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**Working Paper**

## The UK's public finances in the long run: The IFS model

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# The UK's public finances in the long run: the IFS model

IFS Working Paper W13/29

Michael Amior  
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# The UK's public finances in the long-run: the IFS model

Michael Amior, Rowena Crawford and Gemma Tetlow \*

*Institute for Fiscal Studies*

## 1. Introduction

This working paper describes how the IFS's model of the UK's long-run public finances (and those of its constituent nations) is constructed. Our model projects tax revenues, public spending and hence public borrowing and debt up to 2062–63. This is done for the UK as a whole and also separately for Scotland and the rest of the UK. Our approach is closely modelled on that of the Office for Budget Responsibility (OBR), which in turn is based on the approach originally pioneered for the UK by Cardarelli, Sefton and Kotlikoff (2000) and discussed in Banks, Disney and Smith (2000). The results of the OBR's modelling are summarised each year in their *Fiscal Sustainability Report* (henceforth the FSR; see OBR (2013)). The main objective of models of this type is to illustrate the future evolution of revenues and spending driven by changes in the size and demographic composition of the population. However, other drivers of changes in revenues and spending can also be incorporated into the model.

The main objective of the IFS model is to allow us to compare long-run fiscal projections of the constituent nations of the UK, rather than to provide a better (or even necessarily different) forecast for the UK as a whole from that provided by the OBR. In this working paper we describe how the model works and compare the inputs to and intermediate outputs from our model to those of the OBR model. We also describe how each of these inputs and outputs differs between the UK as a whole and its constituent nations. We then summarise the main outputs of the model – in particular, focussing on forecasts for the primary balance and public sector net debt. A more detailed summary of the main conclusions from the comparison of Scotland and the UK, highlighting the sensitivity of our projections to alternative assumptions about – among other things – revenues from the North Sea, interest rates on government debt and productivity growth is provided in Amior, Crawford and Tetlow (2013).

The type of model we have built seeks to answer questions of the type 'is current fiscal policy sustainable without additional taxes needing to be raised or cuts to public spending imposed either now or in the future?'. The basic structure of the model is described in Figure 1.1. The square boxes denote inputs into the model, while the ellipses show the (intermediate and final) outputs produced by the model. Items in dashed boxes denote estimation procedures. The model uses estimated age/sex profiles of revenues and spending to project the impact of population change on the level of revenues from various sources and public spending on different items – and hence public borrowing

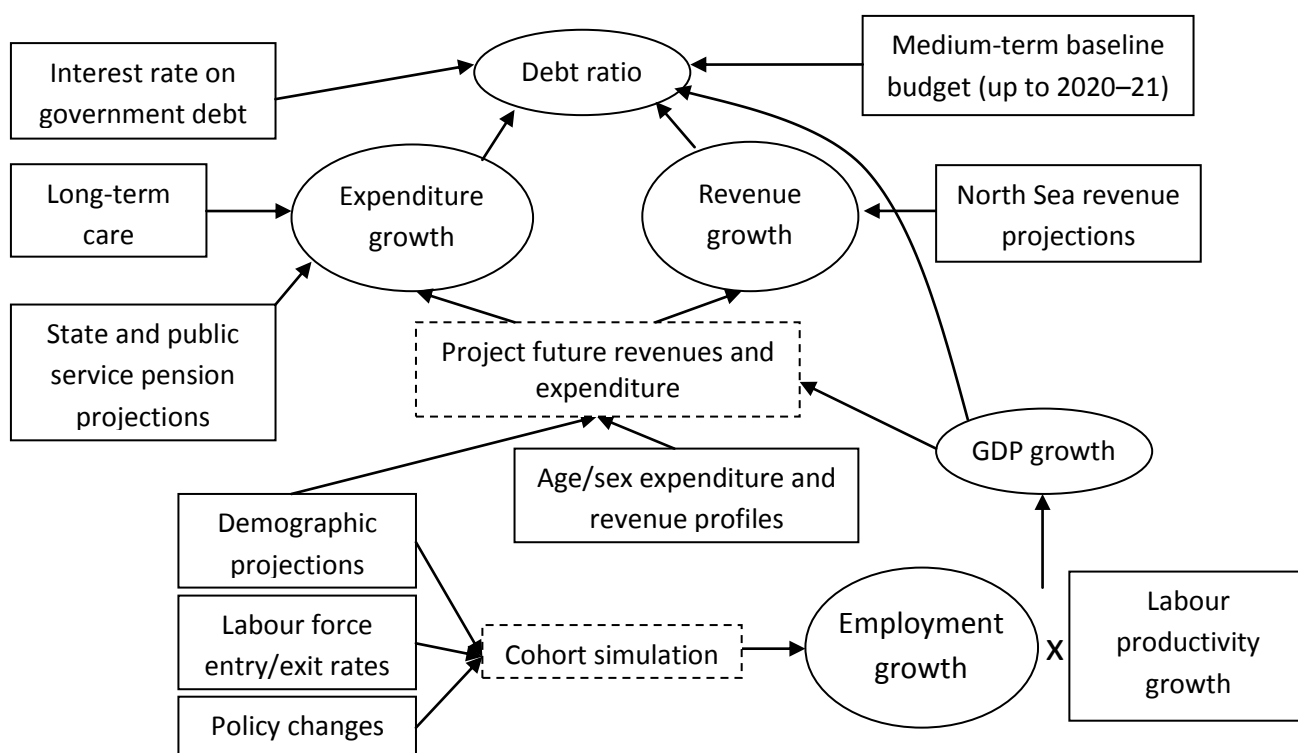
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\*Michael Amior was employed by IFS between February and August 2013 to work on this project; he now works at the Centre for Economic Policy at the London School of Economics. The authors are grateful to Stuart Adam, Carl Emmerson, Paul Johnson, and David Phillips for comments and advice. They also gratefully acknowledge funding from the Economic and Social Research Council (ESRC) through the Centre for the Microeconomic Analysis of Public Policy at IFS (grant reference RES-544-28-5001). The ESRC is supporting a programme of work addressing issues around the future of Scotland. One of the strands focuses on supporting new work at current major ESRC investments before and potentially after the referendum.

and debt – over the next fifty years. The key drivers of changes in the fiscal balance in this model are changes in the demographic composition of the population, coupled with the underlying assumptions that the level of certain types of spending differ across different age/sex groups in the population and that different age/sex groups pay different levels of certain taxes. For example, health spending is skewed towards older people, while education spending is skewed towards the young (as described in Section 5). Therefore, as the average age of the population increases, health spending will tend to increase, while education spending will tend to fall.

The model has three main parts. The first is a forecast for GDP over the next 50 years; this is described in Section 2. The second is a medium run forecast for the level of public sector revenues and expenditures up to 2020–21; this is described in Section 3. The third part is the long-run forecast for revenues and expenditure from 2021–22 to 2062–63; the long-run revenue forecast is described in Section 4, while the long-run spending forecast is described in Section 5. In each of these sections, we describe both how we estimate figures for the UK as a whole and how we estimate figures separately for Scotland and the rest of the UK. Section 6 then summarises the results of the model for the UK as a whole and compares results for Scotland to those for the rest of the UK.

**Figure 1.1. Basic structure of the model**



## 2. Forecasting future GDP

Our forecast for GDP over the medium-term uses the latest forecast produced by the OBR, published at the time of the March 2013 Budget. This forecast runs up to and including the 2017–18 tax year. However, even in 2017–18 the OBR forecasts that the UK economy will be operating below its trend level (that is the level of output consistent with constant unemployment and inflation). This means that further economic recovery (above trend growth) is expected after 2017–18. In line with the assumptions made by the OBR in their July 2013 FSR, we assume that the UK economy experiences

above-trend growth for three more years after 2017–18 in order to return to its trend level in 2020–21. Therefore, our long-run forecast for GDP begins in 2021–22.

Table 2.1 summarises the OBR’s central forecasts for real GDP growth and growth in the GDP deflator over the medium-term; we also adopt these assumptions in our model.

**Table 2.1 OBR medium-term forecasts for GDP growth in the UK (central scenario)**

%	2012– 13	2013– 14	2014– 15	2015– 16	2016– 17	2017– 18	2018– 19	2019– 20	2020– 21
Real GDP growth	0.2	0.8	2.0	2.4	2.7	2.8	2.8	2.8	2.8
GDP deflator growth	1.3	2.3	1.9	1.8	1.7	1.7	1.8	2.0	2.1

Source: Table 4.1 of OBR (2013a) and Supplementary Tables 1.1 and 2.1 of OBR (2013b).

### 2.1 Long run forecast for UK GDP

How quickly the UK economy will grow in future depends crucially on the future size and productivity of the labour force. The size of the labour force will depend in part on the size and composition of the population and also on the employment rates of different groups within the population. How much output the economy produces will also depend on how productive each worker is.<sup>2</sup> The assumptions in our model over each of these components are described below.

#### *Demographic projections*

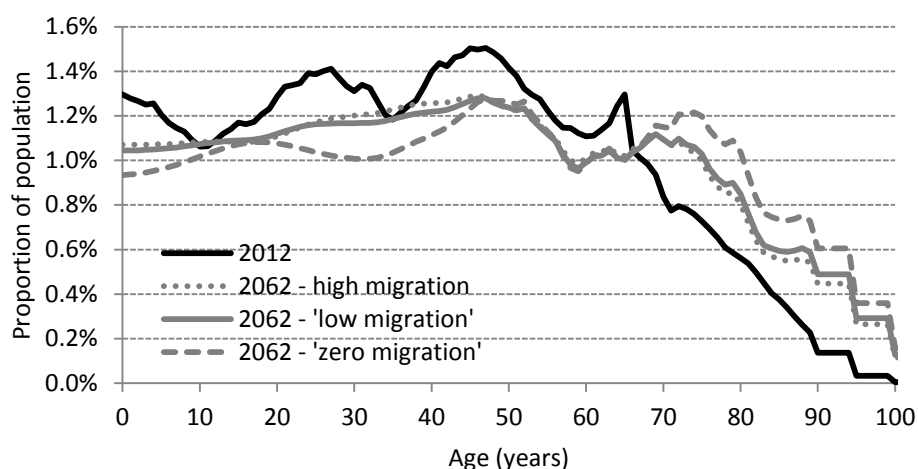
Our projections for the future size and composition of the population are based on Office for National Statistics (ONS) population projections (2010-based). These population projections are estimated based on assumptions about longevity, fertility and net migration, and the ONS produce a number of projections which illustrate the sensitivity of the population projection to these assumptions. The OBR use the ONS ‘low migration’ scenario for their central projections since they believe that the assumption of net inward migration (of 140,000 a year) under that scenario is more consistent than is the ONS’ principal projection with current government policy on visa restrictions and the likely impact of the removal of migration restrictions for A8 migrants across the EU. We therefore also use this scenario in our baseline model but, as the OBR does, we can also use our model to illustrate the impact of alternative assumptions about demographic change on projected economic activity and the state of the public finances.

The age distribution, and not just the future size of the population, is important in determining the evolution of GDP because individuals of different ages differ in their contributions to labour supply (as will be discussed in the next subsection). Figure 2.1 shows the projected age distribution of the UK population in 2012 and 2062, and Table 2.2 highlights the growth in particular age groups. Under the ‘low migration’ scenario the population of the UK is projected to increase by 22.8% between 2012 and 2062, but that growth is expected to be heavily concentrated among older age groups. For example, the population aged 66–75 is forecast to increase by 53.5% over the period, compared to just 9.9% for the population aged 36–45. As shown in Figure 2.1 this would result in the average age of the population increasing, with an increase in the proportion of the population aged over 66 and a

<sup>2</sup> Productivity currently features in the OBR model (and our model) in terms of productivity per worker. However, a natural extension to this approach would be to model hours of labour market participation (by age and sex) and hourly productivity separately.

decrease in the proportion aged under 66; the median age of the UK population is projected to increase from age 39 in 2012 to age 43 in 2062.

**Figure 2.1. Age distribution of UK population, 2012 and 2062**



Notes: 'Low migration' scenario assumes net inward migration of 140,000 per year while the 'high migration' scenario assumes net inward migration of 260,000. The 'zero migration' scenario assumes zero gross and zero net migration.

Source: ONS (2011).

Figure 2.1 also shows how the projected age distribution would differ under different assumptions about migration. Under their 'high migration' scenario, the ONS population projections exhibit slightly slower ageing of the population than in their 'low migration' case, since immigrants are typically of working age. In contrast, under their 'zero migration' scenario (in other words, if demographic change were solely the result of the natural ageing of the current population and future generations born in the UK) they project that the ageing of the population would be greater than in the 'low migration' case, with a larger proportion of the population accounted for by those aged 70 and over, and a smaller proportion of the population consisting of those aged 20–45.

**Table 2.2. UK population growth 2012 to 2062**

Age group	% population 2012	% growth 2012 to 2062	% population 2062
0 - 15	18.7	12.0	17.0
16 - 25	13.2	5.0	11.3
26 - 35	13.2	8.5	11.7
36 - 45	13.7	9.9	12.2
46 - 55	13.8	8.8	12.2
56 - 65	11.6	7.8	10.1
66 - 75	8.6	53.3	10.7
76 - 85	5.3	79.0	7.8
over 85	2.4	290.9	7.5
<i>All</i>	100.0	22.8	100.0

Notes: 'Low migration' scenario.

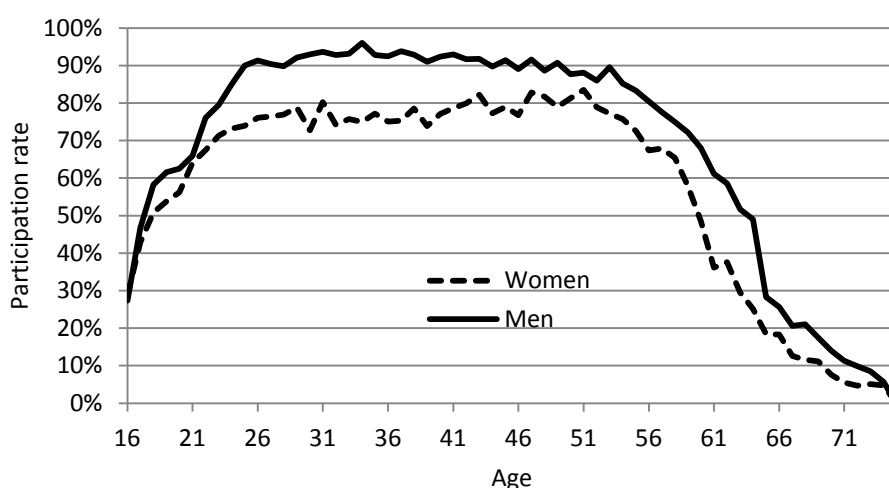
Source: ONS (2011).

### Participation rates

The size of the labour force depends not just on the size and composition of the population, but also on the participation rate (i.e. the proportion who are in, or seeking, employment) of different groups in the population. Participation rates for each age and sex are modelled using cross-sectional data from the Labour Force Survey (LFS), following the same methodology as the OBR.

A baseline participation rate for each age and sex is calculated based primarily on the 2011–12 LFS data (an adjustment is made to the participation rate observed for individuals aged 16–19 which is described below).<sup>3</sup> Individuals are assumed not to be in the labour market when aged below 16 or over 74 (in other words, their participation rate is assumed to be zero). The resulting baseline profile of participation rates is illustrated in Figure 2.2.<sup>4</sup> Participation rates are higher among men than women, and among those aged 25–55 than among older or younger individuals.

**Figure 2.2. UK labour force participation rates at baseline**



Source: Authors' calculations, based on Labour Force Survey 2011–12

Future participation rates for each age and sex are projected by simulating forward the participation rates of the baseline population, taking into account average net entry and exit rates at each age, as shown in Equation 1. New generations are also added at the youngest ages based on an assumed labour force entry rate at age 16, which is described below.

$$PR_t^{as} = \begin{cases} (1 + netEntryRate^{as})(1 - PR_{t-1}^{a-1s}) & \text{if } netEntryRate > 0 \\ (1 - netExitRate^{as}) \cdot PR_{t-1}^{a-1s} & \text{if } netExitRate > 0 \end{cases} \quad (1)$$

$PR_t^{as}$  is the participation rate at age  $a$  and sex  $s$  in year  $t$ ,  $netEntryRate^{as}$  is the net entry rate at age  $a$  and sex  $s$ , and  $netExitRate^{as}$  is the net exit rate at age  $a$  and sex  $s$ .

<sup>3</sup> Although we base our initial estimates of labour force participation on 2011–12 data, which may be depressed due to weak performance of the UK economy in that year, we do allow for above-trend growth in economic output between 2011–12 and 2020–21 (as summarised in Table 2.1). Therefore, our forecasts for future GDP will not be permanently affected by starting from the 2011–12 participation rates.

<sup>4</sup> A similar baseline participation rate profile is obtained from using data pooled LFS data 1997 to 2008.



The net entry and exit rates are estimated by comparing the participation rate for the same cohort between two consecutive years of LFS data, as described in Equations 2 and 3. Since only transitions of cohorts can be observed (and not of individuals), at each age-sex-year combination, only one of the entry and exit rate will be positive; the other will be zero. If the participation rate is growing between years  $t-1$  and  $t$ , then the net entry rate is positive and the net exit rate is zero, while if the participation rate is declining then the net entry rate will be zero and the net exit rate will be positive.

$$netEntryRate_t^{as} = \begin{cases} \frac{PR_t^{as} - PR_{t-1}^{a-1s}}{(1 - PR_{t-1}^{a-1s})} & \text{if } PR_t^{as} \geq PR_{t-1}^{a-1s} \\ 0 & \text{if } PR_t^{as} < PR_{t-1}^{a-1s} \end{cases} \quad (2)$$

$$netExitRate_t^{as} = \begin{cases} 0 & \text{if } PR_t^{as} \geq PR_{t-1}^{a-1s} \\ \frac{PR_{t-1}^{a-1s} - PR_t^{as}}{PR_{t-1}^{a-1s}} & \text{if } PR_t^{as} < PR_{t-1}^{a-1s} \end{cases} \quad (3)$$

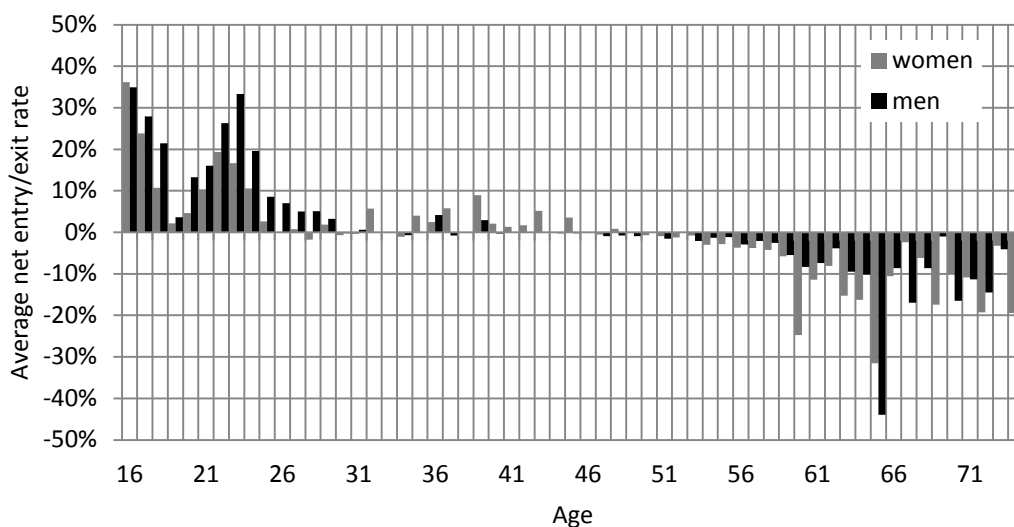
The OBR uses LFS data from 1997 to 2008 to estimate these net entry and exit rates; data from more recent years are excluded to avoid the short-term impact of the recession being built into the long term model. The net entry and exit rates used in our model are the averages observed for each age and sex over these 12 years of data.

There are two complications to this method for estimating future participation rates. The first is that participation rates among the young have been falling in recent years, for example due to the expansion of higher education. This would be expected to be offset by higher entry rates at slightly older ages, when these individuals do enter the workforce, but this is not picked up in our estimated net entry and exit rates, which are based on data from 1997–2008. Therefore, if no adjustment were made, the low participation rates of the young observed in the baseline would filter through to the rest of the population over the course of the projection. Two adjustments are made to offset this problem, one to the baseline participation rates and one to the net entry rates. The OBR’s solution for the baseline is to lock in the participation rates of 16–19 year olds through the entire projection. Specifically, the participation rate of 16-year-olds is assumed to remain identical to that of 2007, the participation of 17-year-olds identical to 2008, 18-year-olds identical to 2009 and 19-year-olds identical to 2010, in all remaining years. We also apply this adjustment in our model. The OBR’s solution for net entry rates is to bring forward the net entry rates by one year for individuals aged 21–24 (for example, for men aged 21 the entry rate is replaced by the (higher) entry rate of men aged 22). However, in our model this adjustment is not sufficient to prevent middle-aged labour supply declining in the long run, so instead we increase the net entry rates for men and women aged 21–24 by 5 percentage points. The resulting estimated average net entry rates by age and sex, after this adjustment for employment rates of the young, are shown in Figure 2.3.

The second complication is how to incorporate the likely impact of changes in the state pension age (SPA) on labour force participation. The female SPA is increasing from 60 to 65 between 2010 and 2018, and then the SPA for both men and women is set to increase to 66 between 2018 and 2020, to 67 between 2026 and 2028, and to 68 between 2044 and 2046. These increases in the SPA are expected to increase labour force participation at older ages in a way that will not be captured by the (time-constant) average net entry and exit rates estimated from LFS data. For example, Cribb,

Emmerson and Tetlow (2013) find that the recent increase in the female SPA from 60 to 61 led to a 7 percentage point increase in employment rates of women at age 60.

**Figure 2.3. Estimated average net entry and exit rates**



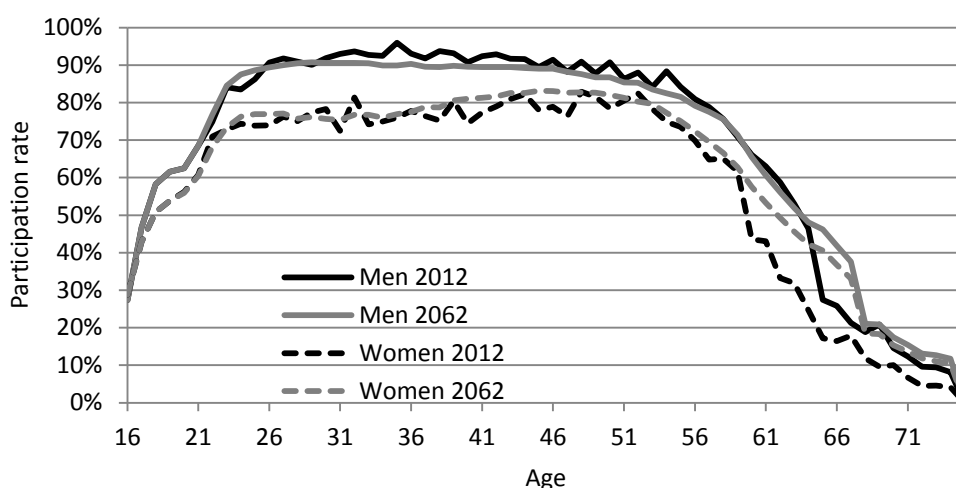
Notes: Positive numbers are net entry rates, and indicate the percentage of those not in work at the previous age who are now in work. Negative numbers are net exit rates, and indicate the percentage of those in work at the previous age who are now no longer in work.

Sources: Authors' calculations using IFS long-run public finance model.

The approach taken by the OBR, which we replicate in our model, is to adjust net exit rates at older ages. First, women aged 60 and over are assumed to have the same net exit rates as men of the same age from 2020 onwards. Second, exit rates in 2020, 2028 and 2048 for individuals within 5 years of the new SPA are shifted backwards one year. This means that, for example, a 66 year old when the SPA is 67 has the same exit rate as a 65 year old when the SPA is 66. Finally, for years between 2012 and 2020, 2020 and 2028, and 2038 and 2048, exit rates for those aged 62–68 are found through linear interpolation. This essentially smoothes the transition of exit rates over a number of years. Figure 2.5 shows the projected participation rates by age for men and women in 2012 and 2062. The only significant change over time is projected to be at ages 60 and over for women, and 65 and over for men, and this difference arises because of the adjustments made for the likely impact of the SPA change. Given the projected population structure in the UK, the average participation rate across individuals aged 16 to 75 in 2012 is projected to be 61% for women and 74% for men, and in 2062 to be 63% for women and 71% for men.

We assume, as does the OBR, that the equilibrium unemployment rate in the UK (otherwise known as the non-accelerating inflation rate of unemployment, NAIRU) is and remains at 5%.

**Figure 2.5. Change in UK participation rates 2012 to 2062**



Source: Authors' calculation using the IFS long-run public finance model.

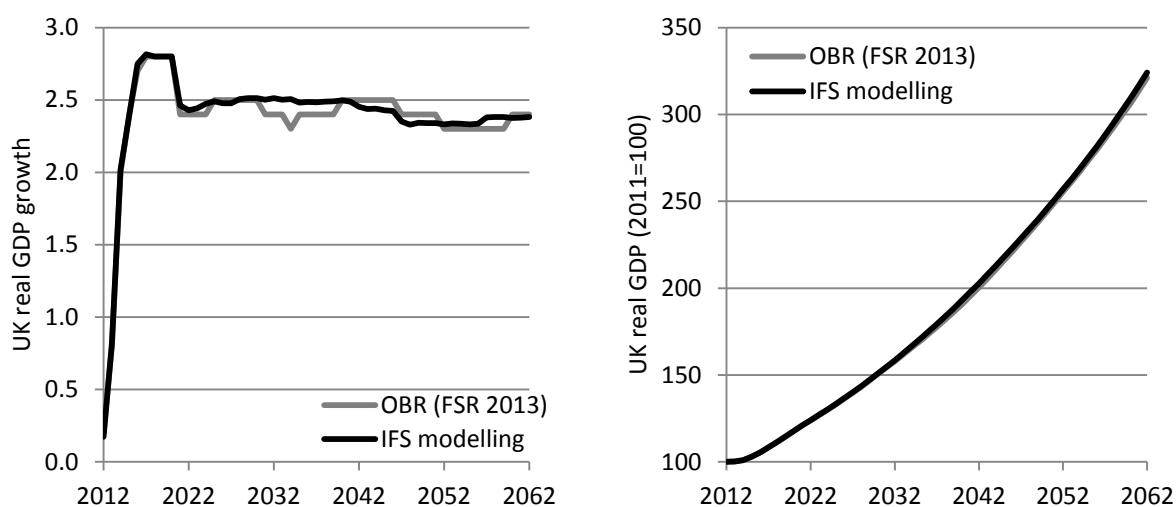
### **Labour productivity**

Labour productivity is assumed to grow at an exogenous rate in our model. The OBR's central estimate is that the productivity of each worker will grow by 2.2% per year and we maintain that assumption in our baseline model. Implicitly this assumes that the UK is able both to replace North Sea activity with other onshore activity as North Sea reserves decline, and increase onshore productivity, such that overall productivity in the economy increases by 2.2% a year. Our model does, however, have the capacity to incorporate the effect of different overall labour productivity growth rates. The effect of making such alternative assumptions is described briefly in Section 6.

### **GDP growth**

GDP growth from 2020–21 is modelled as the product of labour productivity and labour supply. As described in the preceding sections, labour supply is projected in the model, by taking the population projections and weighting by the projected participation rates, while labour productivity is assumed to grow at an exogenous rate. The forecasts for GDP growth that arise from our modelling are compared to those of the OBR in Figure 2.6. Our future projections are very similar to those of the OBR – both our model and the OBR project average GDP growth of 2.4% a year over the period 2020–21 to 2062–63. This similarity is to be expected since our model attempts to replicate their forecasting methodology. Figure 2.6b illustrates our projections for the growth in GDP per capita. This is projected to increase by an average 2.1% a year between 2020–21 and 2062–63 – lower than the growth rate of GDP as some increase in GDP is attributable to population growth.

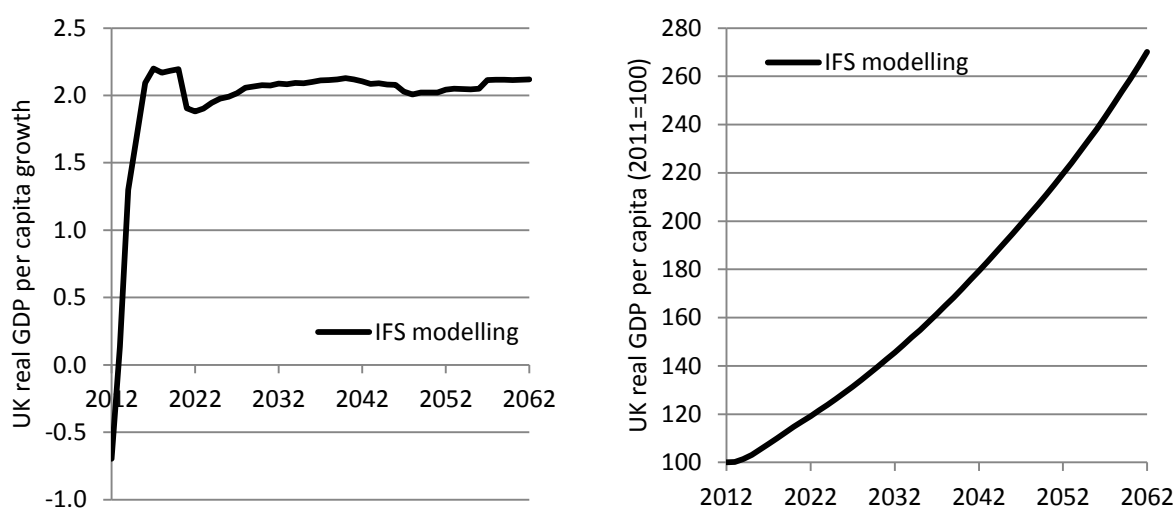
**Figure 2.6. IFS and OBR projections for UK real GDP compared**



Notes: 'Low migration' scenario.

Sources: OBR (2013b), authors' calculation using the IFS long-run public finance model.

**Figure 2.6b. IFS projections for UK real GDP per capita**



Notes: 'Low migration' scenario.

Sources: Authors' calculation using the IFS long-run public finance model.

## 2.2 Projecting Scottish GDP

The main purpose of developing a model to project future GDP is to allow us to project GDP growth separately for Scotland and the rest of the UK (henceforth, RUK). We can do this using the methodology described above for the UK, but with the inputs (demographic change, participation rates and labour productivity growth) specific to the nation in question. This gives us separate forecasts for Scotland and RUK GDP growth that, combined, would equate to UK GDP growth from 2020–21 onwards.

A slight complication arises in the medium term (2012–13 to 2020–21), where forecasting GDP growth on the basis of demographic change, participation rates and long run labour productivity would not replicate the OBR's current forecast for UK GDP growth. This is because – as described above – the economy is forecast to experience above trend growth over this period, in order to

catch back up to its trend level. Our approach to project Scottish GDP over this medium term period proceeds in four steps. First, we take a baseline decomposition of UK GDP between Scotland and RUK provided by the Scottish National Accounts Project (SNAP) in 2011–12, assuming North Sea output is allocated on a geographic basis. On this basis Scottish GDP per capita is estimated to have been £29,527 per capita (in 2013–14 prices) compared with £25,024 for the UK as a whole – in other words, 18% higher.<sup>5</sup> Second, we project how GDP in Scotland and in the UK as a whole would evolve over 2012–13 to 2020–21 if we were to use our long-run model. From that we can calculate the share of UK GDP projected to be accounted for by Scotland in each year. We then apply those Scottish shares to the OBR’s forecast of UK GDP for the medium term period. This is equivalent to assuming that Scotland and the rest of the UK are both currently operating at the same fraction of their trend output levels, and therefore have the same scope for above-trend growth over the next few years (without inducing inflationary pressures).<sup>6</sup> The assumptions regarding long-run demographic change, participation rates and labour productivity in Scotland, and how they differ from RUK, are discussed in turn below. We then present our projections for GDP growth in Scotland compared to GDP growth in RUK.

### ***Demographic change in Scotland***

The ONS produces separate population projections for the nations of the UK based on different longevity, fertility, mortality and migration assumptions. The implied change in the age distribution of Scotland, compared to that of RUK, is described in Table 2.2. The ONS projects that there will be significantly greater growth in the population of the rest of the UK between 2012 and 2062 than in the population of Scotland over the same period. Between 2012 and 2062, the ONS ‘low migration’ projection is for the population of the UK to grow by 22.8% compared to 4.4% growth in the population of Scotland. In addition, in Scotland all of this population growth arises from growth in the population aged 66 and over, while in RUK there is growth in the population at all ages. The median age of the Scottish population is projected to increase from age 40 in 2012 to age 46 in 2062, compared to an increase from 39 to 43 for the UK.

Lower population growth in Scotland will tend to depress projected Scottish GDP growth relative to that in RUK. The more rapid ageing of the Scottish population will also tend to reduce growth in GDP per capita since only individuals aged 16-74 are assumed to participate in the labour force and therefore to contribute to GDP.

