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A WELFARE GENERATION
Lifetime welfare transfers between generations

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Acknowledgements

Summary

Concerns about the living standards of different generations are currently high on the agenda, and appear unlikely to dissipate any time soon. This is particularly the case when the coming decades bring with them a potent mix of increasing longevity and the sheer size of the baby boomer cohort swelling the older population, creating growing fiscal pressures and thus raising the question of 'who pays?'.

Analysis of the effects of tax and benefit policy – whether by age, income or some other characteristic – tends to be related to a particular policy at a given point in time. However, taking full account of the impact of policy change across cohorts requires a much broader and longer view.

This latest research paper, the fourteenth for the Intergenerational Commission, attempts to do exactly that by updating John Hills' seminal research on life-cycle welfare transfers between generations. We determine the extent to which past and future cohorts contribute to the welfare state via taxation and withdraw from its core pillars – education, health and social security – over the course of lifetimes. While this analysis is about averages for entire cohorts, and so does not consider distributional impacts, it does allow a better understanding of the relationship of different generations with the state over their lifetimes.

In practice the UK welfare system runs on a 'pay as you go' basis, with workers contributing to fund support for children, pensioners and those in need. If longevity, cohort size and levels of tax and spend remained the same across time, then, with an annual balanced budget, successive cohorts would put in precisely what they take out. Of course in reality that is not the case, and variation in each of those factors shapes the extent to which different cohorts as a whole are net withdrawers from the welfare state over their lifetimes.

Because the modern welfare state developed as they were in older working age, cohorts that have now mainly reached the end of their lives – members of the forgotten generation (born 1896-1910) and the oldest two-thirds of the greatest generation (1911-25) – emerge as clear net beneficiaries. Measured relative to GDP per capita, these cohorts' average withdrawals were at least 25 per cent higher than their contributions. The silent generation (1926-45), however, were mostly in early working age during the establishment of the modern welfare state from the late-1940s onwards. This means that the increased spend on education for subsequent cohorts, along with health and pension provision they were taxed to fund for other cohorts, was almost greater than the support they received themselves, leaving them with 'net withdrawals' of 5 to 15 per cent.

To consider the lifetime position of younger cohorts that have not yet reached old age we are required to make big assumptions about the future path of tax and spending. In the first instance we follow John Hills' approach and assume that taxes collected in any given year are sufficient to fund welfare spending in that year, and that this spending takes up a growing share of GDP, largely due to growing health spend, as long-term Office for Budget Responsibility (OBR) projections suggest it will. Under these assumptions, cohorts from the baby boomer generation (1946-66), generation X (1966-80) and the millennial generation (1981-2000) all have higher net withdrawals than the silent generation, of around 20 to 25 per cent.

However, these hypothetical outcomes rest on the ability of successive generations to pass ever growing costs – and in particular rising health spending – onto the generations that follow for ever more. The OBR have projected that over the next fifty years the welfare state is projected to increase in size by seven per cent of GDP. In our model, funding this means steadily raising taxation, not only in real terms but also as a share of GDP, largely of working age adults (we assume that the distribution of tax revenues by age retains its current pattern), a situation that seems unlikely to be sustainable indefinitely.

Alternatively, successive cohorts could pass on the growing costs in the form of higher debt. Indeed, OBR projections, which do not assume that tax policy will alter to cover changes in spending, suggest that the growing gap between tax revenues and spending commitments will see the national debt as a share of GDP rise to over 230 per cent by 2066. These are costs associated with retaining a welfare state of a similar level of generosity (i.e. service, which requires per-head funding for health provision to rise by an average 1.5 per cent a year above GDP in the long run) to that of today. If their taxes aren't sufficient to fund this, the implication is that younger generations would be left with a growing debt burden to be financed, an outcome that is similarly unlikely to be sustainable indefinitely.

With neither ever-higher taxation of working age adults nor ever-rising debt appearing feasible long-term approaches, an alternative is for welfare spending to grow less quickly. To consider this position, we model a second set of assumptions under which welfare funding per-head does not rise in future. In this instance, we find that younger baby boomer cohorts are the big winners among generations alive today – the 1961-65 cohort has a net withdrawal from the welfare state around twice as large as that of the 1991-95 millennial cohort. It is notable that under these constant spending assumptions, levels of net withdrawal from the welfare state closely match fluctuations in cohort size, highlighting the all-else-equal advantages of being born into a big generation.

While large welfare reductions (mainly affecting families of working age) are currently underway, in practice a welfare retrenchment of the scale implied by this second set of assumptions would likely be equally as unpalatable as the alternatives of ever-rising working age taxation or debt. In this sense, our scenarios represent some of the extremes between which policy-makers must navigate and highlight the generational conse-quences of finding a way between the two.

While the precise path of future welfare spending remains hugely uncertain, it is clear that successive governments have so far failed to adjust either the UK's tax-raising potential, or its welfare promise for current and future generations, to account for future fiscal pressures. Managing this trade-off is key to finding an equitable distribution of resources across generations and to maintaining the inter-generational contract.

In facing this challenge, it is important to question one assumption that is common to both of the scenarios we have described: that the additional tax burden associated with funding the services we currently value should fall on current or future working age populations. This is particularly the case given cohorts now entering retirement have wealth levels at each age exceeding those of both previous retirees and generations that follow.

What is certain is that of generations alive today, so far the baby boomers have been the winners and the silent generation the losers from generational burden-sharing as the welfare state has expanded and matured. The outcome is less clear for younger generations, their fate will ultimately be decided by future policy choices. As policy-makers wrestle with big questions about the future path of tax and spend we should remember the significant implications for generational living standards and equity.

Tax and spend decisions in any year represent a transfer between generations

Scrutiny of tax and benefit policy tends to focus on outcomes for different household types or at different levels of income, and almost always at a given point in time. One key perspective that this approach misses is the impact on different age groups or generations. Previous research for the Intergenerational Commission has sought to address this gap in policy thinking by assessing the impact of policy choices by age.[1]

For example, in Figure 1 we consider the age-incidence of policies being implemented over the course of this parliament, including cuts to working age welfare and cuts to income tax. We find that this policy combination – on average – reduces incomes among working age families while marginally boosting incomes for those above the State Pension age.

Figure 1: **Impact of tax and benefit policy changes implemented during the current parliament, by age: 2022-23**

Mean change in annual net family income (before housing costs, cash)
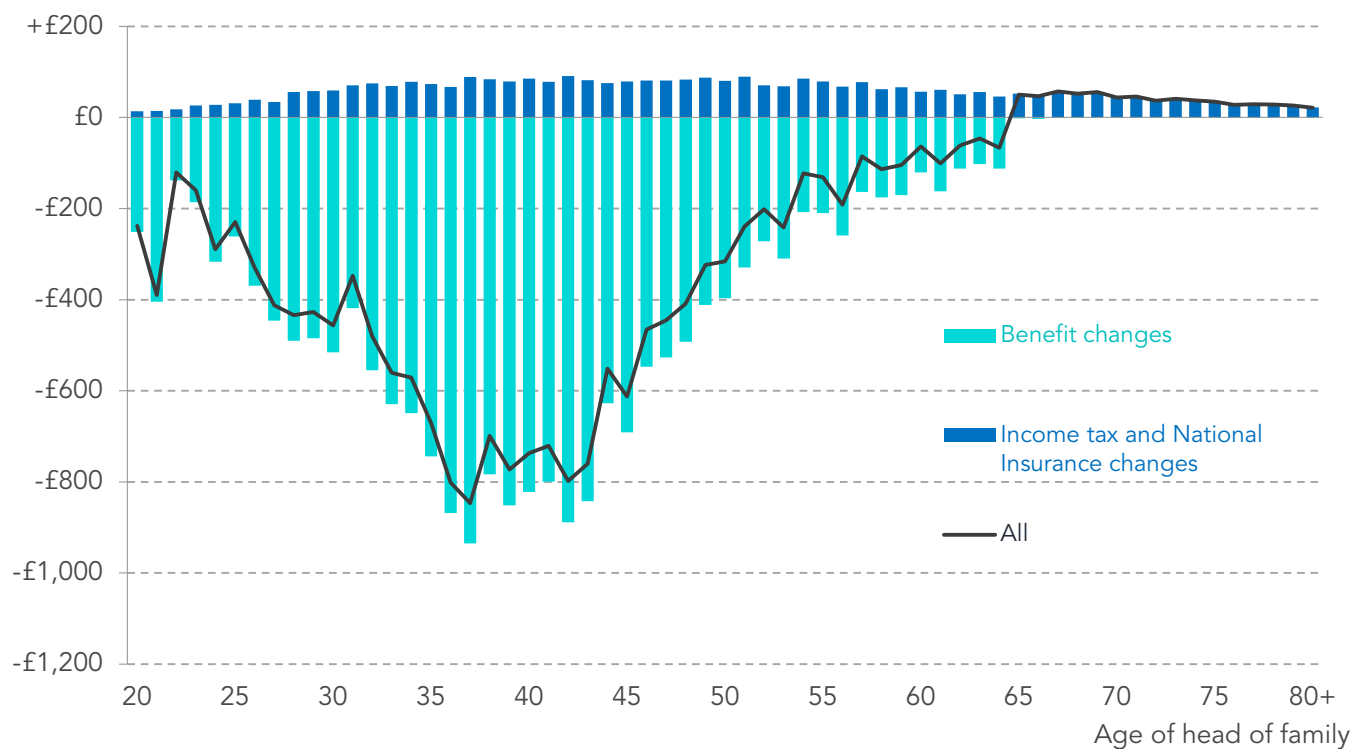
Notes: All changes are compared to policy as it stands in 2017, with tax and benefit thresholds uprated by CPI inflation thereafter. Income tax and National Insurance changes include increasing the income tax personal allowance to £12,500 and the higher-rate threshold to £50,000 by 2020. Working age benefit changes include a further two years of the benefit freeze to most working age benefits, cuts to Universal Credit 'work allowances', and cutting the Universal Credit family element and support for each child beyond the first two for new claims. We assume that Universal Credit is fully rolled out. Economic forecasts as at the 2017 Spring Budget.

Source: RF analysis using the IPPR tax-benefit model

1   L Gardiner, *A Budget for Intergenerational Fairness? Tax and benefit options at the Autumn Budget from the perspective of different generations*, Resolution Foundation, November 2017

But of course, while illuminating and important, such point-in-time, age-based analyses are limited in terms of what they can tell us about generational experiences. As well as any 'dynamic' effects that static analyses like these do not account for, generations progress up the age distribution over lifetimes, so – if policy were to remain constant – today's 'losers' might be tomorrow's 'winners'. As such, it is essential to ask how current changes fit within the broader context of support from the welfare state over lifetimes.

The welfare state by its very nature is built around an intergenerational contract: in the most basic terms people of working age contribute via tax to provide support to children, older people and other groups in need of support.

Figure 2 provides a snapshot of average spend by age in 2021-22 on the core elements of the welfare state – health, education and social security – and the tax revenue collected to pay for that provision, on a per head basis.

Figure 2:   **Figure 2: Average spend and tax revenue per head and area of provision, by age: 2021-22**
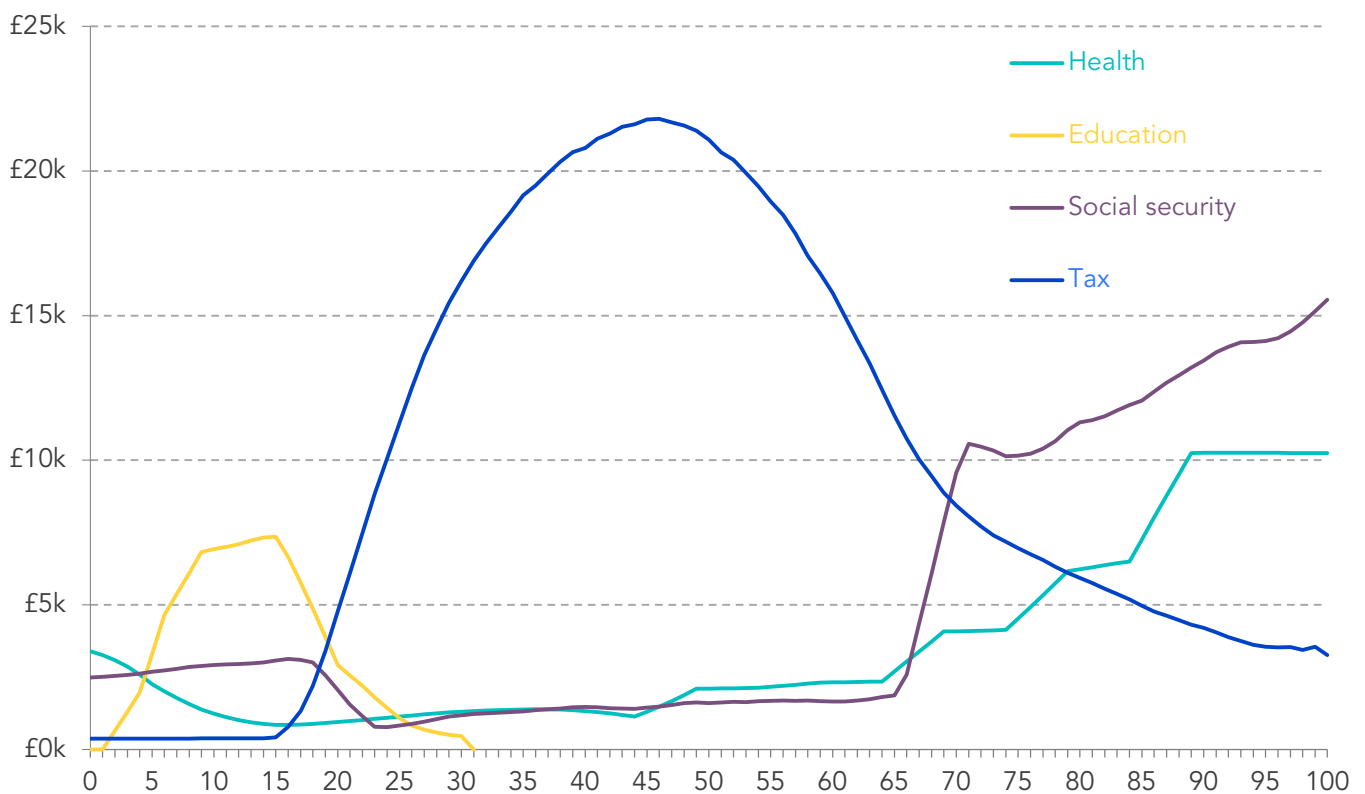
Notes: Tax revenue is calibrated to match the total welfare spend in the given period. Health spend is based on age bands at older ages, which results in the flat profile at age 90+.

