Working paper

The macroeconomic impact from extending working lives

by Ray Barrell, Simon Kirby and Ali Orazgani

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The macroeconomic impact from extending working lives

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A report of research carried out by the National Institute of Economic and Social Research on behalf of the Department for Work and Pensions

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Abbreviations

GDP	Gross domestic product
DWP	Department for Work and Pensions
NiGEM	National Institute Global Econometric Model
NIESR	National Institute of Economic and Social Research
ONS	Office for National Statistics

Glossary of terms

Default retirement age	The age at which an employer can legally retire an employee. The current default retirement age is 65.
Direct tax	Tax paid by households on their income.
Indirect tax	Taxes on consumption, including but not limited to VAT, fuel duty, and tobacco and alcohol Duties.
Government investment	Gross fixed investment by the government.
Government consumption	Government spending on goods and services.
Government interest payments	The interest paid by government on the current stock of gross government debt.
Nominal gross domestic product	The value of goods and services produced in an economy within a year at current market prices.
Participation rate	The proportion of the working age population who are active in the labour market (in work or actively seeking work).
Real gross domestic product	The value of goods and services produced in an economy within a year adjusted for changes in the level of prices.
Social Transfers	Transfers from the government to households, including, but not limited to, the State Pension, child benefit, Jobseekers' Allowance, Income Support and Incapacity Benefit.
State Pension age	The age at which an eligible resident or UK citizen may begin to claim the state pension from the government.

Summary

This report presents findings from research, conducted by the National Institute of Economic and Social Research (NIESR) on behalf of the Department for Work and Pensions (DWP). NIESR were commissioned to simulate the macroeconomic effects from extending working lives using NIESR's global econometric model, National Institute Global Econometric Model (NiGEM).

Research remit

The DWP requested a number of different scenarios to evaluate the effects of extending working lives. The baseline used in this project is a forecast that includes the announced increases in State Pension age[1]. In order to put this work into context the DWP also requested some counterfactual analysis to evaluate the potential losses to the economy if the planned increase in State Pension age and equalisation of women's State Pension age with men's did not take place.

The core of the work commissioned by the DWP concerned the potential impact from future extensions of working life. There are a significant number of scenarios that could be run within this general context. The set of scenarios were chosen to enable a comparison of different plausible variants to be made given the current plans for the increases in the State Pension age. As well as providing macroeconomic results from an extension of working life, they were designed to highlight the differences between less and more radical changes. These include increasing working lives by one, two or three years; implemented at different speeds and over differing future time horizons (starting now or in ten years time). Sensitivity analyses around these results were also undertaken and focused on two phenomena: the hours worked by those that extend working lives and the speed at which investment is increased in response to the expansion of the supply of labour.

Modelling the impact of extending working lives

Extending working lives increases the supply of labour, raising the potential levels of gross domestic product (GDP) and consumption. In addition, extending working lives is likely to lead to an improvement in the position of the public finances, in particular, through boosting tax revenues. If markets work well and the extension is well planned, providing time for people to adjust their retirement decisions, the impacts on the economy and employment would be both positive and large. This report provides an analysis of the effect of such an extension of working life. A number of assumptions are required in the modelling analysis. Consumers, exchange rates and financial markets are assumed to be forward looking and respond to expected changes in interest rates. Labour market bargainers take account of both past and future inflation in setting wages, and unemployment rates will return to equilibrium after a shock, but at a lag. The real wage adjusts to the supply of labour. The UK is assumed to be a small open economy; an increase in the workforce leads to a lower real exchange rate in equilibrium in order to ensure that extra output can be sold. Output is determined in the long run by the supply of labour and the level of technical progress, and the capital stock adjusts to maintain the capital output ratio at its equilibrium level. In addition, we note that those near retirement work about three quarters of average hours worked by those currently in employment. The forecast baseline used for the analysis is NIESR's October 2009 forecast (the underlying population projections are the 2008-based population projections from the Office for National Statistics (ONS)) and has the rate of price inflation on target at around two per

[1] The work was completed before the announcement that the State Pension age would rise to 66 from April 2020.

cent per annum over the medium term. A number of sets of assumptions on the government sector are used. The core set keeps government consumption on baseline and tax rates are constant. All benefits are up-rated in-line with the plans available at the time the baseline was created. If somebody becomes part of the population of working age rather than retired, they can be employed, unemployed or inactive. Given that benefits are up-rated in-line with plans the amount of benefit received by the unemployed changes with the number of unemployed people. Payments to those on other benefits also change in line with the numbers claiming those benefits.

Key findings

Counterfactual analyses

Before examining the macroeconomic effects of extending working lives a simple counterfactual analysis of the impact from not raising the State Pension age as currently planned (plans as of end 2009) was undertaken. In this counterfactual it is assumed that there would be no increase in the age at which people retire, and as such it is a ‘worst-case’ scenario. Retirement ages may well still have risen, even though the State Pension age does not, as a consequence of longer expected lives. This counterfactual includes not equalising women’s and men’s State Pension ages (men’s State Pension age is held at 65 and women’s at 60). These assumptions imply a significantly smaller working age population over the period from 2010. The working age population would be over three million lower by 2030. The initial effect is small, but it rapidly accumulates as the State Pension age for women is due to rise by five years over the period 2010-2020. Real GDP would likely be almost six per cent lower than it otherwise would have been by 2030, with the level of employment around seven per cent lower.

In this analysis government consumption is kept on baseline and tax rates are constant. Total tax receipts would be lower than currently projected. The benefits received by different groups, be they of working or state pensions age continue to be up-rated in-line with the plans implicitly underlying the baseline. Government spending would be higher than projected on the baseline. On the basis of these assumptions the results from the simulations imply the government’s budget balance would have been 3.5 per cent of GDP worse in 2030 than anticipated with the legislated State Pension age change.

Using the **Labour Force Survey**, the Office for National Statistics (ONS) estimates that around 1½ per cent of the working age population withdraw from the labour force through early retirement. The impact on the economy from assuming no such early retirement was simulated from 2000. In the absence of early retirement, these simulations suggest that nominal GDP would have been one per cent (£14 billion) higher than it otherwise was in 2009. Public finances would also have improved. The results suggest a £4 billion improvement in tax revenues, with taxes on household incomes the main contributor.

The main results

The core scenario is a one year increase in working life for the UK population that is gradually phased in over the period 2010-2014. This change is combined with a gradual one year increase in the State Pension age for men and women, expanding the population of working age. By 2014 the working age population will have increased by 1.75 per cent. Over this period the average age of withdrawal from the labour market by women is expected to rise and it is assumed that this continues, with their average age of withdrawal converging with men’s by 2020. As a result the increase in the labour force is smaller than the increase in the working age population. It is assumed that the impacts of the labour force increases are anticipated by both consumers and producers. Consumers know that they will have to save less for retirement, and will spend more in advance of their later retirement, producers will be aware they need more capital to go with the increased future labour force, and hence will invest more now.

A one year extension of working life increases real GDP by around one per cent about six years after its implementation, which is around 80 per cent of the increase in the labour force. The government budget would improve by 0.6 per cent of GDP, and consumption per capita would be more than one per cent higher than on the baseline. Employment would start to rise immediately. In the core scenario, by 2014 employment is likely to have risen by 1.6 per cent (467,000). As markets work slowly, and output follows the increase in the labour force, initially unemployment might be expected to rise, albeit by a small amount, as flows through the labour market will be affected. The unemployment rate might temporarily rise and in the core scenario peaks at 0.2 percentage point two years after implementation. Subsequently, the unemployment rate would be expected to return to baseline implying no effect on the rate of unemployment by 2014.

Alternative scenario: a three year increase in working lives

An analysis of a three year increase in working lives was requested by the DWP since the long-term plans as they stand are for the State Pension age to be increased by three years to 68 by March 2046. This was implemented with the three year extension in working life spread over a decade. In comparison to the one year increase, it has about three times the impact on real GDP in the long-run. Over the first five years the increase in working life looks broadly similar to the core one year extension. However, it is noticeable that the impact on the economy over the first five years is greater in the three year scenario. It is the anticipation of further labour force expansions that increases demand for output by both consumers and producers in the short run. Consumers know that they will have to save even less for retirement under the three year extension than the one year extension, and will spend more in advance of the change in retirement ages, producers will be aware they need more capital to go with the increased future labour force, and hence will invest more now.

Conclusions

In the absence of any changes to the State Pension age by 2030 the working age population would be to be three million less than currently projected. Consequently, the future level of real GDP would be around six per cent lower than is the case with current plans for the State Pension age.

A one year increase in working life phased in over the next few years would raise the labour force available in the UK. In the short run, we would expect there to be a temporary increase in the rate of unemployment as the economy adjusts to this expansion of labour but after four years all the additional labour would be absorbed. By that time the level of real GDP would be boosted by around one per cent. Consumption would rise more than output, as savings could be lower given that people face shorter periods of retirement.

A one year increase in working life with an equivalent increase in the State Pension age would reduce spending and increase tax receipts (both from higher incomes and more consumption) than would otherwise been the case. If government current expenditure is assumed to be fixed to baseline then a one year increase in average working life would improve the government budget balance by 0.5 per cent of GDP after ten years and by almost one per cent after 25 years.

1 Introduction

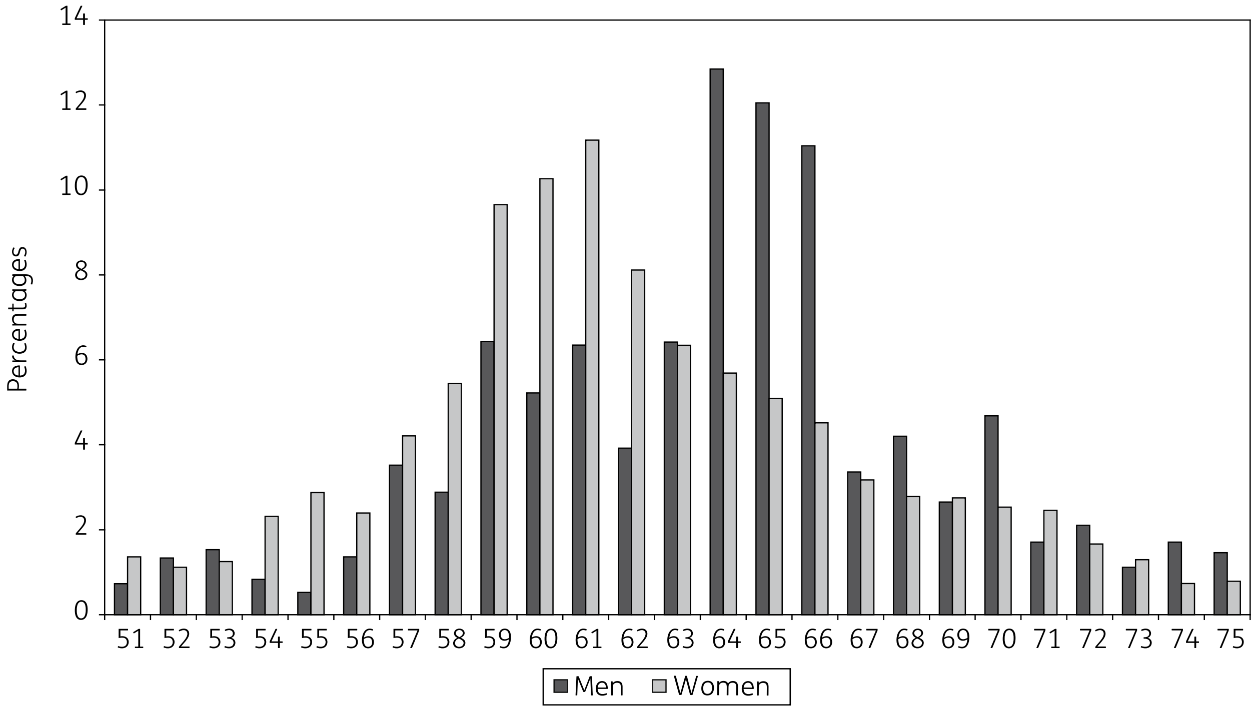
There has been much discussion of the impact of increasing life expectancy on saving and retirement decisions. Since 1990, male life expectancy has been rising at three years a decade, with smaller increases for women. At the same time entry into the labour force has been delayed by increases in participation in post compulsory secondary and tertiary education. As a result, the proportion of life spent in work has been declining, and funding pressures for non working years have been increasing. This report looks at the impacts on output, consumption and the government budget from inducing or allowing people to work longer than they currently do.

The concentration of work can be partly explained by economic phenomena. We highlight three here. The first factor is that for some people earning capacity may decline with age. This means that, as people age, the cost of work, in terms of leisure foregone, becomes increasingly expensive relative to the benefit they gain from working. Working becomes less attractive and, when people feel they can afford an acceptable living standard without working, they retire. The second reason for people to choose the bunching of leisure in retirement is the potential for receipt of a pension, which means that their possible consumption is increased and, therefore, its marginal utility is lower at any given level of earnings.

The marginal utility of leisure is much less affected, making it more likely that people will choose not to work. The third factor is that concentrated working increases people's earning capacity as skills and knowledge are temporarily enhanced. These factors provide reasons for people to take relatively more leisure late in life and thus to retire. Although most individuals are in a position to make their own decisions about their retirement, not all are able to do so. Employers behaviour, contracts, case law and legislation, which we might describe as institutions, that induces retirement at a specific age or makes the choice to work longer more difficult, may also induce some bunching in retirement decisions. Indeed, bunching of retirements at specific ages could be seen as an indicator of the scale of constraints on behaviour.

These observations immediately allow us to identify factors which are likely to encourage people to retire later than they currently do. First of all, a delay in the date at which normal state benefits are available has the effect of lowering income prior to this date if retirement plans are not adjusted, making retirement now more expensive, and hence less likely. The effect is bound to be most marked on the poorest people, because, in proportionate terms, it is a much larger reduction in their expected income than it is for rich people, ceterus paribus. Secondly, poor investment returns, perhaps a consequence of a more general reduction in rates of return or as a result of taxes on income from capital, will mean that people need to save higher proportions of their labour incomes to achieve any given level of retirement consumption. A probable response to lower returns is both that people will reduce their consumption in retirement relative to that in working life and also that they will delay retirement. This effect is bound to be more marked on rich people than on poor people since the latter do not save very much anyway. The age of retirement that people choose will also depend on the expected generosity of the state benefits in their retirement, with a more generous path for future benefits inducing people to retire earlier.

Figure 1.1 The percentage withdrawing from the labour market, by age and sex



Note: For the period April–June 2009.
Source: Figure 4.9 in Office for National Statistics (2009).

Currently there is significant bunching around the current State Pension ages of men and women (see Figure 1.1). Almost two-fifths of men retire between ages 64 to 66, while two-fifths of women retire between ages 59 and 62 inclusive. If the retirement decisions were not influenced by the institutional factor mentioned above then we might expect a rather less-peaked distribution. The objective of recent policy announcements is to induce people close to the current State Pension age to delay the point at which they withdraw from the labour market. Consultations on the restriction of pension tax relief, reducing the generosity of tax relief on pensions should mean that for a given level of saving will provide less of a pension than had previously been expected[2]. Such adjustments should induce an extension in working life for some middle and higher income earners as they adjust to maintain their pension level. The government have also announced a consultation on when to bring forward the increase in the State Pension age to 66 (DWP, 2010), which will induce some extension of working life. But more immediately the government have announced their intention to abolish the Default Retirement Age from next year lifting one of the barriers to those who desire to work beyond the age of 65[3].

2 See the consultation documents available at: http://www.hm-treasury.gov.uk/consult_pensionsrelief.htm

3 See http://www.bis.gov.uk/policies/employment-matters/strategies/default-retirement for details.

The DWP requested a number of different scenarios to evaluate the effects of extending working lives. The baseline used in this project is a forecast that includes the announced increases in State Pension age[4]. In order to put this work into context the DWP also requested some counterfactual analysis to evaluate the potential losses to the economy if the planned increase in State Pension age and equalisation of women's State Pension age with men's did not take place.

The core of the work commissioned by the DWP concerned the potential impact from future extensions of working life. There are a significant number of scenarios that could be run within this general context. The set of scenarios were chosen to enable a comparison of different plausible variants to be made given the current plans for the increases in the State Pension age. As well as providing macroeconomic results from an extension of working life, they were designed to highlight the differences between less and more radical changes. These include increasing working lives by one, two or three years; implemented at different speeds and over differing future time horizons (starting now or in ten years time). Sensitivity analyses around these results were also undertaken and focused on two phenomena: the hours worked by those that extend working lives and the speed at which investment is increased in response to the expansion of the supply of labour.

In this paper we discuss the impacts on the economy from raising the age at which people retire. Later retirement may be driven by a number of factors, such as the removal of constraints, the abolition of a default retirement age in labour contracts, or from changing tax and benefit inducements. Increasing the State Pension age is only one way of inducing people to work longer, but we include it here as one of the factors affecting decisions. We use the National Institute model of the UK economy in NiGEM on a baseline projection to 2059 in order to undertake this evaluation. The model is described in Appendix A. In Chapter 2 of the report we discuss our assumptions in the modelling exercise and the current plans for the State Pension age over the next 40 years. In Chapter 3 we discuss the impacts that expected increases in retirement ages that flow from currently agreed increases in the State Pension age and other currently enacted legislation might have on the economy. In Chapter 4 we look at the impacts on output, employment, consumption and the government budget of people extending their working lives by one year.

Appendix B presents the detailed tables from the core simulations. We note that those near retirement work fewer hours a year than the average of the population of working age, and in order to take account of this we assume that those who choose to exit later work around three quarters of normal hours, and that later retirement does not change earlier behaviour. We examine the sensitivity of our results to these assumptions in Chapter 5. In Appendix C we look at the impact on output and employment from accelerating the adjustment of the capital stock to changes in labour input. The speed at which the capital stock adjusts is crucial to the speed at which the expansion of labour supply is absorbed by the economy. The capital stock is expanded through an increase in net investment, raising overall final demand in the economy. In Chapter 5 we also evaluate the impacts of extending working lives by three years over the next decade, whilst Appendix D discusses the impacts of the same policy over the period 2020 to 2050. Chapter 6 concludes.

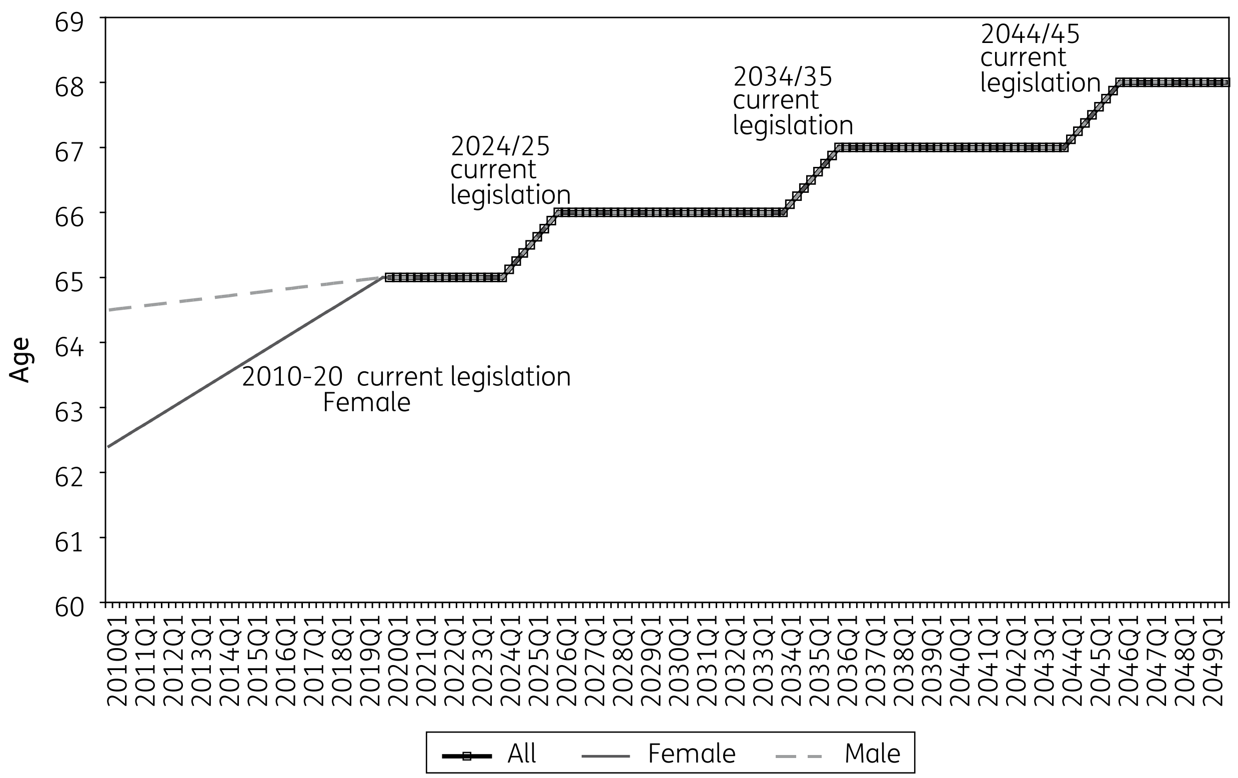
[4] The work was completed before government announced their intention to raise the State Pension age to 66 from April 2020 (see DWP, 2010).

2 Assumptions used in the modelling

2.1 Assumptions: current pension policy plans

We have undertaken three core simulations in this project, each progressively extending working life. We use a baseline where we have implemented the increase in the State Pension age for women between 2010 and 2019 as well as those for men and women that are described in Figure 2.1 in subsequent years. The underlying data for the creation of our baseline was obtained from ONS mid-2008 population projection. Labour force projections and assumptions about participation rates, which depend on the labour force as a proportion of the population of working age, have to take account of the fact that women retire at 62.4 currently and hence a reasonable number of women in the labour force are not included in the population of working age women. On our baseline the State Pension age is used to define the working age population and the average retirement age is used to define the labour force in constructing our baseline.

Figure 2.1 Retirement assumptions on our baseline



Source: ONS and NIESR assumptions.

Figure 2.1 illustrates the effective retirement ages for men and women on our baseline taking into account current legislation for a further three increases in the State Pension age. We assume that the effective age of retirement rises in line with changes in the State Pension age after 2020. The size of the men's, women's and total populations of working age are plotted in Figure 2.2.

From the second quarter of 2010 there is a gradual increase in women's State Pension age and we also assume in retirement ages. The birth date of those covered by the State Pension age change rises by one month every two months (by one year every two years) for a decade, as is detailed in Table 2.1 for the first one year increase in women's State Pension ages. From Table 2.1 we can see that all women born on or before 5 November 1950 will be of pensionable age at mid-2011. This will include all those aged 61 at mid-2011, plus some aged 60. Of those aged 60 at mid-2011, those born between 1 July 1950 and 5 November 1950 will be of pensionable age, but those born between 6 November 1950 and 30 June 1961 will be of working age. This pattern continues throughout the decade and by 2020 the men's and women's State Pension age equalise at 65.

