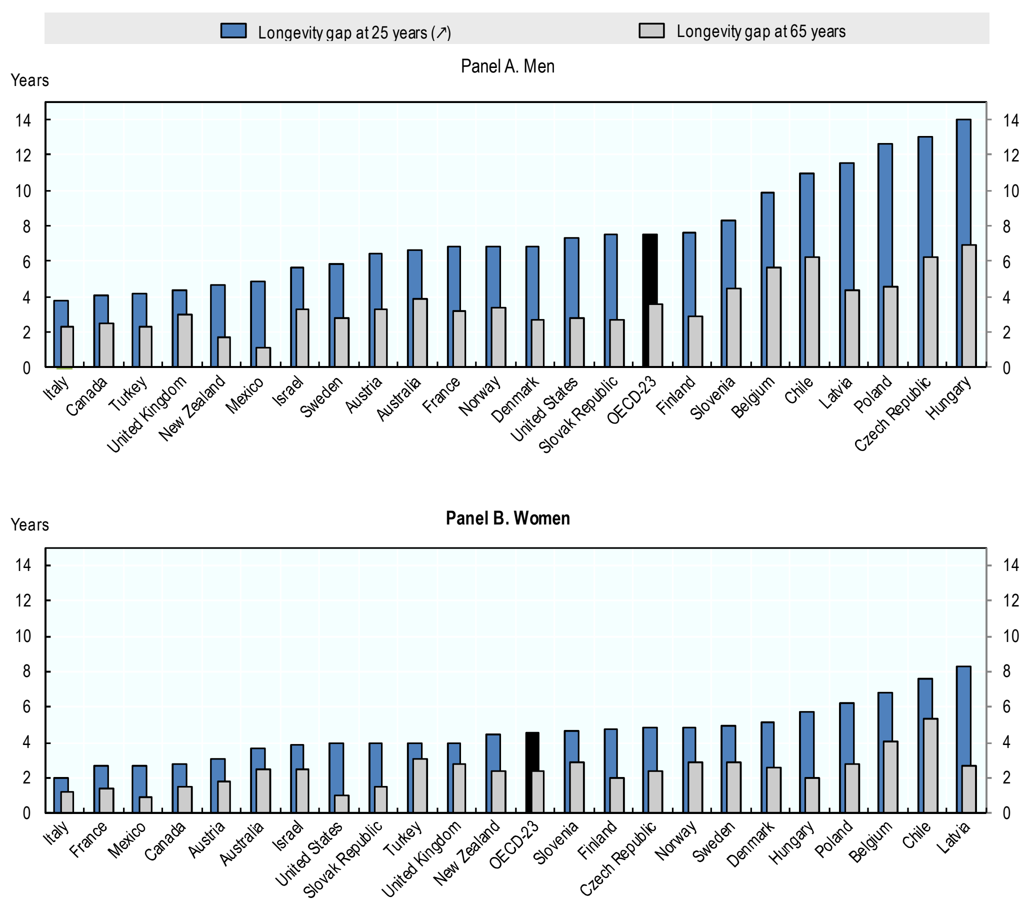
Premature mortality, here defined as the death before the age of 70, is a key driver of total lifespan inequality. However, mortality rate projections by the United Nations (2015) suggest that premature mortality is expected to shrink by 2100. The expected reduction in premature mortality is also likely to lower inequality in well-being over the lifetime. Diaz and Murtin (2017b) compare inequality in lifetime income in France with inequality in lifetime well-being, where the latter captures income (and unemployment) dynamics over a lifetime, which is itself uncertain and differs across individuals. The measure of well-being is equal to lifetime income corrected for the monetised values of both the length of life and unemployment risk. With a Gini coefficient equal to 0.23, inequality in average annual income during a lifetime is substantially lower than income inequality in a given year due to income mobility among the same individuals across ages. On the other hand, if differences in life expectancy are taken into account, the Gini coefficient that measures inequality in lifetime well-being is equal to 0.33, that is an increase of about 10 percentage points. This suggests that about one-third of inequality in well-being is attributable to inequality in lifespan, with the most part coming from premature mortality (Diaz and Murtin, 2017b). Income inequality accounts for the rest.

Wide education-related disparities in longevity

New OECD evidence improving on the quality of commonly used mortality rates at older ages for 23 OECD countries around 2011 reveals large education-related differences in period life expectancy at the ages 25 and 65 (see Murtin et al., 2017, for details).[3] The average gap in life expectancy across countries at age 25 between highly and low-educated men is 7.5 years and 4.6 for women (Figure 4.4). At the age of 65, male gaps are, on average, 3.5 years and female 2.4. Disparities in life expectancy between education levels are especially wide in Chile, Hungary, Latvia and Poland, while comparatively low in Canada and Italy. When expressed as a percentage of the remaining life expectancy of the highly educated, differences between groups are greater at 65 than at 25 years old – 18.5% versus 13.4% among men and 10.9% versus 7.6% for women. In that sense, inequality in longevity by level of education rises with age.

Figure 4.4. Longevity gaps between people of high and low education

At ages 25 and 65 by gender in 23 OECD countries around 2011



Note: United Kingdom refers to data for England and Wales. "High" education corresponds to tertiary education of the 1997 International Standard Classification of Education (ISCED) and "low" education merges the categories "no schooling" and "primary and lower secondary education".

Source: Calculations based on OECD data except for the Slovak Republic for which they are based on Eurostat data. See Murtin, F. et al. (2017), "Inequalities in Longevity by Education in OECD Countries: Insights from New OECD Estimates", *OECD Statistics Directorate Working Papers*, No. 2017/02, OECD Publishing, Paris, http://dx.doi.org/10.1787/6b64d9cf-en for details.

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Evidence regarding *changes* in education-related inequality in longevity in the medium and long term is mixed. It depends on countries, and different measures paint different pictures. Recent studies suggest that, in recent decades, gaps in life expectancy by level of educational attainment have grown in the United States (Meara et al., 2008; Olshansky et al., 2012) and Denmark (e.g. Bronnum-Hansen and Baadsgaard, 2012). Composition effects due to the shrinking shares of people with low levels of education do not seem to account fully for the trend (Hendi, 2015). Currie and Schwandt (2016) confirm that mortality gaps increased among older adults, but decreased among young people between 1990 and 2010 in the United States. Since these younger cohorts will form the future adult population, this suggests that inequality in old-age mortality would decline down the road.

James et al. (2017) report that the longevity gaps between people with high and low levels of education have remained constant or risen slightly over the last decade in Europe. In France, differentials in life expectancy have remained stable (Blanpain, 2016), while Norway[4] has experienced a relatively large widening of gaps over the last four decades (Murtin et al., 2017). In *absolute* terms, reductions over the last 20 years in premature mortality have, in many countries, been greater among the lower educated, who have closed the gap on the highly educated by up to 35% (Mackenbach et al., 2015; Mackenbach, 2016). However, Finland, Sweden, Norway, Denmark, Belgium, Switzerland, Hungary, Lithuania and Estonia have seen a widening of *relative* education-related inequalities in premature mortality, measured by the ratio of mortality rates. Inequalities have remained stable in England and Wales, France, Spain and Italy.[5]

Determinants of education-related longevity gaps

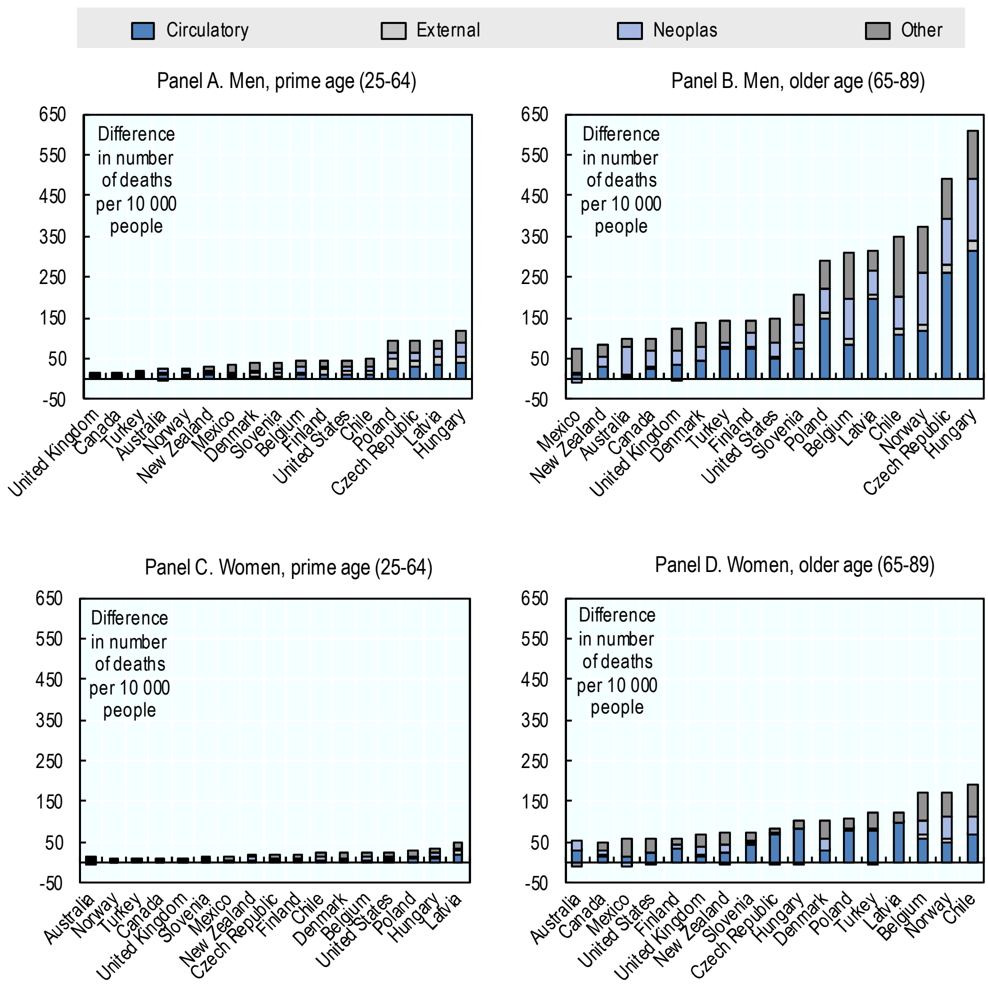
What are the medical causes behind disparities in longevity by level of education? Based on the same sample used in Murtin et al. (2017), the difference in mortality rates between the low- and highly educated is broken down into four broad contributory factors of death; circulatory system diseases, cancers, external causes[6] – such as accidents, complications of medical care or suicide – and other causes (Figure 4.5).

- Among older people, circulatory diseases account for 41% of the difference in male mortality and 49% in female. Next come “other causes”, followed by cancer with a 25% share of the difference in men’s mortality and 14% in women’s.
- Among prime-age adults aged between 25 and 64, “other causes” account for the bulk of the difference in mortality – 32% for men and 39% for women. Next come circulatory system diseases and cancers, with around 25% each of the difference in male and female mortality.

As mortality differentials are about five times greater among older people (aged between 65 and 89) than among prime-age adults, it can be concluded that circulatory problems are the main contributory factor in the mortality gap between the low and highly educated.

Figure 4.5. Breakdown of factors that contribute to differences in mortality rates between the low- and highly educated, 2011

Difference in number of deaths per 10 000 people between the low- and the highly-educated



Note: The figure describes the differences in cause-specific mortality rates between the low- and highly educated groups for each cause of death. The sum of all causes of death is equal to the difference in the total mortality rate between the low- and highly-educated. "High" education corresponds to tertiary education of the 1997 International Standard Classification of Education (ISCED) and "low" education merges the categories "no schooling" and "primary and lower secondary education". United Kingdom refers to data for England and Wales.

Source: Murtin, F. et al. (2017), "Inequalities in Longevity by Education in OECD Countries: Insights from New OECD Estimates", *OECD Statistics Directorate Working Papers*, No. 2017/02, OECD Publishing, Paris, http://dx.doi.org/10.1787/6b64d9cf-en.