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<sup>5</sup> Authors’ calculations based on population figures from the Office for National Statistics and estimates of Scottish GDP from SNAP, inflated to 2013–14 prices using figures for the UK GDP deflator published by HM Treasury. If, instead, we use a population allocation of North Sea output, Scottish GDP is estimated to have been £24,906 per person.

<sup>6</sup> Figures from the Labour Force Survey suggest that over the course of 2012 the unemployment rate in Scotland has been similar to that in England, though towards the end of 2012 and in early 2013 the unemployment rate has fallen in Scotland while in England it has remained largely unchanged (ONS 2013).

**Table 2.2. Comparing Scotland and RUK population projections**

Age group	Scotland			UK		
	% population 2012	% growth 2012 to 2062	% population 2062	% population 2012	% growth 2012 to 2062	% population 2062
0–15	17.3	–6.4	15.5	18.7	12.0	17.0
16–25	13.1	–14.0	10.8	13.2	5.0	11.3
26–35	12.9	–9.8	11.2	13.2	8.5	11.7
36–45	13.4	–7.5	11.9	13.7	9.9	12.2
46–55	14.7	–14.1	12.1	13.8	8.8	12.2
56–65	12.4	–9.4	10.8	11.6	7.8	10.1
66–75	8.9	38.9	11.8	8.6	53.3	10.7
76–85	5.4	66.7	8.7	5.3	79.0	7.8
over 85	1.8	320.6	7.2	2.0	327.5	6.9
<i>All</i>	100	4.4	100	100	22.8	100

Notes: ONS ‘low migration’ scenario.

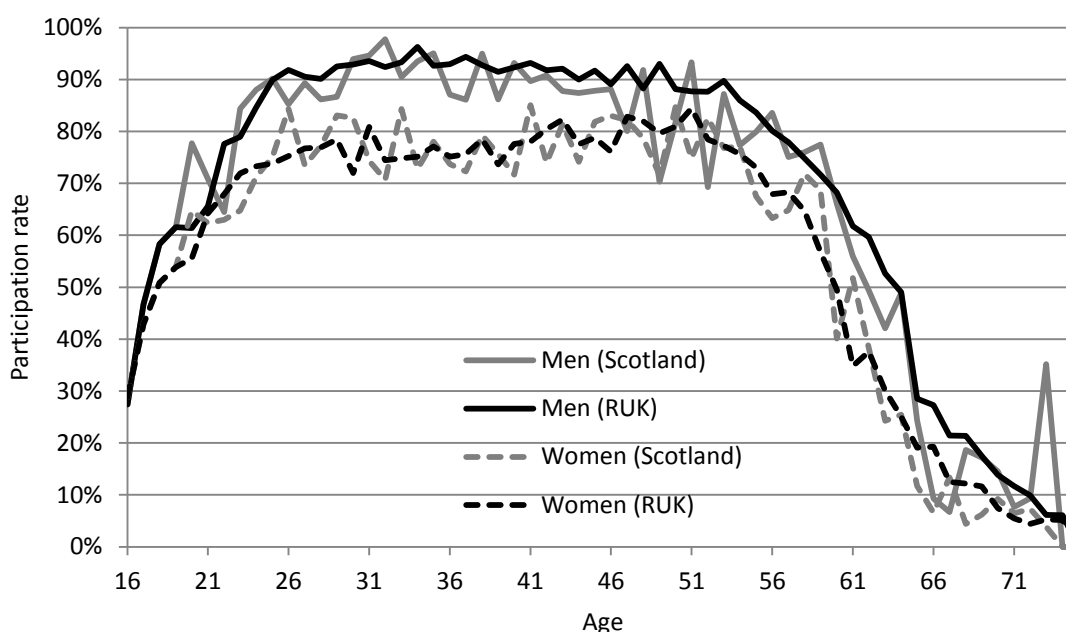
### ***Participation rates in Scotland***

Baseline profiles of participation rates for each age and sex were estimated based on the 2011–12 LFS data for Scotland and RUK separately. However, as illustrated in Figure 2.7, these are not systematically different between Scotland and RUK.<sup>7</sup> Therefore, to avoid “noise” in the data (resulting from the relatively small Scottish sample size) driving differences between the nations in our forecasting model, we instead use the UK participation profile (shown in Figure 2.2) as the baseline for both Scotland and RUK.

Given the relatively small sample sizes for Scotland in the LFS, we cannot estimate net entry and exit rates separately for the individual nations. Therefore, in our model we use the same projected net entry and exit rates for Scotland and RUK. Combined with the same baseline participation profiles, this means that our projections for future participation rates are the same in Scotland and RUK as for the UK as a whole. Differences in overall labour supply growth between Scotland and RUK are, therefore, solely driven by different demographic changes.

<sup>7</sup> Weighting the baseline participation profiles in Scotland and RUK for the composition of the population in 2011–12 suggests that the average labour market participation rate across individuals aged 16 to 75 was 73% and 61% for men and women (respectively) in Scotland, and 74% and 61% for men and women (respectively) in the rest of the UK.

**Figure 2.7. Participation rates in 2011 for Scotland and RUK**



Source: Authors' calculations based on the Labour Force Survey, 2011–12 .

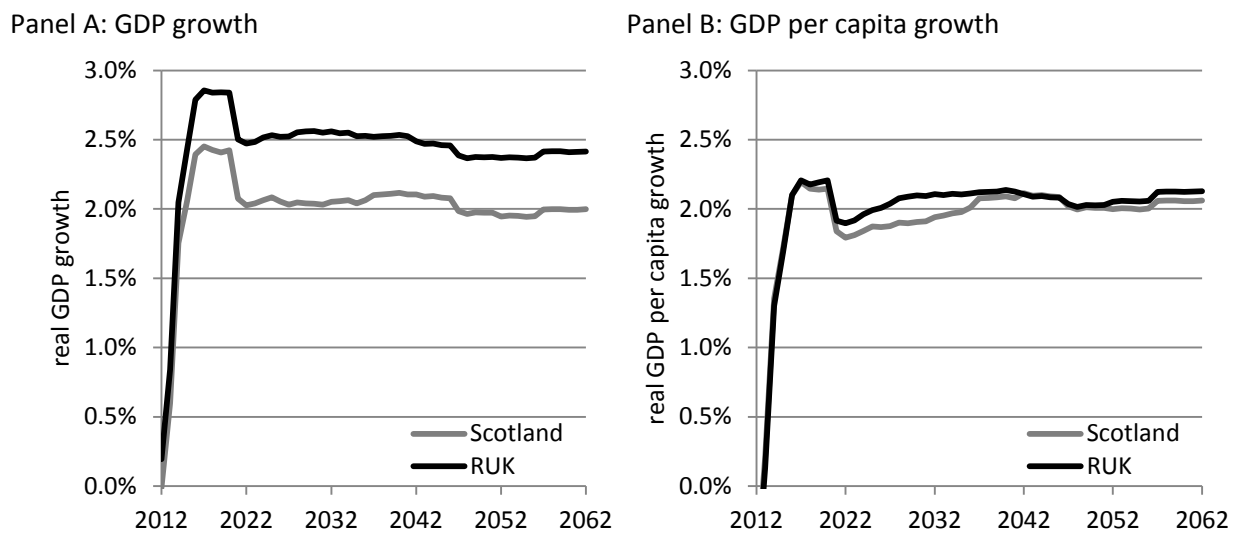
### ***Labour productivity***

In our baseline model we assume that the productivity of each worker in both Scotland and RUK grows at the same exogenous rate of 2.2%. However, as mentioned above, our model allows for different assumptions to be made about the growth of labour productivity in the UK as a whole and/or between different constituent nations.

### ***GDP growth in Scotland compared to RUK***

Figure 2.8 shows how projected real GDP growth compares between Scotland and RUK in our baseline model. Our baseline model uses the ONS 'low migration' population projections, and assumes exogenous labour productivity growth in each nation of 2.2%. Therefore, the differences between the projections arise entirely because of the different demographic projections in Scotland and RUK. Real GDP growth in RUK is projected to be higher than in Scotland in every year, around 2.5% per year over the long run, compared to around 2.0% in Scotland. This is due to the faster growth of the population in RUK. Growth in GDP per capita will be a better indicator of improvements in average living standards than growth in GDP. Panel B of Figure 2.8 shows the projected growth in GDP per capita in Scotland and RUK. GDP per capita is forecast to grow slightly less quickly in Scotland compared to the rest of the UK in the 2020s and 2030s, due to a greater proportion of the population growth in Scotland being among older age groups than in the rest of the UK. Over the period 2021–22 to 2062–63 GDP per capita in Scotland is projected to grow in real terms by 2.0% a year on average, compared to 2.1% in the rest of the UK. All these figures assume that the likely decline in North Sea activity over the next few decades is made up for by increases in onshore productivity. An alternative assumption, in which the decline in North Sea activity is not made up for with any increase in onshore activity, would lead to slower growth in GDP per capita, especially in Scotland.

**Figure 2.8. Projected GDP growth for Scotland and RUK**

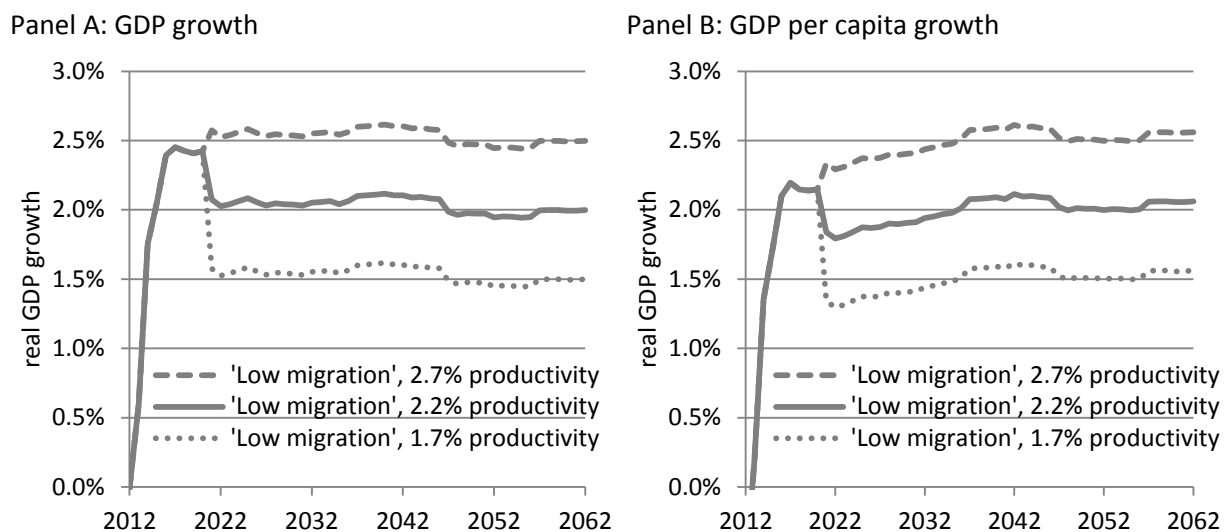


Source: Authors' calculation using the IFS long-run public finance model.

Different assumptions regarding labour productivity growth feed through fairly directly into different projections for long-run GDP growth. For example, if productivity in Scotland were to grow 0.5 percentage points more (less) quickly, then GDP growth in Scotland would also be around 0.5 percentage points higher (lower). This is illustrated in Figure 2.9.

The sensitivity of our projections for Scottish GDP growth to assumptions about migration is illustrated in 2.10. Higher (lower) net migration would increase (decrease) working-age population growth relative to our baseline model, and would therefore increase (decrease) GDP growth. The ONS 'high migration' scenario for future population growth would increase our long-run projections for Scottish GDP growth from around 2.0% per year to around 2.5% per year. Conversely, using the ONS 'zero migration' scenario would reduce GDP forecasts (by around 0.25-0.5 percentage points) to between 1.5% and 1.75% per year. However, alternative assumptions about migration make relatively little difference to projections for GDP per capita growth.

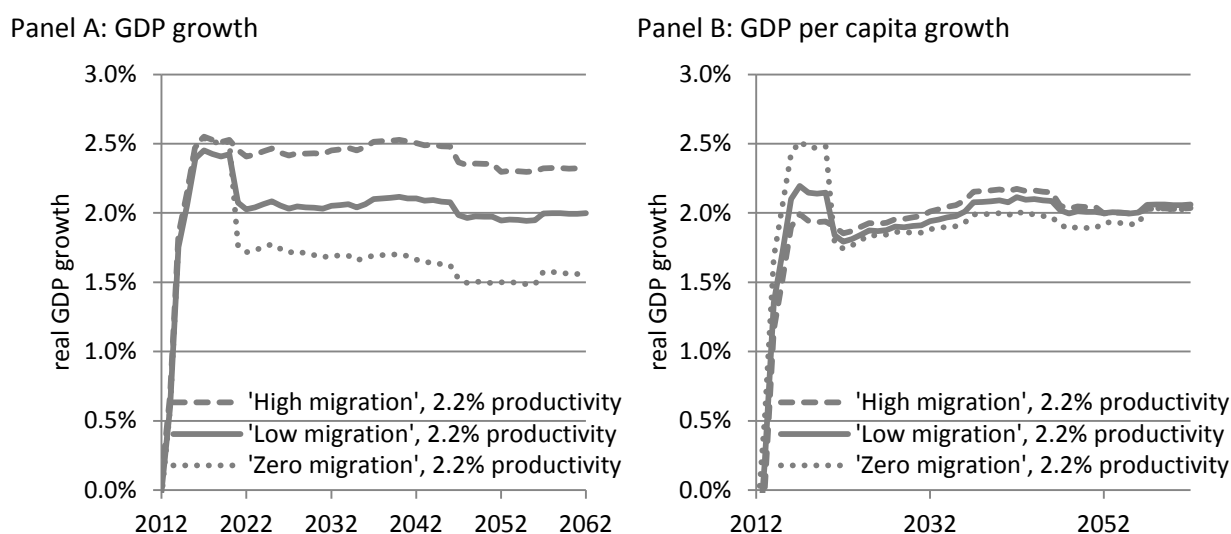
**Figure 2.9. Projected GDP growth for Scotland under different productivity scenarios**



Source: Authors' calculation using the IFS long-run public finance model.



**Figure 2.10. Projected GDP growth for Scotland under different migration scenarios**



Notes: ‘Low migration’ scenario assumes net inward migration of 9,000 per year while the ‘high migration’ scenario assumes net inward migration of 26,000. The ‘zero migration’ scenario assumes zero gross and zero net migration.

Source: Authors’ calculation using the IFS long-run public finance model.

### 3. Medium-term baseline for spending and revenues

In 2012–13, the UK government borrowed 7.4% of GDP.<sup>8</sup> However, to project where we might expect the public finances to be in 50 years’ time, we also need to take into account how the level of tax revenues and spending are expected to evolve over the next few years in response to policies that have already been announced and other economic developments that are expected. Subsection 3.1 describes how we construct a medium-term forecast for revenues in the UK, Subsection 3.2 describes the medium-term spending forecast and Subsection 3.3 then describes how we allocate these revenues and spending between Scotland and the rest of the UK. Subsection 3.4 summarises differences in the evolution of revenues and spending in Scotland and RUK between 2012–13 and 2020–21.

Our forecast for tax revenues and spending over the medium-term uses the latest forecast produced by the OBR, published at the time of the March 2013 Budget. This forecast runs up to and including the 2017–18 tax year. However, even in 2017–18 the OBR forecasts that the UK economy will be operating below its trend level. This means that (as mentioned in Section 2) further economic recovery and thus further improvement in the public finance position is expected after 2017–18. In line with the assumptions made by the OBR in their July 2013 FSR, we assume that the UK economy experiences above-trend growth for three more years after 2017–18 in order to return to its trend level in 2020–21. Therefore, our long-run forecast for revenues and spending (described in Sections 4 and 5) begins in 2021–22.

#### 3.1 Forecasting UK revenues in the medium-term

Table 3.1 summarises the level of different components of public sector revenues between 2012–13 and 2020–21, which constitute our medium-term baseline. These figures, by construction, match exactly the OBR’s medium-term forecast.

<sup>8</sup> Excluding the impact of the transfer of assets from the Royal Mail Pension Plan to the public sector.

Up to 2017–18, the forecasts for revenues used in our model are taken directly from the detailed forecasts for revenues in nominal terms published in the March 2013 *Economic and Fiscal Outlook* (EFO), coupled with the forecasts for GDP published at the same time. These are the same figures that are used in the FSR.

**Table 3.1 Medium-term forecasts for public sector revenues (UK: IFS model)**

<i>% GDP</i>	2012	2013	2014	2015	2016	2017	2018	2019	2020	ppt change
	-13	-14	-15	-16	-17	-18	-19	-20	-21	
Income tax	9.7	9.7	10.0	10.1	10.3	10.5	10.5	10.5	10.5	+0.8
National Insurance contributions	6.7	6.7	6.5	6.6	7.0	7.0	7.0	7.0	7.0	+0.3
VAT	6.5	6.5	6.5	6.4	6.4	6.3	6.3	6.3	6.3	-0.2
Capital taxes	1.1	1.4	1.3	1.3	1.4	1.5	1.6	1.7	1.9	+0.8
Corporation tax (excl. North Sea)	2.3	2.2	2.0	1.9	1.9	1.9	1.9	2.0	2.0	-0.3
North Sea	0.4	0.4	0.4	0.3	0.3	0.2	0.2	0.2	0.2	-0.2
Other non-interest revenues	10.3	10.4	10.5	10.5	10.3	10.2	10.1	10.1	10.1	-0.2
<b>Total non-interest revenues</b>	<b>37.0</b>	<b>37.2</b>	<b>37.1</b>	<b>37.1</b>	<b>37.5</b>	<b>37.6</b>	<b>37.7</b>	<b>37.9</b>	<b>38.1</b>	<b>+1.1</b>

Notes: Capital taxes include capital gains tax, inheritance tax, stamp duties and the Swiss capital tax. North Sea revenues includes offshore corporation tax and petroleum revenue tax.

Sources: IFS model figures up to 2017–18 use data from Table 4.7 of OBR (2013a). From 2018–19 onwards, IFS figures are set equal to OBR forecasts from Supplementary Table 1.1 of OBR (2013b)..

From 2018–19 onwards, we match our forecast to the FSR forecast for each component of revenues. The OBR’s medium-term forecast incorporates a small increase in revenues as a share of GDP after 2018–19, as the economy recovers back to its trend level. In particular, corporation tax revenues and revenues from capital taxes are projected to grow as a share of GDP.

Between 2012–13 and 2020–21, revenues as a whole and most individual revenue streams are forecast to grow as a share of GDP. However, VAT and North Sea revenues are projected to grow less quickly than the economy. Corporation tax revenues are also projected to grow less quickly than the economy between 2012–13 and 2015–16, as a result of announced reductions in the main rate of corporation tax (from 24% in 2012–13 to 20% in 2015–16).

### 3.2 Forecasting UK spending in the medium-term

Table 3.2 provides a comparison of our medium-term forecast for spending and that produced by the OBR. We focus on seven separate components of spending: health, social benefits, state pensions, education, public service pensions, long-term care and a residual category of other non-debt interest spending. We describe the first six of these in turn; the seventh is simply calculated as the residual of total non-debt interest spending less the other seven components. While we show and describe in detail how we construct every year of our medium-term forecast, the only thing that really affects our long-run forecasts is the level of spending in the last year of the medium-run forecast (2020–21). In other words, any differences between our forecast and the OBR’s before that point will not affect the comparison of our long-run forecasts.

### ***Total non-debt interest spending***

For the years 2012–13 to 2017–18, our forecast for total non debt interest spending is taken directly from the OBR’s March 2013 forecast. For the years 2018–19 to 2020–21, we assume that total non debt interest spending will be as forecast by the OBR in the FSR. Total non-debt interest spending is projected to fall from 42.3% of GDP in 2012–13 to 36.1% by 2020–21.

### ***Health***

We take a bottom-up approach to projecting health spending up to 2017–18, based on what we already know about departmental spending settlements up to 2015–16 and some assumptions about growth in health spending thereafter. We assume that health spending in 2012–13 is the same as the figure reported for “health” spending (according to the classification of functions of government) in the 2013 *Public Expenditure Statistical Analysis*, PESA (HMT, 2013). Between 2012–13 and 2015–16, we assume that health spending grows in real terms at the same rate as planned for the English NHS. This assumption leads us to forecast a marginally (0.1 percentage point) higher level of spending on health as a share of GDP in 2014–15 and 2015–16 than the OBR does. In 2016–17 and 2017–18, we assume that total health spending remains frozen in real terms. This assumption leads us to forecast health spending being 0.3 and 0.4 percentage points of GDP higher than forecast by the OBR in 2016–17 and 2017–18, respectively.

For the final three years of the medium-term forecast period, we assume that health spending as a share of GDP will be exactly as forecast by the OBR in the FSR.

### ***Social benefits (excluding state pensions)***

For the years 2012–13 to 2017–18, our forecast for non-pensioner benefits – that is, benefit spending not directed towards pensioners – are based on the forecasts presented in the March 2013 EFO. We assume that total benefit spending will be equal to the sum of social security and tax credit spending, as forecast by the OBR, and calculate “non-pensioner social benefits” as this less spending on state pensions (described below) and pensioner benefits. To this we add a forecast for spending on pensioner benefits excluding state pensions. This gives us a medium-term forecast for non-pensioner benefits. Our medium-term forecast for pensioner benefit spending excluding state pensions is taken directly from the Department for Work and Pensions (DWP) long-term pensioner benefit spending projections, which also are used in the OBR’s FSR projections.<sup>9</sup>

By construction, these assumptions produce a forecast for social benefits spending which is the same as the FSR figure in all years up to 2017–18.

From 2018–19 onwards, we assume that social benefit spending will be exactly equal to the forecast made by the OBR in the 2013 FSR.

### ***State pensions***

Our medium-term forecast for state pension spending is taken directly from the DWP long-term pensioner benefit spending projections, which also are used in the OBR’s FSR projections.

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<sup>9</sup> <https://www.gov.uk/government/publications/long-term-projections-of-pensioner-benefits--2>

## **Education**

As with health spending, we take a bottom-up approach to forecasting education spending up to 2017–18, based on what we already know about departmental spending settlements up to 2015–16 and some assumptions about growth in education spending thereafter. We assume that education spending in 2012–13 is the same as the figure reported for “education” spending (according to the classification of functions of government) in the 2013 PESA (HMT, 2013).

In order to forecast education spending between 2013–14 and 2015–16, we forecast separately spending on higher education and spending on other (non-higher) education.<sup>10</sup> Some elements of education spending in 2012–13 are not identified by education level in PESA. We classify all of these unidentified elements as being part of schools spending, with the exception of education research and development, which we classify as being higher education.

For the years 2013–14 to 2015–16, we assume that higher education spending grows in line with planned real terms increases in the Department for Business, Innovation and Skills departmental expenditure limit. Over the same period, we assume that spending on other levels of education grows in line with planned real increases in the Department for Education’s departmental expenditure limit.<sup>11</sup> These assumptions lead us to forecast education spending that is 0.2 percentage points of GDP higher than forecast by the OBR in 2015–16.

Given the assumptions described above about the level of total non debt interest spending and the other components of spending in 2016–17 and 2017–18 (described above and below), we can infer what real growth rate is required across education spending and other areas of spending to match the overall forecast spending totals. This calculation implies that education spending and the residual category of other spending would need to fall in real terms by an average of 4.1% in 2016–17 and a further 5.0% in 2017–18. We assume that this cut is applied equally across education and the other remaining areas of spending. This gives us a forecast for education spending in 2016–17 and 2017–18 that is exactly in line with the OBR’s FSR forecast.

In the three years from 2018–19, we assume that the level of education spending is as forecast in the FSR.

## **Public service pensions**

The forecast that we use for public sector pension spending in the medium-run is taken directly from the FSR (see Supplementary Table 1.1 of PBR (2013b)). Our forecast, therefore, exactly matches the OBR’s. The forecasts used in the FSR are produced for the OBR by the Government Actuary’s Department.

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<sup>10</sup> The measure of higher education spending recorded in PESA includes the estimated long-run cost to the government of providing student loans (as opposed to the upfront value of the loans made).

<sup>11</sup> Since these assumptions about spending growth are based on plans for departmental spending in England, we are implicitly assuming that the other nations of the UK plan to increase spending on education at the same rate between 2012–13 and 2015–16 as is planned for England.

**Table 3.2 Medium-term forecasts for public sector expenditure (UK)**

<i>% GDP</i>	<b>2012– 13</b>	<b>2013– 14</b>	<b>2014– 15</b>	<b>2015– 16</b>	<b>2016– 17</b>	<b>2017– 18</b>	<b>2018– 19</b>	<b>2019– 20</b>	<b>2020– 21</b>
<b><i>OBR forecast</i></b>									
Health	8.1	8.1	8.0	7.8	7.4	7.0	7.0	6.9	6.9
Long-term care	1.2	1.2	1.2	1.2	1.3	1.3	1.3	1.4	1.4
Education	5.6	5.4	5.3	5.1	4.9	4.6	4.6	4.5	4.5
Pensions	6.0	6.0	6.0	6.0	5.9	5.8	5.8	5.7	5.7
Public service pensions	2.2	2.3	2.3	2.3	2.3	2.3	2.3	2.2	2.2
Other social benefits (incl. pensioner benefits)	7.7	7.4	7.3	7.1	7.0	6.8	6.8	6.7	6.7
Other spending	11.4	11.5	10.8	10.1	9.4	8.8	8.8	8.8	8.7
<b>Total non-interest spending</b>	<b>42.3</b>	<b>42.0</b>	<b>40.8</b>	<b>39.7</b>	<b>38.2</b>	<b>36.7</b>	<b>36.5</b>	<b>36.3</b>	<b>36.1</b>
<b><i>IFS projection</i></b>									
Health	8.1	8.1	8.1	7.9	7.7	7.4	7.0	6.9	6.9
Long-term care	1.2	1.2	1.2	1.2	1.3	1.3	1.3	1.4	1.4
Education	5.6	5.7	5.5	5.3	4.9	4.5	4.6	4.5	4.5
Pensions	6.0	6.0	6.0	6.0	5.9	5.8	5.8	5.7	5.7
Public service pensions	2.2	2.3	2.3	2.3	2.3	2.3	2.3	2.2	2.2
Other social benefits (incl. pensioner benefits)	7.7	7.4	7.3	7.1	7.0	6.8	6.8	6.7	6.7
Other spending	11.4	11.3	10.5	9.9	9.1	8.5	8.8	8.8	8.7
<b>Total non-interest spending</b>	<b>42.3</b>	<b>42.0</b>	<b>40.8</b>	<b>39.7</b>	<b>38.2</b>	<b>36.7</b>	<b>36.5</b>	<b>36.3</b>	<b>36.1</b>
<b><i>Difference (IFS-OBR)</i></b>									
Health	0.0	0.0	+0.1	+0.1	+0.3	+0.4	0.0	0.0	0.0
Long-term care	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Education	0.0	+0.3	+0.2	+0.2	0.0	-0.1	0.0	0.0	0.0
Pensions	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Public service pensions	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other social benefits (incl. pensioner benefits)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other spending	0.0	-0.2	-0.3	-0.2	-0.3	-0.3	0.0	0.0	0.0
<b>Total non-interest spending</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>

Notes: Figures may not sum due to rounding. Figures in 2012–13 (other spending and total non-interest spending) are adjusted to exclude the impact of the transfer of assets from the Royal Mail Pension Plan to the public sector.

Sources: OBR figures are from Table 1.1 of OBR (2013b). IFS figures use various sources, which are described in the text.

### ***Long-term care***

The forecast that we use for long-term care spending in the medium- run is also taken directly from the FSR. The projection they use was provided by the Personal Social Services Research Unit (PSSRU)

and assumes that the reforms to long-term care outlined by the government in February 2013 (following the recommendations of the Dilnot Commission) are implemented.<sup>12</sup> Our projections for long-term care spending over the medium-run therefore exactly match the OBR's by assumption.<sup>13</sup>

### **3.3 Estimating Scotland's share of revenues and spending**

In order to produce a forecast for the fiscal balance of the individual nations of the UK, we must work out what fraction of future public spending will be devoted to the different nations and from which of them the tax revenues will be raised.<sup>14</sup> There are numerous difficulties in doing this, which have been discussed at greater length elsewhere (see Scottish Government (2013a), HMRC (2013a)). Exactly how the spending and revenues are allocated is important, as it can crucially affect the fiscal balance in each nation at the end of the medium-run forecast horizon. Since our model assumes that no further policy changes are made beyond the end of the medium-term forecasting horizon, the fiscal balance at the end of the medium-run horizon plays a crucial role in determining how each nation's borrowing and debt will evolve thereafter.

We allocate revenues and spending between Scotland and the rest of the UK on the basis of the figures for 2011–12 published in Scottish Government (2013a) – henceforth, GERS.<sup>15</sup> We also take into account differences in the expected evolution of population size and age structure between Scotland and the rest of the UK up to 2020–21.

#### ***Estimating the Scottish share of revenues***

Table 3.1 of GERS provides an estimate of what fraction of each revenue stream is raised from Scotland. We use these figures to allocate revenues between Scotland and the rest of the UK in 2012–13.<sup>16</sup> 8.4% of the UK population lives in Scotland and 9.9% of UK GDP (including that produced in the North Sea) is produced in Scotland (assuming Scotland accounts for a geographic share of North Sea production). However, as shown in the middle column of Table 3.3, Scotland is estimated to contribute just 5.6% of inheritance tax revenues each year but 18.4% of revenues from the aggregates levy. Lower inheritance tax revenues in Scotland than the rest of the UK reflects the fact that Scotland contains fewer high wealth individuals and property prices are on average lower in Scotland than the rest of the UK. Aggregates levy is a tax on the commercial exploitation of rock, gravel and sand; this is done more extensively in Scotland than the rest of the UK. The Scottish share

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<sup>12</sup> For further details on the modelling of long-term care costs, see Annex B of OBR (2013b).

<sup>13</sup> The OBR's forecast for long-term care spending is presented in Chart B.3 of OBR (2013b). A corrected version of the data underlying this chart was sent to the authors by the OBR and is used in our model.

<sup>14</sup> The OBR does produce medium-term forecasts for Scottish revenues of those taxes over which power is devolved to Scotland – this includes 10p on each band of income tax, stamp duty land tax, landfill tax, and aggregates levy. We do not make use of these forecasts in our modelling. However, in the cases where we can directly compare our model results to the forecasts from the OBR, the figures look very similar. For example, for landfill tax, the OBR forecast revenue stream from 2012–13 to 2017–18 is: £99 million, £95 million, £104 million, £105 million, £105 million, £108 million (OBR, 2013c). This compares to our projection of: £97 million, £90 million, £97 million, £105 million, £106 million, £105 million.

<sup>15</sup> HMRC has produced an alternative estimate of what fraction of each HMRC revenue stream is raised from Scotland. These are compared to the GERS figures in Table A1 in the Appendix. A discussion of the different approaches is provided by Adam, Johnson and Roantree (2013).

<sup>16</sup> There are a few small revenue streams that GERS does not separately identify (for example, TV licence fee income). We assume that these are allocated to the individual nations on a per capita basis – i.e. 8.4% of the total revenues accrue to Scotland.

of most of the major taxes are closer to the population share – for example, GERS estimates that Scotland contributes 9.0% of onshore corporation tax revenues and 7.4% of income tax revenues.

Throughout our forecast, we assume that Scotland receives a geographic share of the revenues generated by the North Sea. This assumption implies that Scotland receives 94.0% of North Sea revenues (including offshore corporation tax and petroleum revenue tax).

**Table 3.3 Scottish share of revenues in 2012–13 and 2020–21**

Revenue component	UK revenues (as % GDP in 2012–13)	Scottish share in 2012–13: IFS model	Scottish share in 2020–21: IFS model
Income tax	9.7	7.4	7.2
National Insurance contributions	6.7	8.3	8.1
VAT	6.5	8.7	8.5
Corporation tax (excluding North Sea)	2.2	9.0	8.7
Fuel duties	1.7	8.6	8.4
Council tax	1.7	7.7	7.6
Business rates	1.7	8.1	7.9
Alcohol duties	0.7	9.6	9.4
Tobacco duties	0.6	11.4	11.2
Stamp duties	0.6	5.7	5.4
North Sea revenue	0.4	94.0	94.0
Vehicle excise duty	0.4	8.0	7.8
Capital gains tax	0.3	5.7	5.6
Inheritance tax	0.2	5.6	5.5
Insurance premium tax	0.2	8.4	8.2
Air passenger duties	0.2	8.1	7.9
Betting and gaming duties	0.1	9.4	9.3
Landfill tax	0.1	9.0	8.7
Climate change levy	0.0	9.5	9.2
Aggregates levy	0.0	18.4	17.9
<b>Total non-interest revenues</b>	<b>37.0</b>	<b>9.2</b>	<b>8.5</b>

Sources: UK revenues as a share of GDP are from OBR (2013a). Scottish share of revenues are authors' calculations based on Table 3.1 of Scottish Government (2013a).