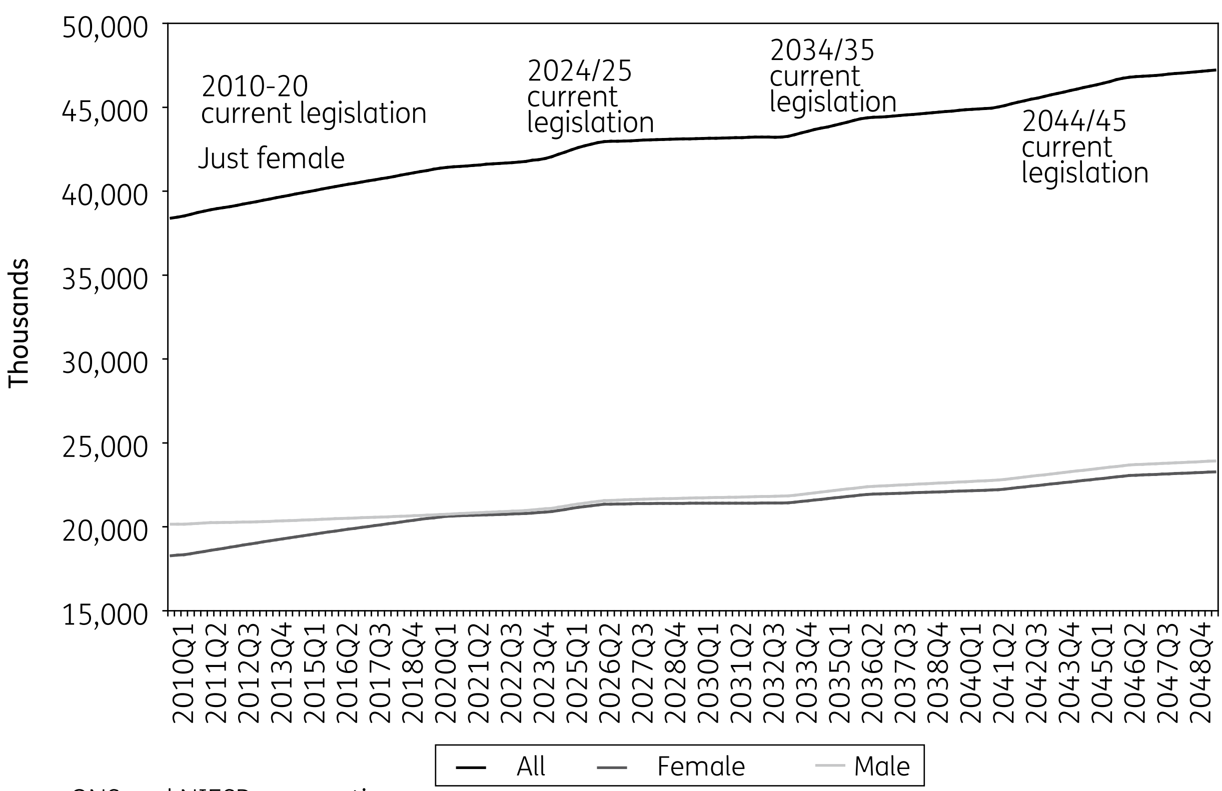
Table 2.1 The onward march of women's retirement ages

Period within which woman's birthday falls	Day pensionable age attained
6 April 1950 to 5 May 1950	6 May 2010
6 May 1950 to 5 June 1950	6 July 2010
6 June 1950 to 5 July 1950	6 September 2010
6 July 1950 to 5 August 1950	6 November 2010
6 August 1950 to 5 September 1950	6 January 2011
6 September 1950 to 5 October 1950	6 March 2011
6 October 1950 to 5 November 1950	6 May 2011
6 November 1950 to 5 December 1950	6 July 2011
6 December 1950 to 5 January 1951	6 September 2011
6 January 1951 to 5 February 1951	6 November 2011
6 February 1951 to 5 March 1951	6 January 2012
6 March 1951 to 5 April 1951	6 March 2012

Source: Government Actuary's Department (http://www.gad.gov.uk/Demography%20Data/Population/2006/methodology/pensionage.html).

Given that the women's average age of exit from the labour market is already 62.4 we assume that each of these one year increments in the State Pension age is associated with an increase in the average exit age for women by half a year. Hence the percentage rise in the labour force of women is around half the increase in women's population of working age. As we define the participation rate of women as the labour force divided by the population of working age it declines on our baseline, as does the overall participation rate, as we can see from Figure 2.3.

Figure 2.2 Projections for the population of working age

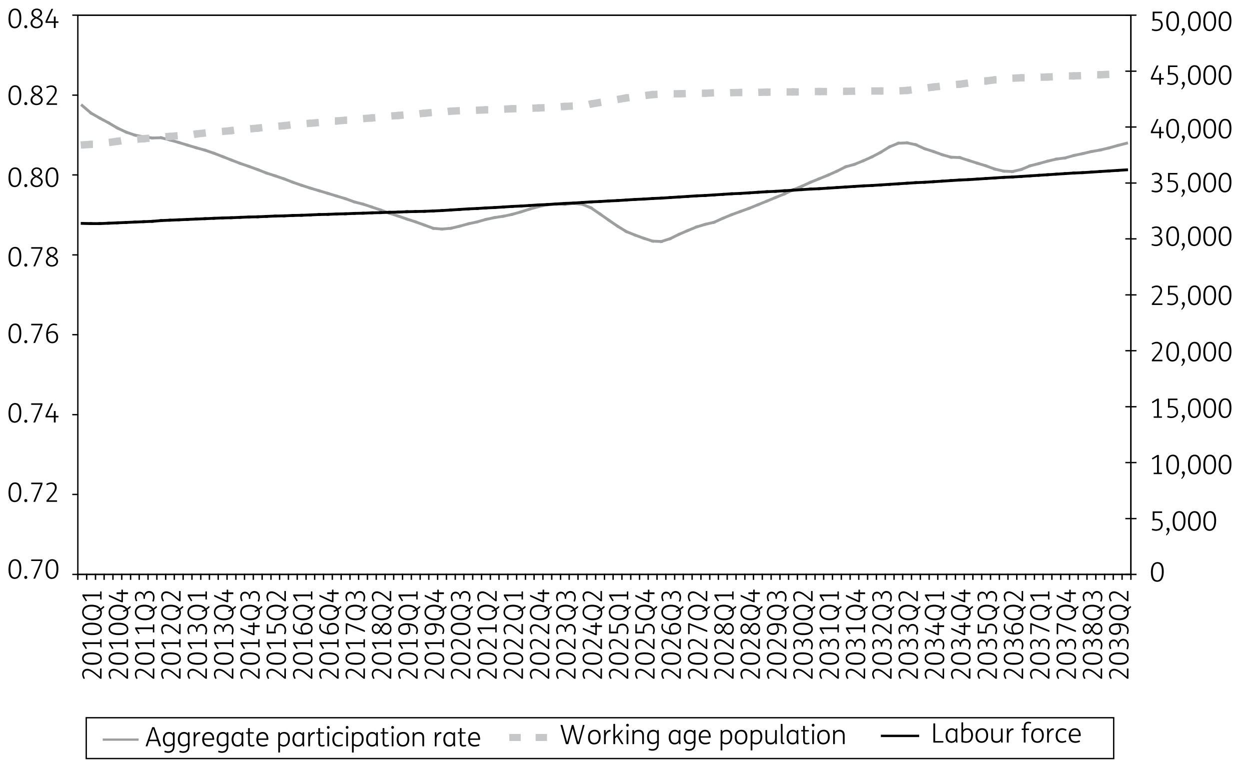


Source: ONS and NIESR assumptions.

We assume that by 2020 men and women exit the labour market at the State Pension age of 65, which is marginally above men's current exit age of 64.5. At the time of writing there is no legislation to increase the State Pension age for men between 2010 and 2020, and therefore, we have not made an adjustment for the participation rate of men[5]. It is to be hoped that men's retirement ages will start to rise in response to both shortfalls in wealth as a result of the crisis in the economy and because perceptions of life expectancy after retirement become more realistic.

5 The work was undertaken before the government announced its intention to the increase in State Pension age to 66 in 2020.

Figure 2.3 Participation, the population of working age and the labour force



Source: ONS and NIESR assumptions.

2.2 Assumptions: economic assumptions underlining the simulations

The economic assumptions used in NiGEM that underpin this report are:

1. Consumers are forward looking, but they discount the future at a higher rate than the market interest rate. The existence of such a myopia premium means that a rise in taxes now that is matched by a cut in taxes in the future will reduce consumption now (we do not assume Ricardian consumers).
2. We assume exchange rates and financial markets are forward looking and respond to expected changes in interest rates. If interest rates are expected to be lower in the future as a result of a policy change then bond and equity prices will rise and the exchange rate will decline now, bringing some of the effects forward.
3. We use price level targeting in our analysis, as we discuss changes in the nominal value of tax revenues into the future. As Barrell, Hall and Hurst (2006) show standard Taylor Rules can leave the price level permanently changed in response to an increase in supply, as can regimes based in nominal targets such as the money stock. This can give misleading results for absolute changes in nominal magnitudes of tax takes and benefit payments. Our forecast baseline has the rate of price inflation on target at around two per cent per annum, and this is maintained in the simulations by an active price level targeting rule.

4 Labour market bargainers take account of both past and future inflation in setting wages, and the unemployment rate returns to equilibrium after a shock, although this takes some time. The real wage adjusts to the supply of labour.

5 We assume that the UK is a small open economy and that an increased workforce leads to a lower real exchange rate in equilibrium in order to ensure that extra output can be sold.

6 Output is determined in the long run by the supply of labour and the level of technical progress, and the capital stock adjusts to maintain the capital output ratio at its equilibrium level. The implications of changing the speed of adjustment of the capital stock are investigated.

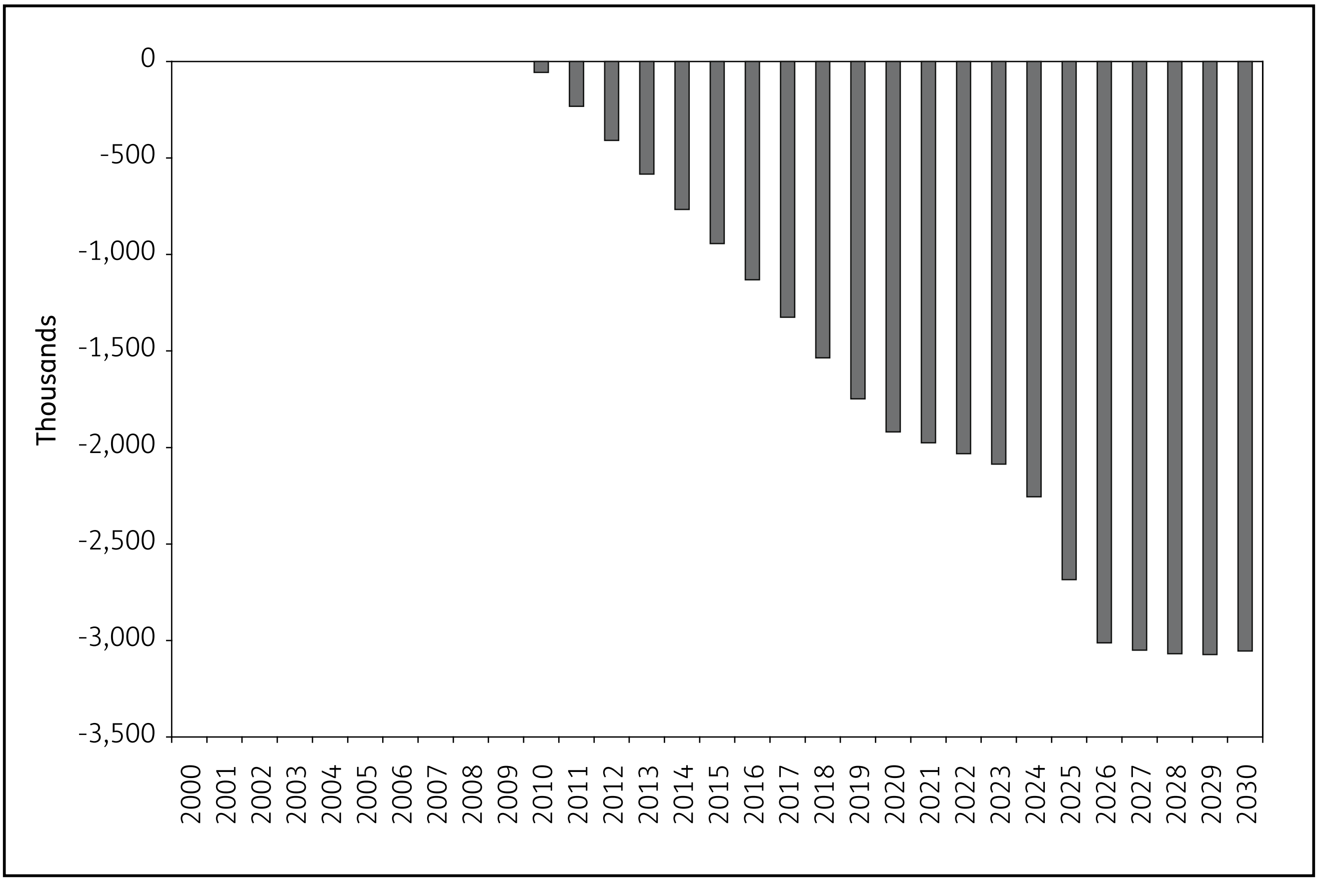
7 We assume that productivity levels of those who remain in the workforce are on average the same as the rest of the population, independent of their age. In most occupations it appears that experience offsets declining physical capacity until late in working lives.

8 As our focus is on the impacts on the public finances from increasing working lives, we use a number of sets of assumptions on the government sector, but our core set keeps government consumption on baseline and tax rates constant. Benefit rates for the unemployed, the retired and those on other benefits unchanged in real terms from the path on our baseline.

3 Retirement counterfactuals

3.1 Simulating the effect of no increases in State Pension age

Figure 3.1 Reduction in the working age population if State Pension age and retirement ages do not change



The impact of holding State Pension ages constant at 60 and 65, for women and men respectively, would be significant, as we can see from the impact on the working age population in Figure 3.1. By 2020 the labour force would be 4.6 per cent smaller than we currently project on our baseline, whilst by 2030 it would be 7.1 per cent lower than on our baseline, with the impact rising to eight per cent after the (abandoning of the) increase in State Pension age in the mid 2030s.

The impact on real GDP would be similar, as we can see from Figure 3.2, as labour supply would be less and capital would have time to adjust. Over the period 2010 to 2030 growth would on average be 0.3 per cent a year lower if we were not to see an increase in the State Pension age and the effective age of retirement. As the withdrawal of the planned increase is gradual we would expect there to be only a small impact on unemployment, as markets work, and we plot the effect on employment in Figure 3.3. However, the household saving rate rises by 2.5 percentage points compared to our baseline by 2020 and by 3.1 percentage points by 2030. Consumption per head would be much lower than on our baseline, not only because people would have had to save more of their current incomes for longer retirements, but less income would have been generated. We estimate that by 2030 consumption per head in the UK would have been around eight per cent lower if retirement ages had not been increasing.

Figure 3.2 Impact on real GDP from a reduction in the working age population if State Pension age and retirement ages do not change

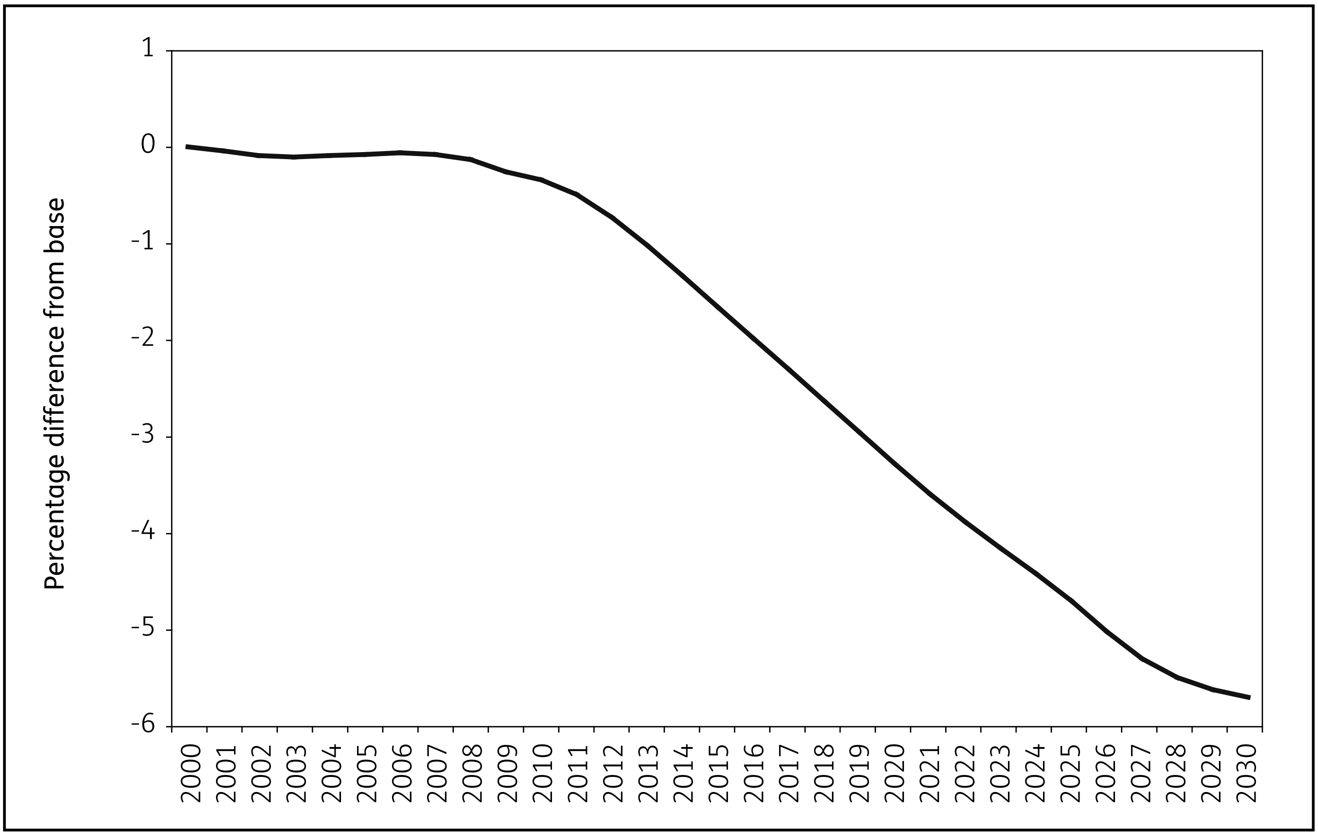
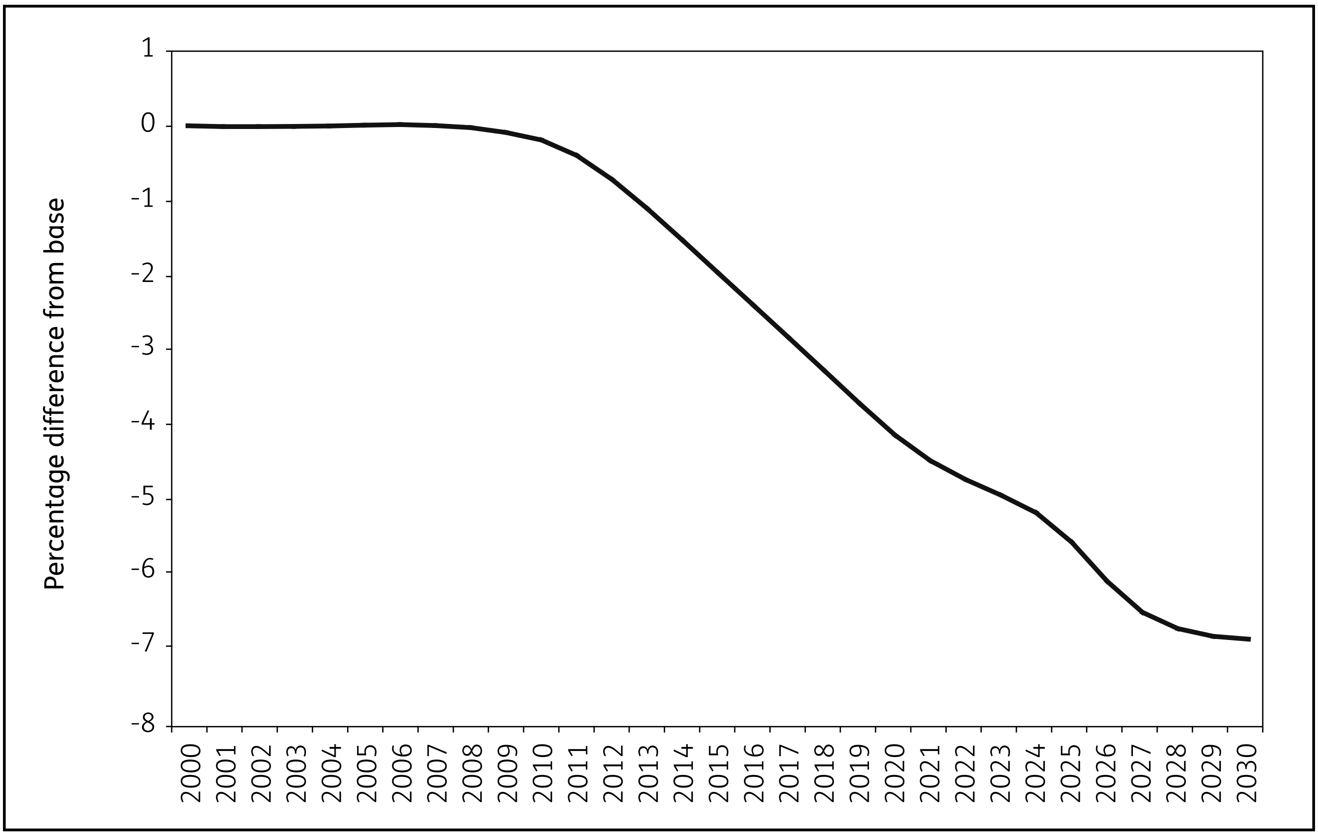
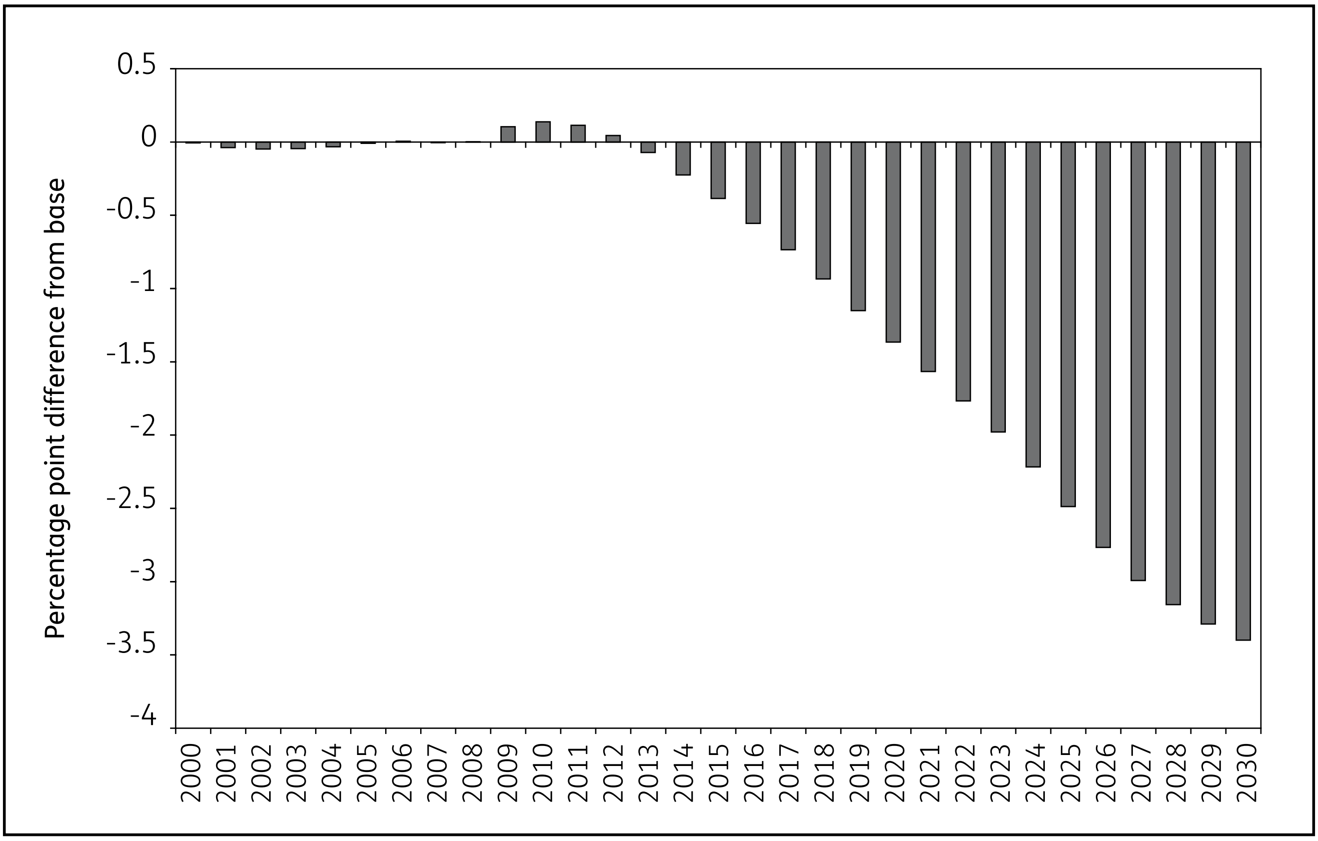


