Office for
**Budget Responsibility**

# Fiscal risks and sustainability

September 2024

CP 1142

# Office for Budget Responsibility: Fiscal risks and sustainability

Presented to Parliament by the
Exchequer Secretary to the Treasury
by Command of His Majesty

September 2024

CP 1142

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# Foreword

The Office for Budget Responsibility (OBR) was established in 2010 to examine and report on the sustainability of the public finances. A central feature of our efforts to meet that remit has been finding better ways to capture and communicate economic and fiscal risks. Ever since our first *Economic and fiscal outlook* (*EFO*) in 2010, we have emphasised the degree of uncertainty around our central forecasts by using probabilistic ranges ('fan charts'), alternative scenarios, and sensitivity analysis. Since 2011, our *Fiscal sustainability reports* (*FSRs*) presented not only long-term projections of the public finances but also sensitivity analysis to changes in key demographic, macroeconomic, and other assumptions. Between 2017 and 2021, we also produced a biennial *Fiscal risks report* (*FRR*), setting out the main risks to the public finances, including macroeconomic and specific fiscal risks.

In the January 2022 update to the *Charter for Budget Responsibility*, Parliament amended the OBR's remit to, in effect, give us greater discretion to determine the content of our annual sustainability report, which had previously alternated between the long-term projections in the *FSR* and the focus on risks in the *FRR*. Since July 2022, we have published our combined analysis in an annual *Fiscal risks and sustainability* report (*FRS*), which incorporates both our biennial long-term projections and updated analysis of major potential fiscal risks. As required under the *Charter*, the Treasury responded to our most recent July 2023 report in November 2023.[1]

In this, our third *FRS*, we focus on three risks to the long-term fiscal outlook: the potential economic and fiscal costs of climate-related damage; the impact of changing health trends on the public finances; and an updated set of long-range fiscal projections, including alternative scenarios concerning productivity and migration.

This report was initially scheduled for publication on 2 July. Due to the General Election that was announced on 22 May and took place on 4 July, we postponed its release to 12 September. This delay did not alter the content of our report which is based on our March 2024 *Economic and fiscal outlook* and government policy as it stood at the time of the 2024 Spring Budget presented by the previous Government on 6 March 2024.

The analysis and projections in this report represent the collective view of the independent members of the OBR's Budget Responsibility Committee. We take full responsibility for the judgements that underpin the analysis and projections, and for the conclusions we have reached. We have been supported in this by the full-time staff of the OBR, to whom we are as usual enormously grateful.

We have also drawn on the help and expertise of officials across numerous government departments and agencies, including HM Treasury, the Bank of England (in particular Lukasz Krebel, Danae Kyriakopoulou and Dooho Shin), the Climate Change Committee, the Department for

[1] HM Treasury, *Government response to the 2023 Fiscal Risks and Sustainability Report*, November 2023.

Environment, Food and Rural Affairs, the National Infrastructure Commission, the Department for Work and Pensions, the Department for Education, the Government Actuary's Department, the Chief Medical Officer, the Department for Health and Social Care and NHS England. We are very grateful for their insight.

In addition, we have benefited from discussions with experts from outside government. In particular, we would like to thank the Network for Greening the Financial System's partner academic consortium, Paul Watkiss and Associates, The Health Foundation, Madeleine Sumption, Alan Manning, and our Advisory Panel members Andrew Scott, Anita Charlesworth, Kayley Hignell, Mairi Spowage, Michael McMahon and Rita De La Feria. We would also emphasise that despite the valuable assistance received, all judgements and interpretation underpinning the analysis and conclusions of the *FRS* are ours alone.

We provided the Treasury with a summary of our main conclusions on 1 August, an updated version of these on 14 August and a near-final version on 22 August. Given the importance of the report to the Treasury in managing fiscal sustainability and risks, we have engaged with Treasury officials throughout the process. We provided a full and final copy of this document once it was complete.

At no point in the process did we come under any pressure from Ministers, special advisers or officials to alter any of our analysis or conclusions.

We would be pleased to receive feedback on any aspect of the content or presentation of our analysis. This can be sent to feedback@obr.uk.

Richard Hughes | Professor David Miles CBE | Tom Josephs

The Budget Responsibility Committee

# Executive summary

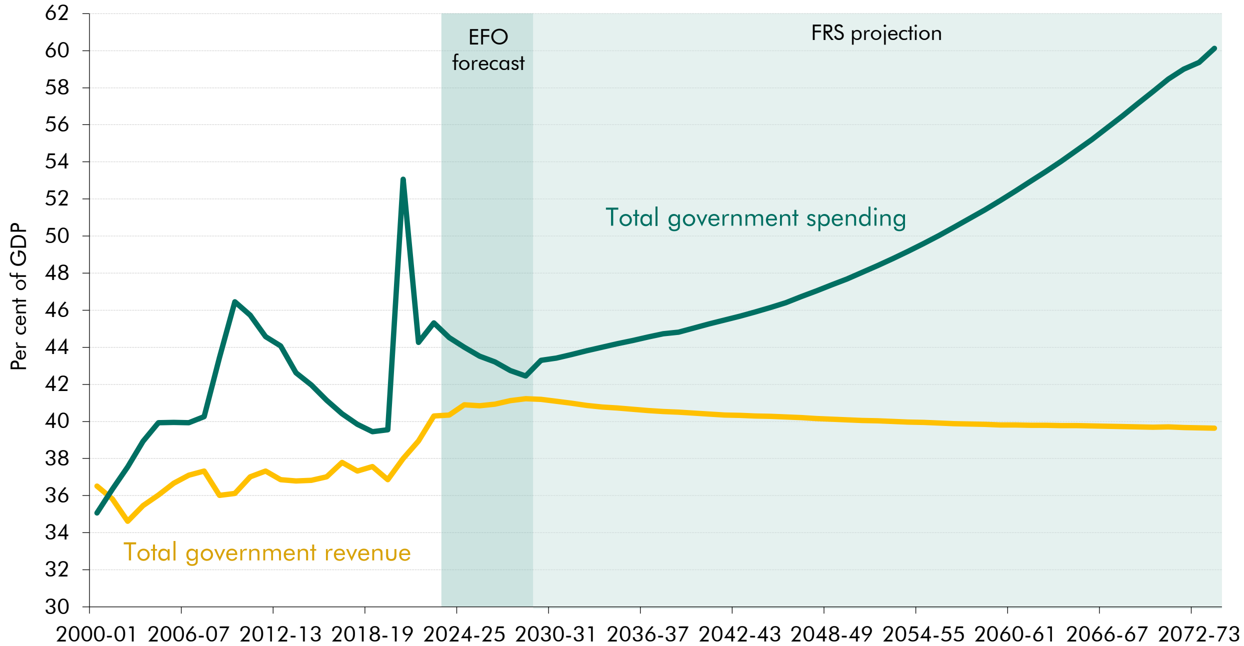
1.1 The past two decades have seen the UK economy hit by a succession of extraordinary shocks, in the form of a global financial crisis, a pandemic, and an energy crisis. The public finances have emerged from these shocks under strain. Deficits have averaged just under 5 per cent of GDP since the start of the century. This has caused debt to more than triple as a share of GDP to 98.1 per cent of GDP by March 2024, its highest level since the early 1960s. Public spending is at nearly 45 per cent of GDP in 2023-24 – its highest sustained level since the mid-1970s – as a result of increased spending on public services, welfare, and interest costs. To reduce the deficit and arrest the rise in debt over the next five years, the previous Government's fiscal plans were based on holding real growth in public spending below that of the economy, and the tax take increasing to 37.1 per cent of GDP, which would be its highest level since the late 1940s.

1.2 Looking ahead, in addition to the inevitability of further shocks, governments in the UK and around the world face a number of longer-term pressures that are likely to weigh on their public finances further. These include:

- an **ageing population**, with a falling birth rate and the 'baby-boom' cohorts moving through retirement putting downward pressure on revenues and upward pressure on spending;
- **climate change,** including the fiscal costs of completing the transition to net zero while also coping with damage from rising temperatures and more severe weather; and
- rising **geopolitical tensions,** with both the previous and current UK Governments aspiring to raise defence spending to 2.5 per cent of GDP.

1.3 The analysis in this report shows that, based on policy settings in March 2024, these and other pressures would eventually put the public finances on an unsustainable path. Over the next 50 years, public spending is projected to rise from 45 to over 60 per cent of GDP, while revenues remain at around 40 per cent of GDP (Chart 1.1). As a result, debt would rise rapidly from the late 2030s to 274 per cent of GDP in our baseline projection. Long-term projections such as these are inherently highly uncertain but there is a similar upward debt trajectory in nearly all the alternative scenarios that we consider. Indeed, debt is projected to rise further to over 300 per cent of GDP, when further shocks and pressures are taken into account. In practice, if these pressures and shocks were to materialise as we project, then governments would need to take mitigating policy action to prevent this debt spiral from occurring. On our baseline projection, to return debt to its pre-pandemic levels would require an average fiscal tightening of 1.5 per cent of GDP per decade over the next 50 years.

## Chart 1.1: Projected total government revenue and spending




Source: ONS, OBR

1.4 This rise in debt and need for fiscal adjustment could be partly alleviated through timely action to tackle growing pressures and also by improvements in underlying economic conditions. As explored in the chapters of this report, over the next 50 years:

- limiting the **rise in global temperatures** to less than 2°C rather than 3°C could alleviate around 10 percentage points of upward pressure on the debt-to-GDP ratio;
- improving the **health of the population** could reduce the rise in debt by a further 40 per cent of GDP; and
- boosting the **productive potential of the economy**, if it does not simply result in higher public spending, could make the biggest difference of all, with every 0.1 per cent increase in productivity growth reducing the rise in the debt-to-GDP ratio by 25 percentage points. A full 1 percentage point increase, equivalent to a return to pre-financial crisis rates of productivity growth, could keep debt below 100 per cent of GDP throughout the next 50 years.

1.5 These and other long-term dynamics are explored in detail in this *Fiscal risks and sustainability* report (*FRS*). The projections in this report are consistent with our March 2024 *Economic and fiscal outlook* (*EFO*) and based on the previous Government's policies as we understood them at the time of the Spring Budget on 6 March 2024. It does not take account of any tax and spending policies announced by the new Government, as these have not yet been confirmed and costed at a fiscal event.[1] In this report:

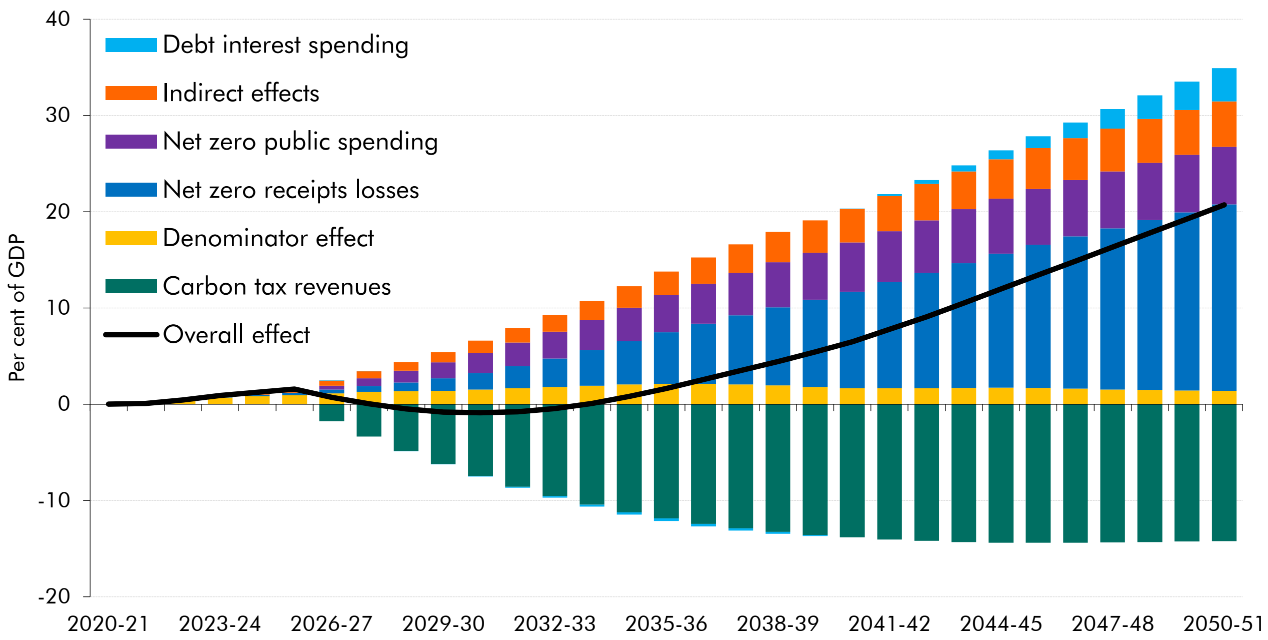
[1] Nor does it include any changes to 2024-25 departmental spending to reflect the Chancellor's announcement on 29 July. Departmental spending in 2024-25 is the subject of an ongoing OBR review.

- **Chapter 2** builds on our previous work on climate change mitigation costs, by exploring the potential fiscal costs of **climate-related damage**.
- **Chapter 3** updates the assumptions driving our long-term projections of **health** spending and looks at the economic and fiscal consequences of alternative health scenarios.
- **Chapter 4** updates our comprehensive **long-term fiscal projections**, including scenarios looking at the fiscal impact of different migration and productivity assumptions.

## Climate change damage (Chapter 2)

1.6 The economic and fiscal risks posed by climate change fall into three broad categories: the *mitigation* costs involved in making the transition to net zero; the costs of physical *damage* caused by higher temperatures, rising sea levels, and increasingly extreme and volatile weather; and the costs of *adaptation* to reduce that damage. In our 2021 *Fiscal risks report* (*FRR*) we looked at the potential economic and fiscal costs associated with climate change *mitigation*. We found that, in an early action policy scenario (based on economic and policy conditions at the time), the transition to net zero could raise the stock of government debt by 21 per cent of GDP by 2050 (Chart 1.2), with the largest single cost being that of lost fuel duty revenue. This estimate was based on the assumptions that government: (i) takes 'early action' to mitigate climate change starting in 2020-21; (ii) funds around one quarter of the economy-wide cost of transition via additional borrowing; (iii) levies a comprehensive carbon tax but does not replace lost motoring taxes as fuel duty declines; and (iv) sees no lasting potential output growth impact – either positive or negative – from the transition.

Chart 1.2: Climate change mitigation: Debt-to-GDP impact from the 2021 *FRR*




Source: OBR

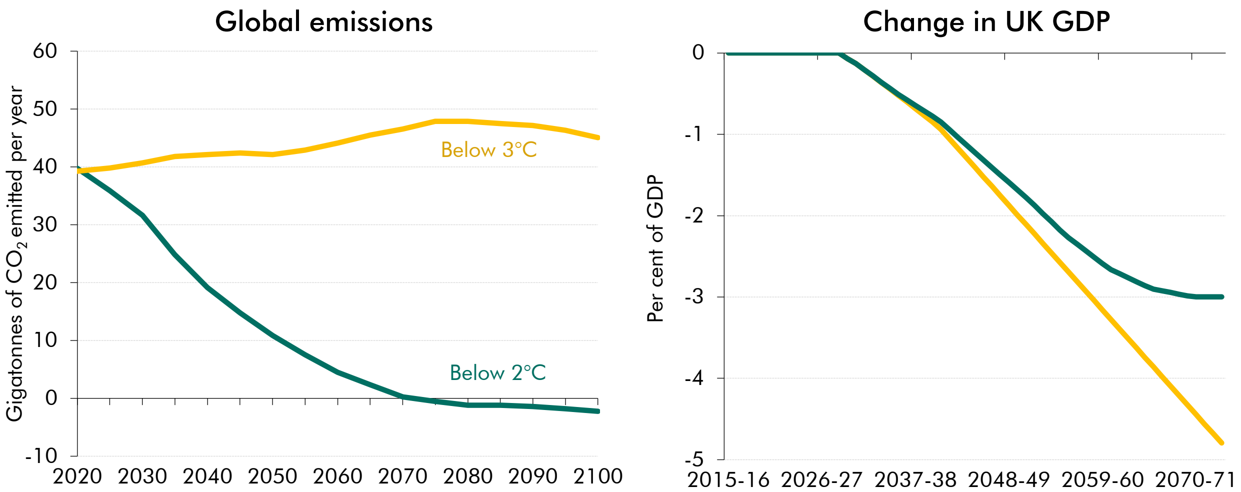
1.7 In this report we build on the analysis of climate change mitigation to look at the economic and fiscal costs of climate-related *damage*. Within the wide range of possible outcomes, we consider two scenarios for the rise in global average temperatures by 2100, based on modelling by the UN's Intergovernmental Panel on Climate Change (IPCC). Summarised in Chart 1.3, these are:

- a **below 2°C rise**, which would be consistent with a successful global effort to reach net zero emissions by around 2070; and
- a **below 3°C rise**, which would be consistent with current global policies and would see emissions continue to rise until the early 2070s before beginning to fall toward the end of the century.

1.8 Rising temperatures and the extreme weather events associated with them generate physical costs for the economy through both chronic and acute effects. Rising average temperatures over time can steadily reduce labour supply, by increasing human morbidity and mortality, as well as productivity, by reducing agricultural output and increasing energy costs for all industries. Acute impacts, arising from an increase in the variety, frequency, and severity of extreme weather events, can lead to loss of life, closure of businesses, damage to commercial and residential property, reduction of agricultural yields, and disruption to product, labour, and insurance markets. Drawing on a range of studies, our central estimates of the long-run damage to the UK economy from climate change is for:

- real GDP to be around 3 per cent lower by 2074 in a below 2°C scenario; and
- real GDP to be around 5 per cent lower by 2074 in a below 3°C scenario.

## Chart 1.3: Global emissions and changes in UK GDP in two climate scenarios



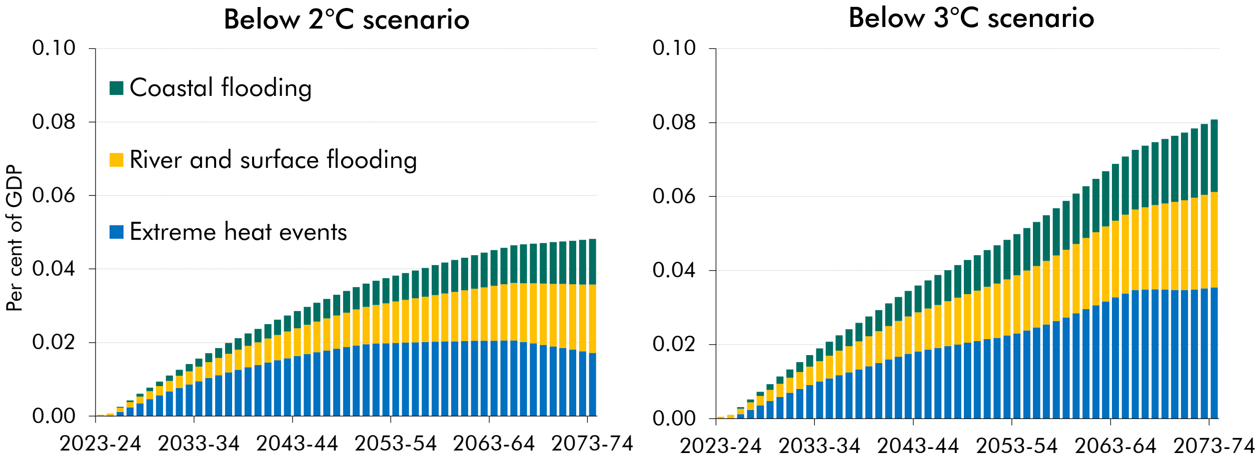

Source: IPCC, OBR

1.9 There is considerable uncertainty around these estimates of climate-related GDP losses. This uncertainty is skewed to the downside, with significantly more adverse outcomes more likely than significantly more benign ones. Nevertheless, as explored further in the chapter, our assumed GDP impacts are within the range of estimates found by credible studies. The reductions in UK GDP from climate-related damage give rise to *indirect* fiscal impacts over the next 50 years. Receipts are assumed to fall one-for-one with nominal GDP, and so are lower in cash terms in the two scenarios due to the smaller size of the economy. On the spending side, we assume that public service and investment spending remain unchanged in nominal terms from the baseline, while all other primary spending (mostly welfare and pensions) moves in line with nominal GDP. Taken together, these indirect fiscal costs from climate-related damage increase the primary deficit in 2074-75 by 0.7 per cent of GDP in the below 2°C scenario and 1.1 per cent of GDP in the below 3 °C scenario.

1.10 The more frequent and severe extreme weather events that accompany the rise in global temperatures are also likely to give rise to additional, *direct* fiscal impacts. These acute fiscal costs can arise due to additional demands on emergency and other public services, damage to publicly-owned infrastructure and other assets, and calls to compensate households and businesses for uninsured damage. While the range of potential acute risks is wide, we focus on three which the literature suggests pose the most significant risk for the UK. There are significant uncertainties involved in estimating the fiscal costs from these risks. But, based on available data and evidence, we project that, in 2024-25 prices, the average additional direct fiscal costs from these three acute risks could sum to £0.8 billion (0.03 per cent of GDP) in the below 2°C scenario and £1.2 billion (0.04 per cent of GDP) in the below 3°C scenario a year. These direct costs, summarised in Chart 1.4, are estimated to comprise of:

- £260 million (0.009 per cent of GDP) to £370 million (0.013 per cent of GDP) for **river and surface flooding**;
- £170 million (0.006 per cent of GDP) to £260 million (0.009 per cent of GDP) for **coastal flooding**; and
- £420 million (0.015 per cent of GDP) to £560 million (0.020 per cent of GDP) for **heatwaves**.

## Chart 1.4: Estimates of the direct fiscal costs under different scenarios



Source: OBR

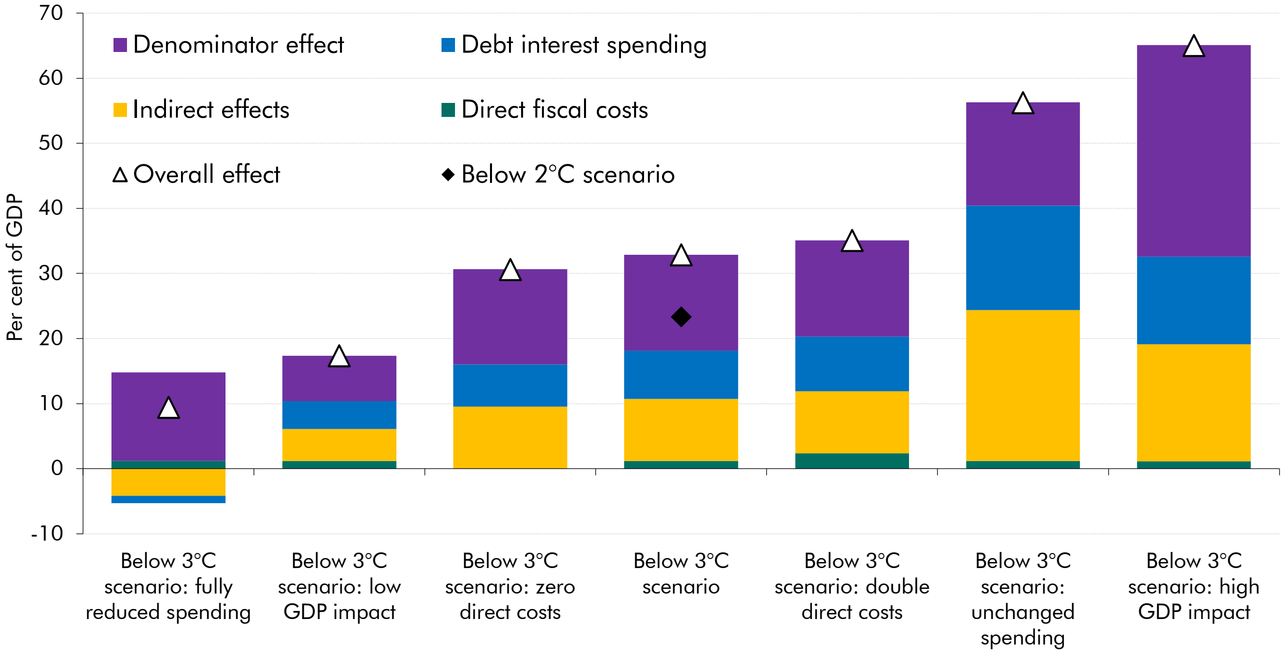
1.11 The total fiscal costs of climate-related damage combine the indirect and direct costs with the cost of servicing the additional debt issued to finance them. Indirect and direct costs together are projected to increase the primary deficit by 0.8 per cent of GDP (£21 billion in 2024-25 prices) in the below 2°C scenario and 1.2 per cent of GDP (£34 billion in 2024-25 prices) in the below 3°C scenario in 2074. It is assumed that these additional indirect and direct costs from climate change damage are financed through extra borrowing. The additional debt interest costs incurred on the resulting increase in the stock of debt are projected to grow to 1 per cent of GDP (£27 billion in 2024-25 prices) in the below 2 °C scenario and 1.3 per cent of GDP (£37 billion in 2024-25 prices) in the below 3 °C scenario by 2074.

1.12 Taking all these indirect, direct, and financing costs into account, we arrive at an overall long-run fiscal cost of climate-related damage over the next 50 years. Under the two temperature scenarios considered, our projection is that the pressure from climate-related damages would:

- increase debt by around 23 per cent of GDP under our below 2°C scenario; and
- increase debt by around 33 per cent of GDP under our below 3°C scenario.

1.13 The uncertainties around these estimates of the fiscal costs of climate-related damage are very large. Uncertainties around the assumptions underpinning the analysis in this report include those around: the global emissions path; the impact on global temperature and weather patterns (including if and when any 'tipping points' are breached); the impact on UK weather specifically; and how all these risks transmit to the UK economy and public finances, including how future governments choose to adjust public service spending in the face of lower nominal GDP growth. Varying some of the parameters underpinning these estimates could reduce the debt impact to below 10 per cent of GDP, if governments chose to mitigate the fiscal consequences of lower nominal GDP growth by reducing public spending in line with the fall in GDP (Chart 1.5). But they could also raise them to just above 65 per cent of GDP in 2074, if the economic impact was more adverse than assumed.

Chart 1.5: Alternative scenarios of the fiscal costs of climate damage – additional debt in 2073-74




Note: Scenario assumptions are described in paragraphs 2.50 to 2.57.
Source: OBR

1.14 Both of these scenarios assume that the UK and most of the world either continue with (in the below 3°C scenario) or enhance (in the below 2°C scenario) their net zero commitments. Therefore, these fiscal costs from climate-related damage should be thought of as additional to the climate change mitigation costs of a similar order of magnitude explored in our 2021 *FRR*. We will update both of these estimates as more evidence emerges. We will return to the third element of climate-related fiscal risks, the potential fiscal costs of adaptation, in future reports.

## Long-term health trends (Chapter 3)

1.15 The health of the population is a key determinant of the economic and fiscal outlook. It was a source of one of the largest short-term fiscal shocks, in the form of the Covid pandemic. It has been an important source of medium-term fiscal pressures, in particular due to rising health-related inactivity. And it is one of the largest long-term fiscal risks, with rising health spending being the single most important driver of the projected increase in government debt over the next 50 years. Having explored the short- and medium-term fiscal implications of health in our 2021 and 2023 reports respectively, this *FRS* takes a fresh look at the long-term economic and fiscal impact of the changing health of the UK population.

1.16 After increasing steadily through much of the 19th and 20th centuries, improvements in life expectancy have slowed since 2010, while healthy life expectancy has actually fallen by a year over the past decade. This widening gap between healthy life expectancy and total life expectancy reflects trends in specific health conditions, in combination with medical advances that have increased life expectancy but also prolonged the period for which people are likely to live with one or more health conditions. Underlying this is a mixed pre-pandemic picture on physical health (with continued improvement in some areas, such as cardiovascular diseases, and a worsening picture in others, such as diabetes); deteriorating mental health; and the impact of the pandemic, which exacerbated existing health challenges and disrupted the delivery of health services.

1.17 The average age and health of the population are two of a number of factors driving public spending on health. Over the past 30 years, total health expenditure in the UK has risen from below 6 per cent to over 11 per cent of GDP, and from well below to slightly above the advanced-economy median. Based on an updated analysis of the main components of health spending, our baseline projection is for real public health spending to grow by an average of 3.1 per cent a year over the next 50 years (left panel of Chart 1.6). This assumes governments respond to rising pressures on health systems by continuing to increase expenditure. Our projection of health spending is composed of the following components:

- Over **our medium-term forecast** horizon through to 2028-29, for which departmental spending allocations are not fixed beyond this year, we assume that total spending grows by 3.3 per cent a year in real terms. This reflects our assumption that current health spending would have to grow by 3.6 per cent a year in order to deliver the NHS Workforce Plan (an assumption based on the previous Government's stated policy).

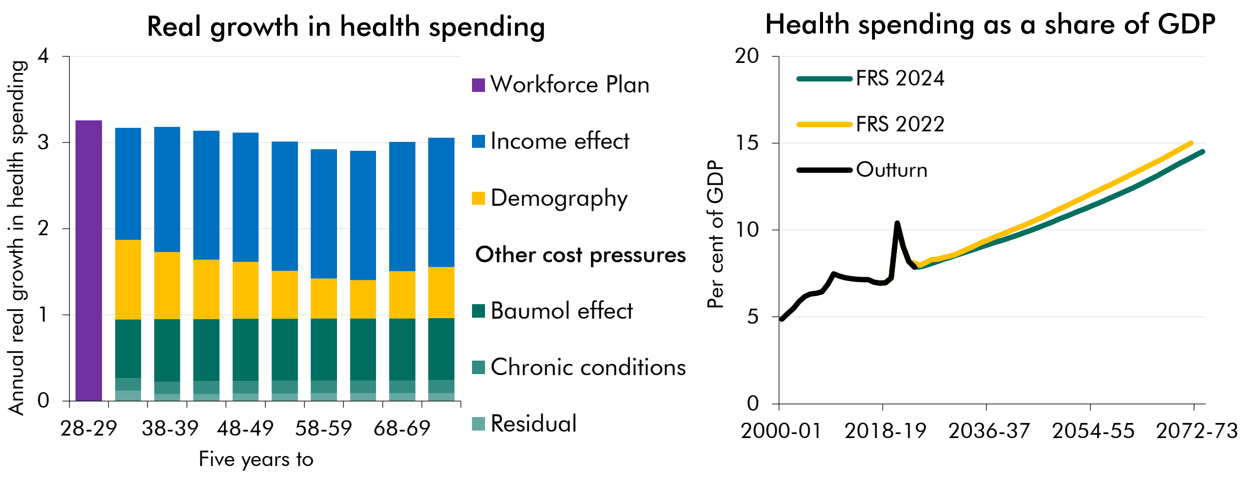
- Beyond the medium-term forecast, **demographic factors,** which include the ageing of the population and the proportion of life expectancy gains people spend in good or ill health, drive an average of 0.6 percentage points per year of the growth in health spending. The population of the UK is projected to increase by 13 million people by 2070, with two-thirds of this change among those aged 65 or older (the age at which health costs per person begin to rise sharply).

- Beyond the medium-term forecast, **the income effect**, which captures the relationship between growth in real GDP and demand for health care, drives 1.5 percentage points of the growth in health spending. This is based on an elasticity to GDP growth of around 0.8, such that, absent demographic changes and other cost pressures, health spending over time would fall as a share of GDP.

- Beyond the medium-term forecast, we assume that **other cost pressures** drive 1 percentage point of the growth in health spending, based on the latest OECD evidence. They include productivity constraints on the delivery of healthcare (the **'Baumol effect'**, 0.72 percentage points); changes in health unrelated to ageing (**'chronic conditions'**, 0.15 percentage points); and the extent to which technological progress increases or reduces costs, which we do not capture explicitly but assume is partly captured by a small **residual** (0.13 percentage points).

1.18 Under these assumptions, public health spending rises from 7.9 per cent of GDP in 2023-24 to 14.5 per cent of GDP by 2073-74. The right panel of Chart 1.6 shows overall growth is slightly slower than in our 2022 projection, leaving health spending 0.8 percentage points lower in 2071-72. This largely reflects updated population projections, with a lower old-age dependency ratio due to higher net migration, and slightly slower projected increases in life expectancy.

## Chart 1.6: Baseline projection for health spending




Source: NHS England, OBR

1.19 Changes in population health have wider fiscal effects beyond just their direct impact on health spending. Healthier people are more likely to be employed, often earn more, and tend to live longer; and the converse is also true for those in ill health. The health of the population therefore also has implications for government tax revenues, welfare spending, pensions, and other age-related spending. In the 2023 *FRS* we explored the wider fiscal implications of the health of the population over the medium term. In this *FRS* we extend this analysis to a fifty-year horizon and construct a set of alternative health scenarios, examining the long-run fiscal implications of better and worse health. These vary assumptions on:

- Self-reported **work-limiting ill health** among those of working age. This falls in the better health scenario or rises in the worse health scenario by 25 per cent by the projection horizon.

- **Life expectancy**, with the population aged over 70 rising by 850,000 people in the better health scenario and falling by that amount in the worse health scenario.

- Gains in **healthy life expectancy**. In our better health scenario, we assume these rise in tandem with gains in life expectancy, whereas in our worse health scenario we assume that gains in life expectancy are spent predominantly in poor health.

- The prevalence of **chronic conditions**. This puts no additional pressure on health spending in our better health scenario. Our worse health scenario doubles the upward pressure they put on spending relative to our baseline projection.

1.20 These changes collectively lower the primary deficit in 2073-74 by 2.1 per cent of GDP in our better health scenario and raise it by 2.3 per cent of GDP in our worse health scenario (Chart 1.7). This is the net result of several, partly offsetting, effects:

- **Health spending** falls by 1.0 per cent of GDP in the better health scenario and rises by 1.2 per cent of GDP in the worse health scenario. In the better health scenario, this fall largely reflects chronic conditions ceasing to push up costs (0.8 per cent of GDP). The fact that life expectancy gains are spent in good health lowers spending further in the better health scenario, but this is mostly offset by the additional healthcare costs of the larger pensioner population. The changes in the worse health scenario are broadly symmetric in the other direction.

- **Pension and other age-related spending** rises by 0.6 per cent of GDP in the better health scenario, reflecting the larger pensioner population due to higher life expectancy. It falls by 0.6 per cent of GDP in the worse health scenario, reflecting the smaller pensioner population in this case.

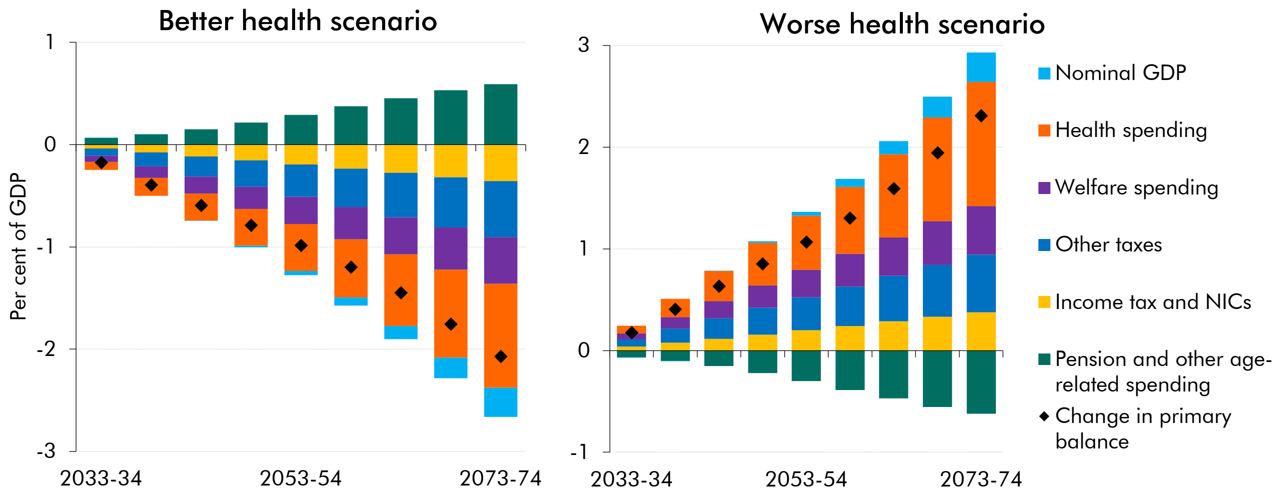
- **Working-age welfare spending** falls by 0.5 per cent of GDP in the better health scenario, and rises by 0.5 per cent of GDP in the worse health scenario. This reflects the participation rate rising or falling by 1.5 percentage points in our scenarios as a result of the changes in work-limiting ill health, lowering or raising spending on incapacity and disability benefits. Those leaving or entering the workforce in these scenarios are assumed to do so at below-average hours and earnings, meaning many remain in receipt of welfare benefits while in work.

- **Income tax and NICs** revenues rise by 0.4 per cent of GDP in the better health scenario, and fall by 0.4 per cent of GDP in the worse health scenario, thanks to the same changes in labour market participation, alongside changes in the hours and earnings of those who remain in work as a result of changes in their health status.

- Revenues from **other taxes** rise by 0.5 per cent of GDP in the better health scenario, and fall by 0.6 per cent of GDP in the worse health scenario, due to a larger or smaller nominal economy. This reflects the level of potential output in 2073-74 rising or falling by around 2.5 per cent, two-thirds of which relates to participation and the remainder to changes in the health status of those in work.

- The **larger or smaller nominal economy** has a small additional effect on the primary deficit as a share of GDP, lowering it by 0.3 per cent of GDP in the better health scenario and raising it by 0.3 per cent of GDP in the worse health scenario.

Chart 1.7: Change in the primary deficit in the better and worse health scenarios




Source: OBR

1.21 By the end of the long-term projection, the compounding impact of lower borrowing and consequentially lower debt interest spending mean that debt is projected to be 44 per cent of GDP lower in the better health scenario, with the reverse effects pushing debt 49 per cent of GDP higher in the worse health scenario. More broadly, our analysis shows that health spending faces upward pressure from a range of sources, raising questions about whether government can continue to meet rising demand and keep debt on a sustainable path. Improvements in health could mitigate this and deliver significant fiscal benefits, but the (very welcome) longer lives that would result from better health lead to offsetting fiscal effects via higher pensioner-related spending. And in recent years trends in health have, if anything, been going in the other direction.

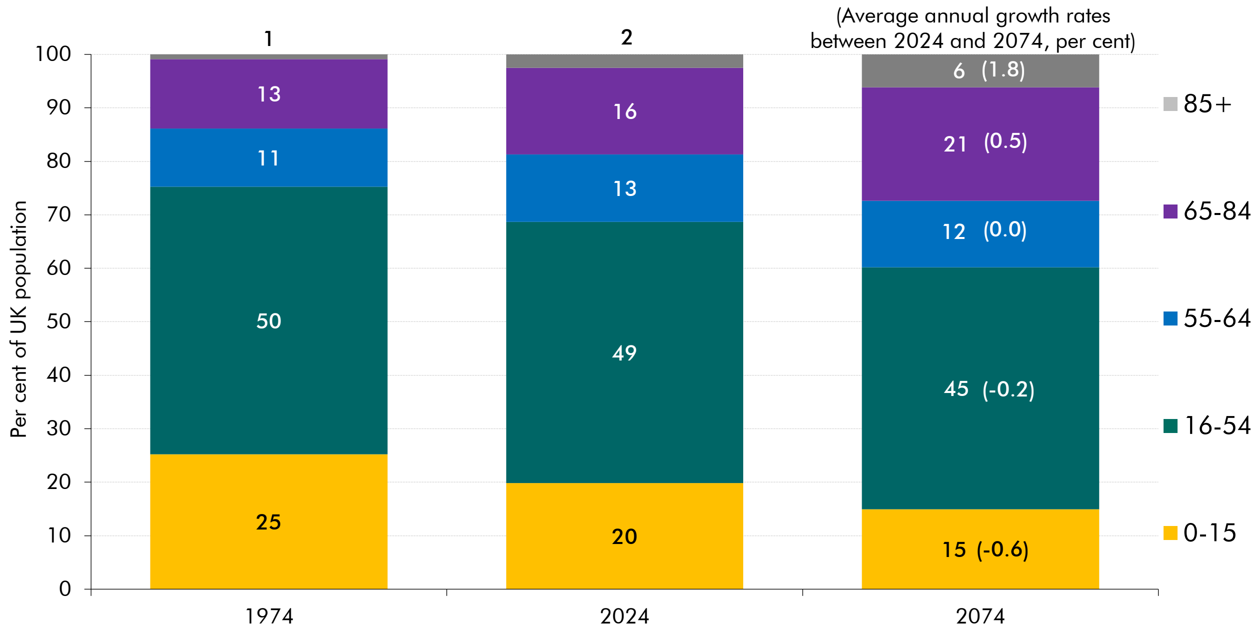
## Long-term fiscal projections (Chapter 4)

1.22 Our final chapter sets out updated 50-year projections for the economy and public finances, based on government policy as it stood in March 2024. We do this by projecting forward the impact of demographic, economic, technological, environmental, health, and other trends on the public finances. As with every assessment we have published over the past decade, these projections show debt on an unsustainable path over the next 50 years. Any estimate this far into the future comes with a high degree of uncertainty, but these projections are useful in plotting a possible path for the UK economy and public finances under current policy. Our alternative scenarios illustrate the sensitivity to different underlying assumptions.

1.23 The total population, based on the ONS's latest projection, rises from 68 million in 2022 to 82 million in 2074. Compared to our 2022 *FRS*, life expectancy and the birth rate are unchanged. The latter is 1.59, below the rate of 2.1 required for the population to remain stable in the absence of other changes and just above the record low of 1.5 reached in 2022. The only change to the population projections is a higher ONS assumption for net migration, which settles at 315,000 a year from 2028-29 onwards, compared to 129,000 a year assumed in *FRS* 2022. Substantially higher assumed levels of net migration mean the total population is 16 million higher than at the end of the *FRS* 2022 projection. With zero net migration from 2022 onwards, the population would gradually decline to around 60 million.

1.24 The population is projected to age considerably over the next 50 years, with the share of over 65s rising from 19 per cent to 27 per cent, with particularly strong growth in the oldest groups (Chart 1.8). The share of under 16s and 16-to-64-year-olds will both decline, respectively by 5 and 4 percentage points. This means that we project the old-age dependency ratio to climb from 31 to 47 per cent over the next 50 years while the young-age ratio falls in the near term before levelling off at 26 per cent from the early 2030s onwards. As migrants are largely concentrated among younger groups, higher migration in the latest projections means the old-age dependency ratio rises by less than in our 2022 projection.

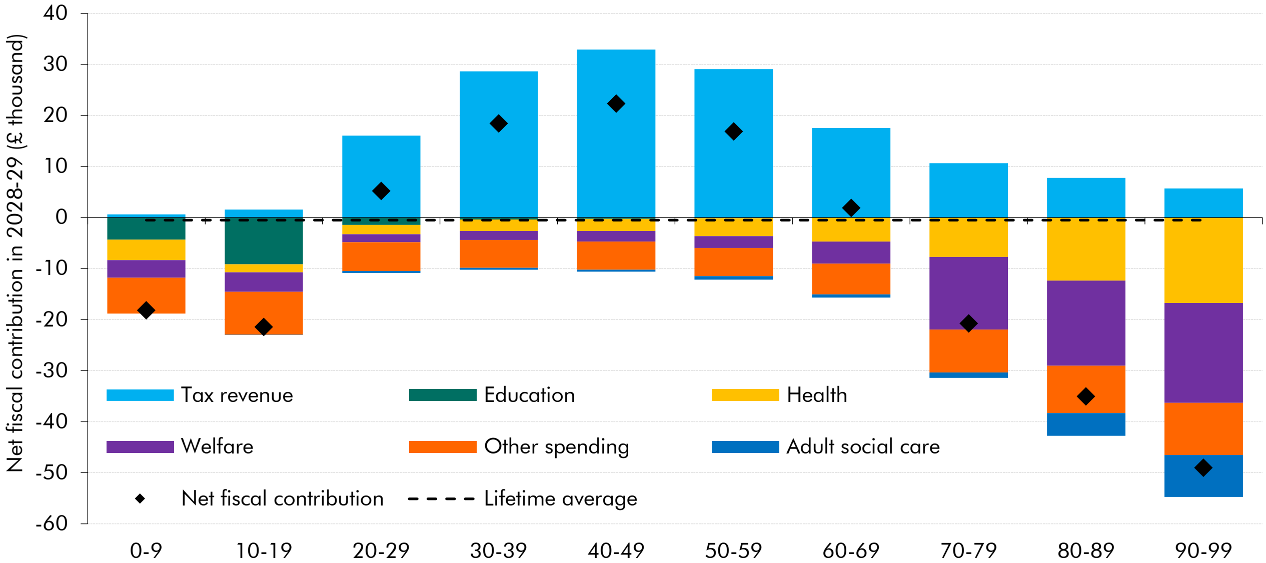
## Chart 1.8: Population age structure in 1974, 2024 and 2074




Note: 2024 and 2074 from the *FRS* 2024 population projection. Average annual growth rate is for the share of the population.
Source: ONS, OBR

1.25 Our long-term fiscal projections employ a set of age-related receipts and spending profiles which estimate how a representative individual's payment of taxes, consumption of public services, and receipt of welfare benefits vary by age. The net fiscal contribution of a representative person becomes positive in the early 20s, once the spending on education, health and welfare from childhood diminishes and the tax revenues they generate through working become significant (Chart 1.9). This contribution peaks around the mid-40s and then cumulatively becomes negative around age 80 as the spending on health and welfare increases and tax revenues dissipate. Therefore, as the population ages in the manner described above, this puts downward pressure on revenues and upward pressure on spending.

## Chart 1.9: Primary receipts and spending by age



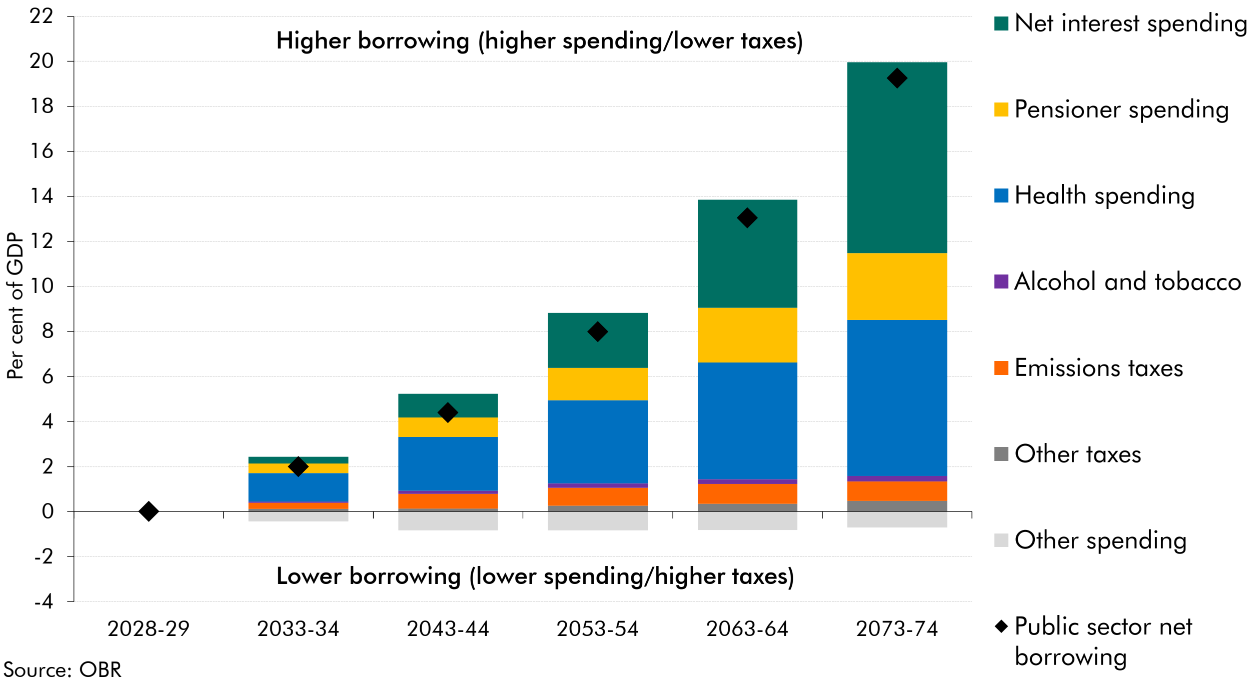

Note: These profiles are constructed on the basis that aggregate primary spending and receipts are broadly in balance, as is the case on average over the medium-term in our March 2024 *EFO*. Therefore they do not capture the fiscal impact of major economic shocks on public spending and receipts.
Source: OBR

1.26 Based on policy settings as they were in March 2024, over the next 50 years these demographic trends and other pressures would drive a growing wedge between government receipts and spending. Total public spending is projected to rise from 45 to 60 per cent of GDP while total government receipts remain around 40 per cent of GDP between now and 2073-74. As a result, government borrowing is projected to rise from 1.2 per cent of GDP in 2028-29 to 20.5 per cent of GDP in 2073-74. The key drivers of this are (Chart 1.10):

- **Health spending** is projected to rise steadily from 7.6 per cent to 14.5 per cent of GDP over the projection. This is driven by the demographic and other cost pressures discussed in Chapter 2.
- **Spending on state pensions** rises from 5.2 per cent to 7.9 per cent of GDP due to both the ageing of the population and the cost of the triple-lock policy.
- **Net interest spending** quadruples from 2.8 to 11.3 per cent of GDP as the stock of debt rises. This is exacerbated by the gilt rate now being 0.2 percentage points *above* the assumed long-run rate of nominal GDP growth throughout our projection, unlike in *FRS* 2022 when it was an average of 1.1 percentage points *below* nominal GDP growth over the first fifteen years.
- **Revenues from emissions taxes** are projected to fall from 1.0 to 0.1 per cent of GDP. This is driven by the fall in fuel duty revenues as we assume electric vehicles account for close to 100 per cent of cars on the road by 2045 following the ban on sales of petrol-driven cars coming into effect in 2035.

- **Tobacco duty** receipts fall from 0.3 per cent to close to zero per cent of GDP, reflecting the Government's progressive smoking ban, which will reduce the number of smokers over time.