Source: OBR, *Fiscal Sustainability Report January 2017*

Three features stand out:

- Spending during childhood is relatively high, reflecting health provision for babies and the cost of education. In addition children pay virtually no tax, making them 'net withdrawers' overall.

- During working age people are on average net contributors: tax revenue peaks, health spend remains relatively low, and social security is also low although rises up to the mid-40s reflecting payments of child-related benefits to families.

- Beyond pension age the position flips back to age groups being net withdrawers on average due to the increasing cost of pensioner benefits and healthcare provision at ages where tax revenues fall. It is noticeable that despite such strong growth in incomes for recent retirees there is still a significant fall in the incidence of tax for people in their 60s. At the very oldest ages social security spend grows due to increasing entitlement to disability benefits.

This distribution of resources by age is a pattern that has been broadly experienced in the past and one that we can expect into the future. However a snapshot fails to tells us how different cohorts have fared over their lifetime. It is only from the life-cycle perspective that we can make comprehensive assessments of the relative generosity of the welfare system for different generations.

Such assessments would be straightforward if the UK had experienced constant policy, longevity and cohort size. In such a scenario, if tax revenues match welfare provision each year, all generations would pay in and take out the same amount over their lives. However, in reality all three factors have varied and are very likely to continue to change, and the state does not fund all spending year-to-year, instead tending to aim for a balanced budget over the medium term horizon. In part such change is due to the maturing of the modern welfare state in the second half of the twentieth century, but also due to the economic cycle, shifting demographics and changing political aims.

Assessing lifetime welfare transfers between generations

To assess the balance of withdrawals and contributions to the welfare state made by different generations, we build on and update John Hills' seminal research on lifetime welfare transfers, last published in 2004.[2] This research was described by the Work and Pensions Select Committee in its 2017 inquiry into intergenerational fairness as *'the most prominent attempt to assess and compare the past and future contributions of different generations over the whole life course.'*[3] In its response to the Work and Pensions Select Committee's inquiry, the government committed to supporting the Intergenerational Commission's efforts to update this analysis, and to examining the results.[4] This

2   H Bowman & J Hills, *Does Britain have a 'welfare generation'? An empirical analysis of intergenerational equity,* Centre for the Analysis of Social Exclusion, London School of Economics and Political Science, 1995; J Falkingham, & J Hills, eds., *The dynamic of welfare: the welfare state and the life cycle,* Prentice Hall, 1995; J Hills, *Inequality and the State,* Oxford University Press, October 2004

3   House of Commons Work and Pensions Committee, *Intergenerational fairness: Third Report of Session 2016–17,* November 2016

4   House of Commons Work and Pensions Committee, *Intergenerational fairness: Government Response to the Committee's Third Report of Session 2016–17,* January 2017

report provides the Intergenerational Commission's findings, in order to support both policy thinking within government and the Commission's consideration of policy recommendations.

Net contributions over the lifetime of cohorts born from 1906 to 2000 are assessed using historic spend, broken down by age, on the three key elements of welfare – education, health and social security. This is coupled with tax revenue data from the same period. To develop a full lifetime for most cohorts, patterns of both spend and revenue are projected forward to 2114 based on OBR and Office for National Statistics (ONS) projections and assumptions.

For context we begin by setting out the demographic and fiscal trends that underpin our analysis.

It's both how long people live and the size of cohort they were born into that matter from a fiscal perspective

Given the pattern of spend by age outlined above, we can expect that an ageing population, one with an increasing share of older people relative to those of working age, is likely to place increasing pressure on welfare spending – in particular health and pensioner social security.

Figure 3 illustrates this potential shift in the 'old-age dependency ratio' (the population age 65 plus relative to the working age population) via population pyramids. In 2000 there were 36.6 million people of working age compared to 9.1 million aged 65 plus. By 2030 those numbers are projected to be 41 million and 15 million respectively. This represents a significant shift in the ratio of the older population to the working age population.

Figure 3: **Population estimates and projections by generation: GB, 2000 & 2030**
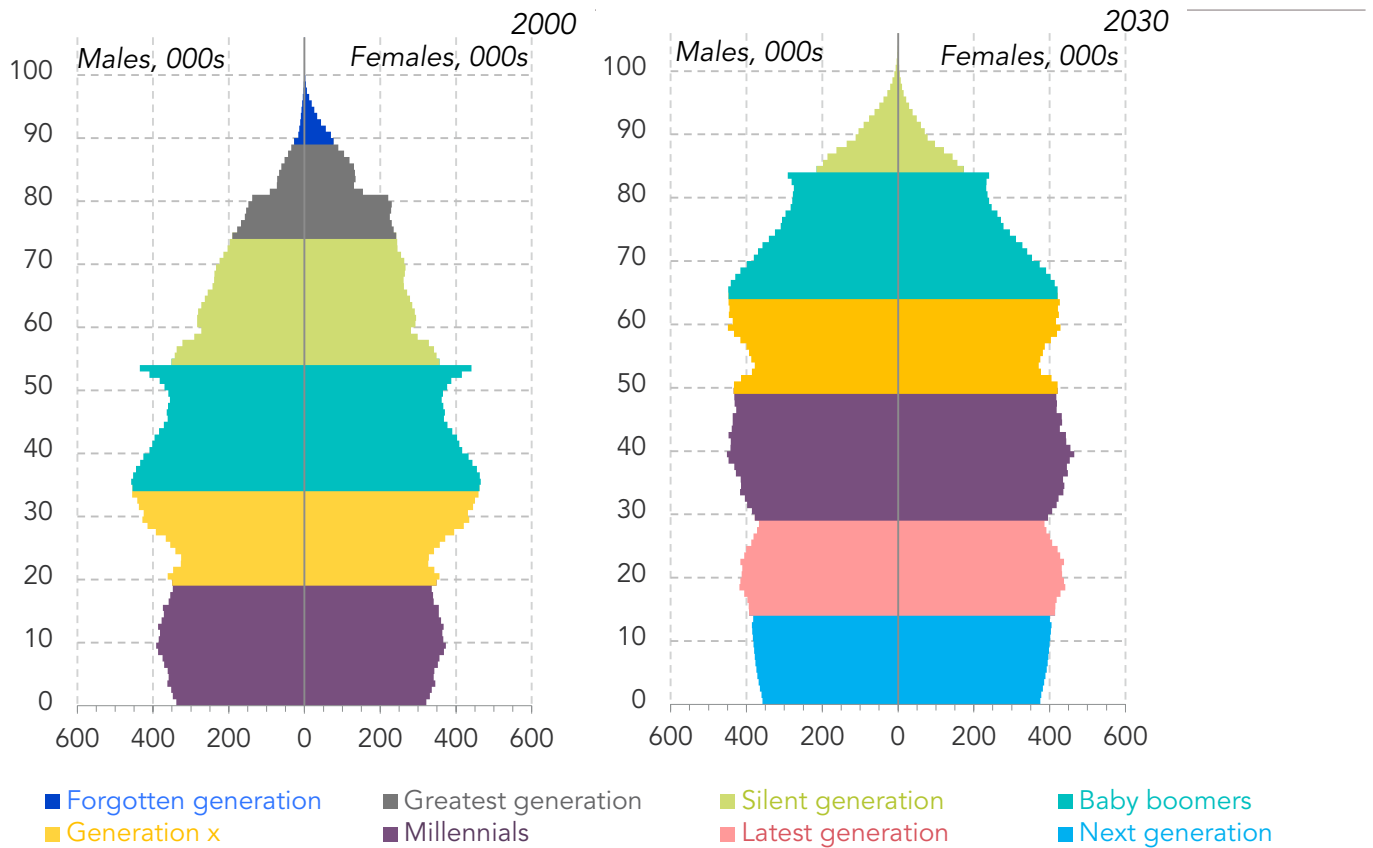
Source: ONS, *Mid-year population estimates 2005*; ONS, *2016-based population projections*

This shift is partly a reflection of increasing longevity, and of course we should remember that as people live for longer the working life is likely to lengthen and health outcomes at given ages improve, reducing the validity of a traditional dependency ratio measure. However, looking beyond the question of longevity, over the next two decades the relative size of the baby boomer generation moving into and through retirement accelerates the long-term ageing of the UK's population (and increases in the dependency ratio) over and above the effects of longevity.

Reflecting back on the life-cycle tax and spending picture shown in Figure 2, it is clear that in a welfare state like the UK's that is run on a 'pay as you go' basis – with the broad intention that tax revenues in a given period fund spending in that period – differently-sized cohorts create challenges. Specifically a bigger cohort like the baby boomers can, in theory at least, benefit from a lower per-head tax burden associated with supporting the smaller cohorts of pensioners ahead of them, and the smaller cohorts of children that follow. The flipside is that a large cohort potentially puts pressure on those smaller ones that follow – an average of 140,000 fewer millennials were born each year than baby boomers[5] – to contribute greater per-head tax revenues to support a larger older population.

The challenges that cohort size brings should not be seen as intractable, however, and the recent trend of increasing numbers of people working to older ages is just one way

5   L Gardiner, *Stagnation generation: The case for renewing the intergenerational contract*, Resolution Foundation, July 2016

in which society can adapt. In particular, future policy decisions will play a key role in determining the fair distribution of resources between generations. With adults of all ages expressing concerns about the living standards of today's younger generation,[6] there is a clear imperative for policy makers to consider this group's interests in particular when determining the distribution of revenue and spending.

Baby boomers also happened to be born during the establishment of the modern welfare state

Figure 4 shows actual UK welfare spending as a share of GDP since 1912, together with OBR projections up to their current horizon of 2066.

Figure 4: **Historic and projected welfare spend as a proportion of GDP: 1918-2066**
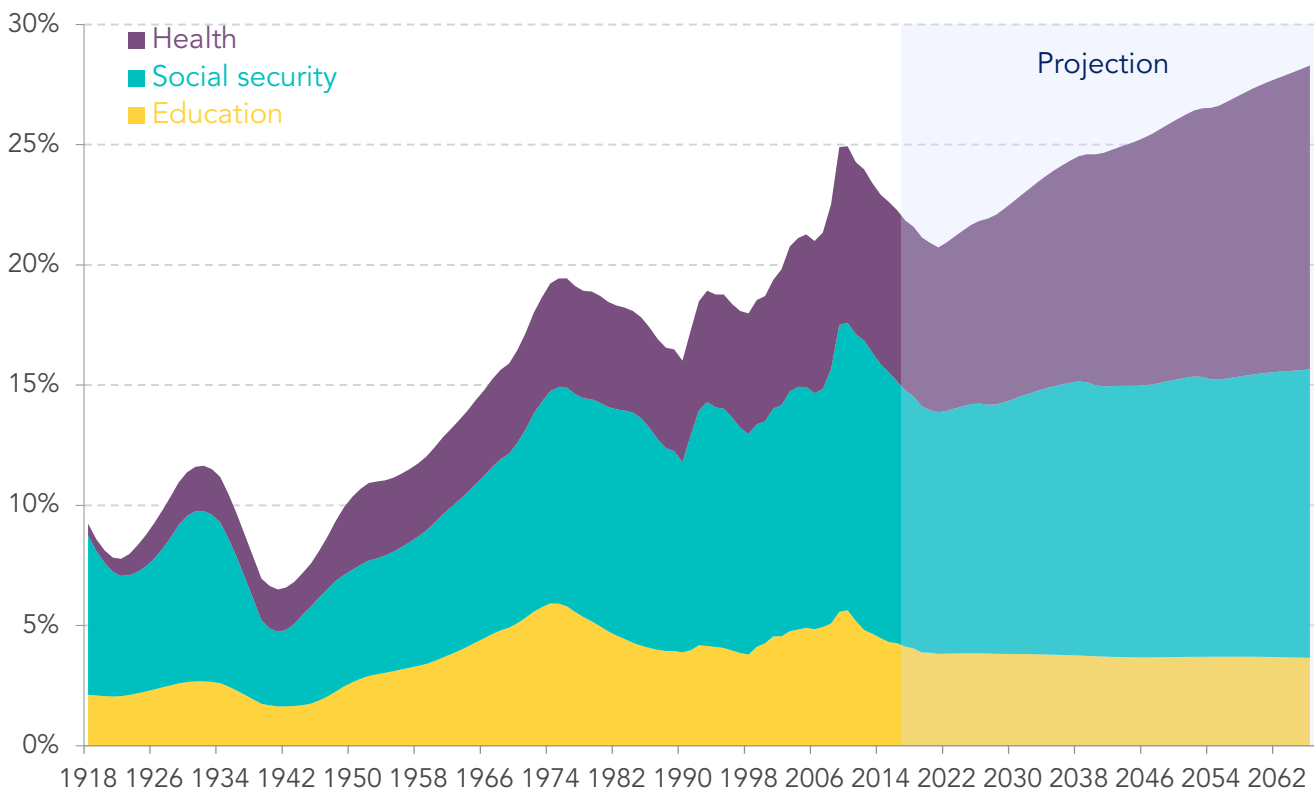
Notes: Data for years prior to 1966 are presented as a five-year rolling average. Total spend is based on the categories used in Hills (2004) so do not map precisely to ONS/HMT/OBR totals in the same spend category.