Figure 3.3 Impact on employment from a reduction in the working age population if State Pension age and retirement ages do not change



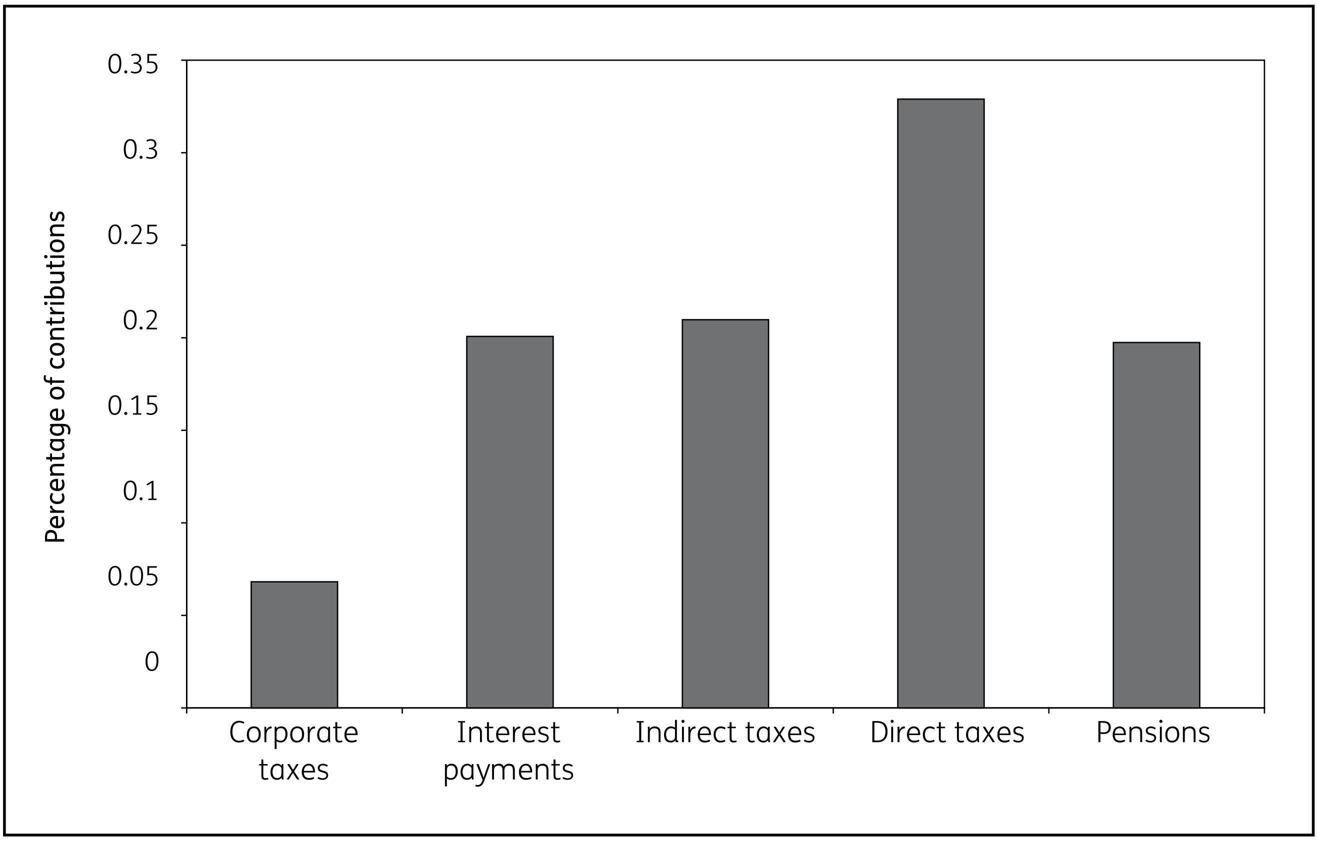
As this a counterfactual exercise we can allow all for any endogenous variations in tax revenues and expenditures to feed through into a shift in the position of the public finances. If we assume that effective retirement ages were fixed, and tax rates, benefit up-rating and government consumption plans are as on our baseline then, by 2030 the government would need to borrow 3.5 per cent more of GDP (see Figure 3.4). Around a fifth of this is due to higher interest payments from the greater accumulation of debt. Figure 3.5 plots the contributions of taxes and spending on pensions and interest payments to the overall deficit increase.

Figure 3.4 Impact on the government budget balance from a reduction in the working age population if State Pension age and retirement ages do not change



The participation rate of those aged 50+ has increased, on average, by 0.54 percentage points over the decade to 2008. Underlying the baseline is the assumption that this trend continues in the future. This continued increase in the rate of labour market participation has a significant effect on the economy. Given the population projections produced by the ONS, a continuous 0.54 percentage point increase in the participation rate boosts the level of real GDP by 3.9 per cent by 2030. The DWP requested an alternative analysis, where participation for this age group increased at a more rapid pace. The impact of a one percentage point increase in the participation rate is broadly double the 0.54 percentage point increase scenario, with real GDP around 7.2 per cent above baseline by 2030.

Figure 3.5 Sources of impact on the budget in 2030 from a reduction in the working age population if State Pension age and retirement ages do not change

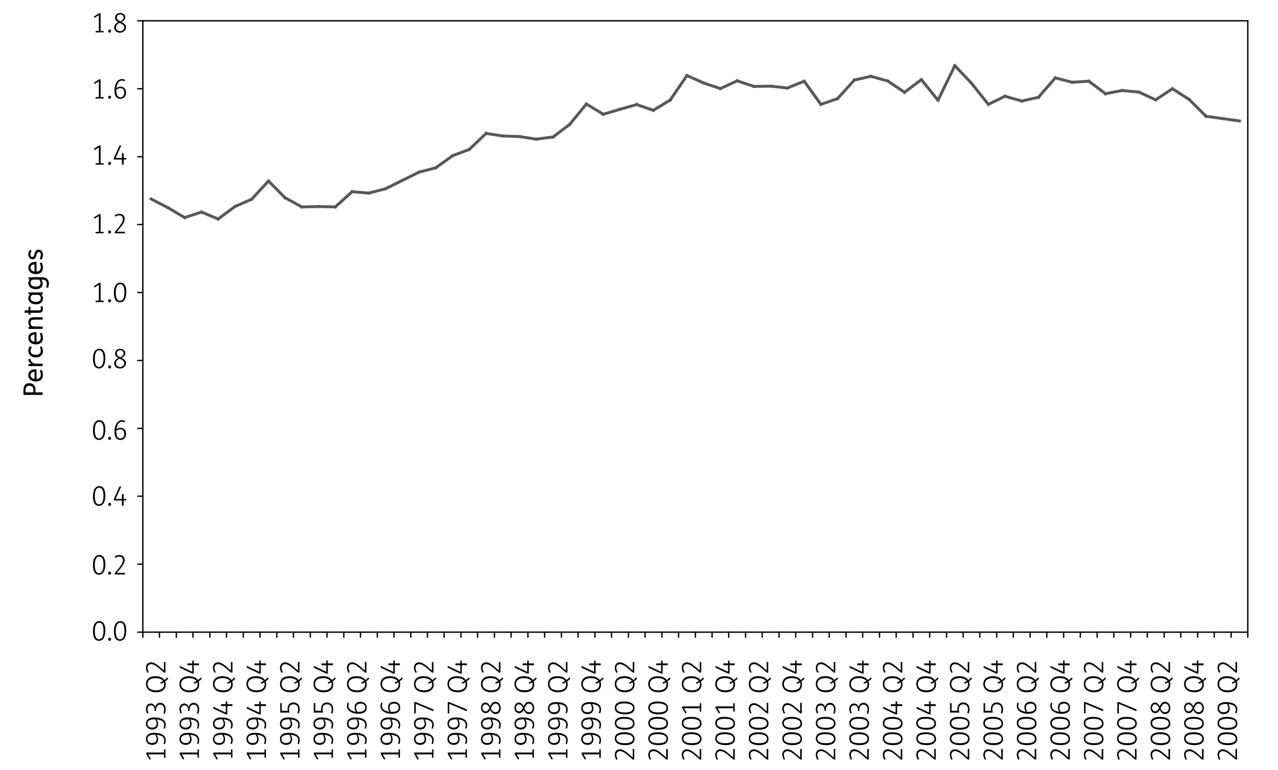


3.2 The effect in the economy by 2009 if there had been no early retirement

We were also interested in the impact on the economy from a change in retirement ages, so that no men retire before 65 and no women retire before 60 in 2009, but those who work longer continue to do so. To implement this scenario we use statistics on the stock of those whom have retired early to create the exogenous shock to apply to the participation rate. Given the adjustment lags in the economy we have applied this shock from 2000, which allows output, employment and tax receipts to adjust to the new equilibrium given our standard assumptions about the responsiveness of private and public sector capital stocks. Figure 3.6 reports the percentage of the working age population who have retired early (i.e. before State Pension age) for the period 1993Q2 to 2009Q3[6]. These people are currently defined as economically inactive in the **Labour Force Survey** data. The participation rate on our baseline would be increased from 2000 in proportion to the series reported in Figure 3.6 if there had been no early retirement over the decade to 2009.

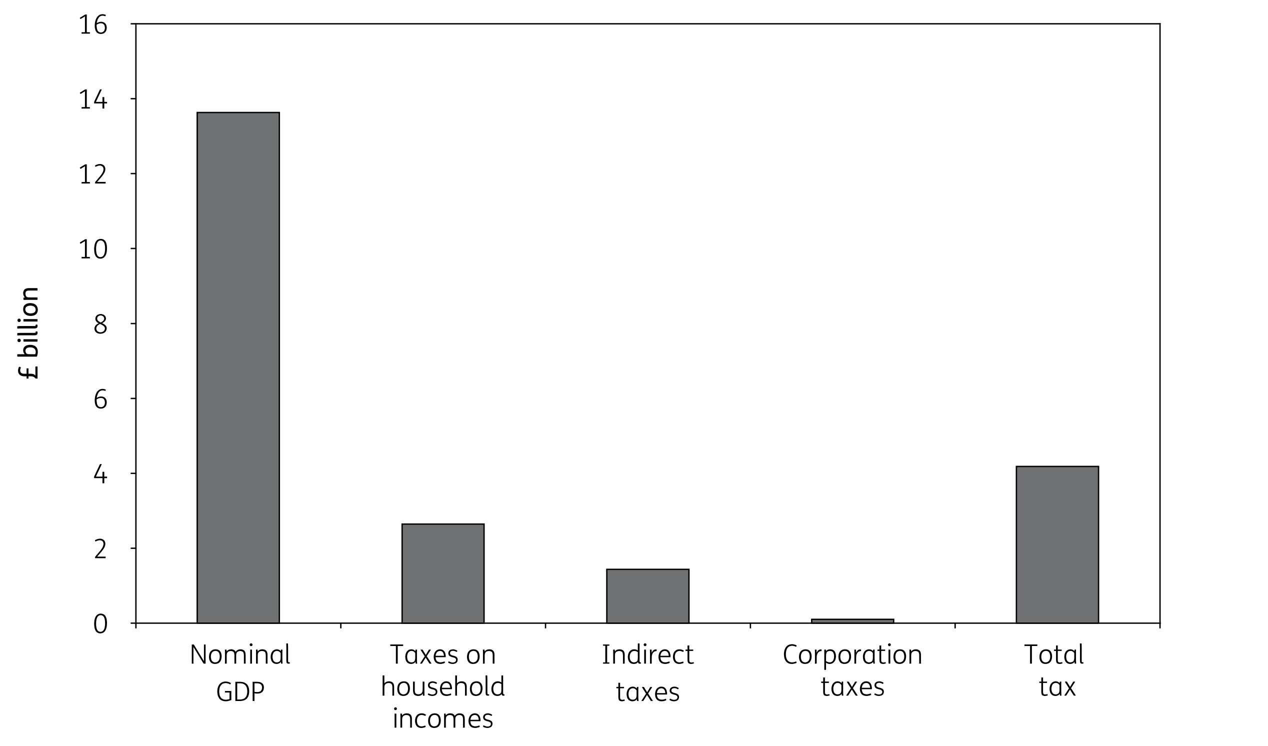
6 Men can retire at 60 with an occupational pension but in terms of extending working lives we define early retirees as those who retire before they have reached State Pension age.

Figure 3.6 The percentage of the working age population who have retired before reaching State Pension age



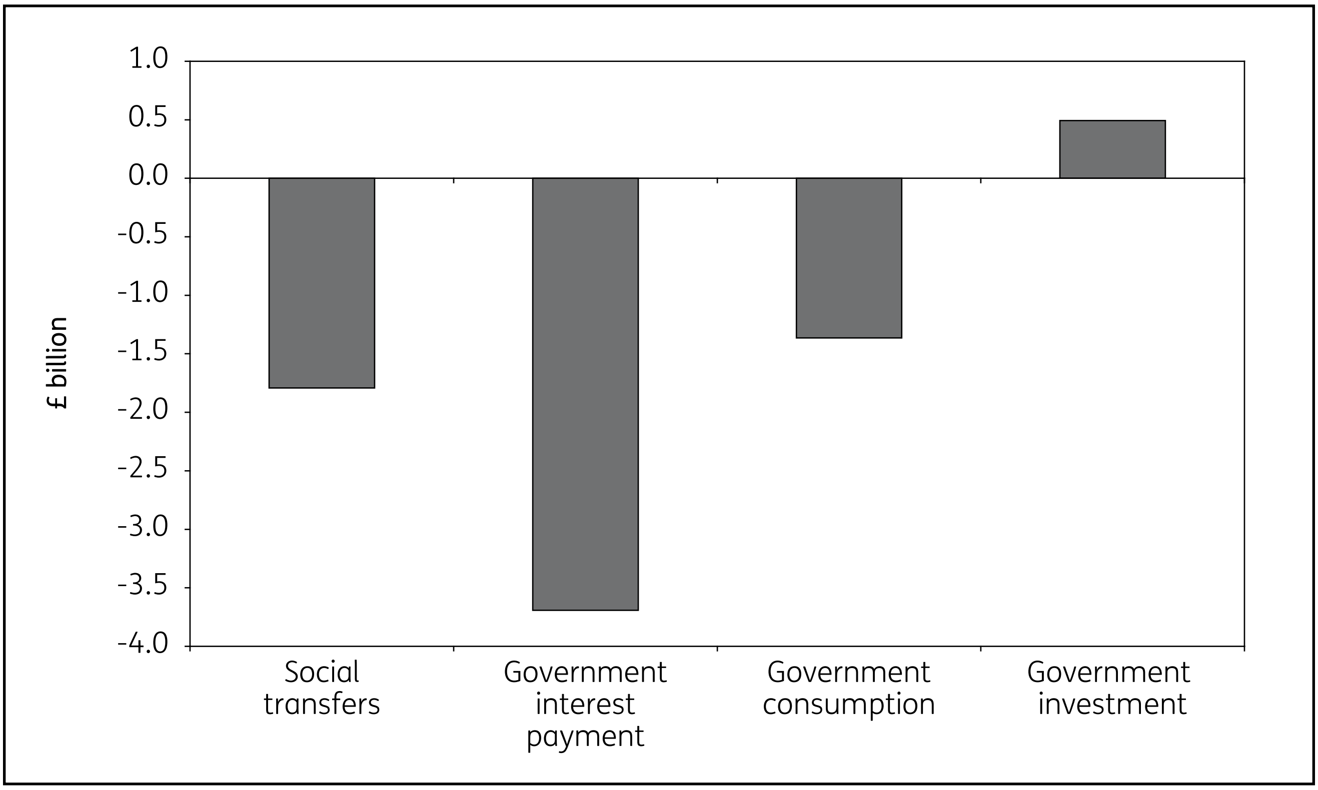
Source: ONS.

Figure 3.7 The impact on nominal GDP and tax revenues in 2009 from raising the average retirement age to include no early retirement



Real GDP in 2009 would be almost 1.5 per cent higher since the capital stock will have adjusted to the expansion of the labour supply. We apply the same assumptions as in the 'core simulations' described in Section 2.2. We assume price level targeting, while tax rates are assume to remain unchanged from our baseline projections and real government consumption expenditure are fixed at its current trajectory. As Figure 3.7 shows, tax revenues would have been around £4 billion greater than currently expected due mainly to higher income tax receipts and more indirect tax revenues from greater consumption. Figure 3.8 reports the impact of this scenario on government spending. The main change is to spending on government interest payments. With a boost to tax revenues and a slight fall in spending due to lower transfer payments and a lower price level in the short term, the accumulation of government debt is significantly lower. This is turn reduces the scale of government interest payments by around £4 billion per annum in 2009.

Figure 3.8 The impact on government spending in 2009 from raising the average retirement age to include no early retirement



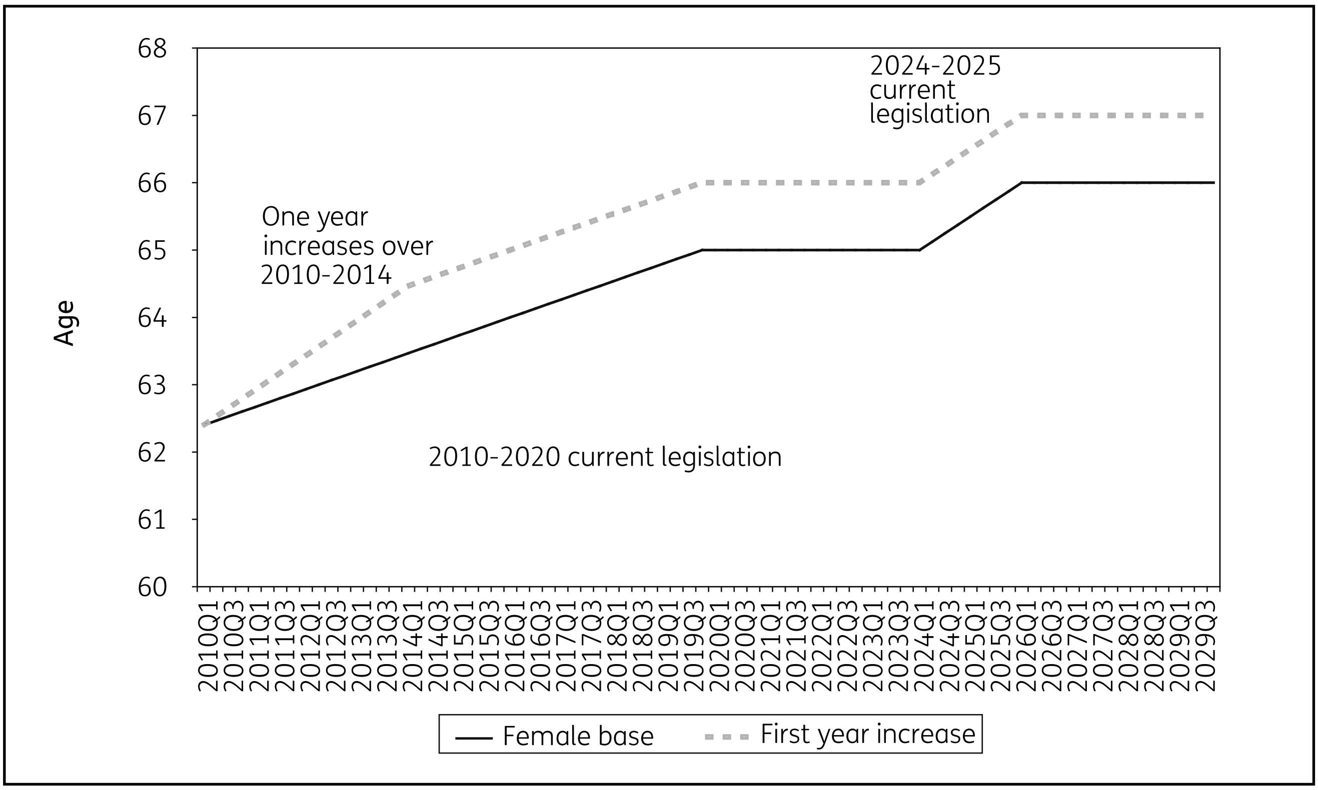
4 The impact of a one year increase in working life

This section reports on the core of the work for the project. The scenarios were chosen to enable a comparison of different plausible variants on extending working lives. They were designed to highlight the differences between less and more radical changes, including increasing working lives by one, two or three years; implemented at different speeds and over differing future time horizons (starting now or in ten years time). Sensitivity analyses around these results are also discussed.

4.1 The construction of the scenarios

We first increase the age of effective retirement by one year for both men and women progressively from April 2010 to March 2014, basing the increments in each quarter on the size of the relevant age group. The State Pension age, which determines the population of working age, and also the age at which retirement takes place increase by a one month every four months for men over this period. The State Pension age increases by three months every four months for women, including the two months for every four months that is already included on the baseline from 2010. However, the effective retirement age for women, which determines the labour force, is assumed to increase only half as fast as the State Pension age. By the end of this period women will retire at age 64.5 instead of 63.5 in March 2014, and men will retire just before 66 as compared to just before 65. By 2020 the average retirement age of men and women is assumed to reach 66, and by 2026 their average retirement age is assumed to have risen to 67[7].

Figure 4.1 Baseline and the one year increase in women's retirement ages



[7] This is one year greater than the plans for the State Pension age that existed up until the recent government announcement that they intend to increase in the State Pension age to 66 in 2020.