The amount of tax paid will depend on the size of the economy in each nation. Due to differential changes in demographics, our forecast (described in Section 2) is that both GDP per capita and the size of the population will grow slightly less quickly in Scotland than in the rest of the UK between 2012–13 and 2020–21. We take this into account in our medium-term forecast for revenues from each nation. Specifically, in order to estimate what fraction of total UK revenues will be accounted for by revenues from Scotland and what share will come from the rest of the UK, we produce a 'ghost' projection for Scotland and RUK for each revenue stream using the same method as described in Section 4 for our long-run forecast. These 'ghost' projections provide an indication of how quickly revenues in Scotland will grow relative to revenues in the rest of the UK, and thus how

the origin of UK revenues will shift over time. (Interested readers should refer to Section 4 for further details on the methodology.)

As described in Section 2, between 2012–13 and 2020–21, real Scottish GDP is projected to grow by 17.9%, while the Scottish population will grow by 2.7%; consequently real GDP per capita is projected to grow by 14.9%. This is compared to 21.3%, 5.6% and 14.9% respectively for the rest of the UK. Therefore, by 2020–21, Scotland will account for 8.1% of the UK's total population and 9.6% of GDP. As a result, the Scottish share of all UK revenue streams (with the exception of North Sea revenues) is projected to decline over the medium-term horizon, as shown in the third column of Table 3.3. We estimate that Scotland contributed 9.2% of total non-interest revenues in the UK in 2012–13 but that this will fall to 8.5% in 2020–21.

### ***Estimating the Scottish share of spending***

Our allocation of public spending between Scotland and the rest of the UK is also largely based on the GERS methodology. However, some of the components of spending that are important in our model are not readily identifiable in GERS; we, therefore, have to make some additional assumptions.

We estimate the Scottish share of education and health spending in 2012–13 using the breakdown provided for these functional areas of spending in 2011–12 in GERS, which uses a similar methodology to PESA (HMT, 2013). We also assume that the distribution of total non-interest spending between Scotland and the rest of the UK is as suggested by GERS. As shown in Table 3.4, we therefore assume that Scotland accounted for 9.3% of all non-interest spending in 2012–13, including 9.1% of health spending and 8.4% of education spending. For all areas of spending shown in Table 3.4, Scottish spending constitutes a larger share of total UK spending than Scotland's share of the population, which was just 8.4% in 2012–13.

We calculate the Scottish share of benefit spending in 2012–13 (including spending on state pensions and other pensioner benefits) using figures provided by the Department for Work and Pensions and the Department for Social Development in Northern Ireland for benefit spending across regions. These figures imply that 8.4% of all UK benefit spending (including state pension) goes to Scotland. Differences in benefit spending between Scotland and the rest of the UK are discussed in more detail in Phillips (2013).

We assume that spending on public service pensions is distributed between Scotland and the rest of the UK in proportion to the fraction of public sector workers currently employed in each of the nations. In 2012–13, 9.1% of public sector workers were employed in Scotland;<sup>17</sup> we, therefore, assume that 9.1% of public service pension spending is done in Scotland.<sup>18</sup>

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<sup>17</sup> This was the fraction of public sector employees working in Scotland according to data from the Labour Force Survey in Q1 2012.

<sup>18</sup> In practice, it might be most equitable to divide future payments for public service pensions in such a way that it reflects the amount of each public sector workers' service that benefitted Scotland. However, incorporating this into our model would require full information on employment histories of public sector workers. This information is not publicly available and such an exercise is well beyond the scope of our modelling.



We assume that spending per head by age and sex on long-term care is the same in Scotland and the rest of the UK.<sup>19</sup> This implies that Scotland accounted for 8.4% of long-term care spending in the UK in 2012–13.

As with revenues, we allow the Scottish share of different spending components to evolve over the medium-term in line with changes in the size and composition of the population. We do this by producing a ‘ghost’ projection of spending in each area for Scotland and RUK, using a very similar methodology to that described in Section 5 for the long-run forecasts. Between 2012–13 and 2020–21, the Scottish population is projected to grow less quickly than the population of the UK as a whole, such that by 2020–21, the Scottish population will comprise just 8.1% of the UK total. As a result, by 2020–21, we forecast that the Scottish share of total UK non-interest spending will have fallen to 9.1%. The decline in the Scottish share of spending is most dramatic in those areas of spending concentrated on the young (such as education), as it is at younger ages that Scottish population growth is projected to be particularly low.

**Table 3.4 Scottish share of spending in 2012–13 and 2020–21 (% of UK total)**

Spending component	UK spending (as % GDP)	Scottish share in 2012–13	Scottish share in 2020–21
Health	8.0	9.1	8.9
(Non-pension) social benefits	7.8	8.4	8.2
Pensions	6.0	8.4	8.3
Education	5.6	8.4	7.9
Public service pensions	2.2	9.1	9.2
Long-term care	1.2	8.4	8.3
Other spending	11.4	11.7	11.3
<b>Total non-interest spending</b>	<b>42.3</b>	<b>9.4</b>	<b>9.1</b>
<b><i>Fraction of UK population</i></b>		<b>8.3</b>	<b>8.1</b>

Sources: UK spending as a share of GDP is from OBR (2013a). Scottish share of spending are authors’ calculations based on Tables 5.4 and 5.5 of Scottish Government (2013).

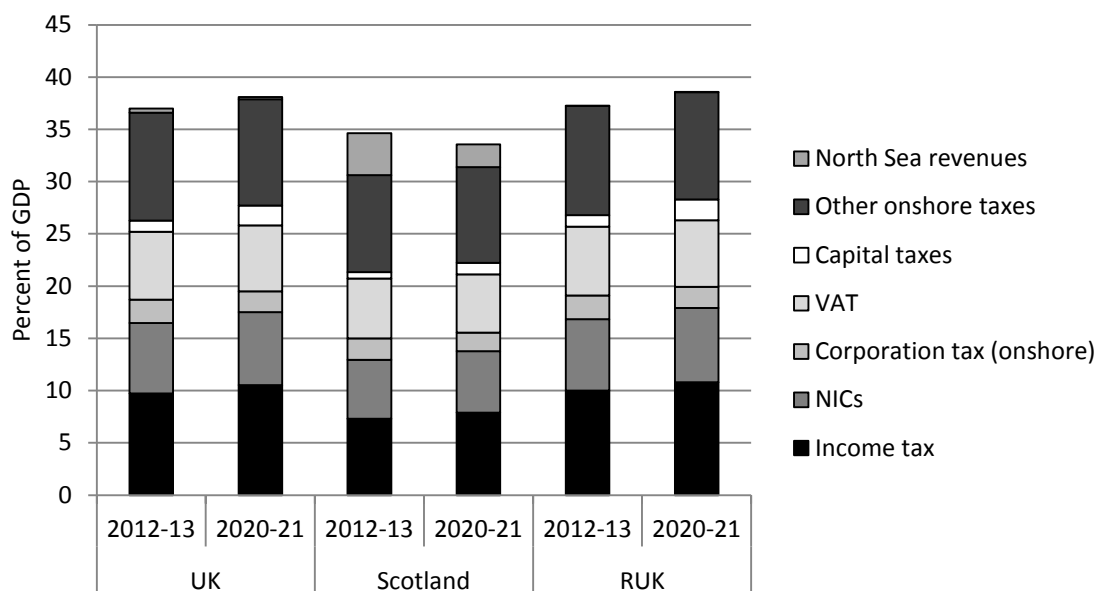
### 3.4. Summary of medium-term changes in revenues, spending and primary balance

Between 2012–13 and 2020–21, for the UK as a whole, revenues are projected to increase more quickly than GDP (as was shown in Table 3.1 and reproduced in Figure 3.1). However, within this some revenue streams are projected to decline relative to GDP. In particular, revenues from the North Sea are projected to fall from 0.4% of GDP to 0.2% of GDP. Given the assumptions just described about the distribution of revenues between the nations, Scotland is more reliant on this declining revenue stream than the rest of the UK is. Therefore, overall Scottish revenues are projected to decline relative to GDP between 2012–13 and 2020–21 – in contrast to the growth projected for RUK: this is shown in Figure 3.1.

<sup>19</sup> Figures for relative spending per head that underlie OBR (2013b) were provided to the authors by analysts at the OBR, and are reproduced in Figure A.25 in the appendix. The assumption that spending per head in Scotland in 2012–13 is the same as in the rest of the UK likely understates the current level of Scottish spending on long-term care. However, our model also assumes that spending per head increases at the same rate in Scotland as in the rest of the UK, which probably overestimates the growth in Scottish spending on long term care, since the UK growth rate incorporates increases in spending on long-term care in England arising from reforms to the way long-term care is financed (introduced in response to the recommendations of the recent Commission on Funding of Care and Support).

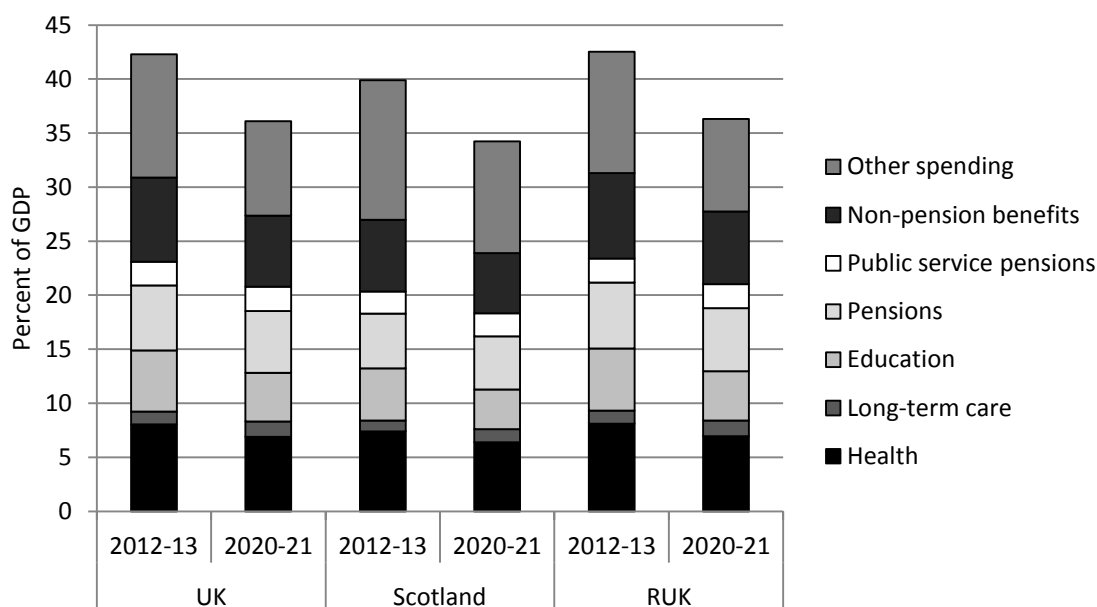
On the spending side, the outlook for Scotland and RUK between 2012–13 and 2020–21 is more similar, as shown in Figure 3.2. Across the UK, public spending is projected to grow less quickly than GDP, as a result of both active policy decisions to cut public spending over the next few years and because of above-trend economic growth.

**Figure 3.1 Change in level and composition of revenues in Scotland and the rest of the UK, 2012–13 to 2020–21**



Source: Authors' calculations using IFS long-run public finance model.

**Figure 3.2 Change in level and composition of spending in Scotland and the rest of the UK, 2012–13 to 2020–21**



Notes: Figures for other spending in 2012–13 are adjusted to exclude the impact of the transfer of assets from the Royal Mail Pension Plan to the public sector.

Source: Authors' calculations using IFS long-run public finance model.

Taken together, these trends in revenue and spending growth in Scotland and RUK mean that RUK's primary balance will strengthen more rapidly than Scotland's. The primary balance is defined as the difference between non-interest revenues and non-interest spending, or equivalently as (the negative of) public sector borrowing less net interest spending. Table 3.5 summarises how total revenues, spending and the primary balance are forecast to evolve as a share of GDP in Scotland and the rest of the UK between 2012–13 and 2020–21.

As described in Section 2, Scotland currently has a higher level of GDP per head than the rest of the UK, which is largely accounted for by output generated in the North Sea. As a result, Scotland is forecast to spend and raise less in taxes than the rest of the UK up to 2020–21 when measured as a share of GDP. However, Scotland had the same similar primary balance to the rest of the UK in 2012–13: non-interest revenues were 5.3% of GDP lower than non-interest spending in both Scotland and RUK. Between 2012–13 and 2020–21, our projection implies that the primary balance will improve in Scotland but will still be in deficit by 0.7% of GDP by 2020–21. The RUK primary balance is also projected to improve over this period but, in contrast to Scotland, RUK is projected to reach a surplus of 2.3% of GDP in 2020–21. The level of the primary balance in the medium-term is a very important determinant of the path of debt in the long-run. All other things being equal, the smaller is the primary surplus that a country has (or the larger the deficit), the more rapidly their debt will grow in future.

**Table 3.5 Medium-term forecasts for spending, revenues and primary balance in Scotland and the rest of the UK**

% GDP	2012–13	2013–14	2014–15	2015–16	2016–17	2017–18	2018–19	2019–20	2020–21
<b>UK (OBR model)</b>									
Non-interest revenues	37.0	37.2	37.1	37.1	37.5	37.6	37.7	37.9	38.1
Non-interest spending	42.3	42.0	40.8	39.7	38.2	36.7	36.5	36.3	36.1
<b>Primary balance</b>	<b>-5.3</b>	<b>-4.8</b>	<b>-3.8</b>	<b>-2.6</b>	<b>-0.6</b>	<b>0.9</b>	<b>1.3</b>	<b>1.7</b>	<b>2.1</b>
<b>UK (IFS model)</b>									
Non-interest revenues	37.0	37.2	37.1	37.1	37.5	37.6	37.7	37.9	38.1
Non-interest spending	42.3	42.0	40.9	39.7	38.2	36.7	36.5	36.3	36.1
<b>Primary balance</b>	<b>-5.3</b>	<b>-4.8</b>	<b>-3.8</b>	<b>-2.6</b>	<b>-0.6</b>	<b>0.9</b>	<b>1.3</b>	<b>1.7</b>	<b>2.1</b>
<b>Scotland</b>									
Non-interest revenues	34.6	34.7	34.1	33.2	33.5	33.2	33.3	33.5	33.6
Non-interest spending	39.9	40.2	39.0	37.7	36.2	34.7	34.5	34.5	34.3
<b>Primary balance</b>	<b>-5.3</b>	<b>-5.4</b>	<b>-4.9</b>	<b>-4.5</b>	<b>-2.7</b>	<b>-1.5</b>	<b>-1.2</b>	<b>-1.0</b>	<b>-0.7</b>
<b>Rest of UK</b>									
Non-interest revenues	37.3	37.5	37.4	37.5	38.0	38.1	38.2	38.4	38.6
Non-interest spending	42.5	42.2	41.1	39.9	38.4	36.9	36.7	36.5	36.3
<b>Primary balance</b>	<b>-5.3</b>	<b>-4.7</b>	<b>-3.7</b>	<b>-2.4</b>	<b>-0.4</b>	<b>1.2</b>	<b>1.5</b>	<b>1.9</b>	<b>2.3</b>

Notes: Figures may not sum due to rounding. Figures for 2012–13 are adjusted to exclude the impact of the transfer of assets from the Royal Mail Pension Plan to the public sector.

Sources: OBR figures are from Table 1.1 of OBR (2013b). IFS figures use various sources, which are described in the text.

#### 4. Long-run forecast for revenues

Projections for future tax revenues in our model depend on two factors: first, how quickly revenues per individual are expected to grow, and second how changes in demographics might affect the

amount of revenues raised from different taxes. Most tax receipts will grow if the population size increases, but if the population becomes increasingly aged, the increase in VAT receipts, for example, would be expected to be greater than the increase in employee National Insurance contributions (NICs), since the latter are only paid by employees aged under the SPA.

The method used to estimate future tax revenues in our model has four steps:

- i. Calculate the level of tax revenues in the baseline year, 2020–21 (see Section 3).
- ii. Estimate, for each tax, what fraction of revenues is raised from each individual of a given age and sex.
- iii. Project the future tax raised per individual, based on an assumption about the growth rate of tax revenues. For most revenue sources we assume that revenue per head grows in line with growth in nominal earnings (the product of assumed growth in labour productivity and the GDP deflator).<sup>20</sup>
- iv. Calculate the total amount raised from each tax by summing the tax raised per individual across the population, given the projected future size and composition of the population (Section 2).

We describe step (ii) and show the final results from step (iv) for each of the major taxes below.

The exception to this four step process is revenues raised from the North Sea (off-shore corporation tax and petroleum revenue tax), where the decline of North Sea oil and gas reserves will also be important in determining the growth rate of North Sea revenues. For this revenue we use long-run forecasts generated outside our model.

The level of future tax receipts can be projected separately for Scotland and the rest of the UK. The projections can differ between the nations due to differences in the baseline amount of revenue raised from each tax, differences in the profile of tax receipts by age and sex, differences in the growth of nominal earnings or GDP per capita and/or differences in projected demographic changes over time between the nations of the UK.

### ***Income tax***

The profile for income tax receipts by age and sex is estimated using the Survey of Personal Incomes (SPI) – an annual sample survey of HMRC income tax records (both PAYE and Self-Assessment).<sup>21</sup> This is a different methodology to that employed by the OBR, who use the Family Resources Survey (FRS) to estimate a profile of income tax payments. We use SPI data rather than FRS data because we think the SPI better captures income tax payments of older individuals than the FRS does. The published SPI data only contains which 10-year age band each individual is in; therefore we are constrained to estimating the average tax paid by individuals of a given sex and age-band rather than each age. The estimated profiles for men and women in Scotland and the rest of the UK are shown in Figure 4.1. The distributions for each nation are indexed, with the level of spending on a 30 year-old man set equal to 1. These show the expected picture that a greater proportion of income tax receipts come from men than women, and from those in the prime years of working life than

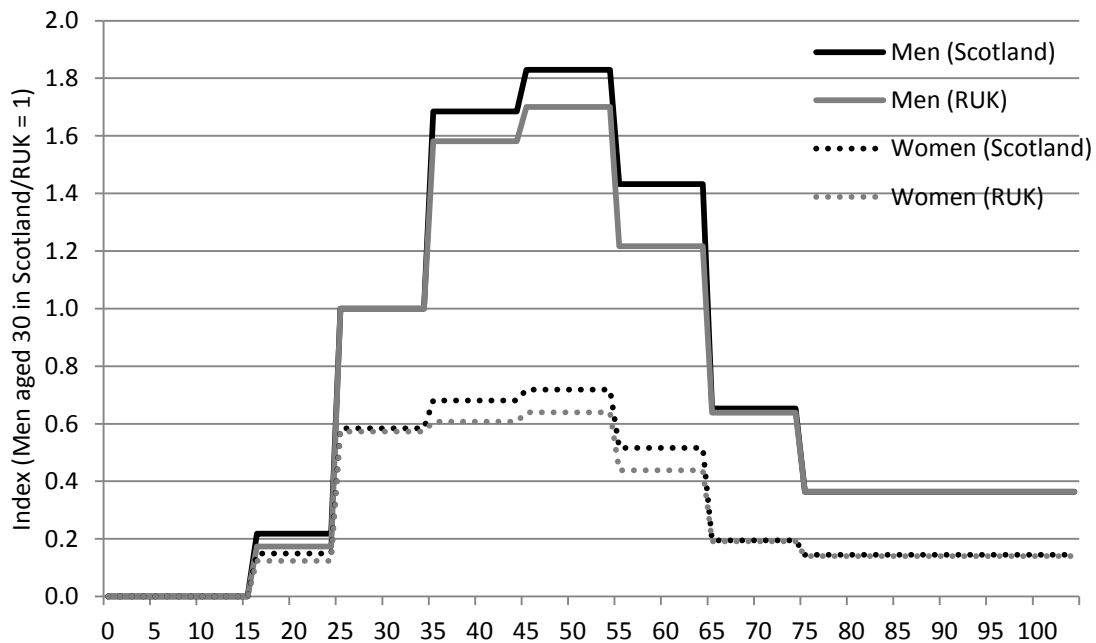
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<sup>20</sup> The exceptions to this are the gross operating surplus of public corporations and revenues from interest and dividends, which are assumed to grow in line with nominal GDP per capita.

<sup>21</sup> Since the SPI data is only representative of tax-payers, we combine it with ONS population estimates to calculate the average tax paid across the whole population in an age-sex cell.

younger or older individuals. The profiles for Scotland and the rest of the UK are very similar, with only slight differences in the proportions contributed by men in their late 20s and men and women in their 40s, 50s and early 60s.

**Figure 4.1. Estimated age profile of income tax receipts**



Notes: We assume that income tax receipts per capita are uniform for ages 70 and above.  
 Source: Authors' calculations using the Survey of Personal Incomes.

We construct long-run projections for income tax receipts in each nation by assuming that revenue per capita in each age/sex/nation group grows in line with that nation's average earnings. We then aggregate up to total revenues based on the ONS' forecast for the size and composition of the nation's population.

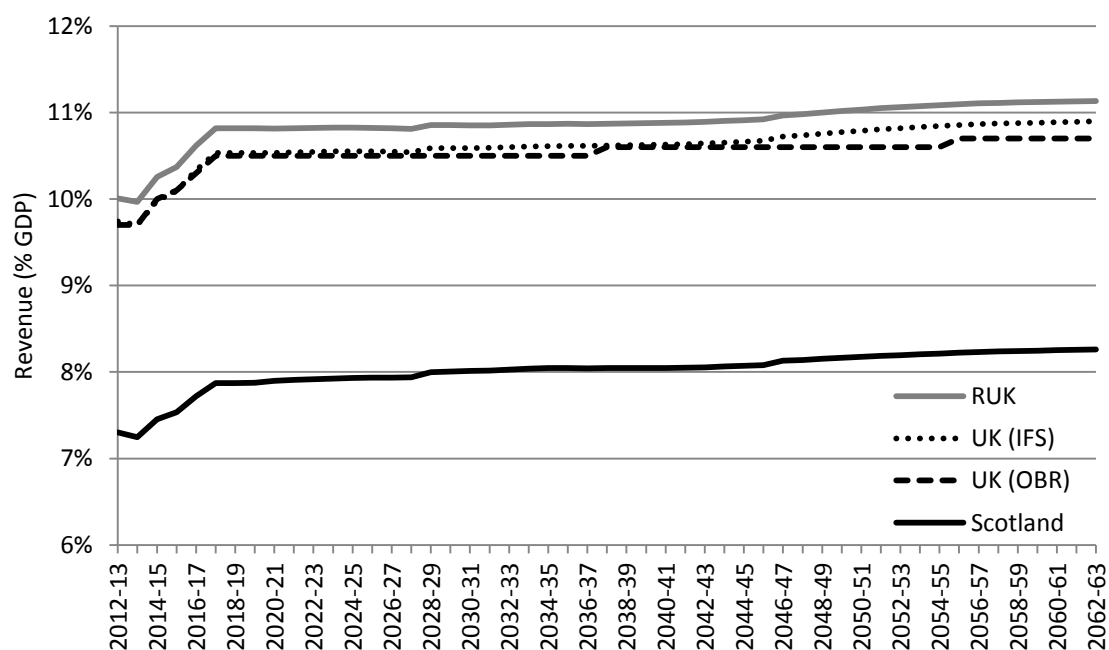
One further adjustment to our projections for future income tax receipts has to be made in order to take into account the likely impact of increasing the SPA on revenues. To include an estimate of the likely effect of this reform, each time the SPA increases by one year we assume that individuals aged at the old SPA on average contribute 90% of the income tax contributions of someone aged a year younger in the previous year (adjusted for average earnings growth) if that amount is more than the average contribution of someone their own age in the previous year. For example, in 2020 when the SPA will increase from 65 to 66, we assume that men and women aged 65 make 90% of the average income tax contribution of someone aged 64 in 2019 (uprated by average earnings growth).<sup>22</sup>

Our projections for income tax receipts as a share of GDP in the UK, Scotland and the rest of the UK are shown in Figure 4.2, along with the OBR's forecast for the UK from OBR (2013b). Our projection for income tax receipts in future is somewhat more optimistic than that of the OBR, as a result of our use of SPI data rather than FRS data to estimate the age-profile of income tax receipts. Income tax receipts are projected to amount to a smaller proportion of GDP in Scotland than in the rest of the

<sup>22</sup> By 2046 when the SPA increases to 68, the implied contribution to income tax receipts of someone aged 67 is around 50% of the contribution of someone aged 59 in 2012.

UK. Over time income tax receipts as a share of GDP in both Scotland and the rest of the UK are projected to increase due to the future changes in the SPA. In real terms income tax receipts per capita in the UK, Scotland and RUK are all projected to increase by an average 2.1% per year between 2017–18 and 2062–63.

**Figure 4.2. Income tax receipts as a share of GDP, by nation**



Notes: OBR forecasts are rounded to the nearest 0.1% of GDP and therefore appear to exhibit a more stepped nature.

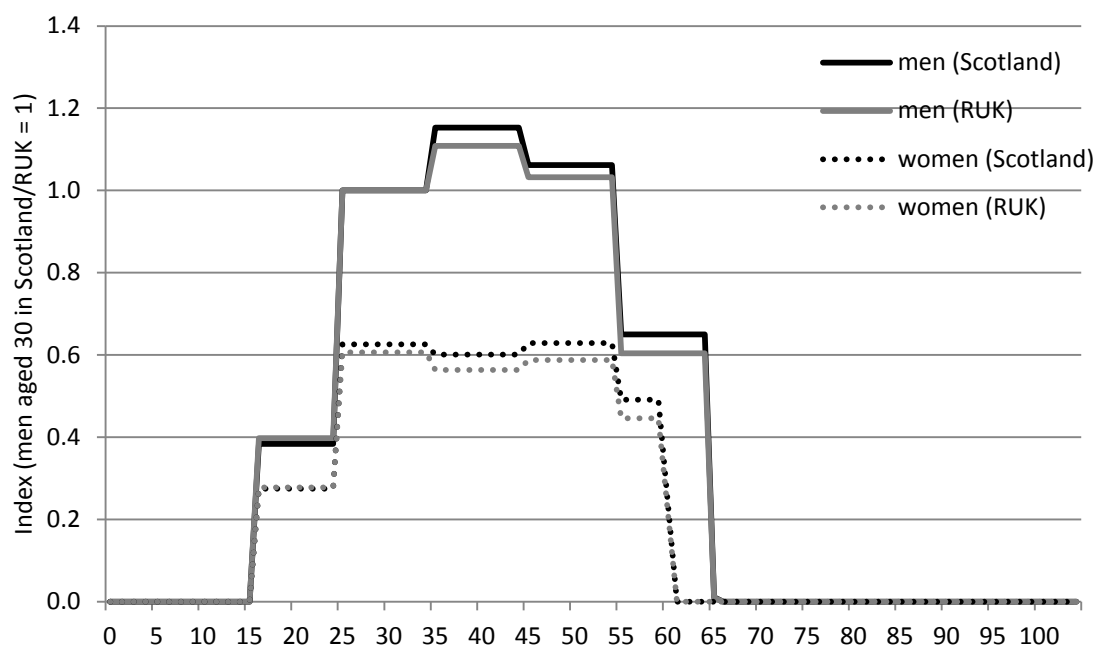
Sources: Authors' calculations using IFS long-run public finance model.

### **National Insurance contributions**

The profile for employee NICs by age and sex is estimated using self-reported data on employee NICs paid taken from the Family Resources Survey. The estimated profiles for men and women in Scotland and the rest of the UK are shown in Figure 4.3. These show the expected picture that a greater proportion of employee NICs receipts come from men than women, and from those in the prime years of working life than younger or older individuals (NICs are not payable by those aged under 16 or those aged over the SPA). The profiles for Scotland and the rest of the UK are virtually identical. We assume that the profile of employer NICs can be approximated by the same profile as employee NICs.

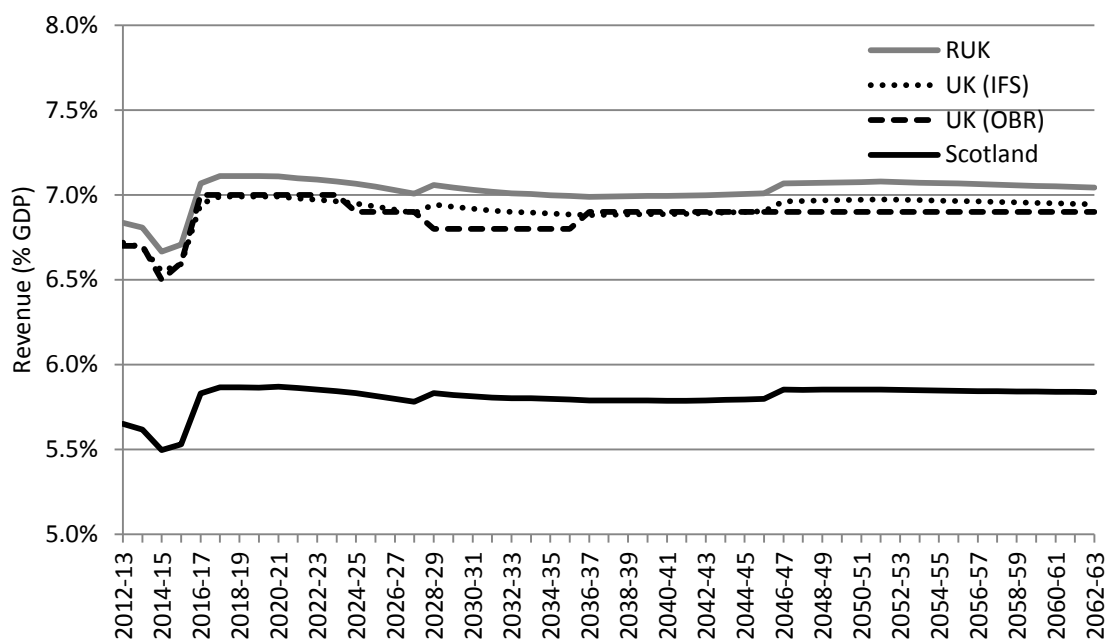
We construct long-run projections for NICs receipts in each nation by assuming that revenue per capita in each age/sex/nation group grows in line with that nation's average earnings. We then aggregate up to total spending based on the ONS' forecast for the size and composition of the nation's population. As with income tax receipts we make an adjustment to account of the possible future impact of the increases in the SPA. This adjustment is performed in an analogous way to the adjustment for income tax, and in effect means that – as the SPA increases – those newly no longer aged over the SPA are assumed to make 90% of the average NI contribution as those who previously were aged just below the SPA.

**Figure 4.3. Estimated age profile of employee NICs, by nation**



Source: Authors' calculations using the Family Resources Survey.

**Figure 4.4. NICs receipts as a share of GDP**



Notes: OBR forecasts are rounded to the nearest 0.1% of GDP and therefore appear to exhibit a more stepped nature.

Sources: Authors' calculations using IFS long-run public finance model.

Our projections for NICs receipts as a share of GDP in the UK, Scotland and the rest of the UK are shown in Figure 4.4, along with the OBR's forecast for the UK from OBR (2013b). Our projection for UK NICs receipts as a share of GDP is slightly more optimistic by 2062–63 than the OBR, as a result of our adjustment for the likely impact of the increase in the SPA to 68 in 2046, which does not appear to have any impact on the OBR's NICs forecast. As with income tax, NICs receipts are forecast to

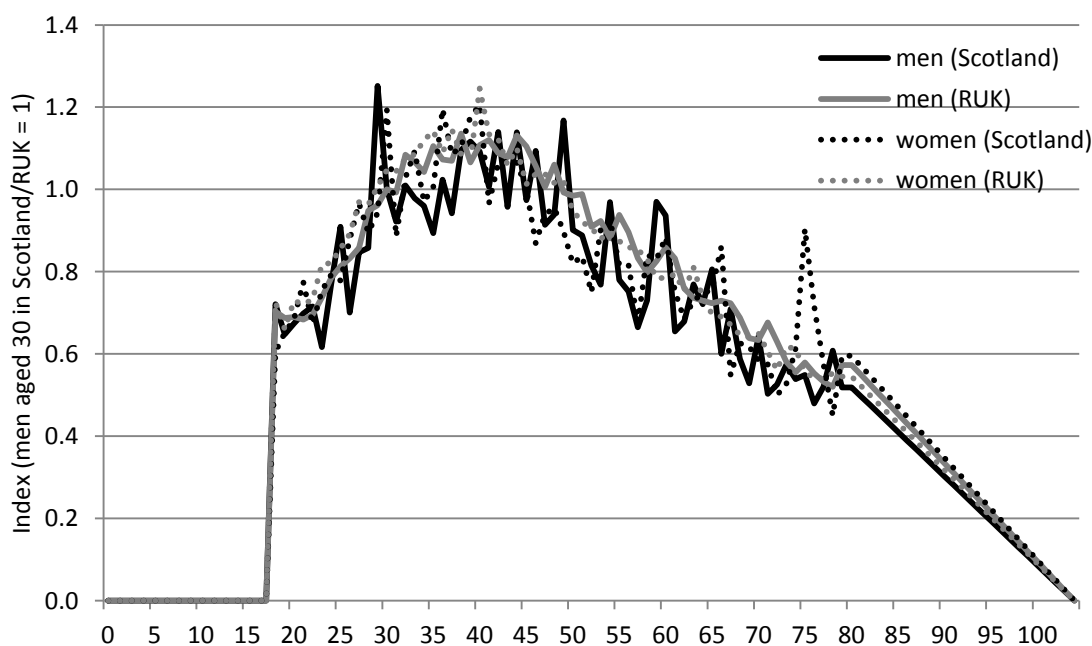
amount to a smaller proportion of GDP in Scotland than in the rest of the UK. Average annual real growth in NICs receipts per capita between 2017–18 and 2062–63 are projected to be slightly lower in Scotland than in RUK, at 2.0% compared to 2.1%, due to the lower projected growth in the population of working age in Scotland.