Source: RF analysis using OBR, *Economic and Fiscal Outlook November 2017*; ONS/HM Treasury, *PESA – various;* Hills, *Inequality and the State, 2004*

Before the Second World War, welfare state coverage was limited mainly to small pension and unemployment payments, with restricted coverage. Healthcare was provided almost entirely by the private and voluntary sectors, and high-quality healthcare was unevenly

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6   H Shrimpton, G Skinner & S Hall, *The Millennial Bug: Public attitudes on the living standards of different generations*, Resolution Foundation, September 2017

spread across the country.[7] Unemployment benefits and old-age pensions began to be provided by the state rather than the voluntary sector after the Old-Age Pensions Act 1908 and National Insurance Act 1911, but they remained small as a share of GDP and subject to intrusive and inconsistent means-testing until the late 1930s.

From the mid-1940s onwards the UK experienced a rapid post-war increase in the share of national resources allocated to health, education and social security. Together, spend on these three largest components of the welfare state reached 20 per cent of GDP by 1974.

In the last forty years the overall level of welfare state spending has fluctuated with economic and political cycles and shifting demographics. For example falling education spend in the early-1980s reflected smaller birth cohorts, but then spend did not rise as the child population grew into the early-1990s. The late-1990s saw the beginning of largely policy-driven increases in spend across all elements of the welfare state. Most recently, spend peaked in the years after the financial crisis, reflecting the automatic stabiliser effect of social security and to a lesser extent a shrinking economy.

Looking ahead, OBR projections suggest that spending on education will remain broadly constant over the next 50 years at 3.8 to 4 per cent of GDP. Social security spending is forecast by the OBR to rise by around 2 percentage points of GDP over the same time period, a rise almost entirely accounted for by state pension spending. Health spending, which is far more sensitive to changes in technology and demographics, is set to grow by far more, reaching 12.6 per cent of GDP in 2066 in the OBR's central spending projections, up from 7.3 per cent in 2016-17. Overall increases in welfare state spending reflect a growing older population, but in the case of health it is also expected that per-head health costs will grow at a faster rate than productivity (as they have done in the past, see Box 1).

Tracking withdrawals and contributions to the welfare state by age

Such historical and future trends in spending clearly highlight how different cohorts will have experienced a welfare state with differing levels of generosity at different points in their lives. Members of the silent generation grew up in an era when 7 to 12 per cent of GDP was spent on the welfare state, but entered working life in an era when welfare state spending (and hence associated taxes) would near-double as a proportion of GDP, with tax rates rising and the tax base being substantially expanded across the working population in this period. Translating these high-level trends into the net contribution or withdrawal across a cohort's lifetime therefore requires a more granular investigation.

To build a cohort profile of the generosity of the welfare state over the lifetime we estimate spend on each welfare component by age-group in each financial year from 1906 to 2016 – and tax contributions by age over this period – using available outturn data. In our first scenario, which follows Hills' approach, we then project future welfare spending forwards to 2114 based on long run OBR assumptions, to project full lifetimes for cohorts born up to the millennium. In each financial year in the projection period, we assume that a matching level of tax revenue is collected, creating an effective 'pay as you go' system where taxes raised in a given year 'fund' welfare expenditure in the same time period. Tax liabilities are allocated by age in line with projected population distributions

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7   N Timmins, *The Five Giants: A Biography of the Welfare State,* 3rd edition, 2017

at each point in time, holding constant the age profile of taxation estimated for 2016-17 using outturn data, but adjusted for a rising State Pension age. Further details of the methodology can be found in Annex A.

It is important to note that in this first scenario our assumption that tax revenue will match welfare spend in any given year means that in years where spend grows, revenue will also grow. As we discuss below, ultimately, over the long run an outcome that requires spend to rise indefinitely would be unsustainable. However, over our forecast period growing revenues are assumed in order to maintain a welfare state of the level of service that is experienced across the age range today, while holding national debt constant. In reality one or more of these factors is likely to give.

This approach only considers the lifetime experience of individual single-year-of-age cohorts in total or on average, and says nothing about the experiences of individual members within them. Therefore we will not capture any changes in the distribution of spending and revenue-raising *within* generations. Intra-cohort inequalities have been explored extensively in other papers for the Intergenerational Commission, however.[8]

Below we set out the cumulative value of support from the welfare state by cohort and age for each element considered in our analysis – education, social security and health spending; and tax revenues. These initial estimates are presented as a share of GDP per capita for each surviving member of the cohort. Converting spend to GDP per capita allows a relative comparison of the value of support from the welfare state over a long period of time, reflecting the resources dedicated to each element at a given point in time. The per-person approach allows us to understand the relative generosity of the welfare state experienced by different generations over their lifetimes for each cohort member – it strips out the effect of cohort size. As such it does not show the relative level of total spend at those ages, which is also dependent upon the size of the cohort population at each moment in time. We would expect total spend increases to slow at the very oldest ages given the small number of survivors at those ages.

Education spend by cohort

Figure 5 shows the cumulative spend on education by cohort, expressed as a share of GDP per capita per cohort member, for selected five-year cohorts born since 1906. The 1956-60 cohort, and those that followed, experienced far higher levels of investment in education than older cohorts, since total education spending tripled as a proportion of GDP between the inter-war period and 1976, when it reached 5.9 per cent of GDP, as shown in Figure 4.

Variation in generosity by cohort either overall or at specific ages tends to reflect historic policy choices. For instance, the 1976-80 cohort experienced a drop-off in generosity of support between ages 11 and 18 compared to predecessors, with some catch up at older ages. This largely reflects the fall in total education spending from an average 5.5 per cent of GDP a year in the 1970s to an average of 4.0 per cent of GDP a year in the 1990s.

8   For example, see: A Corlett, *As time goes by: Shifting incomes and inequality between and within genera-tions*, Resolution Foundation, February 2017; C D'Arcy & L Gardiner, *The generation of wealth: Asset accumu-lation across and within cohorts*, Resolution Foundation, June 2017; D Finch & L Gardiner, *As good as it gets? The adequacy of retirement income for current and future generations of pensioners*, Resolution Foundation, December 2017

Figure 5: **Cumulative education spend per cohort member, by age**
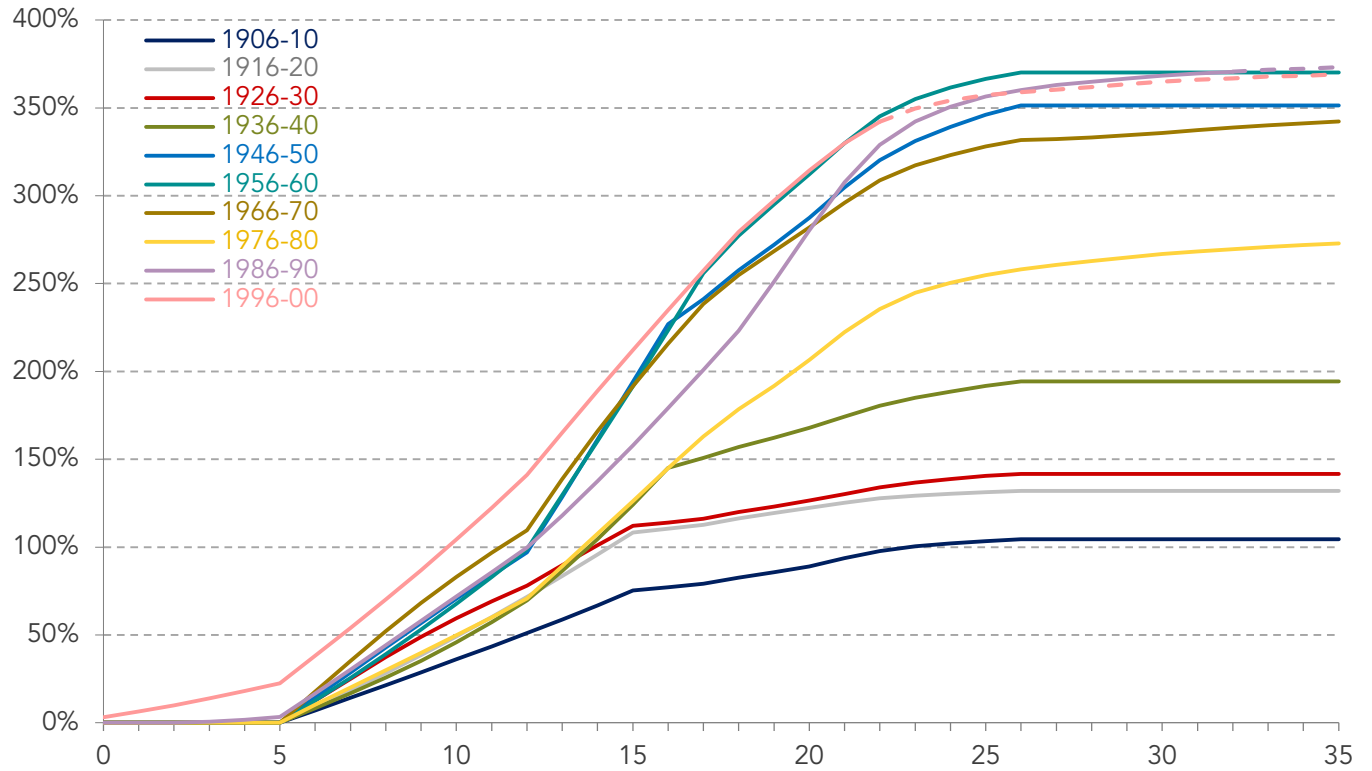
Share of GDP per capita, five-year cohort average

Notes: Solid lines show outturn; dashed lines show projection.
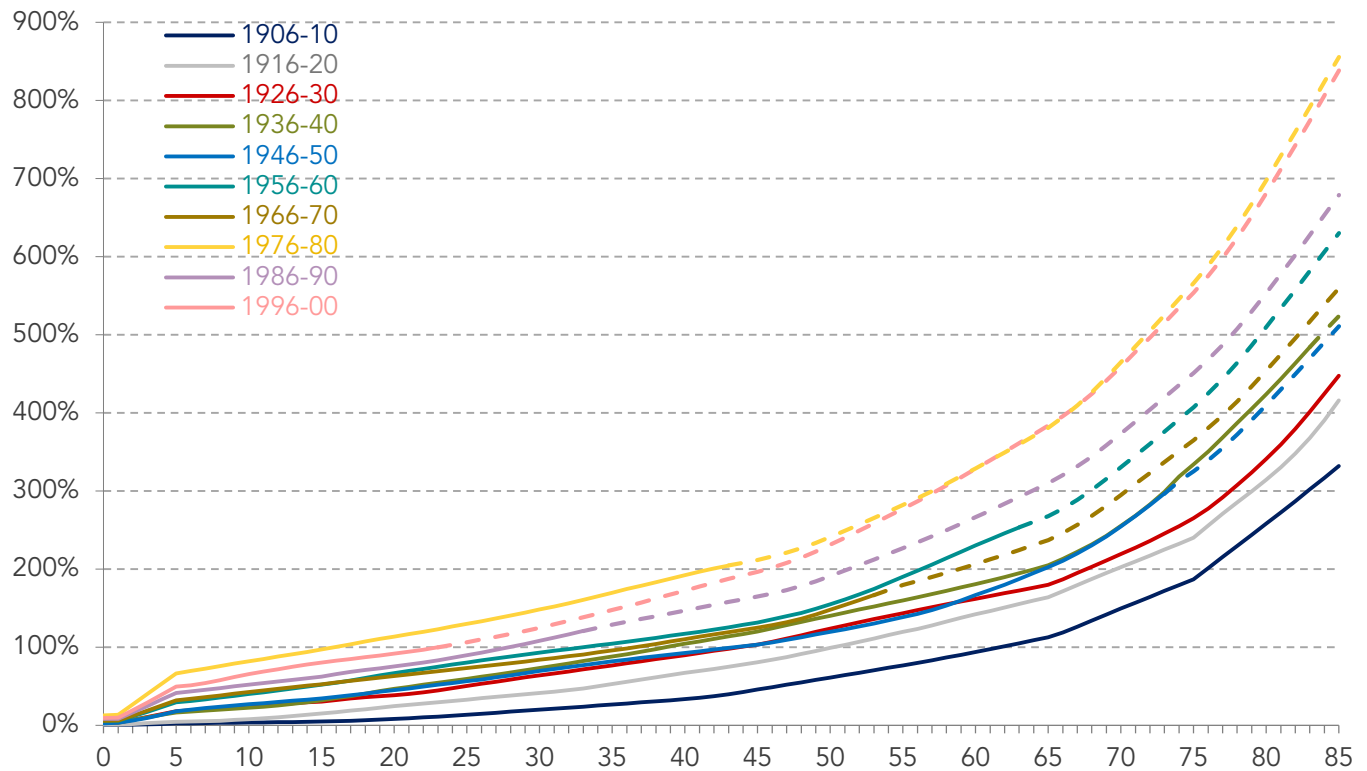
Source: OBR, *Economic and Fiscal Outlook November 2017*, ONS/HM Treasury, *PESA – various*; ONS, *Mid-year population estimates* ONS, *2016-based population projections*; Hills, *Inequality and the State, 2004*

Health spend by cohort

Figure 6 shows the cumulative spend on health for these same cohorts, again expressed as a share of GDP per capita per cohort member. There is a similar pattern to education, except that those born pre-1945 and living to older ages benefit from the establishment of the NHS over their lifetimes, whereas they largely missed out on increased spending on education.