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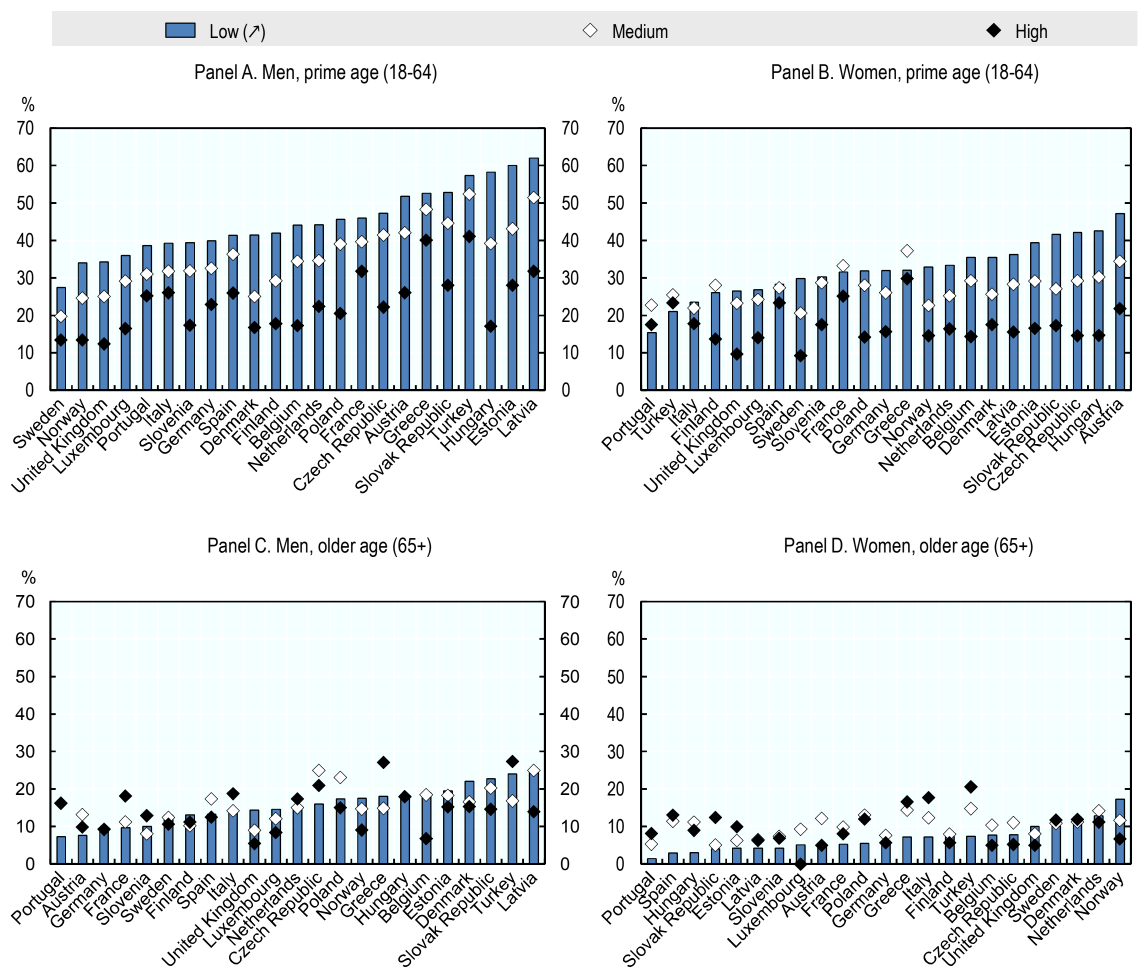
Smoking is a very high risk factor in cardiovascular disease by age, gender and level of education among 23 European OECD countries (Figure 4.6). In almost all of them, prime-age people, both male and female, with lower levels of education are more likely to smoke than those with medium or higher education. An average of 45% of low-educated men and 32% of women between the ages of 18 and 64 smoked daily or occasionally, compared to 23% and 17% of their highly educated peers in 2014. The education gradient in the prevalence of smoking disappears after the age of 65 and even reverses in some countries. Indeed, highly educated elderly men smoke more than their less well educated peers in 10 and women in 13 of the 23 countries. The inference is that part of the education gradient of mortality is attributable to the difference in smoking prevalence before the age of 65.

Smoking accounts for up to half of the observed inequalities in mortality in some countries. When analysing the contribution of smoking to socio-economic inequalities in mortality in 14 European countries between 1990 and 2004, Mackenbach (2016) finds that smoking-related mortality represents a larger fraction of total mortality among people with a lower level of education than among those with higher education, especially among men. In 2000-04, the contribution of smoking to differences in mortality between the low- and highly-educated groups ranged between 19% and 55% across countries among men and 0% and 56% among women. Since the early 1990s, the contribution of smoking to inequalities in mortality by level of education has fallen in most countries among men, but increased among women.

Figure 4.6. Smoking prevalence in 2014

Percent of population, by age, gender and education in 23 OECD countries



Source: Eurostat (2016): Tobacco Consumption Statistics.

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Education is in itself an important determinant of longevity. The long-term causal relationship between education and longevity has been ascertained by Lleras-Muney (2005), who looks at exogenous changes in school laws, and by Murtin (2013), who considers education over very long time spans that encompassed generations (that is education of grandparents and great-grandparents). Both authors find that education is a powerful factor in longevity. Similarly, James et al. (2017), who examine numerous proximate determinants of longevity (including risk factors such as smoking, alcohol and obesity) in a number of OECD countries between 1990 and 2013, conclude that education exerts the greatest effect, followed by air pollution and health spending.[7]

A high level of education has a direct impact upon longevity, in addition to any indirect effect channelled through the reduced consumption of tobacco, alcohol or calories. Moreover, the more educated tend to be more forward-looking (Farrell and Fuchs, 1982), better informed, and more adept at navigating their way through the health system (Deaton, 2003). Although socio-economic factors like income and occupation also contribute to longevity inequality, their two-way relationship with health status makes causation difficult to establish (Chapter 2).

Premature mortality impacts strongly on inequality in lifespan

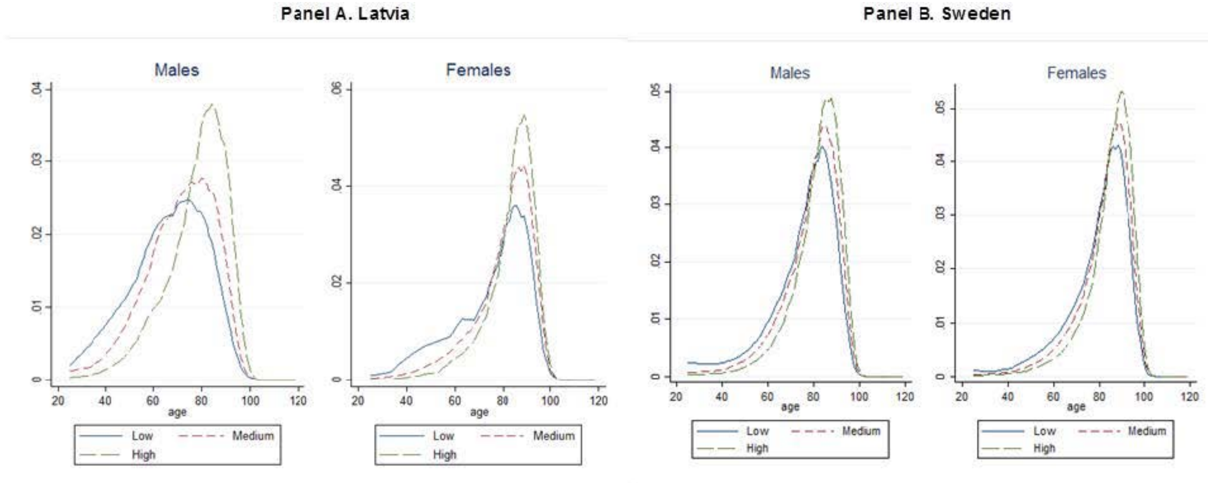
This section now turns to the analysis of the dispersion in ages at death across cohorts and how it is expected to evolve by 2100. The dispersion in ages at death, which constitutes total inequality in lifespan, can be explained mainly by mortality at a relatively early age – and especially by the probability of dying before the age of 70 (defined here as premature mortality).

Lifespan inequality between education groups (or between income and occupational groups) has received much attention in economic studies as socio-economic-related inequality is central to social policies. However, differences in levels of educational attainment account for an average of less than 10% of the overall dispersion in age at death across the studied OECD countries. Figure 4.7 shows the distributions of ages at death by gender and by educational attainment in Latvia (which has a high level of mortality inequality) and Sweden (where mortality inequality is low). Lifespan inequality across education groups is clearly reflected by the shape of lifespan distributions: they are significantly more dispersed among low-educated than highly educated men in both countries, and especially so in Latvia.

However, Figure 4.7 also reveals that the dispersion of lifespan within educational attainment and gender groups makes up the bulk of total lifespan inequality. Breaking down lifespan inequality into inequality in lifespan within and between educational and gender groups[8] shows that the between-group component represents 7.6% of total inequality on average across the 23 studied countries, ranging from 3% in Canada and the United Kingdom to 17% in Hungary (Murtin et al., 2017).

Mortality rate projections by the United Nations (2015) suggest that premature mortality is expected to shrink by 2100, probably leading to a reduction of total inequality in ages at death (irrespective of educational level). Premature mortality (as measured by 100% minus the probability of survival to the age of 70) is expected to affect about 33% of men born in 1950-54 but only 10% of the 2010-14 cohort (Figure 4.8, Panel A). A similar pattern may be observed among women: their premature mortality is expected to fall from 21% to 6% (Panel B).

Figure 4.7. Distribution of ages at death by gender and education in Latvia and Sweden, 2011

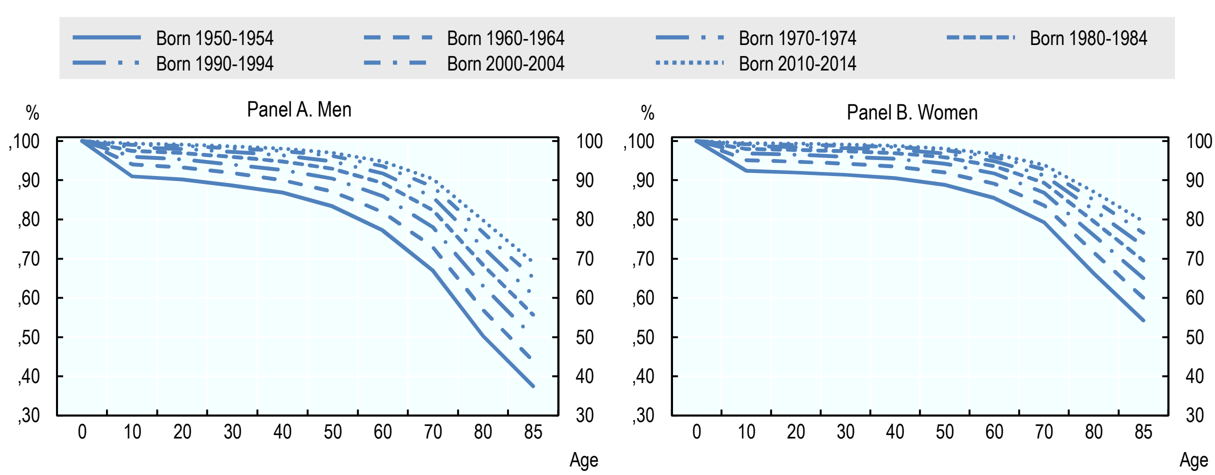


Source: Murtin, F. et al. (2017), "Inequalities in Longevity by Education in OECD Countries: Insights from New OECD Estimates", *OECD Statistics Directorate Working Papers*, No. 2017/02, OECD Publishing, Paris, http://dx.doi.org/10.1787/6b64d9cf-en.

However, limits on the availability of data prevent any firm conclusion as to how lifespan inequality is likely to evolve.[9] Nevertheless, very long lives look set to become the norm. Of men born in 1950-54, 37% are expected to survive to the age of 85, compared to 69% of the 2010-14 birth cohort, while the likelihood of women living to 85 is projected to increase from 54% to 80% from one cohort to the other (Figure 4.8).

Figure 4.8. Probability of survival to a given age, up to 85 years

OECD average by age, gender and birth cohort



Source: OECD calculations based on United Nations (2015), *World Population Prospects: The 2015 Revision*, Department of Economic and Social Affairs, Population Division, United Nations, New York.

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2. Lifetime earnings by cohort, gender and education

How does inequality in earnings between workers with different levels of education develop from cohort to cohort? To answer that question, this section seeks to estimate lifetime earnings by level of educational attainment and gender of cohorts born between the early 1940s and the early 1970s in 13 OECD countries.[10] To that end, it draws on the life-cycle profiles of hourly wages, hours worked, employment rates and survival probabilities. A key aspect of the analysis is that it seeks to capture the cohorts' entire working lives, as explained below in greater detail.