The evolution of the effective retirement age and the population of working age are plotted in Figures 4.1 and 4.2 along with 4.3 and 4.4 below. The impact on effective labour input, rather than the labour force is however, smaller, as we assume that those who do not retire work only three quarters of average hours of those in employment.

Figure 4.2 Baseline and the one year increase in men's retirement ages

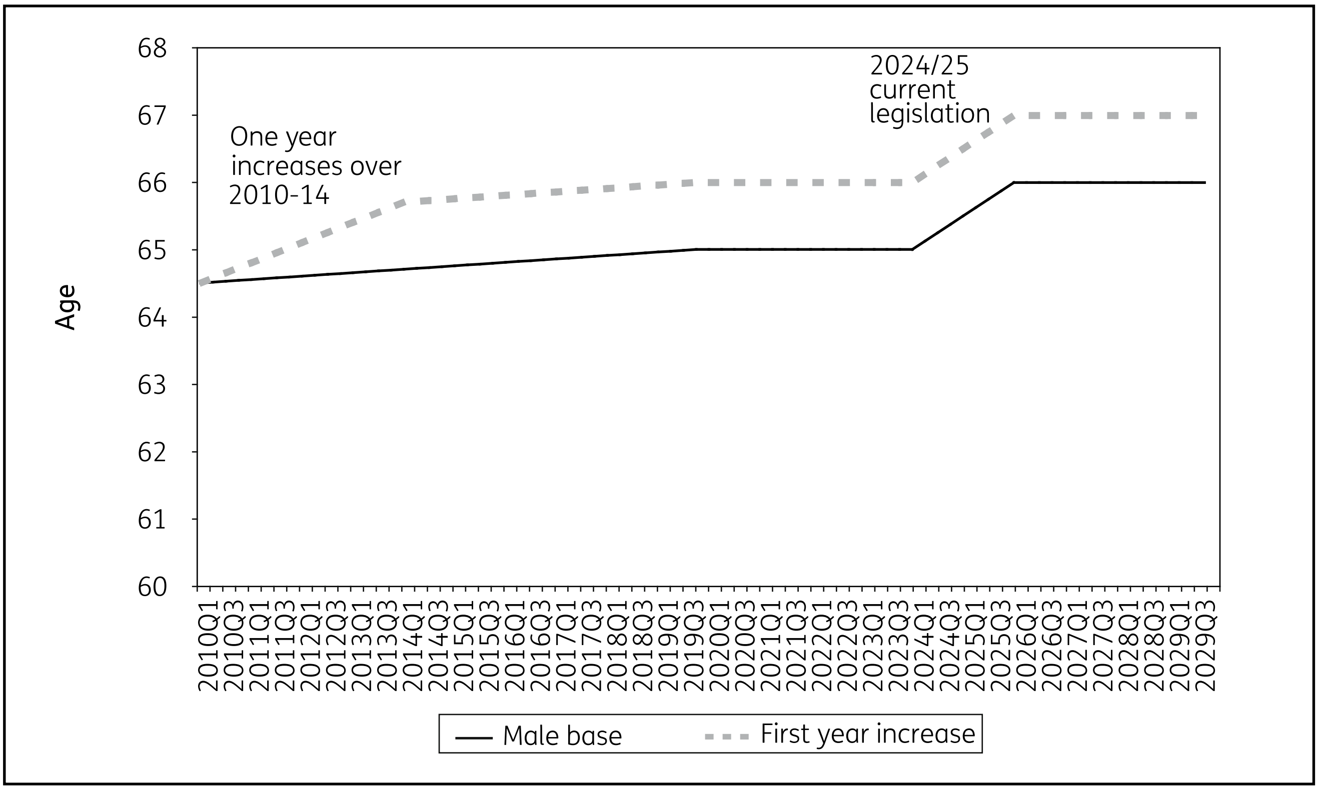
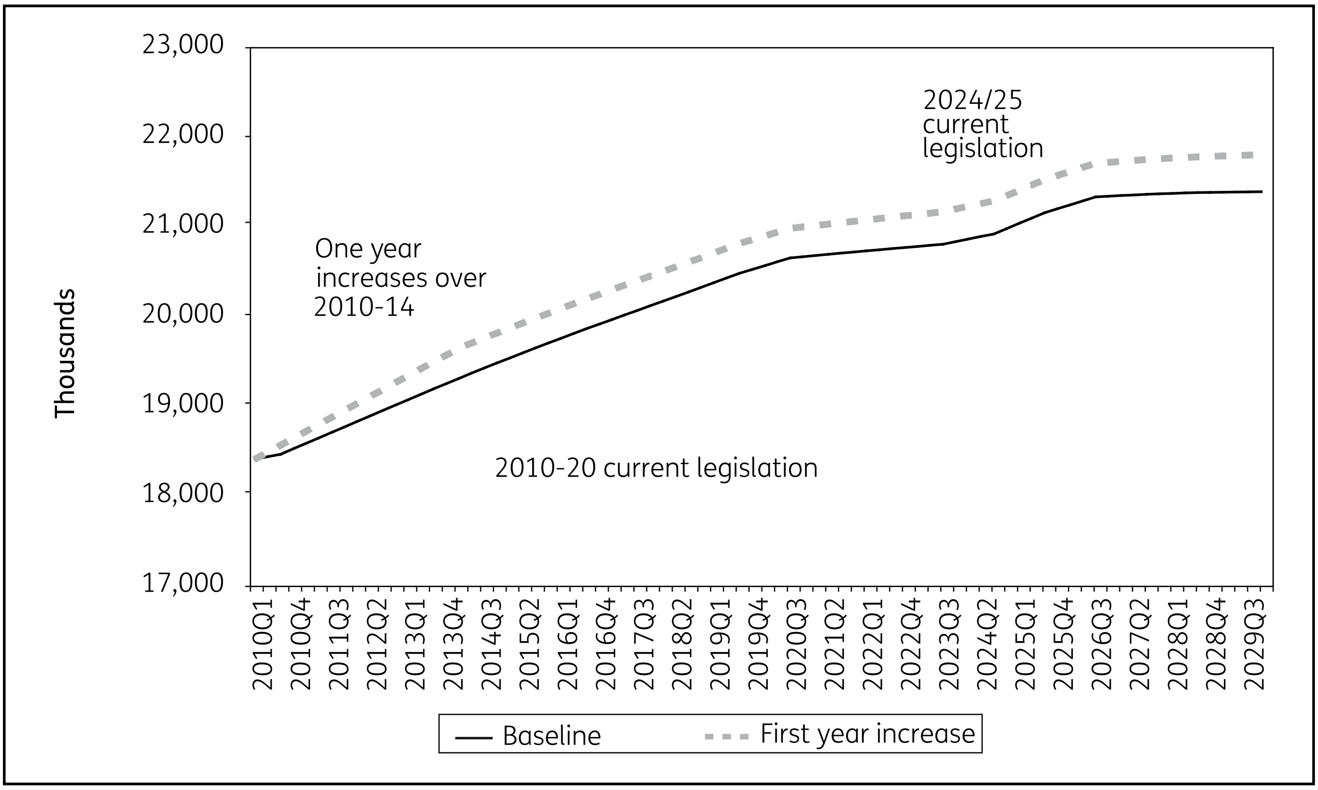
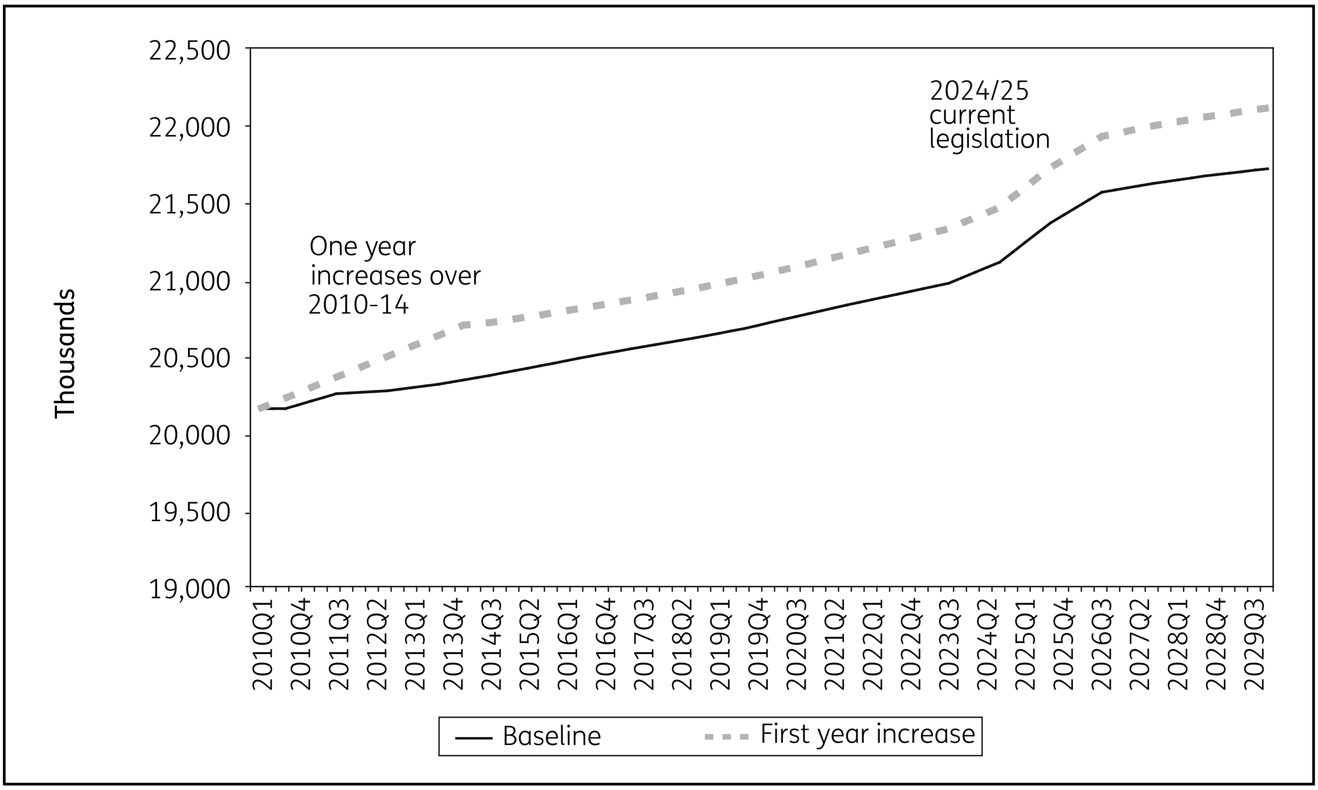


Figure 4.3 The working age population of women under the baseline and the one year increase in working life



As we assume a rise in State Pension age is matched by an equal rise in the effective age of retirement, the rise in the male workforce is proportional to the rise in the working age population. We assume that the hours worked by the retained workforce are the same as those of the age group one year below. However, it is possible that people plan to run down their hours for several years before retirement and they may choose to delay the start of the rundown. If this adjustment were to start one (calendar) year later as a result of an increase in the age at which people retire then the increase in labour input would be greater.

Figure 4.4 The working age population of men under the baseline and the one year increase in working life



We undertake several pieces of sensitivity analysis. The first varies the hours of work undertaken by those retained in the workforce, firstly raising them half way to economy wide average hours and secondly reducing them by the same amount. This is discussed in the subsequent section. We also investigate the impact of varying the assumption concerning the speed of the adjustment of the capital stock. The results from this variant analysis are reported in Appendix C. The capital stock simulations involve both accelerating and slowing the speed of private sector capital stock adjustment, and this has implication for unemployment and hence for the path of the government budget deficit. We also change our assumptions on the speed of adjustment of the public capital stock making it adjust at the same speed as the private sector stock and hence inducing the economy to reach its new equilibrium more rapidly.

4.2 The core scenario

We implement the core scenario as a one year increase in working life, gradually phased in as discussed in Section 4.1 under the assumptions discussed in Chapter 2 along with our hours assumption. Figure 4.5 plots the absolute increases in the population of working age. Figure 4.6 plots the increase in the working age population as a percentage of the baseline population of working age. This clearly shows that this is a gradual increase in the average retirement age. Figure 4.7 shows the maximum size of the increase in the working age population if the one year increase in working life were to be in place in the year in question. Potential increase in the working age population is larger in the early part of this decade than in the last few years of the decade because the size of the relevant cohort shrinks over the period. Given the unequal distribution of population across different age groups it is perhaps unsurprising that the increase is less than two per cent. Indeed it is only by 2014 that the increase in the working age population stabilises at around 1.75 per cent, with the size of the percentage effect depending on the size of the relevant cohort in the year in question. The impacts of the labour force increases are anticipated both by consumers and by producers. Consumers know that they will have to save less for retirement, and will spend more in advance of the change in retirement ages, producers will be aware they need more capital to go with the increased future labour force, and hence will invest more now. In addition to these direct effects financial markets will know that the labour force will increase and that this will put downward pressure on wages, prices and interest rates in the future, and hence the exchange rate will fall marginally as soon as the policy is implemented, and output will be stimulated.

Figure 4.5 The increase in the working age population due to a one year extension in working life

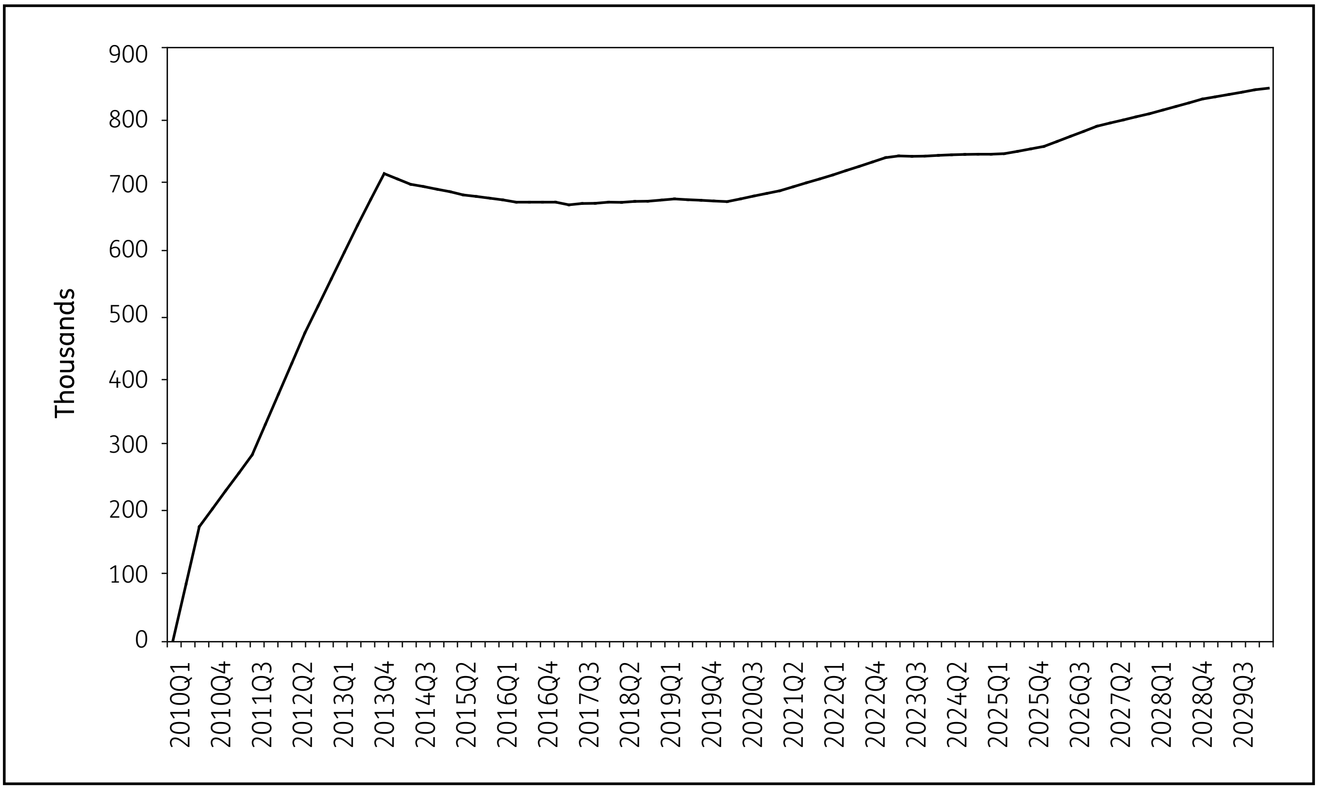
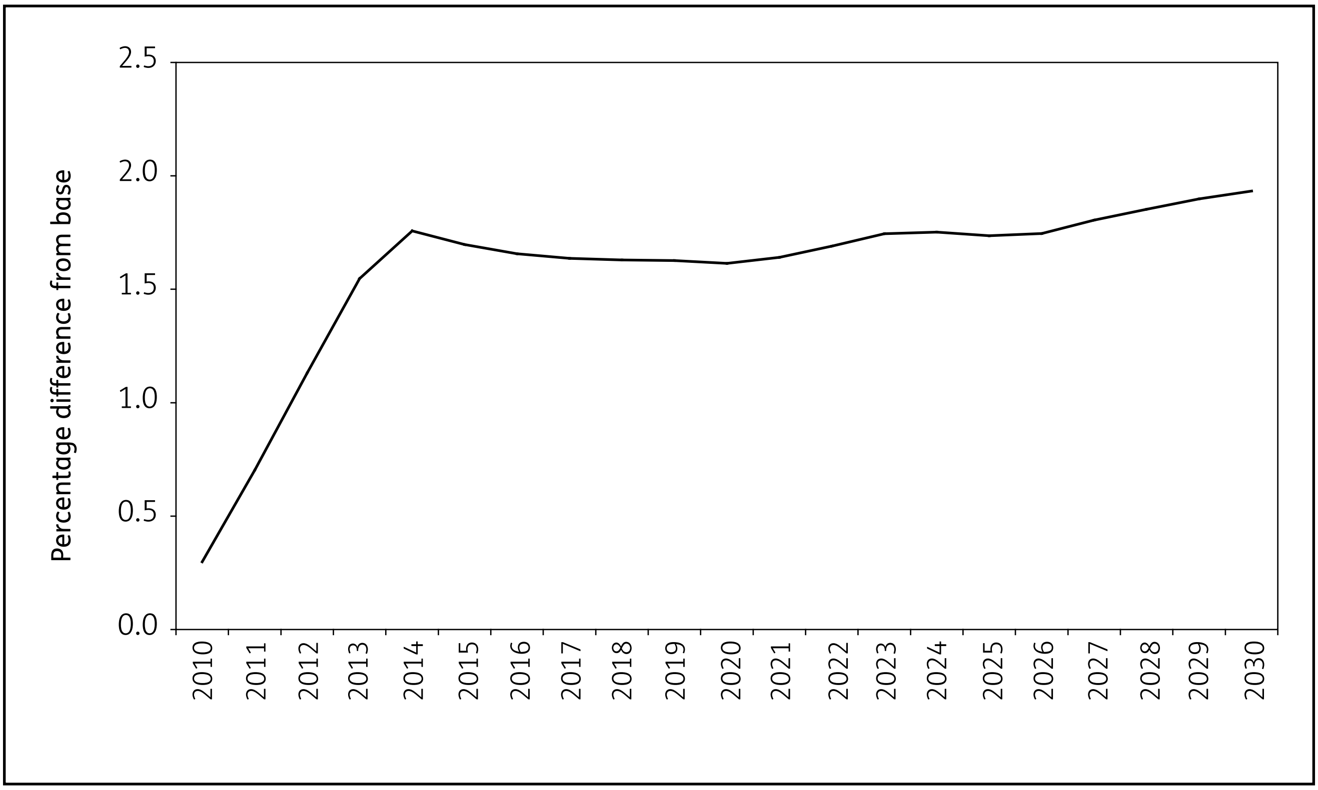


Figure 4.6 The increase in the working age population due to a one year extension in working life, per cent increase in the working age population



The detailed output from the one year increase in working life scenario is reported in Tables B.1 to B.8 (Appendix B). Table B.1 gives the increase in GDP due to a one year increase in average retirement ages in real and nominal terms. Table B.1 also details the impact on consumption and the change in the household saving rate, which declines by around 0.75 percentage points in the long run after a one year extension to working life. Household incomes are increased by around one per cent by the extension in working life. The boost to household consumption is even greater: a one year increase in working life boosts real consumption by almost 1.25 per cent as household incomes are higher, but less saving is required to fund retirement.