## Chart 1.10: Decomposition of change in borrowing from 2028-29 to 2073-74

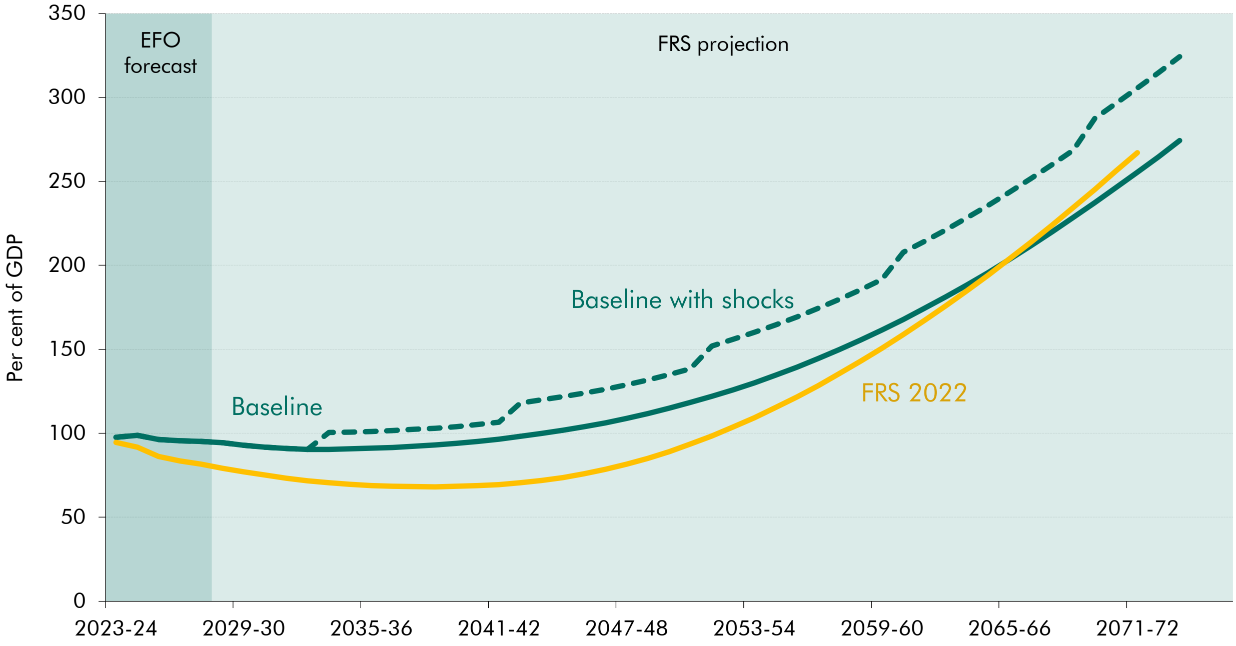



Source: OBR

1.27 The rise in borrowing feeds through into higher debt which eventually, if policy were to be left unchanged, would reach 274 per cent of GDP in 2073-74. Over the first decade of the long-term period, debt is projected to be broadly stable as a share of GDP as the primary balance is initially in surplus and close to the level of the debt-stabilising primary balance. From the early 2040s onwards, the impact of demographics and the increase in net interest payments start to outweigh nominal GDP growth, and so debt as a share of GDP starts to rise exponentially. It is slightly lower than the debt level at the end of the projection period in *FRS* 2022, largely as a result of more favourable demographics and a higher primary balance. Regardless, if these pressures were to materialise as we project then governments would need to take mitigating policy action to prevent this upward debt spiral.

1.28 Our baseline projection does not account for the fiscal consequences of significant economic shocks, which have been an important driver of the path of debt. The impact of shocks on the public finances is skewed to the downside with debt nearly always pushed higher by adverse shocks but rarely significantly reduced by favourable shocks. In line with international and historical evidence, we therefore illustrate the impact of a recession or equivalent shock every nine years, which adds around 10 percentage points to the debt-to-GDP ratio. The dashed green line in Chart 1.11 shows the effect on debt, which rises earlier and reaches 324 per cent of GDP at the projection horizon compared to 274 in the baseline projection.

## Chart 1.11: Projections for public sector net debt



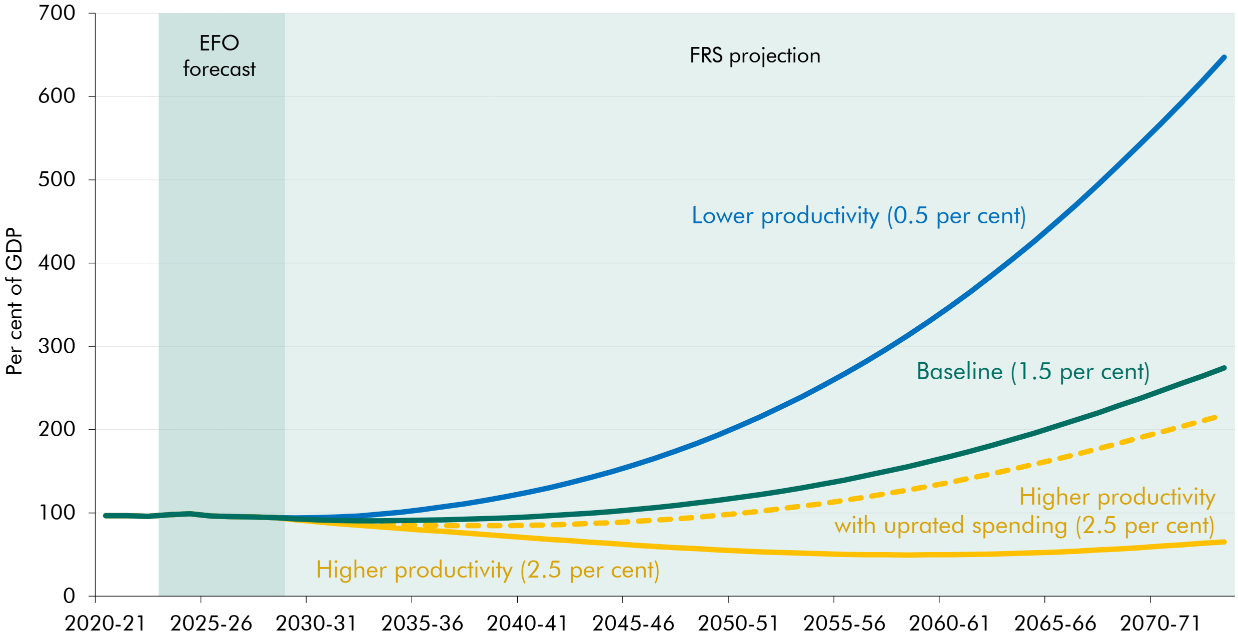
Source: OBR

1.29 Given the very significant uncertainty around any long-term projections we also consider alternative scenarios for some of the key underpinning assumptions:

- On **migration**, we explore how varying the characteristics of new migrants, such as their length of stay and earnings level, might affect the long-term fiscal position. In the shorter length of stay scenario, where half of migrants leave after three years, and so generate savings in areas such as welfare and state pensions, debt ends up about 23 per cent of GDP lower by 2073-74. In the higher earnings scenario, where migrants generate extra tax revenue relative to their consumption of government services and benefits, debt as a share of GDP ends up about 40 per cent of GDP lower. However, in both cases, debt is still projected to be on an unsustainable upward trajectory in the long run. So these scenarios show that, while important in determining the level of debt in any given year, altering migrants' average earnings or varying their length of stay does not fundamentally change the long-run debt dynamics.

- On **productivity**, our alternative scenarios assume that productivity growth is consistently 1 per cent higher or lower than our baseline projection (Chart 1.12). We show that the impact of higher productivity on the public finances depends on how government spending responds to the higher tax revenues that this generates. In our first variant, we assume public sector staff costs and welfare spending are uprated by average earnings, but all other primary spending kept unchanged in nominal and real terms. Under this assumption, sustained higher productivity growth would be significantly beneficial to the public finances, seeing debt in 2073-74 fall to 65 per cent of GDP rather than the 274 per cent of GDP in our baseline. But this would represent a major change of policy by governments compared to what we have seen, on average, over recent decades. In the past, governments have tended to use the proceeds of faster growth to increase the volume of services delivered. In our second variant, we assume that *all* spending rises in line with nominal GDP. Under this assumption, the fiscal position is similar to the baseline projection, showing a relatively modest improvement in the public finances with debt about 60 per cent of GDP lower than in the baseline by 2073-74, despite higher productivity.

## Chart 1.12: Public sector net debt sensitivity to productivity growth assumptions




Source: OBR

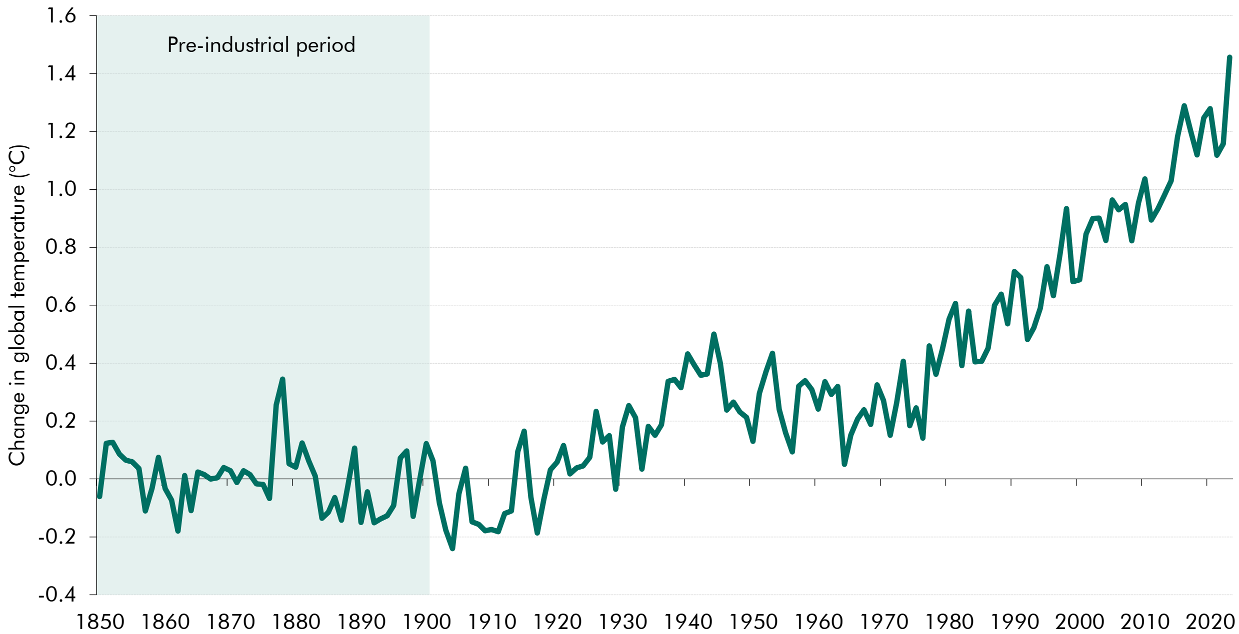
1.30 Under our baseline demographic and economic assumptions, maintaining fiscal sustainability over the long term would almost certainly require further fiscal policy adjustment. Keeping debt at around 94 per cent of GDP would require a fiscal policy tightening of an additional ¼ per cent of GDP every year from 2034-35. Were these fiscal adjustments to come from greater spending restraint, this would require either significant improvements in public sector productivity or strict prioritisation between competing pressures. Were the adjustment to come from further increases in taxation, governments would need to weigh any additional direct revenue yield against the impact of a rising tax take on incentives to work, investment, and save.

# 2 Climate change damage

## Introduction

2.1 Climate change gives rise to a range of potential risks to economies around the globe, many of which developed under relatively stable and cooler conditions until the middle of the last century (Chart 2.1). There is now overwhelming evidence that in the past century, and in recent decades in particular, global average temperatures have been rising. And it has become increasingly clear that much of this rise in temperatures is directly attributable to human activities and the greenhouse gases (GHGs) they create.[1] Throughout this chapter when we discuss climate change, it is this anthropogenic climate change to which we refer.

### Chart 2.1: Change in Earth's recent temperature




Source: UK Met Office Hadley Centre

## Sources of economic and fiscal risks from climate change

2.2 The range of potential economic and fiscal risks presented by rising global temperatures fall into three broad categories:

[1] The stock of GHGs emitted, rather than the flow produced in any single year is the most important determinant of the effect on global warming. The main gases responsible are carbon dioxide, methane, nitrous oxide, and water vapor (which all occur naturally), and synthetic fluorinated gases (or 'F-gases'). Their effects depend on their atmospheric concentration, how long they remain in the atmosphere after being emitted, and their effectiveness at trapping heat.

- **Mitigation** of climate change: the fiscal cost of reducing carbon and other climate-related emissions in order to limit the rise in global temperatures. Government will need to pay for the decarbonisation of its own assets (e.g., public sector buildings and vehicles). It will also lose revenue from fossil fuel-linked revenue streams, such as fuel duty, as consumption shifts to cleaner energy sources. It may also choose to provide some level of subsidy to households (e.g., to help with the cost of replacing gas boilers with low-carbon heating) and firms (e.g., to help manufacturers decarbonise their production processes). Government could also raise revenues in such a way that facilitates the transition to net zero, such as by levying carbon taxes. Finally, climate change mitigation has indirect effects on the government finances, via the impact of the economy-wide transition to net zero on the productive potential of the economy and, therefore, on overall government revenues. The direction and magnitude of this impact is still highly uncertain.

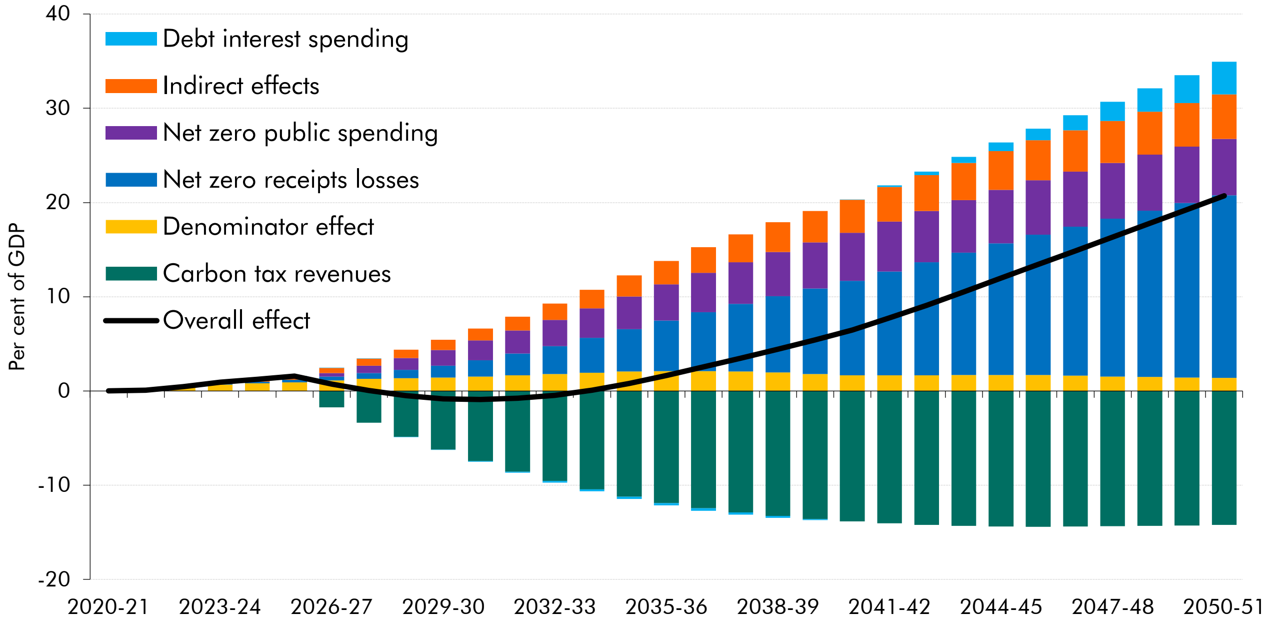
- **Damage** from climate change: the reduction in the productive potential of the economy due to the rise in global temperatures that occurs, and the more extreme and volatile weather associated with this. This includes damage to capital assets used in production, to agricultural outputs, and to the health of the labour force. This presents indirect fiscal risks to governments by reducing economic output, and therefore tax revenue, and may also, for example, increase inflation through higher food prices. Climate change related damage also poses direct fiscal risks to governments by reducing the value of the assets they own (e.g., destruction of transport infrastructure); increasing demands on the public services they provide (e.g., on the public health system to treat heat-related illnesses); and creating pressure to compensate citizens and businesses for some or all of the uninsured losses they have suffered (reflecting expectations that the state may act as the 'insurer of last resort').

- **Adaptation** to climate change: the cost of actions taken to reduce the cost and harm of physical damage. The physical damage from rising temperatures, more extreme weather events, and rising sea levels can be reduced by investments in, for example, cooling systems, more resilient infrastructure, better flood defences, or relocation of vulnerable communities. Some of these costs fall on the government: to adapt its own services (e.g., air conditioning of schools and hospitals); provide key 'public goods' (e.g., coastal flood barriers); and help households and businesses with their own adaptation costs.

## The OBR's analysis of the fiscal risks from climate change

2.3 In our 2021 *Fiscal risks report* (*FRR*), we investigated the potential economic and fiscal costs of climate change *mitigation* for the UK. We found that, in an early action policy scenario, the transition to net zero could raise the stock of debt by around 20 per cent of GDP by 2050 (Chart 2.2). This estimate was based on the assumptions that: government (i) takes 'early action' to mitigate climate change starting in 2020; (ii) funds around one quarter of the economy-wide cost of transition via additional borrowing; (iii) levies a comprehensive carbon tax but does not replace lost motoring taxes from the decline of fuel duty; and (iv) sees no lasting impact from the transition on potential output growth.

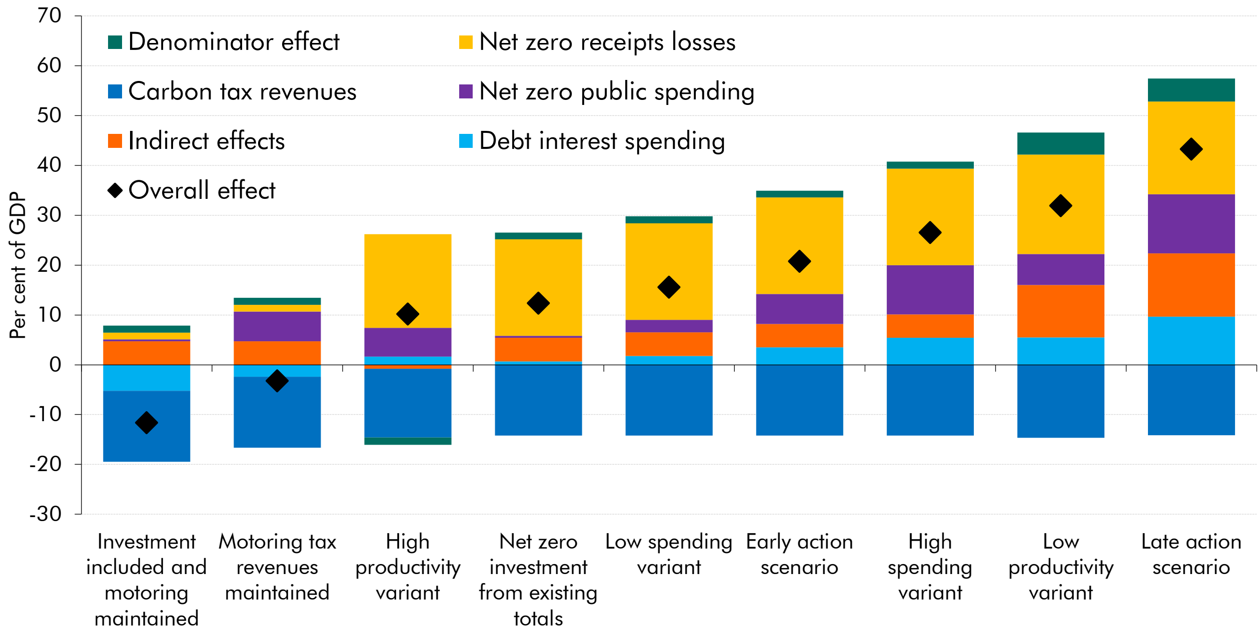
## Chart 2.2: Effect on the debt-to-GDP ratio from the 2021 *FRR*'s early action scenario




Source: OBR

2.4 There is considerable uncertainty around these projections which we illustrated by varying these assumptions (Chart 2.3). At one extreme, we found that if policy action was delayed until the 2030s, the total costs could more than double in debt terms to 43 per cent of GDP by 2050. At the other extreme, if policy action including a carbon tax was taken earlier, government absorbed its share of whole-economy transition costs within its existing investment plans, and fuel duty was replaced with an equivalent tax on motoring, then getting to net zero could deliver a net fiscal benefit and lower the debt-to-GDP ratio by 12 percentage points by 2050.

## Chart 2.3: 2021 *FRR* scenarios: change in public sector net debt in 2050




Source: OBR

2.5 In this report, we build on this previous analysis of *mitigation* costs by assessing the fiscal costs of climate-related *damage*. This helps to provide a more comprehensive account of the potential *total* fiscal cost of climate change to a country like the UK. This is important for two reasons. First, even if the UK were to meet its commitment to reach net zero by 2050, it is far from certain that other countries will do the same. Second, even in a world where all countries work towards net zero, greenhouses gases in the Earth's atmosphere will continue to increase until the point at which net global greenhouse gas emissions reach zero. In the interim, the UK and other countries will face costs from the damage this causes and from the need to adapt to rising temperatures. So, the total fiscal risk from climate change to the UK is likely to include a combination of mitigation, damage, and adaptation costs.

## Assessing the fiscal risks from climate-related damage

2.6 To assess the potential fiscal costs of climate change damage for the UK, our analysis draws on the latest international estimates of the potential economic cost for the UK of rising global temperatures and more extreme weather events. From this, it derives a set of potential fiscal costs for the UK government. These include direct fiscal costs from damage to public sector assets, a share of the economy-wide direct losses from climate-related damage, and the indirect fiscal costs from a reduction in revenues due to lower economic growth.

2.7 Our initial estimates of the potential fiscal costs of climate damage are likely to be at the lower end of plausible outcomes for several reasons:

- First, we consider only a **potential rise in global temperatures of between below 2 and 3 degrees Celsius (°C)** above pre-industrial levels, rather than the more extreme potential scenarios of a 4 or 5°C rise. And we have aimed to produce a *central* estimate of the potential economic damage from climate change given these changes in temperature, rather than a *reasonable worst-case* scenario, which other institutions have used to 'stress test' the resilience of the financial sector and other parts of the economy.[2]

- Second, we have, at this stage, **focused on a subset of potential physical risks** from climate change which are likely to be important for the UK and for which some estimates exist, namely heatwaves, river and surface floods, and coastal flooding and erosion. We have not accounted for the more catastrophic risks that could arise from more radical changes in the global climate (such as breaching a tipping point, like the melting of the Greenland ice sheet, or the collapse of the Gulf Stream)[3] or the transmission of the economic impact of more dramatic changes in climate conditions

[2] For example, the Bank of England's *2021 Climate Biennial Exploratory Scenario* included a 'no additional action' scenario, which captured a worse-than-expected outcome (warming of 3.3°C by 2050) as a stress test of the financial sector. Equity prices in the UK and US are estimated to fall close to 20 per cent in such a scenario. See Bank of England, *Results of the 2021 Climate Biennial Exploratory Scenario (CBES)*, May 2022.

[3] A tipping point is when an event is triggered due to higher temperatures which causes large and irreversible changes to the Earth's climatic system, which may induce and perpetuate a chain reaction of further extreme climatic events. There are thought to be several potential tipping points, for example the thawing of the Russian permafrost, the melting of the Greenland and West Antarctic ice sheets, Amazon Rainforest and Boreal Forest dieback, the die-off of coral reefs, or the collapse of the Gulf Stream. See the Met Office blog, *The Atlantic Meridional Overturning Circulation in a changing climate*, May 2024 for more information.

elsewhere in the world (such as large parts of the tropics becoming uninhabitable) to the UK economy via trade, investment, and migration.

- Third, at this stage these estimates **do not separately and explicitly account for the costs of adaptation.** As discussed in Box 2.1, there is currently no reliable data on current or planned levels of UK government spending on adaptation, nor any reliable analytical framework for relating adaptation spending to future damage costs.

2.8 Perhaps even more so than the first set of estimates on mitigation costs to the public finances in our 2021 *FRR*, the range of potential climate damage costs is very large, as we discuss in Box 2.2. This reflects the greater uncertainty around the impact of emissions on climate change and future climate patterns, compared to the uncertainty around the costs of emission reduction requirements. We have attempted to be prudent in constructing an initial estimate of damage costs and illustrating its sensitivity to alternative assumptions. We will return to the potential fiscal costs of climate change adaptation – the third piece of the puzzle – in future reports. In doing so, we will look to draw on any provisional work produced by the Climate Change Committee (CCC) in advance of its 2026 Fourth Climate Change Risk Assessment – Independent Assessment.[4] And we will revisit and update each element of these estimates as new evidence and analysis becomes available.

## Structure of the chapter

2.9 To explore and estimate the potential fiscal risks from climate-related damage, this chapter:

- discusses the **range of potential physical risks** from climate change;
- considers **how these physical risks can damage the economy** in a country like the UK;
- explores the range of **estimates for the macroeconomic cost of climate-related damage** and presents **two possible scenarios for UK economic losses**: one in a world that is just below 2°C, and one below 3°C, warmer in 2100;
- discusses the potential direct and indirect channels through which this economic damage can **impact the public finances**;
- presents **two possible scenarios for the fiscal cost of climate-related damage** in a below 2°C and below 3°C warmer world in 2100; and
- shows the **sensitivity of these scenarios to plausible alternate assumptions** about the macroeconomic and fiscal costs.

[4] Climate Change Committee, *Proposed methodology for the Fourth Climate Change Risk Assessment – Independent Assessment (CCRA4-IA)*, May 2024.

## Box 2.1: Estimating current and future adaptation costs to the UK

Climate change adaptation involves strategies and actions taken by governments, businesses, and individuals to maintain productivity and prevent damage amidst rising temperatures and more frequent extreme weather events.[a] These measures include modifying work patterns, installing air conditioning, investing in flood defences, upgrading infrastructure (for example, ICT infrastructure, power, water, road and rail), and securing food and other supply chains. While these measures can significantly reduce the economic impact of climate change, they come with additional costs, adding to the fiscal pressures of climate change.

In the UK, the Climate Change Committee (CCC) provides advice to the Government on the risks the UK faces from climate change damage. The Department for Environment, Food and Rural Affairs (Defra) has overall ownership of the UK's adaptation strategy to address these risks, with responsibility for addressing the various risks and enacting the plans lying across multiple departments.

**Current spending on adaptation**

The extent of existing public investment in adaptation is currently unclear. There is no unified reporting or accounting framework for adaptation investment in the UK, and this, combined with the decentralised nature of adaptation responsibilities, makes it difficult to collate the current expenditure. HM Treasury's Green Book guidance requires departments to consider both 2°C and 4°C scenarios when putting together bids for investments with long lifetimes.[b] But despite this, we have found few examples of published cost-benefit analysis comparing projects built to either 2°C or 4°C specification. And, where costs do exist for 4°C compatible investments, no indication is provided of what the alternative costs for projects *not* built to these standards would have otherwise been.[c] The Institute for Government (IfG) has reported that the Green Book guidance on adaptation was "*largely viewed as nice but optional rather than as a real requirement to take adaptation into account*" by departments.[d] Without suitable accounting practices and requirements, it is difficult to isolate the funds directly allocated to adaptation from those that would have been deployed towards essential infrastructure regardless (that is, what the marginal cost of adaptation investment is).

**Future adaptation costs**

Anticipating future adaptation costs presents additional challenges. On top of the current uncertainty on baseline investment, there is uncertainty around the impact on weather patterns in different climate scenarios, how these would specifically affect the UK, and therefore what our investment requirements will be. For instance, modest sea level rises may call for minimal coastal defences, whereas significant increases could necessitate the relocation of entire communities. Defra incorporates CCC guidance into practical initiatives, as outlined in its National Adaptation Programme (NAP3).[e] However, the National Audit Office, the CCC and the IfG have identified the need for a more coherent and goal-oriented adaption policy framework, on the basis that the latest guidance (NAP3) does not include clear adaptation goals, implementation details, or costs.[d-g]

The CCC has begun work on the next Independent Assessment of UK Climate Risk, which is due to be published in 2026.[h] We therefore expect to turn to assessing the potential fiscal costs of adaptation in the coming years, with the hope that some of the currently identified issues and gaps in government reporting and strategy on adaptation will have been, at least partially, addressed in the meantime.

[a] IPCC, *Climate Change 2022: Impacts, adaptation and vulnerability*, 2022.
[b] Defra, *Accounting for the effects of climate change – Supplementary Green Book guidance*, 2024.
[c] For example, the National Infrastructure Commission's, *The Second National Infrastructure Assessment*, 2023, provides infrastructure investment recommendations that would be robust to withstand a 4°C warming world – but it does not provide cost estimates of infrastructure built to withstand only current climatic conditions, or separate out what the marginal adaptation specific costs are from the total costs it provides.
[d] Institute for Government, *Adapting to climate change: How the UK can better manage a rapidly changing environment*, March 2024.
[e] Defra, *NAP3 The Third National Adaptation Programme (NAP3) and the Fourth Strategy for Climate Change Adaptation Reporting*, 2023.
[f] NAO, *Government resilience: extreme weather*, December 2023.
[g] CCC, *Independent Assessment of the Third National Adaptation Programme (NAP3)*, March 2024.
[h] CCC, *Proposed methodology for the Fourth Climate Change Risk Assessment – Independent Assessment (CCRA4-IA)*, May 2024.

# Physical risks of climate change

## Uncertainties around climate change damage

2.10 The future of the Earth's weather system over the remainder of the century is highly uncertain. So too, therefore, is the extent to which the UK will be physically affected by changing climate patterns, and the impact this will have on the economy and public finances. In this chapter, we have not estimated the economic and fiscal cost of the most extreme climate outcomes. As such, rather than representing a 'reasonable worst-case' outcome, the climate-related damage estimates presented in this chapter should be viewed as plausible scenarios at the lower end of the range of possible outcomes.[5] These estimates lie within the range of scenarios used by other official bodies in the UK (the Bank of England), the US (the Congressional Budget Office), and internationally (the Intergovernmental Panel on Climate Change).

2.11 Even within this range there are many sources of uncertainty affecting estimates of the potential economic and fiscal impact of climate change damage:

- **Uncertainty in the global emissions path:** global warming levels are directly dependent on total atmospheric greenhouse gas concentrations. These, in turn, depend on global emissions pathways across all countries. While there remains considerable uncertainty over the UK's total future emissions, this is greatly compounded by the uncertainty of the international community's future emissions, with many large emitters still without sufficient policy plans to meet their stated mitigation ambitions.

[5] On both global emissions data and latest temperature outturn, the IPCC's AR6 low-emissions, low-temperature scenarios (SSP1-1.9) are, for all intents and purposes, missed. In the past decade, global temperature increases relative to 1850-1900 have breached 1.2°C on four separate years, with 2023 recording a 1.46°C increase according to the Met Office. The Met Office is predicting 2024 to record a global average temperature increase of between 1.34°C and 1.58°C. The remaining IPCC scenarios from AR6 have peak temperature changes ranging from around 1.3°C to >7°C (where net zero is not reached). The potential predicted warming range in their current policies scenario (warming below 3°C) is from 1.8°C to 4.4°C (5-95th percentile probability). These lower estimate scenarios of below 3°C warming do not account for any tipping points being breached which could result in significant additional damage.

- **Uncertainty in how much emissions will impact global temperature and weather patterns:** It is clear that certain atmospheric gases will increase global temperatures, and this will alter the global weather system. There are, however, important uncertainties around the extent of these effects, as well as about how the different gasses interact and how sea versus land temperatures are affected.

- **Uncertainty over whether 'tipping points' are breached**: A tipping point occurs when an event is triggered that causes large and irreversible changes to the Earth's climatic system. As discussed above, there are several such potential tipping points, but it is uncertain whether and when any of these points will be breached, and if so, what the result would be.

- **Uncertainty over the impact on UK weather**: It is uncertain how changes in global temperature and weather patterns will affect the UK's climate. Changes in weather patterns could lead to either more or less rain over the UK, greater wind and storm activity or calmer conditions, or even cooler winters if the Atlantic Meridional Overturning Circulation (and by extension the Gulf Stream) slows significantly.[6]

- **Uncertainty over how this risk transmits to the UK economy**: As discussed in Box 2.2, there are a wide range of potential channels through which a changed UK climate could affect the economy. Economies have adapted to existing climatic conditions over hundreds of years, but climate change is now progressing at a much faster rate than historically experienced and is likely to affect capital stocks and labour productivity in ways that may be hard to adapt to in the short run. These changes will result in both pressures on, and shocks to, the economy and public finances.

- **Uncertainty over how impactful international spillovers will be**: The UK is a relatively cool country with relatively small agricultural output, and so the direct economic effect of temperature and extreme weather changes are unlikely to be as severe as in many other countries. However, the UK is highly trade-dependent, so impacts elsewhere could have significant spillovers. For instance, there was a 19.2 per cent increase in food prices in the aftermath of the Russian invasion of Ukraine, due to the combined effect of higher energy costs, disruptions to wheat and fertiliser supplies, and adverse weather patterns. Rising global temperatures could also have an impact on the UK via changes in global migration patterns or the intensification of geopolitical tensions.

2.12 Despite these important uncertainties, to illustrate the channels through which the climate affects the economy, and highlight sensitivities around key assumptions, we have constructed a set of scenarios for emissions, temperature, impacts upon GDP, and various fiscal outcomes in the following sections.

[6] The Gulf Stream is a fast-moving ocean current from Florida that flows across the Atlantic to the UK. It is responsible for the relatively mild winter conditions experienced in the UK compared to many other countries at similar latitudes. It is a part of the larger Atlantic Meridional Overturning Circulation, which conveys warm water from the tropics in upper sea level currents northwards into the north Atlantic, where it cools, sinks and is conveyed down southwards through deeper water currents.

## Possible emissions and temperature pathways

2.13 The UN's Intergovernmental Panel on Climate Change (IPCC) periodically undertakes comprehensive modelling of different future climate paths depending on a variety of different emissions pathways. Its Sixth Assessment Report (AR6) included climate change projections under five illustrative 'shared-socioeconomic pathway' scenarios (SSPs) of how global society, populations, and economies may evolve out to 2100.[7] Each of these SSPs is then combined with a representative concentration pathway (RCP). RCPs are projections of future GHG concentrations and are designated by their 'radiative forcing' values in 2100.[8] Generally speaking, the higher the RCP, the greater the GHG concentrations, and the higher the average expected surface temperature.

2.14 Within this array of potential climate outcomes, we focus our analysis around two of the more central scenarios. As shown in Chart 2.4, these are:

- A **global net zero** pathway where worldwide mitigation efforts are significantly strengthened, such that global net zero emissions is achieved (albeit around 2070, not 2050).[9] The mitigation efforts in this pathway are projected to limit warming in 50 years' time to below **2 degrees Celsius**. We refer to this as the **'Below 2°C'** scenario.
- A pathway associated with **current global policies**. That is the trajectory if the international community meets its current policy commitments. Under this pathway, emissions fall at an insufficient rate to reach net zero. As a result, global temperatures increase by close to **3 degrees Celsius by 2100**.[10] We call this the **'Below 3°C'** scenario. Under this scenario, temperatures will continue to rise beyond 2100, albeit slowly, as net greenhouse gas emissions are still above zero at this point.

2.15 While the future emissions path is highly uncertain, it is reasonable to assume it could fall somewhere between these scenarios: the global trend has been for strengthening mitigation commitments in recent years, meaning that – unless there is rollback of commitments, or an acceleration in emissions from feedback loops, such as tipping points – the future emissions path is unlikely to be higher. However, the emissions path in the 'Below 2°C' scenario is likely towards the limit of what is plausible, as it would require immediate, significant, and large changes in mitigation policies across the globe. There are a range of possibilities for the impact on global temperatures from the emissions levels of these two scenarios: we have chosen the IPCC's 50th percentile probability paths for each.[11]

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7 IPCC, *Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*, 2023. In its latest report the IPCC has moved to using shared socioeconomic pathways (SSP) combined with RCP projections to describe its scenarios. The SSP pathways provide different illustrative future scenarios for how the globe may develop with regards to things like population, urbanisation and technological development. They then combine these SSP scenarios with different RCP scenarios from their prior assessment report (AR5) to produce "SSPx-y" scenarios (with the x indicating the SSP scenario, and the y indicating the RCP scenario).

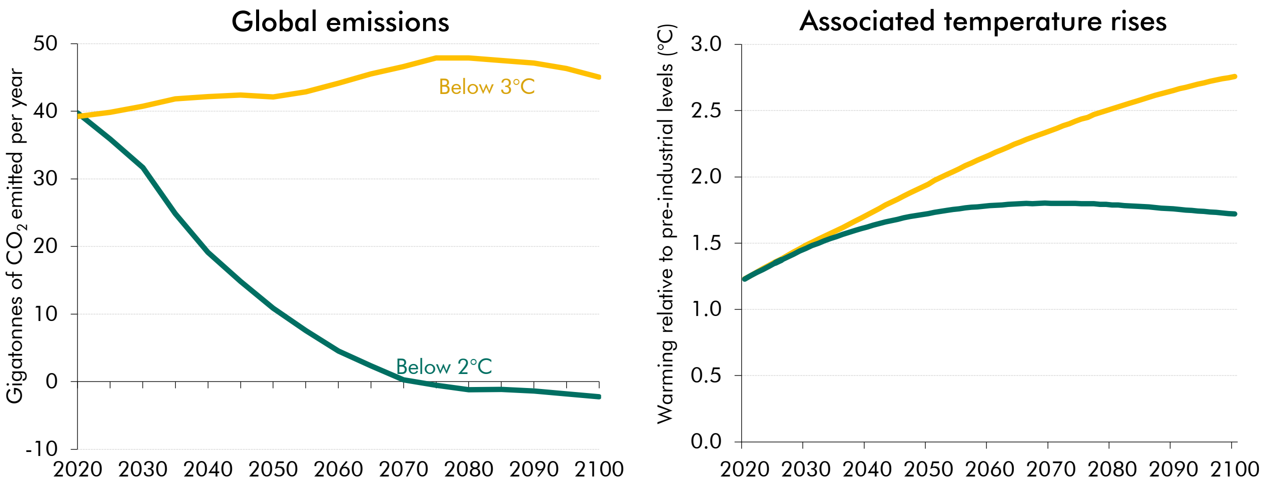
8 Radiative forcing is the changing energy balance in the Earth's atmosphere – that is the radiative flux. Energy from the sun, clouds aerosols and greenhouse gas concentrations all contribute to the radiative forcing. The higher the radiative forcing, the higher the average surface temperature.

9 This is consistent with the RCP2.6 scenario. Temperatures peak around the point that zero emissions are reached, which in this scenario is around 2070, after which temperatures begin to slowly decline for the remainder of the century.

10 This is consistent with the RCP4.5 pathway. While emissions begin to decline slightly by the end of the century, they are still above current emissions levels, and so global temperatures will be expected to continue to rise above 3°C higher than the pre-industrial average into the next century.

11 The 5th to 95th temperature bands for the RCP2.6 scenario (Below 2°C) are 1.3 to 2.3°C and for RCP4.5 (Below 3°C) range from 2.1 to 3.6°C change from pre-industrial temperatures by 2100.

## Chart 2.4: Global emissions pathways and associated temperature rises in two climate scenarios




Source: IPCC

## Sources of climate-related damage

2.16 These changes in average global temperatures are likely to give rise to both chronic and acute environmental impacts:

- **Chronic impacts** are the gradual and long-term impacts over time due to rising average temperatures, rising sea levels, and changing rainfall patterns. While these are the most widespread impacts of climate change, by their gradual nature they are likely to be the ones that societies are more easily able to adapt to over time. For instance, within the UK, the ten warmest years since 1884 have all occurred since 2002 – warm spells have more than doubled, with the average length of a warm spell 5.3 days in 1961-90, increasing to 13 days in the decade 2008-2017.[12]

- **Acute impacts** are caused by an increase in the variety, frequency, and severity of extreme weather events associated with the rise in global average temperatures. This can include heatwaves, floods, storms, cyclones, droughts, and wildfires. These impacts are often more concentrated geographically than chronic impacts, but their sudden and more unpredictable nature means they are likely to be the ones that societies find it more difficult to prepare for and adapt to. For instance, storms Babet and Ciarán (which successively hit the UK in October and November 2023), resulted in at least seven deaths in the UK, and over £500 million in insurance payouts, with around 36,000 home insurance claims and over 5,000 business claims.[13]

2.17 Between the IPCC's fifth (2013-2014) and sixth (2021-2023) Assessment Reports there has been an observed increase in severe climate-related events around the world.[14] This

[12] Met Office, *State of the UK Climate 2017: Supplementary report on climate extremes*, 2018.
[13] Association of British Insurers, *Weathering the Storm*, news article, 14 December 2023; and Met Office, *Storm Babet 18-21 October 2023*, 19 October 2023.
[14] IPCC, *Climate Change 2022: Impacts, Adaptation and Vulnerability*, 2022.

includes acute food and water insecurity in many regions, with resulting increases in malnutrition; increased mortality from higher temperatures; increasing severity and spread of wildfires; and increases in heavy precipitation and flooding.[15] There have also been increases in sea level rise, and in drought and heatwaves across the globe. As we discuss below, this has been mirrored in the UK. The latest IPCC report notes that *"regional changes in the intensity and frequency of climate extremes generally scale with global warming"*, with greater temperature extremes, the intensification of precipitation, and worsening of droughts in some regions all occurring with "*high confidence*".[16]

## The macroeconomic effects of climate damage

2.18 These physical risks of climate change can transmit to the economy through the following ways:

- **Chronic climate impacts** can affect labour supply via, for example, higher levels of heat stress and increases in human mortality. Higher temperatures can also reduce productivity by reducing agricultural output or by increasing energy costs, for example to actively cool business premises or to ensure adequate refrigeration of perishable goods. Higher sea levels and rainfall can also impact the economy's productive capacity through greater depreciation of the capital stock as coastal areas become uninhabitable and land becomes inundated.

- **Acute climate impacts** from more frequent and severe extreme weather events can lead to loss of life, disruption of business, damage to commercial and residential property, loss of agricultural yields, or lower labour productivity. This can also lead to rising insurance costs (or the failure of insurance markets), shifts in relative prices, and changes in trading patterns which force painful structural changes on the economy.

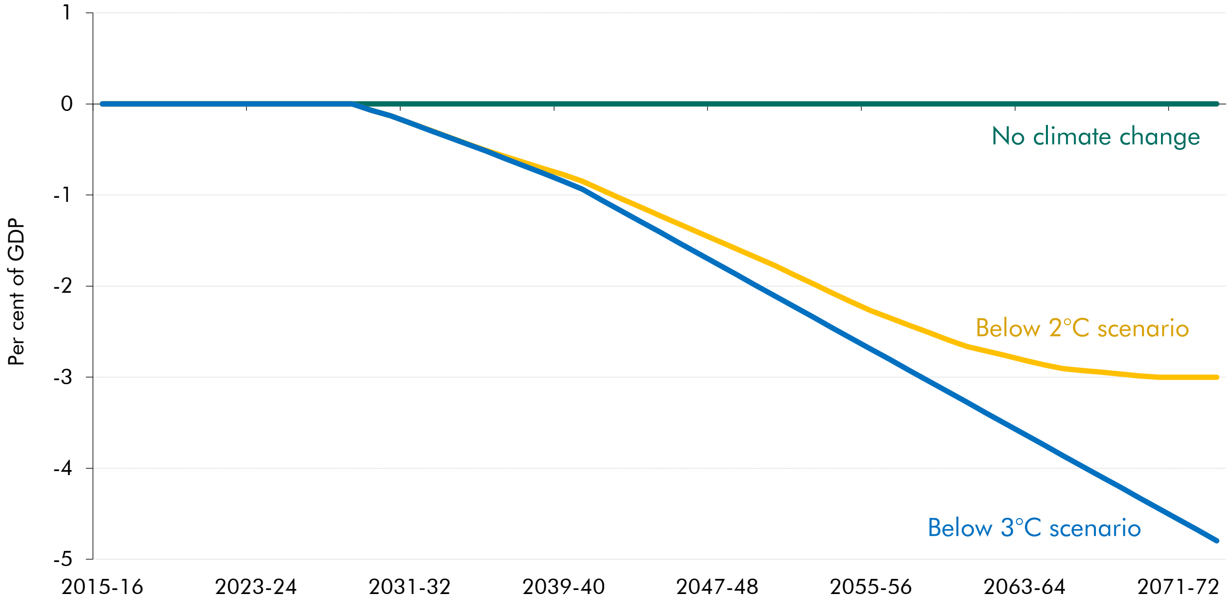
2.19 To produce illustrative scenarios of these impacts of climate change on the UK economy, we have drawn on the 'below 2°C' and 'current policies' scenarios created by the Network for Greening the Financial System (NGFS) for risk assessment purposes, which includes stress testing the financial system.[17] The latter of their scenarios underpins our below 3°C scenario, with the two scenarios being consistent with the IPCC's RCP2.6 (below 2°C) and RCP4.5 (below 3°C) emission pathways. The NGFS scenarios are produced by a group of central banks and financial supervisors in collaboration with an academic consortium, and have been used as inputs by a range of international organisations, including the Bank of England and IMF.[18] They decompose economic impacts into those stemming from the crystallisation of both chronic and acute physical risks, and from transition risks (that is the transition to net zero).

2.20 Based on this, we estimate that the physical damage from climate change in the UK, when compared to a baseline with no climate change impacts, could:

[15] See IPCC, *Climate Change 2023 Synthesis* Report, March 2023.
[16] See, IPCC, *Chapter 11: Weather and Climate Extreme Events in a Changing Climate in IPCC Sixth Assessment Report*, 2023.
[17] See NGFS, *NGFS Climate Scenarios Technical Documentation*, 2023, and NGFS, *NGFS Scenarios for central banks and supervisors*, 2023 for further details.
[18] Members of the consortium include Potsdam Institute for Climate Impact Research, International Institute for Applied Systems Analysis, University of Maryland, Climate Analytics, ETH Zürich, and the National Institute of Economic and Social Research.

- **lower GDP by around 3 per cent by 2074 under a below 2°C scenario**, with the economic impact remaining broadly constant from 2070 onwards as global temperature peaks at 1.8°C higher than pre-industrial level; and
- **lower GDP by around 5 per cent by 2074 under a below 3°C scenario**, as the continued warming throughout the century results in more physical and, as a result, economic damage. These costs would continue to grow into the next century as atmospheric GHG concentrations continue to increase, and temperatures continue to rise.[19] [20]

## Chart 2.5: UK real GDP under different scenarios – difference from baseline




Source: OBR

2.21 There is considerable uncertainty around these estimates of climate-related GDP losses. This uncertainty is skewed to the downside, with significantly more adverse outcomes more likely than significantly more benign ones. For this reason, we show sensitivity analysis that reflects these skewed risks from paragraph 2.49. Nonetheless, these estimated GDP losses are consistent with the growing literature on the economic costs of climate change whose findings are surveyed in Box 2.2.

[19] Our baseline GDP forecast does not explicitly account for the degree of climate change over the projection period (but the outturn will implicitly include the impact of current levels of climate change (around 1.3°C)). Our macroeconomic scenarios assume the impact of both climate scenarios does not begin to be felt until 2028-29 (beyond our medium-term forecast horizon), increasing to the full impacts of each respective scenario felt in 2073-74 compared to a no climate change baseline.

[20] The macroeconomic impact in our scenarios is smaller than those reported in the corresponding NGFS ones. The modelling approach used by the NGFS to produce their scenarios, while extensive, currently does not capture all types of climate damage. As such, for their 'current policies' scenario, they present figures associated with the 95th percentile of the temperature distribution as a way of gauging those impacts not explicitly captured in their methodology. Alongside this, they also make available their estimates based on more central 50th and 60th percentiles. We judge that the latter, which finds that UK GDP will be 4.3 per cent lower in 2050, is more suitable for the purposes of this chapter as we focus on a subset of potential physical risks from climate change. We also exclude any impact from 'transition risks' from global measures to transition away from fossil fuels, given this chapter's focus on physical risks.
To turn this estimate of the long-term macroeconomic impact of climate damage into a 50-year GDP path, we have made the following assumptions: i) all of the additional impacts of physical risks from climate change occur after 2028 for consistency with the medium-term forecast in our March 2024 *Economic and fiscal outlook*, and ii) these impacts can be applied directly to our baseline projection for real GDP growth of a little under 2 per cent over the long term. In effect, this assumes that the impact of physical damage from climate change are not contained within the long-term economic determinants used elsewhere in this report.

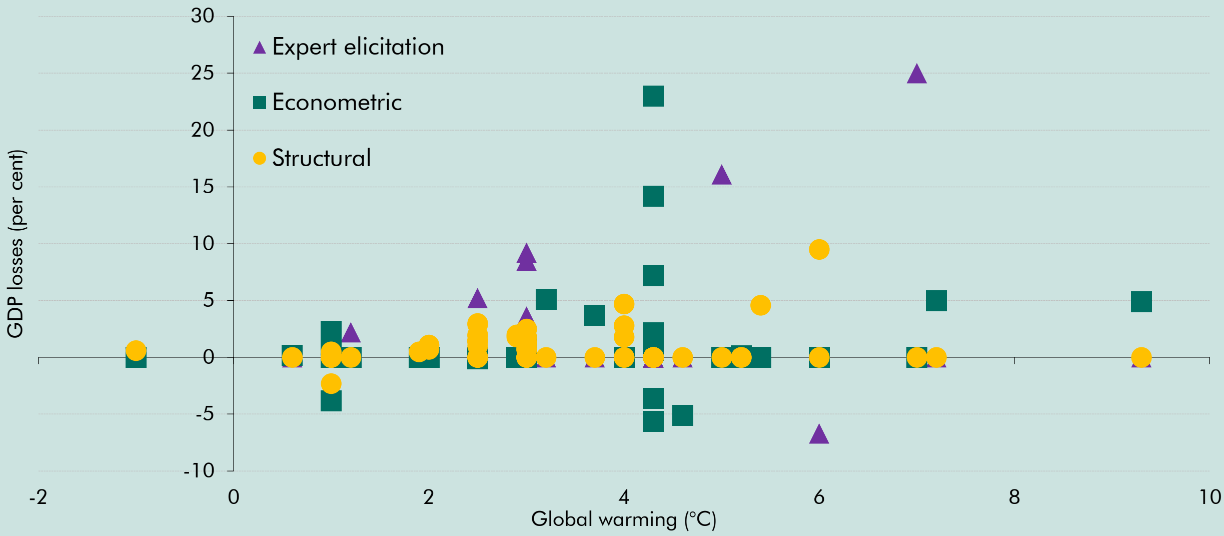
## Box 2.2: Estimating the economic costs of physical damage

A near-consensus amongst economic studies is that the impact of global warming on economic output will be negative, with more warming leading to larger impacts.[a] However, there is a wide range of estimated GDP losses and making comparisons between them is not simple. For instance, as shown in Chart A, one comprehensive meta-study suggests that the estimates of long-run total loss of global GDP from global warming of 4°C are on average *minus* 4.2 per cent, but range between *minus* 23 and *plus* 6 per cent.[b]

The wide range of estimates partly arises from differences in both the physical impacts assumed and the corresponding economic transmission channels which the authors aim to capture. For example, studies vary in whether chronic or acute climate impacts, or both, are being captured and which aspects of the economy they impact. Some estimates are the result of examining such impacts in the context of the domestic economy only, while others also consider the international linkages through cross-country trade and investment. Another source of difference comes from the modelling approaches used. These include:

- **Structural models**, which employ existing relationships between economic variables and their interactions with the physical environment (such as General Equilibrium models).
- **Econometric models**, which empirically link past changes in temperature with changes in economic output.
- **Expert elicitation**, which uses expert judgment to calibrate the effects of climate change.

### Chart A: Estimates of the long-run economic impact of climate change




Note: Tol reports the welfare-equivalent income change from climate change. We assume this is a useful proxy for GDP, as over the long-run global incomes should equal global output. Structural is a combination of enumerative and CGE.
Source: Tol, R., *A meta-analysis of the total economic impact of climate change*, 2024.

As Chart A highlights, estimates of the economic impact of climate change obtained from econometric models are the most varied. In contrast, structural models, which are likely to explicitly model a finite subset of channels and allow for general equilibrium effects (i.e. reallocation of factors), tend to yield the smallest effects. Studies that only capture chronic effects and their domestic effects also tend to find less economic impact. The biggest effects are generally found in studies that capture: (i) both chronic and acute effects; (ii) both domestic and international transmission; and (iii) use econometric models. The largest effects for a given rise in temperature also often come from expert elicitation though some commentators have questioned these results.[c]

Impacts are also heterogenous across regions. For instance, Kalkuhl and Wenz (2020), an econometric study of chronic temperature impacts that underpins the NGFS scenarios, finds that there is a -0.8 per cent impact on GDP for every degree of additional heating in a relatively cool country.[d] Whereas in hotter regions, an additional degree of warming leads to 3.5 per cent of damage. This regional variance in economic impacts is confirmed by several other studies, which generally find that GDP impacts are higher for hotter countries, low-lying coastal countries, and places near the equator.