Education premium in hourly wages over time

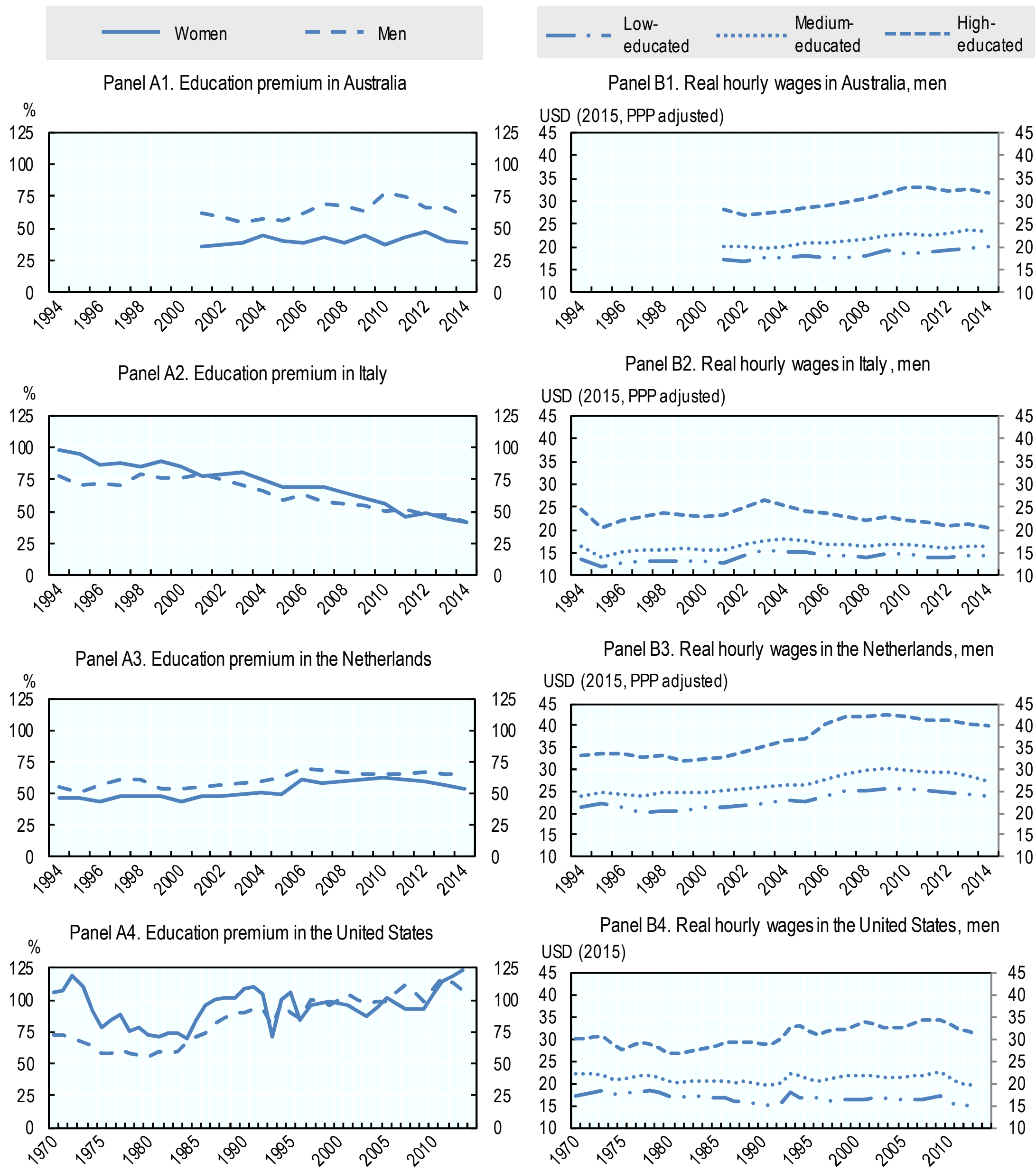
Studies into the education premium – the difference in the hourly wages of the highly and low-educated relative to the wages of the low-educated – usually monitor men over time and tend to find an upward trend in inequality (e.g. Autor, 2014, for the United States; and Dustmann et al., 2009, for West Germany). Accordingly, Figure 4.9 shows the evolution of the education premium by gender (left-hand panels) and the average real hourly wages of men by educational level (right-hand panels) over recent decades in Australia and the United States and – to exemplify patterns in Europe – in Italy and the Netherlands.

The evolution of the education premium over time – of females and males alike – differs widely across countries. In Australia (Panel A.1) it has been broadly stable at about 60% for men and 40% for women since 2001. In Italy (Panel A.2) – where trends have been comparable with those in France, Ireland and Spain – it has declined substantially from around 100% among women and 80% among men in 1994 to a similar level of about 40% for both sexes in 2014. In the Netherlands (Panel A3) – where trends have been comparable with those in Austria, Finland and Switzerland although at different levels – premiums rose between 1994 and 2014 from 55 to 66% among men and from 46 to 53% among women.[11] In the United States (Panel A4) – where longer time series are available – the premium declined throughout the 1970s (from about 105% for women and 75% for men to about 70% and 55%, respectively), mainly due to a strong expansion in the supply of highly educated workers when baby boomers started to enter the labour market (see e.g. Katz and Murphy, 1992). In more recent decades, it climbed back sharply to reach about 120% among women and 110% among men in 2013, due to an increased demand for highly educated workers (Krusell et al., 2000, among others).

The observed trends in the education premium stem from differences in real wage growth between educational groups (right-hand panels of Figure 4.9). In Australia these differences were rather small: real hourly wages of both highly and low-educated men climbed by an average of about 1% a year between 2001 and 2014 (Panel B1). While more stable over a longer horizon, real hourly wages in Italy edged up between 1994 and 2014 among low-educated men, but slipped down by about 1% per annum among their highly educated peers (Panel B2). By contrast, they increased across all levels of education in the Netherlands (Panel B3) over the same period, though faster among the highly educated (0.9% per annum) than those with low educational attainment (0.6%). In the United States (Panel B4), real hourly wages showed a modest average increase among highly educated men between 1970 and 2013 while declining by 0.3% among their peers with low levels of schooling.[12]

Figure 4.9. Education premium in real hourly wages by gender and male real hourly wages by level of education

Development in four selected OECD countries over time



Note: Low-, medium- and high-educated correspond, respectively, to levels 0-2, 3-4, and 5-8 of the 2011 International Standard Classification of Education (ISCED). The education premium is defined as the ratio of real hourly wages of high-educated to low-educated minus 1.

Source: Calculations for Australia use data from the 2001-2014 Household Income and Labour Dynamics in Australia (HILDA) Survey, for Italy and the Netherlands from the 1994-2001 European Community Household Panel (ECHP) and the 2004-2014 European Union Statistics on Income and Living Conditions (EU-SILC) survey, and for the United States from the 1970-2013 Panel Study of Income Dynamics (PSID). The HILDA and PSID are taken from the Cross-National Equivalent File (CNEF). Interpolation is used to retrieve missing years for the period of analysis.

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Education premium in hourly wages from a cohort perspective

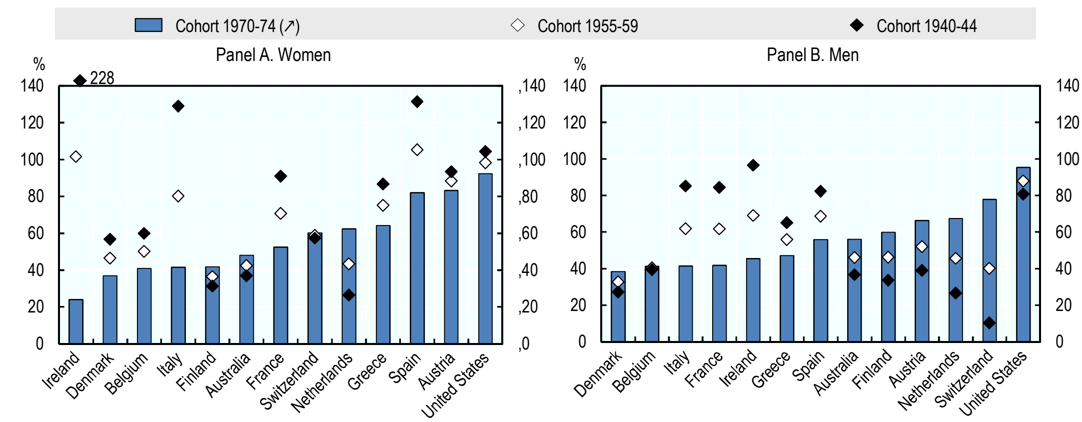
Switching from a time to a birth-cohort perspective involves measuring inequality over the whole working career. To that end, life-cycle profiles of younger cohorts' hourly wages are extrapolated forward as they have not yet completed their working lives. Conversely, the same variables are extrapolated backward when it comes to older cohorts as data on their early working lives are not available (the way data are extrapolated is based on the method described in the first part of Box 4.2.).

Among women, the career average of the education premium in hourly wages has been falling between the 1940-44 and 1970-74 birth cohorts in three-quarters of the 13 OECD countries (Figure 4.10, Panel A) as low-educated women partly catch up with their highly educated peers. Sharp falls have been observed in France and Spain (by 40 and 50 percentage points, respectively) and even steeper ones in Italy and Ireland (90 and 200 percentage points). The decline was most pronounced in countries where the premium was very high in the older cohort born in 1940-44 – especially in Ireland, Italy and Spain. The development of female education in these countries is likely to have played a crucial role. Conversely, the education premium among women increased from the 1940-44 to the 1970-74 birth cohorts in Australia, Finland and the Netherlands where wage growth of the highly educated exceeded the one of the low-educated. In Switzerland, the education premium remained generally unchanged.

As for men (Panel B), the average education premium over the working career has risen from one cohort to the other in a small majority of countries (including Australia, Austria, the Nordic European countries, Switzerland and the United States). Overall, labour demand effects – such as those generated by globalisation and skill-biased technological change which have boosted (reduced) in relative terms the demand for highly (low) skilled labour in OECD countries over time – seem to have dominated the dampening effect exerted by the larger (smaller) supply of highly (low) educated workers. Moreover, with the expansion of education, the share of the highly educated in the workforce has increased while the opposite is true for the share of the low-educated. This structural shift in the composition of the workforce complicates the comparison of the education premium over time. However, these mechanical education-related composition effects, whose total impact is a priori ambiguous, do not seem to have substantially affected the size of the education premium (Box 4.3).

By contrast, the male premium has dropped from initially high levels in the four countries that have recorded the biggest falls among women (Ireland, Italy, France and Spain) and, though to a lesser extent, in Greece, while it has remained generally unchanged in Belgium. A particularly strong expansion of tertiary education in recent decades and the phenomenon of over-education on the job, in particular for the highly educated in Spain (Dolado et al., 2000), as well as the dynamics of the minimum wage are likely explanatory factors of the decline in the education premium in southern Europe (e.g. Pijoan-Mas and Sánchez-Marcos, 2010).

Figure 4.10. Career average of the education premium in real hourly wages for three selected cohorts



Note: Low-, medium- and high-educated correspond, respectively, to levels 0-2, 3-4, and 5-8 of the 2011 International Standard Classification of Education (ISCED). The education premium is defined as the ratio of real hourly wages of high-educated to low-educated minus 1.

Source: OECD calculations based on the data sources and method described in the first part of Box 4.2.

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Box 4.2. Estimating real expected lifetime earnings

Computing the expected lifetime earnings of generations from the 1940s to the early 1970s requires the following data: cohort-specific hourly wages, hours worked, employment rates and survival probability profiles over the whole working career. Analysis therefore extrapolates the profiles of younger generations who have not yet reached retirement and those of older generations for whom data are not available in the early parts of their working lives. For instance, the cohort born in 1960-1964 was last observed at the ages of 50 to 54 in 2014. Their life-cycle profiles need therefore to be extrapolated up to the time at which they retire.

The estimation of life cycle profiles uses a specification which disentangles the effects of age, cohort and time by means of a pseudo-panel approach (Deaton, 1985) that draws on data from the 1994-2001 European Community Household Panel (ECHP), the 2004-2014 European Union Statistics on Income and Living Conditions (EU-SILC), the 2001-2014 Household Income and Labour Dynamics in Australia (HILDA) Survey, the 1970-2013 Panel Study of Income Dynamics (PSID) and the 1999-2014 Swiss Household Panel study. Separate estimates of hourly wages, hours worked and employment rates by country and gender are derived from Equation 4.1:

$$y = \alpha_0 + \alpha_1 Age + \alpha_2 Age^2 + \alpha_3 Cohort + \alpha_4 D^{med} + \alpha_5 D^{high} + \alpha_6 D^{med} \times Age + \alpha_7 D^{med} \times Age^2 + \alpha_8 D^{high} \times Age + \alpha_9 D^{high} \times Age^2 + \alpha_{10} D^{med} \times Cohort + \alpha_{11} D^{high} \times Cohort + \alpha_{12} UGAP + \varepsilon \quad (4.1)$$

where

- y is the logarithm of the hourly wage rate, the logarithm of the number of annual hours worked or the employment rate,
- *Age* and *cohort* (birth year) are continuous variables,
- D^{med} and D^{high} are dummy variables indicating medium and high education (levels 3-4 and 5-8 of the 2011 International Standard Classification of Education respectively),
- $UGAP$ stands for the unemployment-rate gap defined as the deviation of the unemployment rate from the Non-Accelerating Inflation Rate of Unemployment (NAIRU) and is meant to capture cyclical time effects*,
- ε is an error term.

Box 4.2. Estimating real expected lifetime earnings *(cont.)*

Equation 4.1 allows different life-cycle profiles in hourly wages, annual hours worked and employment across education levels. Cohort effects, too, can also differ by level of education. The hourly wage rate and the number of annual hours worked are estimated by ordinary least squares while the employment rate is estimated using a fractional Probit model.

For each group – by country, gender, cohort and level of education – estimated parameters of the α-terms in equation 4.1 are used to predict hourly wages, annual hours worked and employment rates from the age of 20 to 64. They are then factored into equation 4.2 to compute each group's lifetime earnings.

The real expected lifetime earnings of a country's sub-groups – defined by level of education, gender and cohort – are computed at 20 years old (when labour market entry is assumed). They are defined as the sum of expected discounted annual average earnings computed from hourly wages plus the number of annual hours worked plus the probability of employment:

$$E_c \equiv \sum_{a=20}^{T} s_{c,a} \cdot \frac{w_{c,a} \cdot h_{c,a} \cdot e_{c,a}}{(1+r)^{a-20}} \qquad (4.2)$$

where

- c is the cohort,
- a is age,
- E_c denotes the real expected lifetime earnings of cohorts,
- $s_{c,a}$ denotes the survival probabilities,
- $w_{c,a}$ indicates real hourly wages in PPP-adjusted 2015 United States dollars,
- $h_{c,a}$ indicates hours worked,
- $e_{c,a}$ denotes the probability of employment,
- r is the real discount rate of payments accruing after the age of 20 and is assumed to be 2% per year.

Career lengths in all population sub-groups are from 20 to T=64 years. This avoids adding further sources of inequality to the analysis when comparing generations.

*: For the United States, the unemployment rate level instead of the unemployment-rate gap is used as the estimated NAIRU is only available from 1985. Since 1985 at least, the NAIRU has had little variation in the United States, especially compared with other OECD countries.