Figure 4.7 The maximum increase in the working age population from a one year increase in working life

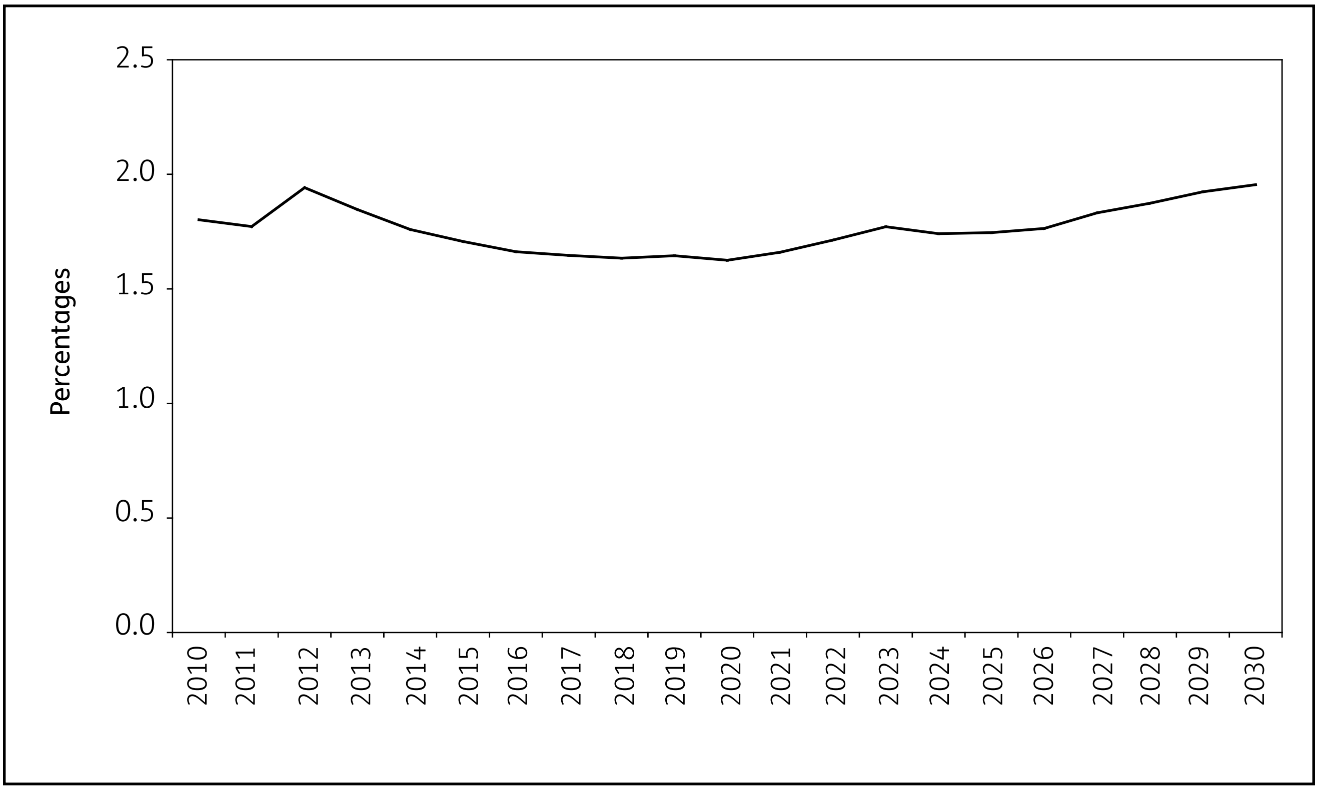
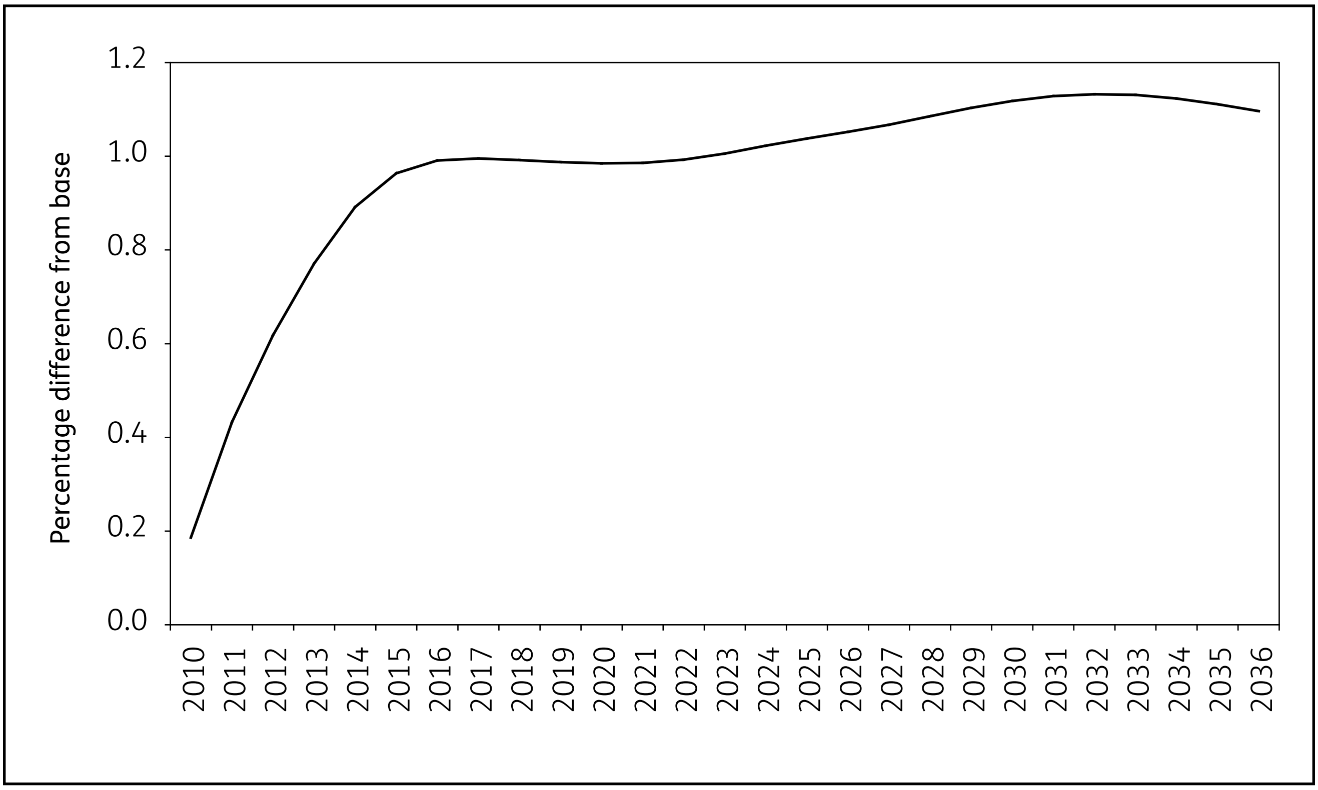


Figure 4.8 The effect on real GDP from raising the population of working age through extending working lives by one year



A one year extension of working life implemented immediately increases real GDP by around one per cent extra after about six years after its implementation, which is around 80 per cent of the increase in the labour force. Figure 4.8 plots the effects on the level of real GDP. These would be smaller for increases in working lives later in the decade, as the relevant cohort is smaller, but as there would be more time to adjust the capital stock in advance the full effects may come through more quickly. Table B.2 detail the impacts on employment and labour input (hours multiplied by employment) which is also plotted in Figure 4.9.

As markets work slowly, and output follows the increase in the labour force, initially unemployment might be expected to rise, albeit by a small amount, as flows through the labour market will be affected. As we can see from Table B.2, employment starts to rise immediately in all scenarios and in the one year scenarios by 2013 employment has risen by 1.3 per cent[8]. The unemployment rate might temporarily rise and in this core scenario peaks at 0.2 percentage point two years after implementation. Subsequently, the unemployment rate would be expected to return to baseline implying no effect on the rate of unemployment from 2014 onwards.

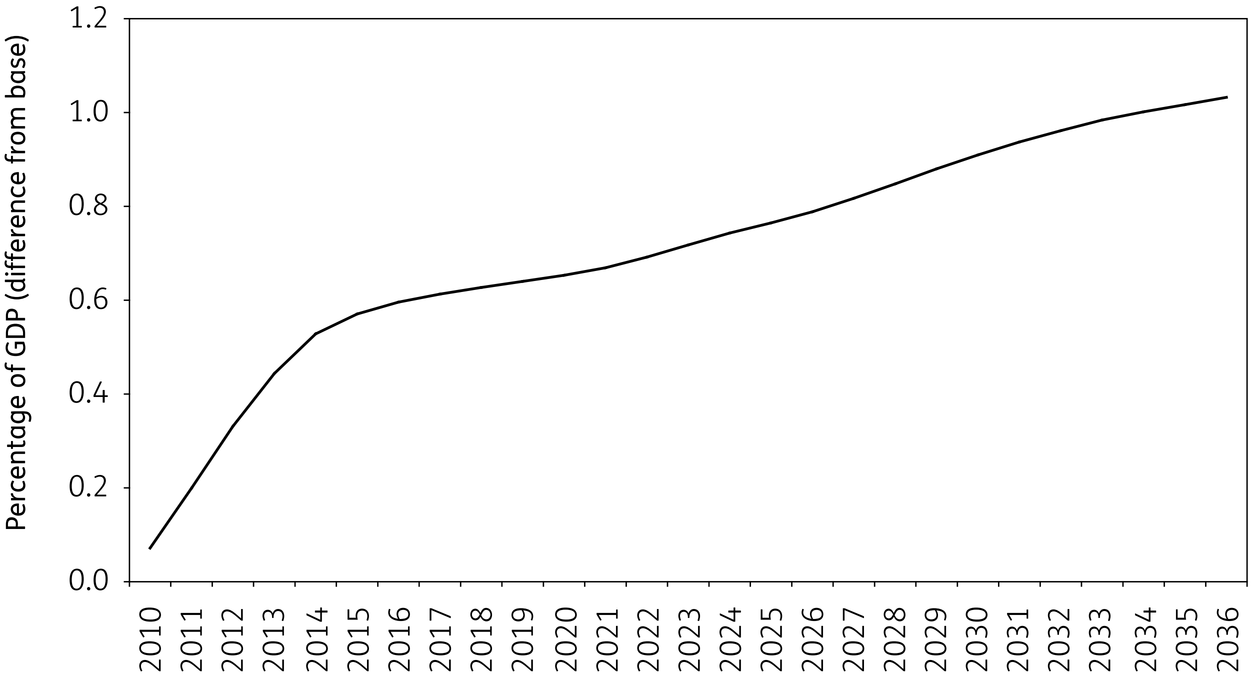
An increase in the size of the workforce without any change in technology available is likely to lead to a decline in real wages in order that more of the same bundle of goods can be sold on the world market. In our core and fast adjustment cases real wages fall by around 0.3 percentage points to help absorb the increased workforce. Each quarter almost a million people flow through unemployment, and some will find it marginally more difficult to find work, but this is only a temporary phenomenon. Indeed, Elsby and Smith (2010) show that outflows from unemployment to employment have held up well in the recent recession. As we have noted the size of the economy has been expanded, but given that the population size is fixed this implies an increase in per capita GDP from the extension of working life.

8 The results presented in this paper are not comparable to the evidence contained in the White Paper on bringing forward the increase in State Pension age (Department for Work and Pensions, 2010). The effect on employment is larger in this report for a number of reasons: our work concerns the extension of working life, not just raising the State Pension age. The White Paper does not allow for any effect through the adjustment of the capital stock. We model an immediate effect, rather than a change that begins in 2018.

Figure 4.9 The effect on the unemployment rate and the labour input from raising the population of working age through extending working lives by a year

The empirical studies of the labour market on which NiGEM is based suggest that an increase in labour supply is absorbed in four years. Barrell and Dury (2003) discuss the wage equations on the model, and show that unemployment is determined by the factors affecting the wage bargain and by productivity. Real wages adjust to equilibrium, and the speed of adjustment depends on the degree to which wage setters look forward or backward in relation to price developments. The equilibrium level of employment will depend on the real wage given by the bargain, and will depend on the labour demand curve as derived in Barrell and Pain (1997). These equations are regularly updated and tested for structural changes. As with migration, which is analysed using NiGEM in Barrell, Gottschalk, Kirby and Orazgani (2009) and Barrell, FitzGerald and Riley (2010) an increase in labour supply from later retirement can be expected to be absorbed first by real wages adjusting downward and then by labour demand increasing as capital is put in place and domestic and foreign demand increases or is diverted to cheaper UK goods.

Figure 4.10 The effect on the government budget balance from raising the population of working age through extending working lives by one year



The effects on the public sector finances are detailed in Tables B.3 to B.8. As we can see from Tables B.3 and B.4, the increase in direct tax revenues (in billions on Table B.4) is larger than the increase in indirect tax, although the percentage increase (on Table B.3) in indirect taxes is larger as consumption, which is the base for indirect taxes rises more than output as consumers need to save a lower proportion of their incomes. This increase in consumption relative to output will be reflected in a slight deterioration on the balance of payments current account, as is discussed in Barrell, Hurst and Kirby (2009). This in part reflects the general need for a smaller stock of financial assets in preparation for a shorter period of retirement, and the composition of wealth will shift toward domestic assets. Corporation tax receipts also rise more than in proportion to income as a change in the labour supply will affect the capital share in the model as the estimated elasticity of substitution is around 0.5. It takes time for corporate tax revenues to rise as profits will increase only as the economy adjusts fully to equilibrium and they are collected with a lag. Table B.5 compares the proportionate effects of individual taxes on the overall increase in revenue, and it is clear that corporation taxes contribute only ten per cent or so of the gain with the rest being shared in nearly equal terms by (larger) direct tax receipts and indirect taxes.

We assume government consumption is fixed in real terms, and only changes in nominal terms if its deflator (or rather the public sector wage rate) is affected. Government investment reacts, albeit slowly and hence spending rises in nominal terms. Transfers to individuals decline, but the fall is only around half of the increase in taxes in 2020 for instance. As we can see from Tables B.6 and B.7, government interest payments fall, and this fall becomes more important over time as the debt stock is paid off. Figure 4.10 plots the effects on the government deficit as a per cent of GDP (with forecast baseline tax rates, forecast baseline government consumption and other items responding endogenously).

The improvement in the deficit continues over the whole of our period of analysis because we assume tax rates remain fixed. An improvement in the budget balance relative to baseline implies a smaller debt stock in the future. As a consequence, government interest payments decline incrementally. The reduction in the deficit is smaller than in Barrell, Hurst and Kirby (2009) in part because we assume here that working lives are extended by one year, whereas previously we had assumed effective working life rose by one year, which given hours near retirement are below average, actual working lives rose by one and a half years. In addition, in that paper we assume government investment plans are set along the forecast baseline trajectory rather than responding to higher output. As a result of our assumptions here a one year increase in working life would improve the deficit by 0.5 per cent of GDP by around 2014 (see Figure 4.10). This number is largely dependent on the assumptions made about tax and spending.

5 Variant analyses

5.1 The importance of the assumptions of average hours worked by those extending their working lives

We have undertaken a sensitivity analysis of the impact of our hours worked assumption, reducing hours for the retained individuals to 61 per cent of average hours, and also raising it to 87 per cent of average hours. We multiply these changes by the per cent increase in population of working age (and hence labour force given no assumptions were made about participation) in our scenario where we have one more year on working life.

The more hours worked by those retained in the workforce the larger the effect on GDP, as we can see from Figure 5.1 which plots the effects on real GDP. Figure 5.2 plots the impacts of the changes in the hours worked assumption on the government deficit. The more hours people work, the higher their incomes and the more tax they pay.

Figure 5.1 GDP effects of one year extension of working lives: variations in the assumption on hours worked

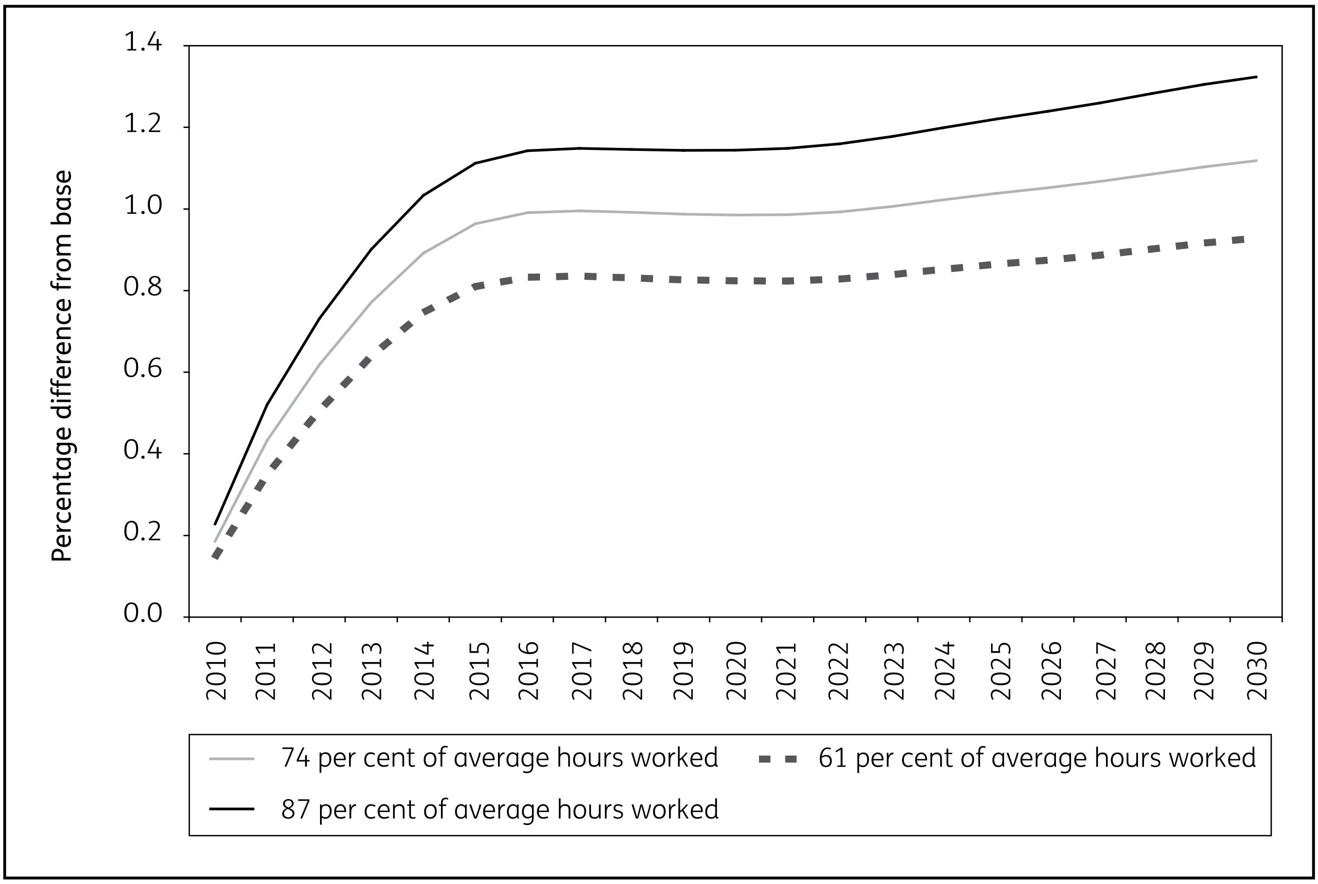
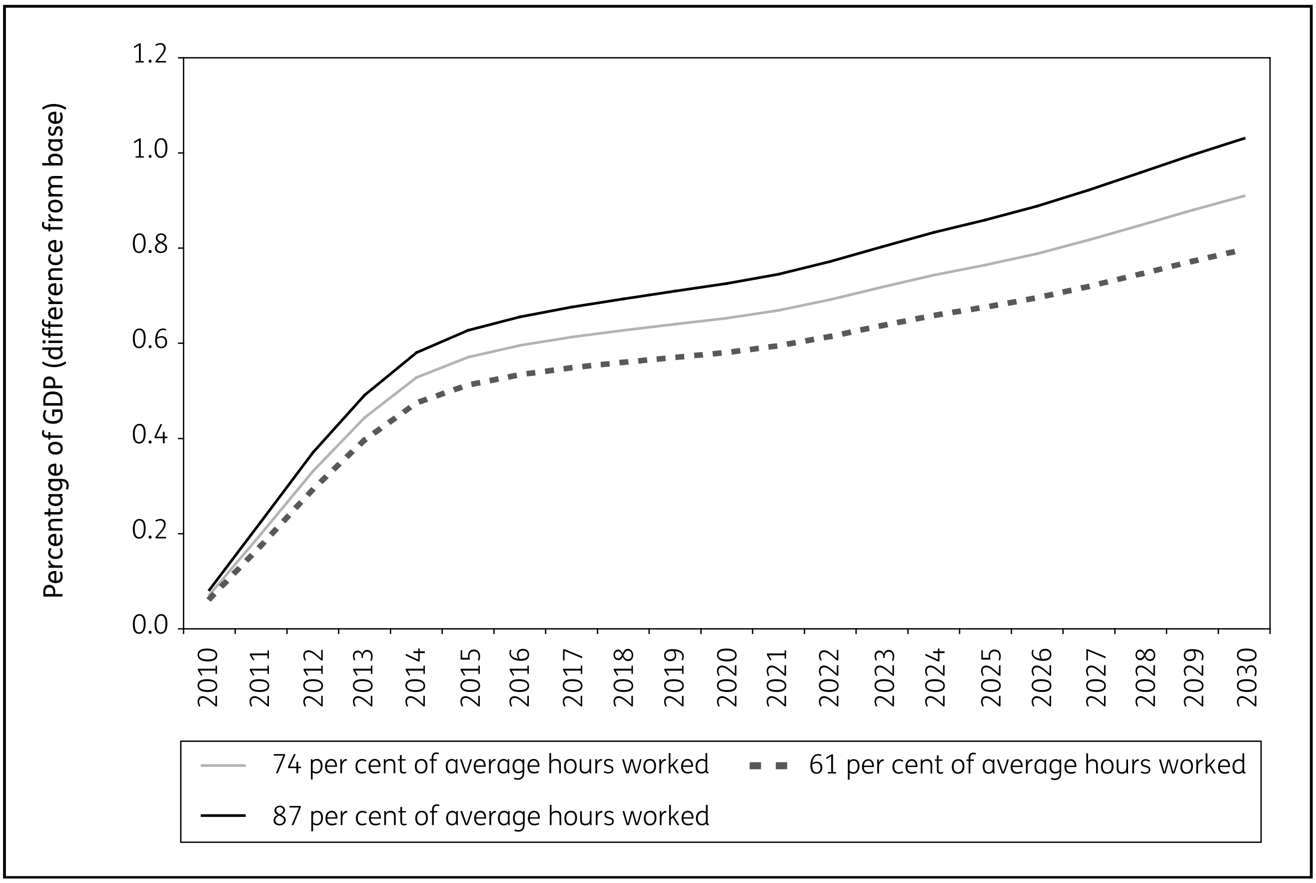


Figure 5.2 Effects on the government deficit from extending working lives by one year: variations in the assumption on hours worked

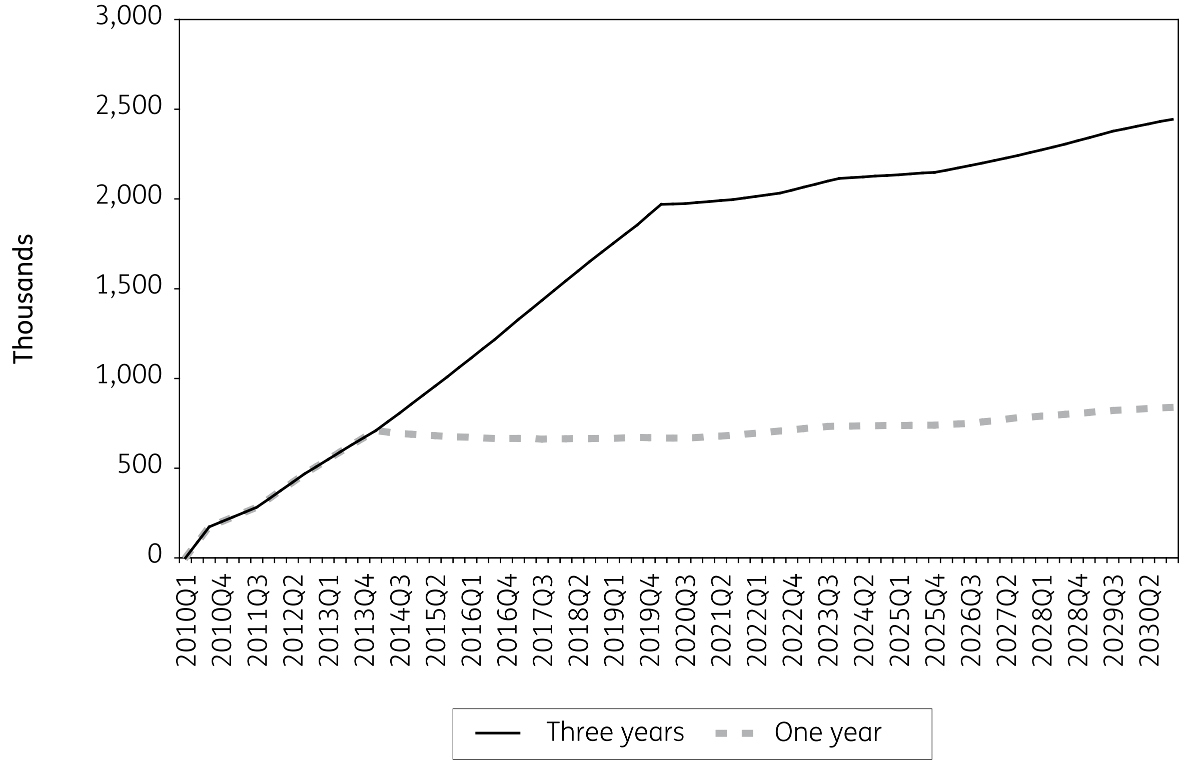


5.2 An alternative scenario: the impact of a three year increase in working lives

The three year increase in working lives is implemented on the same basis as the one year increase discussed in Chapter 4. The three year extension in working life is spread over a decade. Figure 5.3 plots the absolute increase in the population of working age from the three year increase in working life. Figure 5.3 also includes the one year increase for comparison. Figure 5.4 plots the impact on GDP from the three year increase in working life alongside the effect from a one year increase in working life. It is clear from this that the three year increase in working life has about three times the impact in the long-run.