Figure 6: Cumulative health spend per cohort member, by age

Share of GDP per capita, five-year cohort average

Notes: Solid lines show outturn; dashed lines show projection.

Source: OBR, *Economic and Fiscal Outlook November 2017*, ONS/HM Treasury, *PESA – various*; ONS, *Mid-year population estimates* ONS, *2016-based population projections*; Hills, *Inequality and the State, 2004*

There is a noticeable and continual increase in costs for each generation, reflecting both the historical pattern of spend, and an explicit assumption in the OBR projection that health costs will grow faster than productivity (discussed further in Box 1). These assumptions drive growing per head health spending as a share of GDP (to maintain constant generosity in terms of levels of service) for successive cohorts.

i   Box 1: Projecting the future costs of health care

The Office for Budget Responsibility (OBR), in its annual *Fiscal Sustainability Report* (FSR), models two main sources of pressure on future health spending:

» Demographics, and in particular the rising older population; and,

» Non-demographic cost pressures, including techno-logical advances that make healthcare more expensive; the shifting prevalence of different illnesses; and income effects where people spend more on health as their incomes rise.

To account for increasing longevity, the OBR assumes for every year of increased life expectancy that half is healthy and half is not. This is effectively a halfway house between assuming that health spend at given ages remains constant even as longevity rises, and an assumption that health costs only materialise in a given number of years immediately prior to death and so they just get pushed back rather than increasing overall.

In recent decades UK health spending has increased as a proportion of GDP, rising by 3.8 per cent per year on average since 1978-79, in real terms.[1] The OBR's September 2016 working paper *Fiscal sustainability and public spending on health* found that demographic change could only explain a small part of the increase in health spending in recent decades, with non-demo-graphic cost pressures dominating. The report concludes that non-demographic pressures are likely to continue to be the main driver of spending increases in the future, particularly since health technology developments 'have generally been cost-escalating rather than cost-con-taining'. However, future OBR projections are particularly sensitive to assumptions about the path of non-demo-graphic cost pressures.[2]

Similarly, a range of studies – by the OECD (2013), IMF (2010), European Commission (2015) and others – have forecast that health spending will continue to increase as a proportion of GDP in the long term.[3] The OBR's

projections indicate that over the fifty-year period to 2066, health spend is set to grow by an average 0.24 per cent a year as a share of GDP, reaching just over 8 per cent of GDP due to demographic pressures alone. With additional cost pressures on top of demographic change that rises to an average of 1.5 per cent a year, reaching almost 13 per cent of GDP in 2066 – a real terms increase of 73 per cent. Such assumptions have large effects on spend over the long term and clearly carry significant uncertainty.

Clearly a different assumption about growth in health spending will also affect the future generosity of the welfare state by cohort. Figure B1 shows the lifetime cohort generosity of health spend in a scenario in which no ratchet applies to health care costs.. Relative to Figure 6 there is a significant fall in cost increases between successive cohorts in the projection period.

Figure B1: Cumulative health spend per cohort member, by age: 'demographic pressures only' scenario

Share of GDP per capita, five-year cohort average
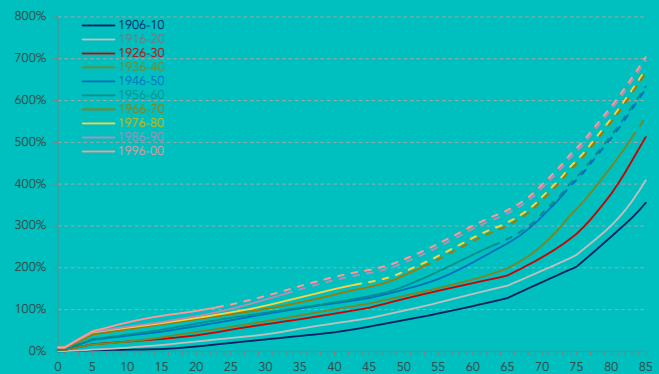
Notes: Solid lines show outturn; dashed lines show projection.

Source: OBR, Economic and Fiscal Outlook November 2017, ONS/HM Treasury, PESA – various; ONS, Mid-year population estimates ONS, 2016-based population projections, Hills, Inequality and the State, 2004

1   M Licchetta & M Stelmach, *Fiscal sustainability and public spending on health*, Office for Budget Responsibility, September 2016

2   Ibid.

3   OECD, *Fiscal Sustainability of Health Systems: bridging health*

and finance perspectives, 2015; IMF, *Macro-fiscal implications of health care reform in advanced and emerging economies*, 2010; European Commission, 'The 2015 Ageing Report: eco-nomic and budgetary projections for the 28 EU member states (2013-2060)', *European Economy* 3, 2015

Social Security spend by cohort

Figure 7 shows the cumulative spend on social security (the working age and pensioner benefit system) per cohort member, again for cohorts born since 1906. It shows that there has been a clear cohort divide as to the generosity of working age support with cohorts since the baby boomer generation experiencing higher levels of support than older generations. During working life the generosity of social security spending per head has increased for each cohort since the baby boomers, reflecting both growth in provision for working families – in various forms, from Family Credit to Universal Credit – and higher levels of spending during economic downturns.

For pensions the picture is more complicated. To a large extent it reflects the fact that while average per head generosity remains at similar levels, the rising State Pension age means younger generations start to receive that support from an older age.

Figure 7: **Cumulative social security spend per cohort member, by age**
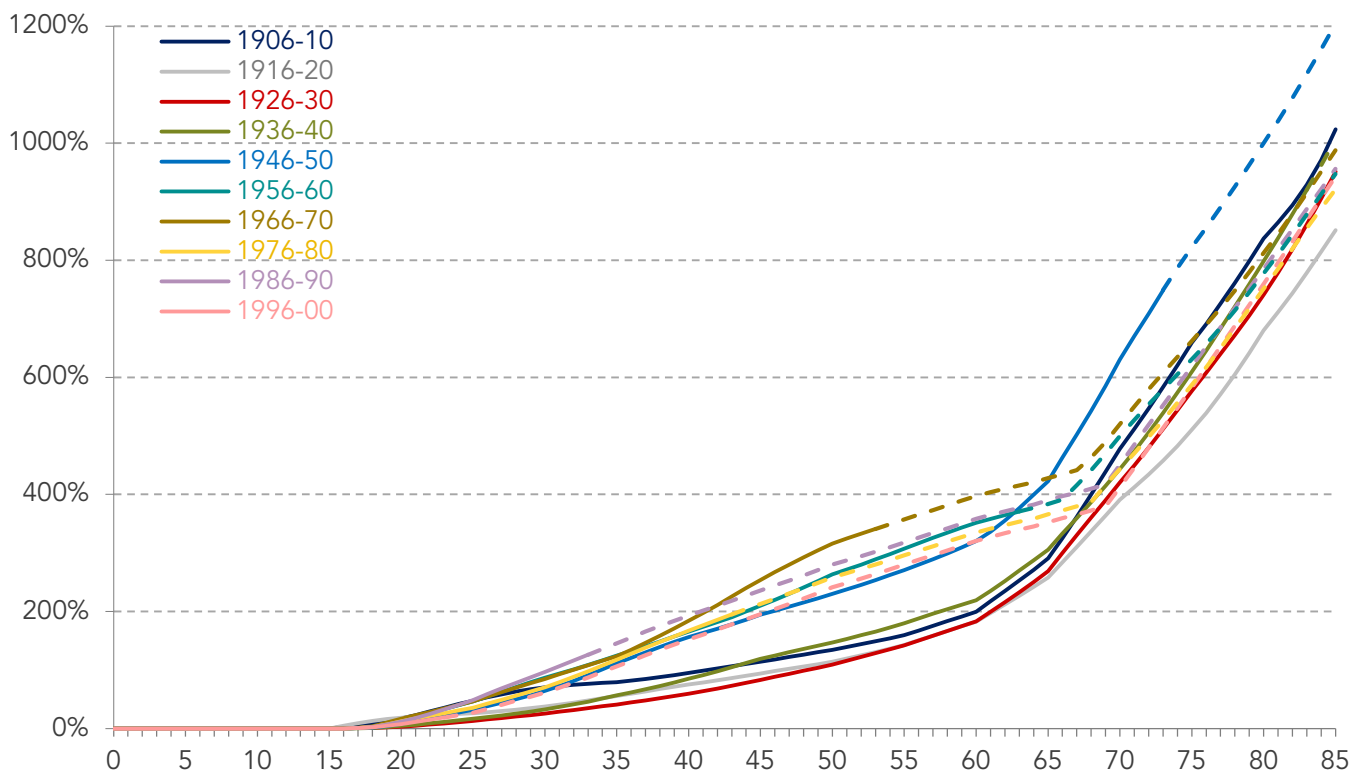
*Share of GDP per capita, five-year cohort average*

Unlike healthcare spending, and in line with OBR projections, we do not project an increasingly generous social security system (in GDP per capita terms) for successive generations in the future on a per cohort member basis. This partly reflects the squeeze on working-age support that we see today (as well as a lesser effect from low levels of and rates of change in unemployment) reducing generosity for millennials. Figure 8 sets

out the historical and near term projected path of social security spend split by support for pensioners and working age households. From 2016-17 the path of support for these two groups has been diverging, while prior to this some of the fall in working age spend reflected the economic cycle. Pensioner benefits have largely been protected, if not boosted via the triple lock, and in turn per head spend is being maintained, gradually rising to 2022. By contrast working age support, set to be reduced by over £12 billion a year by 2020, is falling in generosity on a per head basis.