Education premium in lifetime earnings

Lifetime earnings paint a more comprehensive picture of inequality between groups of different levels of educational attainment. They capture differences in employment rates, hours worked, hourly wages and survival probabilities (Box 4.2). Figure 4.11 shows the average real expected lifetime earnings of five-year birth cohorts from 1940-44 to 1970-74 by gender in the 13 OECD countries.

Differences in lifetime earnings by level of education are greater than in average hourly wages given the education gradient in the other components of lifetime earnings – employment, hours worked and survival probabilities – particularly among women. For example, the ratio of lifetime earnings of highly educated women born in 1970-74 to those of their low-educated peers is estimated at 3.10 (see the right side of Figure 4.11, Panel A:

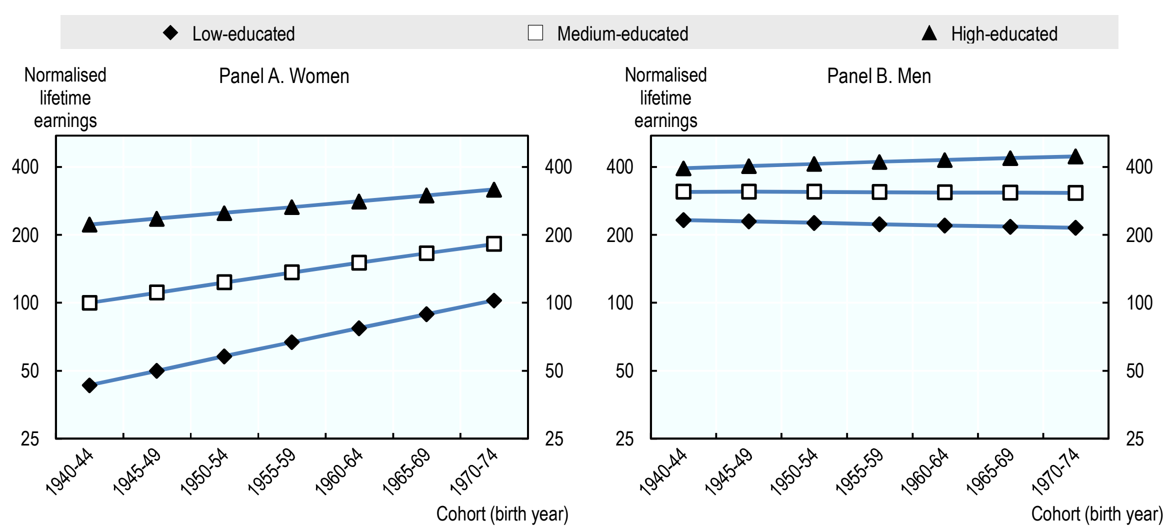
3.10 = 318.0/102.6). This ratio would be reduced to 1.95 if both groups had the same employment rates. Moreover, despite a sizeable gap in life expectancy at birth (Section 2), differences in survival probabilities at working ages between education groups are rather small and contribute little to the education premium in lifetime earnings.[13]

On average among the 13 OECD countries, women's lifetime earnings have increased from one generation to the next at all levels of education. For men, they have risen slightly among the highly educated and fallen a little among the low-educated (Figure 4.11). Two main inferences can be drawn:

- First, the lifetime earnings of younger generations of women have caught up with those of men educated to the same level. The gender gap[14] in lifetime earnings has shrunk by about one-third – from 45% among highly educated cohorts born in 1940-44 to about 30% among those born in 1970-74, and from 80% to about 50% among the low-educated in the same birth cohorts.[15] The pattern is driven chiefly by employment trends. While women's lifetime employment rates have risen robustly from older to younger cohorts, men's have tended to decline. Nevertheless, remaining gaps are wide.
- Second, the education premium of lifetime earnings has declined over generations among women, but has risen among men. The prime reason is that the education gap in employment rates has moved in opposite directions for women and men, as further discussed below.

Figure 4.11. Real expected lifetime earnings by cohort, education group and gender

Normalised to 100 for medium-educated women born in 1940-44, average of 13 OECD countries



Note: Low-, medium- and high-educated correspond, respectively, to levels 0-2, 3-4, and 5-8 of the 2011 International Standard Classification of Education (ISCED). Estimated real lifetime earnings are the sum of expected discounted annual earnings derived from hourly wages, the number of annual hours worked, the probability of employment and the probability of survival (Box 4.2). In every country, the reference group (=100) is medium-educated women born in 1940-44.

Source: OECD calculations based on the data and method described in Box 4.2.

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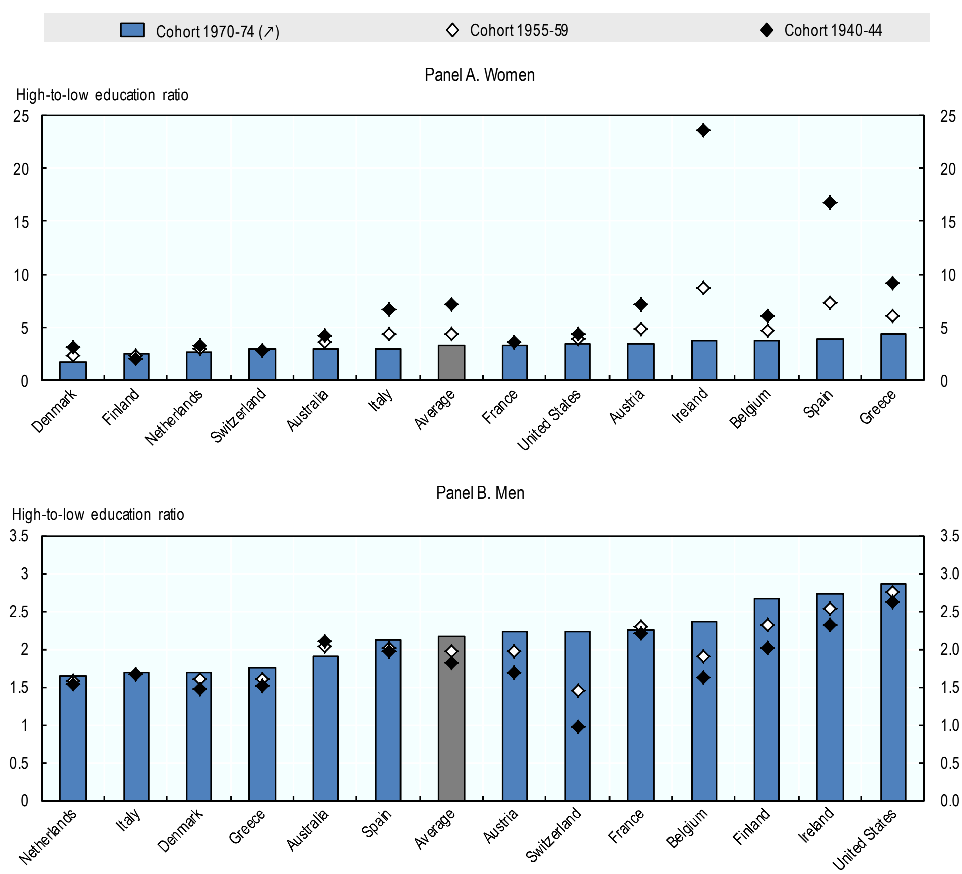
The ratio of the lifetime earnings of the highly educated to those of the low-educated varies widely between cohorts, genders and countries (Figure 4.12). In the 1970-74 female birth cohort, it ranges from 1.7 in Denmark to 4.3 in Greece (Panel A), and from 1.6 in the Netherlands to 2.9 in the United States among men (Panel B).

As for patterns in the high-to-low education ratio, it has declined among women from one generation to the next, except in Finland, France and Switzerland, and has increased among men, except in France and Italy, where it has remained broadly constant, and in Australia where it has decreased slightly. Among women, the cross-generational fall has been very steep in Greece, Spain and Ireland. In Ireland, for example, the ratio of lifetime earnings has fallen from 24 for the oldest cohort to about 4 among the youngest. Declines in education-related employment gaps in the country have added up to the sharp declines in the education premium in hourly wages shown in Figure 4.10.

Figure 4.12. The high-to-low education ratio of real expected lifetime earnings

By cohort and gender in 13 OECD countries



Note: Low-, medium- and high-educated correspond, respectively, to levels 0-2, 3-4, and 5-8 of the 2011 International Standard Classification of Education (ISCED). Estimated real lifetime earnings are the sum of expected discounted annual earnings derived from hourly wages, the number of annual hours worked and the probability of employment (Box 4.2). The high-to-low education ratio of real expected lifetime earnings is defined as the ratio of the lifetime earnings of the highly educated to those of the low-educated.

Source: OECD calculations based on the data and method described in Box 4.2.

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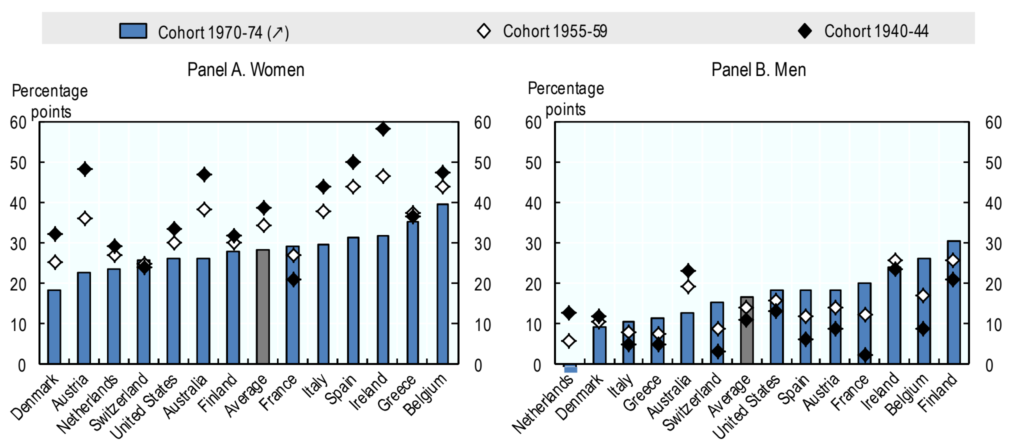
The decline in the female high-to-low education ratio of lifetime earnings across cohorts in most of the countries under study can be attributed to the relatively strong growth in the employment rates of low-educated women compared to their highly educated peers. In contrast, a relatively steeper drop in the employment rates of low-educated men has contributed to an increase in the male ratio (Figure 4.13).

With their average fall among women and their average rise among men, the education-related lifetime employment gaps have been converging across genders (Figure 4.13). These gaps, however, remain substantially wider among women (Panel A) than men (Panel B) for the younger cohorts. In the 1970-74 birth cohort, they range from about 20 percentage points in Denmark to 40 in Belgium for women, and from 0 in the Netherlands to 30 in Finland for men. As for hourly wages, the education-related employment gap has tended to narrow across cohorts (with the exception of France and Switzerland) among women and to widen among men (except in Australia, Denmark, Ireland and the Netherlands). The decline in women's gap has again been considerable in Ireland (26 percentage points) and Spain (18 percentage points). It has also been steep in Austria, at 25 percentage points, and in Australia (21 percentage points).

Figure 4.13. Difference in employment rates between the highly educated and the low-educated

Career average of the difference in percentage points, for three selected cohorts in 13 OECD countries by gender



Note: "Low-", "medium-" and "high-educated" correspond, respectively, to levels 0-2, 3-4, and 5-8 of the 2011 International Standard Classification of Education (ISCED). The education premium is defined as the percentage-point difference in average employment rates between the highly educated and the low-educated.

Source: OECD calculations based on the data sources and method described in the first part of Box 4.2.

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Across countries and cohorts, differences between highly and low-educated workers in hours worked have contributed comparatively little to the lifetime earnings gap, particularly among men. In the 13 OECD countries under study, highly educated male and female workers generally work slightly more hours when employed than their low-educated peers. That tendency has marginally expanded from one cohort to the next among both men and women, contributing somewhat to the rise in the high-to-low education ratio of lifetime earnings among men and attenuating somewhat the decline in this ratio among women.[16] However, educational differences in hours worked on the job remain at a too low level to explain a substantial share of the education premium in lifetime earnings.

Income inequality is deeply engrained at age 50. At that age, a large fraction of lifetime income inequality has settled in terms of both accumulated earnings and pension entitlements. On average across the 13 OECD countries under study, about 60% of the difference in lifetime earnings and pension claims between the highly and low-educated workers is estimated to have accrued by age 50.[17] Just after labour market entry the accumulation of inequalities is rather slow but it accelerates sharply from about age 35. Moreover, much more than 60% of inequality in lifetime earnings is already underway at age 50. The high persistence of wage and employment trajectories implies that experience accumulated by age 50 also generate inequalities of late career outcomes. Finally, because the education system does not typically correct a substantial part of the inequality that is passed through across generations (Chapter 2), income levels during working life are also positively correlated to those during childhood – before labour market entry.[18] The next section examines in greater detail how inequality in lifetime earnings affects that in pension benefits.

Box 4.3. Expansion of higher education and the impact on the education wage premium

In all OECD countries, the average number of years spent in education has risen from one generation to the next, particularly among women. Between 2000 and 2015, the OECD-wide average share of women aged 25 to 64 with high education (levels 5-8 of the 2011 International Standard Classification for Education, ISCED) rose from 21% to 38%. Among men, the increase was from 22% to 32%. Over the same time span, the OECD average share of 25-to-64 year-olds who had not completed upper-secondary education (ISCED levels 0-2) declined from 37% to 22% among women and from 33% to 22% for men.