### VAT

The profile for VAT receipts by age and sex is estimated using data from the Expenditure and Food Survey (EFS) on expenditure on products subject to VAT.<sup>23</sup> Expenditure is summed within the household and then allocated equally to adults within the household (so individuals under the age of 16 are assumed not to contribute to VAT receipts). The EFS data used does not contain information on exact age for individuals aged over 80. We, therefore, simply assume that the proportion of VAT receipts contributed by individuals aged 80 and over declines linearly with age to zero at age 104.

The estimated profiles for men and women in Scotland and the rest of the UK are shown in Figure 4.5. These show the contribution to VAT receipts increasing with age until the early 40s and then declining. There is little difference in the profiles between the nations.

**Figure 4.5. Estimated age profile of VAT receipts, by nation**



Notes: The proportion of VAT receipts contributed by individuals aged 80 and over is assumed to decline linearly with age to zero at age 104.

Source: Authors' calculations using the Expenditure and Food Survey.

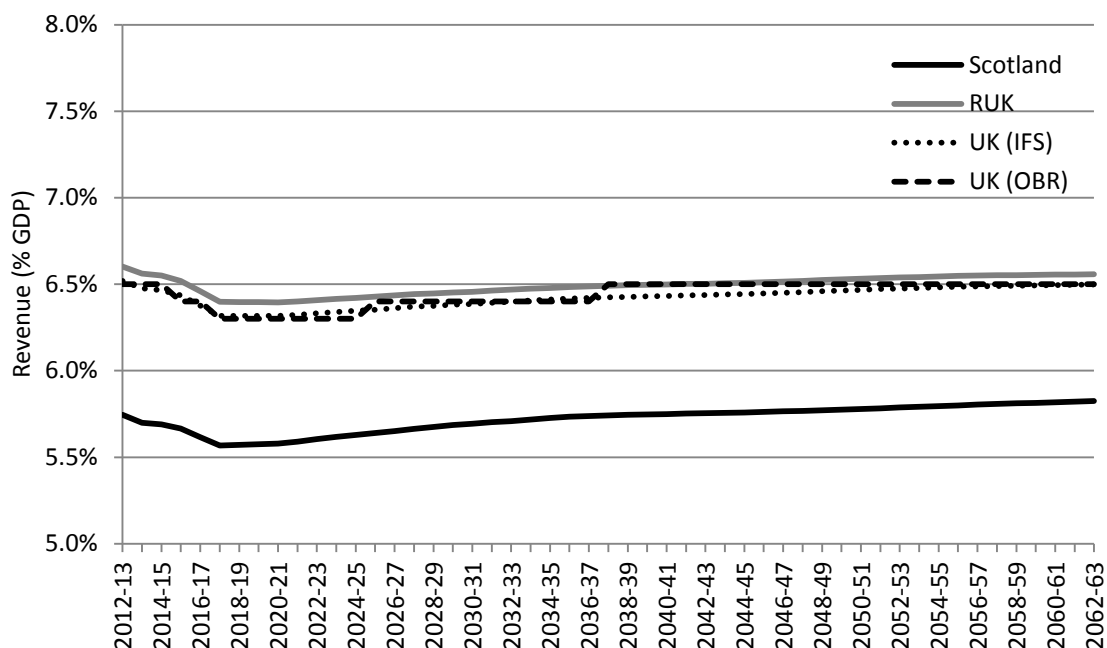
Figure 4.6 shows how our projections for VAT revenues (as a share of GDP) for the UK compare to those of the OBR, and how our projections for Scotland and the rest of the UK compare. VAT revenues in Scotland represent a smaller proportion of GDP than they do in the rest of the UK, at around 5.6% of GDP in 2020 compared to 6.4%. Over time VAT revenues in both nations are forecast to increase slightly as a share of GDP, although slightly more rapidly in Scotland than in the rest of

<sup>23</sup> This allocates both VAT on goods subject to VAT, and the VAT on the inputs to VAT exempt goods, according to individuals' expenditure on products subject to VAT.



the UK. VAT revenues per capita are projected to increase by an average 2.1% per year in real terms between 2017–18 and 2062–63 in both Scotland and RUK (and therefore also in the UK as a whole).

**Figure 4.6. VAT receipts as a share of GDP**



Notes: OBR forecasts are rounded to the nearest 0.1% of GDP and therefore appear to exhibit a more stepped nature.

Sources: Authors' calculations using IFS long-run public finance model.

**Capital taxes (capital gains tax, inheritance tax and stamp duties)**

Capital gains tax is payable on the gains made when assets are sold. To estimate a profile for capital gains tax revenues by age and sex we use data on the distribution of assets held (stocks, shares and gilts), taken from the FRS.<sup>24</sup> The contribution to capital gains tax receipts of individuals in 10 year age bands is assumed to be in proportion to the total asset holdings of the group.<sup>25</sup> The resulting estimated age profiles for each nation are shown in Figure 4.7. The profiles are broadly similar in Scotland and the rest of the UK, although in Scotland the peak contributors are men aged 35–55, while in the rest of the UK it is men aged 45–65.

For inheritance tax we assume that the profile of receipts can also be approximated by the profile of assets held, as in Figure 4.7.<sup>26</sup> We estimate a profile of stamp duty payments by age and sex using data from the EFS. Stamp duty payments are shared equally among adults in the household. The resulting estimated age profiles for each nation are shown in Figure A.2 in the Appendix.

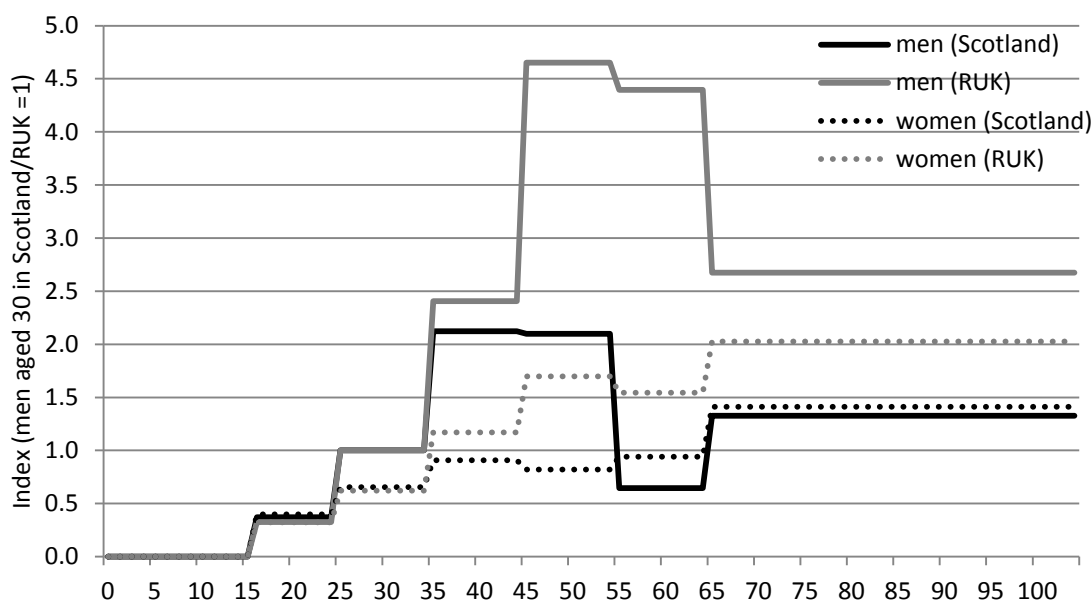
<sup>24</sup> A future improvement to the long-run model would be to estimate the profile for capital gains tax revenues using data from the Wealth and Assets Survey.

<sup>25</sup> 10 year age bands (and the grouping together of those aged 65 and over) is necessitated by the available FRS data, since access to individualised ages requires special permission from the ONS.

<sup>26</sup> An improvement to this approach would be to use HMRC data on the estates passing on death in the last year, combined with demographic projections to take into account the changing death rates at different ages across cohorts.

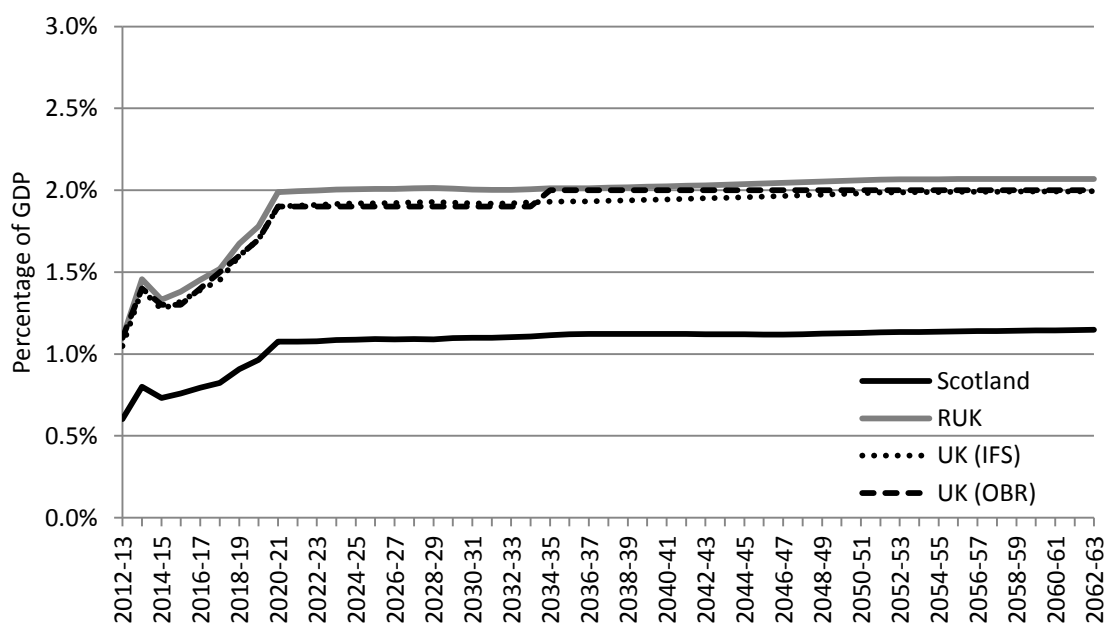
Figure 4.8 shows how our resulting projections for capital tax revenues (as a share of GDP) for the UK compare to those of the OBR, and how our projections for Scotland and the rest of the UK compare. Revenues from capital taxes are projected to be consistently around 0.9% of GDP lower in Scotland than in the rest of the UK. In real terms, per capita revenues from capital taxes are projected to increase by 2.8% per year on average between 2017–18 and 2062–63 in both Scotland and RUK (and therefore also in the UK as a whole).

**Figure 4.7. Estimated age profile of capital gains tax receipts, by nation**



Source: Authors' calculations using the Family Resources Survey.

**Figure 4.8. Revenues from capital taxes as a share of GDP**



Notes: "Capital taxes" includes capital gains tax, inheritance tax and stamp duties. OBR forecasts are rounded to the nearest 0.1% of GDP and therefore appear to exhibit a more stepped nature.

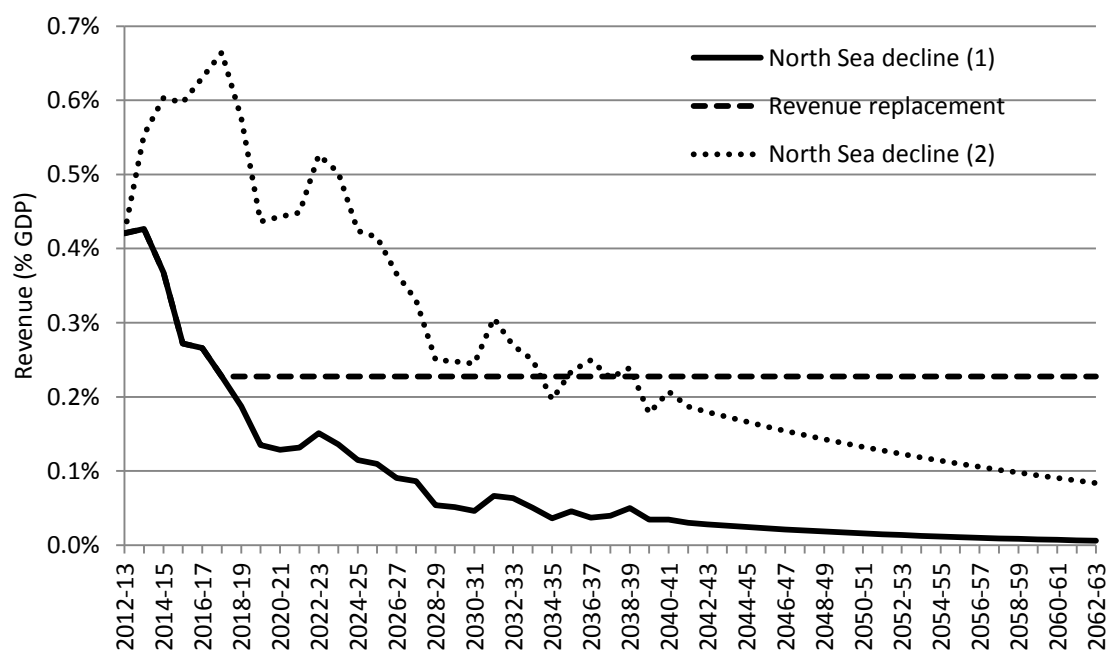
Sources: Authors' calculations using IFS long-run public finance model.

### North Sea (off-shore corporation tax and petroleum revenue tax)

Revenues raised from the North Sea, through corporation tax and petroleum revenue tax, are projected outside our model rather than using the four-step process detailed for other taxes. We treat North Sea revenues differently because the decline of North Sea oil and gas reserves will have important implications for the growth rate of these revenues.

We can use our model to illustrate the impact on the public finances of different assumptions about future North Sea revenues. In its 2013 FSR, the OBR produced long-term projections for oil and gas revenues, by inputting a number of assumptions about future prices, production and expenditure into HMRC's model for field-level revenues. Its resulting central projection suggested that total UK revenues from the North Sea would decline from 0.42% of GDP in 2012–13 to 0.03% by 2040–41. In its long-run projections for the UK public finances, however, the OBR's 2013 FSR methodology was to assume that revenues from the North Sea would decline between 2012–13 and 2017–18, from 0.42% of GDP to 0.23% (as forecast for its March 2013 EFO), but then remain constant as a share of GDP thereafter. Its justification for this assumption is that governments faced with these declining revenue streams might find other ways to raise the same amount of money. These projections for UK North Sea revenues as a share of GDP are illustrated as "North Sea decline (1)" and "Revenue replacement", respectively, in Figure 4.9.

Figure 4.9. North Sea revenues as a share of GDP: UK



Notes: 'North Sea revenues' includes off-shore corporation tax and petroleum revenue tax. "North Sea decline (1)" is OBR central projection for North Sea revenues up to 2040–41 and a continued linear trend thereafter. Revenue replacement is OBR central projection for North Sea revenues up to 2017–18 and then held constant as a share of GDP thereafter. "North Sea decline (2)" is Scottish Government 'scenario 5' up to 2017–18, changing at the same rate as the OBR 'high price' scenario projection between 2018–19 and 2040–41, and then a continued linear trend thereafter.

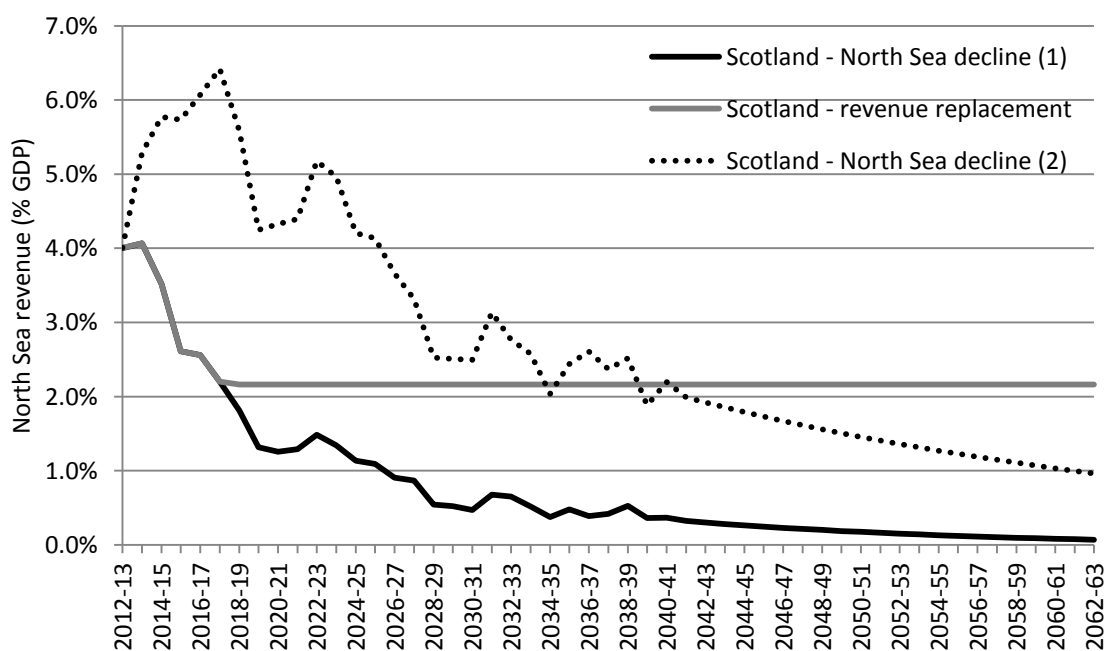
Sources: Authors' calculations based on Office for Budget Responsibility (2013b) and Scottish Government (2013b).

The Scottish government (Scottish Government, 2013b), on the other hand, has suggested that the OBR was too conservative in its EFO forecast for North Sea revenues up to 2017–18, and that both

production and prices would be higher than the OBR suggested, resulting in higher revenues. We therefore also illustrate a scenario in which North Sea revenues turn out as projected by the Scottish government up to 2017–18 (using the most optimistic ‘scenario 5’ from Scottish Government (2013b)), and evolve according to the growth rate projected by the OBR in its ‘high price’ scenario from 2017–18 onwards. This is described as ‘North Sea decline (2)’ in Figure 4.9.

Figure 4.10 shows the resulting projections for North Sea revenues (as a share of GDP) for Scotland. In our “revenue replacement” scenario we assume that Scotland (and the rest of the UK) replaces declining North Sea revenues with other revenue streams from 2017–18 so as to maintain revenues as a share of GDP. In the “North Sea decline” scenarios we assume that Scotland receives its geographical share (94%) of North Sea revenues each year. Revenues from the North Sea represent a much more significant proportion of Scottish GDP than they do in the rest of the UK. They are projected to equal 2.2% of GDP in Scotland in 2017–18 compared to less than 0.1% in the rest of the UK. (North Sea revenues for RUK are projected to be less than 0.1% GDP each year under all our scenarios and are therefore not shown in Figure 4.10.) The decline in North Sea revenues would, therefore, have much more significant implications for the Scottish public finances than for the rest of the UK (or the UK as a whole).

**Figure 4.10. North Sea revenues as a share of GDP: Scotland**



Notes: As Figure 4.9.

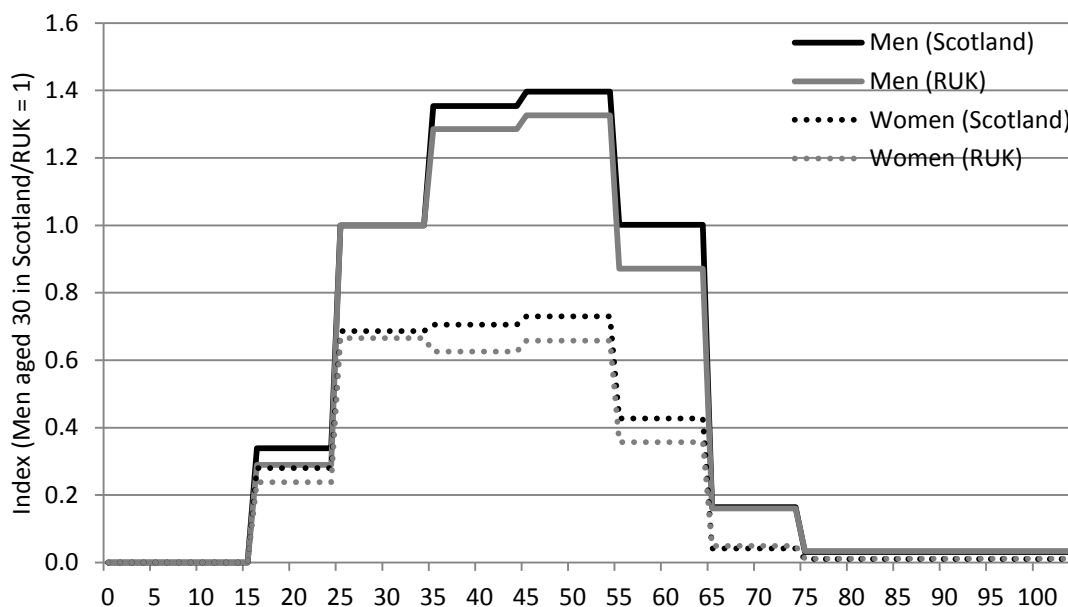
Sources: Authors’ calculations using IFS long-run public finance model.

**On-shore corporation tax**

Corporation tax is a tax charged on the profits of companies. However, following Cardarelli et al (2000), we assume that the age profile of corporation tax receipts can be approximated by the age profile of individual earnings. The justification for this is that, in an open competitive economy with mobile capital this tax would be effectively borne by labour. The age profile of individual earnings is estimated using data from the Survey of Personal Incomes, and the resulting estimated age profile of corporation tax receipts for each nation is shown in Figure 4.11.

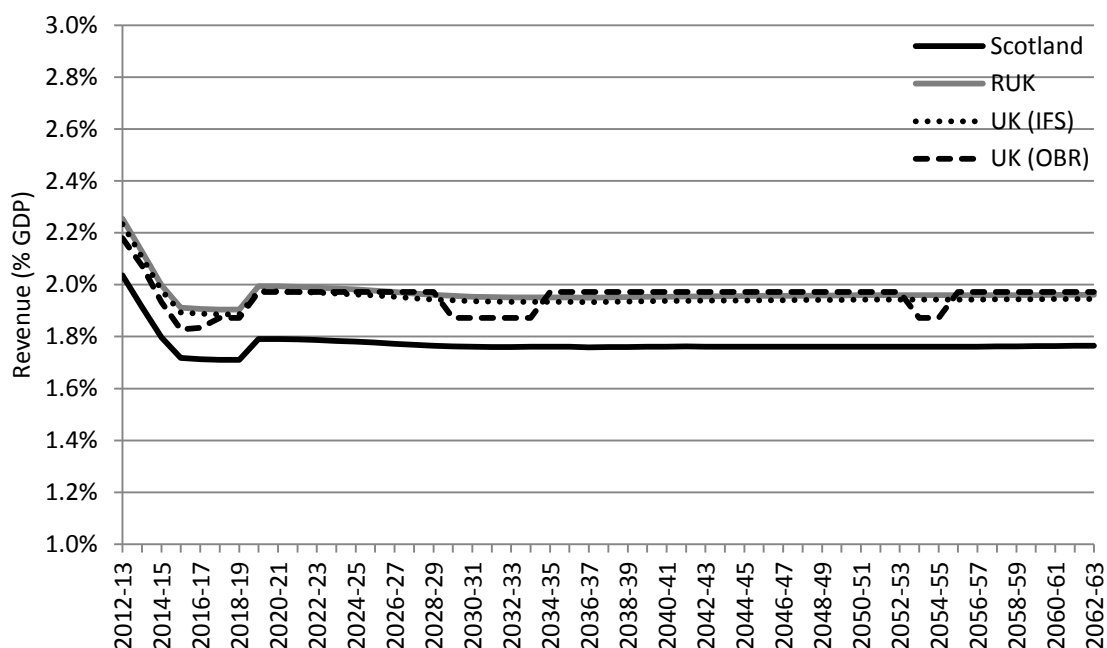
The resulting projections for on-shore corporation tax receipts as a share of GDP for the UK, Scotland and RUK are shown in Figure 4.12. In real terms, on-shore corporation tax receipts per capita are projected to increase by an average 2.1% per year between 2017–18 and 2062–63 in Scotland and RUK (and therefore also in the UK as a whole).

**Figure 4.11. Estimated age profile of corporation tax receipts, by nation**



Source: Authors' calculations using the Survey of Personal Incomes.

**Figure 4.12. On-shore corporation tax, Scotland and RUK**



Notes: "UK (OBR)" projection is backed out from the OBR projection for total corporation tax receipts by assuming that the OBR projection for North Sea revenues is identical to the IFS forecast. OBR forecasts are rounded to the nearest 0.1% of GDP and therefore appear to exhibit a more stepped nature.

Sources: Authors' calculations using IFS long-run public finance model.

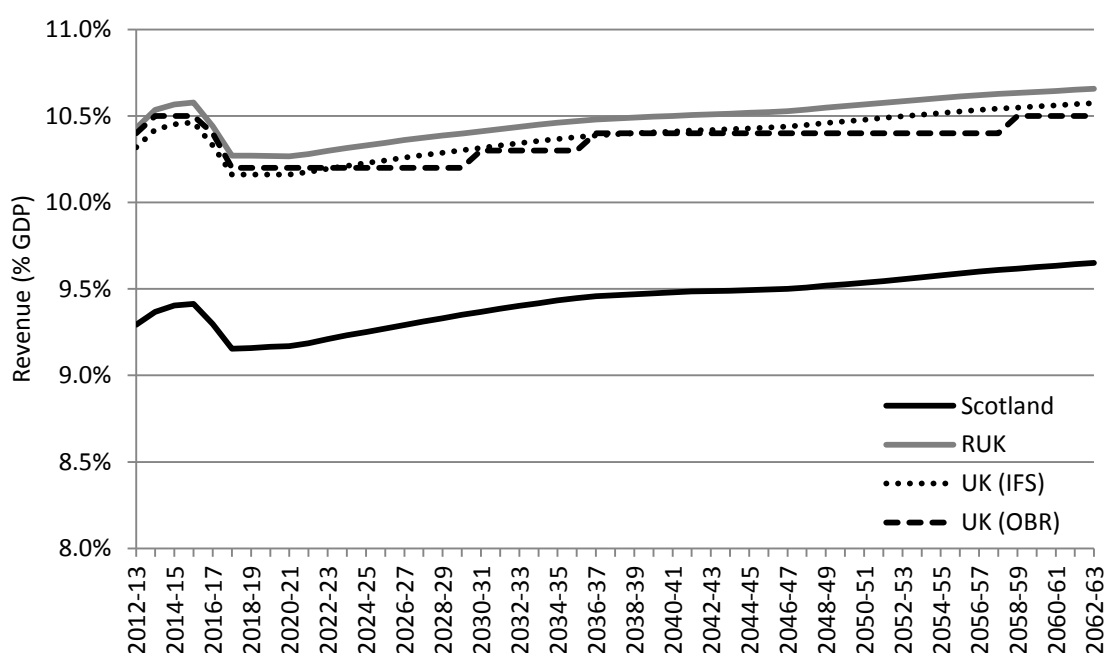
### Other non-interest revenues

Other non-interest revenues include receipts from:

- Council tax: The age-sex profile of council tax payments is estimated using data from the FRS and is shown in Figure A.3 in the Appendix.
- Business rates: These are taxes on non-domestic property including businesses. However, following Cardarelli et al (2000), we assume that the age profile of business rates can be approximated by the age profile of personal expenditure. The justification for this is that, in a competitive economy, this tax would effectively be borne by consumers. The profile of personal expenditure is estimated using data from the FRS, and is shown in Figure A.4 in the Appendix.
- Fuel duties, tobacco duties, alcohol duties, vehicle excise duty, betting and gaming taxes, insurance premium tax and licence fees: The age profiles of these taxes are estimated using expenditure data from the EFS.<sup>27</sup> These are shown in Figures A.5–A.11 in the Appendix.
- Aggregates levy, landfill tax, climate change levy, air passenger duty, other revenues: The age-sex profile of these taxes is assumed to be uniform – in other words, all individuals contribute the same amount regardless of their age and sex.

The estimated age profiles for these taxes do not tend to differ significantly between Scotland and the rest of the UK.

**Figure 4.13. Other non-interest revenues as a share of GDP**



Notes: OBR forecasts are rounded to the nearest 0.1% of GDP and therefore appear to exhibit a more stepped nature.

Sources: Authors' calculations using IFS long-run public finance model.

<sup>27</sup> This implicitly allocates fuel duty paid by firms proportional to household fuel spending. A potential future improvement to the modelling would be to allocate a proportion of total fuel duty receipts in proportion to total household spending.

We construct long-run projections for these revenues in each nation by assuming that revenue per capita in each age/sex/nation group grows in line with that nation's average earnings per capita.<sup>28</sup> We then aggregate up to total revenue based on the ONS' forecast for the size and composition of the nation's population.

Figure 4.13 shows how our resulting projections for the total of these other non-interest revenues (as a share of GDP) for the UK compare to those of the OBR, and how our projections for Scotland and the rest of the UK compare. As a share of GDP, Scotland is projected to raise slightly less from these other revenue streams than the rest of the UK. In real terms, the level of revenue raised per capita is projected to increase by an average 2.1% per year between 2017–18 and 2062–63 in Scotland, compared to 2.2% in RUK (and the UK as a whole).

## 5. Long-run forecast for spending

Our model allows for two main factors to determine the level of public spending in the future. First, spending on different areas will depend on how the need for certain types of spending develops as the size and composition of the population changes. For example, levels of all types of spending will grow if the population size increases, while (for example) levels of health spending will grow particularly fast if the population becomes increasingly aged, and levels of education spending will grow more quickly if the fraction of the population of school age grows. The second factor driving spending growth is how quickly spending per person grows as the economy grows. Section 5.1 describes our model for growth in most of the main areas of public spending in the long-run in more detail.

For a small number of spending areas, a third factor is also important in determining the growth rate of spending. For some areas of spending recent and historic changes in policy mean that average spending per person on particular items will differ significantly across cohorts at the same age. Three areas where this is important are state pensions, public service pensions and long-term care. For these areas of spending, we use long-run forecasts for spending generated outside our model. These are described in Section 5.2.

### 5.1 Spending projections generated within the model

Long-run projections for spending on education, health, benefits and a residual category of other non-debt interest spending (as defined in Table 3.2) are generated by our model. These projections are constructed using a four-step process:

- i. Calculate the total level of baseline spending, in 2020–21 (see Section 3).
- ii. Estimate how this spending is distributed across individuals of different age/sex.
- iii. Project future per capita spending, based on an assumption about the growth rate of per capita spending.
- iv. Calculate total spending in each year by aggregating up per capita spending based on the forecast population size and composition.

This same four-step process can be conducted either for the UK as a whole or for Scotland and RUK separately (with separate baseline spending, age profiles and future growth rates being estimated

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<sup>28</sup> The exception is the gross operating surplus of public sector corporations, where we assume that revenue per capita in each age/sex/nation group grows in line with that nation's nominal GDP per capita.

for each nation). We describe step (ii) and show the final results from step (iv) for each of the four areas of spending below. We describe differences between Scotland and the rest of the UK in each area of spending and show how our forecasts for the UK as a whole compare to those produced by the OBR.

Our baseline model assumes that per capita spending on education, health and social benefits grows in line with average earnings each year<sup>29</sup>, while other non-interest spending is assumed to grow in line with per capita GDP – these are the same assumptions as made by the OBR.<sup>30</sup> The actual level of service that this implies will depend on, among other things, public sector productivity growth, which is likely to evolve differently for different areas of spending. Therefore, our model also has the capacity to incorporate alternative assumptions about the growth rate of individual components of spending, although we do not illustrate those here.

### **Health spending**

Our model produces separate forecasts for three components of health spending. These are: hospital and community health services, prescriptions, and primary care. These are treated separately because the age/sex distribution of spending in these three areas is different from one another and data on the distribution of spending by age and sex in these areas is publicly available. We estimate the age/sex distribution of spending on each of these components from figures published by the Department of Health (DH).<sup>31</sup> These age/sex breakdowns are, unfortunately, only available for England and not for the other nations. We, therefore, assume that the age/sex distribution of spending is the same in the rest of the UK (including Scotland) as it is in England.<sup>32</sup>

We estimate the age distribution of spending on hospital and community health services using figures for mean cost-weighted activity per head published by DH. Average spending per head is reported for five-year age bands, with the exception of those aged 85 and over who are grouped together; we assume that average spending per head is uniform within these age bands. These figures are not available separately for men and women; we, therefore, assume that spending per head is the same for men and women in each age group.<sup>33</sup> Figure 5.1 shows the per capita spending by age group, with spending on 30 year olds normalised to 1. This shows that spending on hospital treatment tends to increase with age and is particularly high among those aged 85 and over.