### UK estimates

Given its geographic position, the UK's projected temperature rise is less than most other regions in the world. As such, UK-specific estimates of the economic impact from climate change tend to find less of an effect than the global average. The impacts are nonetheless significant compared to previous economic shocks the UK has faced.

Two of the most comprehensive studies of potential climate change-related damage to the UK economy generated estimates somewhat above our 5 per cent of GDP loss under a below 3°C scenario:

- The Bank of England's 2021 Climate Biennial Exploratory Scenarios included a 'no additional action' scenario which estimated that 3.3 degrees of warming results in a -7.8 per cent impact on GDP in the UK in 2050.[e] This scenario, as with the unadjusted NGFS figures, was produced for the purposes of stress testing, and models both chronic and acute climate impacts through domestic and cross-country effects.
- The Grantham Institute estimated that 3.9 degrees of global warming produces a -3.3 per cent impact on UK GDP by 2050, and a -7.4 per cent impact by 2100.[f] These figures, in addition to capturing both chronic and acute climate impacts through domestic and cross-country effects, include a 'catastrophic risk' channel which makes up 4.1 percentage points of this impact. As such, it may be capturing channels we have not attempted to calibrate.

[a] See, for example, Tol, R., *A meta-analysis of the total economic impact of climate change*, 2024, as well as the box titled *Estimating Global Economic Impacts from Climate Change* in IPCC, *Chapter 16: Key Risks across Sectors and Regions of IPCC Sixth Assessment Report*, 2023.
[b] Estimates in the meta-study are presented in comparative static terms – that is, the difference in global economic welfare between an equilibrium where there is no future climate change and another equilibrium where there is future climate change.
[c] On elicitation studies, Tol (2024) notes "*Elicitation studies tend to be pessimistic. It is not clear why supposed experts deviate from the published literature*".
[d] See Table 9 of Kalkhul, M. and Wenz, L., *The impact of climate conditions on economic production. Evidence from a global panel of regions*, 2020. The marginal effects on GDP are on the basis that the average temperature is 10 degrees for cooler countries and 25 degrees for hotter countries. Note that these estimates abstract from the slightly lower level of warming in the UK.
[e] Bank of England, *Key elements of the 2021 Biennial Exploratory Scenario: Financial risks from climate change,* 2021. The scenarios are based on how early the transition to a net-zero emissions economy starts, in their 'early action' scenario the transition starts in 2021, in their 'late action' scenario the transition is delayed until 2031 and in their 'no additional action' scenario where no new climate policies are introduced beyond those implemented prior to 2021. Physical risks in the 'no additional action' scenario is calibrated based on climate outcomes that could materialise in the period from 2050 to 2080 if no further policy action were taken.
[f] Grantham Research Institute on Climate Change and the Environment, *What will climate change cost the UK? Risks, impacts and mitigation for the net-zero transition,* 2022.

## The fiscal impacts of climate damage

2.22 The physical risks of climate change can impact the public finances through a number of channels. When considering these different fiscal implications, it is helpful to separate the potential risks into *indirect* and *direct* costs (although some pressures have an element of both).[21]

- **Indirect costs of damage** are those that stem from the reduction in *productivity* and employment due to the chronic impacts of climate change on the economy, and the corresponding potential losses to government receipts and increases in public spending pressures. For example, damage to the capital stock can reduce output or demand on businesses (beyond the cost of the physical damage), reducing profits and the corporation tax receipts they generate. Firms may respond by lowering wages or reducing headcount, which would reduce personal tax receipts. Conversely, pressures on government spending may not fall symmetrically with receipts, and some may increase (for example due to increases in unemployment).

- **Direct costs of damage** are typically those that arise in response to a physical shock which puts direct pressure on the public finances, typically on the spending side. These include, for example, the costs of repairing the road and rail networks following severe flooding, the increased costs on the health system during heatwaves, or pressure to compensate households and businesses for uninsured losses from flooding or other severe weather events.[22] These are best looked at as the additional costs the public sector may need to pay on top of the impacts from GDP losses to the UK economy.

2.23 Taking an example, a flooding event may damage a major rail line, which would have consequences for productivity (people unable to travel to work, for example, until the rail is fixed), which is captured through our *indirect* channel. But in addition to these indirect costs, the government may need to pay for the repairs to the rail, which is captured in the *direct* channel.

2.24 For this work we have focused on setting out plausible estimates for the direct costs of a subset of climate-related damages. In addition, as discussed below in paragraph 2.25, we incorporate the indirect costs using a similar approach to our prior analysis into the fiscal costs of climate change mitigation.

### Indirect fiscal costs

2.25 To estimate the indirect fiscal costs of climate damage, we use our long-term fiscal projection described in Chapter 4 of this *Fiscal Risks and Sustainability* report as the 'no climate change' baseline. We then make the following assumptions about how government

[21] The chronic and acute effects of climate change on the economy, as discussed in paragraph 2.18, do not exactly map onto indirect and direct fiscal impacts above. The *indirect* costs to the public finances will be generated by both acute and chronic damages, though chronic impacts are the main channel. The *direct* costs are nearly all due to acute damages.

[22] There may be direct pressures on government to invest in adaptation measures in the face of a worsening climate. This sort of investment is a near-term fiscal cost that may defray future direct or indirect fiscal costs. However, as noted above, our analysis in this report does not explicitly account for adaptation costs due to current limitations in the available data.

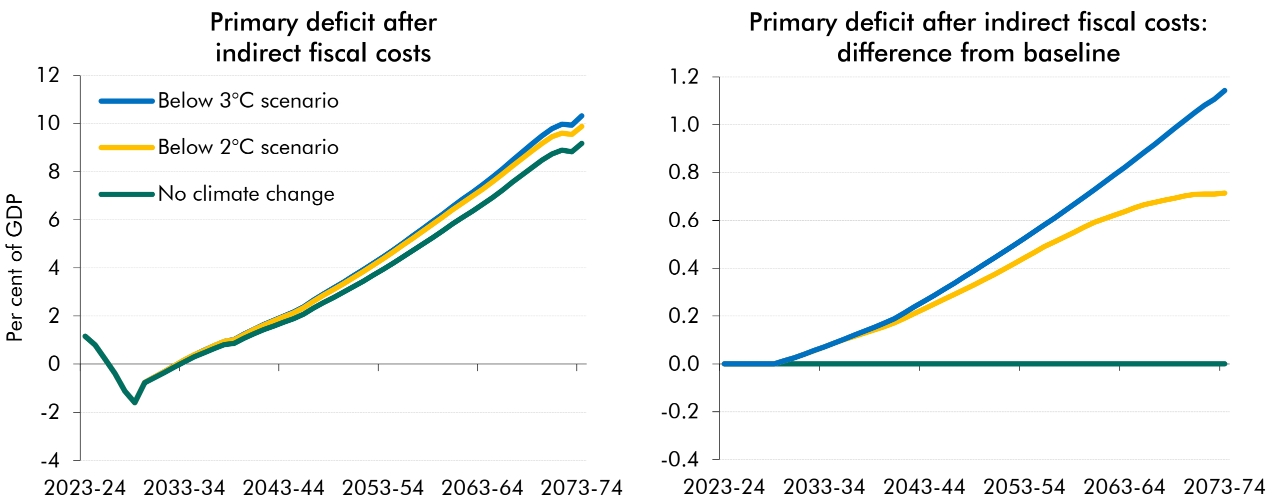
receipts and spending respond to the reduction in GDP in the below 2°C and below 3°C scenarios:

- We assume that **receipts** fall one-for-one with nominal GDP (an elasticity of 1). This means revenues are fixed as a share of GDP between the scenarios and the baseline, and so are lower in cash terms in the scenarios due to the lower size of the economy. For example, cash receipts fall by around 5 per cent by 2074 in our below 3°C scenario.

- For **spending**, we assume that public service and investment spending remains unchanged in nominal terms from the baseline, while all other primary spending (mostly welfare and pensions) moves in line with nominal GDP. This is a bespoke assumption for these climate scenarios and results in the spending-to-GDP ratio responding inversely to changes in GDP with an elasticity of 0.5, since public services and investment spending make up roughly half of total spending. In effect, this assumes government looks to maintain the same public service provision as in the baseline projection, despite a smaller economy and lower cash tax receipts. Alternatively, a government could choose to limit the fiscal impact by reducing the level of public service provision. We also incorporate debt interest costs, though at a later stage after incorporating both indirect and direct costs, as described below in paragraph 2.47.

2.26 The combined effect of these two assumptions on the public finances is shown in Chart 2.6. In the below 2°C scenario, the primary deficit is an additional 0.7 per cent of GDP each year by 2074. In the below 3°C scenario, the primary deficit is an additional 1.1 per cent of GDP each year by 2074. We explore sensitivities around these results from paragraph 2.52.

## Chart 2.6: Indirect fiscal costs under different scenarios




Source: OBR

## Direct fiscal costs

2.27 As discussed above, along with rising average temperatures, extreme weather events are likely to become more frequent and more severe over the next 50 years. To estimate the additional fiscal costs of such events – on top of the indirect fiscal costs described above due to lower GDP – we have focused on three types of risk for which direct costs are most readily quantifiable: river and surface flooding, coastal flooding, and heatwaves. Our illustrative estimates are based on historical data regarding the incidence and economic and fiscal costs of these events in the UK. We have cross-checked these against other information, including international evidence, academic studies, discussions with experts within and outside government, and evidence regarding the shares of past damage costs that have been insured versus uninsured.

2.28 There is a non-negligible risk that, with increasingly more severe events occurring, insurance cover may be insufficient or no longer offered, as is already happening overseas in regions with more extreme weather. If this were to happen in the UK, then there is a risk that the government may need to increasingly act as 'insurer of last resort,' replacing or underwriting existing private insurance arrangements. The potential fiscal costs were this to happen could be significantly more than the costs we have estimated below, which assume the insurance and reinsurance sectors continue to provide effective levels of cover in the UK, and government is only called upon to compensate the uninsured.

## River and surface flooding in the UK

2.29 River and surface flooding can cause significant damage to buildings, agriculture, and infrastructure, and can pose a risk to human health. The UK has experienced a number of severe floods in recent years, triggering activation of government fiscal support programmes in response to five events in the past six years. Direct costs to government include emergency service funding and support to affected households and businesses, administered through local authorities, and damage caused to public sector assets, including roads, rail, power lines, water systems, public buildings and IT infrastructure. [23] Some costs incurred by the private and public sector will be covered by insurance, although insurance premiums may become increasingly expensive.[24] The costs of these events do not fall evenly in terms of frequency, magnitude, or sectors affected.

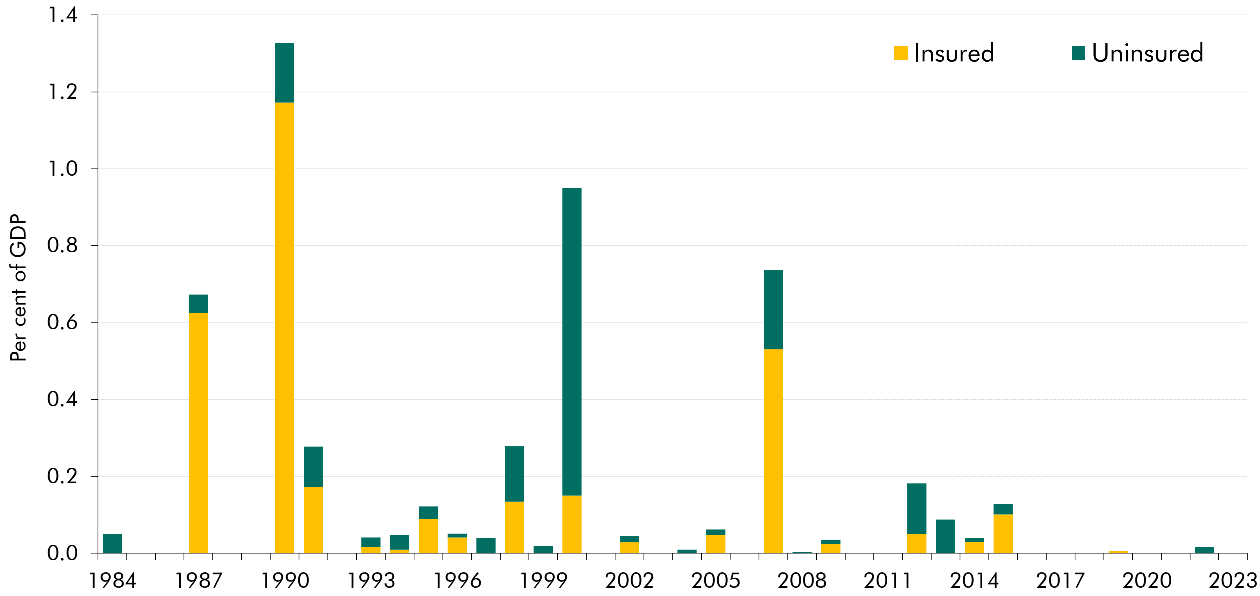
2.30 We base our projections on the current cost of river and surface floods in an average year, and then extrapolate this based on climate projections and the public sector's share of these costs. There are a limited sources available for this. Defra and the Environment Agency (EA) have produced detailed economic cost analysis on only two previous flooding events in the UK, the 2007 summer floods and the 2015-2016 winter floods, which we therefore use as a guide.[25] We discuss these events and impacted sectors in more detail in Box 2.3. We supplement this, as shown in Chart 2.7, with the insured and uninsured damage costs of reported weather events in the UK from 1984 using the EMDAT database, including river floods. Looking at the past two decades, the database shows that flood events (abstracted from other extreme events) as large as in 2015-16 occurred several times, and that the

[23] The relevant schemes are the 'Flood Recovery Framework' set up in 2017, and the 'Farming Recovery Fund'. Both have been activated – the flood recovery framework has been activated for five events since its inception, including most recently for storms Babet in late 2023, and Henk in 2024. The farming recovery fund was activated following the 2019 floods, where £1.4 million was claimed.
[24] The government has taken a variety of actions to keep insurance premiums down for these flood-prone homes, first with a statement of principle following the severe flooding of 2000, where insurers agreed to keep premiums low provided the government invested in flood defences. This was then superseded by Flood Re in 2016 – a UK government operated re insurance provider. As flood risk increases there is a risk that more homes and business will become high risk, beyond the scope of the current scheme.
[25] Defra, *The cost of the 2007 summer floods in England,* January 2010, and Environment Agency, *Estimating the economic costs of the 2015 to 2016 winter floods,* January 2018.

2007 floods were dramatically more costly than these. However, there are several noticeable recent gaps in this source which other data sources indicate carried significant costs – for example the 2019 floods, Storms Ciara and Dennis of 2020, and Henk in 2023.

2.31 Using these sources we estimate that the fiscal cost of 0.05 per cent of GDP seen in the 2015-16 floods is a reasonable illustration of the expected impact of flood events in the UK currently.[26] We then grow this in line with an estimated 67 per cent increase in flood damages in the below 2°C scenario, and a 94 per cent increase in damages in the below 3°C scenario to capture the effects of more frequent and severe flooding.[27] This results in river and surface floods costing 0.02 per cent of GDP more in 2073-74 in the below 2°C scenario, and 0.03 per cent of GDP more in our below 3°C scenario. Over the 50-year horizon this is a net difference of £9.6 billion in today's terms between the two scenarios. This assumes that the government bears the same proportion (36 per cent) of the total cost as it has in recent events (see Box 2.3).[28]

## Chart 2.7: Reported UK damage from extreme weather events




Source: EMDAT

2.32 Our estimates of the overall direct costs from floods (both private and public) are slightly higher than those calculated by other organisations. For example, the NGFS predicts an acute flooding damage impact of 0.1 per cent of GDP by 2050 under both its 2°C and 3°C scenarios, while we predict an impact of 0.11 per cent of GDP under our 2°C scenario and 0.13 per cent of GDP in our 3°C scenario. In terms of *additional* damage, we estimate that

[26] We have taken the economic costs by sector in the Defra report on costs to England and scaled up by 14 per cent to get costs for the UK (based on relative population levels in England versus the whole UK), and attributed each to being paid by the private or public sector, as detailed in Box 2.3.

[27] Sayers et al., *Third UK Climate Change Risk Assessment (CCRA3): Future flood risk*, 2020. Presented within the Third Climate Change Risk Assessment (CCRA), 2021. Figures were derived from the Sayers analysis for a Reduced Whole System Adaption scenario taking the costs for Fluvial and Surface water flooding. Calculated costs would increase by 67 per cent by 2080 in a 2°C scenario and 105 per cent by 2080 in a 4°C scenarios. For our 3°C scenario we assume the increase in flooding falls between these two figures.

[28] We assume that our calculated public sector share of total costs (36 per cent) remains the same throughout the 50 year projection. Should for example, insurance become insufficient, this share could increase significantly. Conversely, the government may choose to cover less of the private sector costs than we assume here, given increasing burdens on public finances, reducing fiscal costs.

from today, there will be an impact of between 0.05 per cent and 0.07 per cent of GDP across the whole economy under the two scenarios. This is similar to the NGFS additional damage estimate of 0.05 per cent of GDP by 2050 under its 2°C scenario, and greater than its 3°C additional damage scenario, which is also 0.05 per cent of GDP. For residential damage in Great Britain, a 2020 study by Sayers estimated an expected annual damage cost of around £230 million today, which increases to £400 million by the 2080s. And in an update to their 2020 report, Sayers (2023) estimated that annual damage costs would be 50 per cent greater compared to its previous estimates.[29] In comparison, our estimates suggest a cost of £456 million (0.02 per cent of GDP) in 2024, which increases to £1.1 billion (0.06 per cent of GDP) by 2074.

## Box 2.3: Estimating the direct fiscal costs of flooding

In June and July 2007, exceptional rainfall caused extensive flooding across the UK, especially in South and East Yorkshire, Worcestershire, Gloucestershire and Oxfordshire, though areas of Wales, Scotland and Northern Ireland were also affected.[a] The Met Office stated that, at the time, it was the wettest summer on record, with 414.1mm of rain falling across England and Wales between May and July, more than any other time since records began in 1766.[b] In 2015-16, serious floods again resulted from a series of heavy rainfall events from 11 named storms that hit Great Britain and Ireland between November 2015 and March 2016. Cumulatively the storms produced record rainfall in both monthly and seasonal accumulation records, with the most significant of these (Storms Desmond, Eva and Frank) impacting Cumbria, West Yorkshire and Lancashire, and North West Scotland the most severely.

Defra and the Environment Agency estimated that the 2007 summer floods cost the UK economy £3.2 billion, while the 2015-16 winter floods cost the economy roughly half of that (£1.6 billion). There are similarities in both floods as to where the major costs fell, as well as some discrepancies, as shown in Table A. For both, the two largest costs to the economy were to residential housing and businesses, although residential housing was a significantly higher cost in the 2007 floods, representing nearly 40 per cent of the total cost, whereas business felt the brunt in the 2015-16 floods at about a third of the costs. These costs we assume fall largely to the private sector. Communication and utilities also experienced large costs in both events. We would assume much of these sectoral costs would fall to the state. However, there is a large difference in costs to the health sector, which made up nearly 10 per cent of the 2007 total costs, but only 2.7 per cent of the 2015-16 floods (and which we assume fall entirely to the public sector). These differences could reflect that the 2007 floods impacted a more populous region of the UK's geography in the southwest of England, as opposed to less populated areas such as North West Scotland.

Based on the more recent of the two studies, we estimate the direct fiscal cost of flooding to be around 36 per cent of the total economic cost. We have assumed that the total reported £4.8 billion in 2024-25 prices (0.2 per cent of GDP) economic cost of the 2007 floods is split into:

[29] Sayers et al, *Beyond the local climate change uplift – The importance of changes in spatial structure on future fluvial flood risk in Great Britain*, 2020.

- £0.9 billion worth of costs to public infrastructure and public health which would fall wholly to the public sector;
- a further £0.7 billion worth of costs in sectors such as energy, water, and rail where the government would pay around half of costs; and
- £3.1 billion in private costs from damage to residential properties, businesses, and vehicles.

This gives an estimated **direct fiscal cost** of £1.3 billion (0.1 per cent of GDP) for the 2007 floods. Performing a similar exercise for the (less severe) 2015-16 floods results in economic costs of £2.1 billion in 2024-25 prices (0.1 per cent of GDP). Of these costs, there is:

- £0.6 billion worth of costs to public infrastructure and public health which would fall wholly to the public sector;
- a further £0.3 billion worth of costs in sectors such as energy, water, and rail where the government would pay around half of costs; and
- £1.2 billion in private costs from damage to residential properties, businesses, and vehicles.

This results in an estimated **direct fiscal cost** of £0.7 billion (0.03 per cent of GDP).

## Table A: The economic costs of the 2007 and 2015 floods in England

| | 2007 | | | 2015-16 | | |
|---|---|---|---|---|---|---|
| | Whole economy cost, £ million | Fiscal cost, £ million | Per cent of cost that is public | Whole economy cost, £ million | Fiscal cost, £ million | Per cent of cost that is public |
| Residential properties | £1,809 | £0 | 0 | £456 | £0 | 0 |
| Businesses | £1,116 | £0 | 0 | £669 | £0 | 0 |
| Temporary accommodation | £142 | £142 | 100 | £48 | £48 | 100 |
| Vehicles | £121 | £0 | 0 | £47 | £0 | 0 |
| Local authorities (excl. roads) | £202 | £202 | 100 | £95 | £95 | 100 |
| Emergency services | £12 | £12 | 100 | £4 | £4 | 100 |
| Environment Agency, flood management | £29 | £29 | 100 | £93 | £93 | 100 |
| Energy | £490 | £245 | 50 | £108 | £54 | 50 |
| Water | n/a | n/a | 0 | £27 | £14 | 50 |
| Rail | £217 | £109 | 50 | £158 | £79 | 50 |
| Road | £125 | £125 | 100 | £287 | £287 | 100 |
| Agriculture | £75 | £0 | 0 | £9 | £0 | 0 |
| Health | £433 | £433 | 100 | £56 | £56 | 100 |
| Education | n/a | n/a | 0 | £5 | £5 | 100 |
| Other | n/a | n/a | 0 | £25 | £12 | 50 |
| **Total** | **£4,771** | **£1,296** | **27.2** | **£2,087** | **£747** | **35.8** |
| *Memo: per cent of GDP* | *0.2* | *0.05* | | *0.08* | *0.03* | |

Note: We have uplifted the original figures in the studies to 2024-25 prices using cumulative GDP deflator growth.

[a] Defra and Environment Agency, *The costs of the summer 2007 floods in England*, January 2010.
[b] Marsh, T., *The 2007 floods in context,* March 2015.

## Coastal flooding costs and risks to the UK

2.33 Coastal flooding affects the economy and public finances in similar ways to river and surface flooding, via the damage done to public infrastructure and private property, and any pressures on emergency services. It could become more prevalent over the next half-century as sea level rises cause further coastal erosion, with 20 to 30 per cent of UK coastline estimated to be vulnerable.[30] Around 500,000 properties are at a 0.5 per cent, or greater, annual risk of coastal flooding and around 9,000 are at risk from erosion.[31] Past coastal flooding has caused considerable damage: the 1953 North Sea floods killed around 300 people in eastern England, inundated around 160,000 hectares of land, with 640,000 cubic metres of Thames water flowing into West Ham following the collapse of 100 metres of sea wall in London's East End.[32] More recently, Storm Xavier in 2013 caused over £1.6 billion in damage.[33] The expected annual economic cost of coastal flooding is currently estimated at around £360 million per year, although this figure exclude the costs of erosion.[34] In the absence of our current coastal defences these costs could be significantly higher.[35]

2.34 Costs from coastal flooding and erosion could grow significantly as sea levels rise. The latest Climate Change Risk Assessment (CCRA3) estimates that the UK will have to manage between 0.27 and 1.12 metres of sea level rise by 2100.[36] By the 2080s the number of properties at risk from coastal flooding and erosion could increase from just over 500,000 (in 2018) to 1.5 million.[37] Significant infrastructure is also at risk, with the CCC estimating that around 1,600km of roads, and 650km of railway lines, could be at risk from coastal flooding and erosion by 2100.

2.35 The CCRA3 report provides figures on the 'expected annual damages' of flooding in the present day and in the 2050s and 2080s for a 2°C and 4°C scenario, with scenarios for different levels of adaptation. We assume that the fiscal share of the expected annual damage is one-half of the total costs. This is a simplified high-level judgement, derived from the analysis underpinning the headline figures,[38] which breaks damage costs into:

- **Residential and non-residential properties**. Damage costs to residential properties makes up about 30 per cent of total damage costs, while damage to non-residential properties accounts for around one quarter. We assume that property damage is by

[30] UK Climate Risk, *Flooding and coastal change*, June 2021.
[31] Ibid.
[32] Met Office, *1953 east coast flood – 60 years on*, January 2013.
[33] Climate Change Committee, *Managing the coast in a changing climate*, October 2018.
[34] Sayers, P.B. et al., *Third UK Climate Change Risk Assessment (CCRA3) Future flood risk, Main Report*, July 2020. Erosion is a significant source of cost, which we add on in addition to the flooding costs to arrive out our fiscal estimates.
[35] The most significant of these, the Thames Barrier, currently protects around £300 billion worth of residential property alone. Environment Agency, *The Thames Barrier – protecting London and the Thames Estuary for 40 years*, May 2024. The cost of its replacement, together with additional costs to protect the Thames estuary, is expected to be around £16 billion. Defra, *Funding Thames Estuary 2100: costs and investment*, April 2023.
[36] This is broadly consistent with Met Office projections. Under an RCP2.6 scenario they predict 0.29 to 0.7 metres of sea level rise in 2100 compared to a 1980-2000 baseline, and for RCP4.5 0.37 to 0.83 metre of rise. From the Met Office, *UKCP18 Marine Report*, 2018.
[37] CCC, *Managing the coast in a changing climate*, October 2018.
[38] Sayers et al., *Third UK Climate Change Risk Assessment (CCRA3) Future flood risk, Main Report*, July 2020.

and large covered privately (for example, through insurance), with 10 per cent falling to the public sector (to help cover un- or under-insured property).

- **Other sectors**, which include damage costs to agriculture and land, infrastructure (power, water, roads and rail), emergency services, hospitals, GPs and care homes, and schools. These costs account for the remaining 45 per cent of annual damage costs, and we assume they all fall to the state.

2.36 Combined this gives us a fiscal share of one-half of the total economic costs.[39] In order to arrive at cost figures for the below 3°C scenario in 2074, we assume that costs are around two-thirds of the way between 2°C and 4°C costs, and that costs rise in a linear fashion from 2055 to 2085. Under a limited "no further action" adaptation scenario (where roughly current levels of investment are maintained, but not strengthened), using the aforementioned assumptions we estimate that the expected fiscal costs of coastal flooding and erosion in the UK will rise from 0.01 per cent of GDP in 2023-24 to 0.02 and 0.03 per cent of GDP in 2073-74, for below 2°C and below 3°C scenarios, respectively.[40] If all coastal adaptation investment were halted this would rise to around 0.14 per cent of GDP in a below 3°C scenario.

2.37 These estimates are similar to, or slightly lower than, estimates derived by other researchers, and so should be viewed as at the conservative end of the cost spectrum:

- A **European Commission** report arrived at a coastal flooding economic cost estimate for the UK of 0.07 per cent of GDP in 2050 and 0.24 per cent of GDP by 2100 (around 0.15 per cent of GDP in 2074).[41] Applying our fiscal share assumption of one-half would be roughly equivalent to a public sector cost of 0.08 per cent of GDP in 2074 – nearly three times greater than our estimate for a below 3°C scenario.

- A **Grantham Research Institute** report into the costs of climate change for the UK provided estimated economic costs of coastal impacts reaching around 0.25 per cent of GDP per year by the 2080s in a below 2°C scenario. (With optimal adaptation, the costs were noted to fall by around 86 per cent, and it is unclear what, if any, adaptation investment was assumed in their headline figure.)[42] Our whole-economy cost of 0.04 per cent of GDP for a below 2°C scenario just falls within their 90 per cent confidence range of 0.03 to 0.85 per cent of GDP. Given we are assuming there is some continued baseline level of investment in adaptation, we might expect our figures to be at the lower end of this range.

[39] The fiscal share is ultimately a policy decision, and in the absence of policy for such events we have made simplified assumptions on where the costs might fall. It is possible that some residential costs may well be borne by the state, and some of the other sector costs (like agriculture and power) may in part fall to the private sector.
[40] The report only provides figures on the costs of coastal flooding, and not coastal erosion. Using previous CCC findings which explored the avoided damages of coastal impacts for both flooding and erosion under planned adaptation scenarios, coastal erosion adds around 41 per cent to total costs. See CCC, *Managing the coast in a changing climate*, October 2018.
[41] European Commission, JRC Technical report, *Adapting to rising coastal flood risk in the EU under climate change*, 2020.
[42] Grantham Research Institute on Climate Change and the Environment, *What will climate change cost the UK? A study of climate risks, impacts and mitigation for the net-zero transition*, May 2022.

## Costs of extreme heat events

2.38 The Met Office defines a heatwave as '*an extended period of hot weather relative to the expected conditions of the area at that time of year*'. The economic costs of these heatwaves are mostly captured in our projections via reduced economy-wide productivity (which we capture fiscally through our indirect effects channel). But there are a number of direct fiscal costs that also need to be captured.[43] These direct fiscal costs arise through several channels:

- **Demands on the health system**: For example, in 2022 there were estimated to be around 3,000 excess deaths during the summer heatwaves.[44] Furthermore, during these heat events many hospitals and practices in the UK had to suspend or limit surgeries due to unsafe temperatures, being in older buildings with insufficient cooling.[45] Extreme heat (days with temperatures above 30°C) are estimated to increase NHS hospital admissions for a range of illnesses beyond heat stroke (in particular for metabolic and infectious diseases), with approximately 8,000 excess hospital admissions per year due to increased temperatures.[46] [47] With average day and night hospital admissions costing around £2,000 per person,[48] these excess admissions alone could cost the NHS in the order of £16 million per year.

- **Failures in transport and other critical infrastructure** that has not been built to operate under higher temperatures (for example rail and bridge infrastructure).[49]

- **Surges in energy demand** that can lead to blackouts and power failures across the economy, impacting the delivery of public services and putting pressure on government to provide compensation or ensure surplus capacity.[50]

2.39 The direct impact of heatwaves depends on the country's baseline average temperatures, and how well adapted their infrastructure, housing, healthcare and communities are to such events.[51] For the UK, a relatively cool country, the probability of temperatures exceeding 30°C on any given day remains relatively low under both a below 2°C and below 3°C

[43] The ONS has estimated that over the decade 2012 to 2021 heat has cost UK productivity an average of £1.8 billion per year (about 0.07 per cent of GDP), with 2020 costing 0.2 per cent of GDP. See ONS, *Impact of hot days on productivity in Great Britain methodology*, May 2024. However, these costs – reduction in productivity – are caught through our indirect effects channel, and not in our direct fiscal costs.

[44] UK Health Security Agency, *Heat mortality monitoring report: 2022*, July 2024.

[45] See for example, University of Birmingham, *2022 heatwave struck off surgery in fifth of UK hospitals*, March 2023.

[46] Rizmie et al., *Impact of extreme temperatures on emergency hospital admissions by age and socio-economic deprivation in England*, September 2022. The authors estimated the cost of high heat for the subset of diseases investigated was on average £10 million per year from 2001 to 2012. Heat related admissions were equivalent to about 6 percent of total admissions during these heat events. This is an underestimation of heat related increases in admission, as it does not include admissions due to for example heat stroke.

[47] ONS, *Climate-related mortality and hospital admissions, England and Wales: 2001 to 2020*, January 2022, estimates that there were an additional 12 thousand hospital admissions per year due to heat, offset by a reduction of 4 thousand per year due to milder winters, resulting in a net 8 thousand increase in admissions due to a warmer climate in the UK.

[48] NHS England, 2022/23 National Cost Collection data.

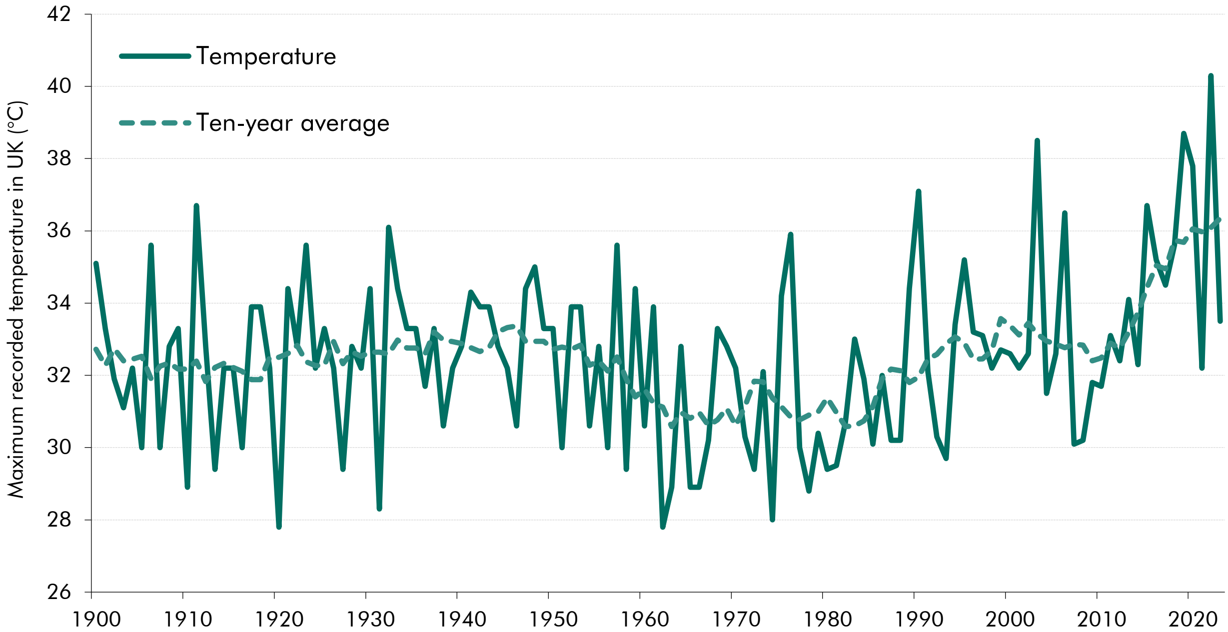
[49] For example, Ferranti et al., *Heat-Related Failures on Southeast England's Railway Network: Insights and Implications for Heat Risk Management*, April 2016. London's Guy's and St Thomas' hospital foundation suffered critical failures in its data centres due to overheating, significantly impacting health services. See NHS, *Review of the Guy's and St Thomas' IT Critical Incident Final Report from the Deputy Chief Executive Officer*, January 2023.

[50] See Drax, *Electric Insights Quarterly Reports: Q2 2022: How Heat Waves Will Change the Power System*, 2022. For example, several Balkan countries were struck by power outages during a heatwave in June this year.

[51] Barrage, L., *Fiscal costs of climate change in the United States*, Economic working paper series, No. 23/380, 2023.

world.[52] Nevertheless, there have been a growing number of heat events in recent years. 2022 saw temperatures breach the 40°C mark for the first time in mainland UK's history, with an observable uptick in the maximum daily temperature recorded each year in the last two decades in particular (Chart 2.8). As a historically cooler country, our buildings, infrastructure, and ways of living are not well adapted to cope when these heat events occur, leaving us more exposed to damages than better-adapted warmer countries.

## Chart 2.8: Maximum recorded temperatures in the UK




Source: CEDA, Met Office, OBR

2.40 To estimate the potential direct costs of current and future heatwaves for the UK we have used a variety of sources and assumptions. In a 2021 report prepared for the UK's CCRA3, the costs of heat-related hospital admissions and infrastructure damage was estimated to be around £300 million per year in the UK in the 2020s.[53] The Government's Third Climate Change Risks Assessment suggests that heat-related risks could cost the UK economy somewhere over £3 billion in today's prices (0.05 per cent of GDP) in a 2°C world by 2080.[54] We therefore assume that whole-economy direct costs of heat start at £300 million (0.01 per cent of GDP) in 2023-24, and peak at £3 billion (0.05 per cent of GDP) in 2065-66 (when emissions near net zero) in our below 2°C scenario.[55] Our estimate of the greater

[52] Indeed, increased average temperatures may also pose a potential economic opportunity in the form of reduced winter mortality, and lower heating demands. See Huang, W. T. K. et al., *Non-linear response of temperature-related mortality risk to global warming in England and Wales*, 2022.

[53] Paul Watkiss Associates, *Monetary Valuation of Risks and Opportunities in CCRA3*, May 2021.

[54] HM Government, *UK Climate Chang Risk Assessment 2022* (CCRA3), January 2022. The third risk assessment sets out 61 climate risks to the UK, assigning them an economic risk of Medium (greater than £10s of millions per annum), High (greater than £100s of millions p.a.), or Very High (greater than £1 billion p.a.) by 2080. There are two-to-three risks related to heat assigned 'Very High' (two directly related – H1 'risks to health and wellbeing from high temperatures' and H6b 'risks from summer household energy demand', and one that is in part related: I1 'risks to infrastructure networks from cascading failures'), one 'High', one 'Medium-High' and two 'Medium'. Our £3 billion figure is therefore likely towards the conservative end of the spectrum, with the potential for these very high risks costs to be much great than £1 billion.

[55] Although CCRA3 reported the total costs of a 2°C world in 2080, under our 2°C warming path peak temperatures would be reached by around the mid-2060s, upon which point they would plateau (as the world reaches net zero), before eventually starting to slowly decline. Therefore, we assume the peak of costs of heat would occur around this point, and before 2080.

costs in our below 3°C scenario is informed by World Bank's estimated probability of 'heat days' (days with temperature above 35°C) for the UK under different climate projections. Scaling up the below 2°C costs by the increase in heat day probability in a below 3°C scenario results in the costs being nearly twice as large in 2073-74 compared to a below 2°C scenario.[56]

2.41 To arrive at an illustrative estimate of direct fiscal costs we have assumed that the government will cover half of these costs. The additional costs on the health care sector are all assumed to fall to government. Similarly, we assume the costs to critical infrastructure such as rail, road and bridges would largely be covered by the state. Excess demands and risks to the power infrastructure from extreme heat, on the other hand, we assume to be met privately, through higher consumer bills. Based on these assumptions, extreme heatwaves cost the exchequer about 0.02 per cent of GDP a year by 2074 in a below 2°C world and about 0.04 per cent of GDP a year in a below 3°C scenario. Over the next 50 years this is equivalent a total of £49 billion and £64 billion (in today's terms) for a below 2°C and below 3°C world, respectively.

2.42 These figures are not dissimilar to other estimates of the cost of heat. The NGFS scenarios that we use in our macroeconomic model have acute impacts of heat increasing GDP losses by 0.04 percentage points from 2024 to 2050 (from 0.55 to 0.59 per cent of GDP) in the below 2°C scenario. The implied whole-economy direct costs in our below 2°C scenario increase by 0.038 percentage points out to 2050 (from 0.011 to 0.049 per cent of GDP). A report on the fiscal costs of climate change in the United States estimated that in a 4°C scenario (more severe than either of our scenarios) heat would increase health expenditure by 0.41 per cent on current levels by 2050.[57] Given current NHS RDEL expenditure, 0.41 per cent additional expenditure would be equivalent to 0.03 per cent of GDP. In our below 3°C scenario the estimated fiscal cost of heat is likewise 0.03 per cent of GDP in 2050 (with health costs accounting for two-thirds of that).

## Total direct fiscal costs due to climate change

2.43 Combining these three sources of direct costs (river and surface floods, coastal floods, and heatwaves), enables us to produce a projection for the increase in direct fiscal costs over the next 50 years, in each of our scenarios Chart 2.9:

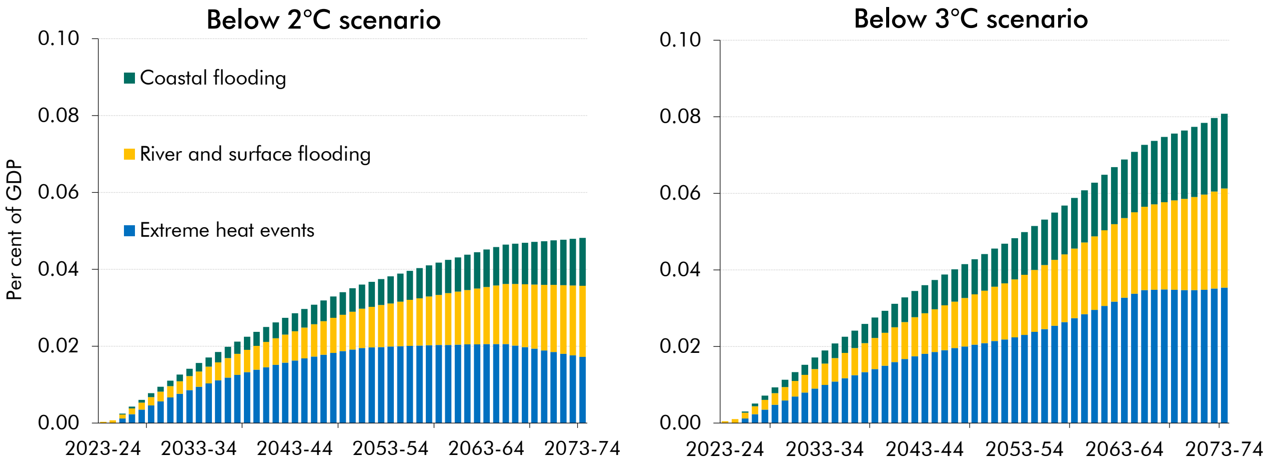
- In the **below 2°C scenario**, annual direct fiscal costs are 0.05 per cent of GDP higher in 2073-74 than today. These costs are relatively evenly split between risks, with river and surface flooding accounting for 38 per cent, heat 36 per cent, and coastal flooding and erosion 26 per cent, of the total.

- In the **below 3°C scenario**, annual direct fiscal costs are 0.08 per cent of GDP higher in 2073-74 compared to today, 0.03 percentage points higher than the below 2°C scenario. The costs in this scenario are largely due to heatwaves, which make up 44 per cent of the costs, with river and surface flooding, and coastal flooding accounting

[56] World Bank, Climate Change Knowledge Portal (2024). Date accessed 28 May 2024.
[57] Barrage, L., *Fiscal costs of climate change in the United States*, Economics Working Paper series, No. 23/280, March 2023.

for just under a third and under a quarter of total costs, respectively.[58] Heat can affect a much wider area, as well as having significantly greater impacts on mortality and morbidity, than river and coastal flooding risks. For example, in recent recorded history the UK has yet to experience a flooding event resulting in anywhere close to 3,000 deaths, yet this has already occurred due to a severe heat event.[59] As mentioned above, as a colder country, the UK is also less well prepared for warmer conditions, while it has had considerable experience with (and is reasonably well prepared for) flooding. Indeed, there is a much higher fiscal cost of flooding in the baseline compared to heat.

## Chart 2.9: Estimates of the direct fiscal costs under different scenarios




Source: OBR

2.44 These direct cost estimates assume that government will continue to provide a degree of compensation to the private sector (to both residential households and businesses), in line with historic trends. Our alternative scenarios vary this assumption.

# Baseline projection of the fiscal costs of climate damage

2.45 As outlined above, we expect that the combination of indirect and direct fiscal costs from a warming climate will put additional upward pressure on the public finances (over and above those demographic and other pressures captured in Chapter 4). The effect of the higher spending from both these is that, under our projections:

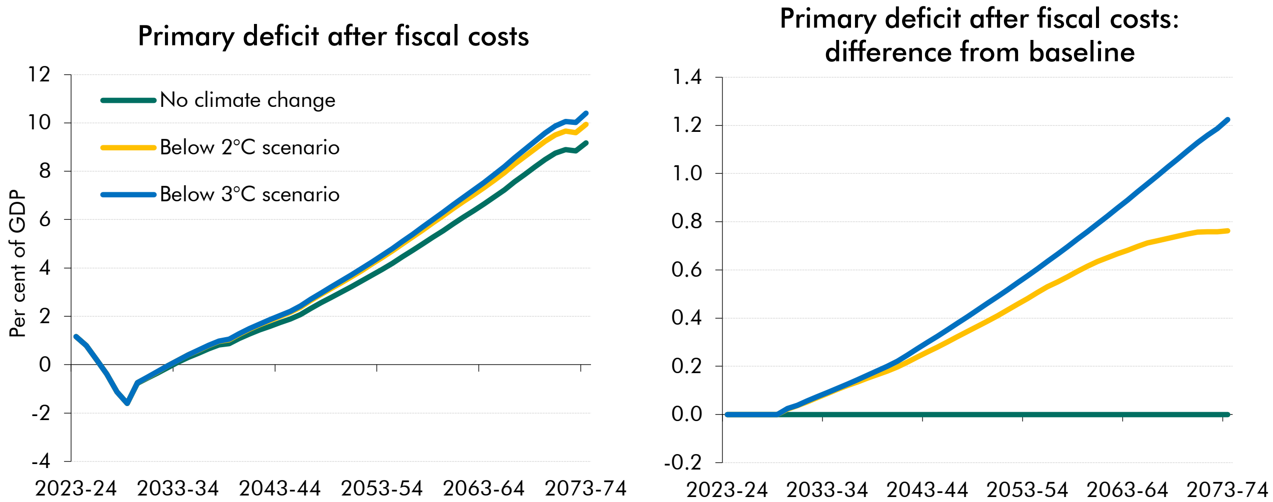
- The primary budget deficit is around an additional 0.8 per cent of GDP higher under our **below 2°C scenario** relative to a no climate change baseline, reaching 9.9 per cent of GDP by 2073-74.

[58] Heat's share is larger in the below 3°C scenario, because in the below 2°C scenario its costs stabilise and then fall, in line with temperature projections beginning to fall as net zero is achieved, whereas in the 3°C scenario heat-related costs continue to rise as temperatures continue to rise. This effect is not seen in the other sectors as we have used end-point cost figures for both 2 and 4°C to derive growth projections.

[59] The Great storm of 1703 is estimated to have killed many thousands (perhaps tens of thousands), although much of this destruction was from wind rather than flooding – with modern reconstructions classifying the event as an extra-tropical cyclone.

- The primary budget deficit is an additional 1.2 per cent of GDP higher under our **below 3°C scenario**, reaching 10.4 per cent of GDP by 2073-74.

## Chart 2.10: Impact of indirect and direct fiscal costs on the primary deficit under different scenarios



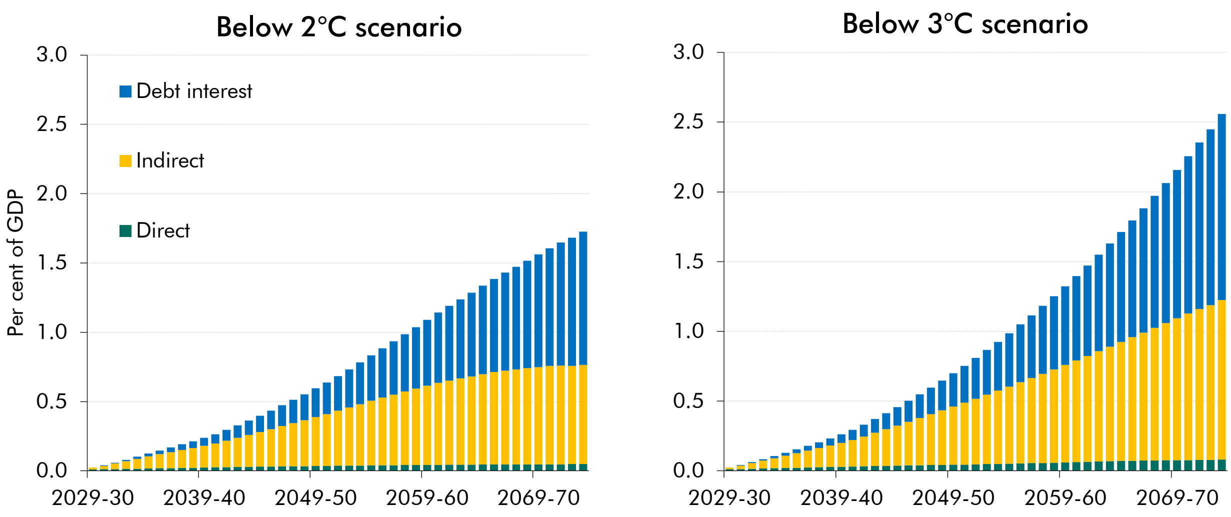

Source: OBR

2.46 To produce an aggregate fiscal projection, in addition to the direct and indirect costs set out above, we also include the cost of debt interest spending on the additional borrowing incurred to finance these costs. We calculate these debt interest costs using the methodology set out in Chapter 4 of this report. The aggregate effect of higher indirect, direct, and debt interest costs is that (Chart 2.11):

- Under our **below 2°C scenario**, public sector net borrowing is higher each year reaching an additional 1.7 per cent of GDP (£47 billion in current prices) in 2073-74. The indirect fiscal costs associated with a 3 per cent smaller economy adds 0.7 per cent of GDP to borrowing. Direct fiscal costs contribute another 0.05 per cent of GDP. By the end of the projections these past increases in borrowing result in a substantial rise in debt interest payments of 1 per cent of GDP.

- Under our **below 3°C scenario**, public sector net borrowing is higher each year reaching an additional 2.6 per cent of GDP (£70 billion in current prices) in 2073-74. The indirect fiscal costs associated with a 5 per cent smaller economy adds 1.1 per cent of GDP to borrowing. Direct fiscal costs contribute another 0.08 per cent of GDP. Higher debt interest costs increase borrowing by a further 1.3 per cent of GDP.

## Chart 2.11: Additional borrowing under different scenarios

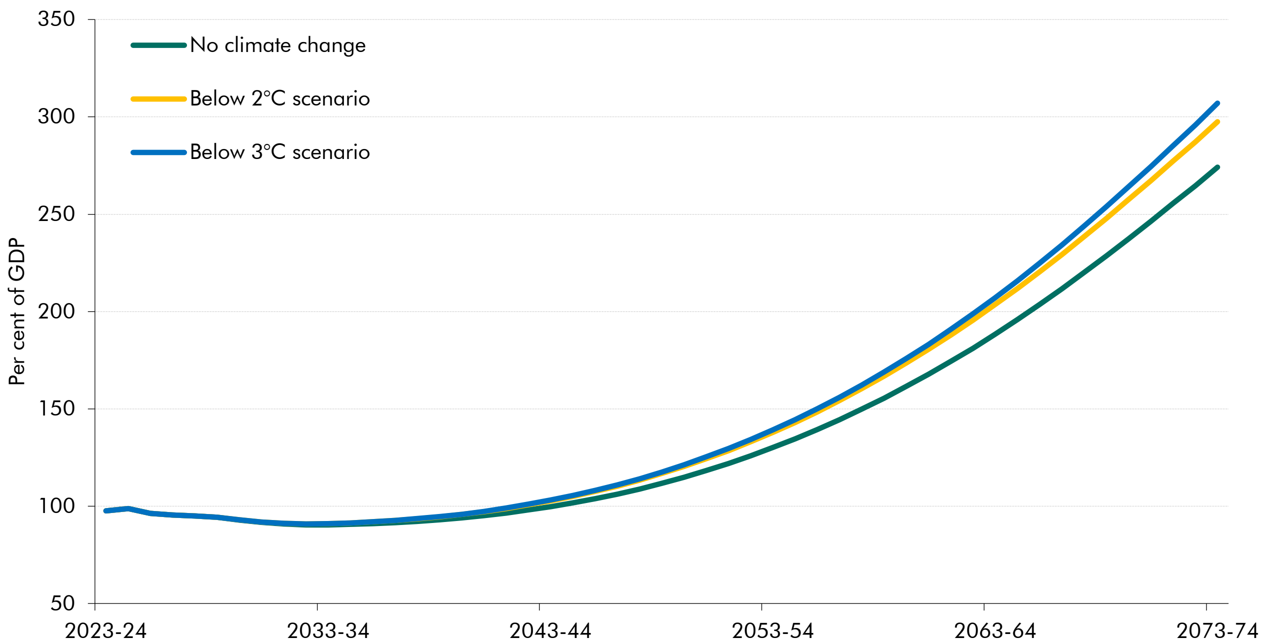



Source: OBR

2.47 Chart 2.12 shows the resulting paths for debt as a share of GDP under these temperature scenarios compared to the baseline long-term projection set out in Chapter 4 of this report. On top of demographic pressures captured in the baseline projection, which lead to debt approaching 275 per cent of GDP in the long term, the additional pressure from climate-related damages lead to:

- The debt-to-GDP ratio being 23 percentage points higher under our below 2°C scenario relative to the baseline at close to 300 per cent of GDP.
- The debt-to-GDP ratio being 33 percentage points higher under our below 3°C scenario relative to the baseline at close to 310 per cent of GDP.