The expansion of higher education changes the composition of ISCED-defined education groups. While the highly educated (ISCED levels 5-8) become a bigger and thus less selective group, the opposite holds for the low-educated (ISCED levels 0-2). As the best performers move up the education ladder first - all other things equal – the average education performance of the 22% men with low education in 2015 is worse than that of the 37% men with low education in 2000. As a result, it is expected that – again all other things equal – the average wage of the low-educated men in 2015 is lower than that in 2000. This composition effect tends to raise the education-related wage premium. The same line of reasoning implies that the increasing share of people with high levels of education adds the least performers to the group of the highly educated which tends to reduce their average wage and, in turn, the wage premium. The total effect of these two composition effects is a priori undetermined.

In order to illustrate the size of the aggregate compositional effect, Figure 4.14 adds to the baseline of Figure 4.10 the education premium in hourly wages – averaged over the working career – of the 1970-74 cohort comparing wages at the same two percentiles of the education distribution as the average low- and highly educated persons of the 1940-44 birth cohort. This perspective excludes a potential compositional effect between the 1940-44 and the 1970-74 cohorts by definition (for details see Geppert, 2018).

The education premium of the 1970-74 cohort does not substantially differ between the percentile and the ISCED definitions in most cases (Figure 4.14). Hence, comparing people educated to high and low levels according to the ISCED definition rather than according to (1940-44) percentiles does not have a major effect on how the higher-education wage premium evolves between the 1940-44 and 1970-74 cohorts in most countries. This indicates that the two opposing components of the compositional effect described above, if present at all, are small in size or offset each other. However, there are a few exceptions.

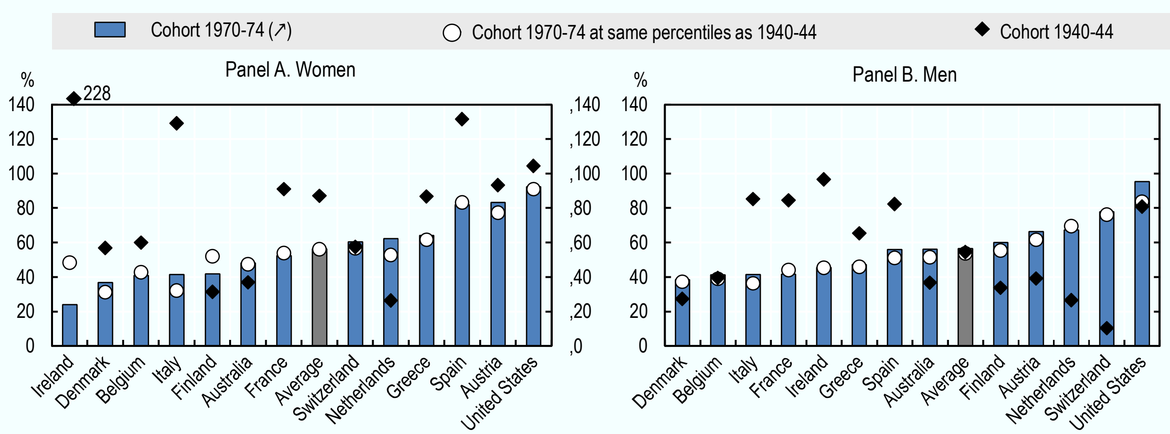
In Denmark, for instance, the ISCED-based female wage premium has fallen from 57% for the 1940-44 cohort to 37% for the 1970-74 cohort. However, if the premium for the 1970-74 cohort is estimated at the same percentiles of the education distribution as the ISCED-defined low- and high-educated women of the 1940-44 cohort, it is then equal to 31% (instead of 37%). The inference is that the positive effect on the ISCED-based premium of the drop in the share of low-educated women between the two cohorts is stronger than the negative effect generated by the increase in the share of the highly educated.

Box 4.3. Expansion of higher education and the impact on the education premium *(cont.)*

In the United States, the increase in the higher education wage premium between men born in 1940-44 and 1970-74 is almost entirely attributable to compositional change – the stronger effect of the decline in the share of the low-educated workers compared to the impact of the increase in the highly educated share. Finally, a small but non-negligible part of the decline in the education premium of women in Ireland can be ascribed to the drop in the proportion of low-educated workers having a stronger effect than the rise in the share of highly educated workers. Overall, however, compositional effects are not the main driving force behind the cohort trend in the education premium in hourly wages.

Figure 4.14. Career average of the education premium in real hourly wages according to ISCED and a percentile definition of education levels

Average over a working lifetime of the 1940-44 and the 1970-74 cohorts in 13 OECD countries



Note: The two percentiles selected for comparison are country-specific and equal the positions of the average low- and high-educated individuals of the 1940-44 cohort in the education distribution of the country concerned. Thus, the education premium of the 1940-44 cohort considered from ISCED and percentile perspectives are by definition identical.

Source: OECD calculations based on the data sources and the method described in Box 4.2.

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3. Impact of lifetime inequality on pensions

Old-age support systems might well have to cope with significantly higher inequalities, strengthening calls for them to play a more redistributive role. However, it is not realistic to expect pension systems to compensate for all the consequences of adverse events and developments that build up over people's working lives. Although most pension systems do perform redistributive functions, particularly to protect retirees against old-age poverty, they can offset only to a limited extent the wide inequalities that develop over the life course.

In most pension systems, inequality in working life translates into inequality in retirement, a pattern reinforced by the rise of defined contribution pensions and some public pension reforms. Workers whose careers are shortened by breaks or late entry into the labour market generally receive lower pensions, especially in systems where there is a close link between old-age benefits and lifetime earnings. As a result, workers with nonstandard jobs and weak attachment to the labour market in old age become more vulnerable.

How lifetime earnings inequality translates into pension inequality depends on the progressivity of pension systems – income inequality in old age is of course a broader question, including the extent to which disparities in earnings generate inequality in income from private savings. Within pension schemes, the redistributive components that cushion the impact of labour market shocks or curtailed careers can take different forms. The overall progressivity of a pension system is determined not only by the relative importance of non-contributory and contributory elements, but also more particularly by instruments such as credits that help cover periods when people are not earning income for reasons such as unemployment or childcare. Socio-economic inequalities in life expectancy also need to be taken into account in assessments of inequality among retirees. If poor pensioners with low levels of education die younger, they receive benefits over a shorter period: their accumulated benefits are proportionally lower than those of their highly-educated peers.

This section deals first with the transmission of inequality from wages to pensions. It then goes on to examine how late-start, interrupted careers impact on pension entitlements. Finally, it seeks to quantify how life expectancy disparities between socio-economic groups affect total pension wealth in retirement. It also explores the distributive implications of raising the retirement age given the inequality in life expectancy.

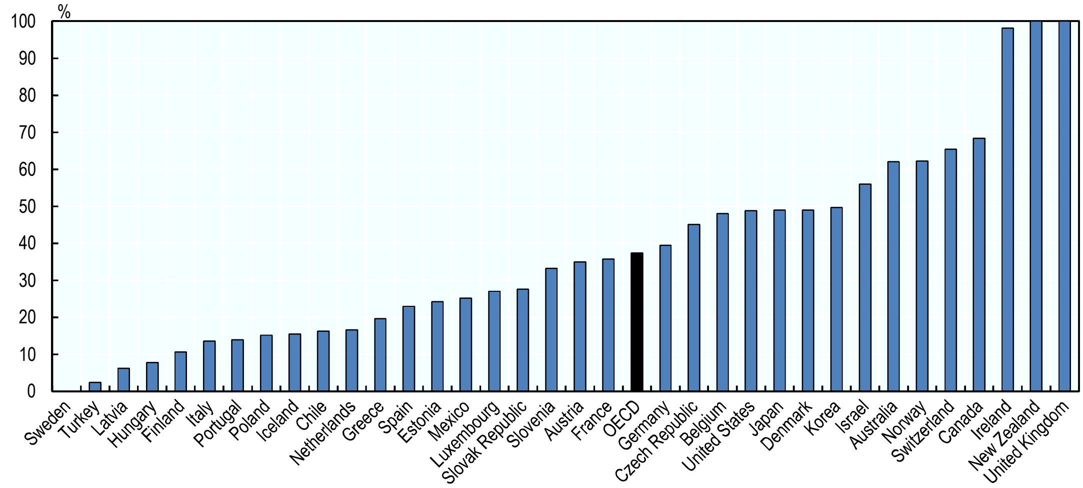
How wage inequality translates into pension inequality

The consequences for pension income of high levels of inequality during working life depend on how progressive the pension system is. OECD (2013) built a progressivity index originally proposed by Whitehouse (2006). It is designed so that a universal basic scheme scores 100% and a pension plan which mirrors wage inequality 0%. The index formally calculates the progressivity of a pension scheme as 1 minus the Gini coefficient of projected pension entitlements divided by the Gini coefficient of earnings. This index is refined here to take into account first-tier pensions even for people who did not work.[19] It is well understood, however, that the focus on pension income ignores retirement income inequality that would result from disparities in income from accumulated private wealth during the working life.

In many countries, pensioners are entitled to basic pensions based solely on residence or they receive social assistance benefit (see Chapter 2 of OECD, 2015). Since all pensioners receive the same benefit and pension income inequality does not arise in mandatory schemes in Ireland, New Zealand and the United Kingdom, their progressivity index scores are 100% (Figure 4.15). By contrast, scores are very low in Sweden, Turkey, Latvia, Hungary and Finland, where pension entitlements are very closely tied to wages. The average OECD index score is 37%, which suggests that pension benefits' Gini score is, on average, equal to 63% of the Gini coefficient of lifetime wages.

Figure 4.15. Progressivity of mandatory pension schemes

Index from 0% (pension scheme mirrors wage inequality) to 100% (universal basic scheme)



Note: The progressivity index is calculated as 1 minus the Gini coefficient of projected pension entitlements divided by the Gini coefficient of wages.

Source: Computations based on the OECD pension model.

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What happens when wage inequality increases? An average of about two-thirds of the increase in wage inequality is transmitted to pension inequality in OECD countries (Figure 4.16). There is a close inverse relationship between the pass-through of wage inequality into pension equality and the progressivity index.[20] There is thus no change in the Gini coefficient of pension benefits from mandatory schemes in Ireland, New Zealand or the United Kingdom in the event of rises in wage inequality, as all three countries provide only basic pensions and social assistance payments which do not change with the level of individual wages. In other words, increases in wage inequality have no effect. They of course still affect retirement income inequality beyond pensions through their impact on the differences in the capacity to save and build private wealth across wage levels.

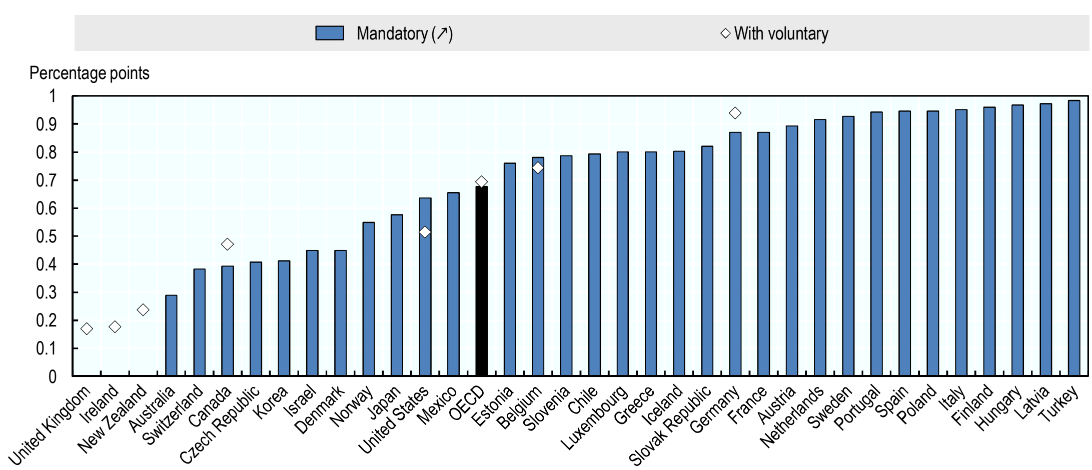
There are seven other OECD countries where a rise of one percentage point in the Gini coefficient of wages generates less than half a percentage point increase in the Gini score of pensions. In Australia and Canada, the means-tested pension component (through the withdrawal rate) ensures that low earners receive higher proportions of state support. In Denmark and Israel, the basic component is much higher for low earners. In Korea, low-income workers are entitled to the basic pension and benefit from the fact that half the earnings-related pension is based on nationwide contributions, thereby redistributing from high to low earners. The Czech system is also redistributive thanks to income thresholds in the calculation of earnings-related pensions, with low earners having a much higher proportion of their earnings replaced at 100%. In Switzerland, contribution threshold levels and a low ceiling on contributions ensure a redistributive element.

By contrast, more than 85% of the wage inequality increase passes through into pensions in over one-third of OECD countries – Turkey, Latvia, Hungary, Finland, Italy, Poland, Spain, Portugal, Sweden, the Netherlands, Austria, France and Germany. In all of them, pensions are very closely tied to earnings. The only controlling factor is the value of the wage ceiling that applies to contributions. However, some countries do not apply ceilings or have ceilings that are over twice average earnings (they appear on the extreme right of Figure 4.16). Austria and Germany, for their part, set ceilings at around 150% of average earnings.