Figure 8: **Welfare spending per person by age group**

Indices of real-terms welfare spending per person (GDP deflator-adjusted: 2010-11 = 100)
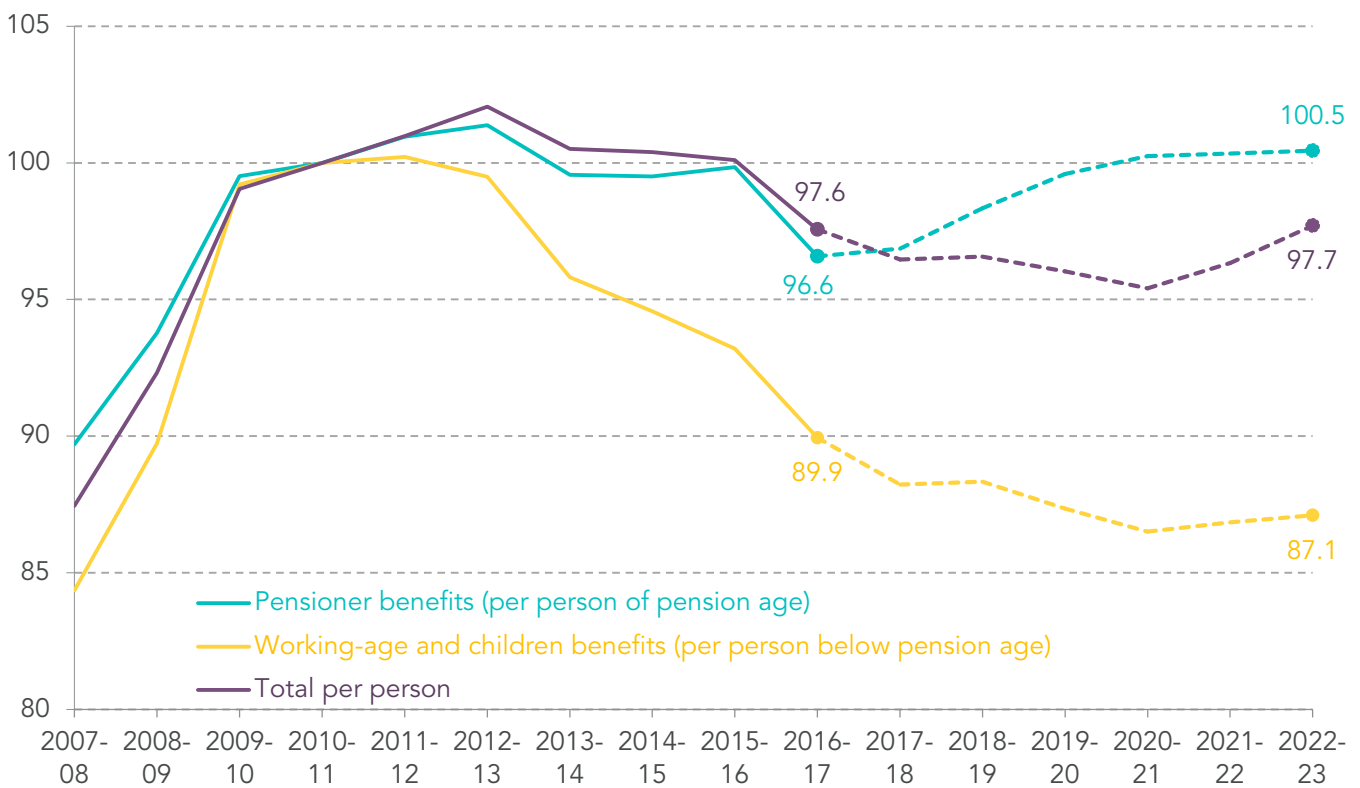
Sources: DWP, Autumn Budget 2017 Expenditure and Caseload Forecasts; ONS, Mid-year population estimates ONS, 2016-based population projections

Over the longer term the generosity of the state pension system on a per-head basis is expected to remain broadly flat relative to GDP per capita, and that comes despite an assumption that the triple lock remains in place. The long-term driver of the rise in total spending that was shown in Figure 4 is a growing older population, to some extent offset by projections for the State Pension age to rise in line with life expectancy.

Tax revenue by cohort

Finally, Figure 9 shows the cumulative tax revenue paid by cohorts over their lifetime, on the same basis as the previous three figures. Tax revenue is defined in our methodology as a combination of National Insurance, income tax, indirect taxes and inheritance tax (set out in more detail in Annex A).

Figure 9: **Cumulative tax revenue per cohort member, by age**
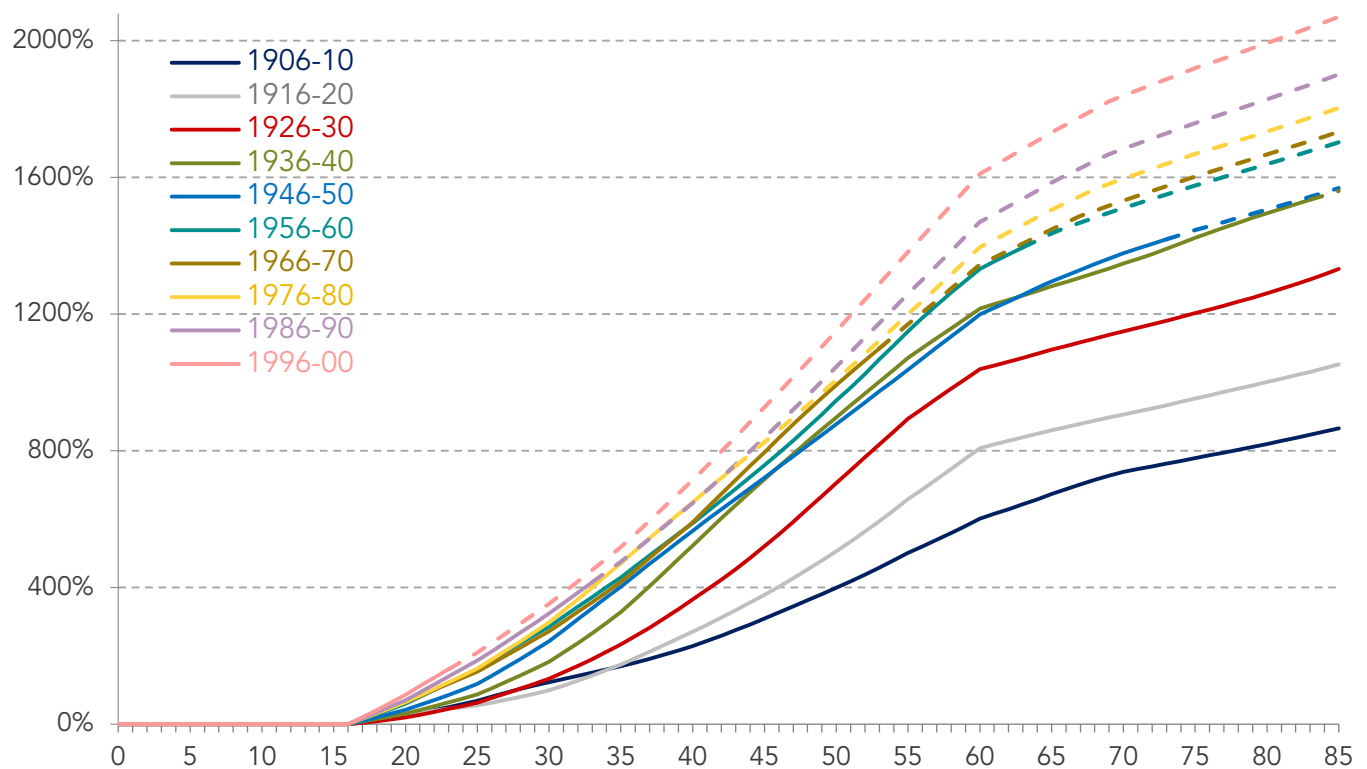
Share of GDP per capita, five-year cohort average

Notes: Solid lines show outturn; dashed lines show projection.

Source: OBR, *Economic and Fiscal Outlook November 2017*, ONS/HM Treasury, *PESA – various; ONS, Mid-year population estimates* ONS, *2016-based population projections*, Hills, *Inequality and the State*, 2004

There was a rapid increase in total tax revenues paid by working age people during the Second World War, and total tax revenue persisted after the war at a permanently higher level.[9] The level of tax paid by successive generations has increased as the welfare state has developed, with the largest cohort-on-cohort change taking place between the 1916-20 cohort (part of the greatest generation) and the 1936-40 cohort (part of the silent generation), as a result of both higher tax rates and a broader tax base.

9   In 1939, income taxes were paid by 10 million people, at a standard rate of 29 per cent, with a surtax of 41 per cent for incomes over £50,000. By 1944-45 the number of people liable for income tax had increased to 14 million, at a standard rate of 50 per cent, with a surtax of 48 per cent for incomes over £20,000. Pay-As-You-Earn (PAYE) was introduced in 1944 to help administer this new higher and broader tax system. See: HM Revenue & Customs, *World War II and PAYE*, 1999

Tax rates and tax bases have changed less rapidly in more recent decades. The two main upcoming changes will be driven by changing longevity (and the associated extension of working lives) and changing cohort sizes. First, those born between 1936-40 and 1956-60 have tended to pay larger overall amounts of tax towards the end of their working lives, largely due to the rise in State Pension age for these cohorts, and higher employment rates at older ages.

Second, the overall level of tax paid by younger generations reflects the greater overall level of welfare spending that we assume is paid from 2010-20 onwards to support a larger older population.

Third, the variation in the total level of taxation paid over the working life for baby boomer to millennial cohorts reflects variations in their cohort sizes. Each member of a smaller cohort tends to make a relatively greater contribution than those from larger cohorts. This outcome stems from our assumption (discussed above) that taxes raised in any given year are sufficient to fund welfare spending in that year, an assumption that may run into problems in reality, as we discuss below.

Net welfare withdrawal over the lifetime

Each of the components above reflect the interactions with the welfare state on a GDP per capita basis for each surviving cohort member. Combining that per member generosity with the size of the cohort in each year provides an estimate of the total withdrawal from and contribution to the welfare state over a cohort's lifetime.

To illustrate the pattern of contribution and withdrawal over the lifetime, Figure 10 sets out the cumulative growth of health, education and social security spend, less tax payments, for the 1976-80 birth cohort. The red line indicates the cumulative net withdrawal for that cohort as it ages. Importantly we only have outturn data for the youngest members of that cohort up to the age of 35. Beyond that point the path of net withdrawal, and the contributions to and withdrawals from the welfare state that underlie it, is entirely projection-based, drawing from population projections and projected support from the welfare state.

Figure 10: Cumulative net lifetime withdrawal from the welfare state by component for the 1976-80 cohort, by age

Share of GDP per capita, five-year cohort average
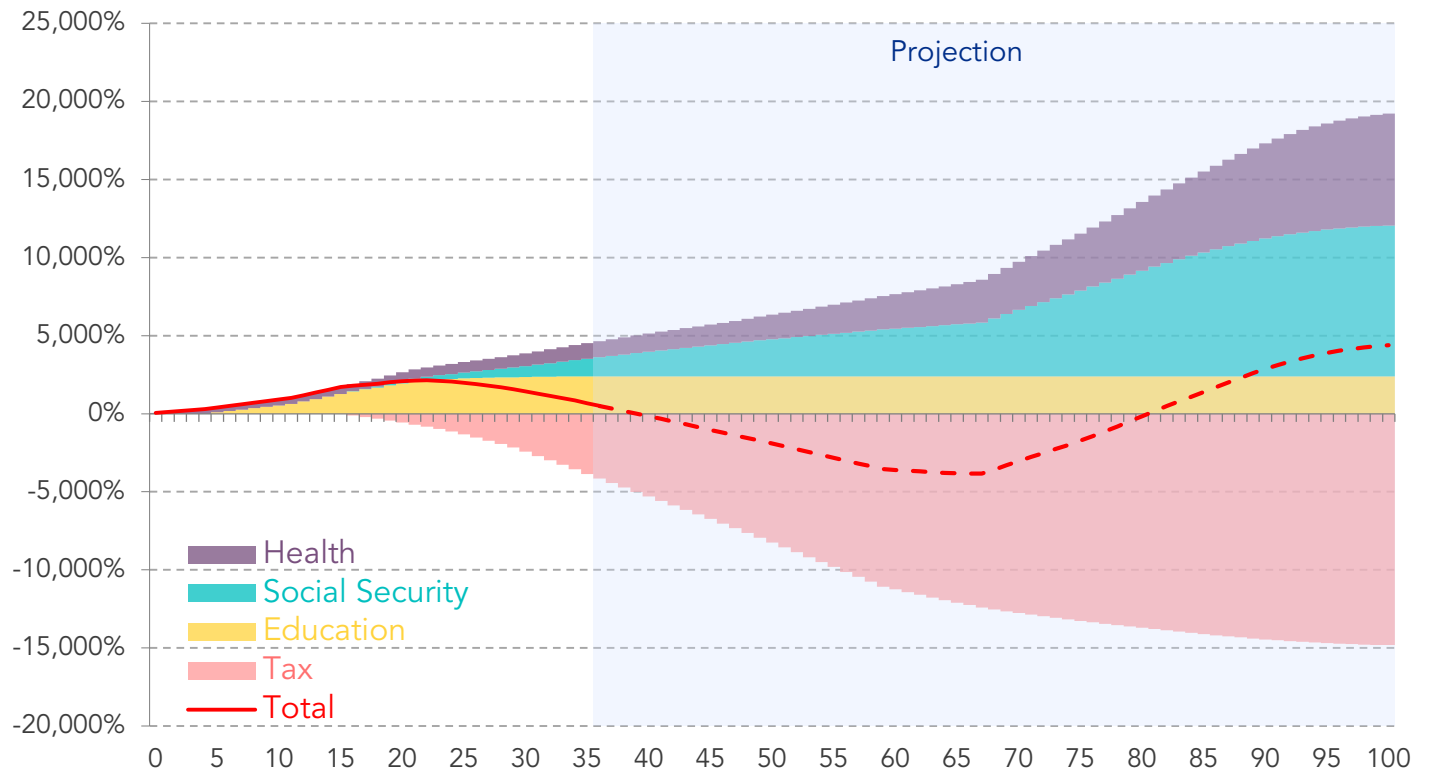
Notes: Solid lines show outturn; dashed lines show projection.

Source: OBR, *Economic and Fiscal Outlook November 2017*, ONS/HM Treasury, *PESA – various; ONS, Mid-year population estimates* ONS, *2016-based population projections*, Hills, *Inequality and the State*

The overall pattern is as we might expect. First there is a cumulative net withdrawal during childhood, which switches to a net contribution after the cohort has paid tax for some years. The peak net contribution is reached by the end of the working life, at which point the cohort starts withdrawing again through health and pensions. The pace of withdrawal slows at the oldest ages because, although generosity on a per cohort member basis is growing, the proportion of the cohort still alive falls rapidly. The cohort reaches a 'cost neutral' point at age 80. Further years of provision at older ages mean the cohort becomes a net withdrawer.