## Chart 2.12: Public sector net debt under different scenarios




Source: OBR

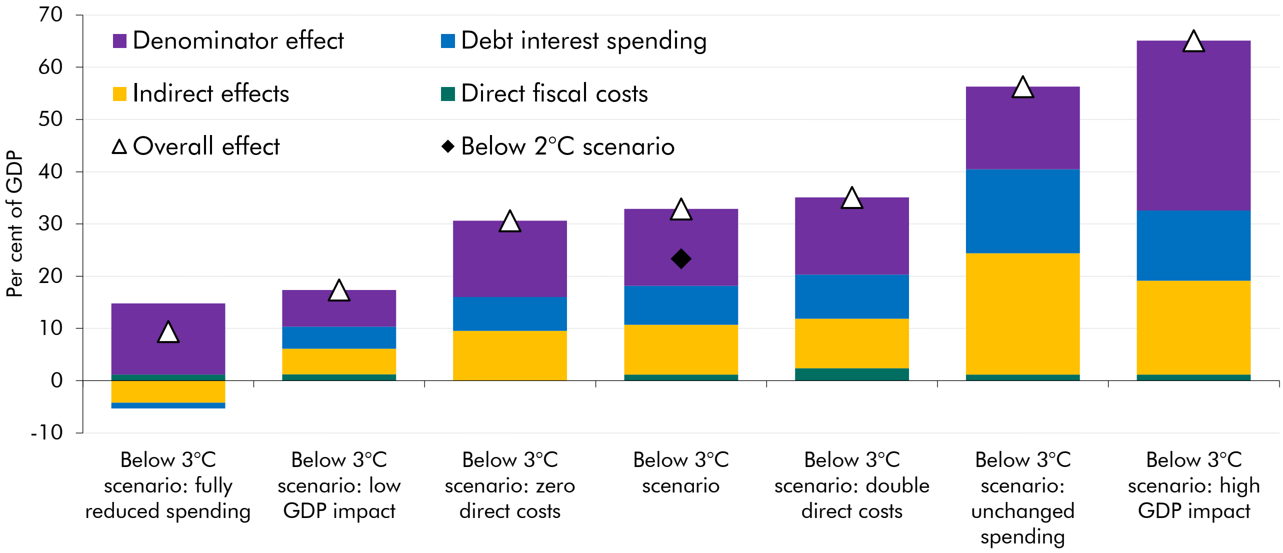
# Uncertainties, key sensitivities, and alternative scenarios

## Uncertainty

2.48 As we have stated throughout this chapter, there is significant uncertainty over many aspects of this work, including but not limited to: the global emissions path, the temperature path, the impact of this on the amplitude and frequency of severe weather events in the UK, the total costs of such events, and the share of these costs that the public sector covers. In the next section, we vary a number of the key assumptions underpinning our estimates to produce a range of scenarios for the cost to public finances of climate change damage. Chart 2.13 summarises each of these scenarios, which we detail in the following sections.

2.49 This analysis focuses on the below 3°C scenario to better highlight the range of potential fiscal risks under a scenario conditioned on a less optimistic outlook of future global mitigation policy.[60] As discussed previously, this analysis does not include the cost of severe tail risk events, such as mass climate migration or if a climate tipping point were to be breached. Such events would likely result in significantly higher costs but are highly uncertain and difficult to model. We also have not included the costs of more severe events occurring overseas which transmit to the UK economy through trade and other channels. The UK imports many of its goods and so international weather events that disrupt a key trade sector could have large impacts on the UK economy.

### Chart 2.13: Alternative scenarios of the fiscal costs of climate change – additional debt relative to baseline in 2073-74




Note: Scenario assumptions are described in paragraphs 2.50 to 2.57. The fully reduced spending scenario assumes that the Government lowers spending and receipts by the same percentage amount as the reduction in GDP. This effect reduces cumulative primary borrowing over the period in this scenario, as spending rises by much more than receipts as a share of GDP in the baseline projection. The debt denominator effect captures the impact of dividing the stock of debt in the baseline projection in 2073-74 by the GDP denominator in the relevant scenario.
Source: OBR

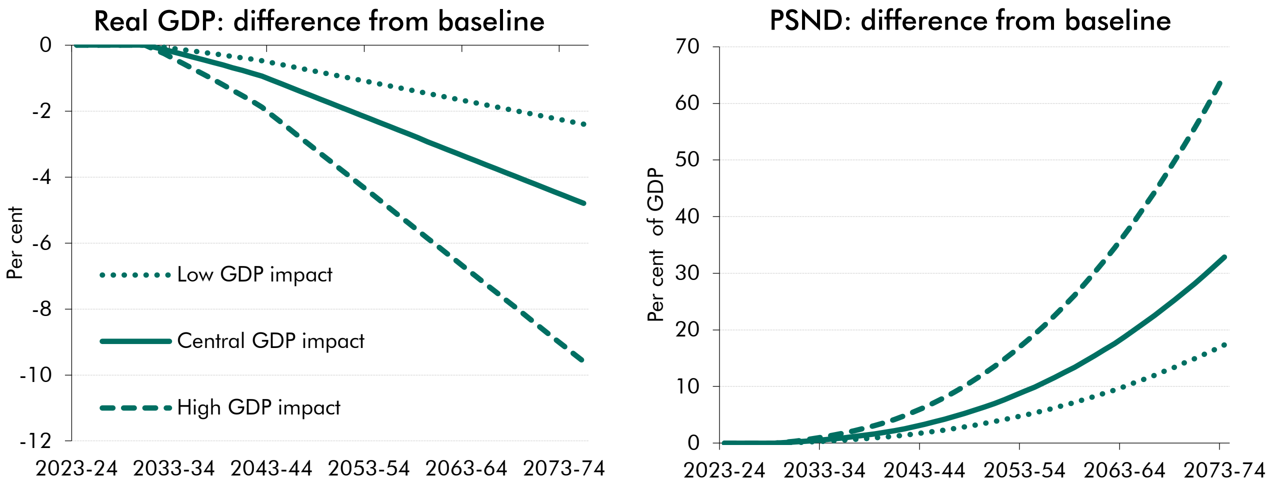
[60] We have not tested the below 2°C scenario for the range of different fiscal and GDP assumptions that we applied to the 3°C scenario. We judge the below 2°C scenario to be at the lower limits of plausible temperature rise scenarios. Therefore, the range of alternatives around the 3°C scenario gives a better indication of the full range of potential fiscal costs of climate change to the UK.

## Alternate GDP assumptions

2.50 As discussed in Box 2.2, differences in the scope of climate impacts included, as well as in the underlying assumptions and modelling approaches employed, means there is also a wide range of estimates for climate-related GDP losses around a given temperature scenario. These risks are likely to be skewed toward more adverse outcomes and so impacts could lie further into the tails of the range of estimates from the surveyed literature.

2.51 To illustrate the range of outcomes for the public finances from alternate GDP assumptions, we construct fiscal projections for both 'high' and 'low' GDP impacts in the below 3°C scenario. These correspond respectively to a 10 per cent and 2 per cent hit to GDP in 2073-74, which broadly covers the range of estimates shown in Chart A of Box 2.2 for 3°C of warming, compared to our estimate of 5 per cent. Under the high GDP impact projection, debt as a share of GDP increases by a further 32 percentage points relative to the below 3°C scenario presented previously in this chapter. This results in the stock of debt being close to 340 per cent of GDP by 2073-74. In contrast, debt-to-GDP is 16 percentage points lower under the low GDP impact projection, with debt settling at around 290 per cent of GDP.

### Chart 2.14: Alternate GDP assumptions and their impact on debt




Source: OBR

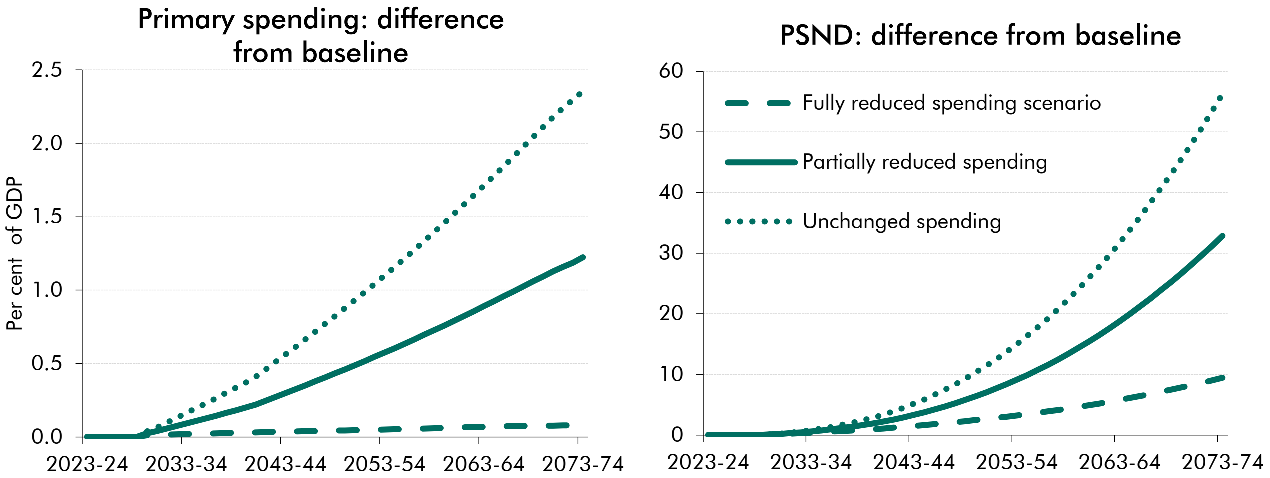
## Alternative expenditure rigidity assumptions

2.52 Future governments will need to choose how to adjust fiscal policy, particularly spending on public services and investment, in response to climate-related reductions in GDP. In our central modelling of the indirect fiscal costs of climate damages, as discussed in 2.25, we assume that spending-to-GDP ratio responds inversely to changes in GDP with an elasticity of 50 per cent. This is a bespoke assumption for the purposes of these climate scenarios which assumes that, despite lower growth, governments maintain public service and investment spending at current real terms levels, but other spending – such as welfare – falls in line with economic growth.

2.53 However, over time in these projections, the increasingly constrained public finances mean that the scope for maintaining public services and investment would become more limited, and government may choose or be forced to reduce public investment and services in line with the smaller economy. Conversely, a government could choose to maintain all areas of spending at current real levels, for example if it felt compelled to maintain the real value of welfare expenditure.

2.54 We explore the fiscal implications of these alternate policy responses under the below 3°C scenario below by considering the two extreme cases. One where the government fully reduces its spending such that the primary spending-to-GDP ratio is close to its level under the no climate change baseline (i.e. an elasticity of 0). And another where primary spending remains unchanged in the face of smaller GDP under climate change (i.e. an elasticity of 1) (Chart 2.15).

## Chart 2.15: Alternate expenditure rigidity assumptions and their impact on debt




Source: OBR

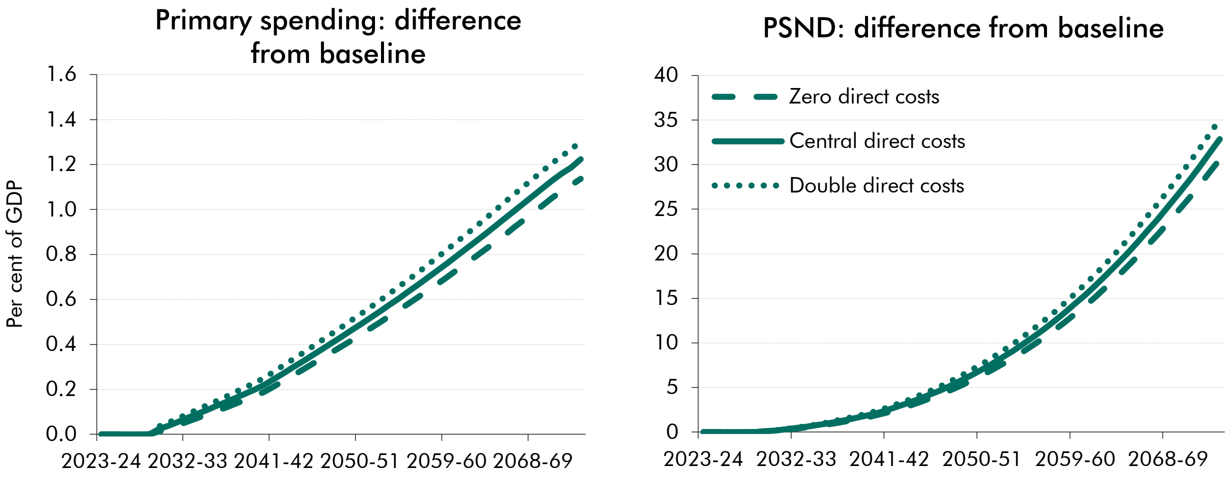
2.55 Under the unchanged spending assumption, debt is projected to increase by a further 23 per cent of GDP relative to the core below 3°C scenario presented elsewhere in this chapter. This leaves the debt-to-GDP ratio at around 330 per cent of GDP by 2073-74. By construction, there is a symmetrical effect under the fully reduced spending assumption which leaves debt lower by 23 per cent of GDP and the debt-to-GDP ratio at around 280 per cent of GDP in 2073-74.

## Alternate direct fiscal costs

2.56 Our direct spending costs are highly illustrative, assuming that the public sector picks up roughly half of the costs of coastal and heat, and 36 per cent of river and surface flooding. But a proportion of these costs are a matter of policy choice. While government is expected to pay for the costs of public asset damage, they could provide higher or lower support to the private sector, for example if the insurance sector were to limit cover provisions. They could easily be twice the assumed level if government faces more bills or pays more of the bills. Conversely, government may instead choose to only cover the cost of public assets and provide no compensation to the private sector and households, or to reduce expenditure on other services to maintain overall spending levels. As a result we produce two scenarios, one in which direct spending costs are doubled, and one in which additional costs are zero.

2.57 Under the double direct fiscal costs scenario, debt is projected to increase by a further 2 per cent of GDP relative to the core below 3°C scenario presented elsewhere in this chapter. This leaves the debt-to-GDP ratio at around 310 per cent of GDP by 2073-74.

## Chart 2.16: Alternate direct fiscal costs and their impact on debt




Source: OBR

# Conclusion

2.58 This chapter provides initial estimates of the potential fiscal risks to the UK economy of climate change damage. As we have noted throughout, this assessment is not comprehensive and should not be seen as a fully developed single-point central estimate of this aspect of the cost of climate change. It provides a range of best-guess central estimates for a subset of the risks, based on currently available data and evidence on how these risks could change over time. It does not assess the important but inherently highly uncertain and difficult-to-model tail risks, which means that it excludes plausible risks which could have significantly higher economic and fiscal costs. This is something we will look to build on in the future when more evidence becomes available.

2.59 This is the second stage in our analysis into the range of fiscal costs from climate change: mitigation, damage, and adaptation costs. Our 2021 *FRR* investigated the costs of mitigation and estimated that the transition to net zero could cost the UK public finances 21 per cent of debt to GDP by 2050 in an early action policy scenario. This was derived using assumptions from that time on, for example, technology costs, government policy, and economic conditions, all of which have changed in the intervening years. Therefore, this figure is not directly comparable to the costs presented in this report. We will look to update these costs in a future *Fiscal risks and sustainability* report.

2.60 In this report, our estimates of the fiscal costs of climate *damage* show that:

- **Under a below 2°C** scenario, in which the world ramps up its mitigation efforts to achieve net-zero emissions this century, the fiscal costs caused by climate change damage could add up to 23 per cent of GDP to the debt-to-GDP ratio by 2073-74.

- **Under a below 3°C** scenario, in which the world maintains its current policy ambitions on net zero, the fiscal costs of climate change could add up to 33 per cent of GDP by 2073-74. This figure could rise to 65 per cent or fall to 9 per cent under plausible alternate assumptions on the impact on GDP and on the response of fiscal policy.

2.61 Both of these scenarios assume that the UK and most of the world either, as in the below 3°C scenario, continue with or, as in the below 2°C scenario, enhance their net zero commitments. Therefore, these *damage* costs should be thought of as *additional* to the *mitigation* costs of the transition to net zero. We did not project our 2021 *FRR* estimates of mitigation costs beyond 2050, and given the changing conditioning assumptions since our prior work, we cannot readily add these two costs together. However, assuming the cost estimates of mitigation out to 2050 are broadly accurate (and then remain constant out to 2074), this could add in the order of an additional 60 per cent or so to the cost of climate change damage reported here.

2.62 A scenario in which the UK and all other countries cease all net zero mitigation efforts (that is, a global unmitigated scenario), including back-tracking on legal policy commitments, would result in significantly higher emissions and temperature pathways, greater hits to GDP, and increased indirect and direct damage costs. It would also significantly increase the probability of any one of the severe tail risks occurring, which could result in an exponential increase in costs. We have not explicitly modelled this scenario (as this is not what the UK is legally committed to, and not the recent trend in global activity), and so are unable to comment on the potential magnitude of costs from such scenarios.

2.63 We will return to the third piece of the climate change puzzle, the potential fiscal costs of adaptation, in future reports. In this report we implicitly assume that current levels of adaptation persist. Increases in adaptation investment, while initially increasing fiscal costs could, over time, reduce the damage costs presented in this report. Potentially this would reduce the net total costs of climate change. However, there are significant uncertainties around both the current level of adaptation spending in the UK and how much and what type of additional adaptation spending would be optimal in the future. This is therefore a complex but important final element of climate change cost analysis which we will seek to address in future reports.

# 3 Long-term health trends

## Introduction

3.1 The health of the population is an important driver of the economic and fiscal outlook. It has been a source of short-term fiscal shocks – most recently in the form of the Covid pandemic which led to the sharpest economic contraction and highest fiscal deficit in peacetime. It has also been an important factor behind medium-term fiscal trends. For example, the post-pandemic rise in health-related inactivity has weighed on the economic recovery and pushed up spending on health-related benefits. Finally, health poses one of the largest long-term risks to the public finances. Previous sustainability analysis has shown that rising health spending is the single most important source of the projected near-tripling in the stock of debt as a share of GDP over the next 50 years.

3.2 Having explored the near-term fiscal impacts of the pandemic in our 2021 *Fiscal risks report*, and the medium-term fiscal risks from rising health-related inactivity in our 2023 *Fiscal risks and sustainability* report (*FRS*), we now take a fresh look at the long-term economic and fiscal impacts of the changing health of the UK population by:

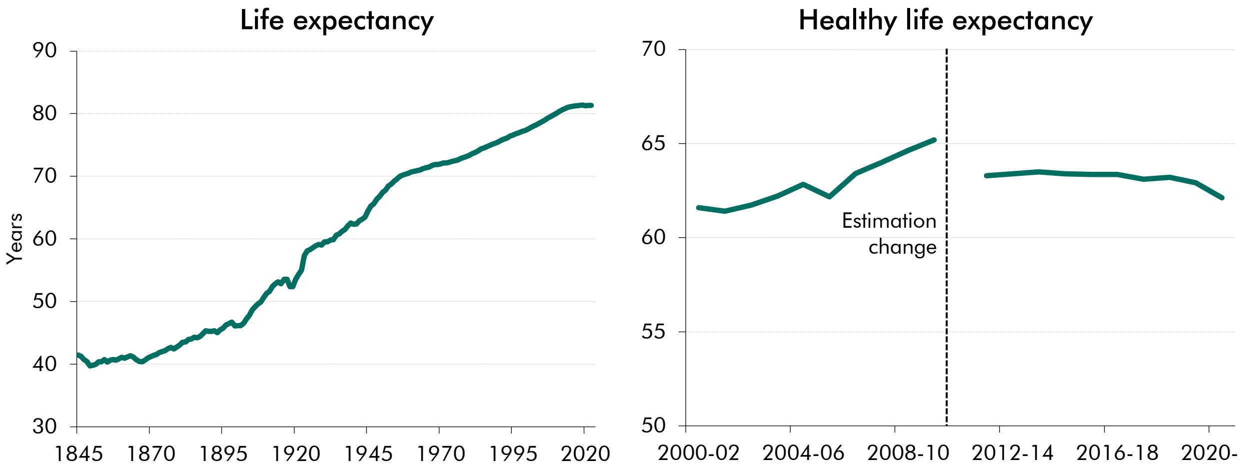
- reviewing recent **trends in the health of the UK population**;
- describing **trends in health spending in the UK** and how these compare to other countries;
- reviewing the latest evidence on the underlying **drivers of health spending**;
- updating our **baseline projection for health spending** over the next 50 years and looking at how it might be affected by **variations in the productivity of healthcare provision** and the **income elasticity of demand for healthcare**; and
- exploring **alternative scenarios for the health of the population,** and their long-term economic and fiscal implications including for GDP, the labour market, tax revenues, and health, welfare, and pension spending.

## Recent trends in the health of the population

3.3 Medical advances and rising standards of working and living conditions have contributed to steady improvements in the health of the population over the past two centuries. Life expectancy doubled from around 40 to just over 80 years between 1845 and 2020, with the fastest gains coming in the first half of the 20th century owing to falling infant mortality and increasing childhood immunisation (shown in the left panel of Chart 3.1). Life expectancy continued to improve, albeit more slowly, after the Second World War, reflecting factors such as a reduction in the prevalence of smoking, the development and deployment of antibiotics, and the establishment of the NHS.

3.4 However, since the early 2010s the pace of improvement in life expectancy has slowed to just one additional year over the past decade, compared to over two-and-a-half years in the decade prior. And *healthy* life expectancy, which peaked at 65 in 2009-11 (under a previous methodology), actually fell by over one year between 2011-13 and 2020-22 under a consistent new methodology (right panel of Chart 3.1).[1] The drivers of these recent trends are debated, but likely to include the growing complexity of medical conditions, widening health inequalities, decelerating improvements in cardiovascular disease mortality, several particularly severe flu seasons, and most recently the Covid pandemic.[2] More generally, the divergence between life expectancy and healthy life expectancy reflects the fact that many of the medical advancements that improved life expectancy in the late 20th and early 21st centuries have also prolonged the period for which people live with, often severe or chronic, health conditions, thereby increasing the average number years of life spent in poor health.

## Chart 3.1: Life expectancy and healthy life expectancy at birth



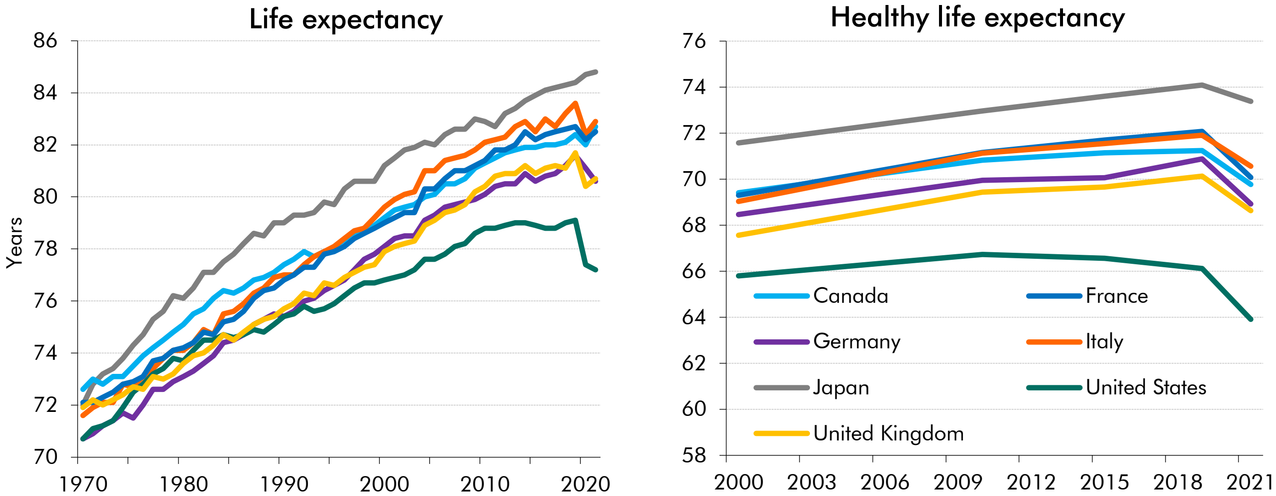

Note: This chart uses period life expectancy values which cover England and Wales and are presented as five-year rolling averages up to the reference year. The ONS's healthy life expectancy (HLE) values for the UK cover rolling three-year intervals. Estimates for HLE from 2009-11 onwards are based on the Annual Population Survey (APS), so are not comparable with previous estimates. Between 2018-20 and 2020-22 HLE values for the UK are not available so are grown in line with changes to HLE in England.
Source: ONS, OBR

3.5 The stagnation in UK life expectancy since 2010 mirrors a pattern seen across all major advanced economies, other than Japan. Over a longer period, the pace of improvement in UK life expectancy has fallen behind most other G7 countries, and now stands two years below Italy, France, and Canada, and four years below Japan (Chart 3.2, left panel). Since the start of this century, the UK has had the second-lowest *healthy* life expectancy over the period shown (based on a different, internationally comparable measure to that shown in Chart 3.1), after the US where healthy life expectancy has been falling since 2010 (Chart 3.2, right panel). Box 2.2 in our 2023 *FRS* explored the relative trends in specific health

[1] Healthy life expectancy is calculated by combining life expectancy data with self-reported survey data on the quality of people's health.
[2] The King's Fund, *What is happening to life expectancy in England*, April 2024; The Health Foundation, *Interpreting the latest life expectancy data*, February 2024.

conditions underlying these developments. It found that, while the UK's obesity rates and mortality from cardiovascular disease are close to G7 averages, mortality from cancer and respiratory illnesses have consistently been the highest in the G7 over the past two decades.

## Chart 3.2: Life expectancy and healthy life expectancy at birth across G7 economies




Note: The measure of healthy life expectancy shown here uses a methodology which is applied consistently by the WHO across countries, but differs from the ONS's measure for the UK which underpins the right panel of Chart 3.1.
Source: Our World in Data, WHO

3.6 The slowdown and partial reversal in health improvements in the UK in recent years can be largely attributed to three factors: a mixed pre-pandemic picture on physical health (with continued improvement in some areas and a worsening picture in others); deteriorating mental health; and the impact of the pandemic itself. Taking each of these in turn:

- **Pre-pandemic physical health**: There are a range of areas in which physical health outcomes continued improving up to the pandemic, including declining mortality rates related to cardiovascular diseases (top-left panel of Chart 3.3), albeit at a slowing rate, and better outcomes related to various cancers.[3] But in other areas, physical health outcomes were deteriorating. These include a rising prevalence of lung conditions (top-right panel of Chart 3.3), that can be partly attributed to smoking, the lagged effects of which continue to take a large toll despite steady declines in smoking prevalence. They also included a range of outcomes related to rising obesity, which almost doubled among adults in England between 1993 and 2019 from 15 per cent to 28 per cent.[4] Obesity is strongly associated with heart disease, some cancers, osteoarthritis, and diabetes (bottom-left panel of Chart 3.3).

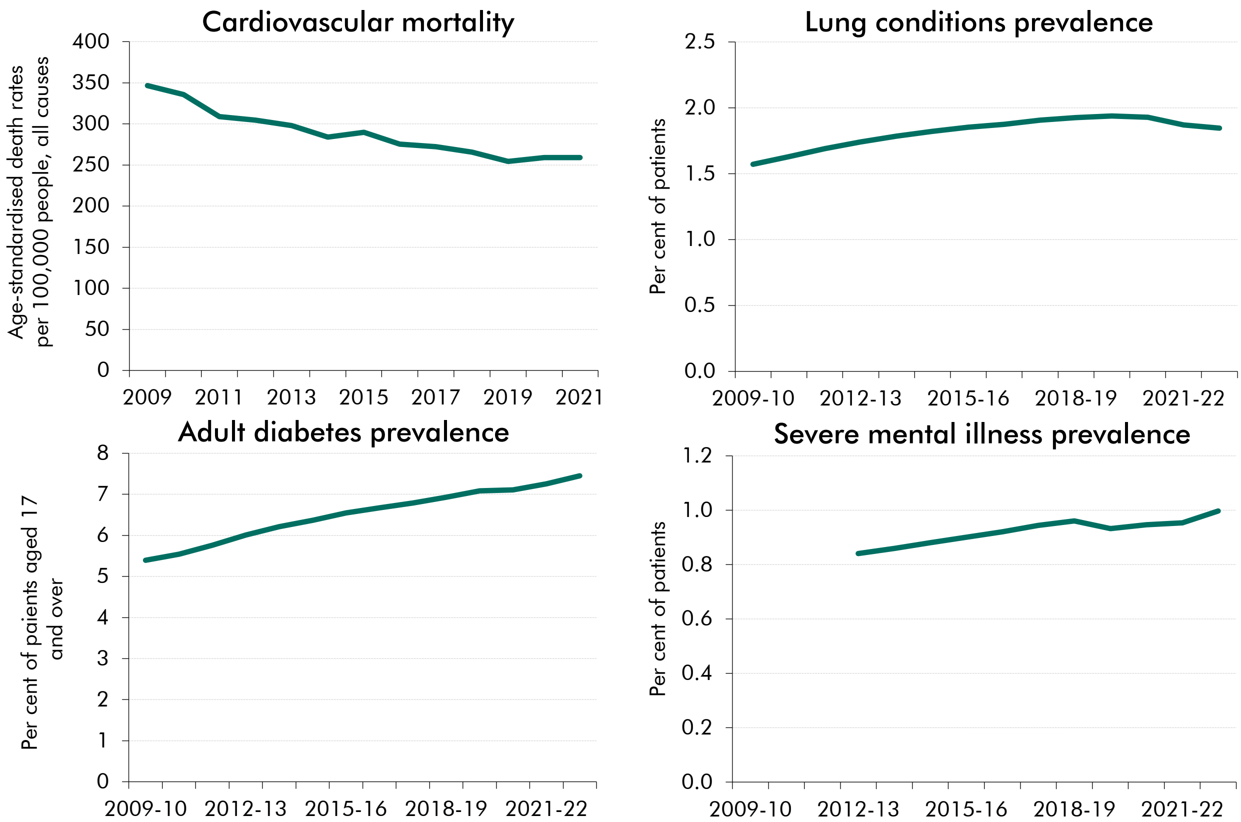
- **Mental health**: Although particularly difficult to assess over time, both self-reported and clinically measured data suggest mental ill health has been rising in recent decades. The Adult Psychiatric Morbidity Survey showed an increase in the prevalence of common mental disorders among 16-64-year-olds of around a quarter between 1993 and 2014 (from 14.1 per cent to 17.5 per cent). And the proportion of patients

[3] Department of Health and Social Care, *Chief Medical Officer's annual report 2020: health trends and variation in England*, December 2020.
[4] House of Commons Library, *Obesity statistics*, January 2023.

on GP practice registers in England with severe mental disorders rose from just over 0.8 per cent in 2012-13 to 1.0 per cent in 2022-23 (bottom-right panel of Chart 3.3).

- **The impact of the pandemic**: As we documented in our 2023 *FRS*, the pandemic has layered additional health challenges onto this pre-pandemic position. These effects came via three channels. First, Covid itself has had an enduring impact on some people's health via symptoms of what has become known as 'long Covid', which were reported by around 2 million UK adults in March 2023.[5] Second, the pandemic exacerbated pre-pandemic mental health trends, particularly in terms of the number of adults reporting anxiety and depression.[6] Finally, the pandemic resulted in disruptions to the provision of wider health services to those with a range of other conditions, exemplified by persistent increases in NHS waiting lists across the nations of the UK. For example, the referral-to-elective-treatment waiting list in England has risen from around 4½ million treatments at the beginning of 2020 to around 7½ million in early 2024.

## Chart 3.3: Trends in selected health conditions

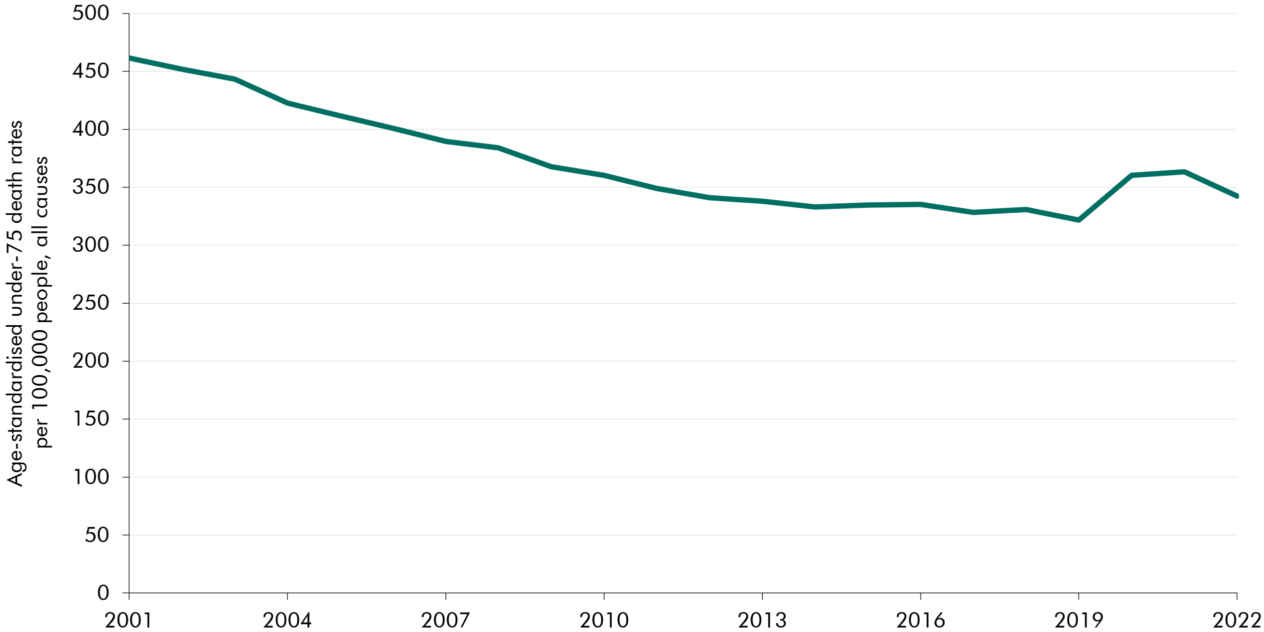



Note: Cardiovascular mortality data covers the UK, all other data covers England. 'Lung conditions' refers to chronic obstructive pulmonary disease. 'Severe mental illness' refers to schizophrenia, bipolar affective disorder and other psychoses as recorded on GP practice registers.
Source: British Heart Foundation, NHS England, Office for Health Improvement & Disparities

[5] We have estimated the number of adults in the UK reporting long Covid symptoms based on the prevalence rates in the ONS's *Self-reported coronavirus (COVID-19) infections and associated symptoms, England and Scotland*.
[6] For example, the share of working-age adults reporting moderate-to-severe depressive symptoms increased from 10 per cent in early 2020 to 19 per cent in late 2022. Source: ONS, *Opinions and Lifestyle Survey*.

3.7 Bringing these outcomes together, Chart 3.4 shows that large reductions in premature mortality – which were the norm through the 20th and early 21st century – significantly slowed during much of the 2010s. The impact of the pandemic can be seen via the clear uptick in premature mortality, where the rate of age-standardised deaths rose above the 2010 level in 2021. There was a slight decline in 2022, but premature mortality remains elevated compared to pre-pandemic levels.

## Chart 3.4: Premature mortality in England




Source: Office for Health Improvement and Disparities

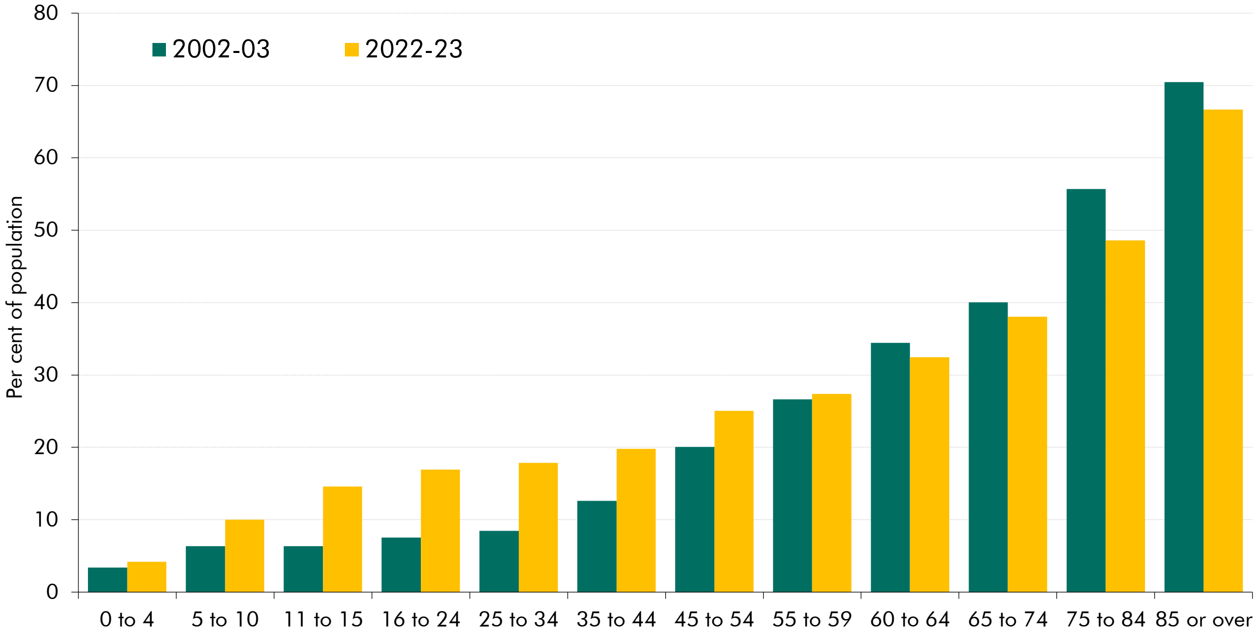
3.8 These worrying recent trends in clinical measures of health are also reflected in the rising prevalence of self-reported disabilities over the same period. While some caution should be exercised in looking at 21st century disability trends given changes in definition, disability prevalence across the population appears to have risen by around a third over two decades, from 19 per cent in 2002-03 to 24 per cent in 2022-23. The rise among working-age adults has been even sharper. Although somewhat more muted, these trends are also seen in a narrower self-reported measure of long-term work-limiting health conditions that we favour in analysis that focuses on the labour market (as we do in the scenarios at the end of this chapter).[7] On this measure, ill health among the working-age population rose from 14.0 per cent in 2014 to 17.5 per cent in 2022.

3.9 Of course, some of the rise in ill health is to be expected given the ageing of the population, and the fact that health problems become markedly more likely as people get older. Chart 3.5 shows this pattern of higher disability prevalence at older ages. It also shows that over the two decades to 2022-23, the likelihood of reporting a disability has risen for those below the age of 60, but actually *fallen* for those aged 60 and over.[8] Indeed, we find that over this period, just over half (53 per cent) of the overall rise in disability prevalence across

[7] See: Haskell, J., and J. Martin, *Economic inactivity and the labour market experience of the long-term sick*, July 2022.
[8] This pattern of change across the age range is mirrored in 2001, 2011 and 2021 Census data.

the population has been driven by ageing, with the remainder related to rising prevalence rates at each age. The importance of population age structure to overall health trends explains why demographic change plays a major part in our approach to projecting health spending over the longer term. But this also highlights the importance of capturing recent trends in chronic conditions among younger age groups.

Chart 3.5: Self-reported disability prevalence by age



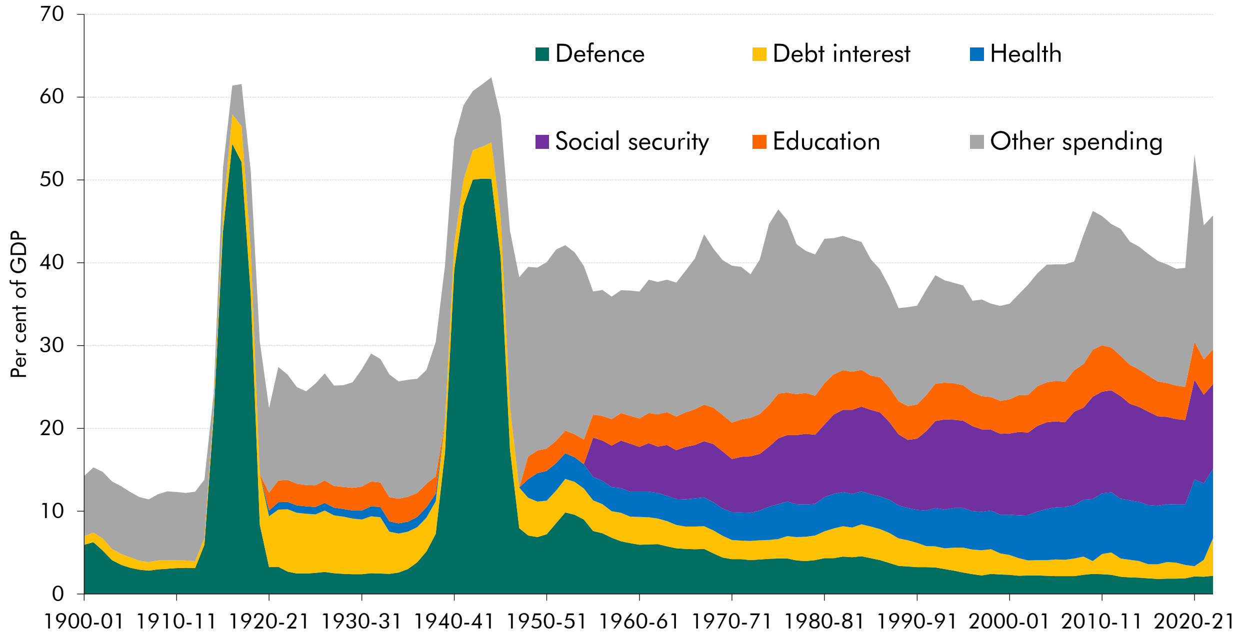

Source: DWP, OBR

## Health spending

3.10 Public spending on health has taken up an increasing share of GDP, tripling from 2.8 per cent in 1955-56 to 8.3 per cent in 2022-23, after rising to an all-time high of 10.5 per cent during the pandemic.[9] Over much of the post-war period, the steady rise in spending on health was partly offset by falling spending on defence and debt interest, which together fell to an equivalent proportion of national income. However, over the past two years, spending on both defence and, particularly, debt interest have begun to rise again as a share of GDP reflecting the Government's growing debt stock, the normalisation of global interest rates, and rising geopolitical tensions.

[9] Other than when comparing internationally, our analysis throughout this chapter mainly focuses on public health spending, which makes up around four-fifths of overall UK health spending. We discuss the role of private spending on healthcare in Box 3.1.

## Chart 3.6: Components of public spending as a share of GDP

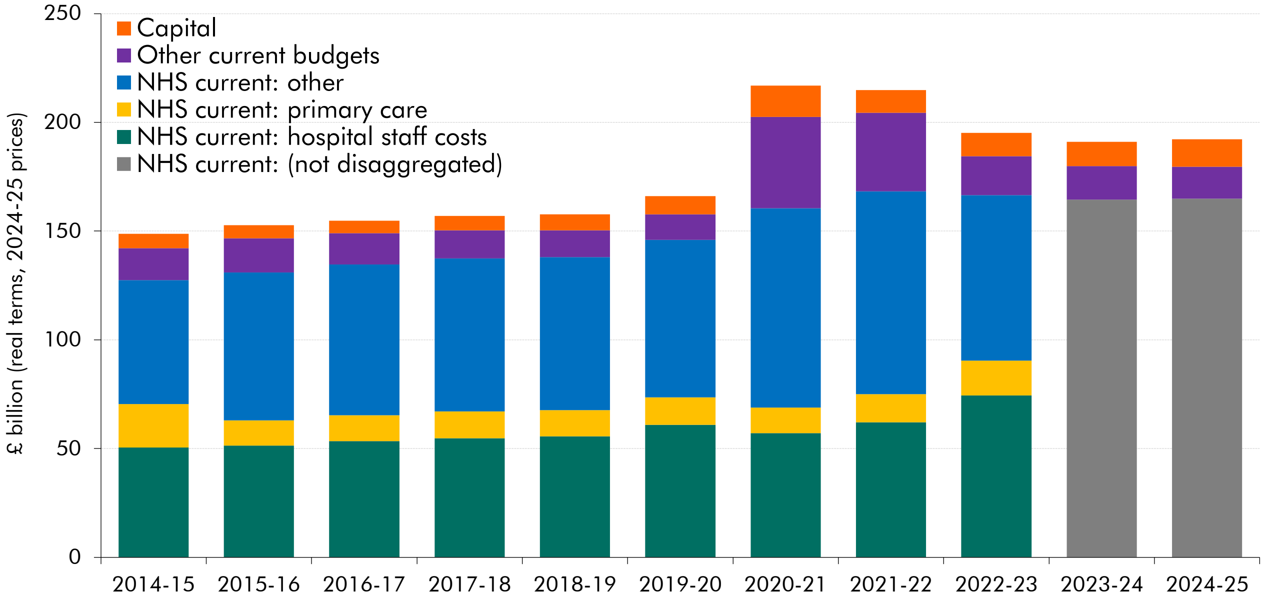



Source: IFS, OBR

3.11 Around 85 per cent (in England) of public health spending flows through NHS England,[10] with a large share of that spent on staff costs within NHS hospitals (Chart 3.7). In the years prior to the pandemic, staff costs in secondary providers made up around 40 per cent of the NHS England budget, while primary care (e.g. GPs and practice nurses) accounted for a further 9 per cent. Current spending outside of the NHS made up around 8 per cent of overall spending in England prior to the pandemic and capital spending around 5 per cent. Health spending in England jumped up by a third in the pandemic years to a peak of around £215 billion (2024-25 prices), but is planned to settle around £190 billion this year, the final year of the current Spending Review period. Health spending has been devolved to Northern Ireland, Scotland and Wales since 1999. Devolved spending represents around 20 per cent of overall UK health spending, with analysis suggesting that spending in the devolved nations has been consistently slightly higher on a per-person basis than it has been in England over the past couple of decades.[11]

[10] Much of the remaining 15 per cent will also go to NHS providers, via local authority public health budgets, for example.
[11] Institute for Fiscal Studies, *The past and future of UK health spending*, May 2024.

## Chart 3.7: Health spending in England




Note: We are unable to disaggregate NHS current expenditure for 2023-24 and 2024-25 because annual accounts for these years are not yet available.
Source: DHSC, The Health Foundation, OBR

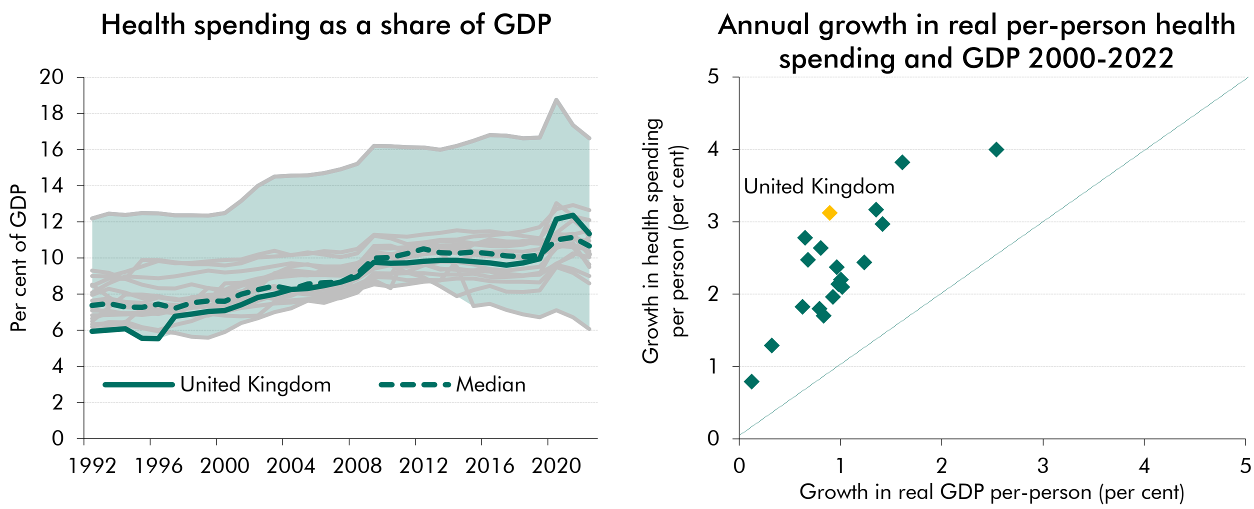
## International comparisons

3.12 Over the past four decades, total (both public and private) UK health spending as a share of GDP has gone from being the lowest to the sixth highest among 19 advanced economies, as shown in the left panel of Chart 3.8. In the first half of the 1990s, the UK was spending around 6 per cent of GDP on both public and private healthcare, compared to an advanced-economy median of 7.5 per cent.[12] UK health spending then sharply increased over the late 1990s and early 2000s, bringing the UK up to the advanced-economy average of around 9 per cent by the late 2000s. From 2010, UK health spending tracked the international trend of broadly flat growth as a share of GDP up to the pandemic. During the pandemic the UK saw one of the largest spikes in health spending, followed by a slight fall as a per cent of GDP in 2022. This left UK health spending at 11.3 per cent of GDP in 2022, just above the advanced-economy average of 10.7 per cent.

3.13 The aggregate trends highlighted in the left panel of Chart 3.8 reflect growth in total per-person health spending far outstripping rises in per-person income since the turn of the 21st century (right panel of Chart 3.8). Across the same 19 advanced economies, between 2000 and 2022, the growth in per-person health spending was at least double that of per-person GDP in all but two countries (Ireland and the United States). The UK (yellow dot) saw the fourth-highest average annual growth in per-person health spending of over 3 per cent, alongside more modest per-person GDP growth of less than 1 per cent.

[12] The suite of 19 countries (including the United Kingdom) consists of the EU14 (excluding Luxembourg), the G7 group, Australia, and New Zealand. It follows international analysis from The King's Fund. See: Dayan., M., et al., *The NHS at 70: How good is the NHS?*, June 2018, and Anandaciva, S., *How does the NHS compare to the health care systems of other countries*, June 2023.