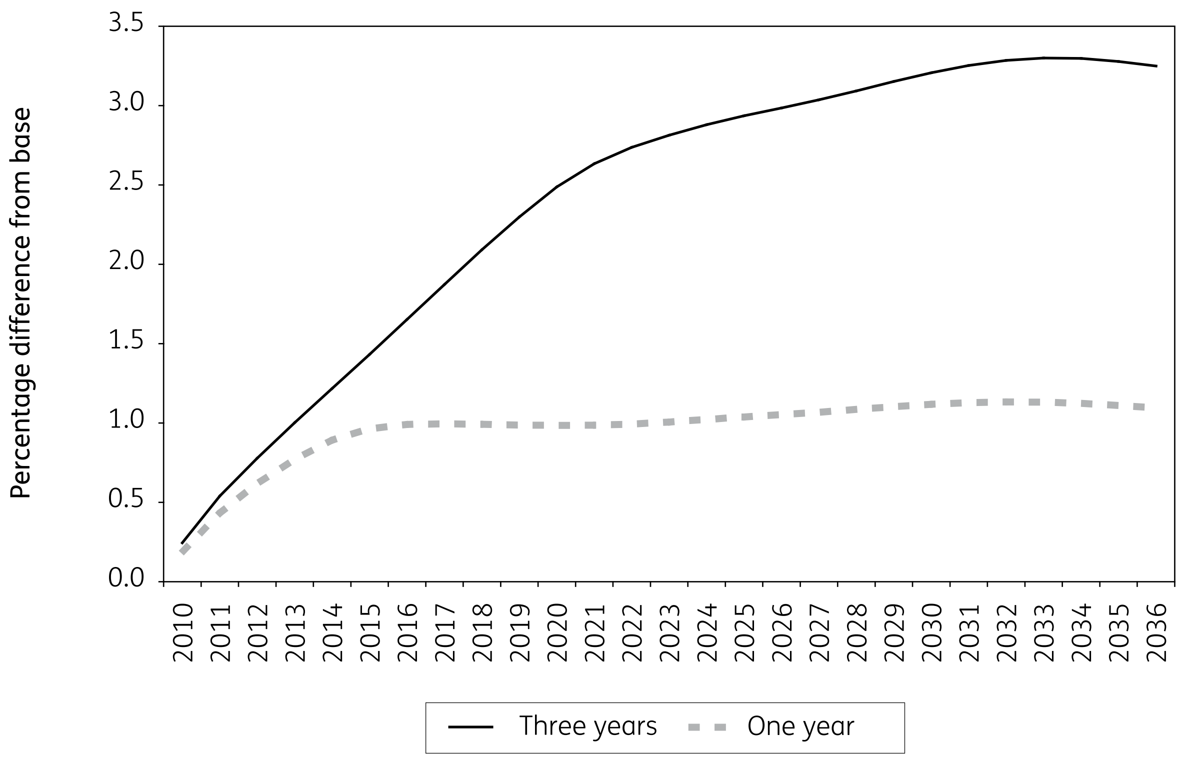
However, it is noticeable that the impact over the first five years is higher under the three year increase than in the one year increase in working life. This is because of the anticipation of labour force increases by both consumers and producers. Consumers know that they will have to save less for retirement under the three year extension than the one year extension, and will spend more in advance of the change in retirement ages, producers will be aware they need more capital to go with the increased future labour force, and hence will invest more now. As in the case of the one year shock there are indirect effects from financial markets who anticipate the increase in the labour force and putting downward pressure on wages, prices and interest rates in the future. As a consequence the exchange rate will fall marginally further in the three year extension to working life than in the one year, stimulating GDP further.

Figure 5.3 Increases in the working age population due to an extensions in working life by three years



Note: The impact of a one year increase in working life is included as a comparison.

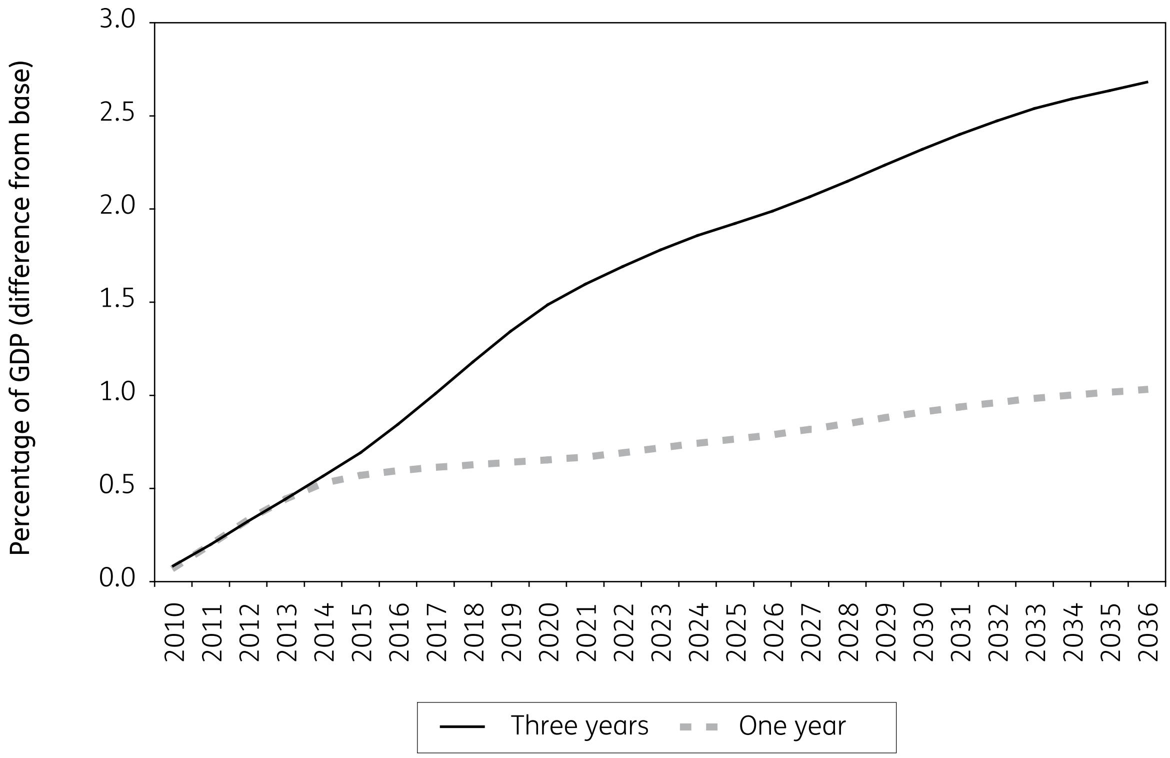
Figure 5.4 The real GDP effect from raising the population of working age through extending working lives by three years



Note: The impact of a one year increase in working life is included as a comparison.

Each extension of working lives increases real GDP by around one per cent extra after about six years after its implementation, which is around 80 per cent of the increase in the labour force. Figure 5.4 plots the effects on real GDP in both the one year and three year scenarios. As markets work slowly, and real GDP follows the increase in the labour force, initially unemployment might be expected to rise, albeit by a small amount as flows through the labour market will be affected.

Figure 5.5 The effect on the government budget balance from raising the population of working age through extending working lives by three years



Note: The impact of a one year increase in working life is included as a comparison.

As in the case of the one year increase in working life we assume government consumption is fixed in real terms, and only changes in nominal terms if its deflator (or rather the public sector wage rate) is affected. Government investment reacts, albeit slowly, and as a consequence spending rises in nominal terms. Transfers to individuals decline, but the fall is only around half of the increase in taxes in 2020 for instance. In both the one year and three increases in working life government interest payments fall. The contribution of the lower interest payments to the improvement in the government's budget balance as the debt stock is paid off. Figure 5.5 plots the effects of both the one year and three year increases in working life scenarios on the government deficit as a per cent of GDP (with forecast baseline tax rates, forecast baseline government consumption and other items responding endogenously).

6 Conclusions

Significant measures have been undertaken to extend working lives, and these will be having an impact on the prospects for economic growth. In the absence of any of the currently legislated changes to State Pension age and changes in retirement behaviour we have seen, by 2030 the working age population would be three million less than currently projected. We undertook a counterfactual analysis of what would have happened if there were to be no increase in State Pension age over the next 40 years. Our results suggest that the future level of real GDP would be around six per cent lower than is currently projected to be the case by 2030. With fixed expenditure plans and tax rates the government's budget balance would be worse by around 3.5 per cent of GDP by the same date.

A one year increase in working life phased in over the next few years would raise the labour force in the UK by around 1.75 per cent, varying from year to year depending on the size of the cohort. In the short run we would expect there to be a temporary increase in the rate of unemployment as the economy adjusts to this expansion of labour. Extra workers can be absorbed if wages are flexible and through normal turnover in the labour market. A key determinant of the speed of adjustment would be the extent to which businesses react and provide the necessary capital with which the expanded labour force is able to work.

Our results suggest a one year increase in working life would, after six years, boost the level of real GDP in the economy by above one per cent. We have assumed that those that extend their working life by one year work around three quarters of average hours worked by others, much as those near retirement choose to do. A one year increase in working life would boost real consumption by over one per cent after five as incomes would be higher and less saving would be required for retirement.

A one year increase in working life would also result in an increase in the tax receipts (both from higher incomes and more consumption) than would otherwise been the case. If government current expenditure did not react to higher output then a one year extension to working life would improve the government budget balance by 0.5 per cent of GDP after four years and by almost one per cent after 25 years. The improvement in the government's budget balance would continue to rise because the debt stock would continue to decline in our scenario, and result in lower government interest payments. There are of course other ways to deal with the structural change in the public finances that longer working lives would bring, and issues of choices over what to consume and when are discussed in Barrell, Holland and Kirby (2010).

Appendix A
The NiGEM model

We utilise the NiGEM model in a version that has similar long run properties to the dynamic stochastic general equilibrium models in use by institutions such as the Bank of England[9]. GDP (Y) is determined in the long run by supply factors, and the economy is open and has perfect capital mobility. The production function has a constant elasticity of substitution between factor inputs, where output depends on capital (*K*) and on labour services (*L*) which is a combination of the number of person in work and the average hours of those persons. Technical progress (tech) is assumed to be labour augmenting and independent of the policy innovations considered here

$$Q = \alpha(\delta(K)^{-\rho} + (1-\delta)(Le^{\lambda_L tech})^{-\rho})^{-1/\rho}$$

We assume forward looking behaviour in production and because of 'time to build' issues investment depends on expected trend output four years ahead and the forward looking user cost of capital. However, the capital stock does not adjust instantly, as there are costs involved in doing so that are represented by estimated speeds of adjustment. The equilibrium level of unemployment is the outcome of the bargaining process in the labour market, as discussed in Barrell and Dury (2003), and the speed of adjustment depends on (rational) expectations of future inflation. Financial markets follow arbitrage conditions and they are forward looking. The exchange rate, the long rate and the equity price will all 'jump' in response to news about future events. Fiscal policy involves gradually adjusting direct taxes to maintain the deficit on target, but we assume that taxes have no direct effect on the labour supply decision. Monetary policy involves targeting inflation with an integral control from the price level, as discussed in Barrell, Hall and Hurst (2006) and inflation settles at its target in all our simulations.

Perhaps the most important feature of the model for our discussion is that consumers react to the present discounted value of their future income streams which we may call total wealth (*TW*), although borrowing constraints may limit their consumption to their personal disposable income in the short run. Total wealth is defined as

$$TW_t = Y_t - T_t + TW_{t+1} / ((1 + rr_t)(1 + my_t))$$

where TW is real total wealth, Y is real income, T are real taxes, and the suffix *t+1* indicates an expected variable which is discounted by the real interest rate rr_t and by the myopia premium used by consumers, my_t. The equation represents an infinite forward recursion, and permanent income is the sustainable flow from this stock. Total wealth and permanent (PI) income can be linked by the stock flow relationship where γ is the rate of return on TW.

$$PI_t = \gamma * TW_t$$

9 The Bank of England Quarterly model is discussed in Harrison *et al*. (2005). NiGEM is discussed in Barrell, Holland and Hurst (2007), Barrell, Hurst and Mitchell (2007) and in other papers at www.niesr.ac.uk NiGEM does not impose maximising equilibrium conditions in the same way as Dynamic Stochastic General Equilibrium models, but has the same steady-state equilibrium properties.

Although consumers know their total wealth and hence their permanent income, they may not consume it all as they are either risk averse or face a probability of death (ρ) in each time period and also a probability (τ) that they will not make the transition from working to not working. If life span is uncertain, then consumers will have precautionary savings as discussed in Blanchard and Fisher (1989). If the length of working life is also uncertain then they may pay a small premium to insure themselves against early retirement, this premium falls with an increase in working lives. During working years consumers save and in retirement use their interest income and run down assets. The saving rate will depend, amongst other things, on the proportion of life that they expect to work, the level of consumption they prefer in retirement and on their desire to leave bequests. In a stationary economy consumption will equal permanent income, and the savings rate will fluctuate around a mean level of zero. The gross stock of financial wealth will depend on the saving rate and on the number of years individuals expect to be retired[10]. Given that there is an optimal wealth to income ratio, WR, in an economy growing at g the saving rate will be $g*WR$ higher to sustain this equilibrium ratio; implying consumption will be lower than permanent income.

Total wealth will also change when asset prices change or when accumulation changes. Non-human wealth may rise when, for instance, house prices rise and this may increase consumption in the short term even though real output may not have risen. We presume that consumption is determined by forward looking behaviour in the long term, but short term adjustment depends upon a number of factors. As Barrell and Davis (2007) show, changes in financial ($dlnNW$) and especially housing wealth ($dlnHW$) will affect consumption (C)[11]. Their estimates suggest the impact of changes in housing wealth have five times the impact of changes in financial wealth in the short run. Barrell and Davis (2007) also show that adjustment to the long run equilibrium shows some inertia as well. Al Eyd and Barrell (2005) discuss borrowing constraints, and investigate the role of changes in the number of borrowing constrained households. It is common to associate the severity of borrowing constraints with the coefficient on changes in current real incomes ($dlnRPDI$) in the equilibrium correction equation for consumption. We may write our equation for $dlnC$ as:

$$dlnC_t = \lambda(\prod lnC_{t-1} - b_0 - lnPI_{t-1}) + b_1 dlnRPDI_t + b_2 dlnNW_t + b_3 dlnHW_t$$

where the long-run relationship between lnC and $lnPI$ depends upon the equilibrium savings rate, and this relationship forms the long run attractor in an equilibrium correction relationship. We should note that permanent income, PI, is a forward looking variable. The logarithmic approximation is explained in Barrell and Davis (2007).

Policy reactions are important in the determination of speeds of adjustment. Nominal short term interest rates are set in relation to a standard forward looking feedback rule. Forward looking long rates should be related to expected future short term rates:

$$(1+LR_t) = \prod^{T}_{j=1'} (1+SR_{t+j})^{1/T}$$

The exchange rate and the equity market are also assumed to be forward looking.

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10 In a stationary world with no risk, no interest rates, a constant level of consumption and no bequests, the saving rate will be related to the proportion of life in retirement (τ) and the number of years in retirement. For instance if interest rates are zero, one third of adult life is in retirement and there are 60 years of adult life then the equilibrium wealth to income ratio will be 6.666. It will be lower if interest rates are positive or desired consumption in retirement is lower than in work.

11 Throughout d is the change operator and ln is the natural logarithm.

In order to evaluate the effects of extending working lives on the public finances we need a reasonably disaggregated description of both spending and tax receipts. We model corporate (*CTAX*) and personal (*TAX*) direct taxes and indirect taxes (*MTAX*) on spending, along with government spending on investment and on current consumption, and separately identify transfers (*TRAN*) and government interest payments (*GIP*). Each source of taxes has an equation applying a tax rate (*TAXR*) to a tax base (profits, personal incomes or consumption). As a default, we have government spending on investment (*GI*) and consumption (*GC*) rising in line with trend output in the long run, with delayed adjustment to changes in the trend. They are re-valued in line with the consumers' expenditure deflator (*CED*). Government interest payments (*GIP*) are driven by a perpetual inventory of accumulated debts. Transfers to individual are composed of three elements, with those for the inactive of working age and the retired depending upon observed replacement rates. Spending less receipts is the budget deficit (*BUD*), which flows onto the debt stock.

$$BUD = CED*(GC+GI)+TRAN+GIP-TAX-CTAX-MTAX$$

We have to consider how the government deficit (*BUD*) is financed. We allow either money (*M*) or bond finance (*debt*).

$$BUD = \Delta M + \Delta DEBT$$

rearranging gives:

$$DEBT = DEBT_{t-1} - BUD - \Delta M$$

In all policy analyses we use a tax rule to ensure that Governments remain solvent in the long run. This ensures that the deficit and debt stock return to sustainable levels after any shock, as is discussed in Blanchard and Fisher (1989). A debt stock target can also be implemented. The tax rate equation is of the form:

$$TAXR = f(\text{target deficit ratio} - \text{actual deficit ratio})$$

If the Government budget deficit is greater than the target, (e.g. -3 per cent of GDP and target is -1 per cent of GDP) then the income tax rate is increased.

Appendix B
Tables for the core scenarios

Table B.1 The impact on GDP, household consumption and the saving ratio from a one year increase in working life

	GDP		Household consumption		Saving ratio
	(a)	(b)	(a)	(b)	(c)
2010	0.19	1.51	0.11	2.01	-0.11
2011	0.43	6.24	0.32	4.64	-0.19
2012	0.62	10.64	0.53	7.73	-0.28
2013	0.77	13.92	0.74	10.62	-0.40
2014	0.89	16.03	0.94	13.00	-0.52
2015	0.96	17.46	1.07	14.70	-0.58
2016	0.99	18.65	1.14	16.01	-0.62
2017	1.00	19.58	1.17	17.03	-0.65
2018	0.99	20.32	1.19	17.88	-0.67
2019	0.99	21.02	1.20	18.64	-0.69
2020	0.99	21.80	1.20	19.39	-0.71
2021	0.99	22.73	1.20	20.19	-0.72
2022	0.99	23.71	1.21	21.05	-0.74
2023	1.01	24.72	1.22	21.95	-0.75
2024	1.02	25.84	1.23	22.86	-0.75
2025	1.04	27.29	1.23	23.86	-0.75
2026	1.05	29.13	1.23	25.03	-0.75
2027	1.07	31.09	1.23	26.35	-0.75
2028	1.09	32.93	1.24	27.66	-0.75
2029	1.10	34.60	1.25	28.91	-0.76
2030	1.12	36.01	1.25	30.03	-0.76

Note: (a) per cent difference from base (constant 2005 prices); (b) absolute difference from base (nominal prices, £ billion); (c) percentage point difference from base.

Table B.2 The impact on employment and labour input from a one year increase in working life

	Employment		Labour input	
	(a)	(b) (thousands)	(a)	(b) (millions)
2010	0.19	54.75	0.11	53.31
2011	0.54	154.49	0.36	167.26
2012	0.93	268.99	0.63	300.91
2013	1.31	382.84	0.90	433.75
2014	1.59	468.87	1.12	546.11
2015	1.69	502.39	1.24	606.77
2016	1.70	511.57	1.26	625.28
2017	1.69	510.76	1.25	624.96
2018	1.67	507.54	1.24	619.12
2019	1.65	504.85	1.22	613.64
2020	1.63	502.57	1.20	610.07
2021	1.63	505.98	1.20	610.64
2022	1.66	516.39	1.21	619.52
2023	1.70	531.64	1.23	635.37
2024	1.72	543.60	1.26	652.39
2025	1.74	550.89	1.28	664.51
2026	1.75	558.61	1.29	674.16
2027	1.79	573.45	1.31	688.21
2028	1.83	590.19	1.34	707.25
2029	1.87	607.21	1.37	726.55
2030	1.91	622.14	1.39	744.18

Note: (a) per cent difference from base; (b) absolute difference from base.

Table B.3 The impact on tax revenues from a one year increase in working life (percentage difference from base)

	Direct Tax	Indirect Tax	Corporation Tax
2010	0.10	0.22	-0.01
2011	0.28	0.48	0.50
2012	0.47	0.76	1.12
2013	0.59	1.00	1.38
2014	0.63	1.17	1.47
2015	0.67	1.27	1.46
2016	0.68	1.33	1.37
2017	0.68	1.36	1.24
2018	0.66	1.37	1.13
2019	0.64	1.37	1.04
2020	0.62	1.37	0.98
2021	0.61	1.37	0.95

continued

Table B.3 (continued)

	Direct Tax	Indirect Tax	Corporation Tax
2022	0.59	1.37	0.93
2023	0.57	1.36	0.94
2024	0.56	1.36	0.95
2025	0.56	1.36	0.98
2026	0.57	1.36	1.00
2027	0.57	1.37	1.02
2028	0.57	1.38	1.03
2029	0.56	1.38	1.03
2030	0.55	1.37	1.02

Table B.4 The impact on tax revenues from a one year increase in working life (absolute difference from base, £ billion)

	Direct Tax	Indirect Tax	Corporation Tax	Total Taxes
2010	0.30	0.29	0.00	0.59
2011	0.90	0.69	0.15	1.74
2012	1.61	1.15	0.40	3.16
2013	2.08	1.60	0.59	4.27
2014	2.37	1.96	0.75	5.08
2015	2.70	2.22	0.81	5.72
2016	3.02	2.42	0.81	6.24
2017	3.29	2.58	0.79	6.66
2018	3.52	2.71	0.76	6.99
2019	3.69	2.84	0.74	7.28
2020	3.85	2.96	0.74	7.56
2021	3.99	3.09	0.76	7.84
2022	4.10	3.23	0.79	8.12
2023	4.19	3.39	0.83	8.40
2024	4.32	3.54	0.89	8.75
2025	4.53	3.70	0.95	9.18
2026	4.78	3.90	1.02	9.69
2027	5.02	4.12	1.08	10.22
2028	5.25	4.36	1.14	10.75
2029	5.45	4.59	1.19	11.23
2030	5.59	4.80	1.23	11.61

Table B.5 The impact on tax revenues from a one year increase in working life (contribution to total change in tax revenues)

	Direct Tax	Indirect Tax	Corporation Tax
2010	0.52	0.49	-0.01
2011	0.52	0.39	0.09
2012	0.51	0.36	0.13
2013	0.49	0.37	0.14
2014	0.47	0.39	0.15
2015	0.47	0.39	0.14
2016	0.48	0.39	0.13
2017	0.49	0.39	0.12
2018	0.50	0.39	0.11
2019	0.51	0.39	0.10
2020	0.51	0.39	0.10
2021	0.51	0.39	0.10
2022	0.50	0.40	0.10
2023	0.50	0.40	0.10
2024	0.49	0.40	0.10
2025	0.49	0.40	0.10
2026	0.49	0.40	0.10
2027	0.49	0.40	0.11
2028	0.49	0.41	0.11
2029	0.49	0.41	0.11
2030	0.48	0.41	0.11

Note: components may not sum to one due to rounding.