To date most cohorts are net contributors but, under our first set of assumptions, are expected to be net withdrawers by the end of lifetimes

Figure 11 compares the cumulative path of net withdrawal from the welfare state by cohorts over their lifetime. This measure does not control for cohort size, so the total withdrawal by larger cohorts may appear to be greater than that of smaller cohorts.

Figure 11: **Cumulative net lifetime withdrawal from the welfare state by age and cohort**

Share of GDP per capita, five-year cohort average
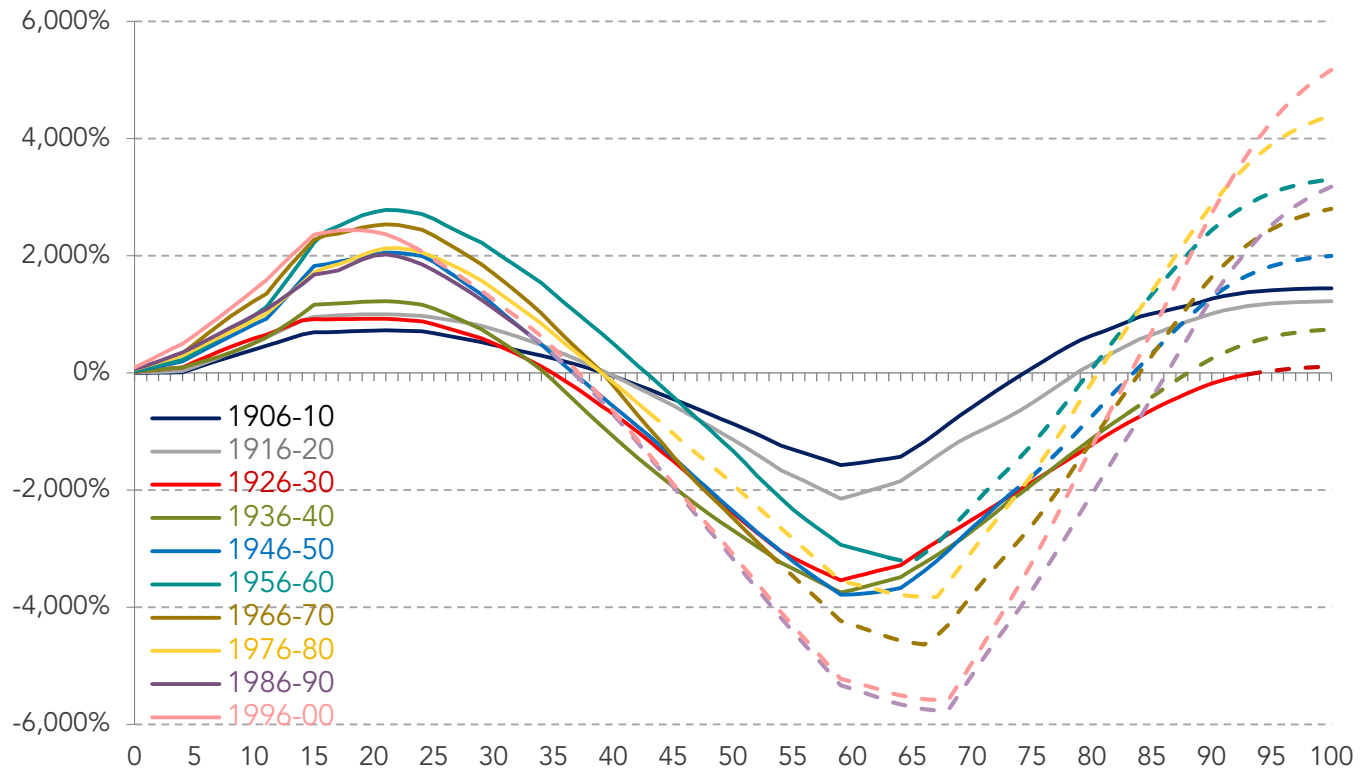
Notes: Solid lines show outturn; dashed lines show projection. Cohort total is an average for the five year birth cohort

Source: OBR, *Economic and Fiscal Outlook November 2017*, ONS/HM Treasury, *PESA – various; ONS, Mid-year population estimates* ONS, *2016-based population projections,* Hills, *Inequality and the State*

The dashed lines show where our analysis uses projections rather than outturn data. Because the majority of these cohorts are only part of the way through their working life most are net contributors to date.

Looking across the entirety of the data – outturn and projection – the broad pattern we have seen for the 1976-80 cohort remains. That is, cohorts are net withdrawers when young and old, turning into net contributors during working life. Importantly, all cohorts are projected to be overall net withdrawers, with this outcome being driven by our assumption that the generosity of the welfare state is maintained into the future.

Beyond this central implication of our assumptions, there are some key differences between cohorts:

• The oldest generations, birth cohorts 1906-10 and 1916-20, experience noticeably smaller levels of both support and taxation throughout their lives. They are net withdrawers because they have called on the established welfare state in old age.

- Cohorts from the baby boomer generation onwards tend to make much greater contributions during working life, but also have relatively high net withdrawal during old age. This reflects the increasing costs of pensions (due to a larger older population) and health spending (due to both a larger older population and increasing costs per head).

- The silent generation are an exception to the rule, making a relatively large contribution during working life but being the cohort closest to taking out only as much as they put in.

For the silent generation this outcome is very much related to their birth coinciding with the development of the modern welfare state. The 1936-40 birth cohort started to reach working age in the mid-1950s. They therefore helped to pay for more generous education provision than they received, and paid higher taxes to fund the pensions and health care of older generations they followed. These two factors almost entirely offset the more generous pension and health provision the silent generation experience themselves.

For the generations that follow baby boomers, the increasing net contribution throughout their working life reflects our assumption that they will need to provide ever greater funds to support a growing older population, comprising the cohorts that precede them. This result stems from our two assumptions that in each financial year withdrawals from the welfare state are matched by contributions, and that health spending increases faster than GDP per capita.

This first assumption also drives the fact that in this scenario, younger cohorts switch to being the biggest net withdrawers by the end of their lives. More of them live for longer and experience a welfare state that grows in generosity. It is future cohorts who are assumed to pick up this ever-rising tab in the taxes they pay during working life.

This growing tax burden at working ages highlights that maintaining current levels of welfare state generosity for future cohorts will eventually be likely, in reality, to run into political realities: precisely what level of taxation should be levied, and who should pay it. In other words, we do not present these projections with a view that they will necessarily happen. Rather, they demonstrate the long-term challenges stemming from the UK's current and future demographic mix in combination with how we prioritise different elements of the welfare state today. As such, we later consider an alternative set of spending assumptions under which welfare state spend does not grow in this way.

First, and taking the analysis one step further, we next express the total lifetime net withdrawal per cohort member. This controls for greater total spend among larger cohorts simply due to their population size.

Maintaining the generosity of today's welfare state in future would mean millennials fare well, but at an increasing cost to generations that follow

Figure 12 builds on the analysis above – where we assume that the level of service from the welfare state is maintained into the future – showing the net withdrawal from the welfare state for each cohort over their lifetime incorporating outturn and projected data. The younger the cohort, the greater the extent to which estimates are based on projections. Expressed as a share of GDP per capita per cohort member, when aged 15 to 19, this reflects the net generosity of the welfare state over a cohort's lifetime while accounting for the size of that cohort as it reaches working age.

Figure 12: **Cumulative net lifetime withdrawal from welfare state per cohort member, by cohort**

Share of GDP per capita
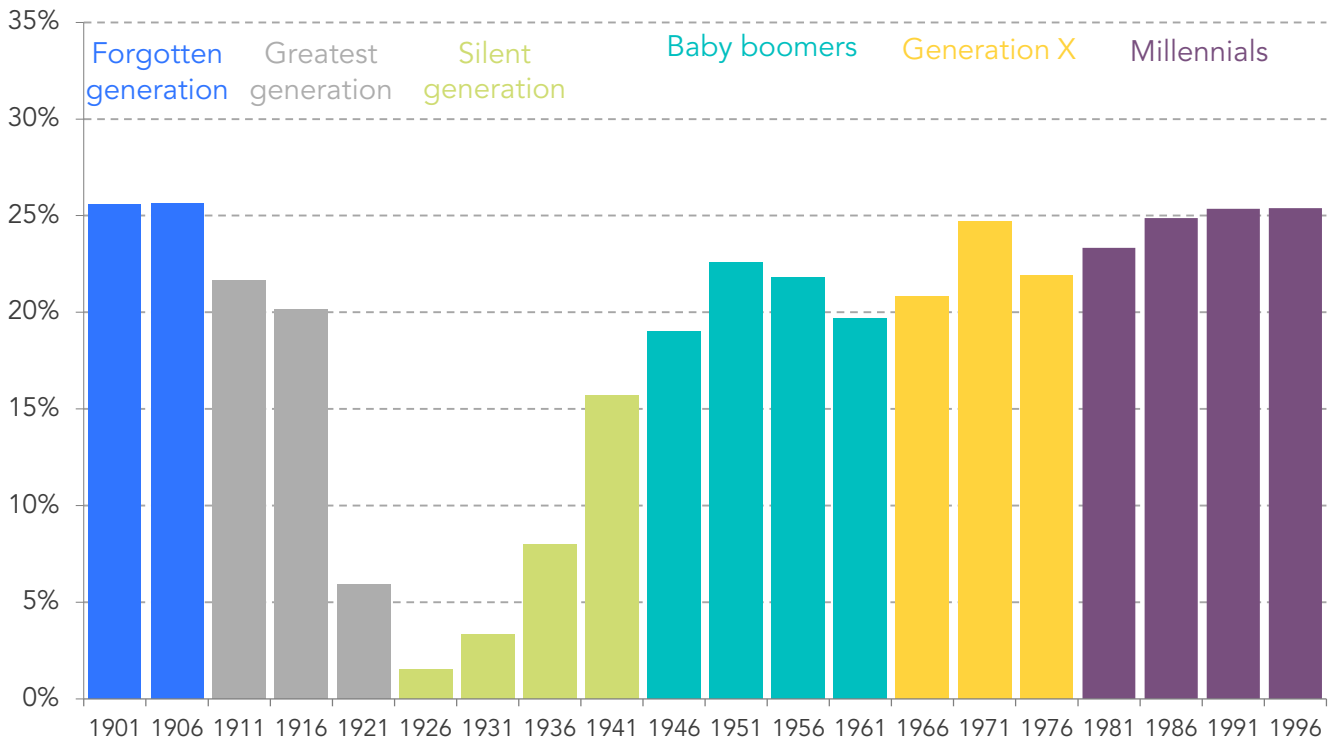
Notes: Solid lines show outturn; dashed lines show projection.

Source: OBR, *Economic and Fiscal Outlook November 2017*, ONS/HM Treasury, *PESA – various; ONS, Mid-year population estimates* ONS, *2016-based population projections*, Hills, *Inequality and the State*
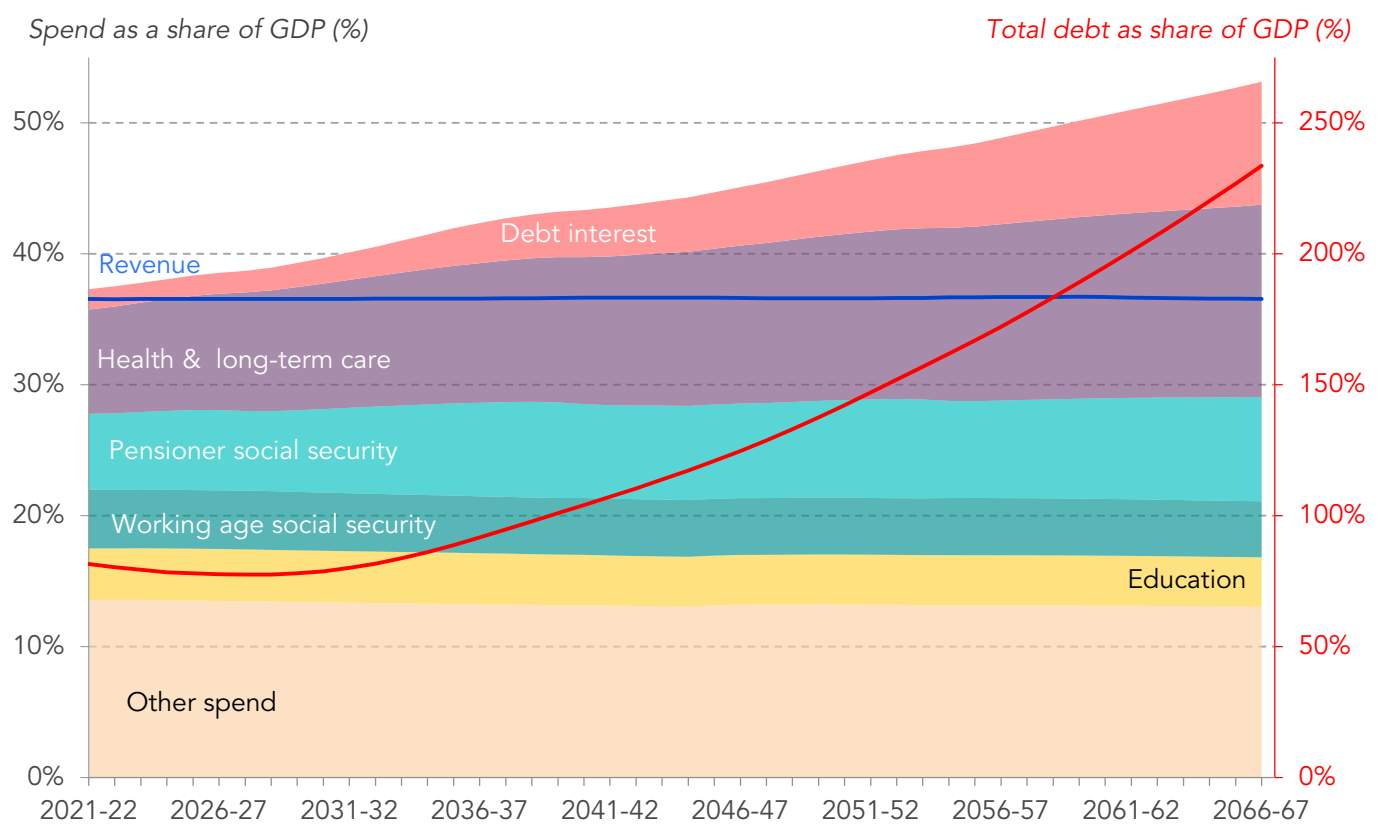
It is clear that the silent generation fare worst. This is due to this generation receiving similarly low levels of spend on their education to other pre-war cohorts, but then in working life bearing the taxation burden of building the welfare state for the generations that follow.