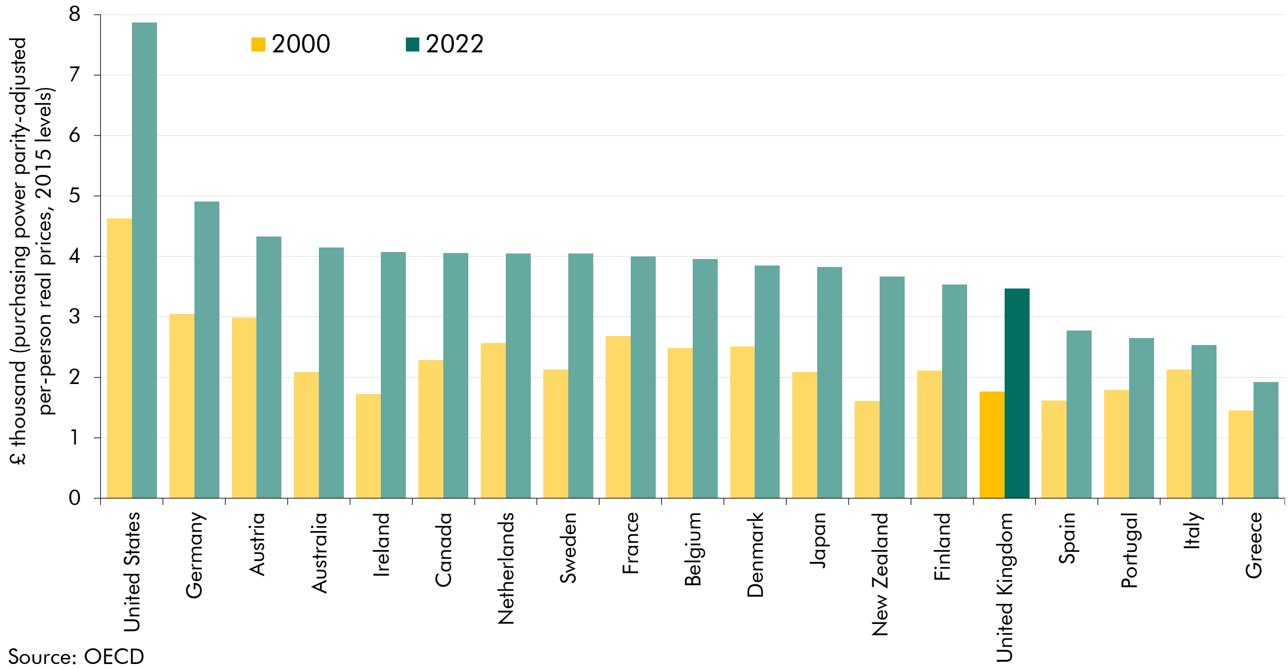
## Chart 3.8: Total health spending across advanced economies




Note: Both charts show total health spending (from private and public sources). The right panel presents growth in real per-person health spending and GDP. The right panel uses modfiied GNI per person instead of GDP per person for Ireland.
Source: Central Statistics Office, OECD

3.14 The steep rises in health spending described above mean the UK spent almost £3,500 per person (in 2015 real-terms prices) on health in 2022 – almost double real per-person spending at the turn of the century. Across the 19 advanced economies analysed in Chart 3.9, the UK still ranked below the average per-person total health spend of £3,880 in 2022 (the UK was fifth from bottom in 2000 and the same position in 2022), even after seeing one of the larger pandemic-related spikes. The fact that the UK has, in the latest data, total health spending as a share of GDP above the advanced-economy median, but one of the lower levels of health spending per-person among this group of countries, reflects the UK's lower GDP per-person relative to most of the countries to its left in Chart 3.9.

## Chart 3.9: Total real health spending per person across advanced economies




Source: OECD

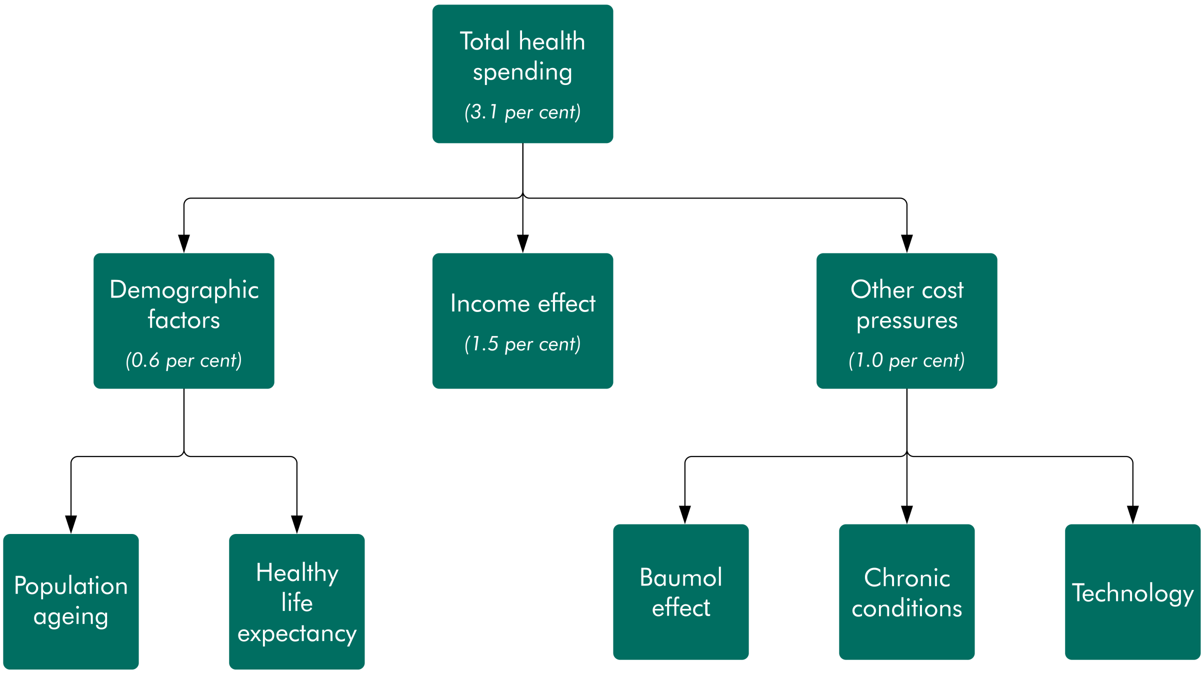
## The drivers of health spending

3.15 This section looks in more detail at the various factors that have put, and are likely to continue to put, upward pressure on public health spending. We set out the evidence behind each of the main drivers, and how we account for them in our projections of future public spending on health. In this report we have further developed the approach used in our previous *FRS*s and *Fiscal sustainability reports* (*FSR*s), which in turn build on the approaches to modelling public spending on health taken by the OECD, European Commission, and the Congressional Budget Office in the US.[13] In addition, we have drawn on more recent UK-specific analysis by The Health Foundation.[14] There are three main channels (summarised in Figure 3.1) that we explore in detail in the remainder of this section, which together drive average annual real growth in public health spending of 3.1 per cent over our long-term projection:

- **Demographic factors**: focusing on how trends in the age structure of the population, life expectancy, and healthy life expectancy (or its inverse, 'morbidity') influence health spending on people of different ages. These factors drive 0.6 percentage points of the average annual real growth in health spending over our projection.
- **The income effect:** examining the relationship between growth in real GDP and demand for public healthcare. This channel drives 1.5 percentage points of the average annual real growth in health spending.
- **Other cost pressures**: including constraints on productivity growth in the healthcare sector (the 'Baumol effect'), changes in health unrelated to ageing ('chronic conditions'), and factors related to technological advancements. These other cost pressures apply to current health spending and drive the remaining 1.0 percentage points of the average annual real growth in health spending over our long-term projection.

[13] See Lorenzoni, L., et al., 'Long-term projections: Different paths to fiscal sustainability of health systems', in OECD, *Fiscal Sustainability of Health Systems*, January 2024; European Commission, *2024 Ageing Report: Economic and budgetary projections for the EU Member States (2022-2070)*, April 2024; Congressional Budget Office, *The 2022 Long-Term Budget Outlook*, July 2022.
[14] The Health Foundation, *REAL Centre Projections: Health and social care funding projections 2021*, October 2021.

## Figure 3.1: The drivers of health spending




Note: Numbers in brackets represent the contributions to the overall average annual real growth in health spending (3.1 per cent) over our long-term projection period, which are disaggregated in more detail in Chart 3.13.
Source: OBR

3.16 Separating the drivers of health spending out into these channels is not straightforward. The studies we draw on generally estimate the coefficients on each driver using historical data in panel regressions. They note that, in this framework, it can be hard to distinguish between changes driven by 'demand' (i.e. the income effect) and changes driven by pressures on costs. For example, in relation to technological progress, the OECD argues that, *"technology affects demographic change, shapes productivity and to some extent reflects consumer demand as incomes rise, such interactions[…]are difficult to account for at the macro level."*[15] And differentiating between 'demand' effects and cost pressures on public health spending may be particularly difficult in a system like the UK's where a large amount of health services do not have a price to the consumer, so demand will theoretically always exceed supply, and is therefore not revealed by it.

## Demography

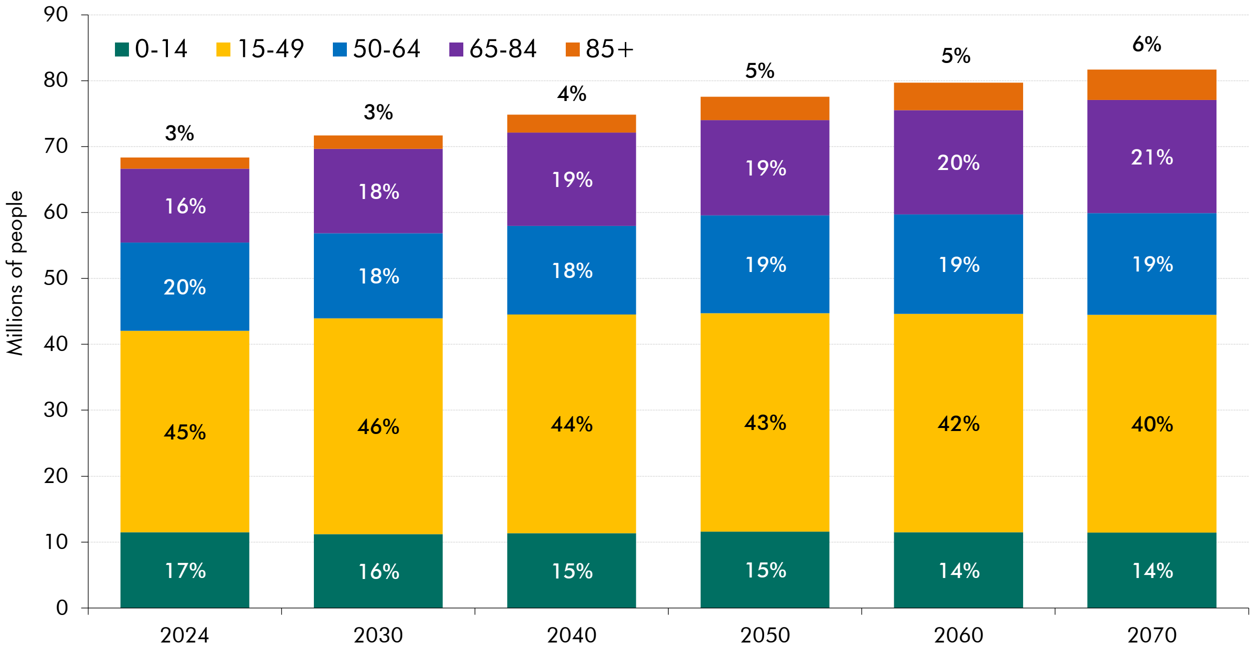
### Population ageing

3.17 A key source of upward pressure on health spending comes from the projected further increase in life expectancy and overall ageing of the population in the UK over the coming 50 years. The ONS currently expects that the UK population will increase by over 13 million

[15] See: Lorenzoni, L., et al., 'Long-term projections: Different paths to fiscal sustainability of health systems', in OECD, *Fiscal Sustainability of Health Systems*, January 2024.

to 81.7 million by 2070 (Chart 3.10). Of this increase, two-thirds is projected to be from those aged over 65, whose numbers are projected to increase by 8.8 million. The number of people aged 15-49 is only projected to rise modestly by 2.4 million over this period, and the number aged 50-64 to rise by only 2.1 million. As a result, the proportion of the population aged 65 and over is projected to rise from 19 per cent in 2024 to 27 per cent in 2070. And the old-age dependency ratio, the ratio of those aged 65 and over to those between 16 and 64, is projected to rise from 30 per cent this year to 47 per cent in 2070.

## Chart 3.10: Population age structure



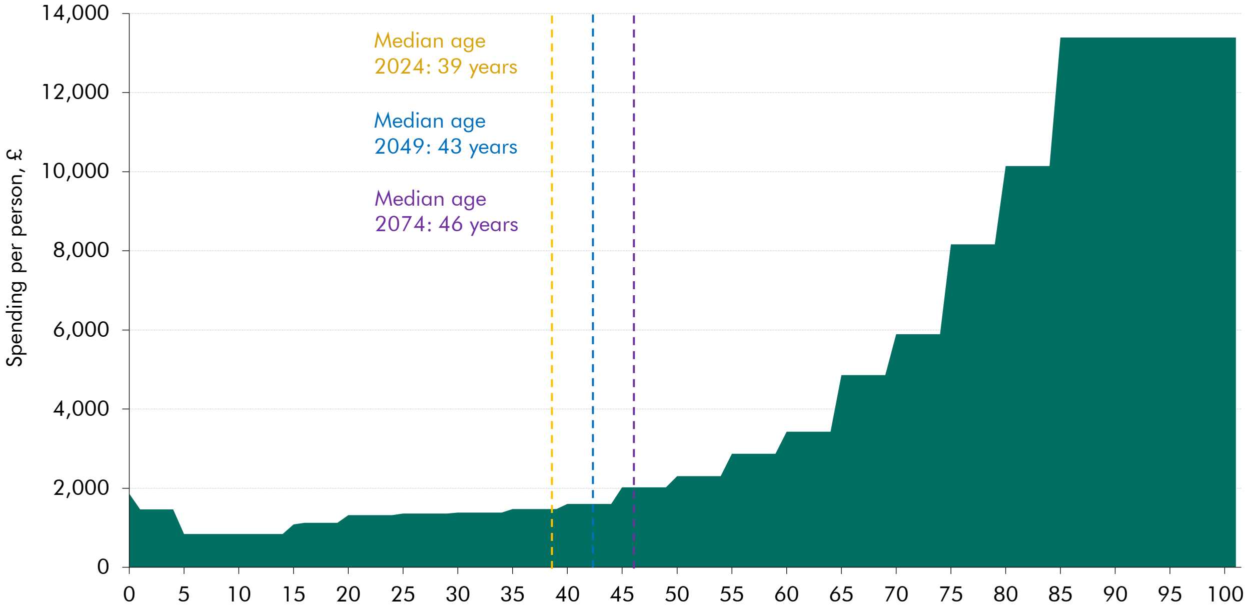

Source: ONS, OBR

3.18 This population ageing matters for health spending because average per-person health costs rise dramatically as people move into and through old age. Chart 3.11 illustrates the representative profile for health spending by age used in our long-term projections.[16] Health spending per person remains relatively flat, at below £2,000, until the age of 45. Average annual per-person costs begin to rise as people enter their late 40s and continue rising into retirement and old age, peaking at over £13,000 per person for those aged 85 and over. In practice, these high costs in old age partly reflect the fact that spending is concentrated in the last years or months of life independently of age, and mortality rates are much higher at older ages.[17] As the median age of the population rises from 39 in 2024 to 46 in 2074, more of the weight of the population falls in the region of rapidly escalating costs.

[16] Our model splits out total current spending into three broad categories: hospitals and community health services, primary care, and prescribing costs.

[17] For this reason, many models separate out age-cost profiles for 'death-related costs' and costs for survivors, in order to apply assumptions about whether life expectancy gains are spent in good or ill health. We have previously taken this approach, but with life expectancy improvements having slowed over time, now find that it has a very limited effect, so have removed it for simplicity.

## Chart 3.11: Representative profile for health spending by age in 2028-29




Source: OBR analysis of NHS England data

### Healthy life expectancy

3.19 Whether gains in life expectancy increase *healthy* life expectancy – the years an individual can expect to spend in good health – has important implications for fiscal sustainability. There are three main theories about the impact of life expectancy on years spent in ill health (or 'morbidity'):

- the **expansion of morbidity** theory suggests that increases in life expectancy tend to be spent largely in ill health. All else equal, the expansion of morbidity will put upward pressure on health spending per person;

- the **compression of morbidity** theory argues that the increases in life expectancy tend to be spent largely in good health. Compression of morbidity, all else equal, will put downward pressure on health spending per person; and

- the **dynamic equilibrium** theory suggests that years in ill health will increase but that the severity of morbidity will fall. Depending on the relative strength of the different effects, this could place upward or downward pressure on health spending per person.

3.20 There is evidence that can be used to support each of these theories. For example, ONS analysis of life expectancies across deprivation deciles shows that those living in the least deprived areas live the longest lives and spend the least time in poor health, not just as a share of life but also in absolute terms.[18] This suggest that certain routes to higher life expectancy which closed the gaps between deprived and less deprived areas might be associated with very significant morbidity compression. On the other hand, Chart 3.1 above shows that, at least since the early 2010s, life expectancy has grown slowly while healthy life expectancy has decreased, consistent with significant morbidity expansion.

[18] ONS, *Health state life expectancies by national deprivation deciles, England: 2018 to 2020*, April 2022.

3.21 Based on evidence that the proportion of remaining life spent in good health is around half of total life after 65,[19] our long-term baseline projection assumes something of a halfway house between these extremes. We project a *partial expansion* of morbidity – with half of life expectancy gains spent in good health and half in ill health.[20] ONS population projections imply that life expectancy at birth increases by one year every 9.5 years (up from eight years last time we looked at health spending in detail in our 2017 *FSR*). This implies that *healthy* life expectancy increases by one year every 19 years. As a result, the cost profile by age, shown in Chart 3.11, also shifts one year to the right every 19 years. This morbidity assumption used in our baseline projection is in line with that used by both the European Commission and the OECD.[21]

## Income effect

3.22 As individuals' incomes rise, they are typically willing to pay more for a given improvement in health or to spend more of their lives in good health.[22] The magnitude of this relationship is captured by the 'income elasticity of demand' for health, i.e. the impact of a unit change in real GDP on real health expenditure. Most studies suggest that as countries become richer, the income elasticity tends to fall as basic healthcare coverage has generally been achieved and the marginal gains from further expenditure on health decline.[23] For example, the latest OECD estimates – which capture demographic effects and cost pressures separately – find an income elasticity of 0.77 across countries.[24] And a European Commission literature survey found that detailed studies based on panel data result in income elasticities around or below one.[25] A comprehensive study by Acemoglu et al., which attempted to control for endogeneity (i.e. the fact that health spending can also affect economic growth) arrived at a central estimate of 0.72 for the United States.[26]

3.23 In line with this literature, we assume an income elasticity of around 0.8 in our baseline projection for public health spending. This implies that, absent demographic effects and other cost pressures raising health spending, the demand for healthcare spending would fall as a share of GDP. In our baseline, this effect contributes 1.5 percentage points to average annual real growth in health spending, given real GDP growth averages 1.8 per cent a year. While our projections assume that all of the pressure from this income effect is felt by the public healthcare system (principally the NHS), demand for healthcare may not necessarily be met via this route, leading instead to increased demand for private provision. We explore the relationship between public and private health spending in Box 3.1.

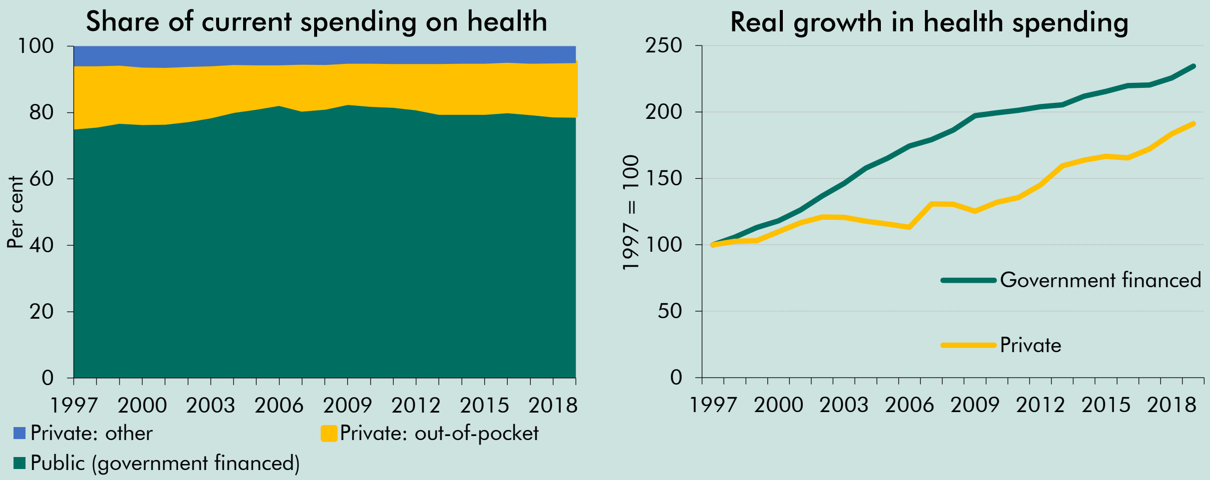
[19] ONS projections suggest that the proportion of life expectancy around age 65 spent in good health lies between 50 to 58 per cent (based on estimates for men and women aged 60-64 and 65-69 in each of England, Northern Ireland and Wales). See: ONS, *Health state life expectancies in England, Northern Ireland and Wales: between 2011 to 2013 and 2020 to 2022*, March 2024.
[20] This is consistent with our assumptions since our 2017 *FSR*.
[21] See: Lorenzoni, L., et al., 'Long-term projections: Different paths to fiscal sustainability of health systems', in OECD, *Fiscal Sustainability of Health Systems*, January 2024; and European Commission, *2024 Ageing Report: Economic and budgetary projections for the EU Member States (2022-2070)*, April 2024.
[22] See, for example, The King's Fund, *Spending on health and social care over the next 50 years Why think long term?*, January 2013.
[23] See: Baltagi, B., et al., *Health Care Expenditure and Income: A Global Perspective,* July 2017.
[24] See: Lorenzoni, L., et al., 'Long-term projections: Different paths to fiscal sustainability of health systems', in OECD, *Fiscal Sustainability of Health Systems*, January 2024.
[25] European Commission, *The 2015 Ageing Report, Economic and budgetary projections for the 28 EU member states,* May 2015.
[24] Acemoglu, D., et al., *Income and health spending: evidence from oil price shocks*, October 2013.

## Box 3.1: Trends in public and private health spending

Our long-term fiscal projections focus on public spending on health, but private spending accounts for a significant share of health expenditure in the UK and particularly in other advanced economies. This box explores recent trends in private health spending in the UK and how this compares with other advanced economies.

Private health spending accounted for 24 per cent of total UK health spending in 1997, with out-of-pocket spending the largest source of private spending, at 18 per cent (Chart A).[a] Private health spending grew relatively strongly in real terms, at around 9.8 per cent annually, until the pandemic. Annual growth peaked at 37.8 per cent in 2000 then slowed down to 8.6 per cent a year on average to 2009. From 2010 to 2019, real growth in private health spending picked up to 11.3 per cent a year, as public health spending growth slowed to 1.8 per cent annually. As a share of total health spending, private spending fell to a low of 16.9 per cent in 2009 before rebounding to 20.7 per cent before the pandemic. This recent trend is supported by more timely Private Health Insurance Network data, which suggests that medical insurance and self-pay/out-of-pocket admissions were at record high levels in 2023.[b]

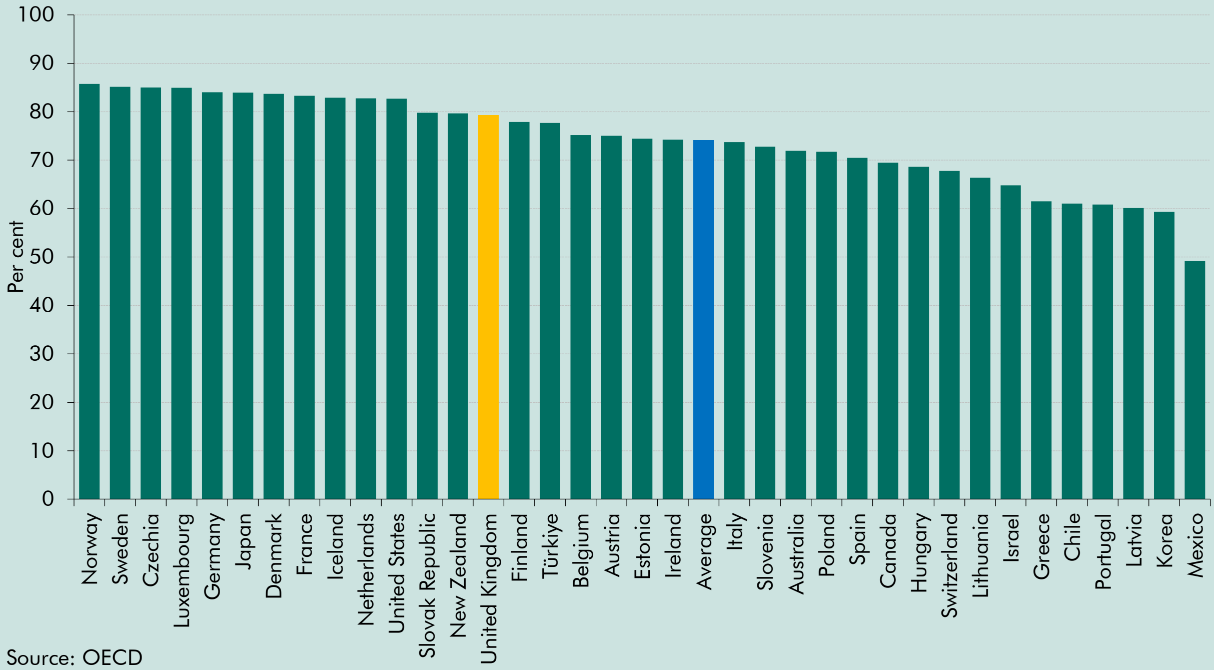
### Chart A: UK health spending by financing source




Note: Other includes enterprise schemes, voluntary heatlh insurance and non-profit.
Source: ONS

These recent trends mean that the UK's share of overall health spending that is financed by government has fallen by 3.1 percentage points between 2009 and 2019. This is in contrast to the average across G7 countries, where the share financed by government has increased by 5.2 percentage points. But, as shown in Chart B, the UK continues to be above average in comparison to other advanced economies in terms of the share of health spending financed by government, at around four-fifths, compared to an advanced-economy average of three-quarters.

## Chart B: Share of health spending that is government financed, 2019




Source: OECD

The rebound in the private share of health expenditure since 2010 in the UK likely reflects some combination of the slowdown in real growth in public spending on health, rising NHS waiting lists, and an increasing preference for private healthcare as disposable incomes rise. Increased use of private healthcare could mitigate some of the fiscal pressures we discuss later in this chapter, including those driven by rising incomes. However, at present, public health spending still accounts for the large majority of overall health spending in the UK, and slightly more than half of the upward pressures on health expenditure in our projections are driven by factors other than pure income effects.

[a] Out-of-pocket expenditures covers consumer expenditure on healthcare goods and services, outside of health insurance schemes. These include client contributions for local authority- and NHS-provided services, and prescription charges.
[b] Private Health Insurance Network, *Private market update: June 2024 United Kingdom*, June 2024.

## Other cost pressures

3.24 Beyond changes in demography and incomes there are a set of other cost pressures driving rising health spending.[27] In our projections of health spending we separate these other cost pressures into three categories:

- a **'Baumol' effect**, which reflects the cost pressure generated by lower productivity in the healthcare sector than in the wider economy;

[27] See: Lorenzoni, L., et al., 'Long-term projections: Different paths to fiscal sustainability of health systems', in OECD, *Fiscal Sustainability of Health Systems*, January 2024; and European Commission, *2024 Ageing Report: Economic and budgetary projections for the EU Member States (2022-2070)*, April 2024.

- the impact of **chronic conditions**, driven by changes in their prevalence beyond those implied by changes in demography and healthy life expectancy; and
- an additional pressure potentially related to **technological progress**.[28]

3.25 Since 2017, our long-term projections for health spending have included a top-down (non-disaggregated) estimate which captures rising cost pressures in the round. In this *FRS* we align to the OECD's latest projection for advanced economies and so assume that these other cost pressures account for 1.0 percentage points of the overall annual real growth in health spending (we apply these pressures to current health spending only).[29] This is slightly lower than the indices we have previously used to grow other cost pressures in current health spending (which were based on 2016 NHS England data). We also decompose this 1.0 percentage point figure into the three components listed above. This illustrative decomposition gives us a fuller picture of the drivers of our long-term health spending projections, as well as allowing us to vary these inputs in our scenarios.

## Baumol cost theory

3.26 Cost and price pressures in the health sector have generally risen faster than in the wider economy, largely reflecting the 'Baumol' cost effect.[30] This describes how some sectors of the economy, especially public services such as health, may not benefit from technological advancements as much as other sectors because of their continued reliance on human interaction. As a result, they tend to experience slower productivity increases than sectors like manufacturing whose production processes lend themselves to automation. However, to retain staff, the health sector will need to increase wages in line with wage increases in other sectors of the economy that experience the faster productivity gains. This results in health sector costs rising relative to the overall output of the economy. In practice, the Baumol effect therefore captures excess health price inflation, relative to other sectors.

3.27 Quality-adjusted productivity growth in the healthcare sector (as measured by the ONS) has indeed lagged whole-economy productivity growth since 1995-96, averaging 0.7 per cent a year, compared to whole-economy growth of 1.2 per cent a year (Chart 3.12). Cumulative growth in health productivity up until 2019-20 was 13.4 percentage points lower than for the economy as a whole. This gap widened dramatically during the pandemic in 2020-21 and has only partly narrowed since. Possible reasons for this slower recovery include lower volumes of patients treated per staff member, slower outflows of patients into social care, and increases in the average severity of illness being treated.[31] As a result, in 2021-22,

[28] This is not an exhaustive list, but it captures some of the main drivers of health spending commonly specified in international studies and facilitates our analysis of variants and scenarios around our baseline projection.

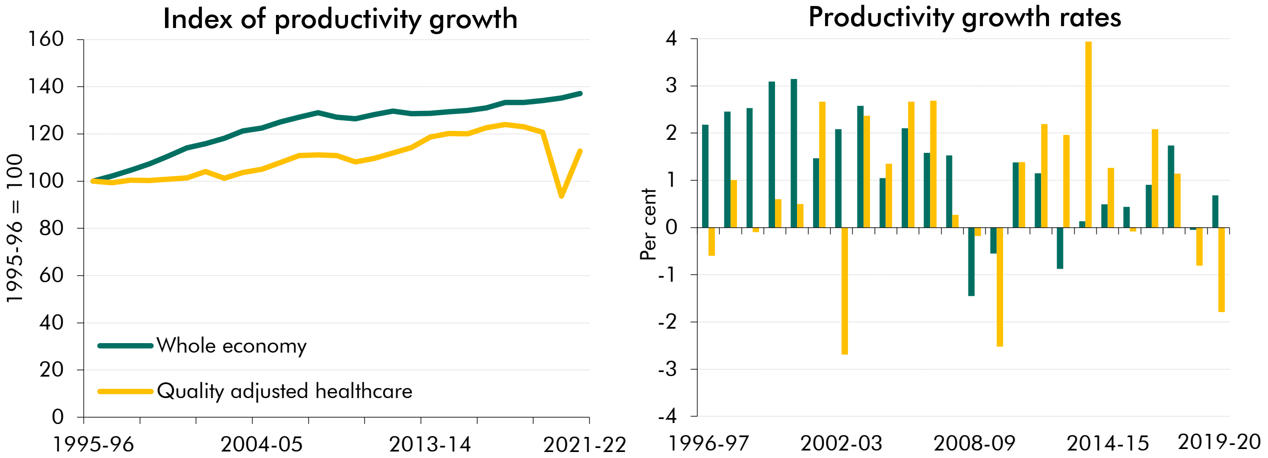
[29] The OECD's latest projection for growth in health spending shows non-demographic, non-income-related costs driving around 1 per cent annual real growth in health spending across advanced economies between 2019 and 2040. In our model we apply this figure to current health spending only. See: Lorenzoni, L., et al., 'Long-term projections: Different paths to fiscal sustainability of health systems', in OECD, *Fiscal Sustainability of Health Systems*, January 2024.

[30] Baumol, W., and W. Bowen, *The Economic Dilemma. A study of Problems common to Theater, Opera, Music and Dance. New York, The Twentieth Century Fund,* 1966.

[31] Institute for Fiscal Studies, *Is there really an NHS productivity crisis,* November 2023 and NHS England, *NHS England public board meeting, agenda item six*, May 2024 highlight a number of the challenges associated with measuring productivity in the healthcare sector and identifying its underlying drivers. These include difficulties associated with capturing all inputs and outputs (particularly those relating

cumulative healthcare sector productivity growth was 8 percentage points lower than pre-pandemic levels and had fallen 24 percentage points behind cumulative growth in whole-economy productivity over the past three decades.

## Chart 3.12: Productivity growth in the healthcare sector and the whole economy




Note: The measure of productivity presented is output per hour.
Source: ONS

3.28 To reflect slower productivity growth in the healthcare sector, and capture the additional health costs it implies, we multiply our forecast for economy-wide productivity growth (which averages 1.5 per cent a year[32]) by the OECD's latest estimate of the Baumol coefficient – 0.48 – in each year of our projection beyond 2028-29.[33] In other words, each 1 per cent of growth in economy-wide labour productivity is associated with 0.48 per cent growth in real health spending, broadly consistent with the divergence between health-specific and economy-wide productivity in recent decades shown in Chart 3.12. This means the Baumol effect drives an average of 0.72 percentage points of the annual growth in health spending over our projection. As such, it accounts for almost three-quarters of the 1 per cent annual growth in real health spending driven by 'other cost pressures.'

3.29 Recent trends in healthcare productivity may not be representative of future trends, particularly as health services recover from the disruption of the pandemic and as growth in inputs (such as staff and equipment) and outputs (such as patients treated) are likely to reflect the spending decisions of future governments and the evolution of processes, treatments, and demand for health services. The right panel of Chart 3.12 also shows that quality-adjusted productivity growth in healthcare has been more volatile than economy-wide productivity growth. So we explore how variations in productivity growth in the healthcare sector would affect the public finances, from paragraph 3.38 onwards.

to community care) and in quality-adjusting outputs to reflect ongoing medical innovations and changes in processes over time. Coupled with the disruptive effects of the pandemic on NHS operations, these challenges mean that it is particularly difficult to identify why productivity in the sector has recovered significantly more slowly than economy-wide productivity.

[32] This 1.5 per cent figure is a mixture of total factor productivity growth and capital deepening.

[33] See: Lorenzoni, L., et al., 'Long-term projections: Different paths to fiscal sustainability of health systems', in OECD, *Fiscal Sustainability of Health Systems*, January 2024.

## Chronic conditions

3.30 The rising prevalence of certain physical and mental health conditions at specific ages (such as those explored in Chart 3.3, above) may also put upward pressure on health spending over and above the effect of demographic changes. While many health outcomes have been improving, at least until recently, several health spending projections factor in rising cost pressures as a result of recent trends in the incidence of disease. This reflects the fact that while life expectancy was rising up to the pandemic (although more slowly than in prior projections), people are getting ill slightly earlier in life.[34] The Health Foundation has estimated that average years without illness fell from 47 in 2010 to 45 in 2019,[35] implying that people are spending more years of their lives in more frequent contact with the health service. In addition, the prevalence of co-morbidities – people living with more than one condition at the same time – has been growing around twice as fast as overall conditions prevalence.[36] This entails more complex (and costly) health interventions required to deal with multiple ailments.

3.31 Many health projection models assume a continuation of recent trends in these areas, commonly termed 'chronic conditions'. Projections by the Nuffield Trust in 2012 suggested that more than half of the additional demand for hospital services over the following decade would be caused by increases in the prevalence of chronic conditions within age and sex groups, rather than population growth or ageing.[37] And The Health Foundation's REAL Centre projects future trends in health condition prevalence based on the historical trend in the age- and gender-specific rate of admissions by condition. On the basis of this and several other inputs, The Health Foundation estimated that real-term NHS funding would need to rise by 3.2-3.5 per cent per year through to 2030-31.[38]

3.32 Over the next fifty years, we assume that the rising prevalence of chronic conditions adds a further 0.15 percentage points per year in upward pressure on real health spending. This estimate combines The Health Foundation modelling on the changing prevalence of a range of common health conditions through to 2040 with estimates of the increased costs associated with a selection of those conditions in a Public Health England study.[39] This produces a 'cost per person' associated with changing condition prevalence over the projection period, which is then combined with initial health spending estimates and population projections to estimate a real annual cost pressure of chronic conditions.

## Technology

3.33 Technological developments within the healthcare sector (including in medical equipment, techniques and procedures), while often improving health outcomes, have generally pushed up costs. While some – such as vaccinations – lower costs by preventing future illness, many

[34] Getting ill earlier in life represents an additional effect to the healthy life *expectancy* modelling assumptions we discuss above, which only capture the health status of *additional years of life* over the projection period, and not any expansion of morbidity beyond this.
[35] The Health Foundation, *Health in 2040: projected patterns of illness in England*, July 2023.
[36] Institute for Fiscal Studies, *Securing the future: funding health and social care to the 2030s*, May 2018.
[37] Roberts, A., and A. Charlesworth, 'Future demand for health care: a modelling study', *The Lancet* 380:S20, October 2012.
[38] The Health Foundation, *REAL Centre Projections: Health and social care funding projections 2021*, October 2021.
[39] The Health Foundation, *Health in 2040: projected patterns of illness in England*, July 2023; Public Health England, *The health and social care costs of a selection of health conditions and multi-morbidities*, July 2020.

expand the range of treatments available, rather than reduce it.[40] Table 3.1 summarises a selection of studies examining the effects of technological developments on health spending.[41] While it is difficult to compare directly across these studies which encompass a wide range of different time periods, countries and methodologies, all find that developments in technology are cost-enhancing rather than cost-saving. Technological changes drive an average of around 35 per cent of the annual growth in health spending, with estimates varying within a broad range of between 5 to 75 per cent.

## Table 3.1: Technology as a driver of health spending, summary of evidence

| Author | Period | Countries | Technology effect |
|---|---|---|---|
| Dreger and Reimers (2005) | 1975-2001 | 21 | 70-75% |
| Di Matteo (2005) | 1975-2000 | USA and Canada | 60-65% |
| Willemé and Dumont (2015) | 1981-2012 | 18 | 37% |
| You and Okunade (2017) | 1971-2011 | Australia | 35-40% |
| Smith et al. (2009) | 1960-2007 | USA | 27-48% |
| Freeman (2003) | 1966-1998 | USA | 27-37% |
| Colombier (2012) | 1965-2007 | 20 | 20% |
| Farag et al. (2012) | 1995-2006 | 174 | 15%+ |
| Okunade and Murthy (2002) | 1960-1997 | USA | 10-26% |
| Ho et al. (2014) | 2002-2010 | China | 5-10% |

Source: OECD, *The impact of technological advancements on health spending* , 2019

3.34 While the role of technology is generally agreed to be cost-enhancing, specifying its effect in comprehensive models for health spending can be challenging. This is partly because quality data that proxies for technology are scarce. And it is partly because technology interacts endogenously with other drivers in these models, such as relative productivity growth across sectors and the demand effect stemming from rising incomes. As a result, OECD modelling captures the effect of technological progress implicitly (via the coefficients on year 'dummies', after controlling for various other factors) rather than explicitly.[42] In a similar vein, we do not disaggregate a specific impact for technological developments in our projections for health spending. In effect we assume that most growth in spending resulting from technological developments is captured by a mixture of our Baumol and income effects. But within our overall 1 per cent annual real growth from other cost pressures on current spending, we do allow for a small, 0.13 percentage point, residual effect, which could partly be attributed to technological developments not implicitly captured elsewhere in our framework.

[40] For instance, the introduction of coronary care units and bypass surgery increased the cost of acute myocardial infection by 33 per cent. See: Cutler, D., and M. McClennan, *Is technological change in medicine worth it?*, 2001.
[41] Table 4.2 in OECD, *The impact of technological advancements on health spending: A literature review*, August 2019, presents estimates of the impact of technology on health spending at the macro level from numerous studies covering various countries and time periods.
[42] This approach captures the effects of technology alongside other drivers of health spending not captured elsewhere in the modelling framework, so should not be viewed as an estimate of the effects of technological developments, in isolation, on health spending.

## Long-term projections for public health spending

3.35 This section brings together the results of our analysis of recent trends in health and healthcare costs into an updated set of long-term projections for public spending on health. It includes:

- an updated **baseline projection** for public health spending over the next 50 years based on trends in the key drivers of health spending discussed above; and
- a set of **variants** around this in which we vary (i) **productivity** within the healthcare system, and (ii) the **income effect**, i.e. the income elasticity of demand for healthcare.

### Baseline projection for health spending

3.36 Chart 3.13 shows the average annual change in real public spending on health at five-year intervals over our 50-year projection. It disaggregates growth into the factors detailed in the previous section: demography, the income effect, and other cost pressures. Spending is projected to grow at an average rate of 3.1 per cent a year, as a result of the following drivers:

- **Over our medium-term forecast horizon through to 2028-29**, for which departmental spending allocations are not fixed beyond this year, we assume that total health spending grows by 3.3 per cent a year in real terms. This is similar to the historical annual average of 3.6 per cent per year in real health spending growth in the 50 years up to the pandemic. Within this overall total:

    1. **Current spending** (which accounts for around 94 per cent of total health spending) grows by 3.6 per cent a year in real terms. This is more than triple the 1.0 per cent growth rate in the overall envelope for current departmental spending in our March 2024 forecast.[43] The growth rate in current health spending reflects estimates of the cost of delivering the NHS Workforce Plan, which aims to increase the size of the NHS workforce by 3.1-3.4 per cent a year between 2021-22 and 2036-37.[44] This assumption is based on the previous Government's stated policy and the current Government will set its own health spending plans at the upcoming Spending Review.

    2. **Capital spending**, which accounts for the other 6 per cent of total health spending, is held flat in nominal terms (falling by 2.1 per cent per year in real terms), in line with the previous Government's plans for overall departmental capital spending in our March 2024 forecast.

[43] See Box 4.2 of our March 2024 *Economic and fiscal outlook* for details.
[44] Institute for Fiscal Studies, *Implications of the NHS workforce plan,* August 2023.

- **Beyond the end our medium-term forecast from 2029-30 onwards**, total health spending is projected to grow at an average rate of 3.1 per cent a year, within which:

  1 **Demographic pressures** account for 0.6 percentage points a year on average. The year-to-year variations stem largely from cohort effects (as specific age cohorts – which differ in size – age and then eventually die). In particular, the large post-war 'baby boom' cohort will be in their 80s by the 2030s, which explains the larger demographic effect this decade.

  2 The **income effect,** captured by an elasticity of 0.8 per cent (as set out in paragraph 3.23), accounts for 1.5 percentage points a year.[45] This rises until 2039-40, in line with our forecast for growth in real GDP, but then remains constant as output growth stabilises for the remainder of the projection.

  3 **Other cost pressures** add an average of 1.0 percentage points to growth in annual real spending, consistent with the latest OECD estimates for all advanced economies. Within this:

    (i) Increasing relative healthcare costs, modelled by the **Baumol effect**, account for 0.72 percentage points, as set out in paragraphs 3.26 and 3.27. This effect remains flat from 2036-37 onwards, as year-on-year growth in economy-wide productivity (against which the Baumol effect is calculated, using the 0.48 elasticity) stabilises at 1.5 per cent.

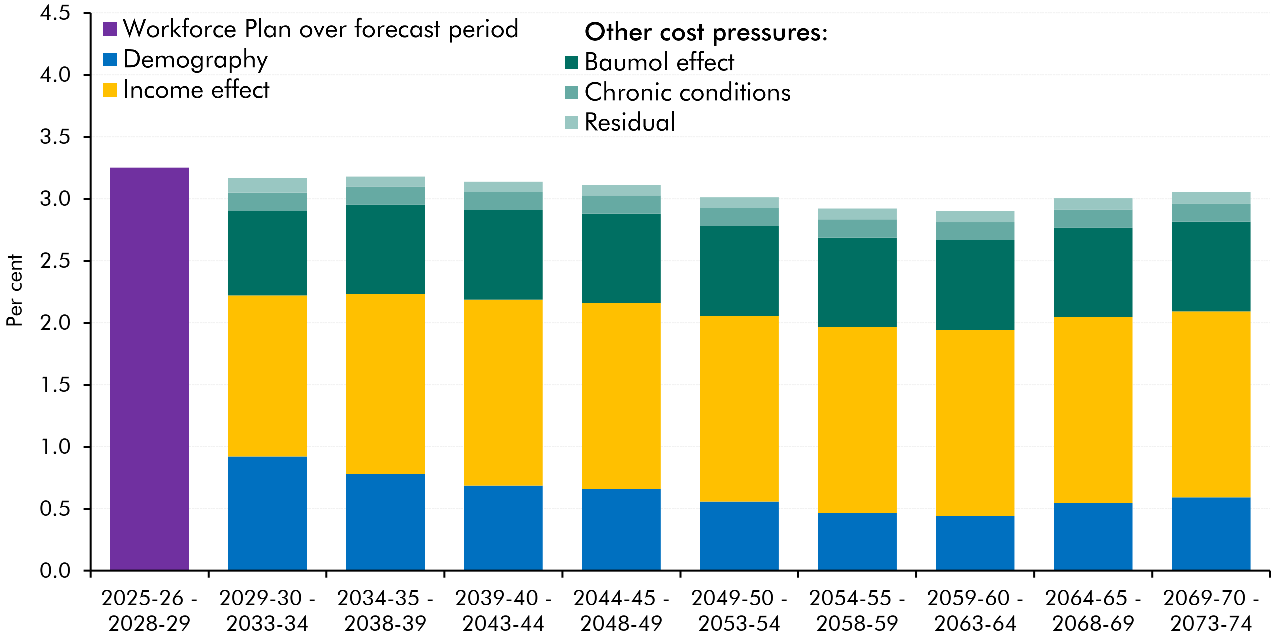
    (ii) The rising incidence of **chronic conditions** adds 0.15 percentage points, as discussed in paragraph 3.30 onwards.

    (iii) There is a **residual** of 0.09 percentage points,[46] which includes any additional effect from technological developments beyond that captured within the Baumol and income effects.

[45] We assume that the increased demand for health spending which results from rising incomes is met in full by future government spending allocations.

[46] This is lower than the 0.13 percentage point figure for the residual discussed above, because that figure applied to current health spending, whereas here we disaggregate the contributions to growth in total public health spending (including capital expenditure), for which other cost pressures add an average of 0.96 percentage points to growth each year. For simplicity, we assume that the Baumol effect and the effect of chronic conditions maintain the same contributions to growth in total spending as they do to current spending, and reduce the residual.

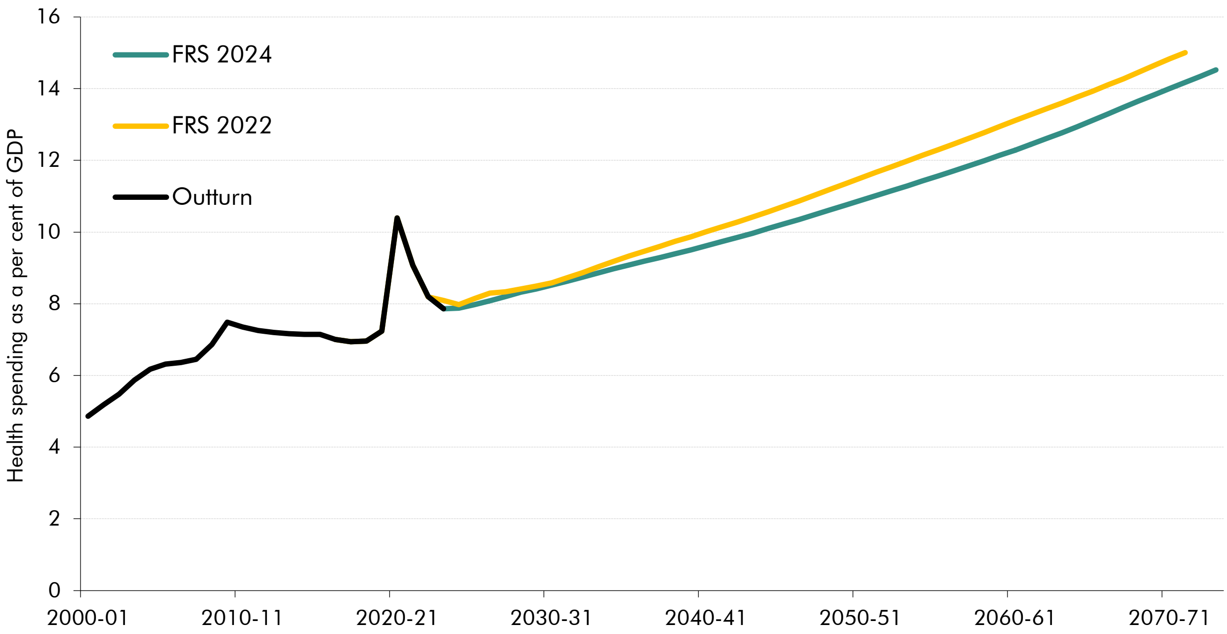
## Chart 3.13: Annual growth in public health spending over the projection period




Source: OBR

3.37 Based on these assumptions, real public health spending grows at a rate of 3.1 per cent per year on average over the next 50 years, around twice the real growth rate of the economy. As a result, health spending is projected to rise from 7.9 per cent of GDP in 2024-25 up to 14.5 per cent of GDP by 2073-74 (Chart 3.14). This is a very slightly shallower trajectory than our projection for health spending in our 2022 *FRS* – in which spending reached 15.0 per cent of GDP by 2071-72. The change reflects slightly lower increases from other cost pressures in the early part of the projection and a more favourable population age structure (with a lower old-age dependency ratio, particularly through the 2030s and 2040s).

## Chart 3.14: Baseline projection for public health spending




Source: IFS, OBR

## Healthcare productivity variants

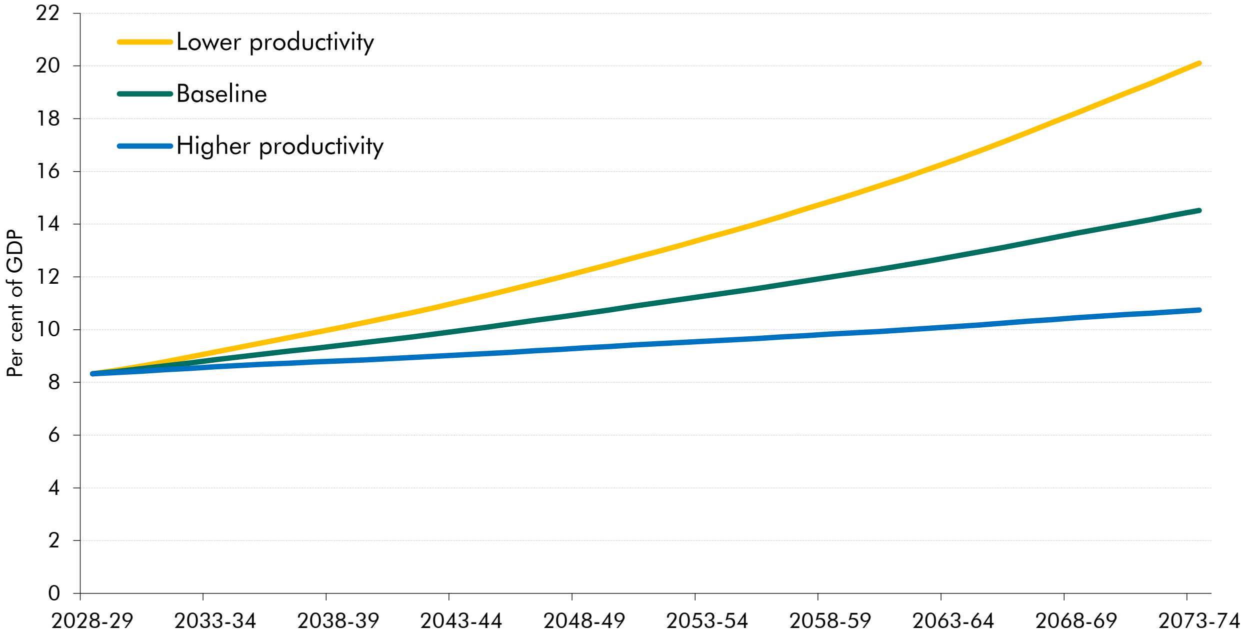
3.38 As discussed above, productivity growth in the healthcare sector has lagged that of the wider economy over the past 25 years by an average of 0.6 percentage points per year, and our estimate of the Baumol effect on health spending implies this divergence will persist. However, this is far from certain, and so our first set of variants explores the implications of higher or lower productivity growth in the healthcare sector.