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<sup>29</sup> Average earnings growth is the product of labour productivity growth and growth in the GDP deflator. Following the assumptions made by the OBR (see Table 3.3 of OBR (2013b)), our baseline model assumes that labour productivity will grow by 2.2% a year in the long run and the GDP deflator will also grow by 2.2%, giving average earnings growth of approximately 4.4% a year.

<sup>30</sup> See page 73 of OBR (2013b).

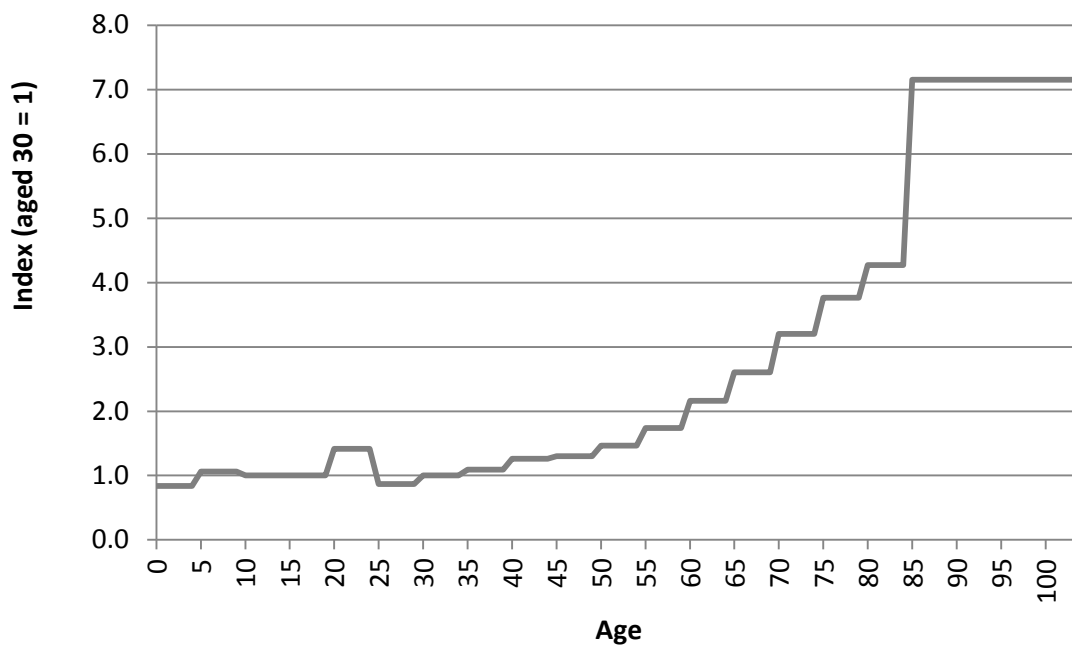
<sup>31</sup> Department of Health (2011).

<sup>32</sup> This assumption about the similarity of the age distribution of spending in Scotland and the rest of the UK may be particularly bad for spending on prescriptions, as Scotland offers free prescriptions to all age groups, whereas these are limited to certain specific groups (including those aged 60 and over) in England and Wales.

<sup>33</sup> While this is clearly a simplifying assumption, which will be violated in some age groups (most obviously as a result of the costs associated with maternity care), it would only potentially lead to errors in our long-run projections in the unlikely event that the sex composition of particular age groups was projected to change dramatically in future. This is not a feature of any of the ONS' scenarios for the future UK population.



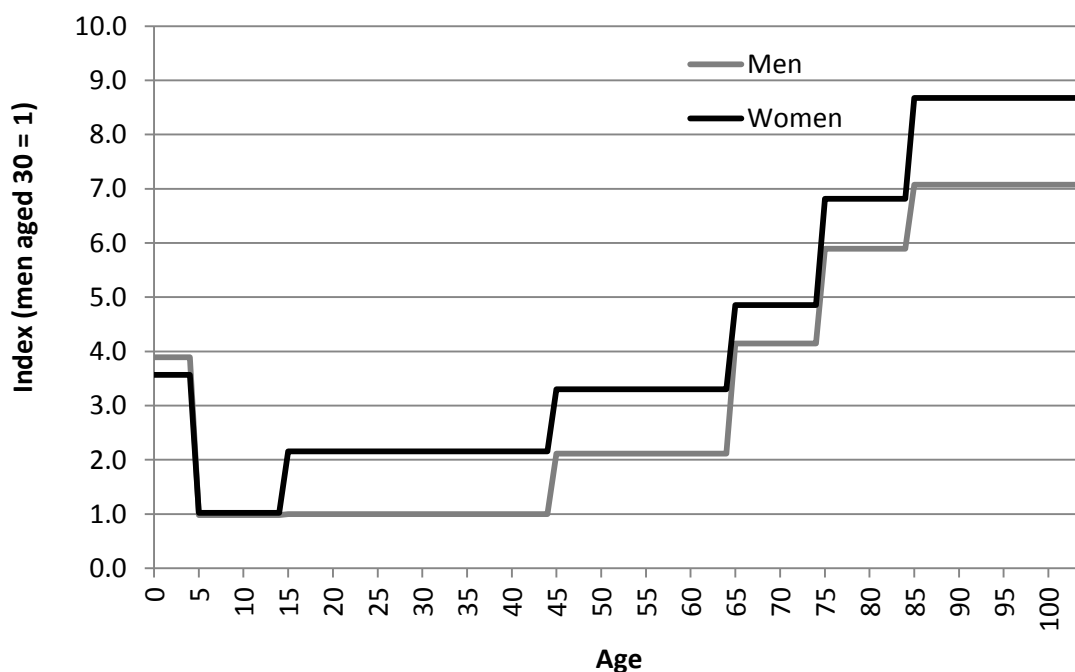
**Figure 5.1. Spending on hospital and community health services, by age**



Notes: Figures are only available for broad age categories; we assume that per capita spending is uniform within these age bands.

Source: Table 2 of Department of Health (2011).

**Figure 5.2. Spending on primary care, by age and sex**



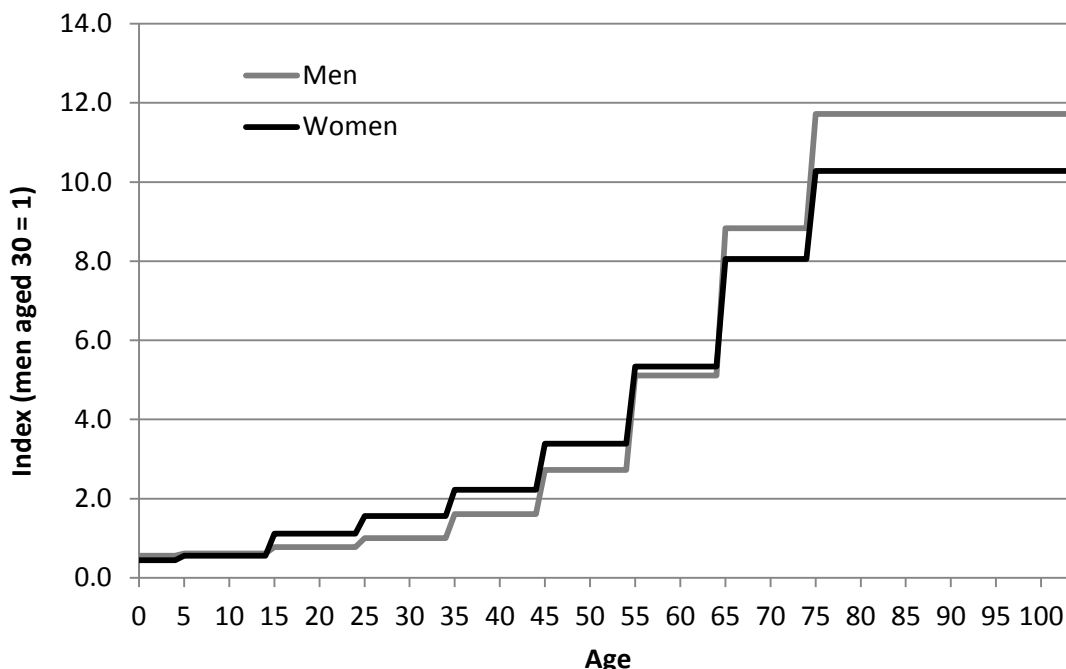
Notes: As Figure 5.1.

Source: Table 12 of Department of Health (2011).

Figures 5.2 and 5.3 show relative spending per head by age group for primary care and prescriptions, with spending on 30 year old men indexed to 1. These figures are also taken from Department of

Health (2011). Figure 5.2 shows that primary care spending is relatively high for very young children but then falls for those aged between 5 and 44 before beginning to rise again. With the exception of very young children, primary care spending is higher on average for women than for men.

**Figure 5.3. Spending on prescriptions, by age and sex**



Notes: As Figure 5.1.

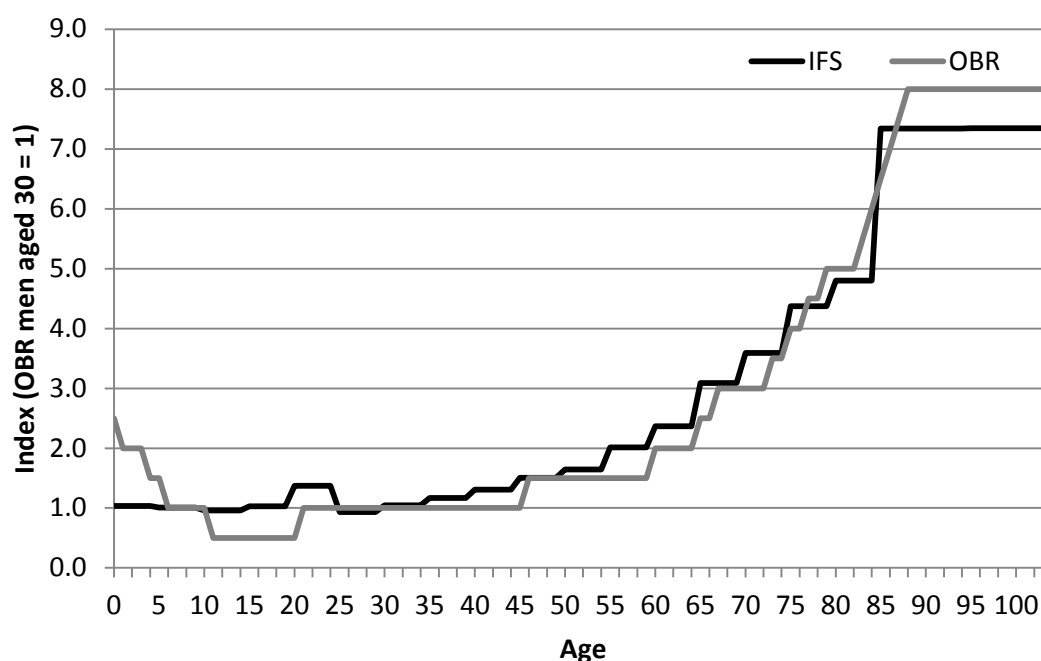
Source: Table 10 of Department of Health (2011).

Figure 5.3 shows that spending on prescription drugs increases significantly with age. Spending on those aged 85 and over is over 10 times as high as spending on 30 year old men. Average spending for women is higher than for men up to the age of 65, at which point the situation reverses.

Figure 5.4 compares our estimated age profile for total health spending with that used by the OBR. The age profile for total health spending is constructed by aggregating the profiles shown in Figures 5.1–5.3, weighted by the share of each component of spending within total health spending in 2011–12. Figure 5.4 shows that our age profile for health spending is broadly similar to that used by the OBR but not identical.

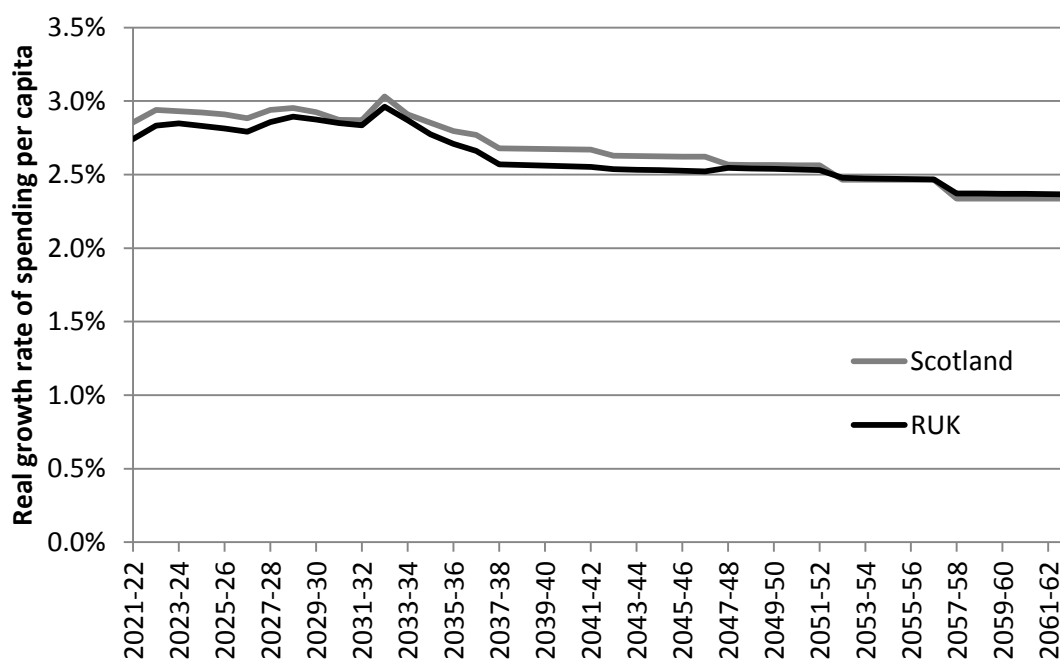
Combining these age distributions of spending with the baseline levels of spending forecast for 2020–21 (which were described in Section 3), the ONS' low migration population projection, and an assumption that per capita (age adjusted) spending will rise in line with average earnings in the long-run, we can produce a forecast for these three components of health spending (and thus total health spending) in the long-run for the UK as a whole and for Scotland and RUK separately. Our baseline forecasts are shown in Figure 5.5. This shows that real growth in health spending per capita will be slightly higher in Scotland than in RUK each year until the 2050s. Between 2020–21 and 2062–63, our projection is that health spending per capita in Scotland will grow at an average annual rate of 2.7%, compared to 2.6% in RUK.

**Figure 5.4. Age profile of total health spending in the UK**



Source: Chart 3.4 of OBR (2013b) and authors' calculations using IFS long-run public finance model.

**Figure 5.5. Real terms growth in health spending per capita, by nation**

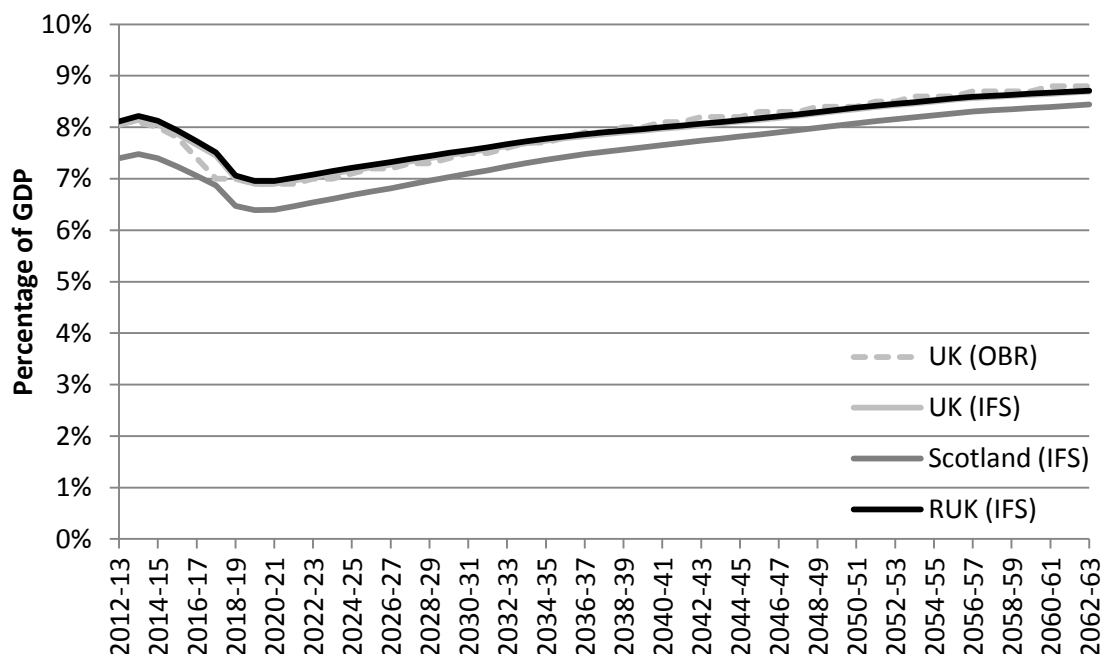


Source: Authors' calculations using IFS long-run public finance model.

Figure 5.6 compares forecasts for health spending as a share of GDP. This shows that for the UK as a whole, and Scotland and RUK separately, health spending will grow more quickly than the economy and so health spending will consume a greater and greater share of total economic output over the next 50 years – rising from 6.9% of GDP in the UK in 2020–21 to 8.7% by 2062–63. The OBR's central forecast is that it will rise to 8.8% of GDP by 2062–63. Health spending in Scotland is projected to

increase by more as a share of GDP than for RUK: by 2.0 percentage points of GDP between 2020–21 and 2062–63 in Scotland, compared to an increase of 1.8 percentage points of GDP for RUK and the UK as a whole.

**Figure 5.6. Health spending as a share of GDP, by nation**



Source: Authors' calculations using IFS long-run public finance model. Supplementary Table 1.1 of OBR (2013b).

### **Non-pension benefits**

We use a bottom-up approach to project spending on non-pension benefits – that is, we sum together separate forecasts for spending on individual benefits. We use data from the Work and Pensions Longitudinal Study (WPLS), available through the DWP tabulation tool, and from the FRS to estimate the distribution of spending on each benefit by age and sex in each part of the UK.<sup>34</sup> We do this using data from the WPLS for 2007 (and pooling the years 2005–2009 from the FRS), rather than using the most recently available data, in order to avoid building any temporary effects of the recession into our long run forecasts.<sup>35</sup> WPLS data is available for Great Britain only, while the FRS covers the whole of the UK.

Our approach is almost identical to that used by the OBR, with one exception: whereas the OBR use the DWP's own externally generated forecast for non-pension benefit spending on pensioners (which incorporates disability living allowance and housing benefit received by pensioners), we forecast these components of spending using the same method as for other non-pension benefits.

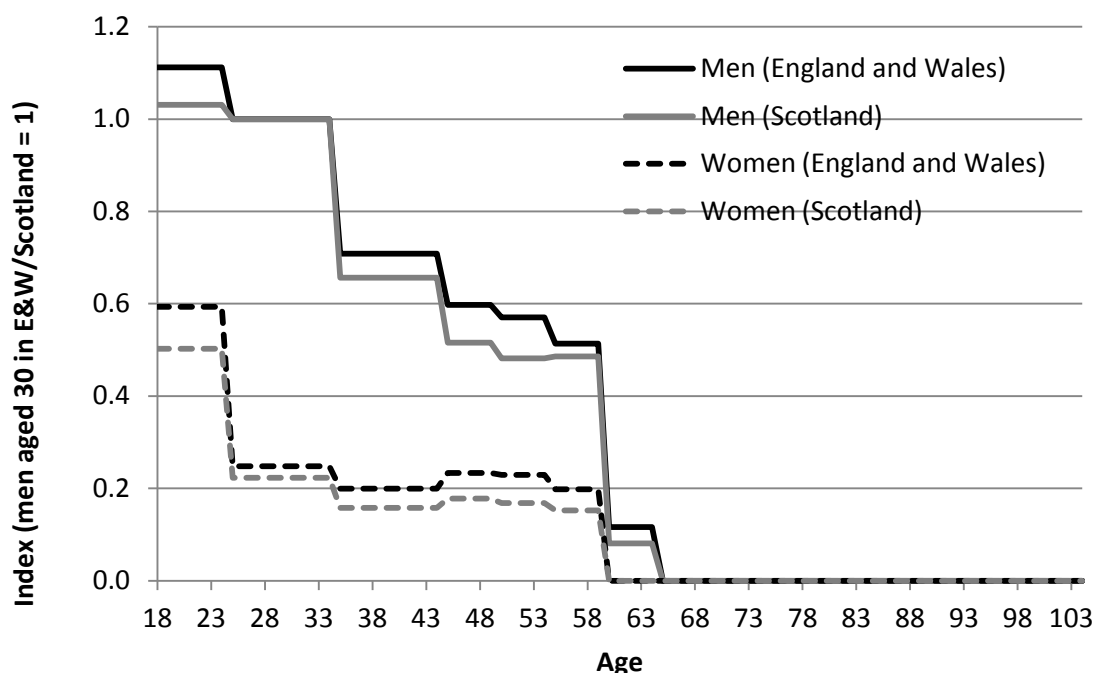
<sup>34</sup> DWP Tabulation Tool is available at <http://tabulation-tool.dwp.gov.uk/100pc/>.

<sup>35</sup> Using data from 2007 has the disadvantage that we cannot observe the distribution of spending on some new benefits – in particular, employment and support allowance. This will only be problematic if the age/sex distribution of spending on new benefits is very different from the distribution of spending on the benefits they replace. For the decomposition of spending between Scotland and RUK, our method will also be problematic if the distribution of spending between the different constituent nations differs substantially for the new benefits. We do not believe that either of these factors is a major concern.

Figure 5.14 at the end of this subsection shows that our forecast for non-pension benefit spending is nonetheless similar to the OBR's.

We estimate age/sex spending profiles for jobseeker's allowance, income support, incapacity benefit, disability living allowance, attendance allowance, carer's allowance, and bereavement benefits using the WPLS. Figure 5.7 shows spending on jobseeker's allowance per person by age group, with spending on 30 year old men indexed to 1. These figures can be calculated for Great Britain as a whole and also for the constituent nations using the WPLS.<sup>36</sup> Figure 5.7 shows that spending per person is higher for men than women. Analogous age/sex distributions for other benefits are shown in Figures A.12–A.17 in the Appendix.

**Figure 5.7. Distribution of spending on jobseeker's allowance, by age and sex**



Notes: As Figure 5.1.

Source: Authors' calculations using DWP tabulation tool; data from 2007.

We use the FRS to construct age/sex spending distributions for tax credits, council tax benefit, housing benefit, child benefit, maternity allowance, social fund payments, and statutory maternity pay. Age/sex distributions for these benefits and tax credits are shown in Figures A.18–A.23 in the Appendix.<sup>37</sup> FRS data record council tax benefit and housing benefit received at the household level. We assume that this spending is directed only towards adults in the household, and allocate the between any adults according to their contribution towards total household income. Child benefit is

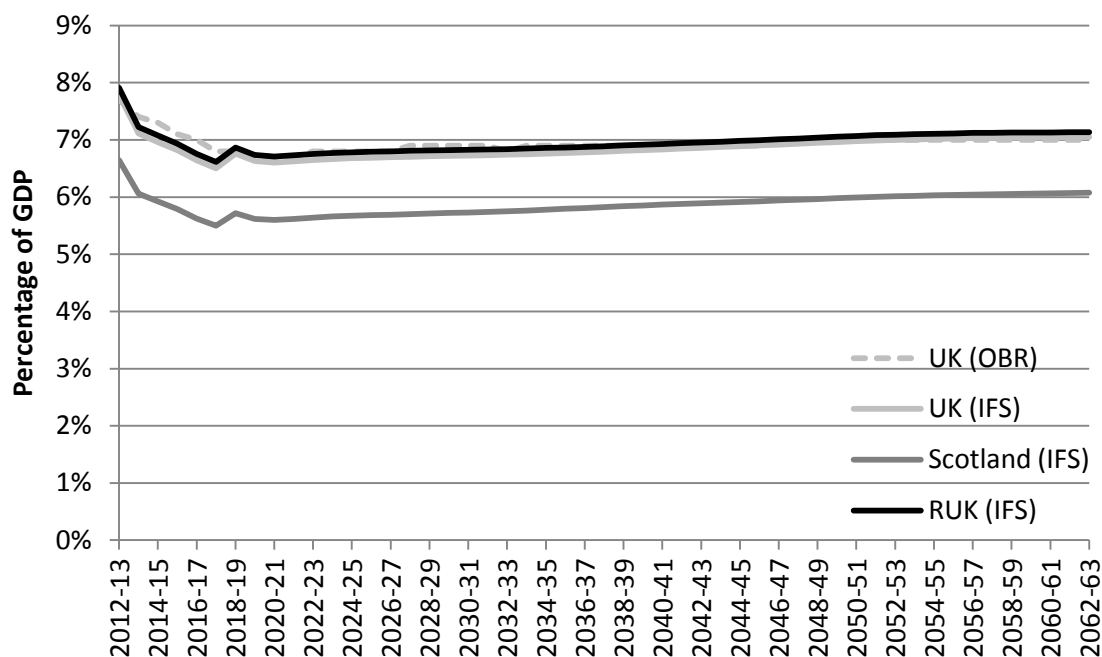
<sup>36</sup> The age/sex distribution of spending in Northern Ireland is not available; we assume that it is the same as in England and Wales.

<sup>37</sup> The localisation of council tax benefit in England from 2013–14 will potentially affect the age/sex distribution of council tax benefit spending but this cannot be reflected in our modelling until more recent FRS data is available. We assume that spending on child benefit is uniformly distributed across children aged under 16 in each nation; per capita spending on child benefit is fractionally (1%) higher in Scotland than in the rest of the UK.

assumed to be distributed equally among all the children (aged 0–15) within the household. The receipt of all other benefits is reported at the individual level in the FRS; we assign spending to individuals on the basis of who reports receiving them.

There are a number of small benefits for which we do not estimate an age/sex profile of spending. These are assumed to be spread uniformly across all adults in the population.

**Figure 5.8. Non-pension benefits spending as a share of GDP, by nation**



Source: As Figure 5.6.

We construct long-run forecasts for each individual benefit by assuming that per capita spending in each age/sex group grows in line with average earnings. Although current government policy is to increase most benefits only in line with growth in the Consumer Price Index, which typically grows less quickly than average earnings, over the long-run this would imply benefit levels declining sharply relative to average living standards. We therefore use the more neutral baseline assumption that benefit rates grow in line with average earnings.<sup>38</sup> We then aggregate up to total spending based on the ONS’ low migration forecast for the size and composition of the population. Our forecasts for total non-pension benefit spending in the long-run are shown in Figure 5.8, along with the OBR’s forecast from OBR (2013b). This shows that we project that benefit spending will increase by 0.5 percentage points of GDP in Scotland between 2020–21 and 2062–63, which is a slightly larger increase than we are projecting for RUK (0.4 percentage points).

### **Education spending**

Our model produces separate forecasts for three components of education spending – schools (including pre-school services), further education and higher education. The age/sex distribution of

<sup>38</sup> This is the same assumption used by the OBR, who discuss the issue in somewhat more detail on page 73 of OBR (2013b).

spending on these three areas across the UK is estimated using data from the Department for Education (DfE) and the LFS.

The age/sex distribution of pupils in schools and pre-schools in the UK is taken from DfE (2012). Figures for the age distribution of pupils in Scotland are taken from Scottish Government (2011). These data provide information on the number of boys and girls in different age groups. The latest data currently available relates to 2011. Using these data, coupled with ONS population estimates, Figure 5.9 shows the fraction of children of different ages who were in publicly-funded schooling in 2011; this is shown for the UK as a whole and for Scotland and RUK separately. The striking difference between Scotland and the UK is in the participation rates of those aged 16 and 17; this is because of the different school leaving ages that applied in Scotland and the rest of the UK.<sup>39</sup>

In order to calculate per capita schools spending, we assume that spending per pupil is the same at all ages (and the same for boys as for girls).<sup>40</sup>

We estimate the age profile of participation in further and higher education using data from the LFS, rather than using official statistics. We choose to do this because LFS data allow us to identify the age of students above 30 and it provides information on the distribution of higher education students (by country of birth) across Scotland and the rest of the UK, which are not (to our knowledge) available from publicly accessible official data. We attribute spending to each of the nations based on the student's country of birth, rather than the country in which they are studying, as the fees paid by students and the funding provided to them depends on their country of origin, rather than where they study. The LFS provides information on whether students in further and higher education are studying part-time or full-time. Figure 5.10 shows the fraction of individuals aged 16 and over who are participating in further education in the UK as a whole and in Scotland and the rest of the UK separately (both part-time and full-time). Figure 5.11 shows analogous figures for participation in higher education. These figures are estimated from pooling data collected between January and March in the years 2006 to 2012 – in other words, these participation rates are the averages seen over these seven years.

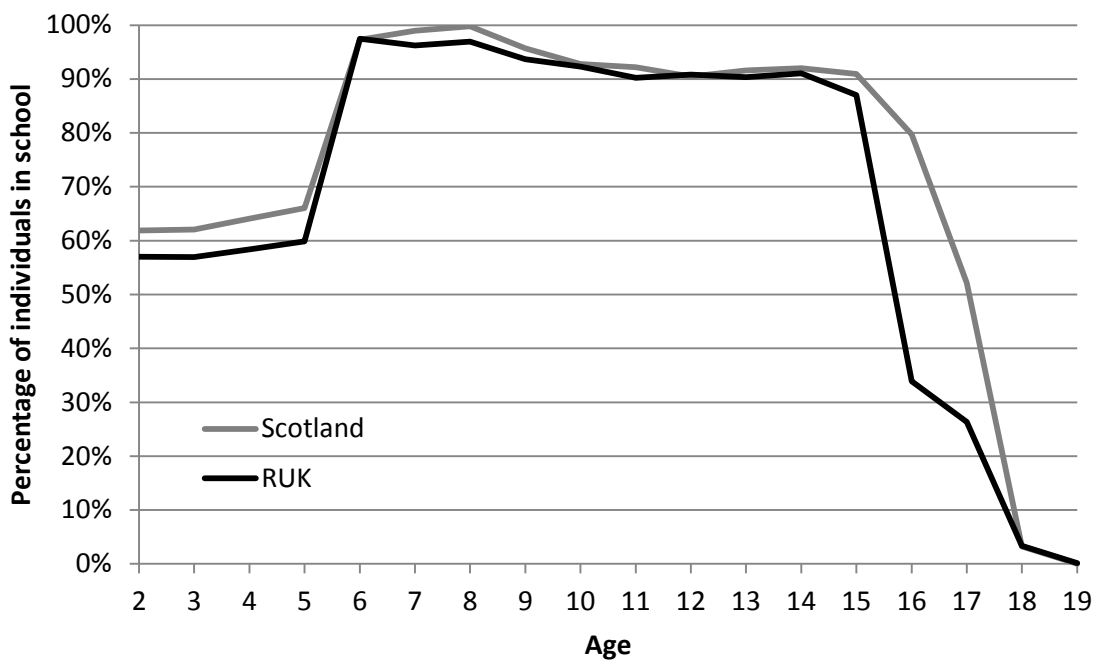
Figure 5.10 shows that a greater fraction of teenagers aged 16–18 are in further education in the rest of the UK than in Scotland – in part offsetting the lower participation in schooling seen in Figure 5.9. However, full-time participation in higher education is somewhat greater for Scottish people than those from the rest of the UK (as shown in Figure 5.11).

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<sup>39</sup> The school leaving age in England and Wales increased to 17 in September 2013 and is due to increase to 18 in 2015. While this would tend to increase spending on schooling at older ages, it will in part be offset by a decline in spending on further education. We do not explicitly take account of either of these effects in our modelling.

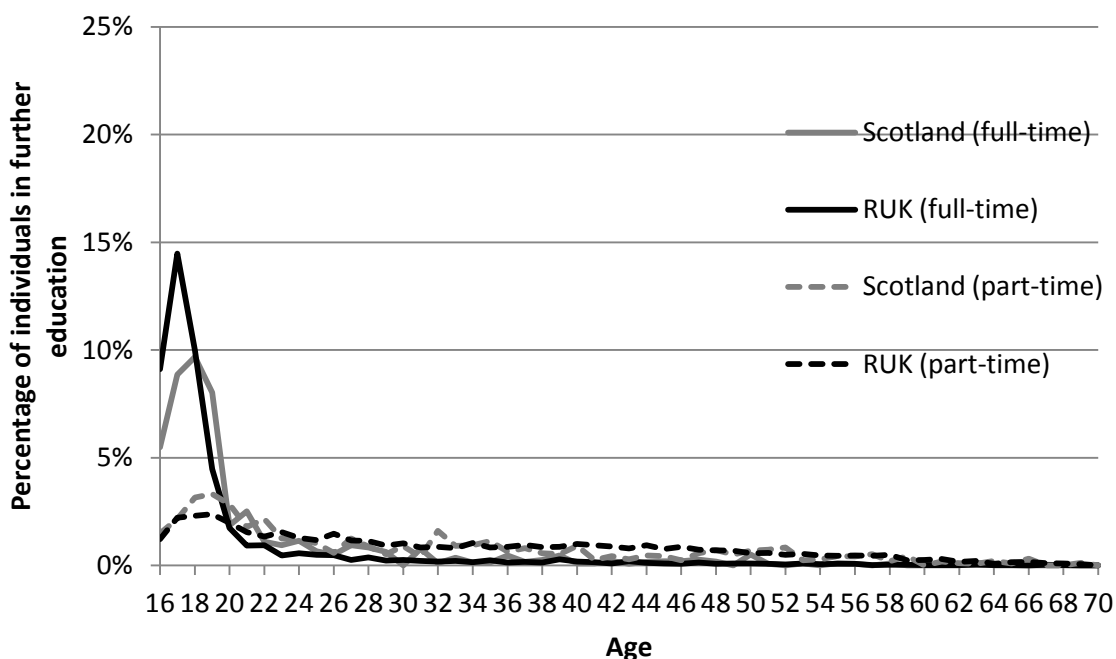
<sup>40</sup> This is a simplification at the UK level, as in practice data suggests that the UK spends more per pupil on secondary aged children than primary aged children (OECD, 2013). However, since this is likely to hold for both Scotland and the rest of the UK, ignoring this variation is unlikely to affect the conclusions of our modelling substantively.