Under this set of assumptions, the net withdrawal for millennials and generation X remains broadly similar to that of baby boomers. But this is only because the increasing cost of servicing their health and pension needs is being met by the generations that follow them. Those growing age-related costs are also great enough to more than offset the additional tax that each of these cohorts pays during their working life to support the generations ahead of them. In this model we are essentially passing the burden of funding the future welfare state onto younger generations, who in turn will face an ever rising tax burden. But as we discuss below, these results – driven as they are by our assumptions – will be likely to run into problems in practice.

The implied path of spend for the future welfare state is unsustainable

The surplus received by the baby boomers and generations that follow is effectively an additional cost passed onto future generations. Figure 13 sets out the OBR's own assessment of what committing to this level of spend would mean on an annual basis from 2016 to 2066, highlighting the key elements of the welfare state. The key difference to the analysis above is that the OBR assume there is no adjustment to the tax take to account for growing levels of spend on the welfare state.

Figure 13: Long-run path of spend, revenue and debt: 2016-2066

Spend as a share of GDP (%) — *Total debt as share of GDP (%)*

Debt interest
Revenue
Health & long-term care
Pensioner social security
Working age social security
Education
Other spend

Notes: Projections are based on 2014-based population projections and do not account for outturn or policy change since January 2017.

Source: OBR, *Fiscal Sustainability Report – January 2017*

As discussed previously, an ageing population and increasing health costs are driving a growing share of GDP to be spent on the welfare state. If total taxation were increased to fund this spending, then tax would rise to nearly 45 per cent of GDP by 2066-67. Such a significant increase in the tax burden – which is implied by our assumption in the modelling above that future taxpayers meet growing costs – appears challenging at the very least, although it would mean shifting the UK's tax take close to levels seen in other developed countries such as the Netherlands or Germany.[10]

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10   OECD, *General government revenue, OECD data 2015*

The OBR's incorporation of the latest government policy decisions into its modelling leads it to an assumption that future taxes do not rise to match growing spending. Like elements of government provision which are assumed to remain broadly stable in relation to current per head value, the incidence of future taxes also remains in line with that of today. However, because over the longer term health costs are expected to rise faster than GDP, and the older population will grow much more quickly than that of working age, the share of GDP being raised via taxation remains broadly flat in coming decades, as shown by the blue line in Figure 13, while health and pension spending increase.

The implication of assuming a broadly consistent tax profile alongside rising welfare spend is that in the OBR's long-term forecasts, the national debt as a share of GDP grows to reach over 230 per cent by 2066. This itself has significant generational consequences, given the accompanying projection that payments to service that debt will rise to over 9 per cent of GDP a year – eventually becoming larger than total spend on pensioner benefits.

Holding to such a positon is likely to be similarly politically and practically challenging as the option of an ever rising tax rate. To avoid such an outcome, the OBR has estimated that getting the long-term debt path on track to reach a ratio of 40 per cent of GDP by 2066 could mean either a one-off tightening of 2.8 per cent of GDP in 2026-67 or 1.1 per cent of GDP per decade. Both these estimates assume that the current deficit is closed first.[11]

Returning to our results summarised in Figure 12, our measure of net withdrawal can also be interpreted as the amount of additional tax each cohort would need to pay to have taken out of the welfare state precisely what they put in. In this sense, the results stemming from our first set of assumptions illustrate the drivers of such increasing spend and highlight the challenging question as to where the burden of providing such a welfare state would ultimately lie.

A relatively large shift in the tax burden may not appear immediately achievable. This would be the case particularly when under the current incidence of tax it would be those of working age who have the bulk of their working life ahead of them, millennials especially, who were expected to shoulder the additional taxation.

By the same logic the baby boomer generation, who are already entering retirement, have few significant tax-paying years left. But that would mean millennials, and the generations that follow supplying the additional revenue to plug the surplus not only of their own generation, but also the ones they follow. Delaying any adjustment to the tax burden or generosity of the welfare state would imply a growing debt that will ultimately be serviced by future generations – be it through interest payments, higher taxes or lower state spend.

Yet the resources available to older generations, including accumulated pension and housing wealth, mean that the ability of these cohorts to increase their own lifetime contribution should not be ruled out. This is particularly the case given that the tax system to date has failed to capture the significant historical growth in household assets, and our modelling assumptions place the majority of the tax burden on those of working age.

In a world in which employment rates continue to rise or technological progress drives strong economic growth, such revenue-raising challenges would appear far less problematic. But these outcomes are hugely uncertain, and even with strong GDP growth the challenge of potential above-GDP health cost inflation would remain. A more fundamental rebalancing in the deal between generations is likely to be needed.

11   It should also be noted that these estimates relate to OBR calculations from their Fiscal Sustainability Review from January 2017. It is likely that the precise estimates will have changed since then, though we can expect the overall scale of updated projections to remain the same.

At the other extreme, in a world in which spend per head remains the same, younger cohorts would lose out to baby boomers

Our projections on this first set of assumptions – increasing the taxation or debt burden on future generations for ever more – appear infeasible in the very long run and challenging in the shorter term future. Therefore we consider a second scenario in which today's welfare spend per head is held constant (in GDP-per-capita terms) in all future years.

In effect, we strip out the rising cost of health which plays such a large role in increasing total future spend. In doing so we assume that the quality of future care would fall, in relation to the progress in health provision that might be expected given the historical path of growth in healthcare costs and the commensurate improvements in quality. As above, we continue to assume that the future age profile of taxes remains in line with the distribution today, and that tax revenues match welfare spending in any given financial year.

Figure 14 shows each cohort's net withdrawal under this alternative assumption. The most obvious and important change is that the net withdrawal for millennials is greatly reduced. This reflects the much lower per-head spend on health costs assumed here than in the results presented in Figure 12. Indeed, the net withdrawal for millennials is more on a par with the silent generation than baby boomers or generation X.

Figure 14: **Cumulative net lifetime withdrawal from the welfare state by cohort member: 'welfare spend held constant' scenario, measured relative to GDP per capita**
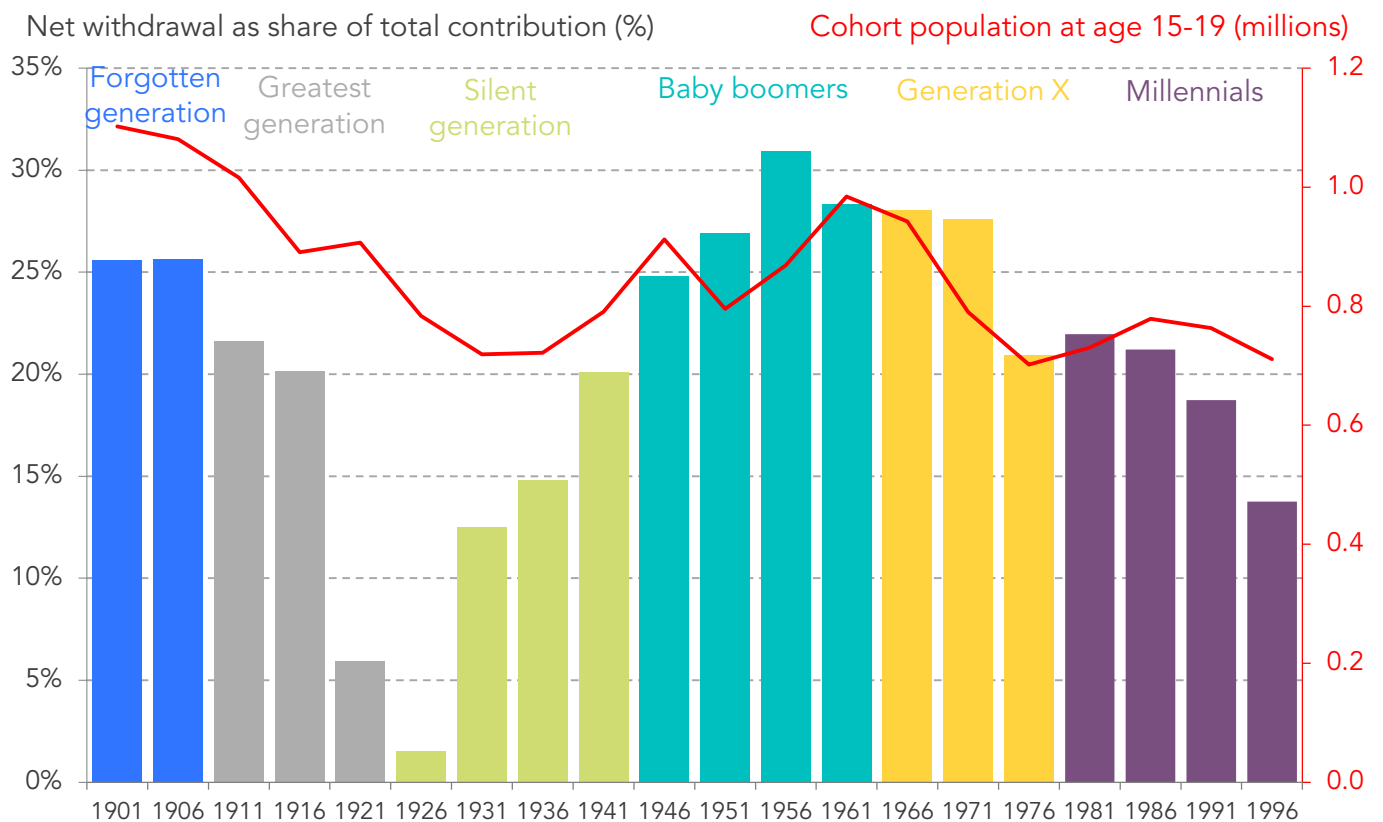
Source: OBR, *Economic and Fiscal Outlook November 2017*, ONS/HM Treasury, *PESA – various; ONS, Mid-year population estimates* ONS, *2016-based population projections*, Hills, *Inequality and the State*

For baby boomers the total net withdrawal is slightly reduced because they experience lower State Pension and health spending than in the above scenario. Future cohorts would remain net withdrawers overall largely because the growing lifespan of each successive cohort still passes a growing cost onto the generations that follow them, albeit a much smaller one than under our first set of assumptions.

Figure 14 also plots the number of births in each cohort as a proxy for cohort size. It is notable that fluctuations in net withdrawals between cohorts closely match birth rates, driven by the greater burden on smaller generations (the silent generation and the millennials) that have to support larger ones behind and ahead of them when they are at peak tax-paying ages. In this sense, this scenario where future welfare spending is held constant relative to the size of the economy and population demonstrates the all-else-equal advantages of being born in a big generation in welfare states funded on a 'pay as you go' basis.

While this second scenario would create a path towards a more sustainable future in terms of taxation or debt levels, the trade-off is a less generous welfare state for future generations, particularly in relation to health provision. At the same time this means that those generations experiencing a less generous welfare state, the younger cohorts of generation X and millennials, are also making a greater contribution over their working life to support the larger baby boomer generation when in old age.

This position would in principle appear untenable. It implies that millennials both accept less generous provision in old age, while getting less support, and that they shoulder a greater tax burden during their working life, over and above the change which is already underway in the form of large working age welfare cuts. It would be an inequitable re-negotiation of the social contract between generations, particularly when older generations today, as a whole, have access to other significant resources via their housing and pension wealth.

Conclusion

The UK's welfare state provides citizens with essential support, with the entire population likely to interact with the education, health or social security systems over their lifetimes. In essence, the welfare state is the embodiment of the social contract that exists between generations.