3.39 In our **higher productivity variant**, we assume a Baumol coefficient of zero, so that productivity in the healthcare sector is assumed to grow in line with the whole-economy average of 1.5 per cent in the long term. This higher productivity assumption may be reflective of the trend outlined in Chart 3.12 of health sector productivity growth outstripping that of the wider economy in every year between 2010-11 and 2016-17. There may also be future productivity gains concentrated in healthcare through AI adoption – potentially reducing administrative burdens on health staff – and the more effective use of healthcare data.[47] In this variant, health spending rises to 10.7 per cent of GDP by the long-term horizon. This is 3.8 per cent of GDP lower than our baseline, but still 2.9 per cent of GDP higher than today (Chart 3.15).

3.40 In our **lower productivity variant**, we assume a Baumol coefficient of 1, more than doubling the productivity differential assumed in our baseline between the healthcare sector and the wider economy. This means that each 1 per cent of growth in economy-wide labour productivity is mirrored by the same growth in real health spending but not in health output. As explored in paragraphs 3.26 and 3.27, the health sector continues to face numerous pressures to its cost of inputs, notably staffing costs and the potentially growing complexity and cost of treatments, that may cause further pressure on health sector productivity. With this lower productivity assumption, health spending rises to 20.1 per cent of GDP in 2073-74. This is 5.6 per cent of GDP above our baseline projection and almost two-and-a-half times its current share of national income.

[47] See: Tony Blair Institute for Global Change, *A New National Purpose: Harnessing Data for Health*, 2024.

## Chart 3.15: Public health spending in the alternative productivity variant




Source: OBR

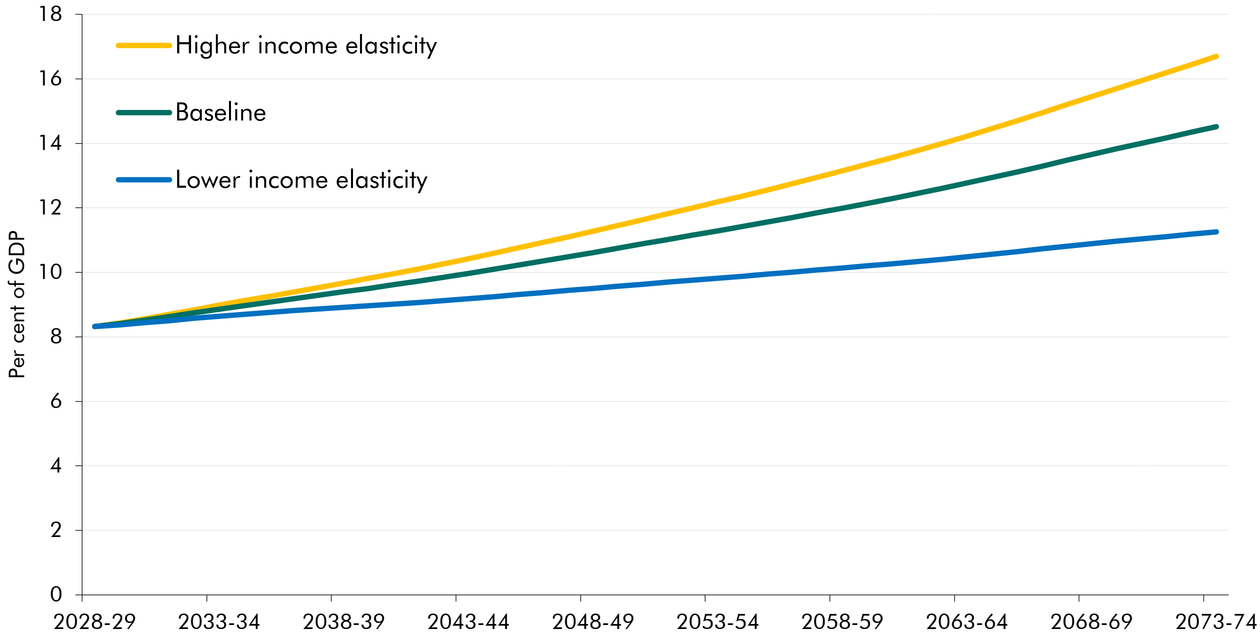
## Income effect variants

3.41 As explored in paragraph 3.36, growth in income is accepted to be one of the key drivers of health spending, but the strength of this relationship into the future is uncertain. In this variant we alter the income elasticity of demand for healthcare assumed in the baseline projection (around 0.8) to 0.5 and 1. This means that, in the **lower elasticity variant**, health consumption rises by half the rise in income (independent of the role of other drivers of health spending: demography and other cost pressures). And, in the **higher elasticity variant**, health consumption rises in line with increases in income. The lower elasticity of 0.5 is somewhat lower than a recent OECD estimate for this value (0.77). But recent estimates for the United States have shown much-reduced elasticities, and this would be consistent with the theory that the income elasticity decreases in the long term as a country becomes richer.[48] By contrast, an income elasticity of 1 would be consistent with trends in some other richer economies in which households also spend a significantly larger share of their income on health.[49] In 2073-74 health spending is 3.3 per cent of GDP lower in the lower income elasticity variant and 2.2 per cent of GDP higher with a higher income elasticity (Chart 3.16). Both of these effects are smaller than the effects of raising or lowering healthcare productivity shown in Chart 3.15.

[48] See: Lorenzoni, L., et al., 'Long-term projections: Different paths to fiscal sustainability of health systems', in OECD, *Fiscal Sustainability of Health Systems*, January 2024, and Asante, D., *Healthcare in the United States: Necessity or Luxury? Analysis of the Impact of the Affordable Care Act on Elasticity of Healthcare Expenditure,* 2024.

[49] Acemoglu, D., et al., *Income and health spending: evidence from oil price shocks,* October 2013 finds that the upper end of the 95 per cent confidence interval from their baseline estimate (0.72) is an income elasticity of 1.13.

Chart 3.16: Public health spending in the alternative income effect variant




Source: OBR

## The wider impact of health on the public finances

3.42 As well as directly affecting health spending, changes in population health also affect other areas of the public finances. These include:

- on the **spending** side, the cost of health-related welfare benefits, pensions, and social care; and
- on the **tax side,** through their impact on labour market outcomes, receipts from income and consumption taxes.

3.43 The economic and fiscal cost of rising ill health among the working-age population has become particularly evident in the wake of the Covid pandemic. Since the pandemic, the number of working-age people classed as inactive has increased by around 1 million. The largest portion of this group is classified as long-term sick, whose numbers reached a record high of 2.8 million (7 per cent of the working-age population) in the three months to April 2024. Alongside rising health-related inactivity, the proportion of people in work with a work-limiting health condition has also increased (from 7.5 per cent of the in-work, working-age population in 2014 to 9.0 per cent in 2019 and 10.4 per cent in 2022). As we set out in our 2023 *FRS*, these changes have significant implications for the medium-term fiscal outlook via their impacts on tax revenues and welfare spending.

3.44 This final section of the chapter explores the *long-term* implications of better health or worse health for the public finances, looking across health spending, pension and other age-related spending, welfare spending, and tax revenues. It aims to present plausible upper and lower scenarios for how health trends could evolve and what this would imply for the public finances. But these scenarios are neutral regarding the drivers of the better or worse health outcomes, and on the policy mix and other factors that might cause them to materialise.

3.45 The two scenarios presented rest on four separate-but-related assumptions about future developments in health through to the 2070s:

- Self-reported, **work-limiting ill health** decreases (in our better health scenario) or increases (in our worse health scenario) by around 25 per cent from 2022 levels. In the better health scenario, the proportion of the working-age population with a work-limiting condition falls by 4.9 percentage points, from 17.5 per cent to 12.7 per cent by 2073-74, slightly more than reversing the sharp 3.5 percentage point rise between 2014 and 2022 discussed in paragraph 3.8. In the worse health scenario, the rate rises symmetrically to 22.4 per cent.

- Changes in the population aged over 70 as a result of higher or lower **life expectancy** are calibrated based on the life expectancy variants in the ONS's 2018 population projections.[50] We apply half of the change in the over-70 population implied by the ONS's high life expectancy population variant, because we assume that not all of the change implied by the variant can be directly related to aspects of the health of the population that can be improved over the projection period.[51] We apply this change in the number of over 70s symmetrically in our better and worse health scenarios, so that by 2073-74 their number rises or falls by around 850,000 people (5 per cent) respectively.[52]

- We assume that all life expectancy gains go to **healthy life expectancy** in our better health scenario, representing a full compression of morbidity. So, in this scenario, healthy life expectancy rises by a year every 9.5 years over the projection period compared to a year every 19 years in our baseline. In our worse health scenario we assume that gains in life expectancy are spent predominantly in poor health. Healthy life expectancy therefore does not rise at all over the next 50 years, representing a further expansion of morbidity.

- We assume that **chronic conditions** cease to put any further upward pressure on health spending in our better health scenario, compared to the 0.15 per cent they add to spending each year in our baseline. In our worse health scenario, they put double the

[50] 2018 was the last population projection in which the ONS produced detailed variants. We focus on those aged over 70 only as they account for the large majority of the changes in the ONS's life expectancy variants, and in order to abstract from population changes that would have implications for our long-term GDP growth assumptions.

[51] Other factors, including some which are not directly related to health such as cohort effects, education levels and income will affect gains in life expectancy. See Luy, M., et al., *The impact of increasing education levels on rising life expectancy: a decomposition analysis for Italy, Denmark, and the USA,* March 2019, and Walczak, D., et al., *Impact of Income on Life Expectancy: A Challenge for the Pension Policy*, April 2021.

[52] This scale of change is also broadly consistent with an increase in the rate of mortality improvement of around 25 per cent above the central assumption (i.e. a similar scale of change to that we assume for work-limiting ill health). The central assumption for the rate of mortality improvement in ONS projections has consistently been 1.2 per cent a year; the rate in the high life expectancy 2018 variant was 1.8 per cent, implying a rate in our preferred half-way position of around 1.5 per cent.

amount of upward pressure on health spending – 0.3 per cent – in line with upper-bound estimates of changes in the prevalence of conditions and their costs.

## Health spending, pensions, and other age-related spending

3.46 Chart 3.17 shows how better or worse health affects health spending, pension spending, and other age-related spending. In the better health scenario, lower net spending on these items reduces the primary deficit by 0.4 per cent of GDP, while in the worse health scenario higher net spending increases the primary deficit by 0.6 per cent of GDP in 50 years. These changes reflect:

- **Changes in the prevalence of chronic conditions** (shown in the yellow bars), which affect our projections for health spending. In the better health scenario, a reduction in prevalence reduces health spending, and therefore the primary deficit, by 0.8 per cent of GDP. In the worse health scenario, higher prevalence of chronic conditions increases spending and the primary deficit by 1.0 per cent of GDP (a larger effect due to compounding).

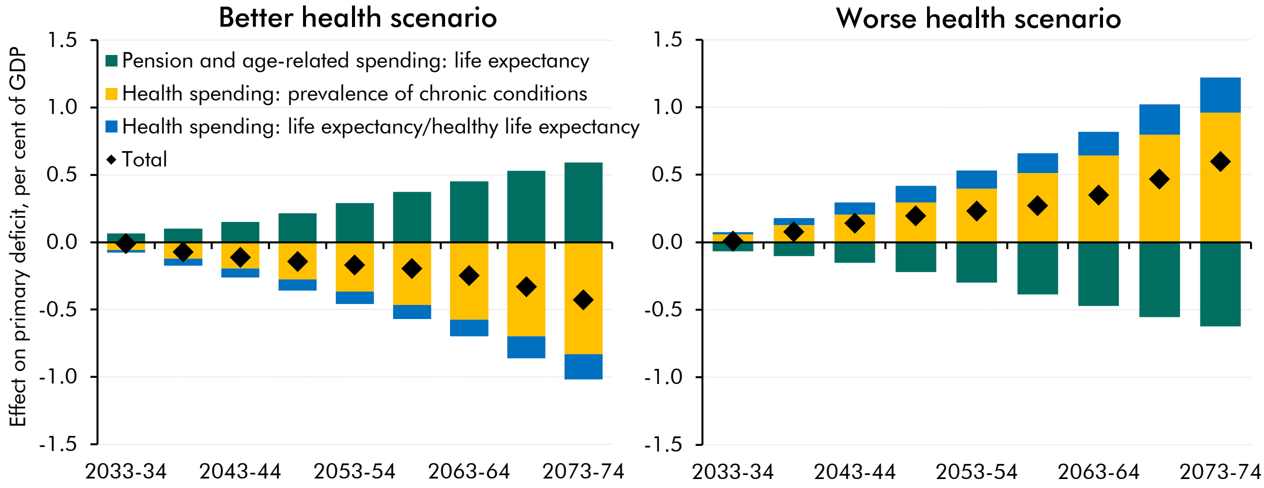
- **Changes in life expectancy and healthy life expectancy** (shown in the blue bars) which reduce health spending, and therefore the primary deficit, by 0.2 per cent of GDP in the better health scenario, but increase them by 0.3 per cent of GDP in the worse health scenario. These changes have a relatively modest effect as the gains in healthy life expectancy (which reduce health spending) in the better health scenario are partly offset by a higher number of people aged over 70 (which raises health spending). In the worse health scenario, reductions in healthy life expectancy are partly offset by lower health costs due to fewer over-70s.

- **Changes in pension and other age-related spending** (shown in the green bars), which stem from the symmetric changes in the number of people aged over 70 in our scenarios.[53] These items of spending include the state pension, pensioner housing benefits, public sector pensions, and adult social care spending.[54] In the better health scenario, higher life expectancy pushes up this spending, and the primary deficit, by 0.6 per cent of GDP. In the worse health scenario, lower life expectancy reduces spending by the same amount. This effect largely stems from state pension spending, which accounts for around 0.4 per cent of GDP (two-thirds of the change).

[53] We do not model any effects on pensioner disability benefit spending as we assume that any increases in the number of people aged over 70 in the better health scenario would be offset by a reduced share of claimants (as the population is assumed to be healthier). In the worse health scenario the same logic applies in reverse.

[54] Each differs in the number of people affected in the scenarios, with state pension uptake assumed to increase or decrease by the full 850,000 change in over 70s. The other spending items experience more limited changes as they affect a smaller number of people (for example, public sector pensions are only paid to public sector workers and pensioner housing benefit is means-tested, so only paid to poorer pension-age households).

## Chart 3.17: Health, pension, and other age-related spending in the scenarios

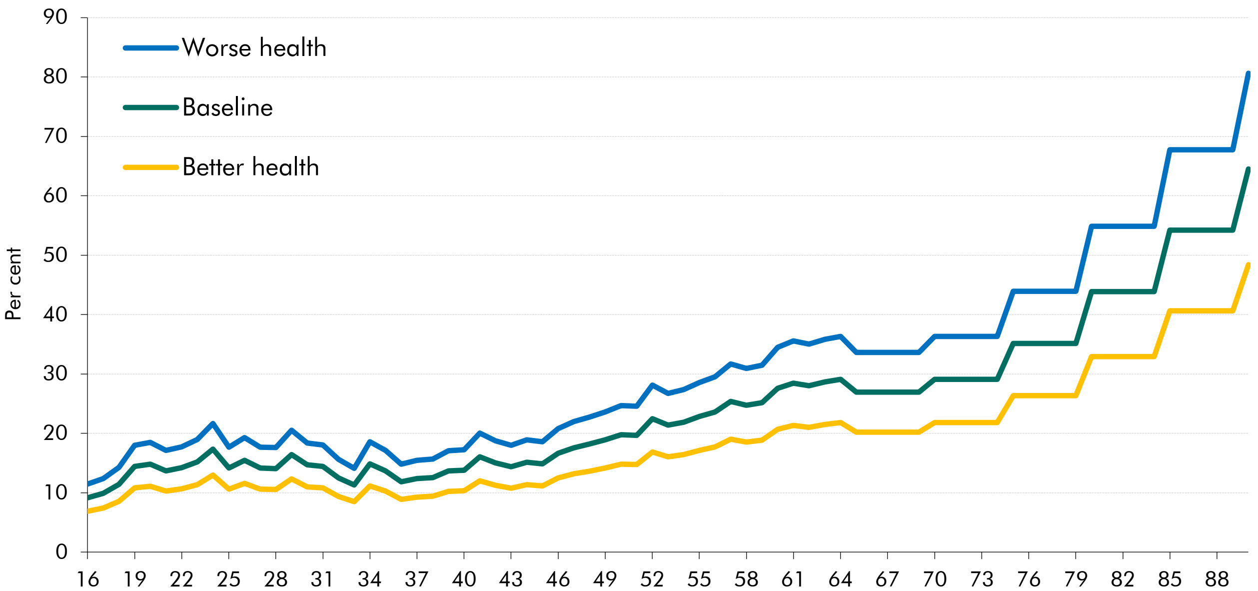



Source: OBR

## Labour market and economy

3.47 Heath status also affects the public finances via its impact on the taxes received from, and welfare benefits paid to, those in work or of working age. Our approach to calculating the effects of better or worse health on the economy, working-age welfare spending, and tax revenues in our scenarios starts with an estimate of the effects on labour market participation. We apply the 25 per cent change in the rate of work-limiting ill health set out above, at each year of age (Chart 3.18).[55] These outcomes are reached by the end of the projection period (2073-74), with progress towards them happening linearly from the end of our medium-term forecast (2028-29).

## Chart 3.18: Work-limiting ill health rate by age in the scenarios in 2073-74

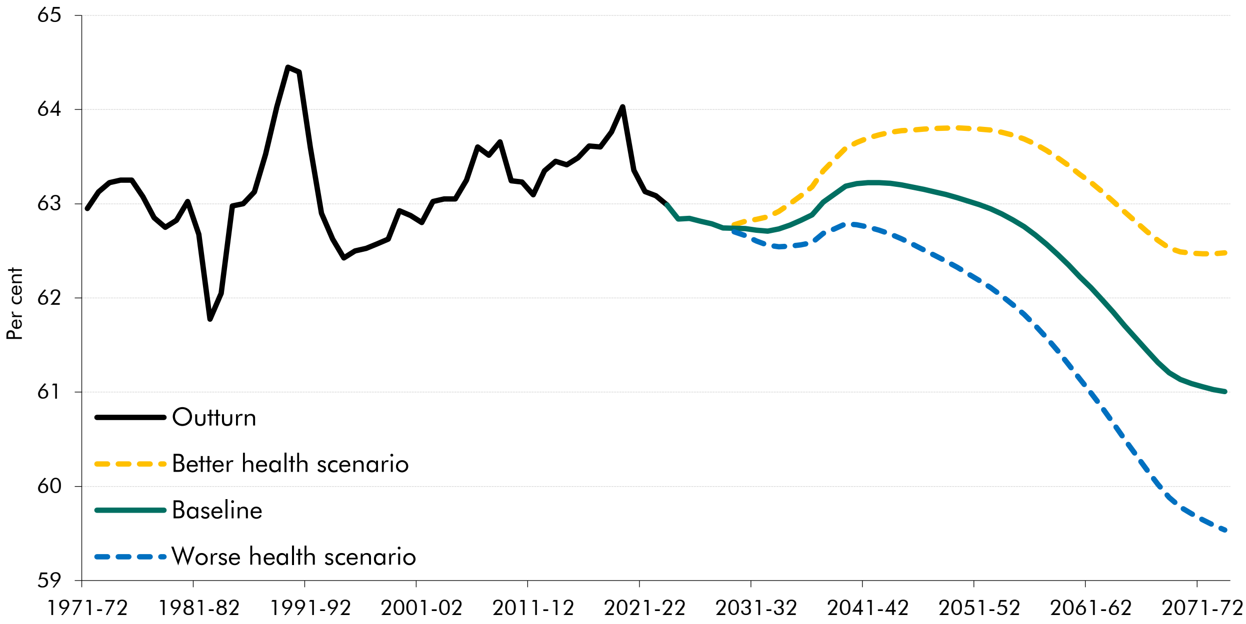



Source: ONS, OBR

[55] As well as the 25 per cent increase or decrease in work-limiting ill health rates, we shift the curve shown in Chart 3.11 to the left or right in line with our assumptions about changes in healthy life expectancy in the better and worse health scenarios, set out above.

3.48 To translate these changes in self-reported work-limiting ill health into participation changes, we estimate and apply a 'health participation factor'. This represents the impact that switching from good health to ill health (or vice versa) has on an individual's chance of participation in the labour market, controlling for other factors. Based on regression analysis using Labour Force Survey data we estimate this factor at 28 per cent, i.e. those with a work-limiting health condition are 28 per cent less likely to participate in the labour market.[56] Multiplying the health participation factor through by the changes in self-reported health status at each age results in our estimates of changes in the participation rate over the projection period, shown in Chart 3.19. In our better health scenario, the participation rate rises by 1.5 percentage points (1 million people) by 2073-74. The results in the worse health scenario are symmetric.

## Chart 3.19: 16+ participation rate in the scenarios



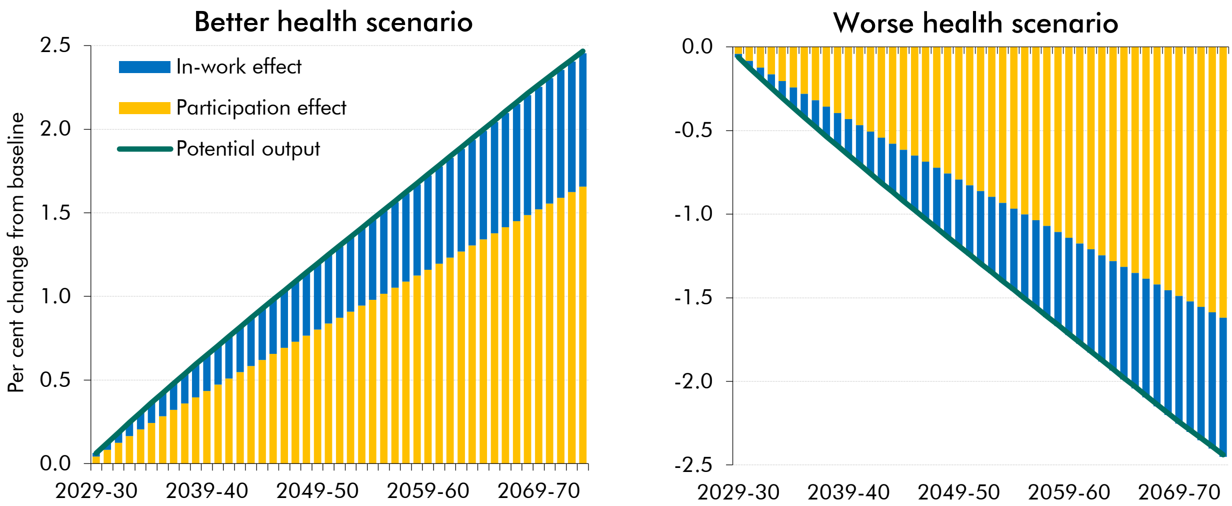

Source: ONS, OBR

3.49 To assess the overall economic impact of these participation changes, we model the changes to potential output that are implied by these changes in participation. Based on analysis in our 2023 *FRS*, we assume those leaving or entering the workforce are 68 per cent as productive as those permanently in the workforce. In our better health scenario, lower rates of inactivity lead to a larger labour force, which increases potential output by 1.7 per cent by 2073-74. The boost to potential output from those entering the labour force is slightly offset by a small drop in the average hours and productivity of the workforce which comes from the lower average hours and productivity of those entering. The reduction in potential output in our worse health scenario is symmetric.

[56] This is based on analysis of the ONS's Labour Force Survey (2022). Using Haskell and Martin's definition of a work-limiting health condition, we assess the likely impact of this on participation while controlling for sex, age, qualifications, and homeownership. We plan to publish an Article setting out this analysis in greater detail. See: Haskell, J., and J. Martin, *Economic inactivity and the labour market experience of the long-term sick*, July 2022.

3.50 To come to a full picture, we also need to consider the labour market implications of the changing health of those who remain in work. We apply the same proportional changes in this group's self-reported health status across the age range shown in Chart 3.18, which results in around 1 million fewer or more people in work with a work-limiting condition in the better and worse health scenarios respectively. Again, based on assumptions in our 2023 *FRS*, we assume the average hours and wages of people with a work-limiting health condition are each around 80 per cent of those without a work-limiting health condition. In our better health scenario, fewer people with a work-limiting health condition in the workforce leads to a 0.8 percentage point increase to potential output by 2073-74. So the overall boost to potential output in our better health scenario is 2.5 per cent by the end of the projection (Chart 3.20). In our worse health scenario, potential output falls by 2.4 per cent, made up of a 1.6 percentage point decrease from lower participation and a 0.8 percentage point decrease from more people in work with a work-limiting health condition.

## Chart 3.20: Level of potential output in the scenarios




Source: OBR

## Working-age welfare

3.51 As we explored in Chapter 2 of our *2023 FRS*, varying the health outcomes of the population can have several fiscal implications. One is a change to working-age welfare spending through two separate channels:

- **Incapacity benefits**: in line with the approach in our 2023 *FRS*, we assume that three-fifths of people who move between inactivity and employment receive universal credit when working, while the remaining two-fifths are assumed to exit the welfare system entirely when moving from inactivity into work. The increase or decrease in welfare spending as a result of moving between inactivity and employment is £10,900 per person for those in the first group, and £15,300 per person for those in the second group, in 2029-30, the first year of our long-term projection.

- **Disability benefits.** As in our 2023 *FRS*, we assume that three-fifths of those that move between inactivity and employment receive personal independence payment (PIP) when out of work.[57] And we assume that the number of in-work PIP claimants changes in line with the number of people employed with a work-limiting condition, with 14 per cent of this group assumed to claim.[58] In each case, welfare spending changes by a projected £7,800 per person (in 2029-30).

## Tax revenues

3.52 A change in the health outcomes of the population also feeds through to changes in tax revenues arising from two broad channels:

- First, a **direct impact on income tax and National Insurance contributions (NICs)** due to changes in the participation rate, and the earnings and hours of those in work. As set out in paragraph 3.49, individuals that flow between inactivity and employment are assumed to do so at reduced earnings relative to the average employee,[59] generating lower-than-average tax gains or losses, and those in work with a limiting condition similarly have lower hours and earnings. This results in a projected average tax gain or loss per person of £6,500 (in 2029-30) via participation, and an average gain or loss of £5,100 per person via changes in the health status of those in work.

- Second, there is **an indirect impact on other tax revenues due to changes in potential output and the size of the nominal economy.** This determines revenues from other indirect taxes, such as VAT and corporation tax, that move in line with the movements in nominal GDP.

## Overall impact on the public finances

3.53 To calculate the effects of variations in health status on fiscal aggregates we combine the long-term effects on health, pension and other age-related spending, working-age welfare, tax receipts, and the changes to output outlined above. In our **better health scenario**, the primary deficit is 2.1 per cent of GDP lower than the baseline by 2073-74, due to the following:

- **Lower health spending** drives the largest change in the primary deficit at 1.0 per cent of GDP. As shown in Chart 3.17 this is largely through the assumption that chronic conditions cease putting upward pressure on health spending.

- **Lower working-age welfare spending** reduces the primary deficit by 0.5 per cent of GDP, with almost two-thirds coming through lower incapacity benefits spending and the remainder through lower spending on disability benefits.

- **Higher tax receipts** contribute 0.9 per cent of GDP, three-fifths coming indirectly through the rise in other taxes due to the larger nominal economy. The remaining two-

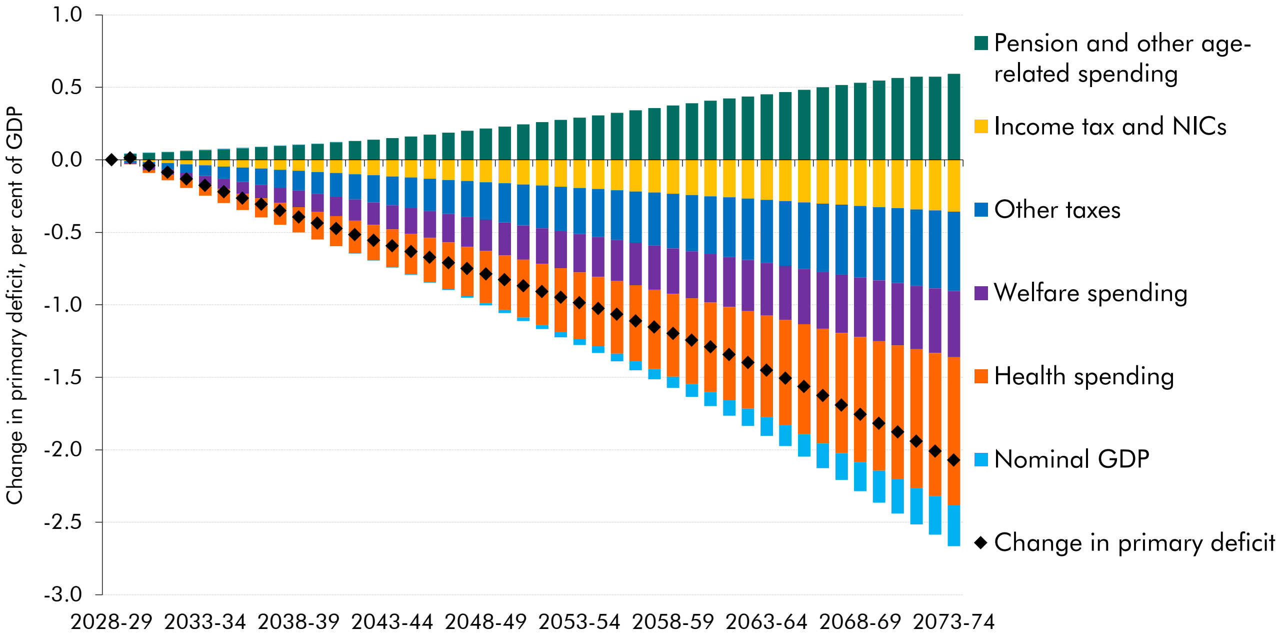
[57] Based on OBR analysis of Labour Force Survey microdata. We assume a symmetric approach for flows from employment to inactivity due to long-term sickness.
[58] Based on DWP analysis of PIP caseload data.
[59] We assume that the unemployment rate remains unchanged in the scenarios, meaning a small amount of the increase or decrease in participation is felt in unemployment.

fifths comes directly from higher personal tax revenues due to increased earnings and hours worked.

- These downward effects are partially offset by **higher pension and other age-related spending**, which pushes the primary deficit up by 0.6 per cent of GDP, largely through increased state pension spending, reflecting higher life expectancies.

- A **larger nominal economy** reduces the primary deficit as a share of GDP by 0.3 percentage points. This reflects two effects. Higher GDP reduces the primary deficit by 0.5 per cent of GDP, but this is offset by a 0.2 per cent of GDP rise in health spending due to the income effect.[60]

## Chart 3.21: Primary deficit in the better health scenario

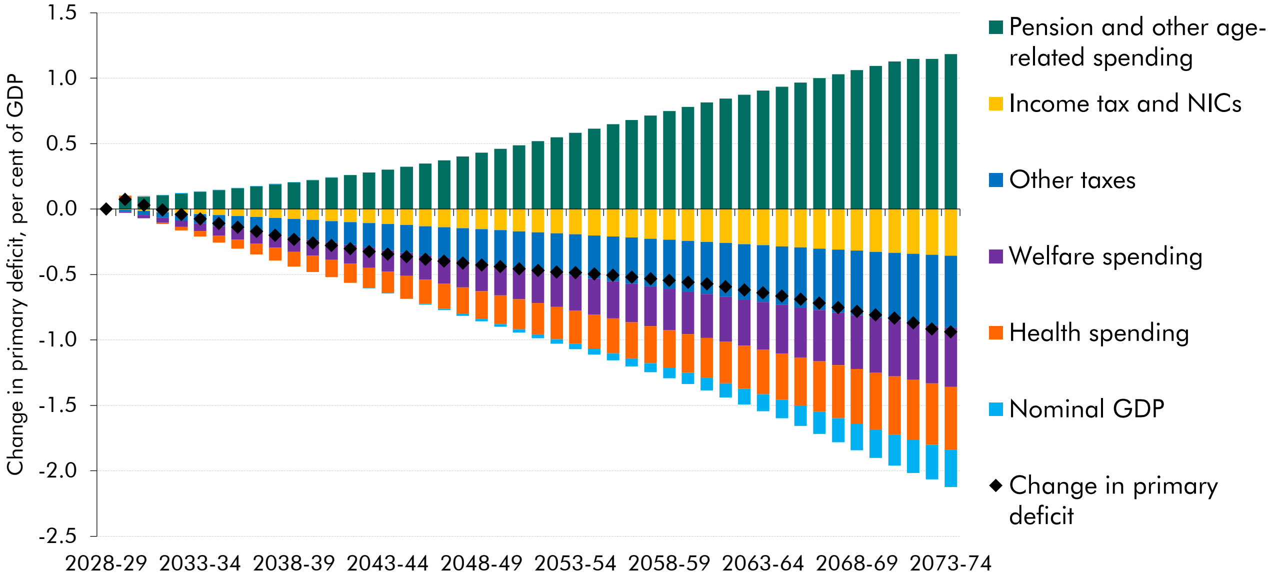



Source: OBR

3.54 The fiscal impact in this scenario is highly sensitive to the assumptions made about the longevity effects of people being healthier, and any possible responses to longer lives (such as changes in the state pension age). For example, if we applied all (rather than half) of the 1.7 million change in the over-70 population implied by the ONS's 2018 high life expectancy population variant in our better health scenario, the overall reduction in the primary deficit would fall by 1.1 per cent of GDP to just 0.9 per cent of GDP in 2073-74 (Chart 3.22). This reflects significantly higher pension and other age-related spending (shown in the significantly larger green bars, relative to Chart 3.21) and the effects of an additional 850,000 people aged over 70 on health spending (shown in the smaller negative orange bars, relative to Chart 3.21).

[60] We assume an income effect consistent with the elasticity of 0.8, set out in paragraph 3.23, so health spending rises by 0.8 per cent for each 1.0 per cent increase in GDP, relative to the baseline.

## Chart 3.22: Primary deficit in better health scenario using full high-life-expectancy variant

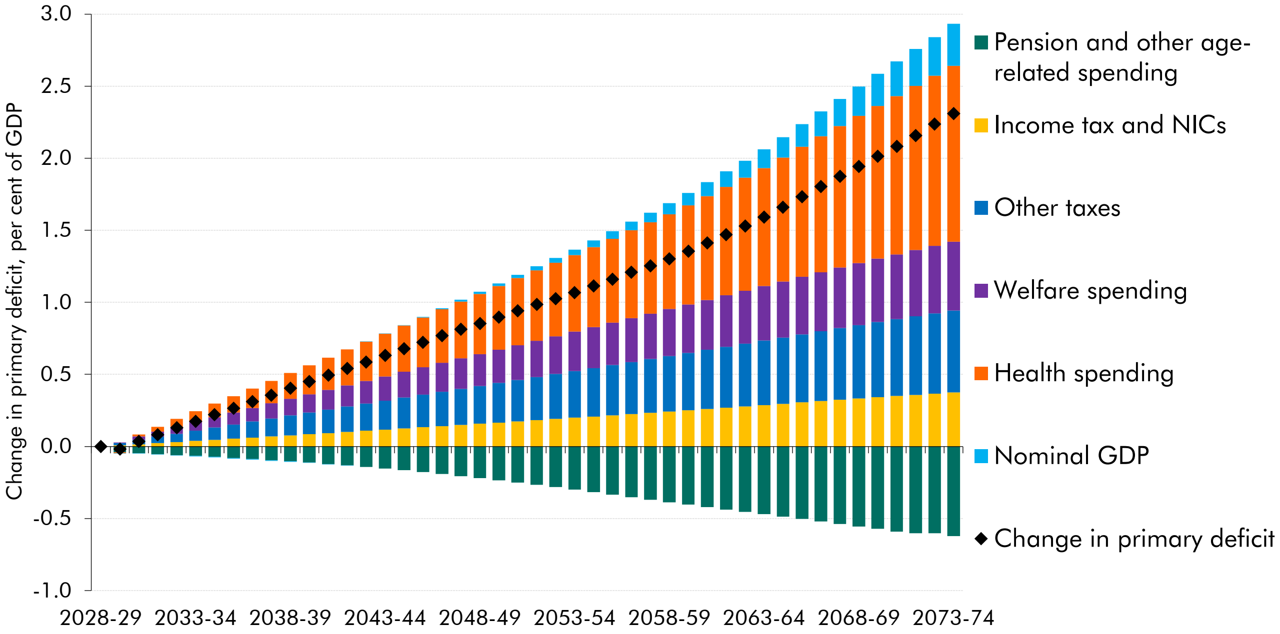



Note: This chart presents the effects on the primary deficit of assuming the 1.7 million increase in people aged over 70 implied by using the ONS's higher life expectancy population variant in full. Only the green and orange bars are different to Chart 3.21.
Source: OBR

3.55 In our **worse health scenario**, the primary deficit is 2.3 per cent of GDP higher than the baseline by the long-term horizon. This is due to:

- **Higher health spending**, which increases the primary deficit by 1.2 per cent of GDP, reflecting lower healthy life expectancy and the greater pressure exerted on health spending by chronic conditions.
- **Higher welfare spending**, which increases the primary deficit by 0.5 per cent of GDP, reflecting higher spending on incapacity benefits, which drives two-thirds of the change.
- **Lower tax receipts**, which increase the primary deficit by 0.9 per cent of GDP. This reflects lower employment and earnings, which reduce income tax and NICs receipts by 0.4 per cent of GDP, and the wider effects of a smaller nominal economy on other receipts, which fall by 0.6 per cent of GDP.
- **Lower pension and other age-related spending** works in the opposite direction, reducing the primary deficit by a symmetrical nominal amount to our better health scenario, equivalent to 0.6 per cent of GDP, largely due to lower life expectancies reducing state pension spending.
- A **smaller nominal economy**, which increases the primary deficit by 0.3 per cent of GDP. Lower GDP increases the primary deficit by 0.5 per cent of GDP, but this is offset by a 0.2 per cent fall in health spending due to the income effect.

Chart 3.23: Primary deficit in the worse health scenario



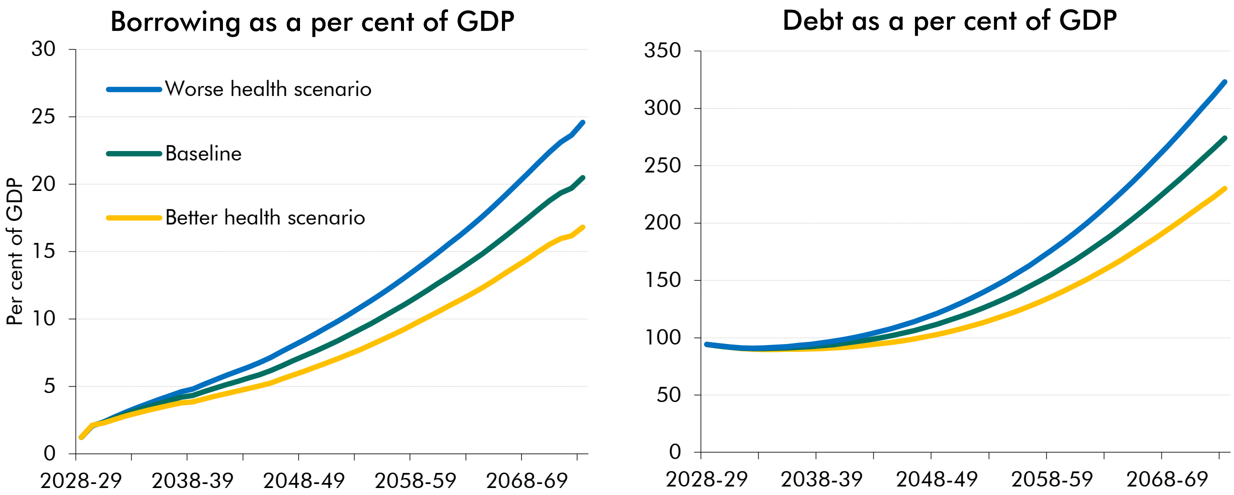

Source: OBR

3.56 Chart 3.24 and Table 3.2 brings together the effect of the primary deficit changes outlined above with the consequential impacts on debt interest spending to generate the implications of the two scenarios for overall borrowing, and debt as a share of GDP, compared to the baseline borrowing and debt projections set out in Chapter 4 of this report:

- In the **better health scenario**, public sector net borrowing is 3.7 per cent of GDP below our baseline by 2073-74, at 16.8 per cent of GDP, with lower debt interest spending contributing a further 1.6 per cent of GDP to the change in the primary deficit. The compounding impact of lower borrowing and higher GDP means public sector net debt is 44.3 per cent of GDP lower by the end of the long-term projection, with two-thirds of this coming from lower debt interest and health spending.

- In the **worse health scenario,** borrowing is 4.1 per cent of GDP higher by 2073-74, at 24.6 per cent of GDP, with a 1.8 per cent of GDP contribution from debt interest, further to the primary deficit impact outlined above. Debt is 48.9 per cent of GDP higher in the same year, with the asymmetry relative to the better health scenario reflecting comparatively higher health spending and debt interest spending.

Chart 3.24: Borrowing and debt in the scenarios



Source: OBR

Table 3.2: Changes in borrowing and debt in the scenarios

| | Per cent of GDP | | | |
|---|---|---|---|---|
| | Change in borrowing | | Change in debt | |
| | Better health | Worse health | Better health | Worse health |
| **Total change** | **-3.7** | **4.1** | **-44.3** | **48.9** |
| *of which:* | | | | |
| Health spending | -1.0 | 1.2 | -12.5 | 14.8 |
| Pension spending | 0.6 | -0.6 | 7.8 | -8.1 |
| Other taxes | -0.5 | 0.6 | -7.7 | 8.0 |
| Welfare spending | -0.5 | 0.5 | -6.4 | 6.7 |
| Income tax and NICs | -0.4 | 0.4 | -4.8 | 5.1 |
| Debt interest | -1.6 | 1.8 | -16.6 | 18.3 |
| Nominal GDP | -0.3 | 0.3 | -4.1 | 4.2 |

## Conclusions

3.57 Health spending remains a very significant long-term pressure on the public finances. The analysis in this chapter shows that if health consumption rises in line with incomes and an ageing population, and if governments continue to finance the large majority of health spending, it will be difficult to move to a more sustainable path for public debt. As shown in Chart 3.15, this could be substantially mitigated by healthcare sector productivity growth matching that in the wider economy, but this has been difficult to sustain historically. And as shown in our alternative health scenarios, improving the average health of the population can deliver significant fiscal benefits through greater labour market participation, reduced spending on health and welfare benefits, and higher tax revenues. Narrowing health inequalities could also bring important long-term fiscal benefits via similar mechanisms. However, recent trends in the UK have shown health stagnating, or even deteriorating. And there are potentially offsetting fiscal impacts (via higher pensioner-related spending) from healthier people living longer lives that could limit the extent of any fiscal benefits from improvements in health.

# 4 Long-term fiscal projections

## Introduction

4.1 This chapter provides an updated assessment of the overall sustainability of the public finances over the next 50 years. We do this by projecting forward the impact of demographic, economic, technological, environmental, health, and other trends on the public finances. To ensure consistency with our latest published medium-term *Economic and fiscal outlook* (*EFO*), we base the projections on government policy as it stood in March 2024, incorporating explicit long-term policy commitments where they exist, for example the pensions triple lock and increases to the state pension age, as well as implicit commitments in areas like education, health, and social care. The projections also recognise that some tax revenue sources are likely to be eroded over time, for example fuel and tobacco duties, as a result of both policy and behavioural changes.

4.2 This allows us to produce illustrative 50-year projections for public sector receipts, expenditure, borrowing and debt, which highlight the significance of demographic and other pressures on the long-term fiscal position. There is clearly significant uncertainty around the assumptions that underpin these projections. We address this by setting out a range of sensitivities and scenarios based on alternative economic assumptions. This provides a more comprehensive assessment of the likely scale of the fiscal challenge ahead.

4.3 To explore the long-term sustainability of the public finances, this chapter:

- details the **key demographic and economic assumptions** used in the construction of the long-term fiscal projections;
- presents our updated **long-term fiscal projections**, including the path of public sector receipts, expenditure, borrowing, and debt over the next 50 years;
- discusses what they imply for various **indicators of fiscal sustainability**;
- explores the **sensitivity of the projections to alternative assumptions**, including for migration and productivity, along with the health and climate scenarios presented in Chapters 2 and 3; and
- includes the decade-by-decade fiscal tightening that would be necessary to stabilise the debt-to-GDP ratio in the long term.

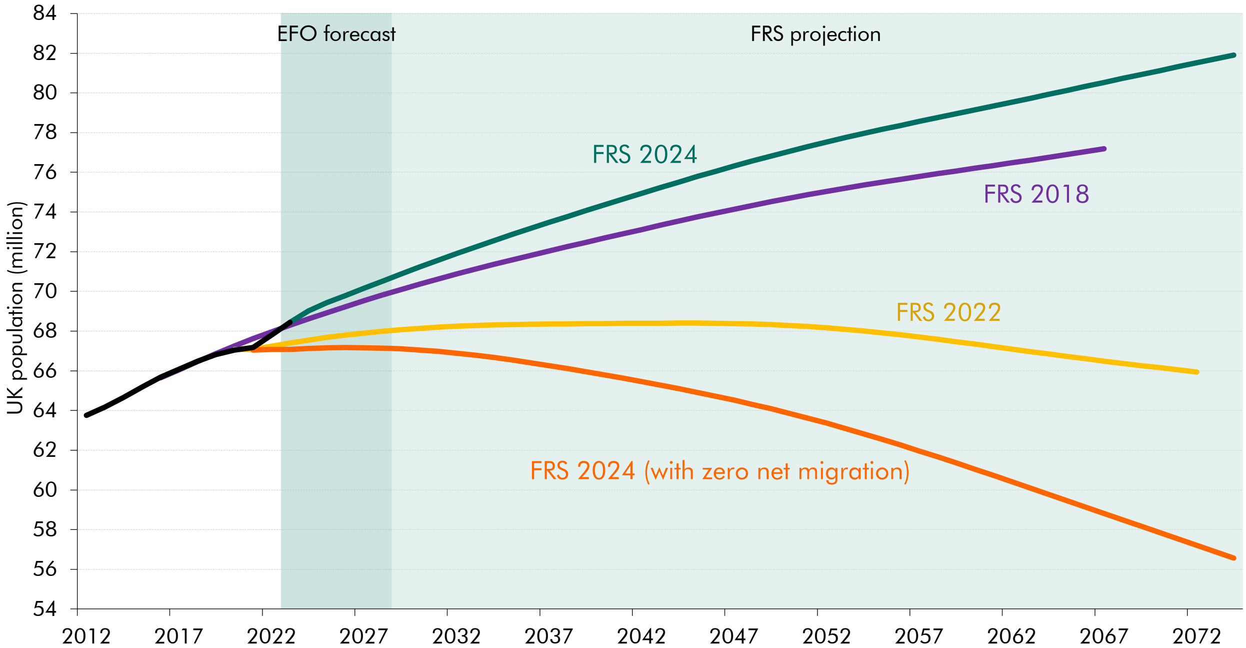
## Key long-term demographic and economic assumptions

4.4 The size and demographic structure of the population play an important role in determining the path for the economy and public finances in the long term. Individuals' use of public services will vary across their lifetime. So too will the amount of tax they pay (see Chart 4.6). The proportion of people of younger and older ages relative to those of working age is therefore an important driver of the demand for public services and spending relative to the amount of tax being generated in the economy.

### Size of the population

4.5 For our demographic projections, we use the latest ONS population projections released in January 2024, with an adjusted path of net migration in the *EFO* forecast period. These are based on migration data to mid-2023, with birth rates and life expectancy assumptions unchanged from the projections released in January 2022 and used in our 2022 *Fiscal risks and sustainability* report (*FRS*). In this projection, the population rises from 68 million in 2022 to 82 million in 2074 (Chart 4.1, green line). This is 16 million (24 per cent) higher than at the end of the *FRS* 2022 projection in 2072, which had the population slightly falling to 66 million. This change is entirely due to much higher assumed levels of net migration in the latest ONS projections than in previous projections.

### Chart 4.1: UK population outturns and successive projections

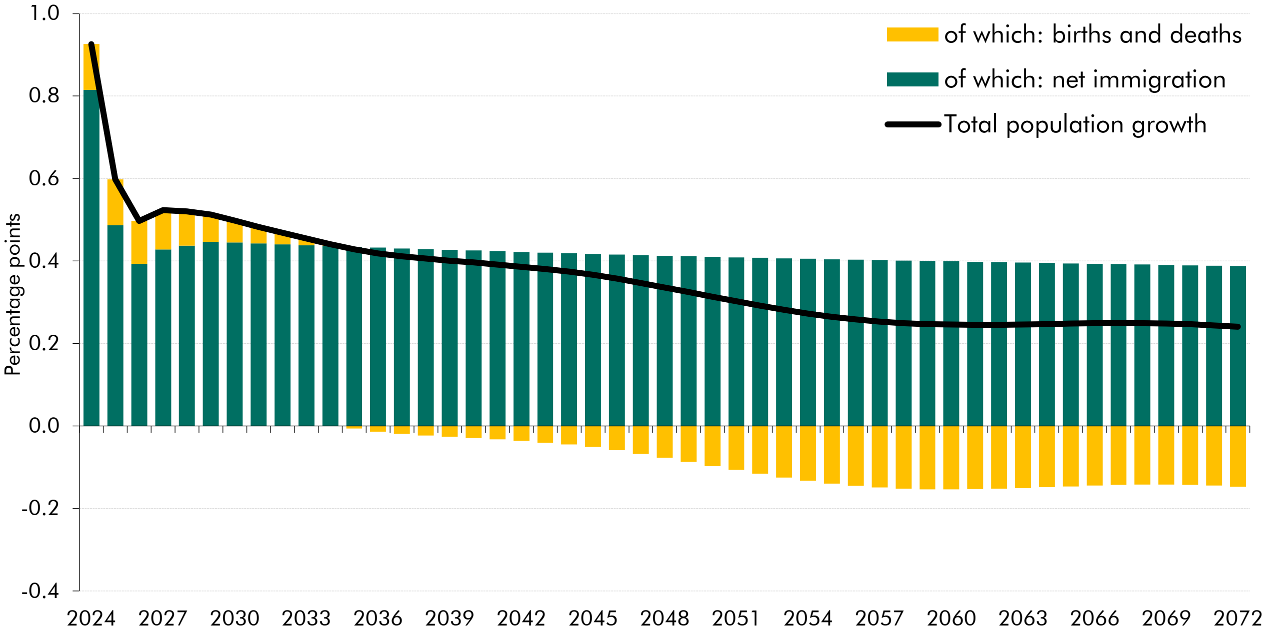



Source: ONS, OBR

4.6 Population growth falls from an average of 0.7 per cent a year in the 2010s and 0.6 per cent a year in the 2020s to around ¼ per cent a year from 2060 onwards, driven by a falling birth rate and an ageing population (Chart 4.2). From 2035, the ageing of the population means deaths exceed births such that the assumed level of net migration accounts for all population growth after this point. With zero net migration, the population would gradually fall to 57 million in 2074, 25 million fewer than in our new baseline projection (Chart 4.1, orange line).

4.7 The assumed level of **net migration** over the next 50 years is therefore critical in determining the size and demographic composition of the population in these projections. In line with the ONS, we assume steady-state net migration remains at 315,000 a year.[1] The ONS arrived at this number based on the 10-year average flow of net migration to mid-2023 (with the choice of the 10-year horizon reflecting consultation with an expert panel). While this level of net migration is consistent with recent elevated flows following the introduction of the post-Brexit migration regime, it is also much higher than other historical periods. Net migration flows averaged around 70,000 in the 1990s, 220,000 in the 2000s, and 100,000 over the last 50 years. It is also significantly higher than net migration of 129,000 a year assumed in our 2022 *FRS*. The outlook for net migration is clearly extremely uncertain, particularly given the relatively new post-Brexit migration regime and further changes in migration policy over the past year.