Table B.6 The impact on government expenditures from a one year increase in working life (percentage difference from base)

	Social Transfers	Government interest payments	Government consumption	Government investment
2010	-0.19	0.29	-0.08	0.71
2011	-0.50	0.49	-0.02	1.07
2012	-0.84	0.41	0.06	1.20
2013	-1.18	0.13	0.07	1.22
2014	-1.36	-0.28	0.03	1.17
2015	-1.36	-0.71	-0.01	1.10
2016	-1.31	-1.26	-0.03	1.07
2017	-1.26	-1.83	-0.03	1.05
2018	-1.21	-2.38	-0.04	1.04
2019	-1.17	-2.93	-0.05	1.04
2020	-1.13	-3.50	-0.06	1.05
2021	-1.12	-4.09	-0.07	1.06
2022	-1.12	-4.74	-0.08	1.07

continued

Table B.6 (continued)

	Social Transfers	Government interest payments	Government consumption	Government investment
2023	-1.13	-5.42	-0.10	1.07
2024	-1.11	-6.16	-0.12	1.08
2025	-1.08	-6.94	-0.12	1.09
2026	-1.05	-7.77	-0.12	1.12
2027	-1.04	-8.65	-0.11	1.15
2028	-1.03	-9.56	-0.12	1.16
2029	-1.01	-10.49	-0.13	1.15
2030	-1.00	-11.44	-0.15	1.13

Table B.7 The impact on government expenditures from a one year increase in working life (absolute difference from base, £ billion)

	Social Transfers	Government interest payments	Government consumption	Government investment
2010	-0.41	0.10	-0.27	0.31
2011	-1.15	0.21	-0.06	0.37
2012	-1.96	0.20	0.19	0.38
2013	-2.83	0.07	0.23	0.38
2014	-3.45	-0.17	0.09	0.37
2015	-3.60	-0.49	-0.05	0.36
2016	-3.66	-0.97	-0.11	0.36
2017	-3.71	-1.53	-0.15	0.37
2018	-3.77	-2.15	-0.19	0.38
2019	-3.84	-2.81	-0.25	0.40
2020	-3.90	-3.54	-0.31	0.43
2021	-4.05	-4.34	-0.36	0.45
2022	-4.26	-5.22	-0.44	0.47
2023	-4.51	-6.18	-0.57	0.50
2024	-4.68	-7.22	-0.70	0.52
2025	-4.75	-8.34	-0.77	0.55
2026	-4.85	-9.55	-0.78	0.59
2027	-5.10	-10.85	-0.78	0.64
2028	-5.36	-12.26	-0.86	0.67
2029	-5.64	-13.80	-0.99	0.70
2030	-5.91	-15.48	-1.18	0.71

Table B.8 Contribution to the improvement in the government's budget position from a one year increase in working life (proportion of government budget change)

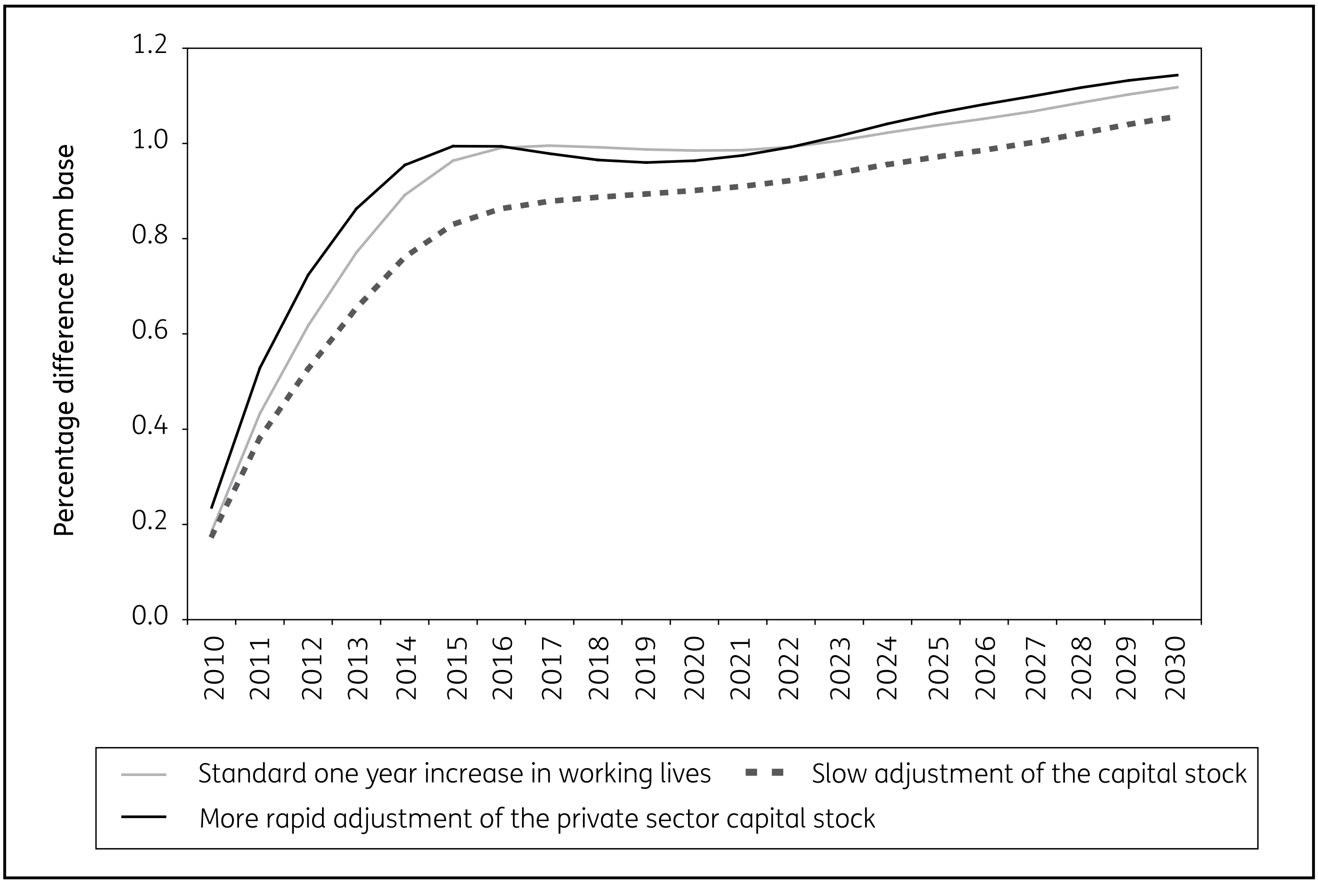
	Total tax	Expenditure less Government interest payments	Government interest payments
2010	0.68	0.43	-0.12
2011	0.73	0.35	-0.09
2012	0.73	0.32	-0.05
2013	0.67	0.35	-0.01
2014	0.62	0.36	0.02
2015	0.60	0.35	0.05
2016	0.59	0.32	0.09
2017	0.57	0.30	0.13
2018	0.55	0.28	0.17
2019	0.53	0.27	0.20
2020	0.51	0.25	0.24
2021	0.49	0.25	0.27
2022	0.46	0.24	0.30
2023	0.44	0.24	0.32
2024	0.42	0.23	0.35
2025	0.41	0.22	0.37
2026	0.40	0.21	0.39
2027	0.39	0.20	0.41
2028	0.38	0.19	0.43
2029	0.36	0.19	0.45
2030	0.35	0.19	0.46

Note: components may not sum to one due to rounding.

Appendix C
Variant analysis: the impact from varying the speed of the adjustment of the capital stock

This sensitivity analysis concerns the speed at which the private sector capital stock adjusts, and this depends, both on incentives available to speed adjustment, and the perceptions of private sector decision makers about the prospects for the economy. We choose to emphasise this aspect as policy makers can change incentives and persuade decision makers to change their behaviour, and hence we wish to emphasise the benefits of so doing.

Figure C.1 GDP effects from extending working lives by one year: different adjustment speeds of the private sector capital stock



In our core case where the age of retirement rises by one year the capital stock has adjusted to its new equilibrium by 2020, some six years after the full increase in the labour force is complete. If we increase the speed of adjustment so that the capital stock adjustment is completed four years earlier output rises more rapidly. If we slow adjustment speeds by the same proportion the capital stock is only two-thirds of the way towards its equilibrium in 2020. These differences are reflected in the adjustment of output displayed in Figure C.1, and the difference from forecast baseline continues to change because the increase in the population of working age also continues to increase, as we can also see from the figure.

The importance of the capital stock adjustment speeds for outturns for the government deficit and for unemployment are clear in Figures C.2 and C.3. When private sector capital adjusts more rapidly there is an earlier increase in incomes, and therefore, in tax receipts, and also more rapid adjustment of unemployment and hence lower transfers, as we can see from Figure C.2.

Figure C.2 Effects on the government budget balance from extending working lives by one year: different adjustment speeds of the private sector capital stock

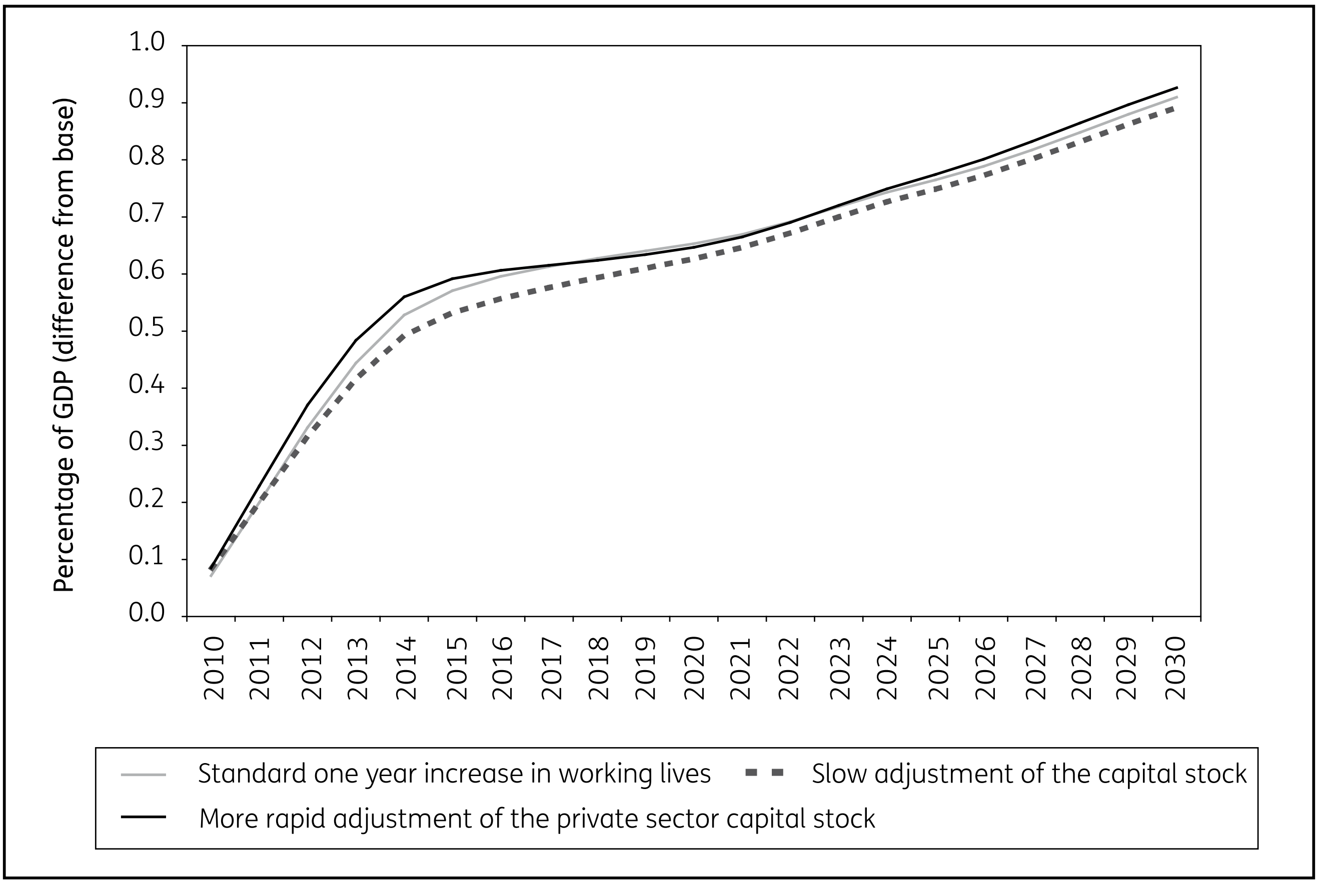
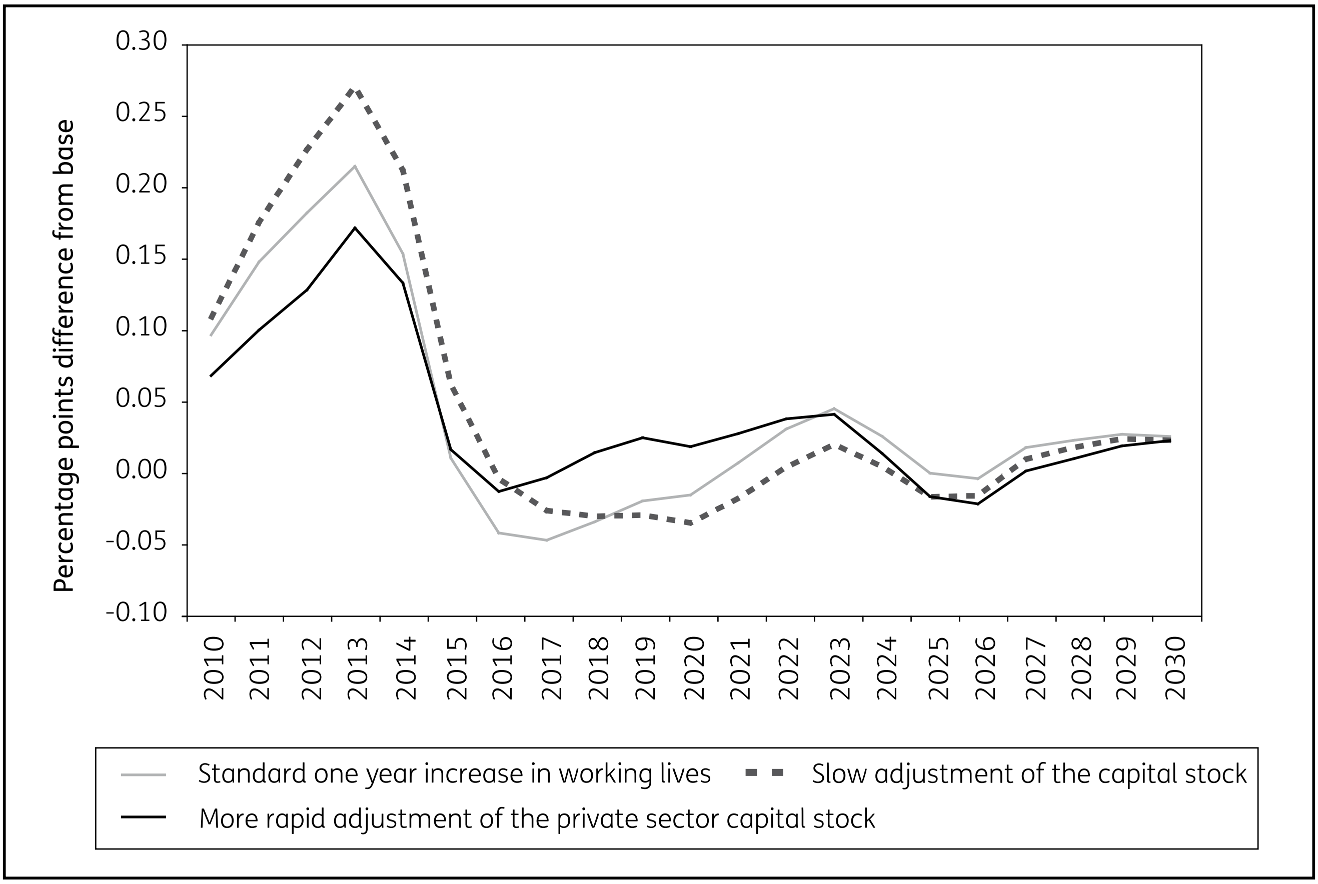


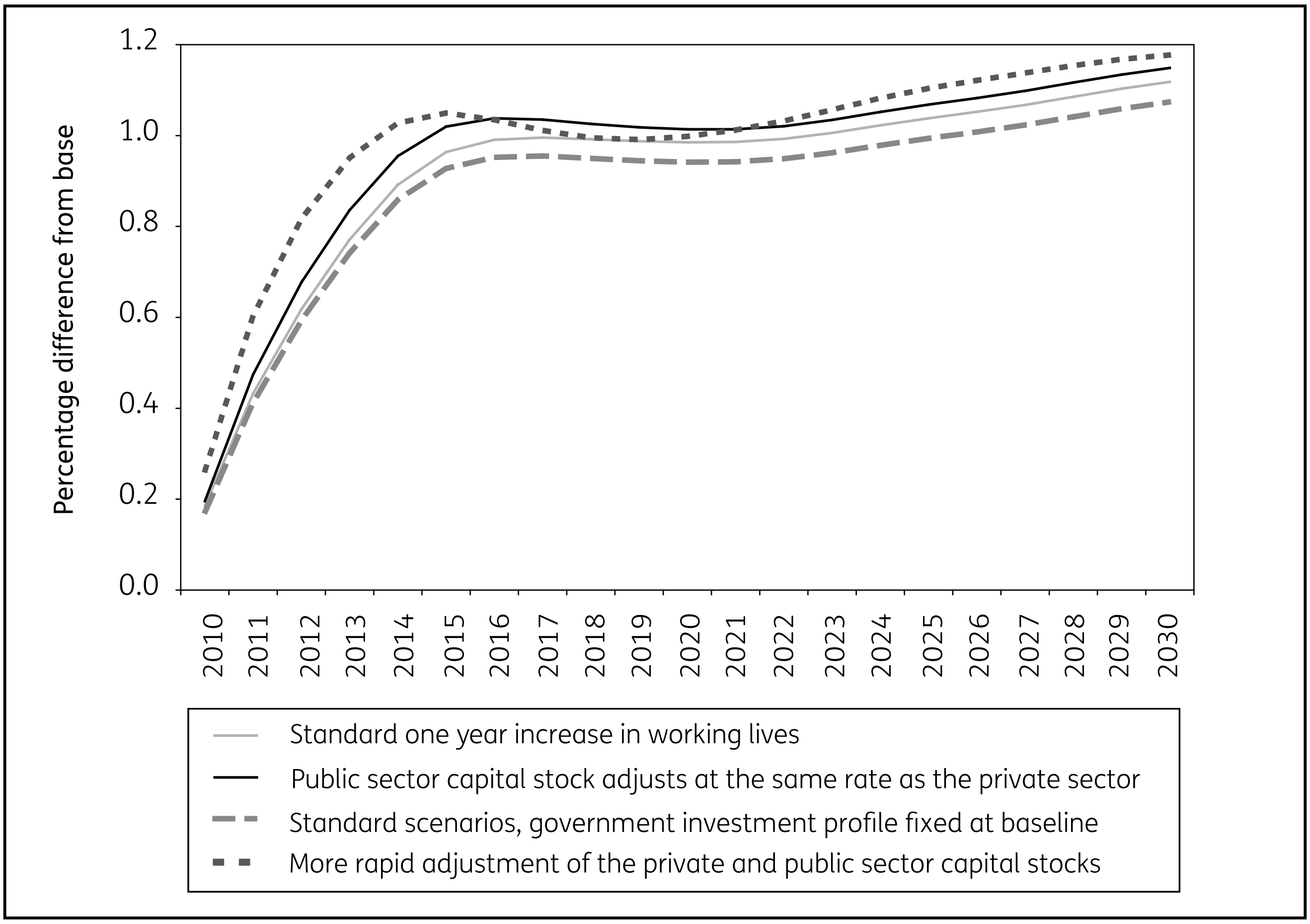
Figure C.3 Effect on unemployment from extending working lives by one year: different adjustment speeds of the private sector capital stock



If the labour market is unchanged a policy that induces people to stay on at work longer than they had chosen will lead to a slight rise in unemployment, as flows through the labour market will be affected. Employment starts to rise immediately, and unemployment also rises. By 2013 employment has risen by 1.31 per cent whilst the unemployment rate has risen by 0.2 percentage point. More rapid capital stock adjustment reduces the effect on the unemployment rate from the minimal 0.2 percentage points to around 0.15 percentage points. The increase in the workforce is fully complete by around 2016 in all cases.

Of course, if labour market adjustment were to be more rapid then unemployment would rise by less. It is perhaps more difficult to design labour market policies than investment incentives, but as the potential increase in unemployment is likely to be located amongst certain groups with a high propensity to flow through unemployment such as the low skilled, young new entrants and women returning to the labour force, it should be possible to design polices to speed adjustment further.

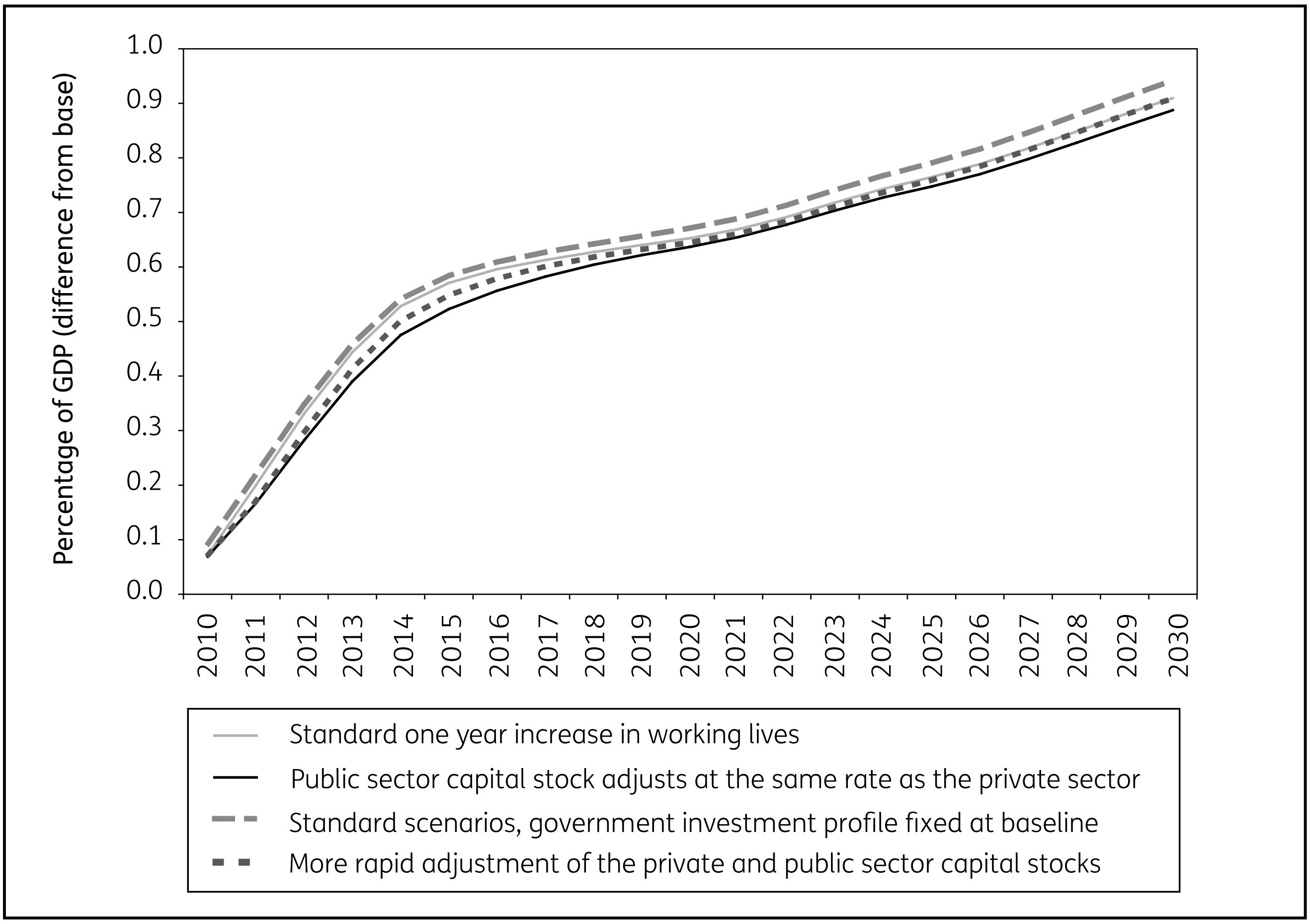
Figure C.4 Output effects from extending working lives by one year: variations in the speed of adjustment of the public sector capital stock



The speed of adjustment of the public sector capital stock will also affect the speed at which the economy adjusts and also the scale of government budget deficit it experiences. This speed is clearly a policy parameter for the government, and hence its effects can be subjected to a cost benefit analysis. In Figures C.4 and C.5 we plot four scenarios, with the first being our core case of a one year increase in retirement ages.