When voluntary pensions are taken into account in the seven countries which have coverage levels greater than 40% (Belgium, Canada, Germany, Ireland, New Zealand, the United Kingdom and the United States) (OECD, 2015), the effect of wage inequality is amplified since high-earners tend to be better covered by voluntary pensions (Chapter 5). The effects of voluntary pensions on the inequality pass-through shown in Figure 4.16 should be seen as a maximum transmission given the assumptions made about their coverage.[21] The result is that, in the seven countries, the accounting for voluntary pensions raises the transmission of wage inequality from 0.38 to 0.46 – that is an increase of about 20% in the pass-through of inequality attributable to voluntary pensions.

Figure 4.16. How increases in wage inequality affect pension inequality

Percentage point change in the Gini index of pensions for a 1 percentage point increase in the Gini index of wages, full career case



Note: The graph refers to gross (i.e. pre-tax) wages and pension benefits.

Source: Computations based on the OECD pension model.

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How late-start, interrupted careers affect pension entitlements

Working a full career is becoming increasingly uncertain in today's labour markets. Many countries currently experience very high levels of unemployment, particularly among the young. Workers with careers shortened by late entry or breaks will usually receive lower pensions, especially in systems where pension benefits and lifetime earnings are closely tied.

Chapter 3 of OECD (2015) examines in detail the effect on pension entitlements of delaying labour market entry by five years, taking five or ten years off work for childcare, or spending three or five years unemployed. It also takes an in-depth look at the various instruments built into pension systems which might ease some labour market shocks. None of the case studies, however, analyse the full consequences for careers that both start late and undergo interruptions.

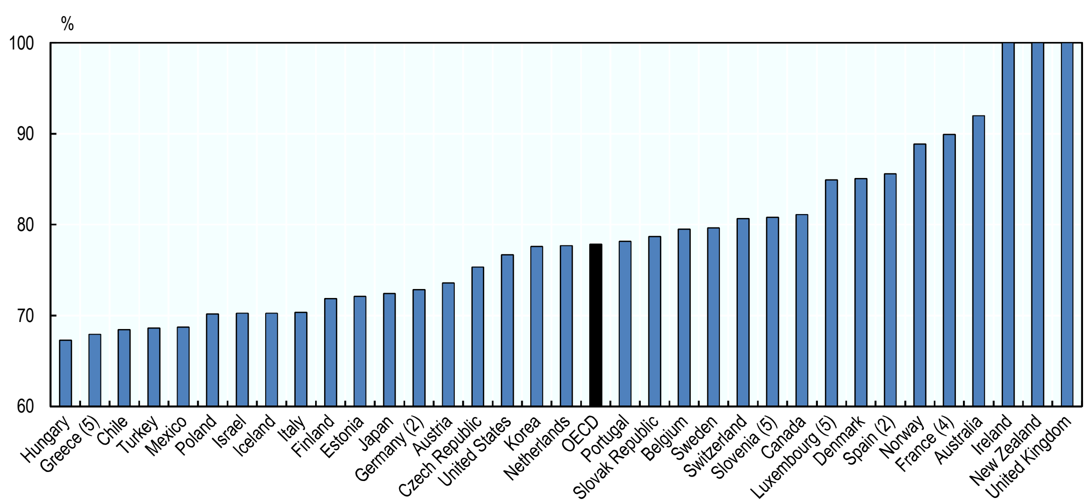
Pension entitlements are therefore calculated for male average earners who enter the labour market at 25 years old (rather than the standard 20) and spend ten years unemployed between the ages of 35 and 45. What they would receive is measured against the OECD baseline pension, corresponding to a full career from the age of 20. In the absence of any mechanism to offset late starts and career breaks, such an incomplete-career scenario would translate into a drop of about 35% in pension benefits. The OECD average projected fall based on legislated pension rules is 22% on average across countries (Figure 4.17). This means that redistributive/stabilisation devices would offset about 37% – that is (35-22)/35 – of the shortfall in this relatively extreme case.

Under this scenario, the level of mandatory scheme pensions among latecomers with gaps in their record is, on average, 78% of that of a 20-year-old starter with an unbroken career. There are, however, considerable variations from country to country. Pensions in Ireland, New Zealand and the United Kingdom are unaffected by shorter careers as they are either residence-based basic in New Zealand, or contribution-based basic in Ireland and the United Kingdom.[22] But these three countries are exceptions.

The biggest drops – of 30% or more – would come in Hungary, Greece, Chile, Turkey, Mexico, Poland, Israel, Iceland and Italy. In Greece, this accounts for five additional years of work at older ages. Indeed, whilst the retirement age in most countries is relatively independent of contribution histories, workers who have gaps in their records need to work to a later age than full-career workers in six countries – France, Germany, Greece, Luxembourg, Slovenia and Spain. For example, late-start workers with unemployment gaps in their careers need to work two years longer in Germany and Spain, four in France, and five in Greece, Luxembourg and Slovenia to avoid being penalised for early withdrawal.

Figure 4.17. Gross pension entitlements of average earners who start at age 25 and experience ten years of unemployment

Percentage of full-career entitlements, mandatory pensions only



Note: Figures in brackets are the number of years more (than workers with unbroken careers) that labour-market latecomers with career gaps must work to qualify for a full pension. No number in brackets corresponds to 0 years.

Source: Calculations based on the OECD pension model.

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In Australia, although there is a 15-year gap in contributions to the defined contribution scheme, the Age Pension makes up for over two-thirds of the fall in pension levels, leading to a benefit equal to 92% of that of the full-career worker. In France, too, a latecomer with an unemployment history also qualifies for around 90% of a full-career worker's pension by working four years longer at older ages. The proportion is 70% in Israel, by contrast, where the pension system also has a strong DC component and no means-tested element.

Quantifying the impact of disparities in life expectancy on pension entitlements

Although low earners typically enjoy greater pension replacement rates than high earners (OECD, 2015) thanks to basic and minimum pensions, income-tested benefits and ceilings on contribution levels, they tend to have a lower life expectancy (see Section 2). Few pension arrangements take life expectancy disparities into consideration, so low earners generally receive benefit over shorter periods than high earners, which lowers their total effective pension payments – that is their pension wealth. OECD-wide, the highly educated (usually high earners) can expect to live an average of three years longer at the age of 65 than workers with low educational attainment (usually low earners).[23]

Is there, then, a method of quantifying the impact of a three-year difference in life expectancy on pension wealth, that is in the discounted stream of expected pension payments? It is assumed that low-wage workers (on 50% of average earnings) have a 1.5-year shorter life expectancy than the average-wage earner who, in turn, dies on average 1.5 years earlier than high earners (200% of average earnings) – on condition that they survive until the retirement age. The specific earnings levels are chosen arbitrarily, but have very little impact on the estimated effect of differences in life expectancy.

The annuity factor is the parameter of the pension system which is affected by changes in life expectancy through the set of survival probabilities. In addition to the influence of life expectancy, it is determined by the retirement age, the indexing of benefits during retirement and the discount rate (Box 4.4).

For low-income earners, lower survival probabilities reduce the annuity factor, which reduces pension wealth. The opposite holds true when it comes to high earners. Applying the three-year difference in life expectancy reduces the annuity factor of low earners relative to that of high earners and, by the same token, lessens their relative pension wealth (Figure 4.18).

Box 4.4. Calculating pension wealth and annuity factor

Pension wealth is equal to the discounted flows of pension benefits, b_t, expressed by:

$$PW = \sum_{t=R}^{T} \frac{b_t\, s_t}{(1+r)^{t-R}}$$

where s_t is the probability of survival to age t conditional on being alive at retirement age R, with T being the terminal age. The retirement age – the age at which a full-career worker who enters the labour market at the age of 20 can retire on a full pension – is country-specific. If pension benefits rise during retirement at indexed rate x, then pension wealth is equal to:

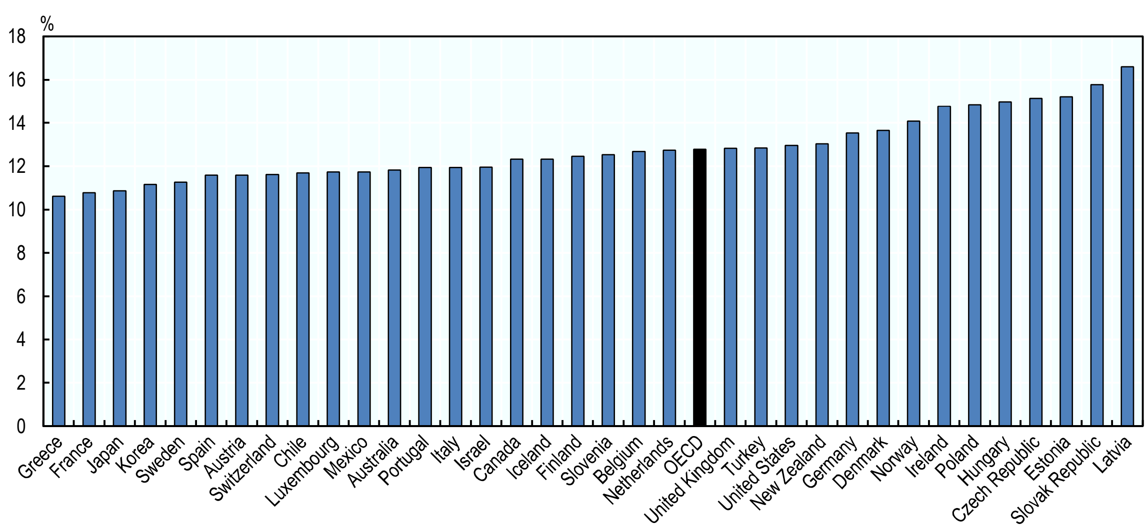
$$PW = b_R \sum_{t=R}^{T} \frac{(1+x)^{t-R}\, s_t}{(1+r)^{t-R}} \equiv b_R * AF_R$$

In other words, cumulated pensions are the product of pension benefit on retirement and the annuity factor (AF), which is equal to:

$$AF_R \equiv \sum_{t=R}^{T} \frac{(1+x)^{t-R}\, s_t}{(1+r)^{t-R}}$$

Figure 4.18. Declines in pension wealth attributable to a three-year shortfall in remaining life expectancy at retirement age

Fall in pension wealth between low and high earners due to a three-year life expectancy shortfall



Source: Calculations based on the OECD pension model.

StatLink http://dx.doi.org/10.1787/888933567616

Across the OECD, assuming a three-year difference in life expectancy on retirement penalises low earners by 12.8% in their total pension benefits relative to high earners compared to the common life expectancy baseline. High earners enjoy greater relative pension wealth in all OECD countries – by over 10% in Greece to nearly 17% in Latvia.

The differences across countries arise mainly from the effect of remaining life expectancy at the time of retirement and the indexation of benefits in payment. For example, the expected duration of retirement is longest in France, Greece, Japan and Korea. At the other extreme life expectancy is shortest in the Czech Republic, Estonia, Latvia and the Slovak Republic, where the three-year difference in life expectancy exerts the greatest effect. All these estimates are relatively large and encourage policy makers to consider adjusting pension parameters to account for how life expectancy varies with different socio-economic factors. As a result, apparently distribution-neutral schemes, such as pure defined-contribution pension, are in fact regressive.

A further issue relates to the distributive consequences of raising the retirement age in line with life expectancy gains. If the effective retirement age were raised across the board, the increase would eat relatively more deeply into low earners' average remaining life expectancy due to mortality differences. All other things being equal and ignoring changes in replacement rates, in particular, accumulated pension entitlements would fall due to the retirement-age increase relatively more among low earners than among high earners. The relative fall would, however, remain relatively small. If the retirement age were to be increased by three years between 2015 and 2060, the pension wealth of low earners relative to that of high earners would fall by a cross-country average of 1.2%.

Moreover, if the same argument – that is lower life expectancy for low earners – is applied to retirement ages that would be kept constant in a context with similar life-expectancy gains for everyone, then the total pension benefits of low-income pensioners would increase relatively more. An increase in the retirement age together with longer life expectancy would restore neutrality. However, if gains in life expectancy were not evenly distributed and favoured higher-income groups, so further exacerbating inequality in life expectancy, a higher retirement age would raise equity concerns. As discussed above, though, there is conflicting evidence about trends in life-expectancy inequality. In some countries, however, such as Denmark and the United States, it has risen.

Leaving health to one side, the main reason why a higher retirement age might affect more disadvantaged groups perhaps relates to the shortage of employment opportunities as they near retirement. It is a serious issue. However, this does not imply that raising the retirement age is the wrong policy. Low-earning workers' struggle to find work in their later years throws into relief the importance of labour market policies that foster a more inclusive elder labour participation (Chapter 5). After all, shortcomings in the labour market are the root cause of these difficulties.

4. Policy foresight to address unequal ageing

This section presents the results from the pilot Global Future Elderly Model (Global FEM)[24] for Belgium, Italy and the United States. Global FEM projects health and economic circumstances of representative cohorts of individuals born in the late 1940s, the mid-1950s and the late 1960s.[25] As the cohort born in the late 1960s is just turning age 50, these projections help policy makers to foresee the extent to which this younger cohort would be different from the cohorts that have preceded it; and the degree to which emerging differences need to be considered when introducing new policies. These preliminary results show how the Global FEM model may be used to test the potential future impact of a policy reform. The model is still in the pilot phase; hence current outcomes are subject to further validation. Results are presented from a policy scenario to increase the normal retirement age within public pension plans.[26]

Large share of life expectancy gains in good health in Belgium and Italy but not in the United States

Results from Global FEM show different dynamics in the United States and the two European countries, Belgium and Italy. While life expectancy gains generate an increase in both healthy and unhealthy years of life in Belgium and Italy, there are very limited total gains and almost none in good health in the United States between cohorts born in the early 1940s and one-quarter of a century later (Table 4.1). In the two European countries, a substantial share of life expectancy gains at age 50 is projected to be disability-free – about 70% in Belgium and 60% in Italy on average across men and women – which of course also means that not all years gained will be spent in good health.