## Chart 4.2: Contributions to population growth




Source: ONS, OBR

4.8 Other demographic assumptions are shown in Table 4.1. Both birth rates and life expectancy are unchanged from *FRS* 2022. The **birth rate** of 1.59 births per woman is below the rate of 2.1 required for the population to remain stable in the long term in the absence of migration or changes in mortality.[2] Like most advanced economies, the birth rate in the UK has declined over recent decades from close to 3 in the 1960s to around 2 in the early 2010s, to reach 1.5 in 2022. **Life expectancy** is 82.2 years for men and 85.3 years for women and has reduced from earlier projections primarily as a result of slower

[1] We have adjusted the ONS projection over the *EFO* forecast period. See Box 2.3 in our March 2024 *EFO*.
[2] These are long-term birth rates, 25 years into the projections. The birth rate is modestly lower in the initial years of the projections.

increases in life expectancy in recent years, which have lowered assumptions about the long term. There is also some impact from the pandemic.

## Table 4.1: Demographic assumptions

| | Birth rate per woman[1] | Life expectancy at birth in 2045 | | | | Long-term average annual net inward migration (thousand) | Size of population in 2072 (million) | |
|---|---|---|---|---|---|---|---|---|
| | | Period | | Cohort | | | | |
| | | Males | Females | Males | Females | | 16-64 | Total |
| *FRS* 2024 | 1.59 | 82.2 | 85.3 | 90.1 | 92.6 | 315 | 47.4 | 81.5 |
| *FRS* 2022 | 1.59 | 82.2 | 85.3 | 90.1 | 92.6 | 129 | 37.2 | 65.9 |
| *FSR* 2020 | 1.79 | 82.8 | 85.7 | 90.6 | 92.8 | 129 | 40.3 | 71.6 |
| *FSR* 2018 | 1.84 | 83.9 | 86.7 | 93.3 | 95.6 | 165 | 44.1 | 78.0 |

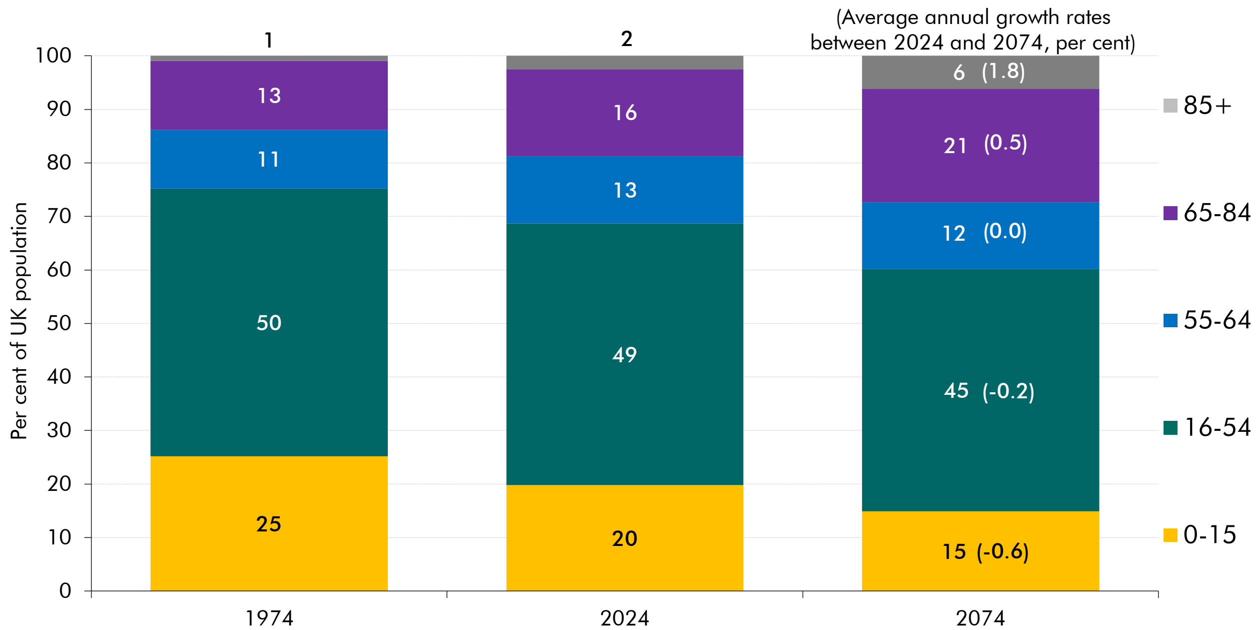
[1] Per woman aged 15 to 46.

Source: ONS, OBR

## Age structure of the population

4.9 A declining birth rate coupled with a modest further rise in life expectancy among future cohorts means that the population ages significantly over the 50-year projection (Chart 4.3). The share of over 65s rises from 19 per cent in 2024 to 27 per cent in 2074, while the 16-to-64-year-old share falls from 61 to 58 per cent. The share of children under 16 falls from 20 to 15 per cent of the population. Higher net migration attenuates what would have been an even larger ageing of the population as migrants are assumed to be predominantly of working age when they arrive.

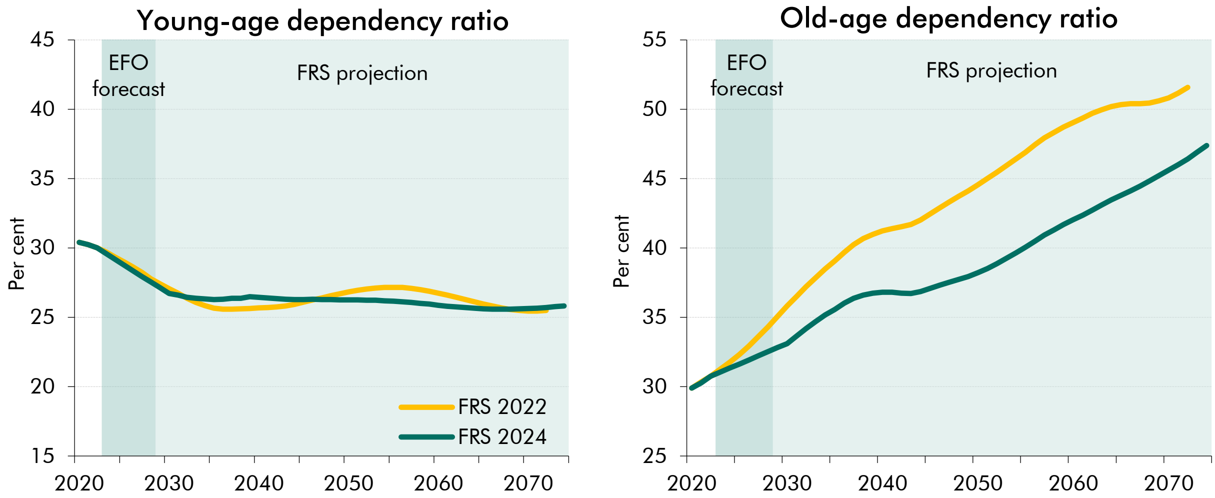
## Chart 4.3: Population age structure in 1974, 2024 and 2074




Note: 2024 and 2074 from the *FRS* 2024 population projection. Average annual growth rate is for the share of the population.
Source: ONS, OBR

4.10 The declining birth rate reduces the young-age dependency ratio (the proportion of individuals between the ages of zero and fifteen relative to the size of the 16-to-64-year-old population) from around 30 per cent in 2023 to 26 per cent by 2074. This reduces spending on education, child healthcare, and benefits as a share of GDP. The old-age dependency ratio, the proportion of those 65-and-over relative to those 16-to-64 is expected to rise throughout the forecast period, from 31 per cent in 2023, to about 47 per cent in the long term. Higher net migration means the old-age dependency ratio is lower in every year than in *FRS* 2022 which, all else equal, reduces spending on health, social care, and pensions as a share of GDP.

## Chart 4.4: Young- and old-age dependency ratios

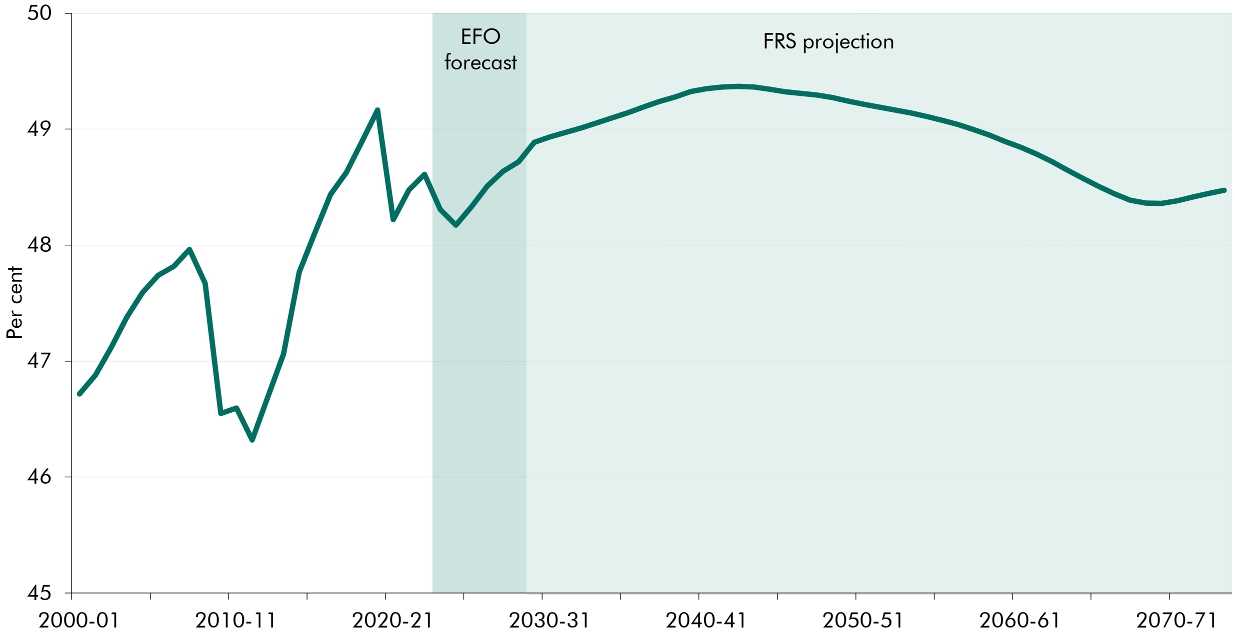



Source: ONS, OBR

## Employment

4.11 In our projections, the economic impact of demographic change comes primarily via its consequences for the proportion of the population in employment. Until the early 2040s, the share of the total population in employment rises due to an increase in the working age population, driven by net migration. The increases in the State Pension age (SPA) to 67 between 2026 and 2028 and to 68 between 2037 and 2039 also contribute to the rise in the share of the population in employment by extending working lives. Over the 30 years beyond the early-2040s, the employment-to-total population ratio declines by around a percentage point as the population ages, so a greater share is in retirement. Another rise in the SPA to 69 between 2072 and 2074 leads to a slight uptick in the employment ratio at the end of the projection.

## Chart 4.5: Share of total population in employment




Source: ONS, OBR

## Other economic assumptions

4.12 Alongside the demographic assumptions outlined above, the key economic assumptions in our long-term fiscal projections include productivity, inflation, and interest rates. These assumptions are in line with our *Long-term economic determinants* published in May 2024 and more detail is set out in the Supplementary tables. In summary, we assume:

- **Trend growth in productivity**, or output per hour, rises from 1.2 per cent in the final year of our medium-term forecast to 1.5 per cent by the mid-2030s. This reflects a combination of some per-worker capital deepening and rising total factor productivity.

- **Real GDP growth** averages around 1¾ per cent a year. This is almost ½ a percentage point a year higher than our *FRS* 2022 projection due to stronger population growth.

- **CPI inflation** remains at the 2 per cent target. The ONS has announced that from 2030 the methodology for RPI will be aligned precisely with the CPIH measure of inflation.[3] As an interim assumption, RPI and RPIX inflation both match CPI inflation from 2030-31.

- **Bank Rate** and **gilt rates** average around 4.1 and 4.3 per cent, respectively. The **growth-corrected interest rate** (the difference between the average yield on the stock of debt and the nominal growth rate of the economy or 'r-g') converges on 0.2. The growth-corrected interest rate is higher than *FRS* 2022 over the first couple of decades, but converges to the same point thereafter.

[3] HM Treasury and UK Statistics Authority, *A response to the consultation to the reform on retail prices*, November 2020.

# Long-term fiscal projections

4.13 Based on the demographic and economic assumptions described in the previous section, this section presents an updated set of long-term fiscal projections over the next 50 years. The starting point for these projections is the detailed five-year forecasts for government revenue, spending, borrowing, and debt, as well as government policy set out in our March 2024 *EFO* forecast.[4] Where they exist, we also incorporate explicit long-term policy commitments as they stood at the time of our March 2024 forecast. From the final year of that forecast in 2028-29, our long-term fiscal model uses a representative profile of tax and spending by age to estimate the fiscal consequences of demographic and other structural changes over the subsequent 45 years. Despite the elevated degree of uncertainty on any estimate reaching out 50 years into the future, these projections are useful in plotting a possible path for the UK economy and public finances under current policy.[5] The alternative scenarios presented later in this chapter illustrate the sensitivity of these projections to different underlying assumptions.

## Receipts and spending by age

4.14 Many major government spending and revenue items are sensitive to changes in the age structure of the population over the next 50 years. Chart 4.6 shows the representative tax and primary spending profiles by age that form the basis of our long-term projections.[6] The key features are:

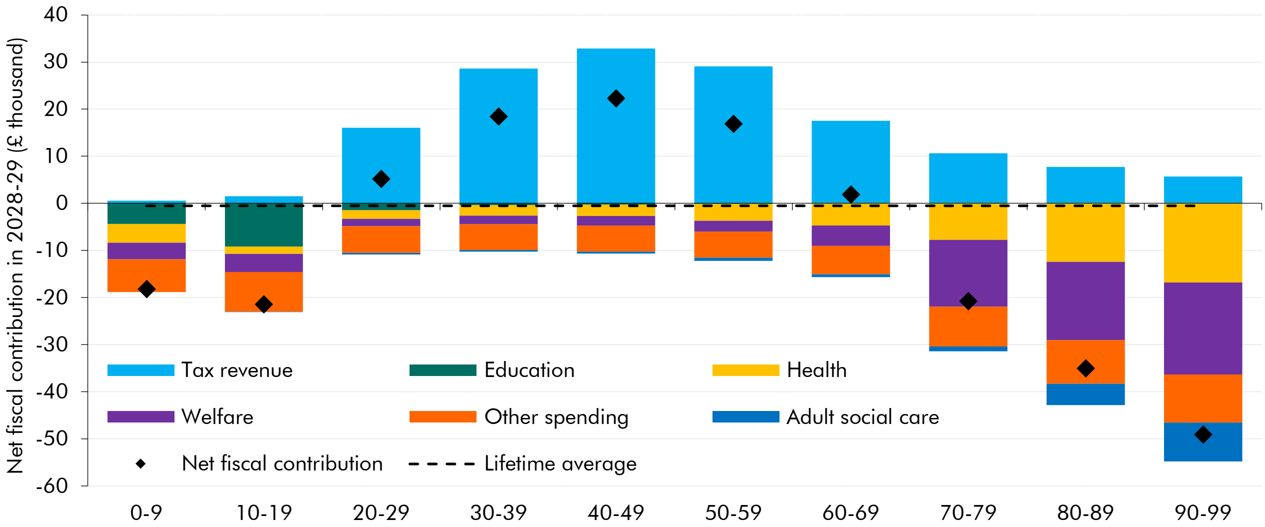
- the relatively high levels of **spending on children and young people** for health, education, and welfare;
- the relatively low levels of **spending on working-age people**, the bulk of which is their pro-rata share of general 'public goods' such as defence and transport;
- the relatively high levels of **spending on older people** on pensions, health, and social care; and
- **tax revenues** becoming significant as a person enters working life in around their 20s, rising steadily until their mid-40s, and then falling steadily thereafter.

4.15 Taking primary spending and receipts together, the net fiscal contribution of this representative person starts off negative from birth, turns positive around age 23, peaks around their mid-40s, and then turns negative again at around age 70 and by rising amounts thereafter. It is at around age 80 where the representative person no longer makes

[4] These projections therefore do not take into account the departmental expenditure limits (DEL) spending pressures identified in HM Treasury's document *Fixing the foundations: Public spending audit 2024-25* published on 29 July 2024. In response, the OBR has initiated a review into the preparation of the March 2024 DEL forecast, which will conclude ahead of our next *EFO* forecast on 30 October 2024.
[5] The precise policy assumptions underpinning our projection are laid out in the Supplementary tables.
[6] These tax and spending profiles were initially calculated in the 2010s. We have scaled them up to account for changes in tax and spending policy since that time, and capture changes in the price-level. Our ambition is to update these profiles completely in due course. We use separate representative spending and revenue profiles for males and females over their lifetimes which are aggregated together for illustrative purposes in this chart.

a cumulative positive contribution. This means that an average person with a life expectancy of 82 years in 2028 can be expected to be broadly fiscally neutral over their lifetime.

## Chart 4.6: Primary receipts and spending by age

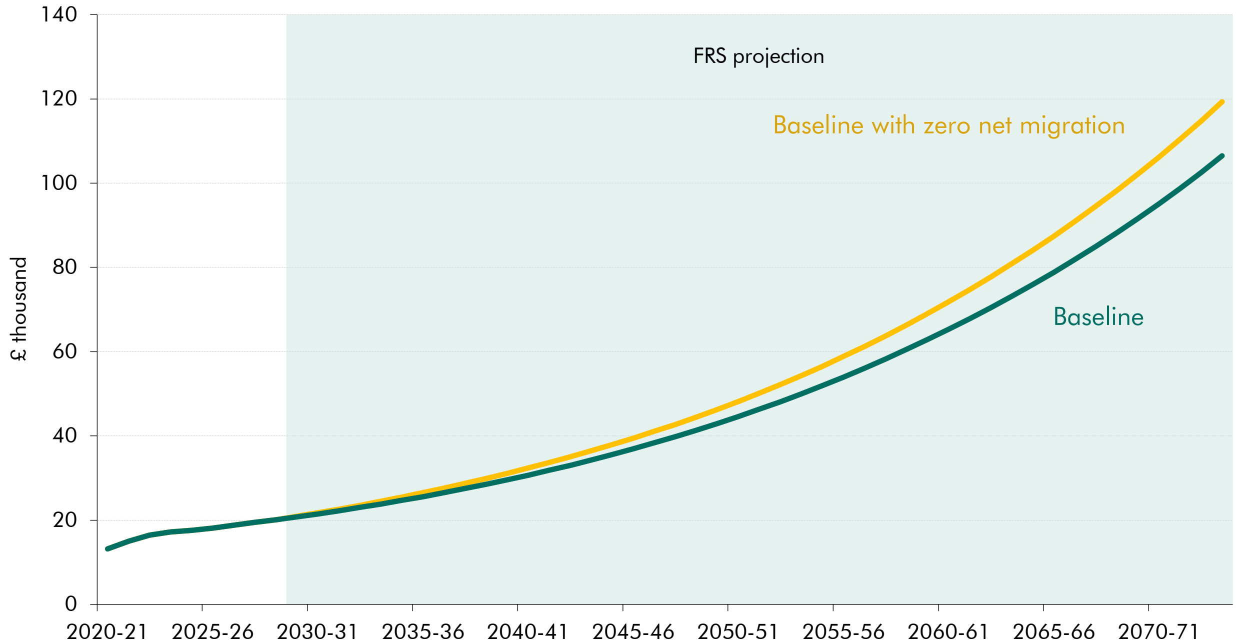



Note: These profiles are constructed on the basis that aggregate primary spending and receipts are broadly in balance, as is the case on average over the medium term in our March 2024 *EFO*. Therefore they do not capture the fiscal impact of major economic shocks on public spending and receipts. The impact of such shocks on long-run fiscal sustainability is explored in the debt shock scenarios presented later in this chapter.

Source: OBR

4.16 These profiles capture tax revenues and expenditure (including capital expenditure) per person, but they do not account for the impact on the public finances of changes in the capital stock per person due to changes in population. The level of the public capital stock per person is an input into the quality of public services that an individual is likely to receive. In our projections, we assume that the public sector capital stock remains relatively flat as a share of GDP, as government investment grows in line with nominal GDP on average. In real terms, this means that the public sector capital stock per person rises in every year of our projection. However, the capital stock is also diluted by the increase in population in this projection due to higher migration (it would also be diluted if there were a higher birth rate). Therefore, the level of capital stock per person in this projection is substantially lower, relative to a projection with no migration (Chart 4.7). This implies there may be a further fiscal cost to government from population growth, from either net migration or births exceeding deaths, than we have modelled here. The size of the additional fiscal costs depends on whether all the capital stock needs to be scaled up for a larger population. For example, the defence capital stock may not need to expand proportionally with population, and the education capital stock may not need to expand if population growth is due to migrants arriving as adults.

## Chart 4.7: Real public sector capital stock per person




Source: ONS, OBR

## Tax and spending projections to 2073-74

4.17 Our long-term fiscal projections apply the latest population projections to these receipts and spending by age profiles, together with bespoke modelling for certain taxes and a set of assumptions about the future evolution of per-person spending levels:

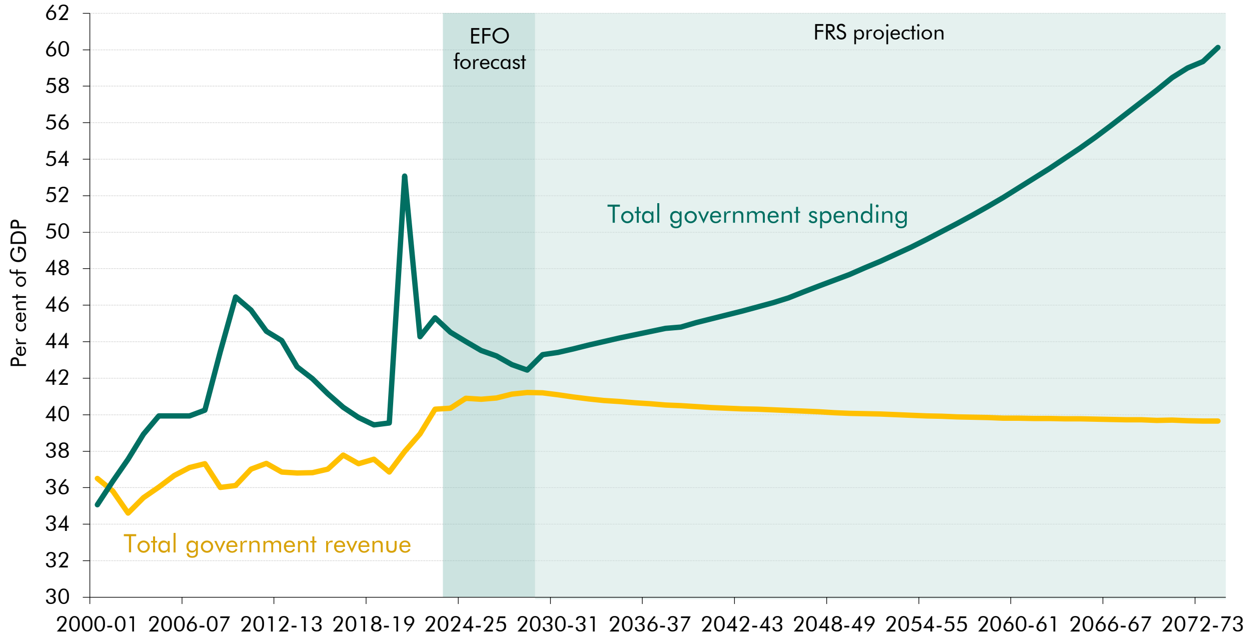
- For government **revenues**, age-adjusted, per-person receipts form the basis of our projection for individual tax heads, and we use bespoke modelling in cases such as fuel and tobacco duty where current government policy is likely to affect future tax receipts.
- For **non-health spending**, age-adjusted, per-person allocations are raised in line with earnings.
- For **health spending**, age-adjusted, per-person allocations are increased each year to reflect our assumption that non-demographic pressures (like the rising prevalence of chronic diseases or the cost-raising nature of technological advances in the healthcare sector) will be accommodated, as explained in Chapter 3.

4.18 Given the demographic changes described above, with the median age of the population rising from 40 to 46, a growing gap between government revenues and spending opens up over the next 50 years. As summarised in Chart 4.8 and discussed in more detail in the next sections:

- Government **revenues** rise slightly as a share of GDP until 2028-29, as forecast in the March 2024 Budget, primarily as a result of frozen thresholds in the personal tax system. However, from 2028-29 onwards, they are projected to gradually decline as a share of GDP, mainly due to the erosion of revenues from fuel and tobacco duties.

- Government **spending** falls as a share of GDP until 2028-29 based on the Government's plans set out in the March 2024 Budget. However, from 2028-29 onward, spending is projected to steadily increase as a share of GDP, driven by demographics and other pressures.

## Chart 4.8: Total government revenue and spending




Source: ONS, OBR

### Government receipts

4.19 Total government revenue is projected to decline from 41.2 per cent of GDP in 2028-29 to 39.6 per cent of GDP by 2073-74. As shown in Table 4.2, this is driven primarily by a reduction in emissions taxes (principally fuel duty) in addition to the loss in tobacco duty from further falls in smoking incidence:

- **Income tax** is projected to be relatively flat at around 11 per cent of GDP over the projection period. The downward pressure from an ageing population (resulting in fewer working-age adults) is offset by a larger share of workers being older and having higher earnings as a result.

- **National insurance contributions (NICS)** are assumed to fall very slightly over the projection period from 6.0 per cent of GDP to 5.8 per cent of GDP, driven by the increasingly large proportion of the population above the state pension age.

- **Corporation tax, VAT and capital taxes** are projected to remain broadly flat as a share of GDP (at around 3½, 7½, and 2 per cent respectively) across our projection, because we assume the relevant tax bases – for example consumption and profits – broadly grow in line with nominal GDP.

- **Net-zero-affected taxes** fall from 1.2 per cent of GDP in 2028-29 to 0.3 per cent in 2073-74 (Chart 4.9). These include vehicle excise duty and emissions taxes, but most of the fall is driven by fuel duty revenues which decline from 0.9 per cent of GDP in 2028-29 to zero from 2057-58. This is because we assume the ban on sales of petrol-driven cars comes into effect in 2035 and electric vehicles account for close to 100 per cent of cars on the road by 2045. By contrast, vehicle excise duty is assumed to be flat as a share of GDP from 2028-29, reflecting the Autumn Statement 2022 decision to equalise VED treatment of internal combustion engine and electric vehicles from 2025.

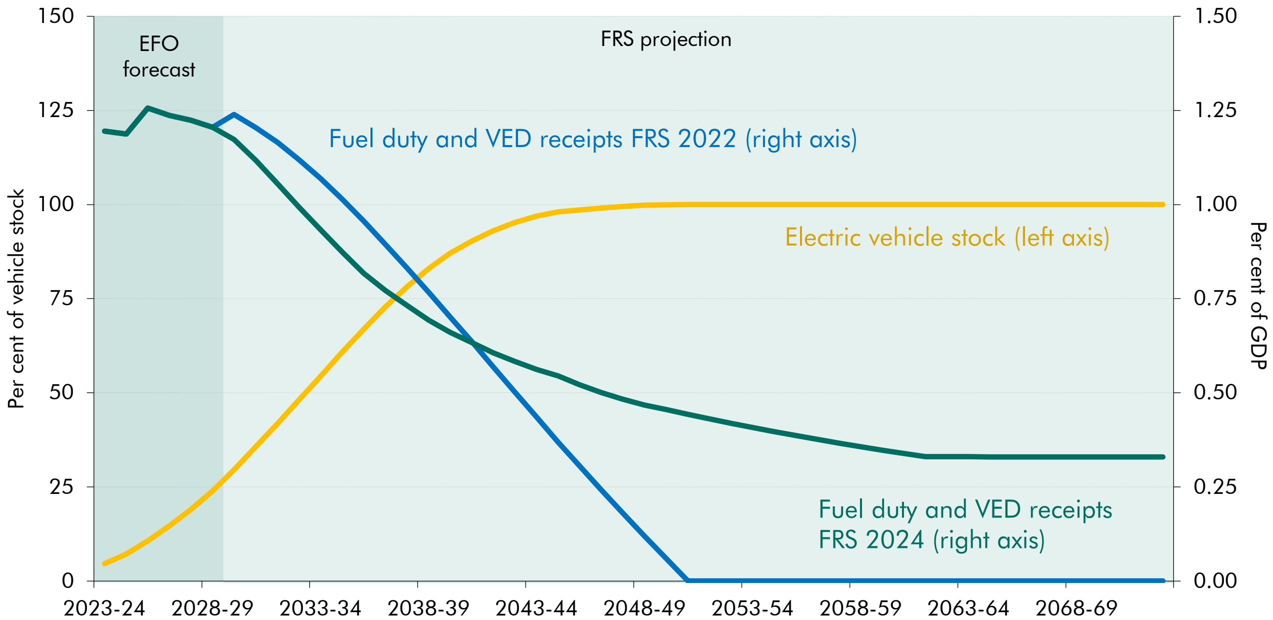
- **Other receipts** fall from 8.5 per cent of GDP in 2028-29 to 8.2 per cent in 2073-74. This is mostly due to tobacco duty receipts falling from 0.3 per cent of GDP in 2028-29 to close to zero per cent of GDP from 2059-60. This reflects the Government's progressive smoking ban which will reduce the number of legal smokers over time and therefore receipts from tobacco duty. These projections also include the introduction of a vaping tax in accordance with stated policy in March 2024. The revenues brought in by this tax are too small to cover lost tobacco revenues.

## Table 4.2: Receipts projections

| | Per cent of GDP | | | | | | |
|---|---|---|---|---|---|---|---|
| | Forecast[1] | | FRS projection | | | | |
| | 2023-24 | 2028-29 | 2033-34 | 2043-44 | 2053-54 | 2063-64 | 2073-74 |
| Income tax | 10.2 | 11.3 | 11.3 | 11.3 | 11.3 | 11.3 | 11.2 |
| NICs | 6.6 | 6.0 | 6.0 | 6.0 | 6.0 | 5.9 | 5.8 |
| Corporation tax | 3.6 | 3.6 | 3.6 | 3.6 | 3.5 | 3.5 | 3.5 |
| VAT | 7.3 | 7.4 | 7.4 | 7.4 | 7.4 | 7.5 | 7.4 |
| Capital taxes | 1.4 | 1.9 | 1.8 | 1.8 | 1.9 | 1.9 | 2.0 |
| Net-zero-affected taxes | 1.4 | 1.2 | 0.9 | 0.6 | 0.4 | 0.3 | 0.3 |
| Interest and dividends | 1.5 | 1.3 | 1.3 | 1.3 | 1.2 | 1.1 | 1.2 |
| Other receipts | 8.4 | 8.5 | 8.4 | 8.3 | 8.3 | 8.2 | 8.2 |
| **Total receipts** | **40.4** | **41.2** | **40.8** | **40.3** | **40.0** | **39.8** | **39.6** |

[1] Receipts consistent with the March 2024 *Economic and fiscal outlook* .

## Chart 4.9: Electric vehicle stock and fuel duty projections




Source: OBR

## Public spending

4.20 Total public spending is projected to rise steadily as a share of the economy from 42.5 per cent of GDP in 2028-29 to 60.1 per cent of GDP by 2073-74. As shown in Table 4.3, this 17.7 per cent of GDP rise in spending over the 45-year projection period is driven by a combination of demographic and non-demographic pressures in the following areas:

- **Debt interest spending** has increased sharply in recent years due to the spike in inflation and increases in interest rates. With the stock of debt rising and long-term gilt rate above the assumed long-run rate of nominal GDP growth, debt interest spending more than triples over the long term from 4.1 to 12.5 per cent of GDP.

- **Health** spending is projected to rise steadily by 6.9 per cent of GDP from 7.6 per cent to 14.5 per cent of GDP over the projection. This is driven by the demographic and other cost pressures explored in depth in Chapter 3.

- **Adult social care** spending is also projected to rise by 0.9 per cent from 1.5 per cent of GDP to 2.4 per cent of GDP by 2073-74, driven by a combination of demographic pressures and real-terms unit-cost growth, similar to those that drive health spending.

- **Education** spending is projected to fall slightly by 0.5 per cent of GDP to 3.6 per cent of GDP by 2073-74. This is driven by a falling young-age dependency ratio due to the below-replacement birth rate and a migrant population that is skewed toward those of working age.

- **State pension** spending is projected to rise by 2.7 per cent of GDP, from 5.2 per cent to 7.9 per cent of GDP over the projection. This is driven by both the ageing of the population and the cost of the triple-lock policy. The uprating policy is estimated to account for 1.2 percentage points (or just under half) of this rise by the end of the projection period, compared to uprating the state pension with average earnings growth.

- **Public service pensions** net expenditure is assumed to fall by around 0.6 per cent of GDP over the long term due to a combination of contributions into the schemes, which are linked to average earnings, growing more quickly than pension payments, which are assumed to be uprated with CPI, and nominal GDP growing more quickly than net benefit expenditure.

- **Spending on other public services,** which are not materially affected by demographics, are assumed to be flat as a share of GDP at their medium-term level at around 8 per cent of GDP for current spending and 3.7 per cent of GDP for other departmental capital spending. There are risks to these assumptions, such as the Government's stated ambition to increase defence spending from 2.0 to 2.5 per cent of GDP.

## Table 4.3: Spending projections

| | Per cent of GDP | | | | | | |
|---|---|---|---|---|---|---|---|
| | Forecast[1] | | FRS projection | | | | |
| | 2023-24 | 2028-29 | 2033-34 | 2043-44 | 2053-54 | 2063-64 | 2073-74 |
| Health | 7.9 | 7.6 | 8.9 | 10.0 | 11.3 | 12.8 | 14.5 |
| Adult social care | 1.3 | 1.5 | 1.6 | 1.8 | 2.1 | 2.2 | 2.4 |
| Education | 4.4 | 4.2 | 4.0 | 3.8 | 3.8 | 3.7 | 3.6 |
| State pensions[2] | 4.9 | 5.2 | 5.6 | 5.9 | 6.4 | 7.4 | 7.9 |
| Pensioner benefits | 0.7 | 0.7 | 0.8 | 0.8 | 0.9 | 1.0 | 1.0 |
| Other welfare benefits | 5.2 | 5.3 | 5.1 | 5.0 | 5.1 | 5.1 | 5.1 |
| Public service pensions | 1.9 | 1.9 | 1.8 | 1.5 | 1.4 | 1.4 | 1.4 |
| **Total age-related spending** | **26.3** | **26.4** | **27.7** | **29.0** | **31.0** | **33.6** | **36.0** |
| Other current | 8.5 | 8.3 | 8.2 | 8.1 | 8.1 | 8.0 | 8.0 |
| Other capital | 5.2 | 3.7 | 3.7 | 3.7 | 3.7 | 3.7 | 3.7 |
| Debt interest | 4.5 | 4.1 | 4.4 | 5.1 | 6.5 | 8.7 | 12.5 |
| **Total spending** | **44.5** | **42.5** | **44.0** | **45.9** | **49.2** | **54.0** | **60.1** |

[1] Spending consistent with the March 2024 *Economic and fiscal outlook* .
[2] Includes many items in addition to the basic state pension and single-tier pension, such as pension credit, winter fuel payments and the Christmas bonus.

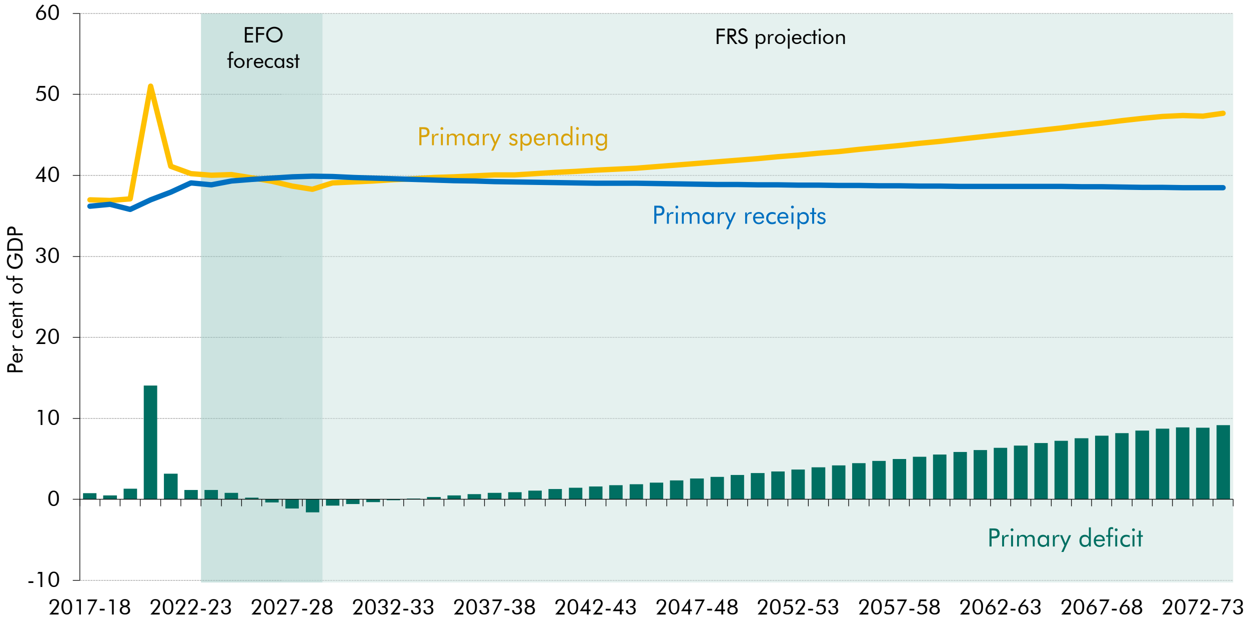
## Primary deficit

4.21 The primary deficit is borrowing excluding net debt interest costs and is a key driver of fiscal sustainability. In our March 2024 *EFO* we forecast a primary surplus of 1.6 per cent of GDP in 2028-29, which would be the largest surplus since 2000-01. This was driven by a forecast rise in the tax-to-GDP ratio to a near post-war high and the previous Government's plans to constrain real-terms growth in departmental spending to below that of the economy. This size of the primary surplus is sufficient to put debt on a falling path as a share of GDP in the first few years of our long-term projection, when the pressures of an ageing population have not yet fully manifested. However, over the long term, as these pressures build up, the primary deficit rises by 10.8 per cent of GDP, ending up in a deficit of 9.2 per cent of GDP by 2073-74 (shown in Chart 4.10). The largest contributor to this deterioration is health spending, which rises by 6.9 per cent of GDP, with the next largest contributor being state pension spending, which rises by 2.7 per cent of GDP.

## Borrowing

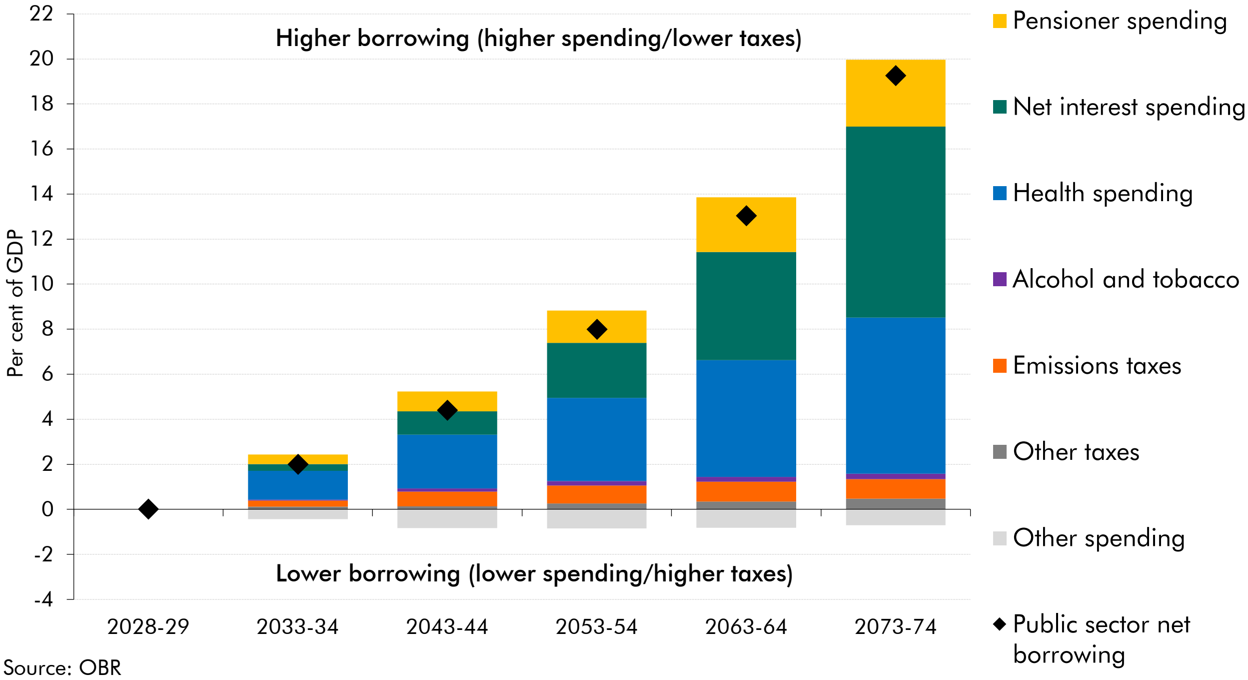
4.22 Public sector net borrowing (PSNB) is projected to rise from 1.2 per cent of GDP in 2028-29 to 20.5 per cent of GDP by 2073-74, driven by our projections of a slight fall in receipts and significant rise in spending. As shown in Chart 4.11 below, and explained above, the primary drivers of this are the sharp rises in health and pension spending. The increase in PSNB accelerates over the projection period as demographic pressures increase and the primary balance deteriorates. The resulting growth in the debt stock then drives an increase in net interest spending, creating a 'snowball' effect. This is largely concentrated in the final two decades of our projection, as the deterioration in the primary balance accelerates, driving up borrowing, debt, and net interest spending. As shown in Chart 4.11, by the end of the projection period, net interest payments are driving around 40 per cent of the increase in PSNB. In practice, if these projections began to materialise it is almost certain that governments would need to take corrective action to prevent the public finances falling into what would likely be an unsustainable debt spiral. We consider the fiscal policy adjustment required to do this from paragraph 4.54.

## Chart 4.10: Primary receipts and spending




Note: Positive bars are a primary deficit, negative bars are a primary surplus.
Source: OBR

## Chart 4.11: Decomposition of change in PSNB from 2028-29 to 2073-74

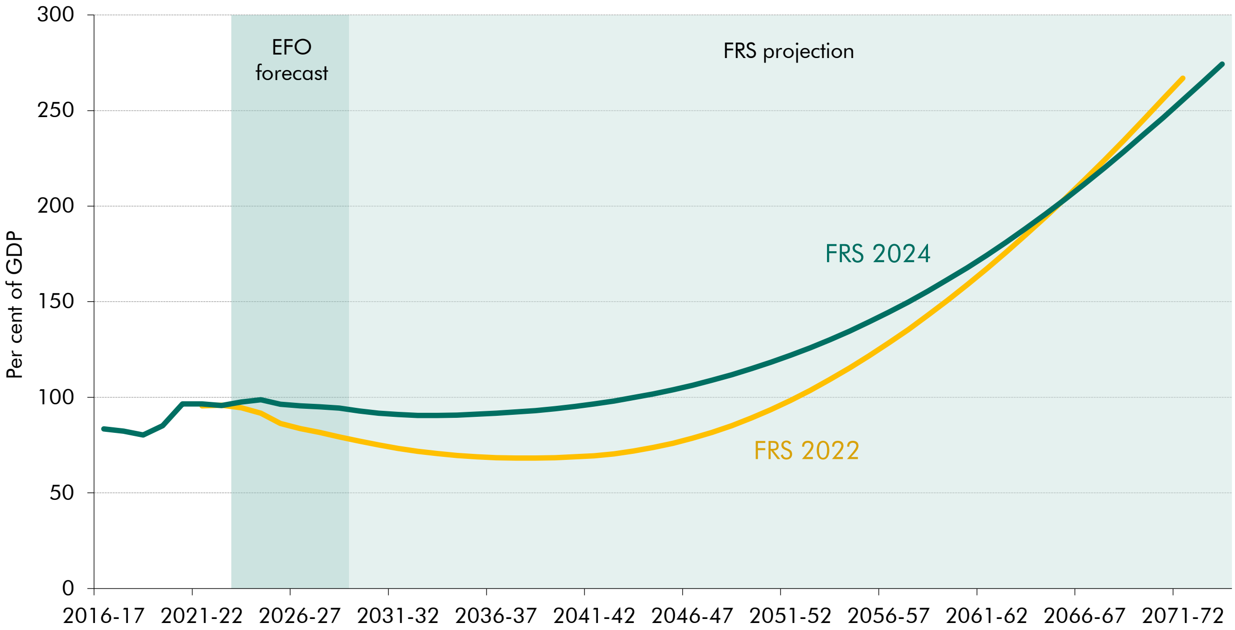



Source: OBR

## Debt

4.23 Rising borrowing in each year of our projection adds to debt and, as a result, public sector net debt (PSND) is projected to almost triple as a share of GDP from 94 per cent in 2028-29 to 274 per cent of GDP by 2073-74.[7] As Chart 4.12 shows, over the first decade of the long-term period, debt is projected to be broadly stable as a share of GDP. This is because, as set out above, the primary balance is initially in surplus and close to the level of the debt-stabilising primary balance (the primary surplus required to offset net interest costs and keep overall debt growing no faster than GDP).[8] From around the early 2040s onwards, the impact of demographics on the primary balance and the increase of net interest payments start to outweigh the rise in nominal GDP growth, and so debt as a share of GDP starts to rise exponentially.

### Chart 4.12: Projections of public sector net debt



Source: OBR

[7] Financial transactions also add to the debt stock over the long term though they are assumed to be relatively small in the long term as they consist only of student loans write-offs and accruals adjustments.
[8] In 2028-29, the primary surplus as a share of GDP is 0.3 percentage points higher than needed for stabilising debt, as noted in the March 2024 *EFO*.

## Table 4.4: Baseline projections of fiscal aggregates

| | Per cent of GDP | | | | | | |
|---|---|---|---|---|---|---|---|
| | Forecast[1] | | FRS projection | | | | |
| | 2023-24 | 2028-29 | 2033-34 | 2043-44 | 2053-54 | 2063-64 | 2073-74 |
| Public sector current receipts | 40.4 | 41.2 | 40.8 | 40.3 | 40.0 | 39.8 | 39.6 |
| Total managed expenditure | 44.5 | 42.5 | 44.0 | 45.9 | 49.2 | 54.0 | 60.1 |
| Public sector net borrowing | 4.2 | 1.2 | 3.2 | 5.6 | 9.2 | 14.3 | 20.5 |
| Public sector net debt | 98 | 94 | 90 | 100 | 130 | 188 | 274 |
| *Memo: Primary spending* | *40.0* | *38.3* | *39.6* | *40.8* | *42.7* | *45.3* | *47.7* |
| *Memo: Primary receipts* | *38.8* | *39.9* | *39.5* | *39.0* | *38.8* | *38.6* | *38.5* |
| *Memo: Primary deficit* | *1.2* | *-1.6* | *0.1* | *1.7* | *3.9* | *6.6* | *9.2* |
| *Memo: Net interest* | *3.0* | *2.8* | *3.1* | *3.9* | *5.3* | *7.6* | *11.3* |

[1] Estimates are consistent with the March 2024 *Economic and fiscal outlook* .

4.24 Table 4.5 decomposes changes in the long-term debt path compared to our last major projection in *FRS* 2022. Receipts are forecast to be higher in the medium term than in *FRS 2022*, which, combined with a larger population, drives a stronger profile for receipts in the long term relative to *FRS* 2022. On the spending side, a lower old-age dependency ratio means that health and adult social care spending is lower than *FRS 2022* in aggregate. Overall, changes due to other public service spending areas broadly offset: education and welfare spending have a higher starting point in the medium term, while other areas of public service spending are implicitly lower in our medium-term forecast. Finally, higher debt interest spending in our medium-term forecast, coupled with a less favourable growth-corrected interest rate in the first couple of decades relative to *FRS* 2022, results in additional upward pressure on debt by the end of our projection. Overall, debt is projected to be slightly lower than our previous projection, largely as a result of more favourable demographics, and a higher primary surplus in the medium term which provides a more beneficial starting point for our long-term projection relative to *FRS* 2022.

## Table 4.5: The effect of revised key assumptions on debt since *FRS* 2022

| | Per cent of GDP |
|---|---|
| | 2073-74 |
| | Debt |
| *FRS* 2022[1] | 287 |
| Difference | -13 |
| Starting level of debt | 2 |
| Public sector current receipts | -5 |
| Age-related spending | -3 |
| *of which:* | |
| Health and adult social care | -15 |
| Education | 7 |
| Welfare and public service pensions | 6 |
| Other spending | -12 |
| Debt interest | 4 |
| *FRS* 2024 | 274 |

[1] We extrapolated debt in the final year of our FRS 2022 projection for an extra 2 years, allowing us to make this comparison.

## Dashboard of fiscal indicators

4.25 In recent *EFOs* we have published a dashboard of wider balance sheet and debt affordability metrics. We compare each metric against the median that prevailed from 1967-68 to 2006-07 (the four decades preceding the financial crisis before debt ratcheted higher). In this report we publish a similar table (Table 4.6) looking at the position over a 50-year horizon.

4.26 Across this horizon, public sector net debt (PSND), net financial liabilities (PSNFL), and net liabilities or net worth (PSNW) are all projected to rise to reach levels that would be among the highest ever observed.[9] Net debt and net financial liabilities both fall until the early 2030s but rise exponentially from there onwards as demographic and cost pressures build. Net worth follows a similar path, although with a less pronounced improvement in the first two decades of projections. The increases in net worth are also driven by a rise in accrued liabilities of public sector pensions because as the public sector workforce grows, contributions grow by a combination of workforce and average earnings growth, and accrued pension entitlements are indexed to CPI inflation. This drives the relatively larger increases in (inverted) net worth relative to net debt, particularly in the final two decades of our projection.

4.27 Also shown in the bottom panel of Table 4.6 are two debt affordability metrics. Net interest costs are projected to rise as a share of GDP in each decade at an ever-increasing rate. They would be higher than the pre-financial crisis median in every decade from the 2040s onwards. This is a result of two key factors. Firstly, the stock of debt as a share of GDP on which interest is paid, would not only in these projections be larger than the pre-2007 median, but would be larger in every decade (apart from the 2030's) than at the end of our medium-term forecast. Secondly, the growth-corrected interest rate is projected to be positive throughout our long-term projection. Net interest costs as a share of revenues are also projected to increase sharply as revenues fall and debt rises, meaning that by 2073-74 almost one third of tax revenues would be going to servicing debt.

### Table 4.6: Dashboard of balance sheet and debt affordability indicators

| | Pre-2007 median | 2028-29 | 2033-34 | 2043-44 | 2053-54 | 2063-64 | 2073-74 |
|---|---|---|---|---|---|---|---|
| | | Level (per cent of GDP, unless otherwise stated) | | | | | |
| **Balance sheet metrics** | | | | | | | |
| PSND | 36.3 | 94.3 | 90.4 | 99.9 | 130.1 | 188.4 | 274.3 |
| PSNFL | 31.6 | 78.7 | 75.7 | 84.8 | 120.1 | 180.9 | 269.0 |
| PSNW (inverted) | -12.4 | 63.9 | 63.3 | 70.2 | 103.7 | 163.1 | 250.0 |
| **Debt affordability metrics** | | | | | | | |
| Net interest costs | 2.8 | 2.8 | 3.1 | 3.9 | 5.3 | 7.6 | 11.3 |
| Net interest costs (per cent of revenue) | 7.9 | 7.1 | 7.9 | 9.9 | 13.6 | 19.7 | 29.4 |

Note: Pre-2007 median is from 1967-68 to 2006-07 in levels. PSNW has been inverted to facilitate comparisons with the other three metrics.