Barrell, Hurst and Kirby (2009) assumed government investment stayed on its core trajectory, and we repeat that assumption here, and the improvement to the government budget deficit is larger than our other scenarios, but the impact on output is inevitably smaller. If the public sector capital stock adjusts at the same pace as the private sector stock then output will grow more rapidly, but the deficit will be worse because of higher spending on investment without enough of an increase in tax revenues to offset it.

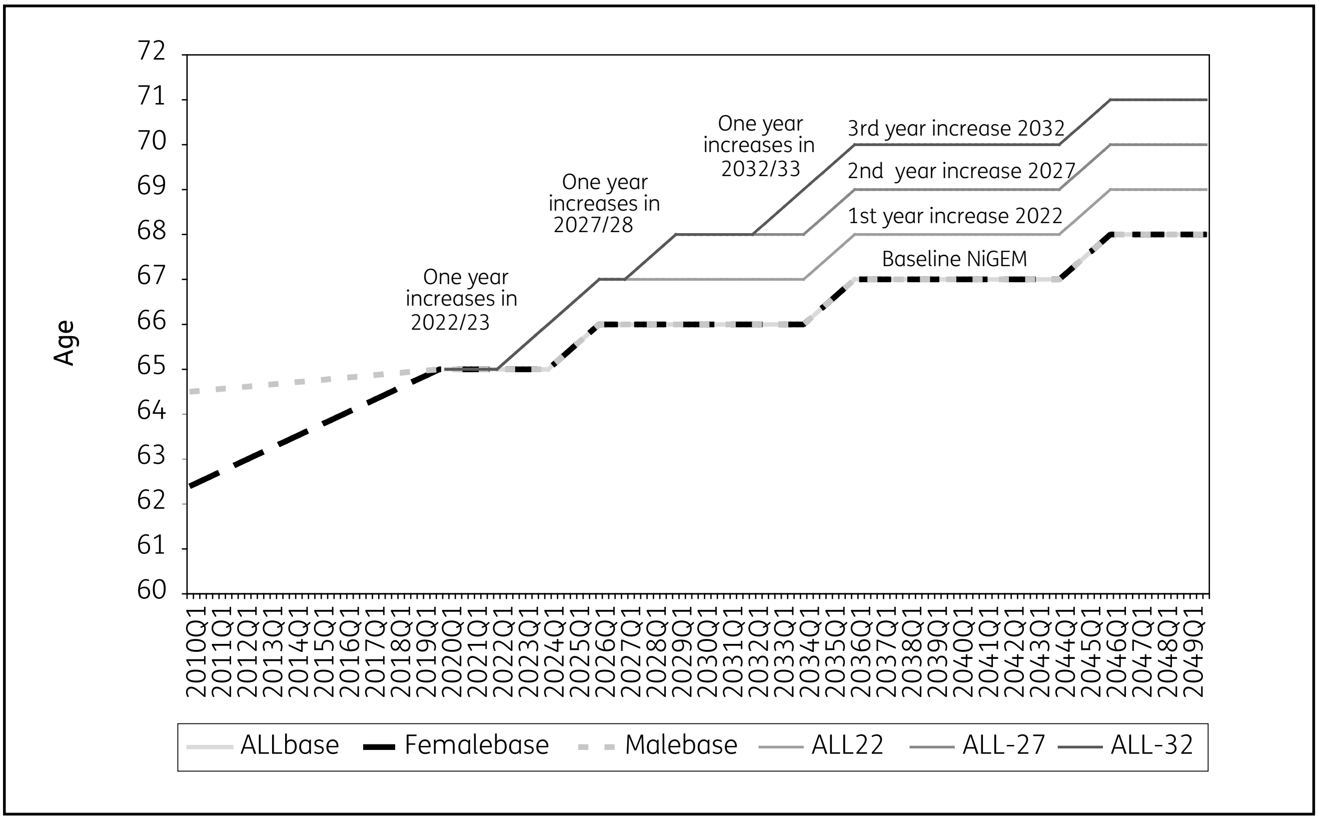
Figure C.5 Effects on the government borrowing from extending working lives by one year: variations in the speed of adjustment of the public sector capital stock



Appendix D Variant analysis: a delay in the extension of working lives

The current legislation for increasing the State Pension age (State Pension age) has been embedded into projections for the working age population by the ONS. From 2020 to 2050 there is legislation to increase the working live in three stages. These include 2024-25 to 66 years old, 2034-35 to 67 years old and 2044-45 to 68 years old. The legislation has increased working lives by one year over a two year period with the assumption that there is an even distribution of birthdays for any age groups. For example the ONS has taken projected number of men and women aged 65-67 years old at mid-2025 and they have looked at the distribution of birthdays of these age groups according to Table D.1 which shows the date at which pensionable age is attained for those born between 6 of April 1959 and 5 April 1960.

Figure D.1 Incrementing retirement ages by one year every five years to 2032



After constructing a new baseline scenario out until 2050 we undertook scenarios where we have increased the working lives both for men and women over two year's periods in three stages for both five and ten years intervals. These innovations to the age of retirement and are plotted in Figures D.1 and D.6, whilst the impacts on the population of working age are plotted in Figures D.2 and D.7 The increase in working lives has the same pattern as in the baseline, in that retirement ages are increased by one year over a two year period. These changes have to be fitted in with existing legislation, and hence they have to be introduced just before or just after an existing extension of working lives. For the scenario involving a five year interval between increases we increased the working live in 2022, 2027, and 2032.

These increments to the population of working age depend upon the demographic structure as they are implemented, and in 2022/33 the one year extension raises the labour force by 1.75 per cent, whilst in 2027/28 it raise the labour force by 1.83 per cent, and by 1.88 per cent in 2032/33. As with our previous experiments we assume those who remain in the workforce put in fewer hours than average, and hence the impact on output is smaller than the increase in employment. As working lives have been extended, consumption rises more than output and the saving ratio will fall. The effects on output depend upon the size of the age group that is drawn in to (or retained in) the labour force, and hence the impact on output varies over time, as we can see from Figure D.3.

Figure D.2 The effects on the population of working age of incrementing retirement ages by one year every five years to 2032

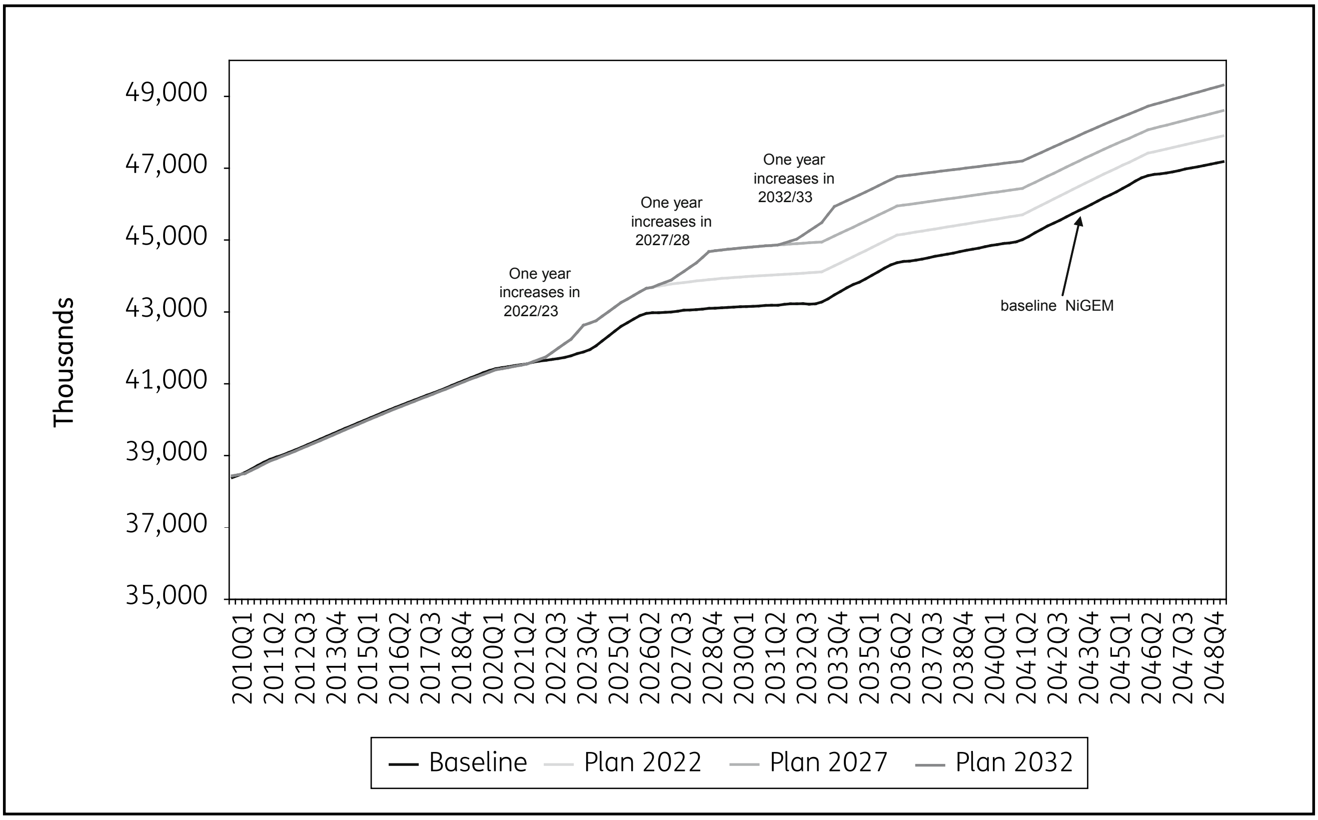
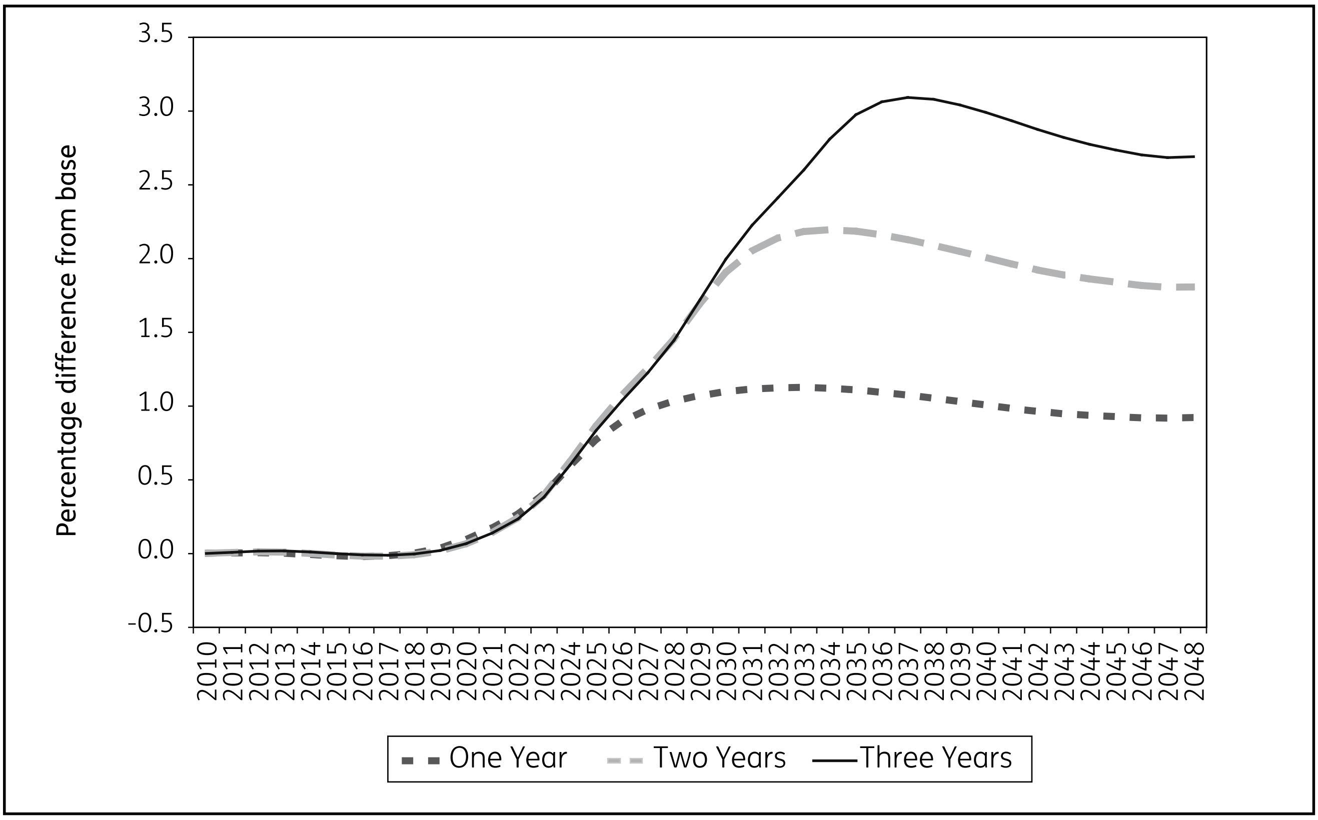
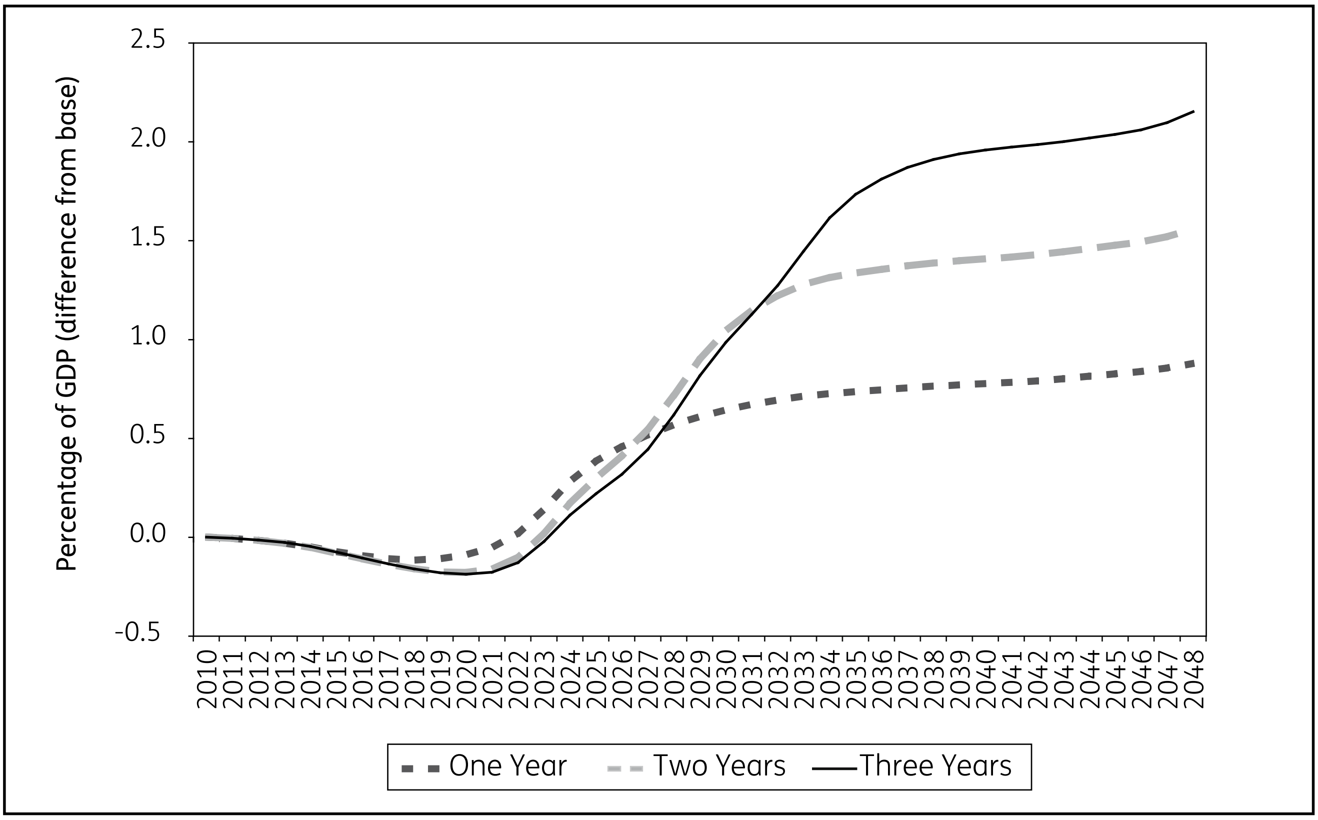


Figure D.3 The effects on real GDP of incrementing retirement ages by one year every five years to 2032



Household consumption starts to rise well ahead of the planned increase in the labour force, as forward looking consumers recognise that they need lower levels of saving for retirement. This induces some inflationary pressure, and output rises in advance of the increase in labour supply. As a result interest rates rise to keep inflation on target. Consequently, government interest payments increase. These increased interest payments are sufficient to offset the increased revenue from higher consumption, especially given the size of the government debt stock on our baseline which is discussed in Barrell and Kirby 2010.

Figure D.4 The effects on government deficits of incrementing retirement ages by one year every five years to 2032

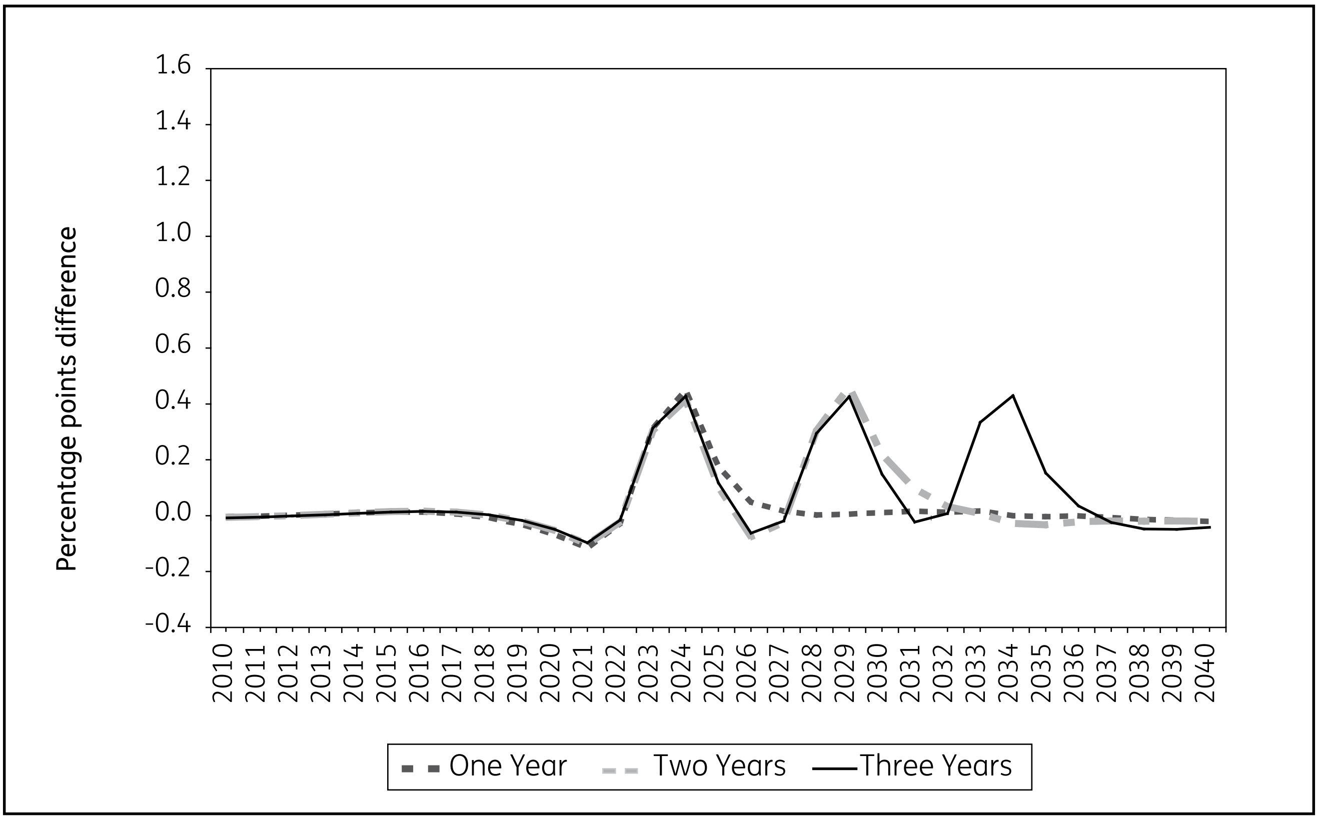


The overall impact on the public finances is plotted in Figure D.4, and we have assumed, as above that the direct tax rate, and all other tax rates are fixed at their baseline levels, and that government consumption stays on plan, Government investment adjusts in line with output and government interest payments fall as less debt is issued. In the long-run the improvement in the budget balance is around 0.6 per cent of GDP for each year's increment in working lives. The gains cumulate as a declining debt stock reduces government interest payments.

The increase in the labour force is anticipated, but the market is not frictionless, unemployment might be expected to rise by just over a fifth of the increment in the labour force, as we can see from Figure D.5. However, unemployment returns to its equilibrium within two years as flows through the labour market adjust.

As part of the analysis for the DWP NIESR also constructed a set of scenarios where working lives were increases by an additional three years over the period between 2020 and 2050. These additions were an increment on the existing plan to increase retirement ages in the middle of each decade, and they were introduced gradually in 2020, 2030 and 2040. Impacts on output, employment and the public finances were similar to those discussed here. Details are available from the authors upon request.

Figure D.5 The effects on unemployment of incrementing retirement ages by one year every five years to 2032



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