For example, while 50-year-old men (women) born in 1960s in Belgium are expected to gain 5.5 (3.8) years of life compared to those born in early 1940s, 4.0 (2.7) of these additional years are expected to be disability-free. In Italy, the situation is less favourable as men (women) are expected to gain 5.0 (3.0) years but only 2.9 (1.8) would be disability-free. Moreover, the number of years with three or more serious health conditions (cancer, diabetes, heart disease, hypertension, lung disease, and stoke) after age 50 increases in all countries, by 1.7 years in Belgium, 2.2 years in Italy and 3.1 years in the United States. These years represent about one third of life expectancy gains in Belgium and over one half in Italy. By contrast, the 3.1-year increase in the United States is larger than total life expectancy gains of only 1.6 years.

According to Global FEM projections, the educational gradient in remaining life expectancy at age 50 is stronger in Belgium and the United States than in Italy. The highly educated born in the late 1960s who reached age 50 can expect to live longer than their low-educated peers by 7.5 years in the United States, 6.2 years in Belgium and 3.8 years in Italy. Moreover, in all three countries, the highly educated in all cohorts are projected to spend more years without any disability than their counterparts with less education (Table 4.1); from almost 7 years in Italy and Belgium to 11 years in the United States for the 1960s cohort. Furthermore, after age 50, the low-educated are projected to live more years with three or more chronic diseases than their highly educated peers in all countries.[27]

Turning to changes in longevity disparities, life expectancy has been growing faster for men than for women in all three countries. However, educational gaps in life expectancy are stable in Belgium, while there is some further divergence in Italy and the United States (Table 4.1). For example, life expectancy at age 50 is projected to grow by 3.6 years for the low-educated and by 3.7 years for the highly educated between the cohorts born in the early-1940s and late 1960s in Belgium.[28] The respective numbers are 3.1 versus 4.1 years in Italy, and 0.1 versus 1.2 years in the United States.[29]

Table 4.1. Remaining years of life, of disability-free life and of life with 3+ chronic diseases after age 50

By cohort, gender and education in Belgium, Italy and the United States

Country	Outcome	Cohort	Gender			Level of education		
			All	Men	Women	Low	Middle	High
Belgium	Remaining life years	Early 1940s	28.2	24.6	31.6	26.2	28.8	32.3
		Mid-1950s	31.1	27.8	33.9	28.5	30.7	35.0
		Late 1960s	32.9	30.0	35.4	29.8	32.1	36.0
		1960s-1940s	4.7 yrs (17%)	5.5 yrs (22%)	3.8 yrs (12%)	3.6 yrs (14%)	3.4 yrs (12%)	3.7 yrs (12%)
	Disability-free life years	Early 1940s	23.2	21.1	25.3	21.0	24.2	27.9
		Mid-1950s	25.3	23.7	27.0	22.5	25.5	29.5
		Late 1960s	26.5	25.0	28.0	23.1	26.1	29.9
		1960s-1940s	3.3 yrs (14%)	4.0 yrs (19%)	2.7 yrs (10%)	2.2 yrs (10%)	1.9 yrs (8%)	2.0 yrs (7%)
	Life years with 3+ chronic diseases	Early 1940s	6.7	6.1	7.3	7.1	6.5	5.8
		Mid-1950s	7.6	7.2	8.0	8.2	7.5	6.6
		Late 1960s	8.4	8.2	8.5	9.3	8.3	7.5
		1960s-1940s	1.7 yrs (25%)	2.1 yrs (35%)	1.2 yrs (16%)	2.2 yrs (31%)	1.8 yrs (29%)	1.7 yrs (29%)
Italy	Remaining life years	Early 1940s	30.8	26.1	34.7	30.7	29.9	33.4
		Mid-1950s	33.0	29.1	36.1	32.5	32.3	35.8
		Late 1960s	34.8	31.1	37.7	33.7	34.7	37.5
		1960s-1940s	4.0 yrs (13%)	5.0 yrs (19%)	3.0 yrs (9%)	3.1 yrs (10%)	4.8 yrs (16%)	4.1 yrs (12%)
	Disability-free life years	Early 1940s	25.3	22.9	27.7	24.8	25.7	30.0
		Mid-1950s	26.8	24.9	28.6	25.4	27.1	31.3
		Late 1960s	27.7	25.9	29.5	25.7	28.2	32.4
		1960s-1940s	2.3 yrs (9%)	2.9 yrs (13%)	1.8 yrs (7%)	0.9 yrs (4%)	2.5 yrs (10%)	2.4 yrs (8%)
	Life years with 3+ chronic diseases	Early 1940s	7.1	6.5	7.6	7.4	6.6	5.8
		Mid-1950s	8.3	7.9	8.6	9.1	7.6	6.8
		Late 1960s	9.3	9.1	9.4	10.3	8.9	7.3
		1960s-1940s	2.2 yrs (31%)	2.6 yrs (40%)	1.8 yrs (24%)	2.9 yrs (40%)	2.3 yrs (35%)	1.5 yrs (25%)
United States	Remaining life years	Early 1940s	29.7	27.7	31.5	26.5	29.9	33.0
		Mid-1950s	30.3	28.3	32.3	25.6	29.8	33.5
		Late 1960s	31.3	29.4	33.2	26.6	30.9	34.1
		1960s-1940s	1.6 yrs (6%)	1.7 yrs (6%)	1.6 yrs (5%)	0.1 yrs (1%)	1.1 yrs (4%)	1.2 yrs (4%)
	Disability-free life years	Early 1940s	22.5	21.7	23.2	17.8	23.0	27.0
		Mid-1950s	22.3	21.5	23.0	15.4	21.9	26.2
		Late 1960s	22.4	21.8	23.0	15.2	22.2	26.3
		1960s-1940s	-0.1 yrs (0%)	0.1 yrs (0%)	-0.3 yrs (-1%)	-2.7 yrs (-15%)	-0.8 yrs (-4%)	-0.7 yrs (-3%)
	Life years with 3+ chronic diseases	Early 1940s	6.5	6.2	6.8	6.7	6.6	6.1
		Mid-1950s	8.6	8.3	8.8	8.7	8.7	8.2
		Late 1960s	9.6	9.3	9.8	9.6	9.7	9.3
		1960s-1940s	3.1 yrs (47%)	3.1 yrs (50%)	3.0 yrs (44%)	2.9 yrs (43%)	3.1 yrs (48%)	3.3 yrs (53%)

Source: Global FEM.

StatLink http://dx.doi.org/10.1787/888933567635

Shifts in the composition of populations in terms of educational attainment over time have a significant impact on these trends. Even though disability-free years are expected to decrease by more than half a year in each educational group in the United States, the aggregate is expected to remain almost constant. Similarly in Belgium, the aggregate increase in disability-free years across cohorts is over three years, whereas the increases in each educational group are around two years (Table 4.1).

Working lives are expected to lengthen

Projected gaps in employment at older ages between European countries (Italy and Belgium) and the United States are closing due to strong increases in employment rates in Italy and Belgium (Table 4.2). Italians and Belgians born in the late 1960s are expected to work only four months less after age 50 than their US peers; this difference exceeds four years for Belgians and five for Italians born in the early 1940s. These increases are strongest among women, from 4.4 to 10.7 years in Belgium and from 3.4 to 9.4 years in Italy, against only 1.0 year from 9.7 to 10.7 years in the United States. As a consequence, the gender gap in employment after 50 is narrowing to below two years in Belgium, while remaining larger than four years in Italy.

Projections of working years are conditional on individuals' health and socio-economic histories. In all three countries, there are substantial and persistent differences in the length of working lives by level of educational attainment. Highly educated born in the late 1960s are expected to work longer after age 50 by 5.2 years in Belgium, 6.3 years in the United States and 6.9 years in Italy. These duration gaps are widening from 4.8 years for the early 1940s cohort in Belgium and 6.1 years in Italy. By contrast, the duration gap is narrowing slightly from 6.6 years in the United States.

Changes in pension systems, raising life expectancy and prolonging working lives result in changes in the duration of claiming a pension. Trends in the number of years claiming a pension differ widely across countries (Table 4.2). In the United States, that duration is stable on average across cohorts at about 17.5 years. Belgium would record a marked increase from about 14 to 16.5 years between the cohorts born in the early 1940s and the late 1960s due to life expectancy gains. By contrast, the length of the period claiming a pension would fall sharply from slightly more than 18 years to about 14 years due to higher effective retirement ages. Overall, these trends imply that, across countries and cohorts, the average duration of pension receipt is the longest for the early 1940s cohort in Italy where it is will be the shortest for those born 25 years later in Italy.

Due to shorter working lives and higher life expectancy women claim pensions for a longer period in all countries and in all cohorts except in Italy for the early 1940s. Moreover, there is a clear educational gradient in the estimated average claiming years, with the highly educated claiming pension for around five to six years longer than their low-educated counterparts in all countries and cohorts.

Table 4.2. Average duration of working for pay and of claiming pension after age 50

By cohort, gender and education in Belgium, Italy and the United States

Country	Outcome	Cohort	Gender			Level of education		
			All	Men	Women	Low	Middle	High
Belgium	Life years working for pay	Early 1940s	6.9	9.3	4.4	5.6	7.0	10.4
		Mid-1950s	9.8	10.8	8.7	7.8	9.6	13.0
		Late 1960s	11.5	12.3	10.7	9.1	10.8	14.3
		1960s-1940s	4.6 yrs (66%)	3.0 yrs (32%)	6.3 yrs (141%)	3.5 yrs (62%)	3.8 yrs (54%)	3.9 yrs (37%)
	Life years claiming public pension	Early 1940s	14.1	12.4	15.7	12.1	15.7	17.1
		Mid-1950s	15.8	14.1	17.4	13.2	16.2	19.0
		Late 1960s	16.4	15.0	17.8	13.4	16.5	19.1
		1960s-1940s	2.3 yrs (16%)	2.6 yrs (21%)	2.1 yrs (13%)	1.2 yrs (10%)	0.8 yrs (5%)	1.9 yrs (11%)
Italy	Life years working for pay	Early 1940s	5.8	8.2	3.4	4.8	7.3	10.9
		Mid-1950s	10.0	13.1	7.0	8.0	11.1	15.1
		Late 1960s	11.5	13.6	9.4	9.2	12.4	16.1
		1960s-1940s	5.7 yrs (99%)	5.4 yrs (66%)	6.0 yrs (176%)	4.4 yrs (91%)	5.1 yrs (70%)	5.2 yrs (48%)
	Life years claiming public pension	Early 1940s	18.3	19.1	17.4	17.6	19.1	22.4
		Mid-1950s	13.8	13.4	14.1	12.6	13.9	18.2
		Late 1960s	13.9	13.2	14.5	12.2	14.2	18.5
		1960s-1940s	-4.4 yrs (-24%)	-5.9 yrs (-31%)	-2.8 yrs (-16%)	-5.4 yrs (-31%)	-4.9 yrs (-26%)	-3.9 yrs (-17%)
United States	Life years working for pay	Early 1940s	11.0	12.3	9.7	8.2	10.8	14.8
		Mid-1950s	11.3	12.4	10.3	7.8	10.8	13.8
		Late 1960s	11.8	13.0	10.7	8.0	11.5	14.3
		1960s-1940s	0.8 yrs (8%)	0.7 yrs (6%)	1.0 yrs (10%)	-0.2 yrs (-3%)	0.7 yrs (6%)	-0.5 yrs (-4%)
	Life years claiming public pension	Early 1940s	17.3	15.3	19.2	14.6	17.7	19.4
		Mid-1950s	17.4	15.5	19.1	13.5	17.2	19.4
		Late 1960s	17.6	15.8	19.3	13.8	17.6	19.3
		1960s-1940s	0.3 yrs (2%)	0.5 yrs (3%)	0.1 yrs (1%)	-0.9 yrs (-6%)	-0.1 yrs (0%)	-0.1 yrs (-1%)

Source: Global FEM.

StatLink http://dx.doi.org/10.1787/888933567654

Policy scenario: Impact of raising the retirement age

The strength of Global FEM is its ability to estimate the health and economic impacts of various policy proposals on different population groups. The policy example presented here is a hypothetical scenario where governments consider the impacts of raising both the normal and early retirement age to 70 and 65, respectively, for the late-1960s cohort. Many OECD countries have implemented or are considering an increase in the legal retirement age to achieve financial sustainability or preserve retirement income adequacy in a financially sustainable way (OECD, 2015). This policy represents a more substantial change in Belgium, where the normal retirement age is scheduled to increase from 65 today to 66 in 2025 and 67 in 2030, than in Italy, where it is being gradually raised with increases in life expectancy, thereby reaching 67 already in 2019 and rising beyond that over time. In the United States, the normal retirement age is increasing from 66 in 2014 to 67 by 2027.[30]

The Global FEM baseline projections, which reflect current policies, are compared to the results after the intervention. As would be expected, the policy change increases the average projected years spent working for pay in all countries: by 1.2 years in Italy, 1.6 in the United States and 3.3 in Belgium (Table 4.3). Such a reform would have a similar impact on the changes in the duration of the working life after age 50 among educational groups in Italy, should slightly reduce the educational gap in Belgium and widen it slightly in the United States. However, the impact on the educational gap is small, not exceeding half a year in each country.