[9] Net worth is a measure of net assets rather than net liabilities, so has been inverted to aid comparability.

## Alternative long-term scenarios

4.28 Given the significant degree of uncertainty around these long-term projections, in this section we consider the implications of a set of alternative scenarios for key underlying assumptions. These include:

- considering alternative **migration scenarios** which illustrate how different characteristics of migrants affect the public finances in the long run;
- considering alternative **productivity scenarios** which shows the impact of higher or lower productivity on fiscal sustainability;
- incorporating **stylised economic and fiscal shocks** into the projections to show their cumulative negative effect on the public finances; and
- comparing the **health and climate scenarios** from the first two chapters in this report to our baseline projection.

## Migration scenarios

4.29 With the birth rate of 1.6 per woman well below the replacement rate of 2.1, migration is the sole source of population growth from 2035 onwards in the ONS population projections that we use. We have explored the implications of higher or lower *levels* of net migration in previous *FRS*s and *FSR*s, for example in *FRS* 2022 we looked at the fiscal implications of net migration of 205,000 a year compared to our baseline projection of 129,00 a year. In this report we consider alternative scenarios for the *composition* of migration – specifically looking at age, earnings, and length of stay – which also have important long-term economic and fiscal consequences. This complements and extends the analysis in Boxes 2.3 and 4.5 of our March 2024 *EFO*, which looked at these issues over our shorter five-year forecast horizon.

4.30 In our baseline projection, migrants are more likely to be of working age than the resident population, which affects the participation rate, but we otherwise assume they have the same economic characteristics as the resident population. So, for example, migrants have the same average earnings, pay the same in taxes, and consume the same amount of public services as the average resident. There has been a significant change since Brexit in both migration policy and the composition of migration, the long-term consequences of which remain uncertain. The rest of this section therefore looks at how varying these economic characteristics could change the long-run fiscal impact of net migration.

### Representative migrants

4.31 As shown by the black line in Chart 4.13, an average UK resident in our long-term projections is net fiscally negative at the early years of their life as they ‘consume’ education and health services but are not yet working and paying tax. They then enter the labour force and start contributing more to taxes than they consume in spending, so becoming a net fiscal contributor. As they grow older, people stop earning, draw on their state pension and 'consume' a large amount of health and social care, so their net fiscal contribution turns negative again beyond the age of around 80. (See Chart 4.6 above for more detail).

4.32 The green line in Chart 4.13 shows the cumulative fiscal impact of a representative migrant who comes to the UK at the age of 25, the average age of newly arrived migrants in the ONS projections. As described above, this representative migrant has the same age-adjusted economic and fiscal profile as a representative resident, with three exceptions:

- Most migrants make an additional revenue contribution through **visa fees and health care charges**, until they leave or get settlement in the UK. This is estimated at around £12,500 for the illustrative migrant on a skilled worker visa that reaches settlement.
- Most migrants are not eligible for **welfare benefits** for the first five years of their stay in the UK.
- There would be an additional fiscal impact if the Government wanted to keep capital stock per person constant and prevent dilution of **the public capital stock**, which would require an increase in public investment for each additional person (which in 2028-29 would equal £20,000), which is not captured in our tax and spending profiles. This £20,000 is likely to be an overestimate as parts of the capital stock, such as defence, are not likely to need to increase proportionally with population, and an increase in the education capital stock would likely not be needed for an adult migrant. In Chart 4.13 we include this additional spending for a representative migrant, but not for a representative UK resident as births and deaths are roughly equal in our baseline projection. Increases in the population due to a higher birth rate would have similar implications to net migration for public investment if the Government wanted to keep the public capital stock per person constant.

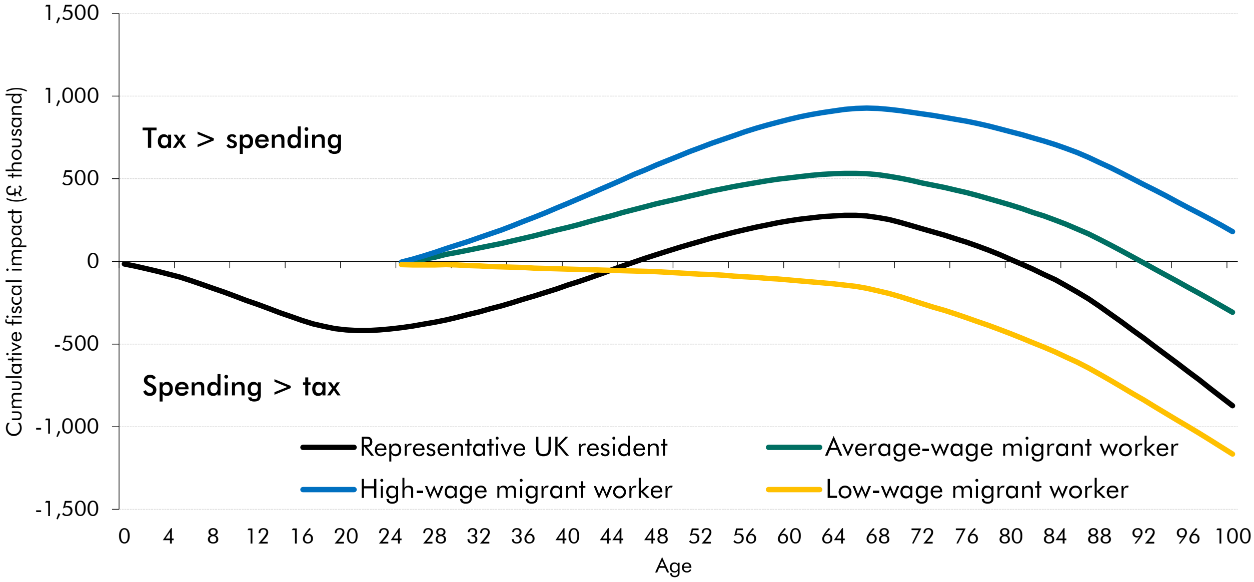
4.33 Chart 4.13 shows how three characteristics of migrants can affect their net fiscal contribution compared to the average UK resident:

- **Age**. In the ONS population projections, the net inflow of migrants has an average age of 25. An illustrative migrant worker arriving to the UK at this age and earning the average UK salary is a net fiscal contributor (green line) by their second year. By contrast, an average resident of the same age is still a net fiscal recipient and does not become a net fiscal contributor until their 40s. This is because, unlike the UK resident, the migrant has not previously consumed UK public services, particularly education and health in their childhood. For the average migrant this difference persists over the lifecycle as at all subsequent ages they will have consumed fewer public services than an equivalent person born and educated in the UK.
- **Earnings**. Due to the differences in taxes paid over the working life, a higher wage migrant worker is more fiscally beneficial than the average UK resident (black line) over their lifetime. For example, a high-wage migrant earning 30 per cent more than the UK average would still be a net benefit to the public finances even if they lived to

100. However, an illustrative low wage migrant worker arriving at 25 and earning half the UK average becomes less fiscally beneficial (yellow line) than the average UK resident in their early 40s.[10]

- **Length of stay**. Migrant journey data shows that the vast majority of migrant students eventually leave the UK, while migrant workers and their dependants are more likely to stay for life. Of those that leave, we estimate that their average stay is around three years. The chart shows that migrants that stay only for part or all of their working life are the most fiscally beneficial as they don't stay long enough to start consuming public services in old age.

## Chart 4.13: Cumulative fiscal impact of representative migrants




Note: Cumulative fiscal impact includes the cost of a skilled work visa, NHS surcharge, indefinite leave to remain and immigration skills charges for employers. Figures for migrants includes the fiscal spending required to keep public capital stock per person constant.
Source: OBR

4.34 An additional consideration is the fiscal impact of any dependants that accompany the main migrant. According to our analysis of Home Office visa data, there were 0.3 dependants per main applicant on average over 2021 and 2023. Policy restrictions announced in December 2023, that mostly came into force by April 2024, are expected to sharply reduce the number of dependants per main applicant. The fiscal impact of a child dependant is likely to be similar to that of the representative UK person, depending on their age at arrival to the UK. So a young child would initially be net fiscally negative and then gradually turn positive if they stay for an extended period in the UK. The fiscal impact of a full migrant household would therefore depend on all of the factors set out above such as the earnings of the adult migrants and the age of their children. Given the wide range of possible households we have opted to model a more typical migrant on a work visa and no dependants. We use this analysis of the fiscal implications of representative migrants to

[10] Our illustrative analysis only considers the direct tax and spending impact of each person. Under the current visa system, many migrants have arrived to work in the health and social care sector or other shortage occupations, which may have fiscal impacts not captured in this framework.

construct scenarios that illustrate the aggregate impact of varying these compositional factors for our long-term fiscal projections.

## Shorter length of stay scenario

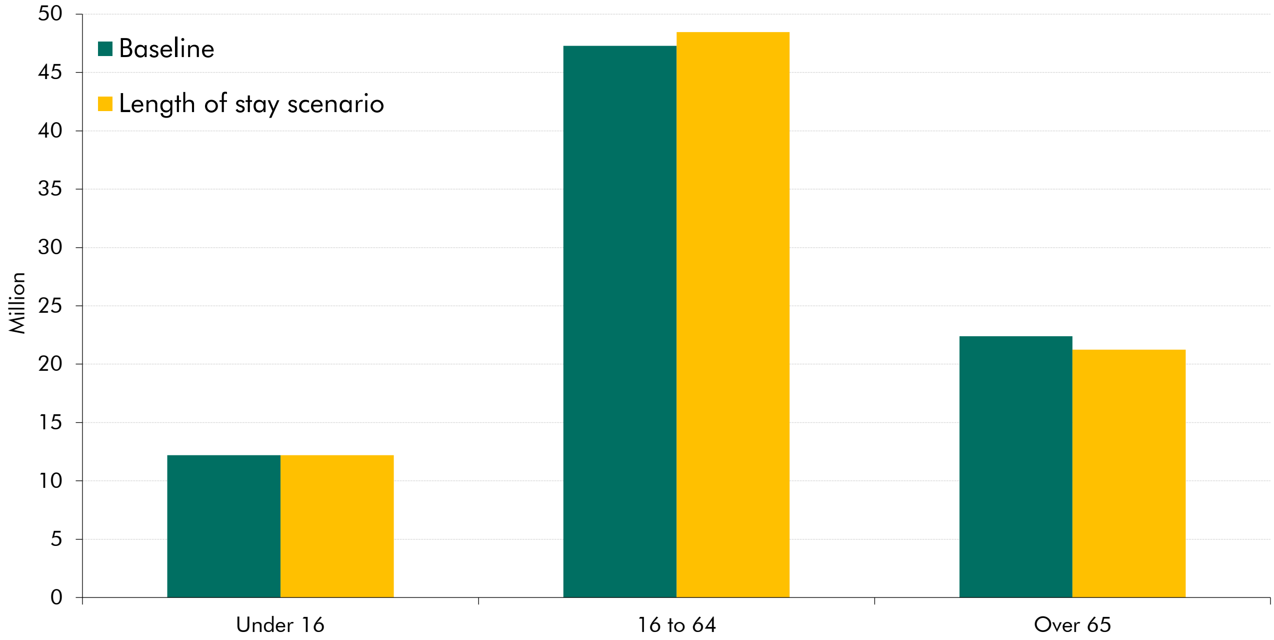
4.35 We first consider the impact of varying the average length of stay for new migrants. In our baseline projection, once immigrants arrive in the UK, they are implicitly assumed to have the same probability of leaving as the existing population and their age-specific fiscal impact is also no different to an average person. The data on migrants' length of stay in the UK shows it is more varied than this simplifying assumption used in our projections. The share of migrants that stay in the UK for more than 10 years varies by visa type: around half of those arriving on a work visa, around one-fifth of students, and just over four-fifths of those on a family or other visa.[11] For those that do leave the UK within a 10-year period, the most common length of stay is three years for all these visa types.

4.36 In this scenario, we therefore adjust our baseline projection to illustrate the fiscal impact of a different length of stay. We keep the total level of net migration constant, so the size of the population is unchanged from our baseline projection. However, we make an illustrative adjustment so only half of new migrants continue to stay in the UK with the same probability as the general population, while the other half leave after three years and are replaced by younger new immigrants. In this scenario, while the total population does not change, there are around 1.2 million more 16-to-64-year-olds compared to our baseline projection and, equivalently, 1.2 million fewer people over 65 in 2074 (Chart 4.14).

4.37 The scenario therefore has stronger growth in the 16-to-64-year-old population than in our baseline projection. This is particularly the case beyond the 2050s as half of the immigrants who would reach retirement age in our baseline projection have left the UK and been replaced by someone of working age in this scenario. We assume employment growth and nominal GDP growth increase in line with the increase in the 16-to-64-year-old population, with no change in productivity growth. By the forecast horizon, nominal GDP is 2.2 per cent higher than our baseline projection. All other economic assumptions remain as in our baseline projection, including Bank Rate and gilt rates, so the growth corrected interest rate (r-g) falls in this scenario.

[11] Student and work visa figures include dependants.

## Chart 4.14: Length of stay scenario: population age structure in 2074




Source: ONS, OBR

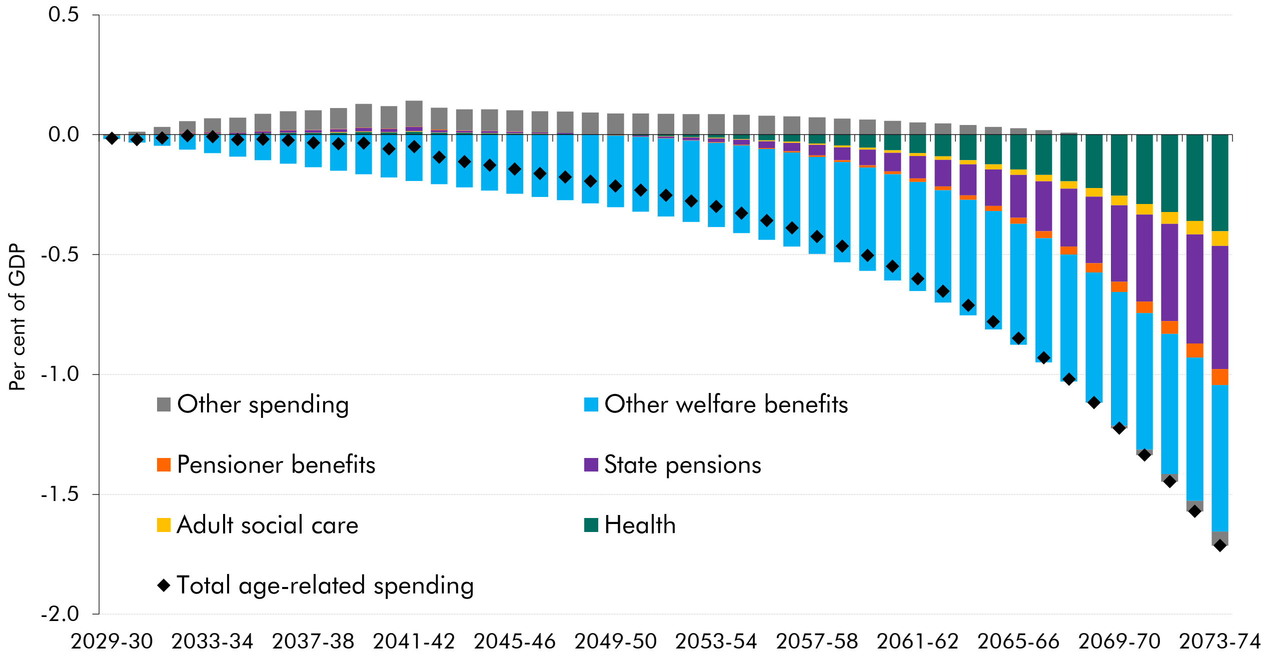
4.38 Driven by our primary spending by age profiles shown in Chart 4.6, primary spending as a percentage of GDP is 1.7 per cent of GDP lower in this scenario than in the baseline by 2073-74. In particular, spending on:

- **State pensions** falls sharply given the lower share of the population aged over 65. By the end of our forecast horizon, spending on state pensions is 0.5 percentage points lower than our baseline projection.

- **Other welfare benefits (e.g. universal credit and child benefit)** falls faster over the forecast relative to our baseline. This is driven by a fall in the share of the population who are eligible for welfare benefits as now half the 16-to-64-year-old migrant population leave before they are eligible. By the end of our forecast horizon, spending on other welfare benefits is 0.6 percentage points lower than the baseline.

- **Health** falls relative to the baseline at a slower pace than welfare spending as migrants are assumed to have the same access to health services as those with permanent domestic residence. The fall of 0.4 percentage points relative to the baseline by the end of the forecast horizon is driven by demographic changes relative to the baseline in the form of a large increase in the share of 16-to-64-year-old people and fewer people aged over 65.

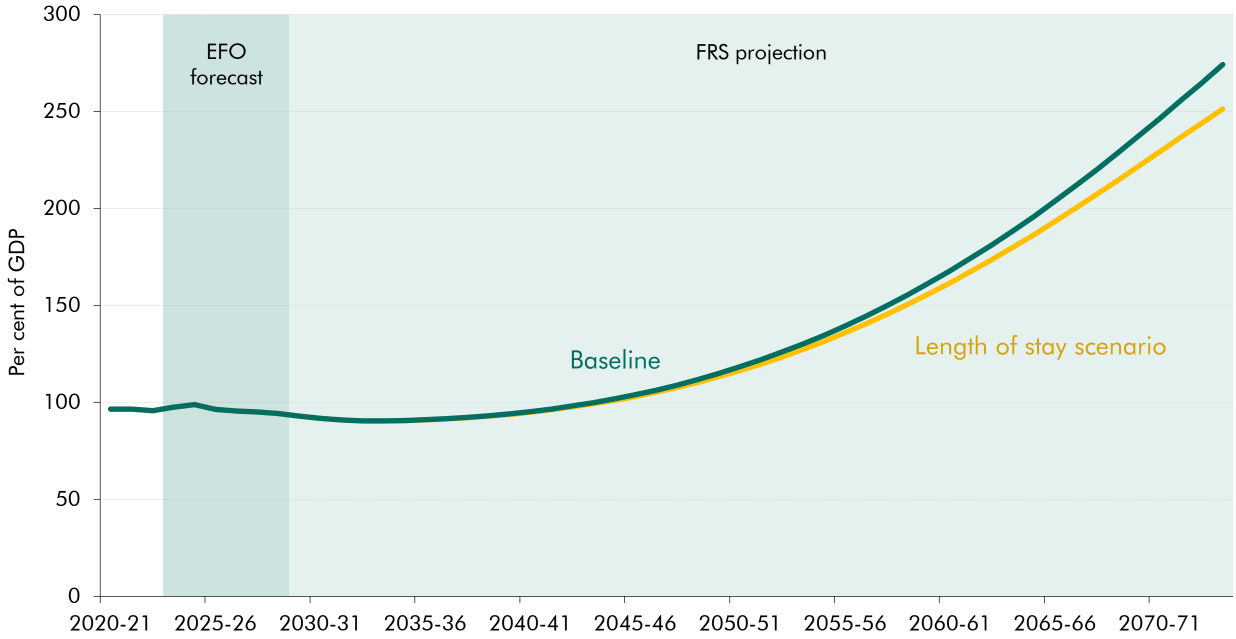
## Chart 4.15: Length of stay scenario: non-interest spending relative to the baseline




Source: OBR

4.39 The combination of more 16-to-64-year-olds relative to the baseline and only half of these migrants being eligible for welfare payments from 2028-29 onwards reduces primary spending by 1.7 percentage points relative to the baseline by the end of the forecast horizon. Primary receipts are 2.2 per cent higher than the baseline in nominal terms but remain the same as a percentage of GDP by the end of the forecast horizon. As such, the primary balance improves slightly by 1.7 percentage points by the end of the forecast horizon. This, in addition to lower net interest payments, sees debt lower than the baseline but still steadily rising. From a starting point of 94 per cent of GDP in 2028-29, PSND instead increases to 251 per cent of GDP by the end of the forecast horizon, 23 percentage points lower than in the baseline projection, shown in Chart 4.16.

## Chart 4.16: Length of stay scenario: public sector net debt




Source: OBR

## Migrant earnings scenarios

4.40 Our second migration scenario looks at the impact of new working-age migrants having higher or lower earnings than the average UK resident. In the higher earnings scenario, we assume migrants earn 30 per cent more than the average resident. In the lower earnings scenario, we assume migrants earn 50 per cent less than the average resident. These are in broadly in line with the 25$^{th}$ and 75$^{th}$ percentile of migrant earnings, in their first year of arrival, relative to the UK-born average in the ONS Labour Force Survey.[12] By the projection horizon, this group makes up around one-fifth of total employment. In the higher earnings scenario, nominal GDP is 6 per cent above our baseline projection by 2073-74. In the lower earnings scenario, nominal GDP is 10 per cent lower. For these scenarios we assume that the net interest rate on debt is unaffected by the change in growth rates as a result of changes to migrant earnings in our scenarios.

4.41 In the **higher earnings scenario**, the larger nominal economy means that by 2073-74:[13]

- **Nominal primary receipts** are 6.2 per cent higher than the baseline. This is driven by higher nominal GDP growth relative to the baseline and our assumption that the receipts-to-GDP ratio stays the same.

- **Nominal primary spending** is 2.9 per cent higher than the baseline. This is driven by higher public sector pay costs, pensions, pensioner benefits, other welfare benefits and

[12] Low sample sizes and volatility in recent periods means that these figures should be interpreted with caution.
[13] These results are dependent on assuming changes in the nominal economy only filter through to spending via staff costs and non-discretionary spending elements uprated by earnings. This also assumes the state does not alter the volume of services it provides in light of changes to productivity.

public sector net investment being uprated by average earnings. All other areas of primary spending are unchanged in nominal terms.

- The **primary balance** improves by 1.4 percentage points of GDP and **net debt** falls until around 2035 before rising to 235 per cent of GDP by the end of the forecast horizon, 40 percentage points of GDP below the baseline projection.

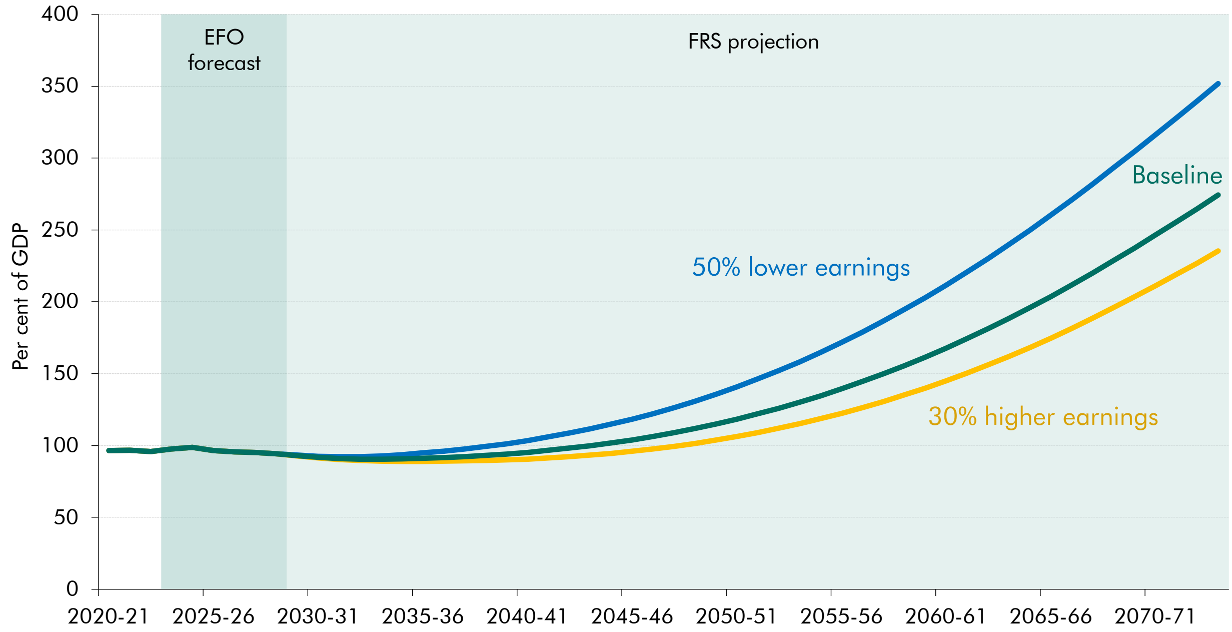
4.42 In the **lower earnings scenario**, the smaller nominal economy means that by 2073-74:

- **Nominal primary receipts** are 10.3 per cent lower than the baseline. This moves in line with the decrease in nominal GDP which is driven by lower taxable earnings on migrant workers than assumed in the baseline scenarios.

- **Nominal primary spending** is 4.8 per cent lower than the baseline. This is driven by lower public sector pay costs, pensions, pensioner benefits, other welfare benefits and public sector net investment being uprated by lower average earnings which falls by 0.3 percentage point below the baseline. All other areas of primary spending are unchanged in nominal terms, which more than offsets the aforementioned savings.

- The **primary balance** worsens by 2.9 per cent of GDP and **net debt** rises in every year to reach 351 per cent of GDP by the end of the forecast horizon, 76 per cent of GDP above the baseline.

## Chart 4.17: Migrant earnings scenarios: public sector net debt




Source: OBR

4.43 These scenarios show that while important in determining its level in any given year, altering migrants' average earnings or varying the length of stay does not fundamentally change the long-run debt dynamics: debt still rises substantially across the projection period and is on an unsustainable trajectory at the end of the fifty-year period. Even in our upside scenarios, the median age of the population rises by the end of the fifty-year period which increases public spending pressures particularly on healthcare and public pensions. However, the size of the fiscal adjustment required to stop public debt from spiralling does vary across these scenarios.

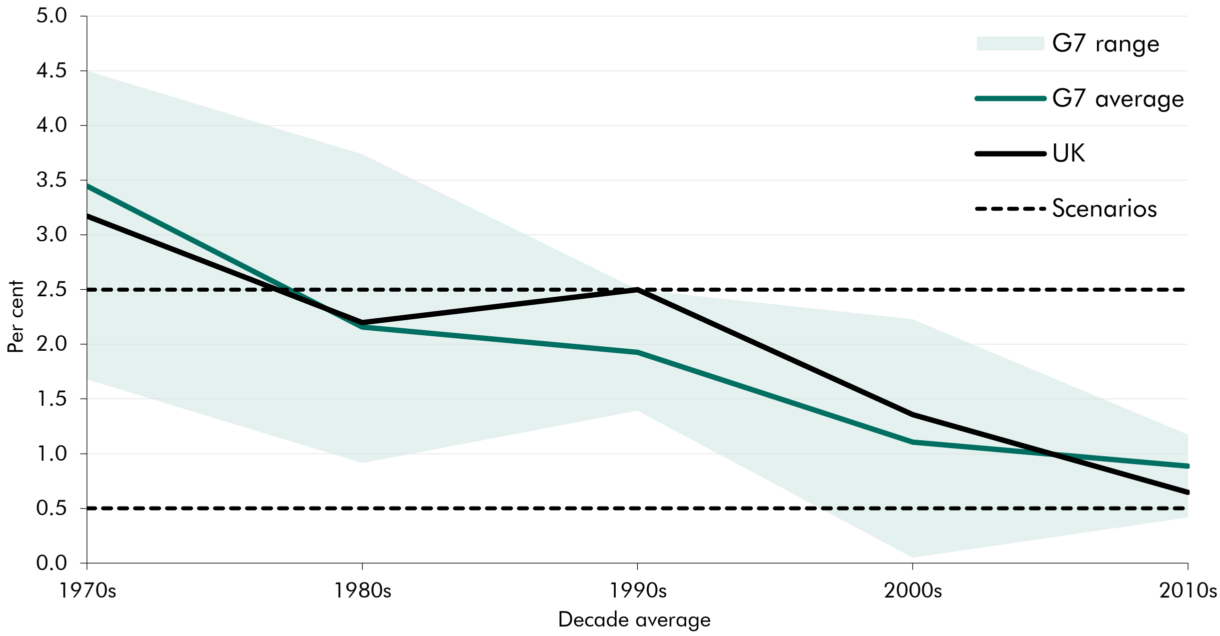
## Productivity scenarios

4.44 Our long-term fiscal projections are highly sensitive to assumptions on long-run growth in economy-wide productivity. To illustrate its impact, we construct two alternative productivity scenarios:

- a **higher productivity scenario** in which productivity growth increases to **2.5 per cent** a year from our baseline projection of 1.5 per cent. This would bring productivity growth broadly in line with the UK's average during the 1990s (Chart 4.18). In this scenario, nominal GDP is 55 per cent higher by 2073-74 than in our baseline projection.

- a **lower productivity scenario** in which productivity growth falls symmetrically to **0.5 per cent** a year. This would be around the average in the decade following the financial crisis. In this scenario, nominal GDP is 36 per cent lower by 2073-74 than in our baseline projection.

### Chart 4.18: G7 and UK productivity growth




Note: The G7 average is the unweighted mean productivity growth among the seven constituent countries.
Source: OECD, OBR

4.45 In translating this economic scenario into fiscal inputs, we assume that:

- **average earnings** change with productivity and there is no change in **interest rates** as productivity changes. As a result, r-g settles at -0.8 in our higher productivity scenario and 1.2 in our lower productivity scenario compared to 0.2 per cent in our baseline projection, which has a significant impact on interest costs and debt dynamics, as described below.

- within **primary spending**, public sector staff costs and welfare spending are uprated by average earnings. All other areas of primary spending are kept unchanged in both real and nominal terms. This is a key assumption as it means that higher productivity growth translates into lower spending as a share of GDP, and lower productivity growth translates into higher spending as a share of GDP. The history of public spending in the post-war period in the UK, and most other developed economies, would suggest that in practice governments have chosen to keep spending as a share of GDP relatively constant despite the relatively high economic growth seen in this period. For example, in the UK total public spending as a share of GDP has only varied between 35 per cent of GDP and 53 per cent of GDP since 1948, despite the economy being six times larger in real terms. We therefore also look at a further variant of the higher productivity scenario where real spending rises with GDP to keep spending as a share of GDP constant.

- **primary receipts** rise or fall with nominal GDP such that the receipts-to-GDP ratio remains consistent between baseline and scenario.

4.46 Looking at their fiscal implications, in the **higher productivity scenario** with annual **productivity growth of 2.5 per cent**:

- **Receipts** are 55 per cent higher than the baseline by the end of our forecast horizon.

- **Primary spending** is 28 per cent higher than the baseline by 2073-74.

- The **primary balance** remains in surplus from the medium-term forecast until around 2060, and is 8 percentage points higher than the baseline by the end of our forecast horizon reaching 0.7 per cent of GDP.

- **Net debt** assuming interest rates on the stock of debt is unchanged from the baseline, falls steadily over the projection period to reaches 65 per cent at the end of the forecast horizon, 209 percentage points lower than in the baseline.

4.47 Conversely, in the **lower productivity scenario** with annual **productivity growth of 0.5 per cent**:

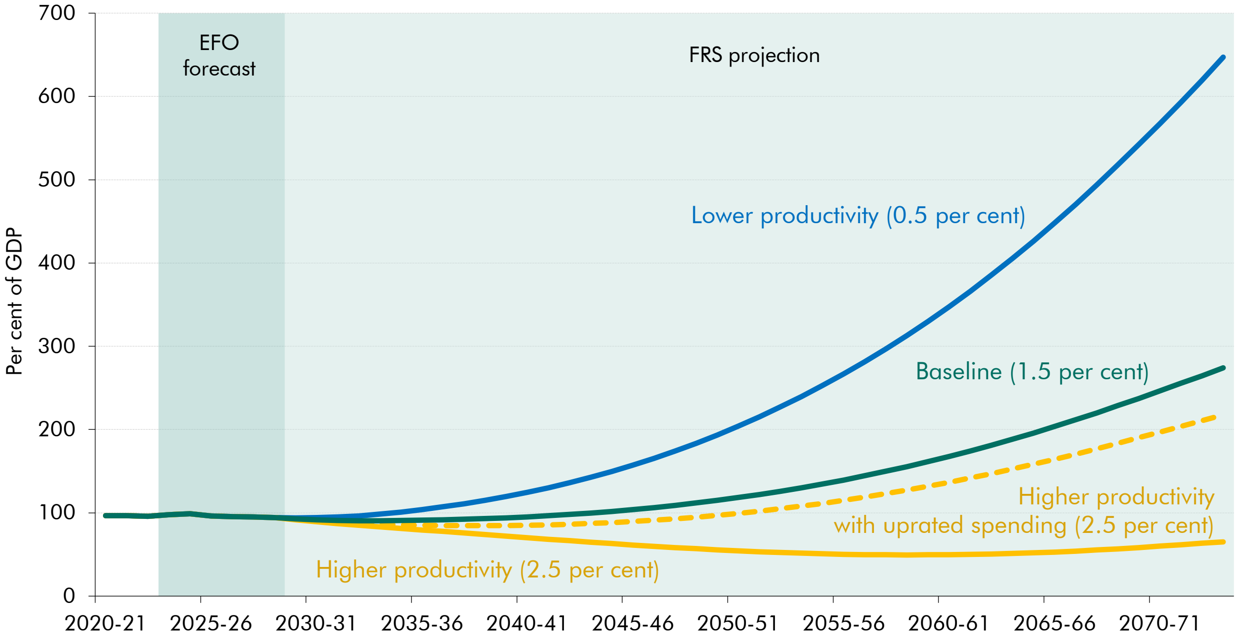
- **Receipts** are 36 per cent lower than the baseline by the end of our forecast horizon.

- **Primary spending** is only 16 per cent lower than the baseline by 2073-74.

- The **primary balance** moves into deficit in 2031-32, two years earlier than the baseline and remains in deficit until the end of the forecast horizon. By the end of our forecast horizon, the primary balance is 15 percentage points lower than the baseline, reaching -24 per cent of GDP.

- **Net debt** rises in every year and reaches almost 650 per cent of GDP by the end of the forecast horizon, more than twice as high as in the baseline.

## Chart 4.19: Productivity scenarios: public sector net debt




Source: OBR

4.48 The path of debt in the higher productivity scenario is largely driven by the assumption that government takes all the fiscal benefit of higher growth by keeping much of public spending unchanged in real terms and allowing spending to fall as a share of GDP. In the higher productivity scenario variant included in Chart 4.19 (dotted yellow line), where we assume that spending instead stays constant as a share of GDP, consistent with the pattern seen broadly over the past 50 years of economic growth, there is only a small improvement in the debt level at the end of the projection period compared to the baseline (driven by r-g remaining lower in this variant than in the baseline due to higher growth). This suggests that for a sustained rate of higher productivity to improve the fiscal position would also require government to act to constrain public spending as a share of GDP. However, if spending were constrained, productivity growth of roughly 2.3 per cent a year would be enough to keep debt broadly stable by the 50-year horizon. This would require productivity growth at a level not seen on a sustained basis in any G7 country since the 1990s.

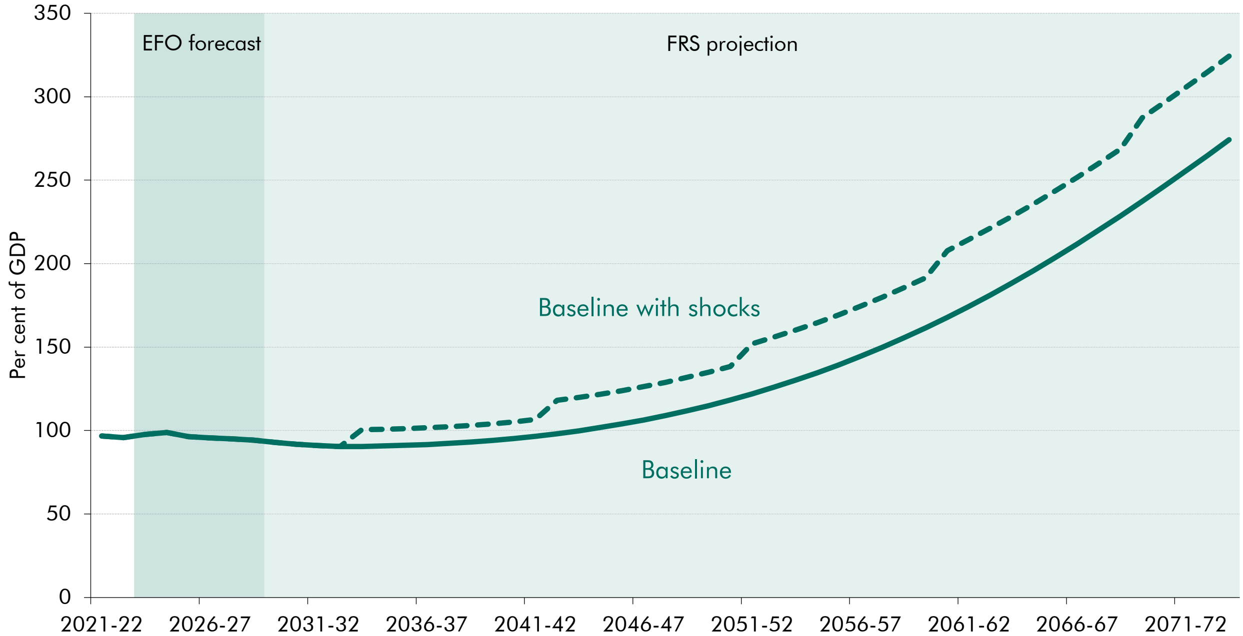
4.49 As stated above, interest rates are unchanged in our scenarios, which allows r-g to vary from 0.2 in the baseline, to 1.2 and -0.8 in the lower and higher productivity scenarios, respectively. Some economic theory suggests that the natural interest rate (R*) could be sensitive to productivity growth and therefore interest rates might change in line with productivity. Adjusting interest rates together with productivity, leaving r-g constant, would decrease the impact on PSND in both scenarios. In the higher productivity scenario higher growth in receipts would be partially offset by higher debt interest spending, albeit on an increasingly smaller debt stock. In the lower productivity scenario the impact from lower receipts growth would be partially offset by reduced spending on debt interest payments due to lower interest rates.

## Impact of economic and fiscal shocks

4.50 The fiscal consequences of significant economic shocks have been an important driver of the path of debt. For example, over the past 25 years, the UK stock of debt has increased from 36 per cent of GDP in 2007 to 98 per cent of GDP this year, largely because of shocks. The stock of debt rose by 29 per cent of GDP in the two years following the 2008 financial crisis, and by 11 per cent of GDP in the two years following the 2020 Covid pandemic. Importantly, the impact of shocks on the public finances is skewed to the downside. Debt is nearly always pushed higher by adverse shocks through both the indirect impact of lower growth on tax receipts and the cost of any direct government financial support to households and businesses. However, debt is rarely significantly reduced by favourable shocks, because the underlying fiscal improvement in the public finances is often spent either through higher public spending or lower taxation.

4.51 International and historical evidence suggests that a typical recession can add around 10 percentage points to the debt-to-GDP ratio.[14] And there have been seven recessions in the 62 years from 1956 to 2018, or one every nine years on average.[15] We therefore analyse the sensitivity of our baseline net debt projection to a shock that adds 10 per cent of GDP to debt every nine years. The ratchet effect this has on debt is shown in Chart 4.20. It raises the baseline projection for net debt from 274 to 324 per cent of GDP in 2073-74. It also means that debt initially rises more sharply and slightly earlier, in 2033-34 rather than 2034-35 in the baseline projection, and would exceed 200 per cent of GDP five years earlier a result of these shocks compared to the baseline projection.

### Chart 4.20: Baseline and stylised shocks: public sector net debt



Source: OBR

[14] See, for example, IMF, *Analyzing and Managing Fiscal Risks—Best Practices*, June 2016.
[15] See our 2019 *FRR*.

## Health and climate scenarios

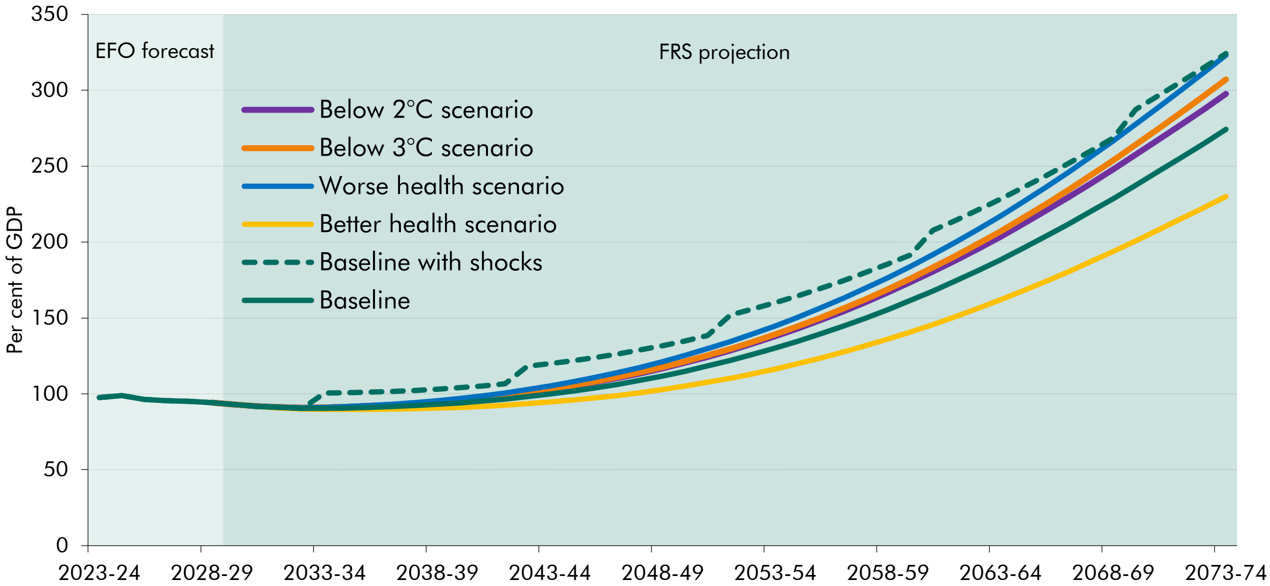
4.52 The previous two chapters of this report look in depth into two important long-term pressures on the public finances: the damage due to climate change and the cost of health. In this section we incorporate their findings into our long-term projections for the public finances. As shown in Chart 4.21:

- the **climate damage** scenarios in Chapter 2 assess the potential fiscal costs from the physical damage caused by a warming climate: the direct costs from severe flooding and extreme heat events, and the indirect costs from rising temperatures and more extreme weather events leading to lower potential output. These estimates, while highly uncertain, suggest that, in the below 2°C scenario and the below 3°C scenario respectively, debt as a share of GDP reaches 298 and 307 per cent of GDP, 23 percentage points and 33 percentage points higher than our baseline projection, due to climate-related damages. This is without accounting for the costs of transitioning to net zero which would further increase debt.

- the **health scenarios** in Chapter 3 explore variations in population health via changes in life expectancy, healthy life expectancy, the prevalence of chronic conditions, and work-limiting ill health. Over the long term, this has significant implications for health spending, other age-related spending, and taxes and welfare spending through effects on labour market participation and productivity. The upside scenario estimates that better health could lead to a debt level of 230 per cent of GDP by 2073-74, whereas the worse health scenario results in an increase to 323 per cent of GDP in the same year, compared to 274 per cent of GDP in the baseline.

4.53 In all of these scenarios, debt starts to rise and is on an unsustainable upward trajectory from around the middle of this century. Even the most favourable scenario, where better health leads to much lower health spending pressures, only delays the start of this upward trajectory. And in the scenario where the economy is hit by shocks every nine years, which on the basis of past experience is highly likely, debt starts to track upward much earlier. In the next section we assess the fiscal adjustment governments would need to make to counter these pressures and keep the public finances on a sustainable long-term path.

Chart 4.21: Baseline with shocks and scenarios: public sector net debt




Source: OBR

## Fiscal gaps: policy adjustment to maintain sustainability

4.54 In our baseline projection and in most of the scenarios explored in the sections above, the combination of demographic and other cost pressures puts government debt on an ever-rising trajectory that would clearly not be sustainable. The only scenario where this does not take place is based on the UK achieving sustained productivity growth at levels not seen for 30 years, combined with governments choosing to use the fiscal benefits of this higher growth to reduce debt by allowing spending to fall as a share of GDP.

4.55 UK government debt has only exceeded 200 per cent of GDP on two occasions, at the end of the Napoleonic and Second World Wars, and in very different economic, fiscal, and demographic circumstances from today. So, in practice, if these projections were to begin to materialise, it is almost certain that governments would need to take corrective fiscal action to prevent the public finances falling into what would likely be an unsustainable debt spiral. In this section, we consider the fiscal policy adjustment that would be needed to keep debt on a sustainable path in the face of these pressures.

4.56 We assess this by estimating the 'fiscal gap', which is the change in the primary balance needed to keep the debt-to-GDP ratio below or at a certain threshold over a given period. It can be expressed either as an immediate and permanent change in the primary balance or a gradual tightening of fiscal policy over the projection period, and we consider both approaches under our baseline projection and projection with stylised shocks.

4.57 There is no consensus on the optimal level of debt consistent with long-term sustainability or how quickly it should be returned to in the face of shocks and pressures. We therefore look at two examples: (i) returning debt to 75 per cent of GDP, which is the broad level seen in the 2010s before the Covid and energy price shocks; and (ii) maintaining debt at roughly its current level of close to 100 per cent of GDP. Both these levels are much higher than the roughly 40 per cent of GDP in debt held by the Government before the 2008 financial crisis.

4.58 Table 4.7, below, shows the necessary tightening to return debt to 75 per cent of GDP. To bring debt to this level by the end of the long-term projection, the Government could either: (i) at the start of the projection period, implement a one-off, permanent tightening of about 4.1 per cent of GDP; or (ii) implement a phased tightening of 1.5 per cent of GDP a decade.

4.59 Table 4.7 also shows the adjustment to the primary deficit required to keep debt at 75 per cent of GDP in the scenario where the public finances are hit by a shock every nine years, as described in paragraph 4.50 above. The adjustment to the primary deficit is about one-quarter larger in this case for the both the one-off permanent and the incremental adjustment.

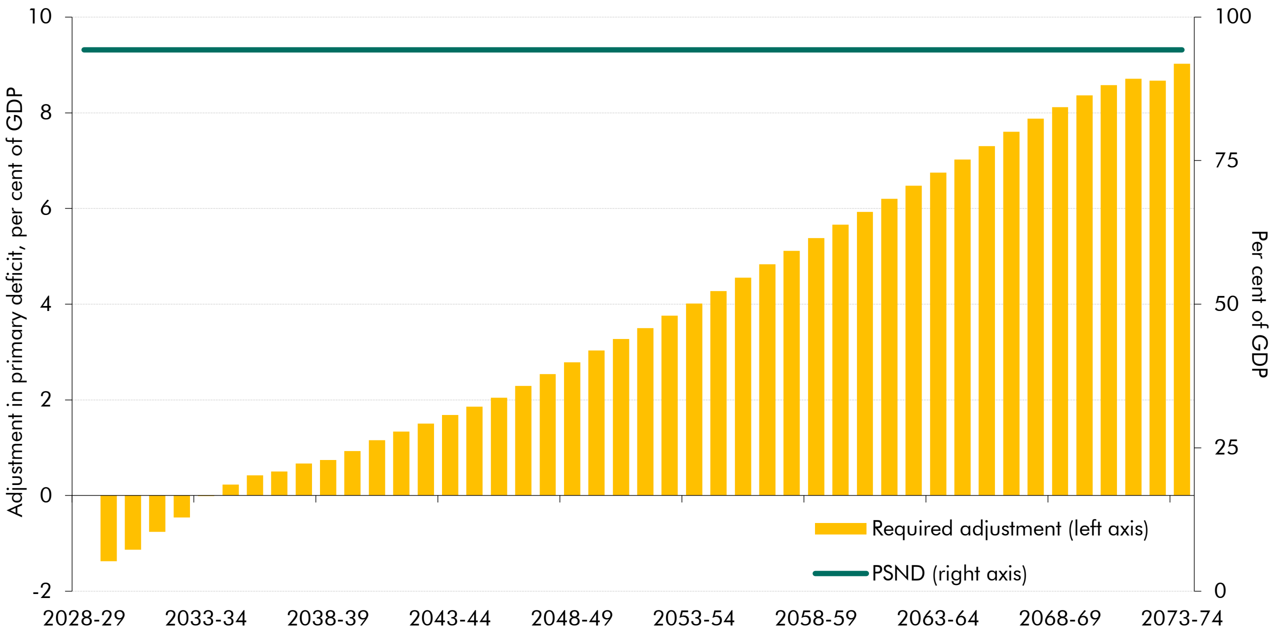
## Table 4.7: Fiscal gap estimates to hit 75 per cent debt-to-GDP ratio in 2073-74

| | Adjustment in primary deficit, per cent of GDP |
|---|---|
| Baseline projection (one-off tightening) | -4.1 |
| Baseline projection (phased tightening)[1] | -1.5 |
| Baseline projection with shocks (one-off tightening) | -5.1 |
| Baseline projection with shocks (phased tightening)[1] | -1.9 |

[1] Adjustment required each decade.

4.60 The fiscal tightening required to maintain debt flat as a share of GDP at the medium-term position (94.3 per cent of GDP) is illustrated by Chart 4.22 below. Initially, the Government would be able to loosen fiscal policy, thereby running a larger primary deficit than in our baseline for the first five years of the long-term projection period. However, from the mid-2030s, as demographic pressures start to bite, the Government would then need to tighten fiscal policy by an additional ¼ per cent of GDP every year. To achieve stable debt in the economic shocks scenario would essentially require an additional 10 percentage point tightening for one year following the shock every nine years, in order to prevent the shock from increasing debt.

## Chart 4.22: Progressive tightening needed to keep debt flat in baseline projection




Source: OBR

## Summary

4.61 The UK public finances have deteriorated significantly over the past 25 years, partly due to the impact of a series of significant economic shocks. From this starting point, this chapter has set out projections for the public finances over the next 50 years. Long-term projections such as these are clearly highly uncertain. However, in nearly all the variants, within a couple of decades, pressures such as demographic change, rising healthcare costs, and climate change, push debt onto a permanent upward trajectory which would be unsustainable. If the economy is hit by another major economic shock in the next decade, then this upward trajectory would initially be sharper and start earlier.

4.62 The scenarios we have produced highlight the sensitivity of these projections to changes in the characteristics of migration, and to higher or lower economy-wide productivity growth. The length that migrants stay in the UK and whether they are high or low earning makes a material difference to the fiscal position over the long term. However, even in the most fiscally beneficial scenario, where migrants are higher earning or more likely to leave the country before reaching old age, debt is still eventually on an unsustainable upward trajectory. This is also the case when we incorporate into the baseline projection the better heath scenario from Chapter 3. And incorporating the potential fiscal costs from the physical damage caused by climate change set out in Chapter 2 only increases the pressure on debt over the long term. Debt does fall rapidly in the higher productivity scenario, however this is based on the UK achieving sustained productivity growth at levels not seen for 30 years, combined with governments choosing to use the fiscal benefits of this higher growth to reduce debt by holding most of spending flat in real terms and so allowing spending to fall as a share of GDP.

4.63 If the growing fiscal deficits implied by these projections were to start to materialise, then in practice government would need to adjust fiscal policy to prevent an unsustainable debt spiral. This could be achieved by either cutting spending or raising taxes, or a combination of the two. While such policy adjustments would be difficult to deliver, the longer that is left before doing so, the more challenging it will become to prevent debt from spiralling upward.

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