**Figure 5.9. Participation in publicly-funded schooling and pre-schooling**



Notes: Official data do not provide a precise age-breakdown for pupils aged between 2 and 4; we have assumed these pupils are evenly distributed across this age range. Official data also do not disaggregate the ages of pupils aged 19 and over; we have assumed they are all aged 19.  
 Source: Authors' calculations based on Table 1.2 DfE (2012) and Tables 2.4, 3.4 and 4.3 of Scottish Government (2011).

**Figure 5.10. Participation in further education**

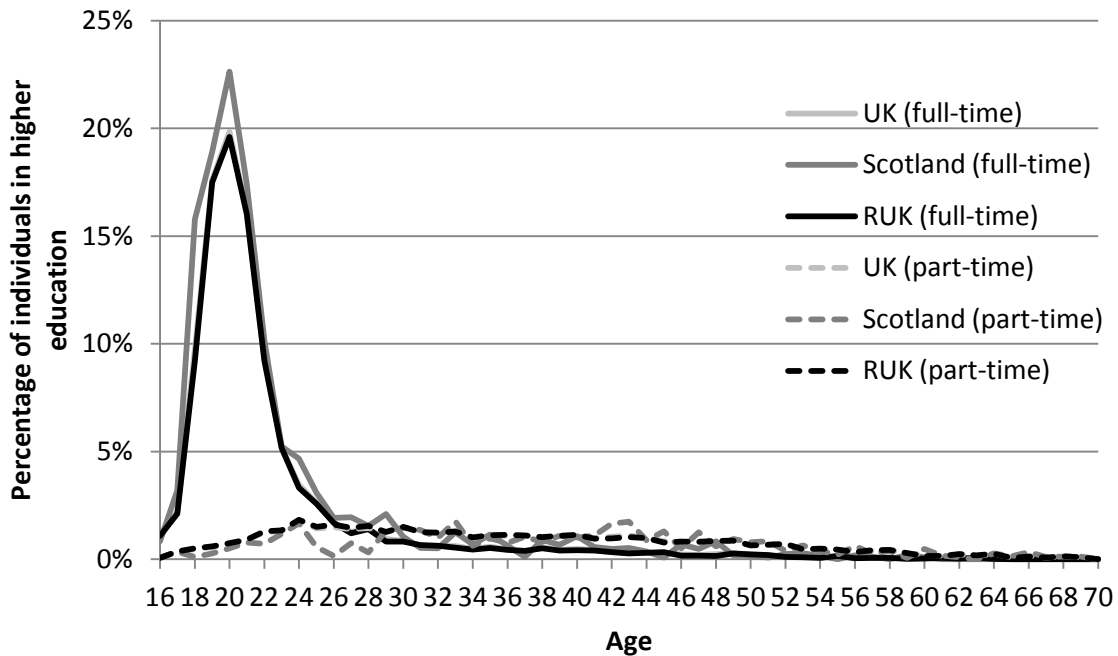


Notes: Students are categorised by their country of birth, rather than the country in which they are studying.  
 Source: Authors' calculations based on Labour Force Survey, 2006–2012.



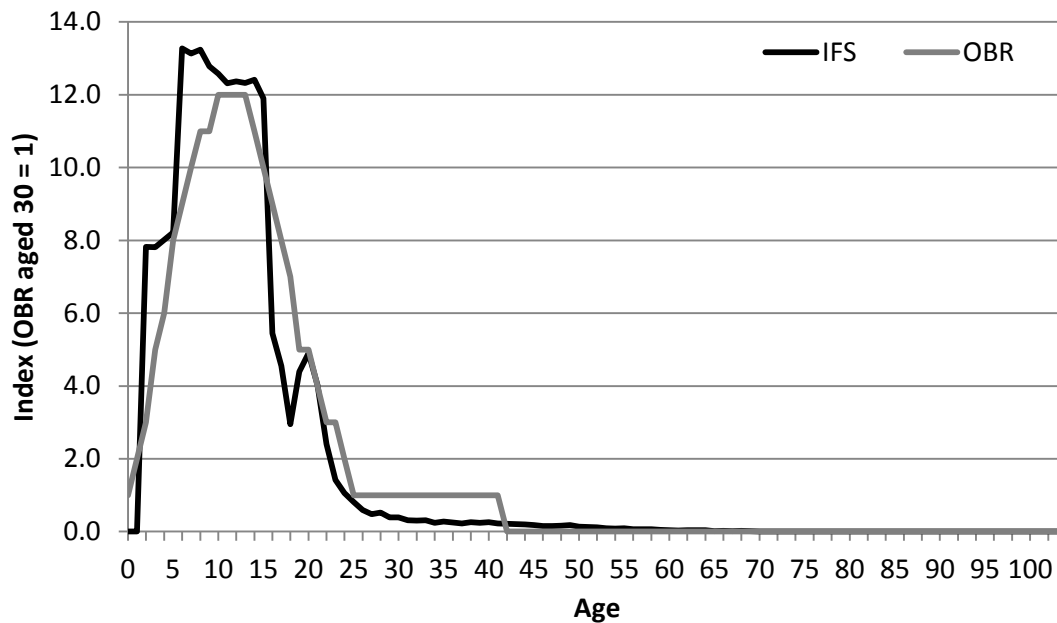
In order to calculate per capita further and higher education spending, we assume that half the amount of spending is dedicated to each part-time student as to full-time students, and that spending on full-time students is the same across all age groups. We assume that levels of spending are the same for men and women.

**Figure 5.11. Participation in higher education**



Notes: As Figure 5.10.  
Source: As Figure 5.10.

**Figure 5.12. Age profile of total education spending in the UK**



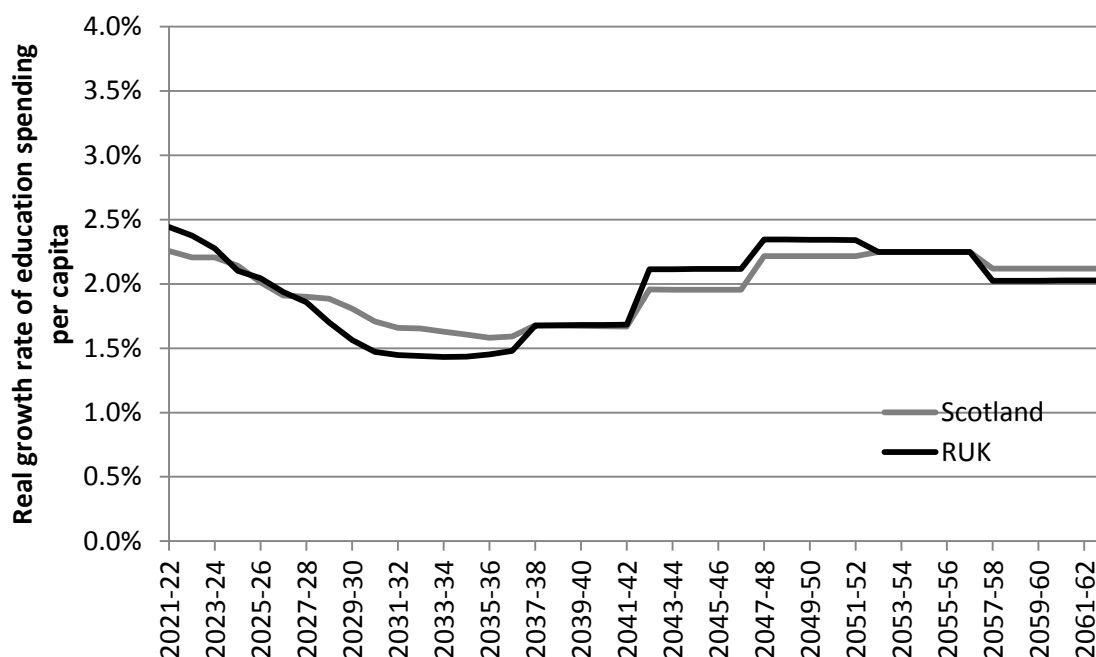
Notes: Each line shows the estimated age distribution of total education spending.  
Source: Authors' calculations using IFS long-run public finance model. Chart 3.4 of OBR (2013b).

Figure 5.12 compares our estimated age profile for total education spending with that used by the OBR. The age profile for total education spending is constructed by aggregating the profiles shown in Figures 5.9–5.11, weighted by the share of each component of spending within total education spending. Figure 5.12 shows that our age profile for education spending is broadly similar to that used by the OBR but not identical.

Combining these age distributions of spending with the baseline levels of spending forecast for 2020–21 (which were described in Section 3), the ONS’ low migration population projection, and an assumption that per capita (age adjusted) spending will rise in line with average earnings in the long-run, we can produce a forecast for these three components of education spending (and thus total education spending) in the long-run for the UK as a whole and for Scotland and RUK separately. Our baseline forecasts for the real growth rate of total education spending per capita are shown in Figure 5.13. This shows that education spending per capita is projected to grow at a similar rate in Scotland as in RUK in future. On average, between 2020–21 and 2062–63, education spending per capita is projected to grow at 2.0% a year in Scotland and in RUK.

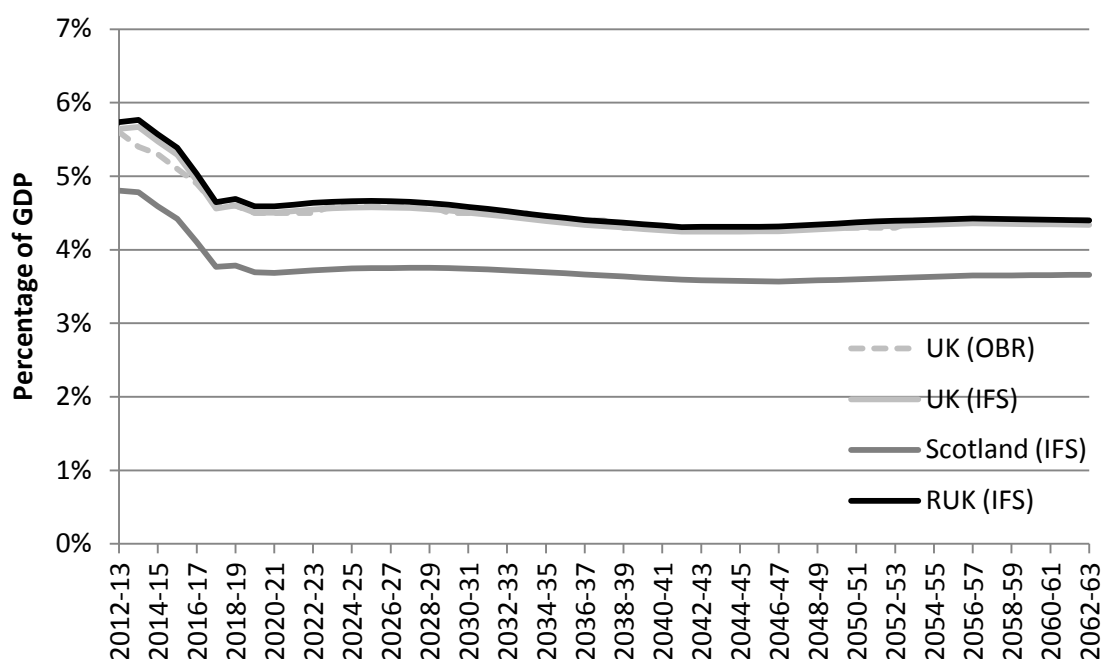
As shown in Figure 5.13, in 2012–13, we estimate that education spending accounted for 4.8% of Scottish GDP, compared to 5.7% for the rest of the UK. By 2062–63, our baseline forecast is that education spending will have fallen to 3.7% of GDP in Scotland and 4.4% in RUK. Between 2020–21 and 2062–63, Scottish spending on education is projected to decline by 0.2 percentage points of GDP, compared to a slightly larger decline (of 0.5 percentage points) for RUK (and the UK as a whole). Figure 5.14 also shows our forecast for education spending in the UK as a whole and how this compares to the OBR’s long-run forecast. The forecasts are almost identical: from 2021–22 onwards, the difference between the two forecasts is less than 0.1% of GDP in each year.

**Figure 5.13. Real terms growth in education spending per capita, by nation**



Source: Authors’ calculations using IFS long-run public finance model.

**Figure 5.14. Education spending as a share of GDP, by nation**



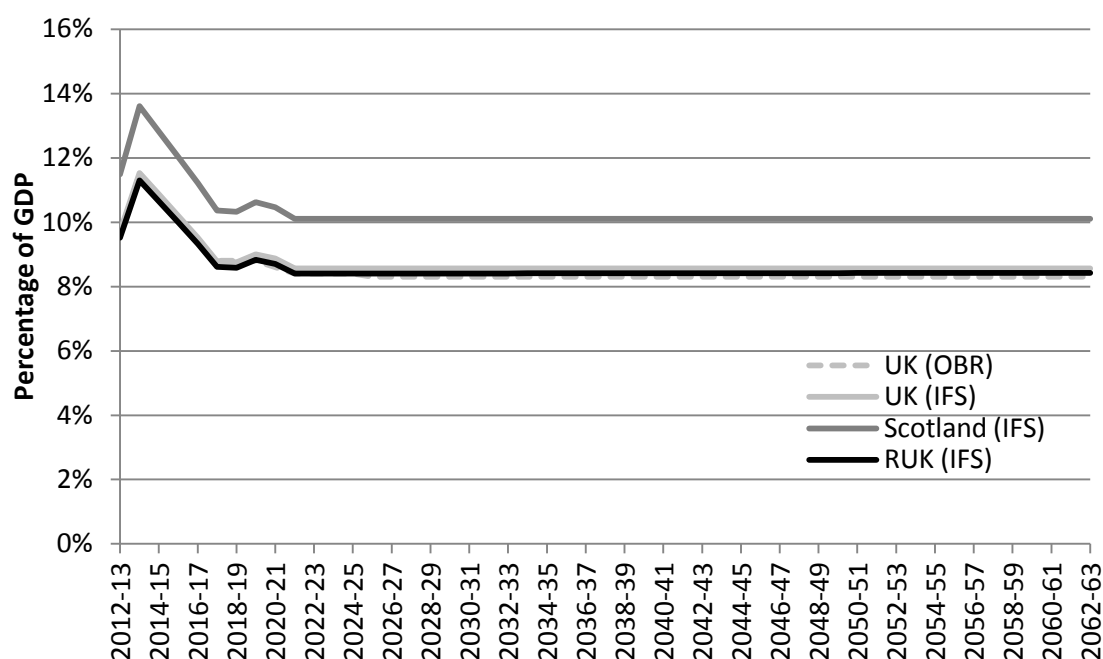
Source: As Figure 5.6.

**Other spending**

All other components of non-debt interest spending – that is, excluding those explicitly discussed above and those discussed in Section 5.2 – are assumed to be enjoyed uniformly by individuals of all ages. These other areas of spending include defence, policing, transport, prisons and overseas aid. These are predominantly non-excludable public goods from which it is reasonable to assume that all UK residents benefit equally. In other words, we assume that the demand for spending on these items is not sensitive to the age structure of the population, only to its total size. Our baseline model assumes that per capita spending on these items grows in line with per capita GDP, which is shown in Figure 2.8.<sup>41</sup> As a result, spending on these other areas remains constant as a share of GDP in the long run – as shown in Figure 5.15.

<sup>41</sup> This is in line with the assumption made by the OBR. However, there is a strong argument (for consistency with the other areas of spending) to assume instead that per capita spending on these items increases in line with average earnings growth. This assumption could easily be incorporated into the model instead.

**Figure 5.15. Other spending as a share of GDP, by nation**



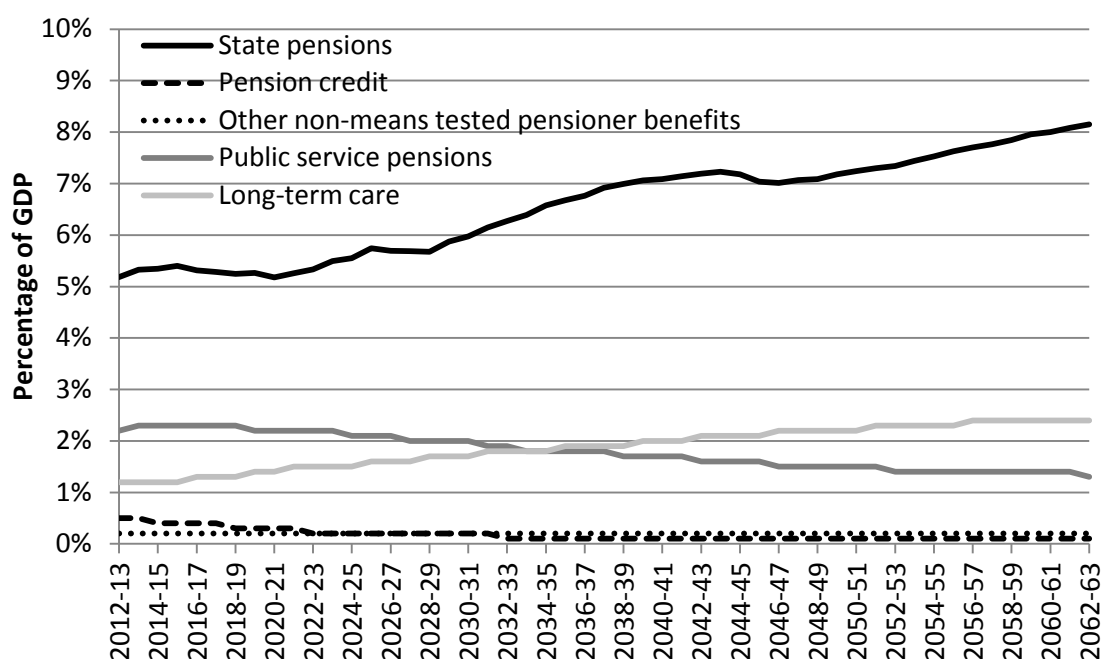
Source: As Figure 5.6.

## 5.2 External projections

Spending on state pensions (and other pensioner-specific benefits), public service pensions and long-term care will be driven not only by demographic trends but also by recent and historic changes in policy which mean that spending per head will differ between cohorts. For these areas of spending, rather than generating a long-run forecast within our model, we make use of external forecasts produced by DWP (for pensions), the Government Actuaries Department (for public service pensions) and the PSSRU (for long-term care). These are the same external projections used by the OBR. The approach we take for incorporating all three of these external forecasts into our model is the same; we, therefore, discuss them together here.

The OBR publishes the forecasts for these components of spending that underlie their FSR projections; these forecasts are provided by the OBR in terms of percentage of GDP. These forecasts are shown in Figure 5.16. “Pensions” includes state pensions, pension credit, winter fuel payments and free TV licences for those aged 75 and over. As mentioned above, we model other benefit payments to pensioners (notably, housing benefit and disability living allowance) as part of non-pension benefit spending – this is described in Section 5.1. The OBR only provides figures for these external forecasts rounded to the nearest 1 decimal place; we smooth these profiles over time to get rid of the resulting discrete jumps.

**Figure 5.16. Pension and long-term care spending: external projections**



Notes: Pensions spending includes spending on the basic state pension, state second pension, single-tier pension and pension credit, as well as spending on winter fuel payments and free TV licences for those aged 75 and over.

Source: Table 1.1 of OBR (2013b) and DWP long-term pensioner benefit expenditure projections.

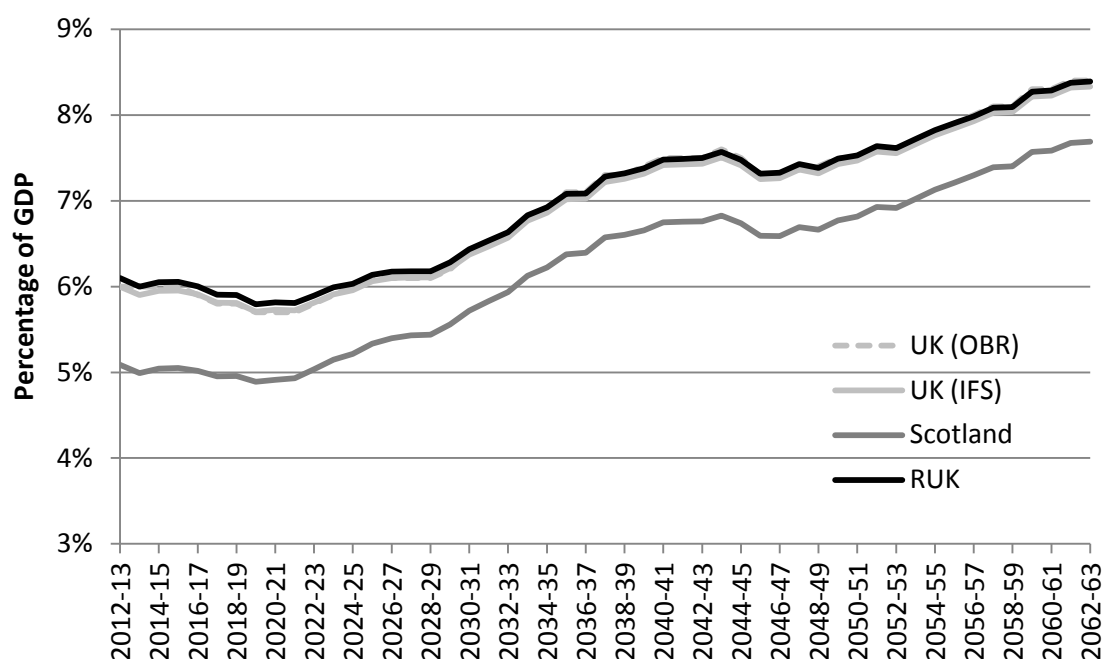
### ***Estimating Scotland's share of long-run state pensions and pensioner benefit spending***

Although the external projections provide us with a long-run forecast for total spending at the UK level, in order to produce separate forecasts for Scotland the rest of the UK, we have to judge which part of this forecast spending will be done in Scotland and which elsewhere in the UK.

As described in Section 3, we calculate the Scottish share of total pensioner benefit spending at baseline using data from DWP and Northern Ireland. We then have to make a judgment about how total pensioner benefit spending will grow in future in Scotland relative to growth in RUK.

For state pensions and other non-means tested pensioner benefits, we assume that the amount spent per pensioner grows at the same rate in Scotland and RUK. In other words, by 2062–63, total spending in Scotland will differ from that in RUK only because of two factors: a difference in the number of pensioners living in Scotland, and any difference in per pensioner state pension spending at baseline. For pension credit spending, we also take into account the age/sex distribution of pension credit spending at baseline and factor this into the long-run forecasts. The age/sex distribution of pension credit spending in 2007 is shown in Figure A.24 in the Appendix. Figure 5.17 shows the resulting forecasts for pension spending as a share of GDP in Scotland and RUK.

**Figure 5.17. Pension spending as a share of GDP, by nation**

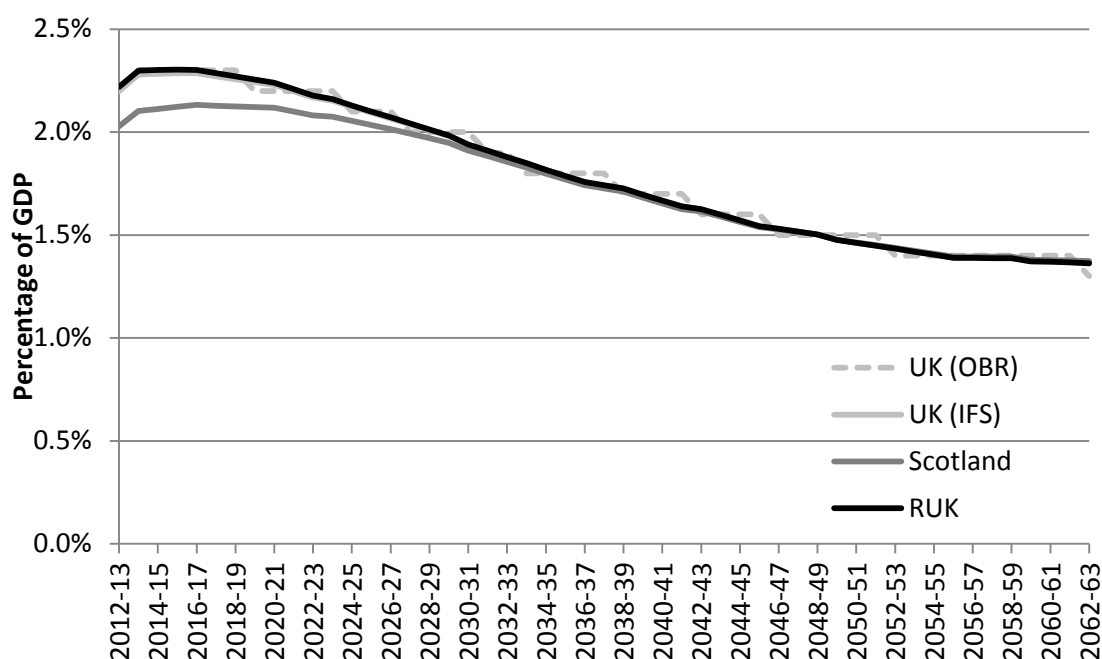


Source: As Figure 5.6.

***Estimating Scotland’s share of public service pension spending***

As described in Section 3, we assume that public service pension spending at baseline is distributed between Scotland and RUK based on the current distribution of public sector workers between the two countries. In the future, we assume that the amount spent on average per pension-aged person grows at the same rate in Scotland and RUK. In other words, by 2062–63, total spending in Scotland on public service pensions will differ from that in RUK only because of two factors: a difference in the number of pensioners living in Scotland, and the difference in per pensioner spending at baseline. As a result, our baseline forecast is that in 2062–63, 8.2% of total UK spending on public service pensions will be done in Scotland. Figure 5.18 shows forecasts for public service pension spending as a share of GDP.

**Figure 5.18. Public service pension spending as a share of GDP, by nation**

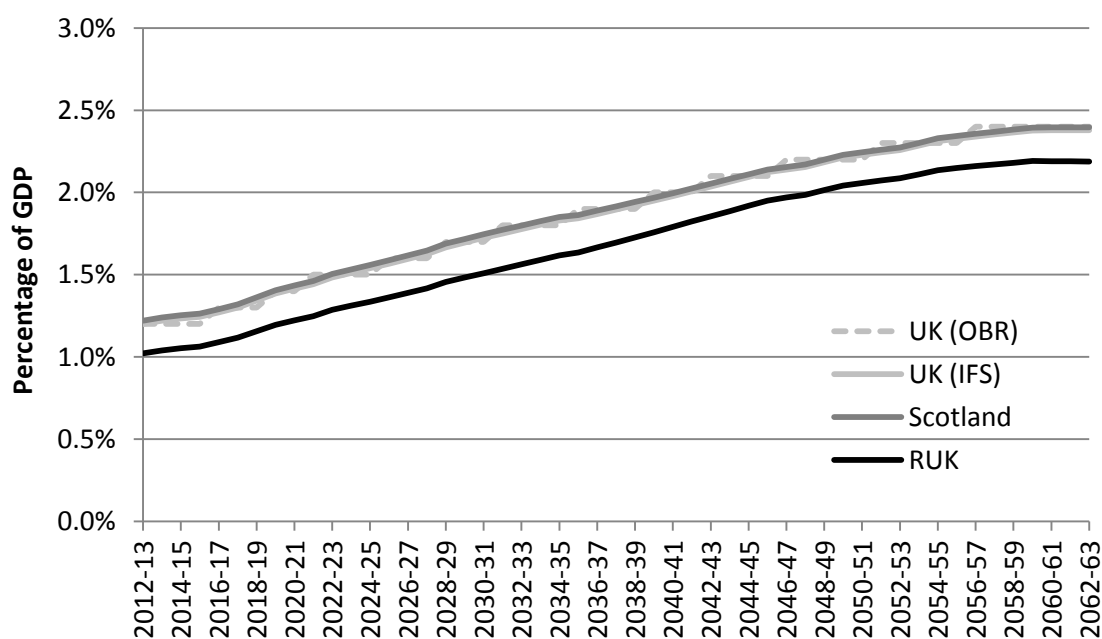


Source: As Figure 5.6.

**Estimating Scotland’s share of long-term care spending**

As described in Section 3, we assume at baseline that spending on long-term care per person is the same at each age/sex in Scotland as it is in the rest of the UK. Our baseline model also assumes that spending per head grows at the same rate throughout the UK in future. Therefore, differences in the way that forecasts for Scottish and RUK spending evolve are driven solely by different demographic trends. The resulting long-term forecasts are shown in Figure 5.19.

**Figure 5.19. Long-term care spending as a share of GDP, by nation**



Source: As Figure 5.6.

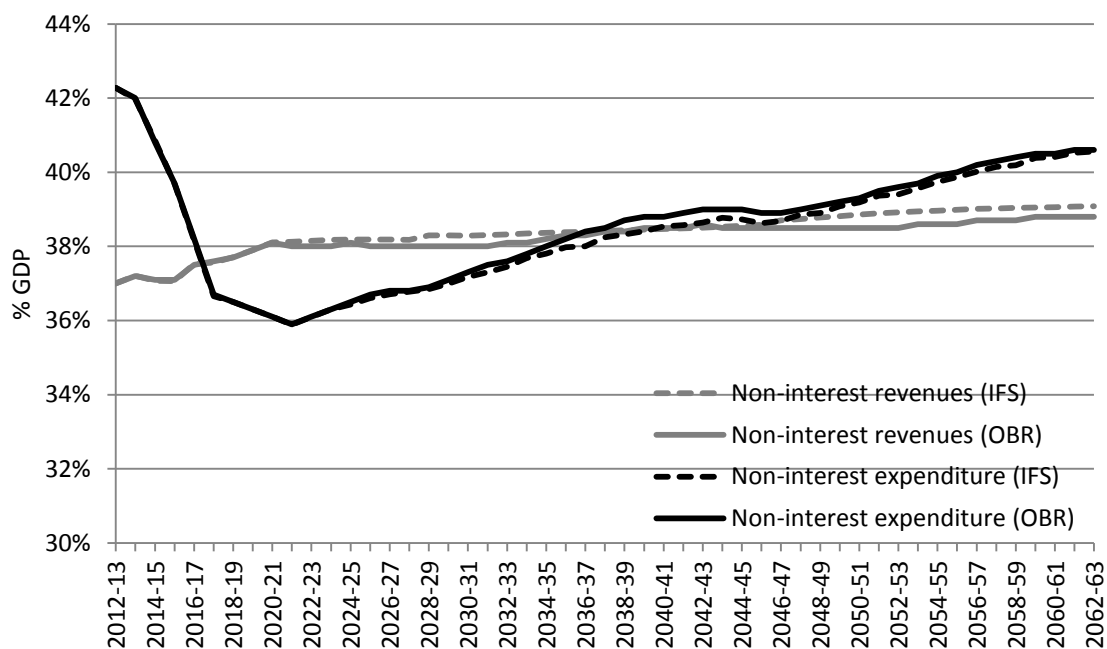
## 6. Long-run forecasts for debt and borrowing: main results

### 6.1 Comparing IFS and OBR headline forecasts for the UK

Figure 6.1 summarises how total non-interest revenues and spending are forecast to evolve as a share of GDP in the UK between 2012–13 and 2062–63 according to our model, and how that compares to the OBR forecasts. On the whole, our forecasts are very similar to those of the OBR. Over the next fifty years revenues are forecast to increase slightly as a share of GDP, while spending is forecast to fall markedly until the 2020s – as the UK government’s planned fiscal consolidation is implemented and the economy is expected to experience above-trend growth – and then increase relatively rapidly for the rest of the period. Compared to the OBR forecasts, our model projects slightly greater revenues in the late 2020s to early 2030s and late 2040s to 2050s, arising from the greater increases in income tax and NICs receipts arising from the SPA changes that our model includes. Conversely our model predicts slightly lower spending in the mid 2030s to mid 2040s.

The net effect of our projections for non-debt interest revenues and spending is shown in Figure 6.2, which compares our forecast for the primary balance to that of the OBR. Given our higher forecast revenues and lower forecast spending, our model projects a slightly more favourable picture for the primary balance than the OBR forecast from the late 2020s, although the gap narrows towards the end of the forecast period and the difference is at most 0.5% of GDP in any year. The overall picture is for an improvement until the 2020s, before the effect of demographic changes increases spending pressures and the outlook deteriorates. From 2039, our model forecasts that the primary balance will be in deficit and continuing to deteriorate over time.