Yet a combination of cohort size, longevity, policy changes and the economic cycle can mean that some generations are set to do better than others from this social contract. Our assessment suggests that the silent generation is likely to benefit the least, due to their cohort size and the fact they were born well before much of the modern welfare state was constructed. By contrast, in both our modelling scenarios the baby boomers do relatively well. The outlook for younger generations is less certain, and our scenarios underscore the tension that the UK now faces between a rising tax burden, rising national debt, and reduced welfare generosity for younger cohorts.

In considering which path to take, there is the opportunity to question one assumption that has endured throughout this analysis: that any additional tax burden implied by future welfare spending should fall on working age populations. This is particularly the case given cohorts now entering retirement have wealth levels at each age that exceed those of both previous retirees and generations that follow. Previous research for the Intergenerational Commission has demonstrated that the UK's tax system has failed to capture any of the gains from huge increases in household wealth relative to the size of

the economy over the past half-century.[12] The analysis in this paper suggests that such an oversight may no longer be tenable, and forthcoming policy papers for the Intergenerational Commission will explore what could be done to expand the UK's tax base in this direction.

Looking ahead, the welfare deal between the generations is under increasing strain. A failure of successive governments to truly grapple with the pressures of rising longevity, exacerbated by the large size of the baby boomer generation now entering retirement, makes the aspiration of providing future generations with a welfare state of today's generosity a challenging one. It is vital that government now considers how best to distribute available resources today and into the coming decades to ensure fairness across generations (and of course within them as well).

This is a renegotiation that will be easier if more is done to boost future productivity and get the lifetime earnings of millennials back on track. Policy options to this end are explored in a forthcoming policy paper for the Intergenerational Commission. Additionally, furthering the longer working lives agenda by positively supporting people to work to older ages will help by boosting older cohorts' lifetime incomes and ultimately their contribution to the welfare state. A forthcoming paper for the Intergenerational Commission will explore the role of policy in this area too.

It is of course entirely possible that other events and developments will change the outlook considerably, but it is important that government understands and considers the scenarios implied by long-term tax and spending projections as it makes policy today. A more detailed analysis of how to address the national debt and ensure more widely that future generations can enjoy a prosperous society will be discussed in a future report for the Intergenerational Commission on 'social inheritance'.

This report has highlighted crucial challenges regarding the sustainability of the welfare state for future generations. It provides new perspectives on the intergenerational impact of current policy plans, which the Intergenerational Commission will consider as it works towards a set of recommendations designed to ensure fairness between generations in the years to come.

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12   C D'Arcy & L Gardiner, *The generation of wealth: Asset accumulation across and within cohorts*, Resolution Foundation, June 2017

Annex A: Method

All figures and analysis in this report from 1996 onwards cover the UK as a whole, in years prior to that estimates are on a GB basis, estimates are adjusted to remain in line with GB level estimates. However, this makes little difference to the overall results because the main findings are calculated on the basis of GDP per capita. Below we set out in more detail some of the main assumptions and data sources underpinning our analysis. Patterns of welfare spend are based upon historic outturn data and projections. Tax revenue is assumed to equal that total welfare spend in each future year, applying the age distribution of how that tax revenue is collected.

Historical and projected changes in health spending

Health spending by cohort for years to 2001 is sourced from Hills' original work. Total health spending for 2004-05 to 2016-17 is taken from the 'medical services' line in the Public Expenditure Statistical Tables (PESA), and divided across single-year-of-age cohorts according to their relative size.

For years between 2016-17 and 2020 we use the OBR projection for aggregate health spending from their Economic and Fiscal Outlook, applying the long term growth trend from the 2017 Fiscal Sustainability Review.

Per head spend in future years is based on per head estimates presented in the OBR's Fiscal Sustainability Report), 2017. These are then increased to account for health costs across the entire population to grow at a faster rate than GDP growth (which may weight away from the older population if the greatest future advances and costliest treatments are concentrated among health problems for the older population). Finally total health costs are calibrated in line with the OBRs long term trend.

Historical and projected changes in education spending

Similar to data for health spending, historical education spending is sourced from Hills' original work for years up to 2001. Spending totals are drawn from PESA for nursery and higher education for 1997 to 2016, and for primary and secondary education for 1999 to 2016. The yearly spends on each of the nursery, primary and secondary education budgets are divided up by single-year-of-age, again according to the relative size of each single-year-of-age cohort. The number of people enrolled in higher education by single-year-of-age is calculated from the Labour Force Survey, figures which are used to divide the age incidence of higher education spending across the 18 to 34 age distribution (across which we assume the whole higher education budget is spent). For years from 2017 onwards we align with the latest Economic and fiscal Outlook and then increase spend with the trend from the January 2017 Fiscal Sustainability Review. In each year spend is apportioned by single years of age based on population estimates of people aged 2 to 34, with that spend weighted to account for the relative generosity of spend for nursery, primary, secondary and higher spending according to their relative proportions in the last outturn year (2016).

Historical and projected changes in social security spending

As for health and education spending, outturn data for social security spending prior to 2001 is mostly sourced from Hills' original work. We consider spending on the major areas of social security: state pensions, housing benefit, tax credits, unemployment benefits and disability benefits. Spend on children is apportioned to the parent based on the distribution of children in working age households by age. Outturn data related to the pattern of spend by age from 1998 to 2016 on each type of social security is sourced from the Department for Work and Pensions' (DWP's) Spring Budget 2017 Expenditure and Caseload Forecasts, and historical administrative data sources. Total spending on each type of social security from 2017 to 2021 is drawn from the DWP's forecasts, aligned with the latest Economic and Fiscal Outlook, and then increased with the overall trend from the January 2017 Fiscal Sustainability Review. For years from 2022 onwards we apportion future spend by age based on the distribution of spend by age from outturn data for 2016, adjusting for State pension age rises and, over the very long term, the introduction of the new State Pension which results in flat rate spend per head once fully in place (plus additional payments for other pensioner benefits, the largest of which is disability).

Historical and projected changes to individual sources of taxation

This study divides the taxes used to 'fund' the welfare state (education, health and social security) in to four categories: income tax, national insurance (employee NICs), indirect taxes (including VAT, stamp duties, vehicle taxes and alcohol duty) and inheritance tax.

The total revenue required in each year is equal to the total spend on the welfare state. We then assume that all employee NICs (employer NICs are included within the indirect tax pool in line with the historical approach) are used to finance welfare state spending, and that the balance of funding required is made up from the other three categories of taxation in proportion to their relative sizes.

Total tax revenue data for each category of tax comes from past editions of the Treasury Blue Book.[13] The indirect tax category is derived from a government accounting code (D2) for total taxes on production and imports paid to central government, local government and the European Union. Pre-2001 data is taken from John Hills' original work, in which figures were provided for every five years. We interpolate the tax revenue in each intervening year by stepping up revenue in equally-sized increments. Outturn data from 2002 to 2016 is taken from OBR documents. Projections for tax revenues from 2017-22 use the OBR's five-year forecast. Tax revenues from 2023 onwards are uprated by projected population change for each single year of age.

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13 Office for National Statistics, *UK National Accounts, The Blue Book time series dataset,* October 2017

Figure 15: **Government revenue as a percentage of nominal GDP: 1916-2016**
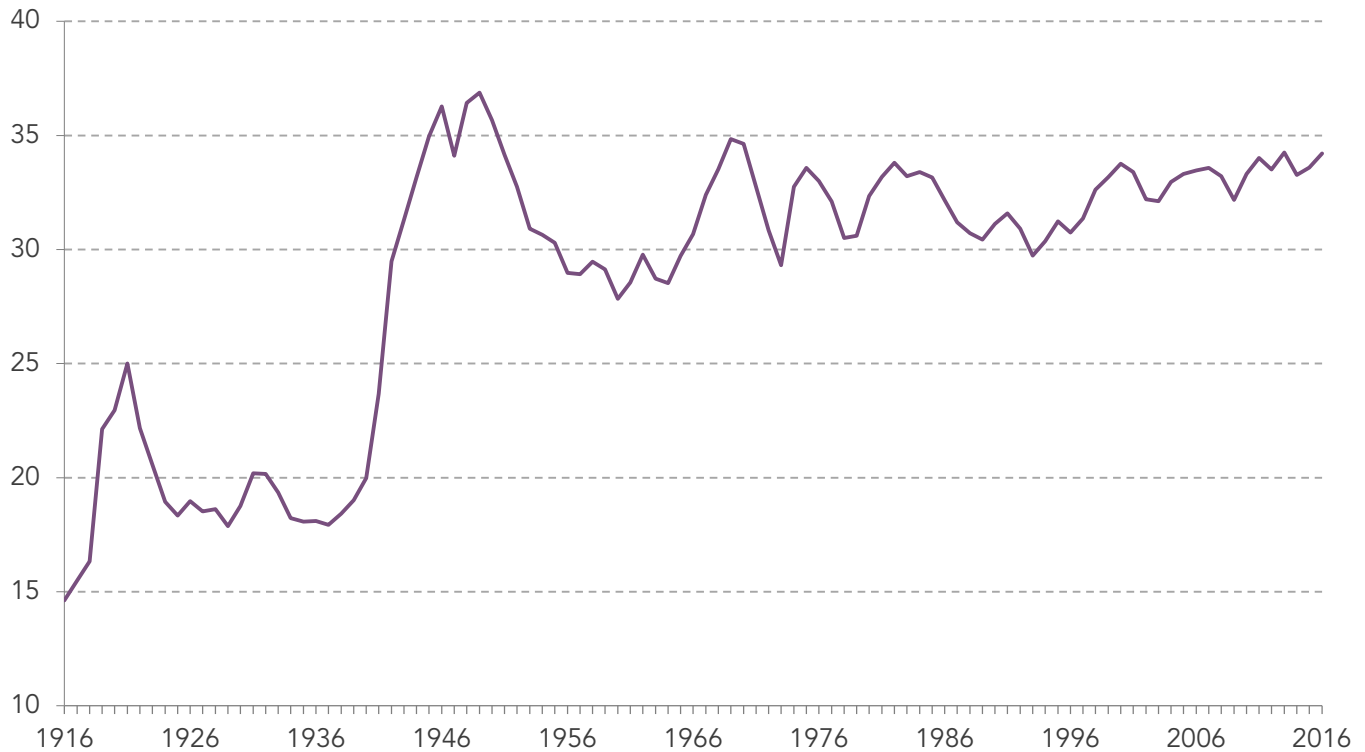
Source: Bank of England

Having calculated the total revenue from each tax that finances welfare state spending in each year, we then allocate the incidence of these taxes across the population by single year of age. Data for population size by single year of age comes from the ONS's UK and regional population estimates, 1838-2015.[14] We use the central ONS population projections when forecasting future cohort sizes, and use ONS cohort life expectancy tables to capture past and future changes in longevity. In all instances we adjust our estimates to account for changes in the State Pension age which usually involves maintaining the share of tax paid at one year before State Pension age.

Age splits for the revenue from individual taxes are taken from yearly HMRC and ONS data for the period 1999 to 2015. Information on tax incidence by age (or even income by age) is, in general, scant. Earlier incidence studies from the 1930s and 1940s cited by Hills (1995) concentrated on incidence by income not age group. Historic estimates draw on and utilise the original approach undertaken by Hills (1995) with some minor adjustments to align with latest outturn data, or where appropriate historic outturn data that can be used to adjust the original method.

National insurance revenues by single year of age are spread across the 16 to State Pension age group using the same age breakdown as for income tax incidence, for all

14   Office for National Statistics, *UK and regional population estimates 1838 to 2015*, 2016

years up to 2009. From 2010 onwards we increase the upper boundary of the employee NIC-paying population to reflect the equalisation and then rise of the State Pension age to 66 and beyond, keeping pace with longevity improvements in the long run.

For **income tax** revenues from 1999 to 2015 we use an HMRC age breakdown of tax revenue by five-year age band, assigning the revenue from each five-year age band (data which originates from the Survey of Personal Incomes) to single years of age according to the population size in each year.[15] We assume all income tax is paid by people aged from 16 to 99 years. For years prior to 1999 we use the age incidence profile for income tax from the 1999-2000 financial year, scaling revenues according to single year of age population size. For years from 2016 onwards we use the age split by single year of age calculated from the HMRC's age breakdown for 2014-15.

To calculate the age split for **indirect tax** revenues for each year from 1977-2015, we first calculate a working-age/pensioner share of from each year's indirect tax incidence data in the Effects of taxes and benefits on UK household income (ETB) statistical bulletin. Revenues are then apportioned between the two age groups by single year of age according to population size. For years before 1977 and beyond 2016 we apply the same approach scaling single-year-of-age incidence by population share.

Lastly, the age breakdown for inheritance tax, for 2001-2014, is derived from HMRC data on inheritance tax payable by age band of deceased. The HMRC data is converted from 10-year age bands from ages 45 plus to single years of age applying ONS Deaths statistics. In historic and future years we utilise ONS estimates and projections of the incidence of death adjusted for the incidence of inheritance tax payments from outturn data.[16]

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15   HM Revenue & Customs, *Distribution of median and mean income and tax by age range and gender*, March 2017

16   HM Revenue & Customs, *Inheritance tax statistics: Table 12.5 - assets in estates by gender, age and marital status of deceased*, July 2017