The net effect of retiring later on the discounted flow of lifetime pension benefits (pension wealth) results from different mechanisms. On the one hand the average benefits might become higher due to longer period of contributions and lower remaining life expectancy when claiming retirement (which mechanically increases pensions in Italy). On the other hand, the benefits are received for a shorter period of time and in a more distant future (hence a lower discounted value). The policy change results in a large estimated decrease (13%) in the average lifetime pensions in the United States. By contrast, pension wealth declines and increases very slightly in Belgium and Italy, respectively. The intervention would impact the pension wealth quite similarly among educational groups in each country (Table 4.3).

Table 4.3. Impact of rising retirement age on duration of working life and pension wealth

By gender and education in Belgium, Italy and the United States for the cohort born in the 1960s

Outcome	Country	Cohort	Gender			Level of education		
			All	Men	Women	Low	Middle	High
Life years working for pay after age 50	Italy	Status quo	11.5	13.6	9.4	9.2	12.4	16.1
		Intervention	12.8	14.9	10.6	10.4	13.7	17.3
		Difference (%)	1.2 (11%)	1.3 (9%)	1.2 (13%)	1.2 (14%)	1.3 (10%)	1.2 (8%)
	Belgium	Status quo	11.5	12.3	10.7	9.1	10.8	14.3
		Intervention	14.8	15.4	14.2	12.6	14.3	17.4
		Difference (%)	3.3 (29%)	3.2 (26%)	3.5 (32%)	3.4 (37%)	3.5 (32%)	3 (21%)
	United States	Status quo	11.8	13.0	10.7	8.0	11.5	14.3
		Intervention	13.4	14.5	12.3	9.3	13.0	16.0
		Difference (%)	1.6 (13%)	1.5 (12%)	1.6 (15%)	1.2 (16%)	1.6 (14%)	1.7 (12%)
Discounted lifetime public pension benefits in 2010 USD ('000s)	Italy	Status quo	731.9	696.4	772.9	625.7	755.9	945.5
		Intervention	738.8	720.0	775.3	640.7	758.5	954.0
		Difference (%)	6.8 (1%)	23.6 (3%)	2.3 (0%)	15.0 (2%)	2.6 (0%)	8.4 (1%)
	Belgium	Status quo	476.4	508.6	439.7	394.3	462.7	522.8
		Intervention	465.3	483.2	439.4	383.4	452.8	508.1
		Difference (%)	-11.1 (-2%)	-25.4 (-5%)	-0.3 (0%)	-10.9 (-3%)	-10.0 (-2%)	-14.6 (-3%)
	United States	Status quo	500.9	517.8	465.1	343.0	464.1	549.1
		Intervention	434.2	440.0	407.4	298.2	404.2	470.6
		Difference (%)	-66.7 (-13%)	-77.8 (-15%)	-57.7 (-12%)	-44.8 (-13%)	-59.9 (-13%)	-78.5 (-14%)

Source: Global FEM.

StatLink http://dx.doi.org/10.1787/888933567673

Notes

1. Global FEM uses dynamic microsimulation to project the health and economic characteristics of OECD countries. For this pilot, Global FEM was developed and validated for Belgium, Italy and the United States. All results presented in this section were produced using the Global FEM Model and have been averaged over 50 repetitions.

2. Cohort life expectancy calculates and/or projects the actual lifespan of a same-year birth cohort, while period life expectancy calculates the hypothetical lifespan of a person by factoring in current mortality rates among individuals of various ages (and, therefore, from different birth cohorts). When pooling all country-, cohort- and period-observations in the same sample, average cohort life expectancy is estimated to be equal to period life expectancy at birth plus 9.6 years, due to declining mortality at the same age across cohorts. In other words, the 2015 birth cohort will live about ten years longer than period life expectancy at birth in 2015 suggests.

3. The new collected data show estimated longevity gaps at age 65 between the highest and lowest education groups which are substantially larger in most countries than those found in previous studies, due to more precise information on mortality after the age of 75.

4. In Norway, the life expectancy gap between high and low educational groups was four years among both men and women in the 1970s, widening to five among women and seven for men in the late 2000s (Murtin et al., 2017).

5. Mackenbach (2016) also reports that absolute inequalities in self-assessed health were mostly constant in the 17 European countries between the 1990s and the 2000s, whereas relative inequalities grew. Measures of inequality in mortality by education are subject to composition effects as the distribution of education changes over time. Alternative measures immune to this problem are available, but constructing them is complicated and their robustness is untested (Murtin et al., 2017).

6. For details see http://apps.who.int/classifications/icd10/browse/2016/en (Chapter XX, V01-Y98).

7. The effect of higher education appears to be greater among lower- and middle-income OECD countries than in high-income ones.

8. Breaking down lifespan inequality into inequality in lifespan within and between educational and gender groups is based on the Theil index of lifespan inequality as further explained in Murtin et al. (2017, p. 32).

9. The United Nations cuts off survival data at the age of 85. It is not possible, therefore, to calculate total inequality in lifespan and reflect trends in mortality in very old age.

10. The data analysis pools various waves from the Cross-National Equivalent File (CNEF) to include Australia (2001-14), Switzerland (1999-2014) and the United States (1970-13). It also pools the 1994-2001 waves from the European Community

Household Panel (ECHP) and the 2004-14 waves from the European Union Statistics on Income and Living Conditions (EUSILC) to include another ten European OECD countries. These countries are Austria, Belgium, Denmark, Finland, France, Greece, Ireland, Italy, the Netherlands and Spain. Five countries with available data were not included because their shares of the population by education group were not reliable in some years (the United Kingdom and Luxembourg) or because survey findings were not reliable, probably because samples were too small (Korea and Portugal). Finally, Germany was excluded due to the difficulties of measuring and aggregating work careers of older cohorts in East and West Germany. However, ruling out the five countries had little effect on the country averages shown in Section 3.

11. In Belgium, Denmark and Greece (not in the figure), more mixed patterns emerge, with the female and male education premium showing slight declines and rises, respectively.

12. This evidence for the United States is consistent with the findings of Autor (2014) based on Current Population Survey data.

13. The ratio would further drop from 1.95 to 1.90 if survival probabilities were identical. Note that the education gradient in survival probabilities is taken into account when computing lifetime earnings, but is assumed constant across countries and cohorts due to data limitations. So, while the gradient affects the level of lifetime earnings of the highly and low-educated similarly across countries, it does not affect how the ratio of lifetime earnings of the two groups changes from one cohort to another. The average education gradient used refers to the average of the 23 OECD countries studied in Section 2 (Figure 4.4) which does not cover all countries studied below. However, educational differences in longevity have been found in a broader range of OECD countries (e.g. Mackenbach, 2016).

14. Following the standard definition of gender gaps, it is here equal to the difference in lifetime earnings between genders over male's levels.

15. Extrapolating the education-specific profiles in lifetime earnings for generations born after 1970-74 entails a further decrease in the gender gap. However, such extrapolations should be taken very cautiously, as the underlying data cover only a limited part of careers.

16. Results for hours worked are not shown here but are available upon request.

17. The result refers to both, men and women, born in 1970-74 and is based on the OECD pension model.

18. A high positive correlation of the educational attainment of children with that of their parents leads to a positive correlation of between the income level of adults and their parents' income which they share during childhood.

19. The wage distribution is assumed constant across countries. It is first assumed that the distribution comprises people with zero, low (50% of average wage), average (100%) and high (200%) earnings over the entire working lifetime. It is further assumed that 15% of people have zero earnings and that the total earnings distribution generates a score of 0.35 in the Gini index. It follows therefrom that the shares of low earners, average earners and high earners are 16.5%, 45.3% and 23.3%, respectively.

20. The pass-through is computed here from a shift in the wage distribution that increases the Gini index from 0.35 to 0.38, which is achieved by 15% of people with

zero earnings, 24% of low-income workers, 34% of average-wage workers and 27% of high-wage workers.

21. Indeed, it is assumed that coverage is concentrated at the top of the earnings range, so that all those on 200% of average earnings are covered first, followed by those on 100% and then by those on 50% (if needed, based on the coverage levels presented in Table 10.1 of OECD (2015). The Gini index of pension inequality is then calculated for both mandatory and voluntary schemes at both proportions of earnings identified above.

22. In Ireland and the United Kingdom, a sufficiently long contribution period guarantees eligibility to a flat-rate pension benefit independent of the individual's earnings level.

23. This refers to the average of the 23 OECD countries studied in Section 2 (Figure 4.4) which does not cover all countries studied below. However, educational differences in longevity have been found in a broader range of OECD countries (e.g. Mackenbach, 2016).

24. See endnote #1.

25. The OECD is collaborating with the University of Southern California Schaeffer Center for Health Policy & Economics and the University of Rome Tor Vergata Centre for Economic and International Studies (CEIS) to develop the pilot Global FEM from the US Future Elderly Model (US FEM). The US FEM is a mature model that has been used for a wide variety of health and social policy evaluation studies, including those related to reforms of the US Medicare and Social Security programmes (Goldman, 2014; National Academies, 2015).

26. Two other scenarios aimed at prolonging working life have been modelled with Global FEM: an improvement in the health of at older ages and an increase in the skills and employability of older workers. The first scenario estimates the effects of introducing a diabetes prevention programme. The second scenario analyses the impacts of introducing an active labour market programme to help older unemployed people to find a job.

27. The education gradient is less pronounced in the United States where the highly educated are expected to live only three months less with three or more chronic diseases compared to three years in Italy and almost two years in Belgium in the cohort born in the late 1960s.

28. A high education level is equivalent to tertiary education (ISCED 5+) and a low education level to at most a lower secondary level of education (ISCED 0-2).

29. Results reveal also an increase in the education gap in the duration of disability-free lives in Italy and the United States by 1.4 and 2.0 years, respectively, but a stable gap in Belgium.

30. The policy applies to the cohort born in the late 1960s and is phased in immediately.

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Annex 4.A1

Calculating multi-dimensional living standards

Multi-dimensional living standards (MDLS) is a metric developed as part of the OECD Inclusive Growth Initiative to help policy makers assess:

- how their policies and programmes might affect societal outcomes through their impact on the income and non-income components of well-being;
- how those outcomes are distributed across households.

To help assess possible synergies and trade-offs between goals, the MDLS methodology draws on:

- estimates of "shadow prices" to evaluate the importance of non-income aspects of well-being;
- assumptions about degrees of "aversion to inequalities".

For measuring the income-related dimension of MDLS, the OECD uses household real disposable income. As for non-income dimensions, it uses employment conditions and health status, measured respectively by the unemployment rate and by gaps in cohort life expectancy at birth measured against a longevity benchmark. Non-income factors are valued by the "equivalent income method" (Fleurbaey and Blanchet, 2013) defined as the *hypothetical income that would make an individual indifferent between her/his current situation in terms of non-income aspects of life and a benchmark situation*.

To monetise the benefits from non-income components, shadow prices need to be worked out. While shadow prices can be derived in several ways (see Boarini et al., 2015, for a review and Boarini et al., 2016, for a robustness analysis), they fall within a relatively narrow range. Estimated shadow prices are country-specific and, for present purposes, age- and cohort-specific too, as they depend on income, longevity and unemployment in a non-linear way. Estimates for 26 OECD countries (Boarini et al., 2016) imply that the well-being benefit of a 1-percentage-point fall in the unemployment rate is equivalent to a gain in average household income of 1.9% and that the benefit of a one-year increase in (period) life expectancy at birth is equivalent to an income gain of 5.9%.

Once equivalent income has been calculated for each individual, MDLS measures can be aggregated into country living standard measures as in Boarini et al. (2016), by level of education or age cohort, as in this report (see also Diaz and Murtin, 2017a). Aggregation takes the form of a generalised mean, equal to average living standards minus a penalty for inequality in living standards between individuals. Standard calibration is used to adjust the inequality penalty to the gap between average and median living standards, so that the resulting MDLS index translates the situation of the median household.

Table 4.A1.1 below displays the estimated MDLS indicators of various age groups in the United States born in 1950-54. Age-specific longevity benchmarks have been used so that longevity gaps are valued differently between age groups but similarly between cohorts at a given age. MDLS indicators for different cohorts at a given age are therefore comparable, but not across age groups in a given cohort. The table shows that the shadow prices of longevity at 60 are higher than at 30 – because older people value shorter remaining lifetimes over income more than younger people do.

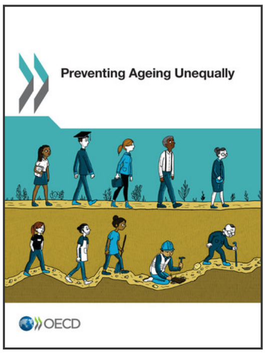
Table 4.A1.1. Calculating multi-dimensional living standards by cohort

1950-54 cohort in the United States

		Living standards calculation					Memorendum items				
Year	Age	Income	Correction for longevity gap	Correction for unemployment	Inequality penalty	Living standards	Longevity	Longevity benchmark	Longevity shadow price	Unemployment	Unemployment shadow price
1980	30	24 843.1	-11 152.1	-4 970.5	-2 555.9	8 547.8	51.0	60.4	4.1	11.8	1.4
1990	40	29 548.0	-14 375.1	-4 616.4	-2 767.4	10 183.5	41.7	49.3	5.6	9.0	1.5
2000	50	35 877.3	-18 254.8	-4 338.2	-3 874.2	11 759.5	32.9	38.3	8.5	6.8	1.6
2010	60	35 084.7	-16 921.1	-2 958.9	-4 740.7	11 987.4	24.6	27.8	14.1	4.7	1.7

Source: OECD calculations.

StatLink http://dx.doi.org/10.1787/888933567692



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