**Figure 6.1. UK non-interest revenues and spending, IFS and OBR compared**

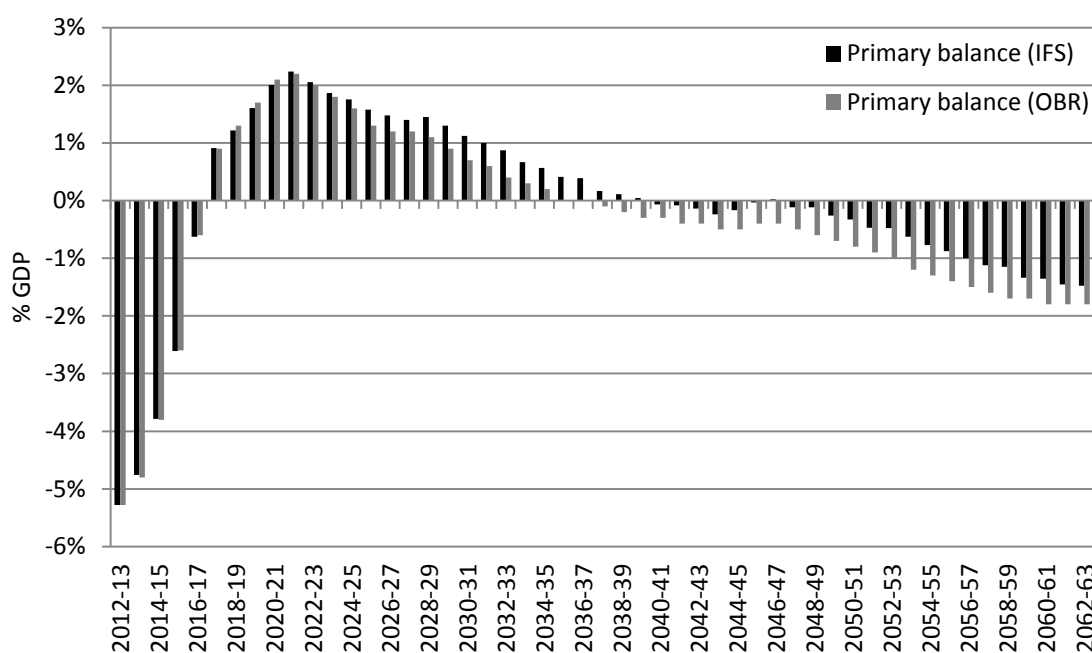


Notes: Non-interest expenditures in 2012–13 are adjusted to remove the effects of the transfer of the Royal Mail pension fund to the public sector.

Source: Supplementary Table 1.1 of OBR (2013b) and author’s calculations using IFS long-run public finance model.



**Figure 6.2. UK primary balance, IFS and OBR compared**



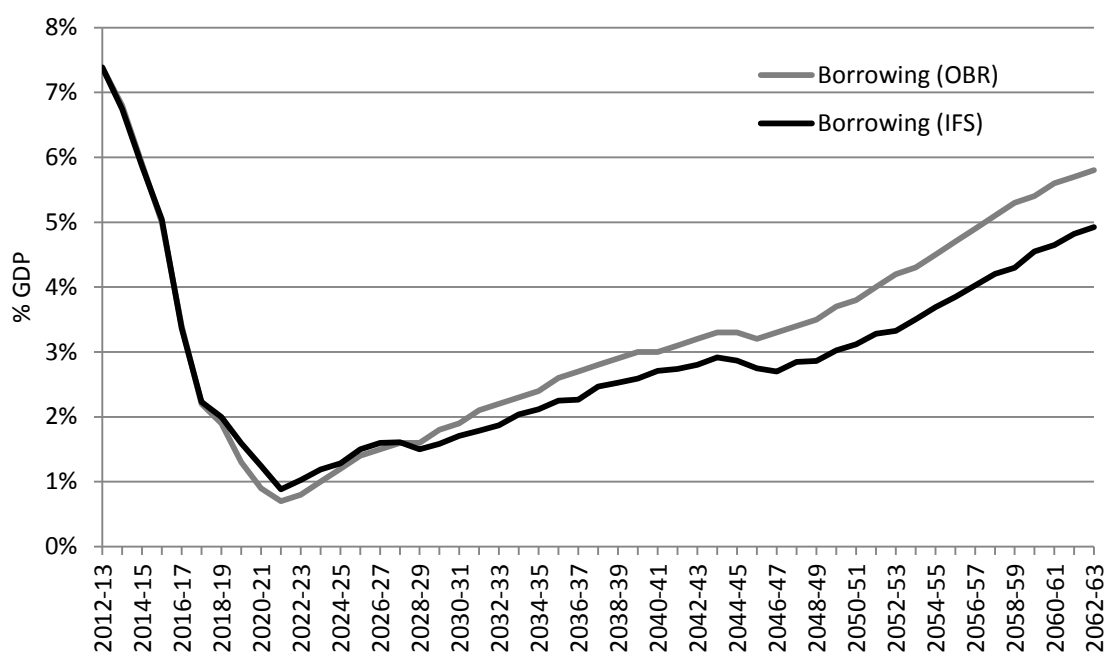
Notes: Primary balance in 2012–13 is adjusted to remove the effects of the transfer of the Royal Mail pension fund to the public sector.

Source: As Figure 6.1.

Public sector net borrowing is equal to (minus) the primary balance plus net debt interest payments (i.e.  $PSNB = -(non\text{-}interest\ revenues - non\text{-}interest\ spending) + net\ debt\ interest\ payments$ ). Net debt interest payments are calculated in our model by applying an assumed exogenous interest rate to the previous year’s public sector net debt. Our basic assumption is that this interest rate converges from current rates to a long run rate of 5% by 2026–27 and remains at this level thereafter, as assumed by the OBR. However, different assumptions on the interest rate can be applied in our model, and the interest rate can be assumed to differ between Scotland and the rest of the UK, with consequent implications for net debt interest payments and the evolution of public sector net debt.

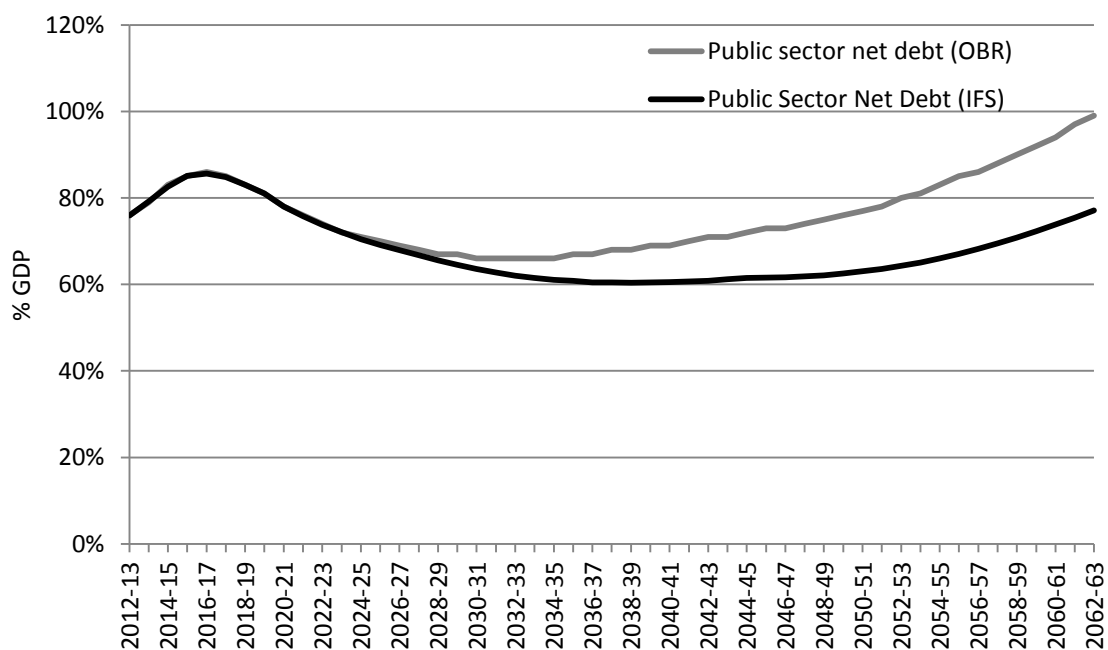
Figure 6.3 shows how the projections of our model for borrowing compare to the OBR forecasts in the long-run. As with the primary balance, our projections are slightly more optimistic (forecasting lower borrowing) than those of the OBR. The difference increases over time as the lower borrowing forecast in previous years feeds through into lower public sector net debt and therefore lower annual net debt interest payments in our model.

**Figure 6.3. UK public sector net borrowing, IFS and OBR compared**



Notes: PSNB in 2012–13 is adjusted to remove the effects of the transfer of the Royal Mail pension fund to the public sector.  
Source: As Figure 6.1.

**Figure 6.4. UK public sector net debt, IFS and OBR compared**



Source: As Figure 6.1.

In our model, public sector net debt in a given year is calculated by adding borrowing in that year to debt in the previous year. The projections from our model for the evolution of debt over the long-run are compared to those of the OBR in Figure 6.4. As a result of our more favourable projections for borrowing, our projection for the evolution of debt is somewhat more optimistic than that of the

OBR. However, the overall picture, of a decline in public sector net debt until the 2030s before the start of a trajectory of ever increasing debt, is the same in both our and the OBR's projections.

### **Conclusions on our model**

The main objective of the IFS model is to allow us to compare long-run fiscal projections for the constituent nations of the UK, rather than to provide a better forecast for the UK as a whole from that provided by the OBR. Our approach is closely modelled on that of the OBR, and therefore it is a reassuring test of both our model and the OBR's that our projections for the UK look very similar. As summarised in Table 6.1, our models differ to a small extent on total revenues and total spending, and this feeds through into borrowing, which over the course of 50 years feeds through into the relatively large differences in our projections for debt (since figures for debt cumulate the annual differences in borrowing).

**Table 6.1. Summary of fiscal aggregates, IFS and OBR compared**

<i>Percent of GDP:</i>	<b>2012–13</b>	<b>2062–63</b>	<b>Ppt change (2062–63 – 2012–13)</b>
<b>IFS</b>			
Total non-interest spending	42.3%	40.6%	–1.7
Total non-interest revenues	37.0%	39.1%	+2.1
Primary balance	–5.3%	–1.5%	+3.8
Net interest	2.1%	3.4%	+1.3
Public sector net borrowing	7.4%	4.9%	–2.5
Public sector net debt	75.9%	77.1%	+1.2
<b>OBR</b>			
Total non-interest spending	42.3%	40.6%	–1.7
Total non-interest revenues	37.0%	38.8%	+1.8
Primary balance	–5.3%	–1.8%	+3.5
Net interest	2.1%	4.0%	+1.9
Public sector net borrowing	7.4%	5.8%	–1.6
Public sector net debt	75.9%	99.0%	+23.1
<b>IFS – OBR</b>			
<i>Total non-interest spending</i>	<i>0.0%</i>	<i>0.0%</i>	<i>0.0</i>
<i>Total non-interest revenues</i>	<i>0.0%</i>	<i>0.3%</i>	<i>+0.3</i>
<i>Primary balance</i>	<i>0.0%</i>	<i>0.3%</i>	<i>+0.3</i>
<i>Net interest</i>	<i>0.0%</i>	<i>–0.6%</i>	<i>–0.6</i>
<i>Public sector net borrowing</i>	<i>0.0%</i>	<i>–0.9%</i>	<i>–0.9</i>
<i>Public sector net debt</i>	<i>0.0%</i>	<i>–21.9%</i>	<i>–21.9</i>

Note: 2012–13 figures for non-interest spending, primary balance and public sector net borrowing are adjusted to remove the effects of the transfer of the Royal Mail pension fund to the public sector.

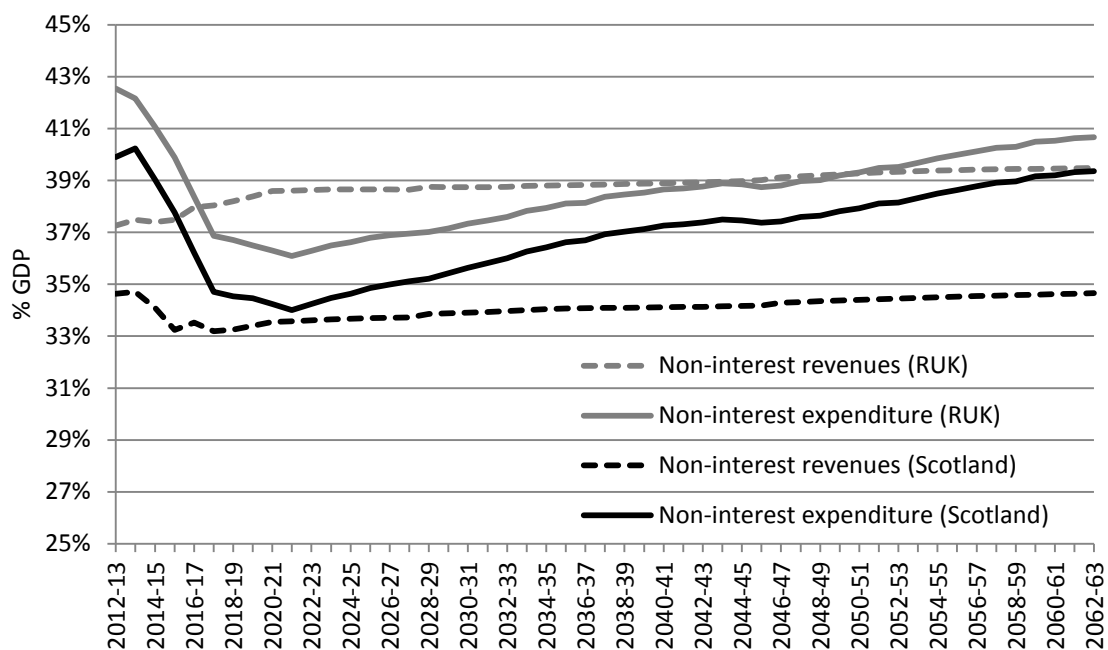
Source: As Figure 6.1.

## **6.2 The outlook for Scotland from our basic model**

In our basic model we project the outlook for the Scottish public finances by applying to Scotland the OBR's central assumptions for the UK from their 2013 FSR. More specifically, we assume that the populations of Scotland the rest of the UK will change according to the ONS' 'low migration' projections, that productivity per worker will grow at 2.2% across Scotland and the rest of the UK, that North Sea oil revenues decline to 2017–18 but are then replaced as a share of GDP, and that Scotland and the rest of the UK will both face the same interest rate on their net debt (a long run rate of 5% from 2026–27). In addition, we assume that 94% of North Sea revenues (a geographical

share) accrue to Scotland, and that Scotland would take a population share of the UK's accrued public sector net debt in 2015–16.

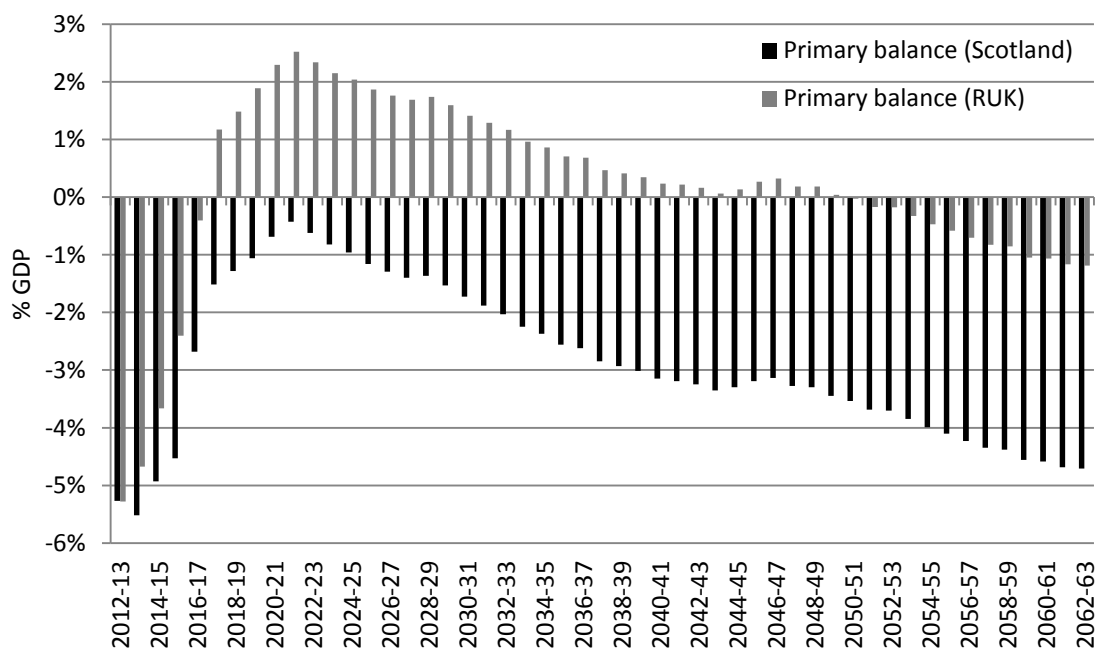
**Figure 6.5. Non-interest revenues and spending, Scotland compared to the rest of the UK**



Notes: Figures for 2012–13 are adjusted to remove the effects of the transfer of the Royal Mail pension fund to the public sector.

Source: Authors' calculations using IFS long-run public finance model.

**Figure 6.6. Primary balance, Scotland compared to the rest of the UK**



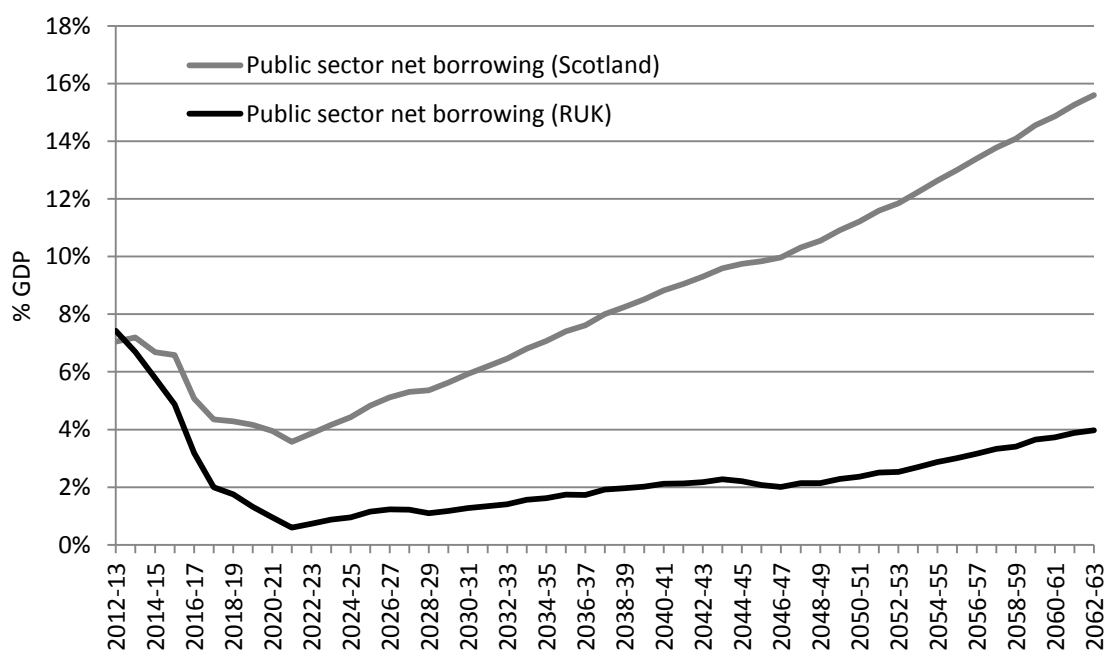
Notes: As Figure 6.5.

Source: As Figure 6.5.

Figure 6.5 shows the resulting projections for non-interest revenues and spending in Scotland compared to the rest of the UK. Both spending and revenues are smaller as a share of GDP in Scotland than in the rest of the UK. However, while in the rest of the UK spending is forecast to fall below revenues in 2017–18 and remain that way until 2043–44, Scotland is projected to have spending that exceeds their revenues throughout the whole period. The resulting primary balance is shown in Figure 6.6.

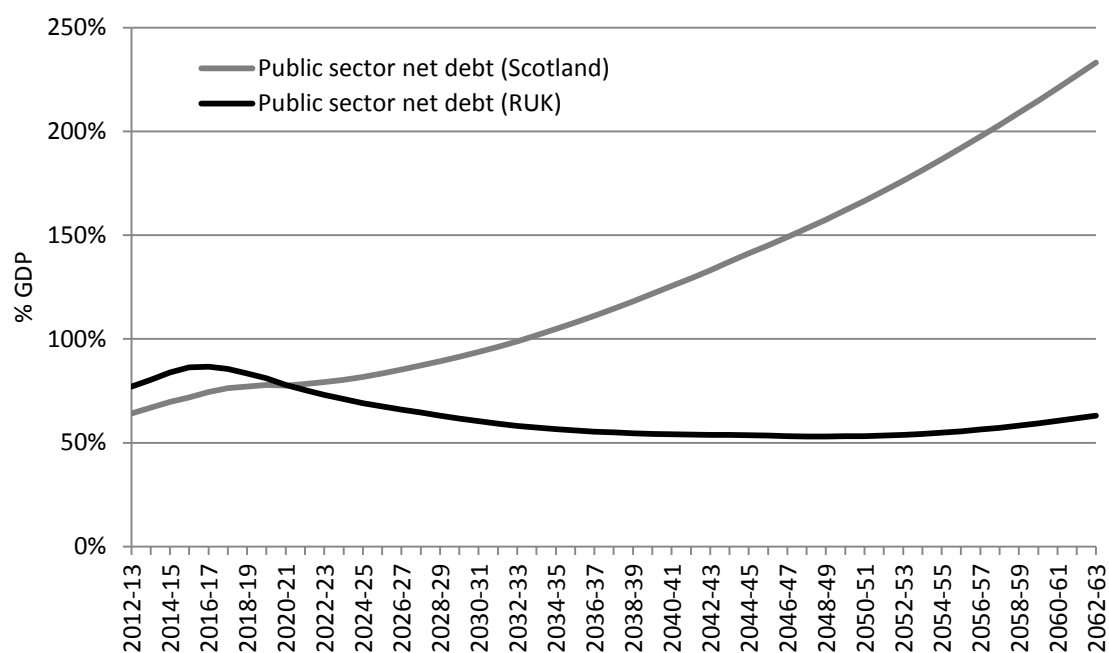
The projections for public sector net borrowing and net debt, assuming Scotland takes a population share of the UK’s accumulated debt from 2015–16, and pays the same interest rate on its net debt as the UK is forecast to, are shown in Figures 6.7 and 6.8. These do not suggest a sustainable public finance position for Scotland. While public sector net debt would represent a smaller share of GDP in Scotland than in the rest of the UK in 2015–16, the significantly higher (and more rapidly increasing) level of borrowing in Scotland would put Scotland immediately onto a path of ever increasing national debt, forecast to exceed 200% of GDP in the 2050s. (In reality, of course, such a situation is unlikely to occur – the Scottish government would almost certainly need to take action to reduce borrowing before this point was reached, and if it did not, the interest rate payable on public debt would be unlikely to remain at the 5% that the OBR has assumed for the UK in the long-run.)

**Figure 6.7. Public sector net borrowing, Scotland compared to the rest of the UK**



Notes: As Figure 6.5.  
Source: As Figure 6.5.

**Figure 6.8. Public sector net debt, Scotland compared to the rest of the UK**



Source: As Figure 6.5.

**Table 6.2. Summary of fiscal aggregates, Scotland compared to the rest of the UK**

	% GDP			Change in % GDP	
	2012–13	2017–18	2062–63	2012–13 to 2017–18	2017–18 to 2062–63
<b>Scotland</b>					
Total non-interest spending	39.9	34.7	39.4	–5.2	4.7
Total non-interest revenues	34.6	33.2	34.7	–1.4	1.5
Primary balance	–5.3	–1.5	–4.7	3.8	–3.2
Net interest	1.8	2.8	10.9	1.0	8.1
Public sector net borrowing	7.0	4.3	15.6	–2.7	11.2
Public sector net debt	64.2	76.2	233.2	12.1	156.9
<b>RUK</b>					
Total non-interest spending	42.5	36.9	40.7	–5.7	3.8
Total non-interest revenues	37.3	38.0	39.5	0.8	1.4
Primary balance	–5.3	1.2	–1.2	6.5	–2.4
Net interest	2.1	3.2	2.8	1.0	–0.4
Public sector net borrowing	7.4	2.0	4.0	–5.4	2.0
Public sector net debt	77.1	85.5	63.1	8.5	–22.4

Notes: As Table 6.1.

Source: Authors’ calculations using IFS long-run public finance model.

Table 6.2 summarises the differences in our projections for the main fiscal aggregates between Scotland and RUK. The worse picture for borrowing and debt projected for Scotland than RUK – illustrated in Figures 6.7 and 6.8 – arises in part due to a decline in non-interest revenues in Scotland between 2012–13 and 2014–15 (due to a projected decline in North Sea revenues) compared to an increase for RUK, and in part due to a greater projected increase in non-interest spending between 2017–18 and 2062–63. These differences compound over time since they result in higher borrowing in Scotland, which feeds through into higher debt, and therefore higher debt interest payments, and

thus higher borrowing in future. Between 2017–18 and 2062–63 net interest payments are projected to increase by 8.1% of GDP in Scotland compared to a decline of 0.4% of GDP in RUK. This accounts for a large proportion of the greater increase in borrowing between 2017–18 and 2062–63 projected for Scotland than RUK (an increase of 11.2% of GDP compared to 2.0% of GDP). The implication of this is that fiscal action taken in the medium term could make a significant difference to the projected outlook for borrowing and debt illustrated in Figures 6.7 and 6.8. Amior, Crawford and Tetlow (2013) discusses in more detail the scale of fiscal tightening that would be required to put the Scottish public finances on a sustainable footing for the next 50 years.

### 6.3 Alternative modelling assumptions

The picture for the Scottish public finances could look better than described in Section 6.2, for example if labour productivity growth in a independent Scotland were greater than the 2.2% assumed by the OBR for the UK as a whole. Alternatively, the picture could look considerably worse, for example, were we to assume that the Scottish government was not able to offset the OBR’s forecast decline in North Sea oil revenues by raising an equivalent share of GDP from other sources.

Table 6.3 below describes the alternative assumptions that can be made about the inputs into our model from 2021–22. Alternative assumptions can be made about demographic change, labour productivity growth, the growth and allocation of North Sea revenues, and the allocation and interest rate payable on the national debt, and different assumptions can be made for Scotland as for the rest of the UK. Some of these assumptions are very flexible – for example, we can assume any alternative interest rate on debt. However, for other assumptions we are more constrained in the alternatives we can choose. The most binding constraint is productivity growth, where we are constrained to choose one of the three alternatives considered by the OBR. This is because productivity growth affects the forecasts for spending on state pensions and public service pensions and we only have external projections for long-run spending on these areas under the three alternative assumptions for productivity growth described in Table 6.3.

A fuller discussion of the outlook for the Scottish public finances, illustrating the sensitivity of the projections described in Section 6.2 to these assumptions, is contained in Amior, Crawford and Tetlow (2013).

**Table 6.3. Alternative assumptions possible in the IFS long-run public finances model**

	<b>Basic model assumptions</b> (UK/Scotland/RUK)	<b>Alternative assumptions</b> (can differ by nation)
<b>Population growth and demographic change</b>	ONS ‘low migration’	ONS ‘high migration’, ‘zero migration’, ‘young age structure’, ‘old age structure’
<b>Labour productivity growth</b>	2.2%	1.7%, 2.7%
<b>North sea revenues</b>		
Growth to 2017–18	OBR ‘central’ projection	Any external forecast
Growth from 2017–18 onwards	Constant as % GDP	Any external forecast
Allocation to Scotland	Geographical share (94%)	Any alternative allocation
<b>Public sector net debt</b>		
Interest rate payable	Rising to 5% in 2026–27; constant thereafter	Any interest rate
Allocation to Scotland in 2015–16	Population share	Any alternative allocation

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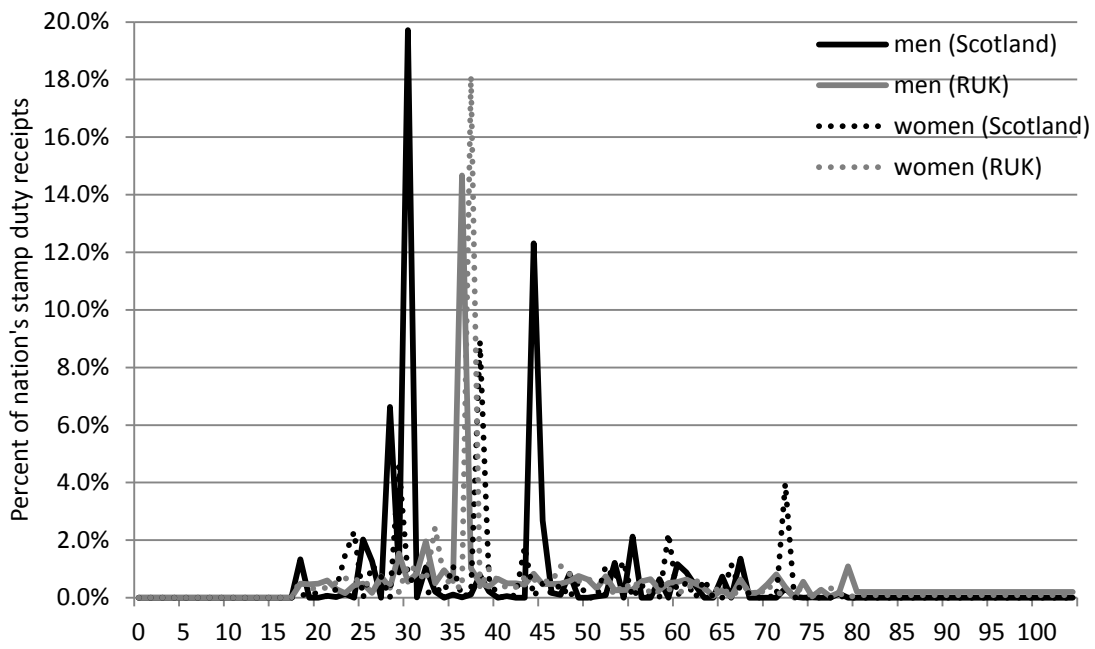
## Appendix

**Table A.1 Comparing GERS and HMRC allocation of HMRC revenues to Scotland**

Revenue component	Scottish share in 2011–12: GERS	Scottish share in 2011–12: HMRC
Income tax	7.4%	7.3%
National Insurance contributions	8.3%	8.2%
VAT	8.7%	8.5%
Corporation tax (excluding North Sea)	9.0%	7.7%
Fuel duties	8.6%	8.4%
Council tax	7.7%	–
Business rates	8.1%	–
Alcohol duties	9.6%	9.8%
Tobacco duties	11.4%	11.2%
Stamp duties	5.7%	4.6%
North Sea revenue	94.0%	82.6%
Vehicle excise duty	8.0%	–
Capital gains tax	5.7%	6.4%
Inheritance tax	5.6%	7.8%
Insurance premium tax	8.4%	7.2%
Air passenger duties	8.1%	8.2%
Betting and gaming duties	9.4%	9.6%
Landfill tax	9.0%	9.1%
Climate change levy	9.5%	9.5%
Aggregates levy	18.4%	16.6%
<b>Total HMRC receipts</b>	–	<b>9.8%</b>
<b>Total non-interest revenues</b>	<b>9.9%</b>	–

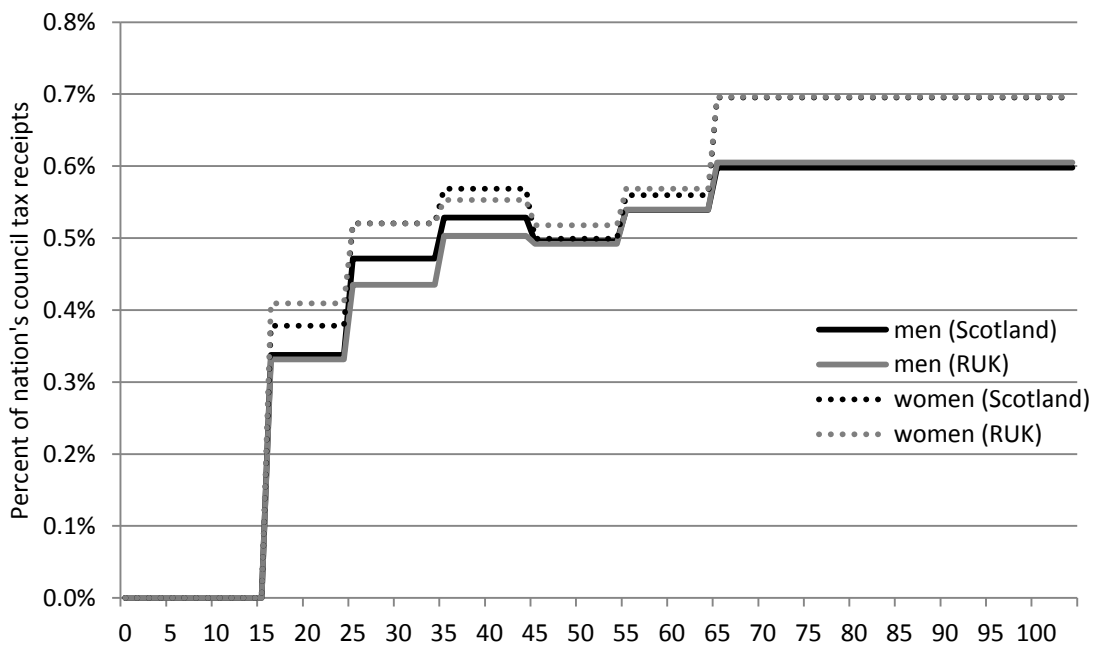
Sources: Table 3.1 of Scottish Government (2013) and Table 1 of HM Revenue and Customs (2013b).

**Figure A.2. Estimated age profile of stamp duty receipts, by nation**



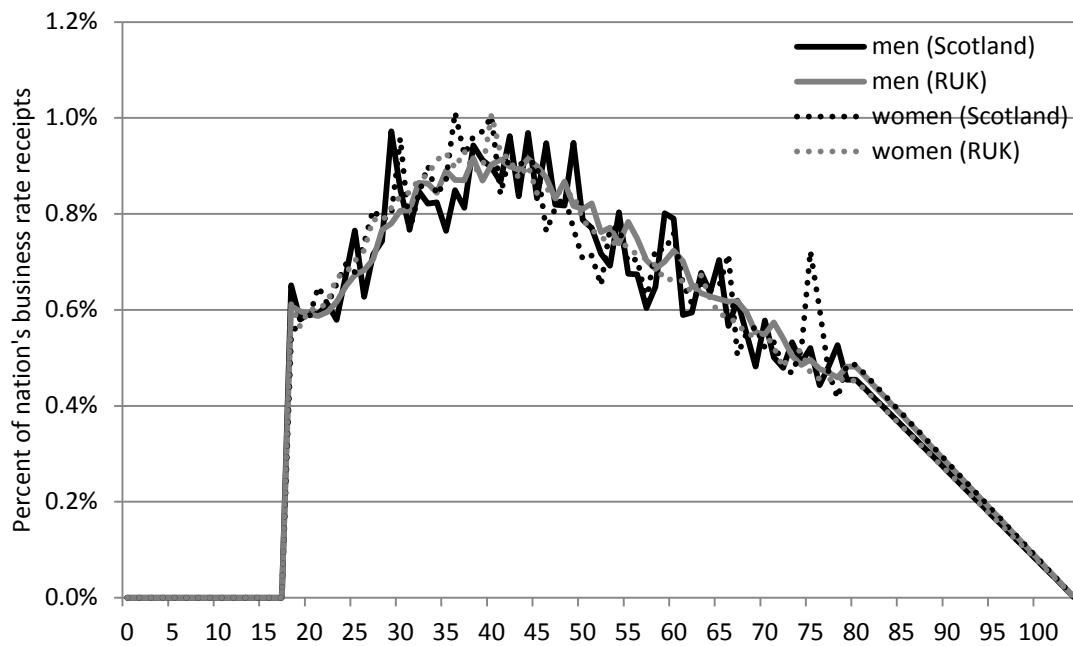
Notes: Includes stamp duty land tax and stamp duty on stocks and shares.  
 Source: Authors' calculations using the Expenditure and Food Survey.

**Figure A.3. Estimated age profile of council tax receipts, by nation**



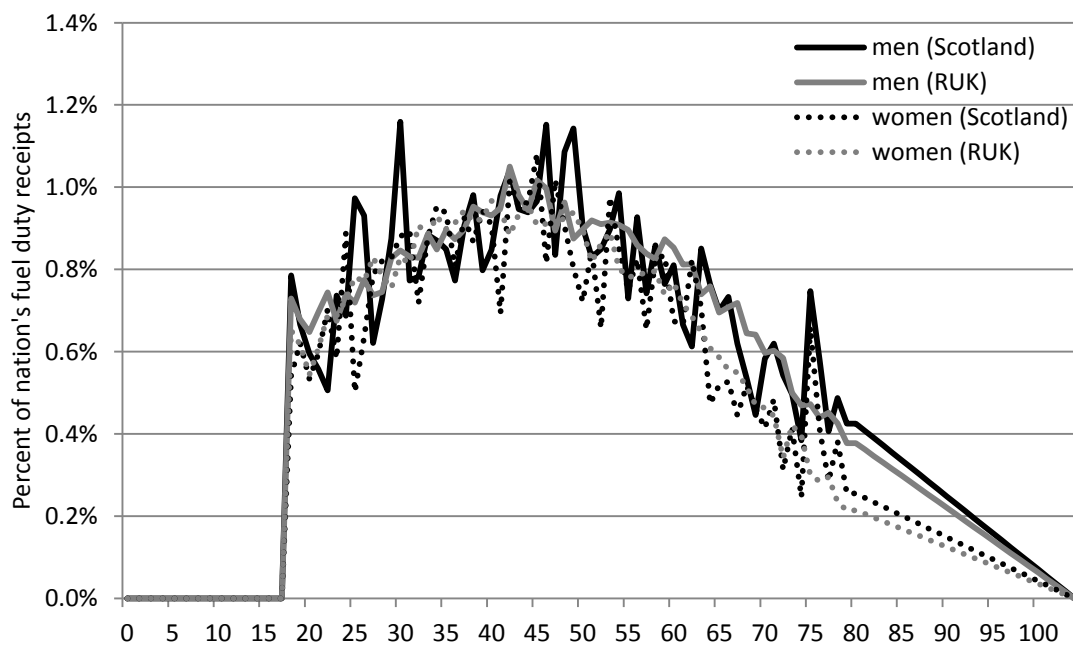
Source: Authors' calculations using the Family Resources Survey.

**Figure A.4. Estimated age profile of business rate receipts, by nation**



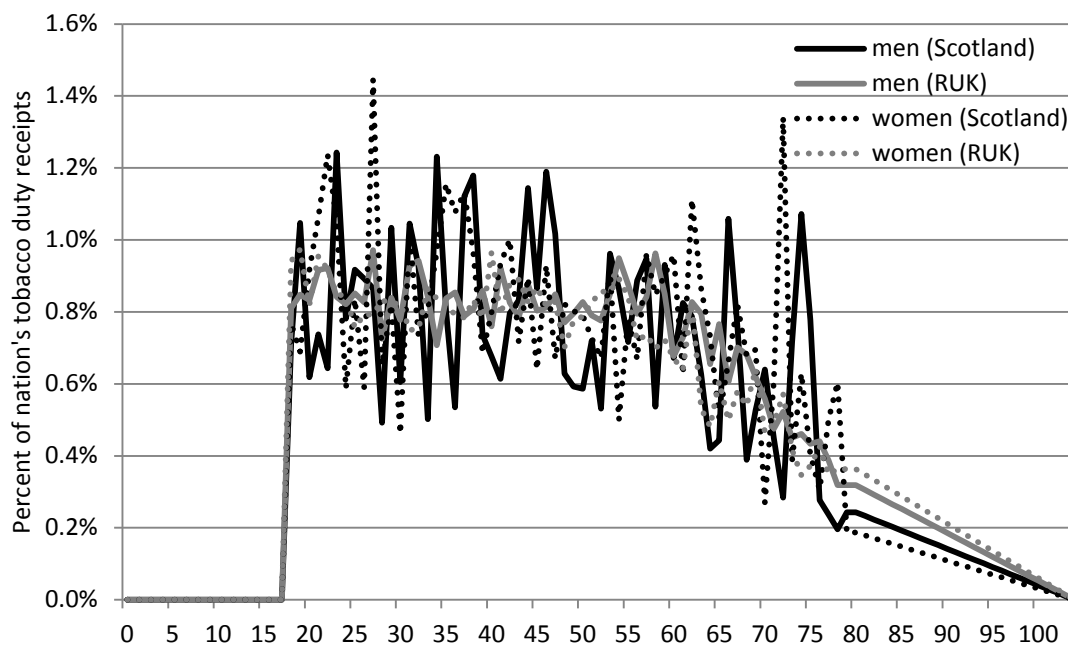
Source: Authors' calculations using the Family Resources Survey.

**Figure A.5. Estimated age profile of receipts from fuel duties, by nation**



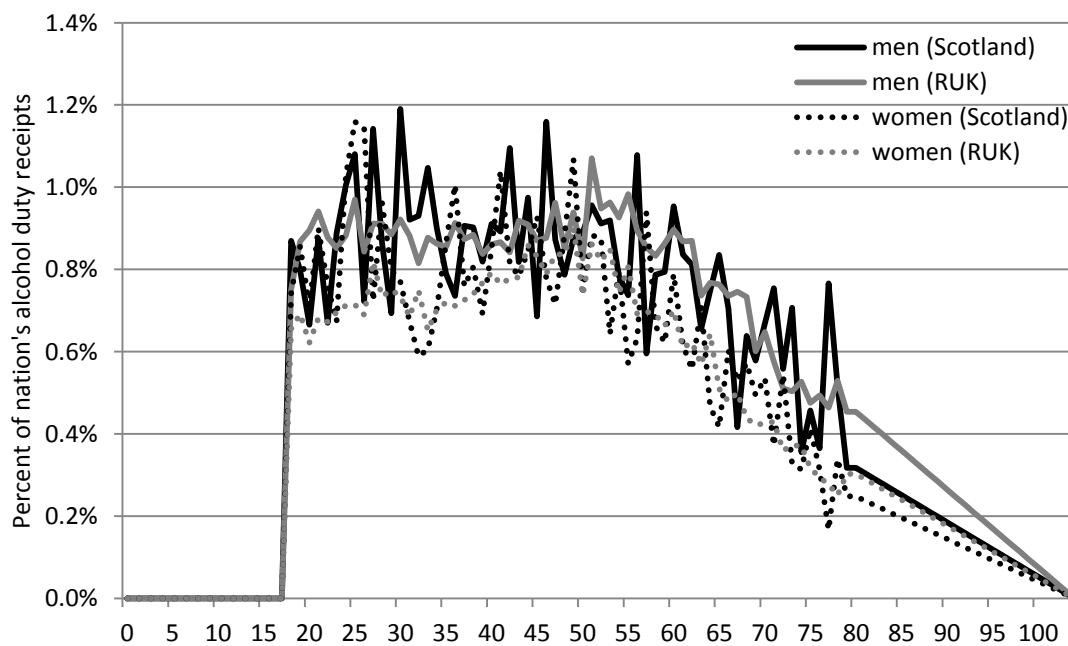
Source: Authors' calculations using the Expenditure and Food Survey.

**Figure A.6. Estimated age profile of tobacco duty receipts, by nation**



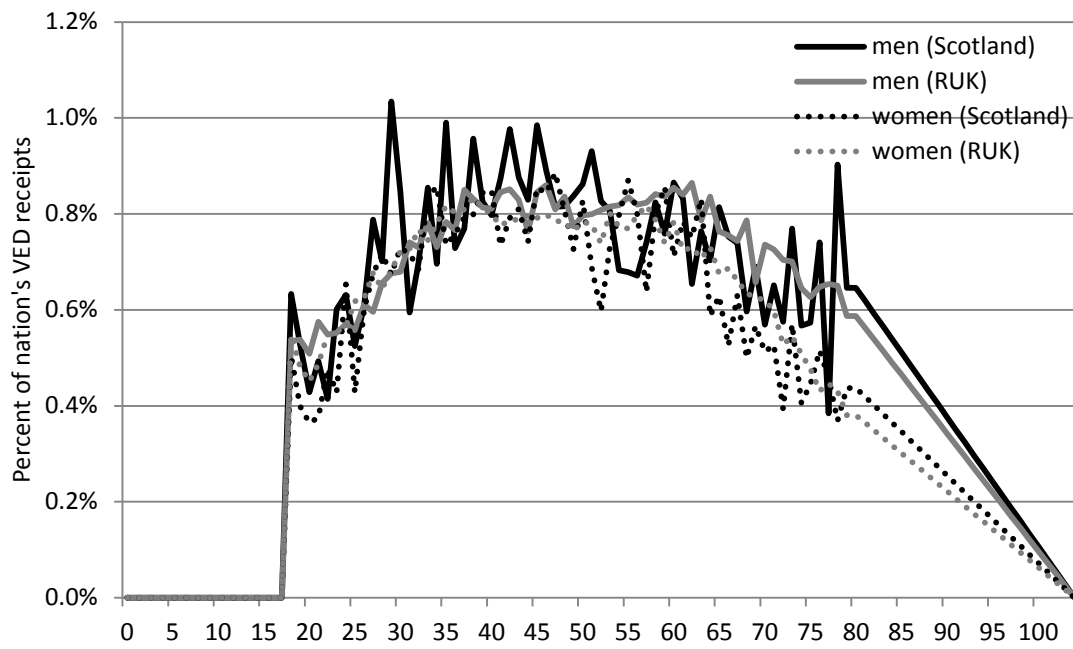
Source: Authors' calculations using the Expenditure and Food Survey.

**Figure A.7. Estimated age profile of receipts from alcohol duties receipts, by nation**



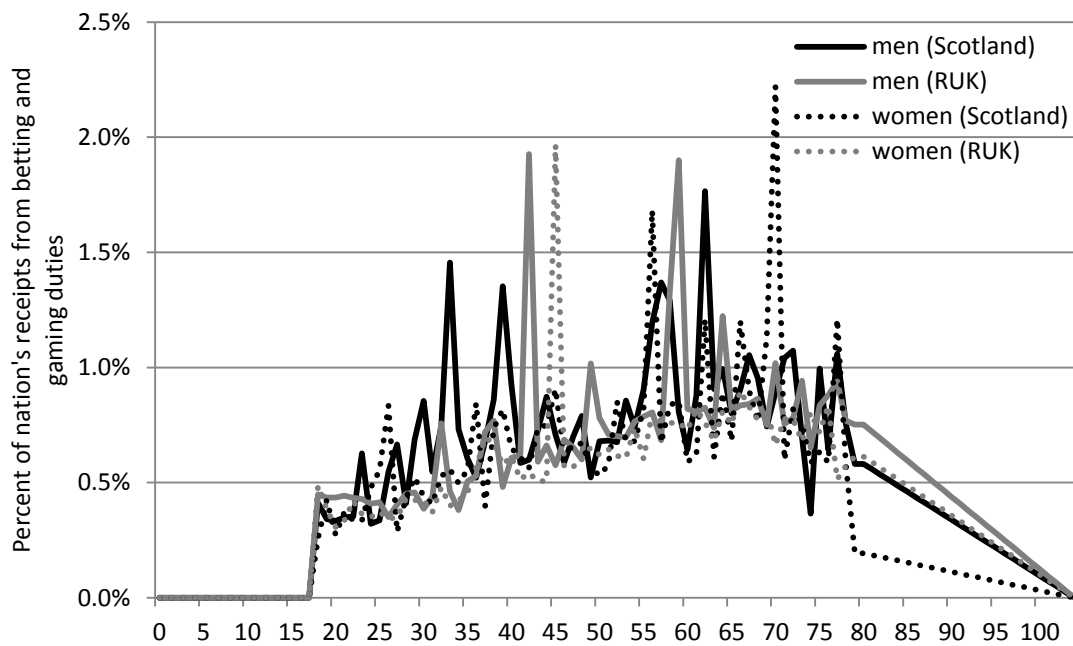
Source: Authors' calculations using the Expenditure and Food Survey.

**Figure A.8. Estimated age profile of Vehicle Excise Duty receipts, by nation**



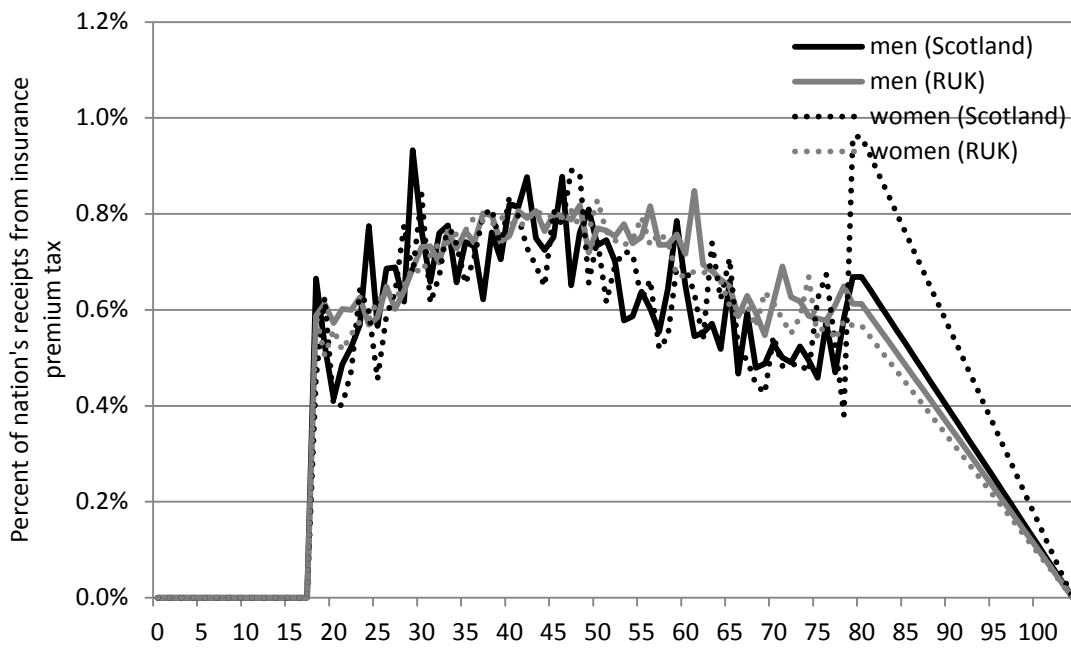
Source: Authors' calculations using the Expenditure and Food Survey.

**Figure A.9 Estimated age profile of receipts from betting and gaming duties, by nation**



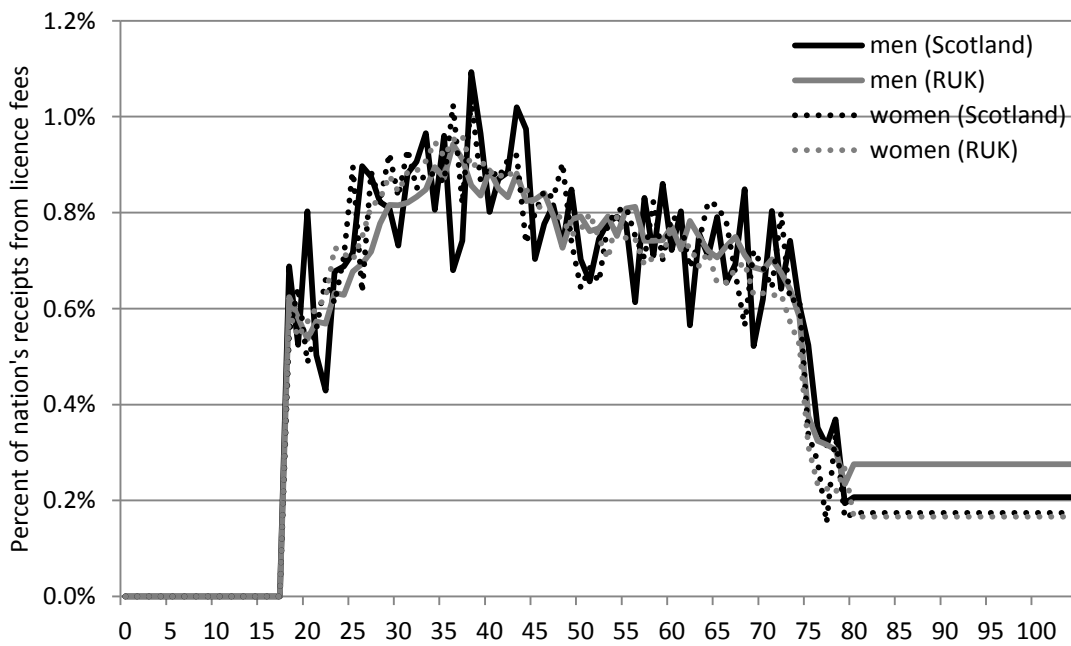
Source: Authors' calculations using the Expenditure and Food Survey.

**Figure A.10. Estimated age profile of receipts from insurance premium tax, by nation**



Source: Authors' calculations using the Expenditure and Food Survey.

**Figure A.11. Estimated age profile of receipts from licence fees, by nation**



Source: Authors' calculations using the Expenditure and Food Survey.

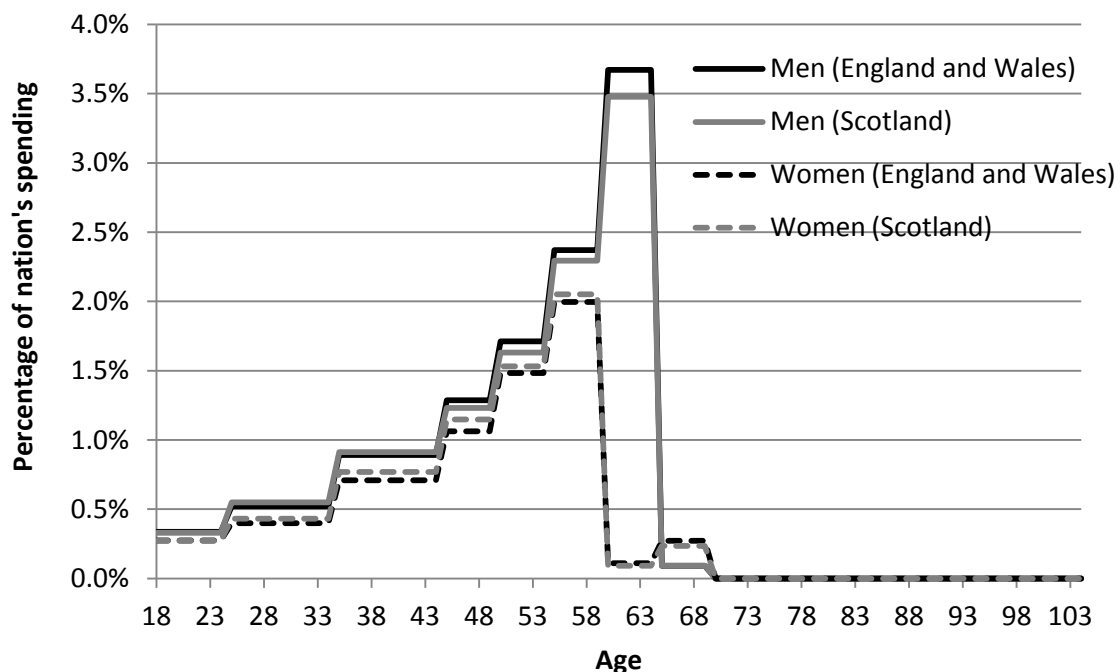
**Figure A.12. Distribution of spending on income support, by age and sex**



Notes: Figures are only available for broad age categories; we assume that per capita spending is uniform within these age bands.

Source: Authors' calculations using DWP tabulation tool; data from 2007.

**Figure A.13. Distribution of spending on incapacity benefit, by age and sex**

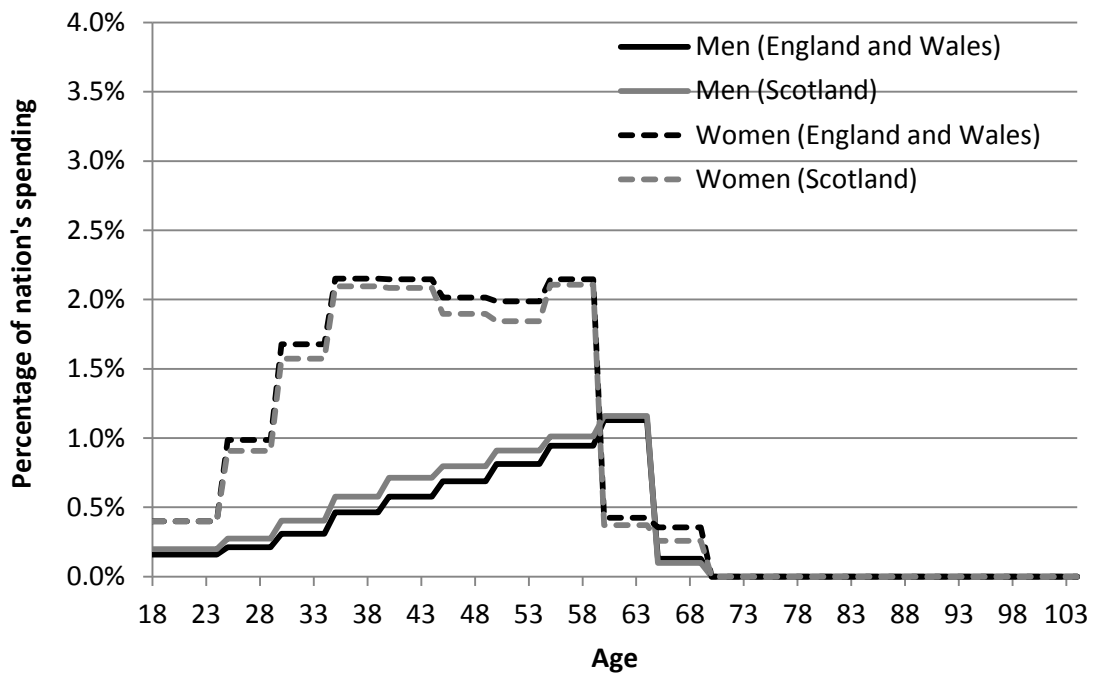


Notes: As Figure A.12. DWP report aggregate spending on men and women aged 65 and over; we assume that this is directed only towards those aged 65–69.

Source: As Figure A.12.



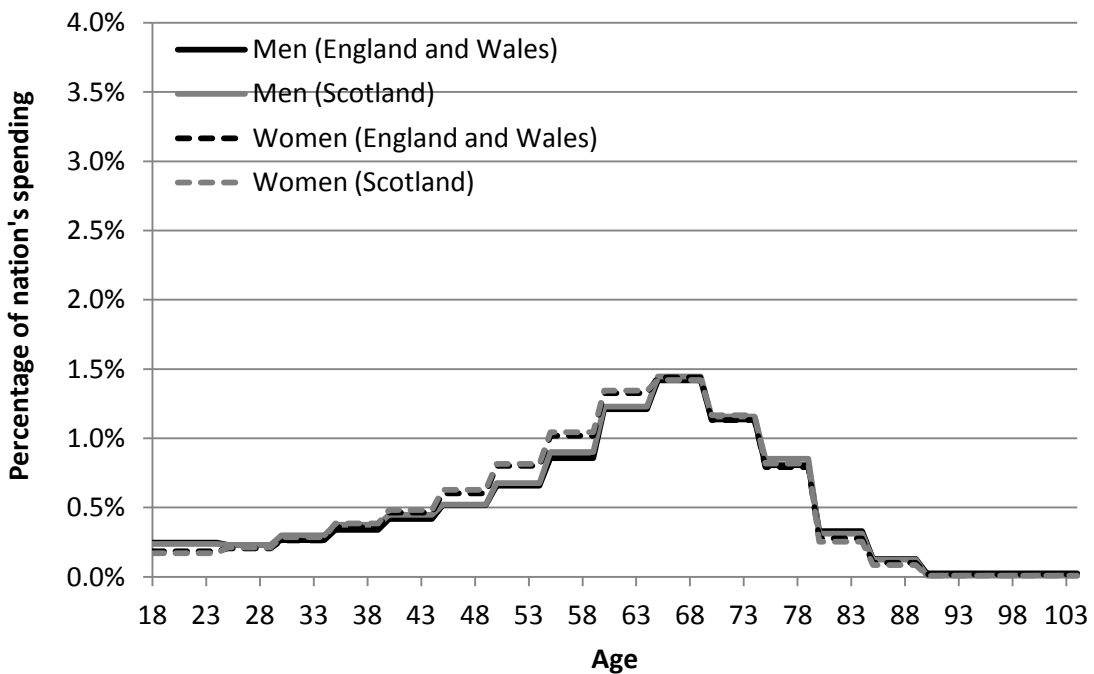
**Figure A.14. Distribution of spending on carer's allowance, by age and sex**



Notes: As Figure A.13.

Source: As Figure A.12.

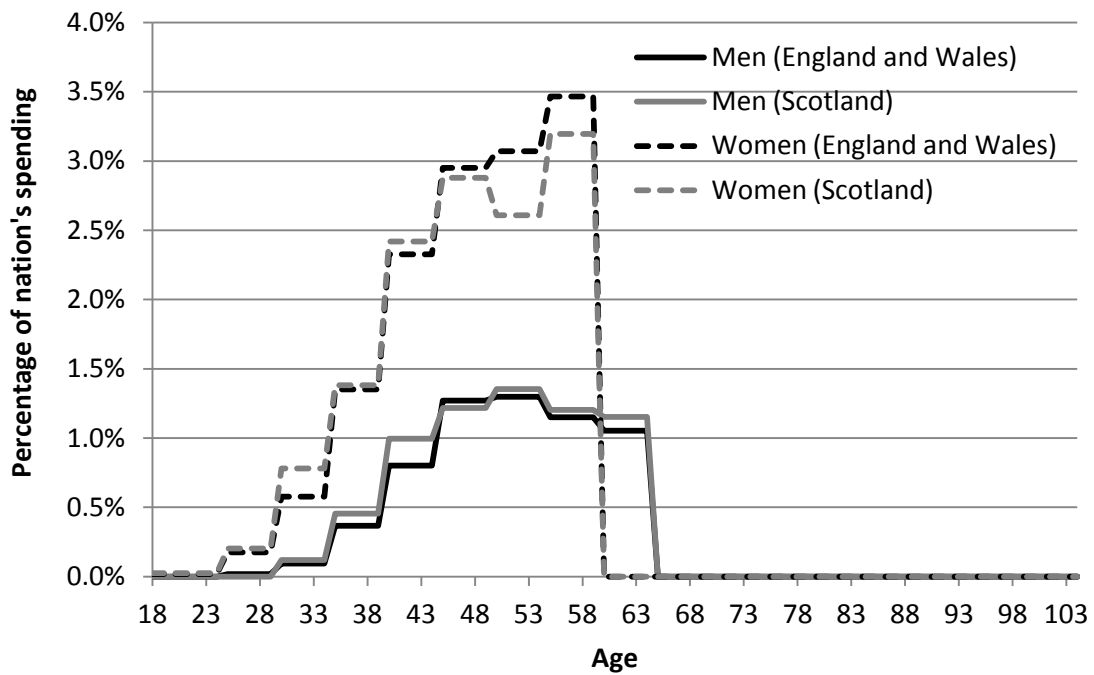
**Figure A.15. Distribution of spending on disability living allowance, by age and sex**



Notes: As Figure A.12.

Source: As Figure A.12.

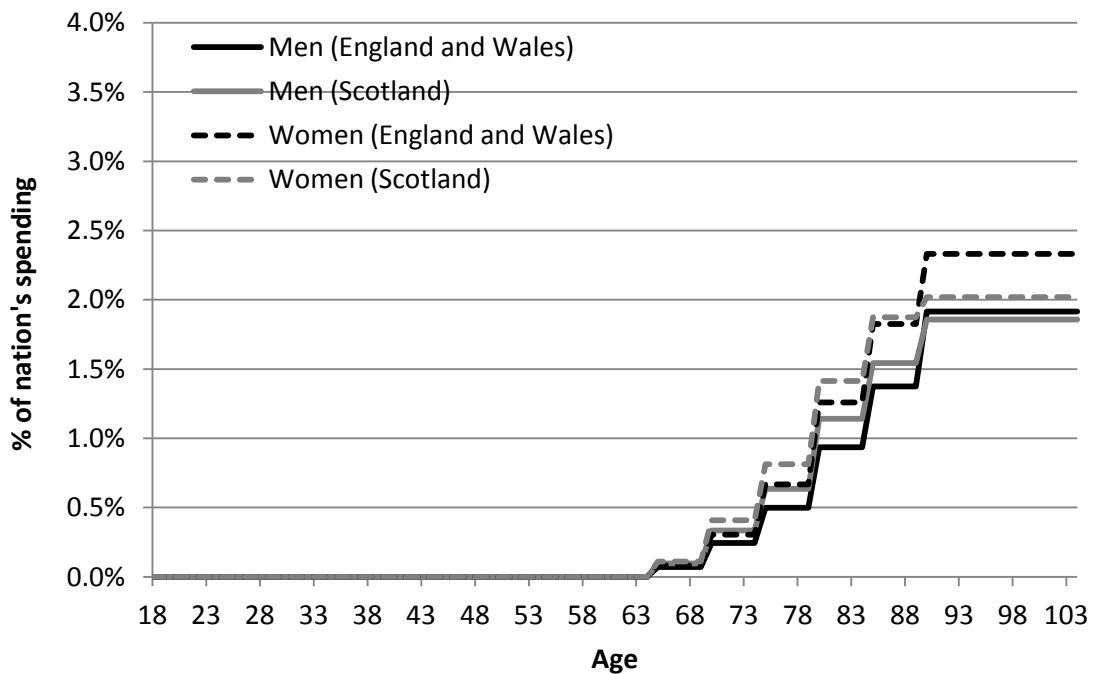
**Figure A.16. Distribution of spending on bereavement benefits, by age and sex**



Notes: As Figure A.12.

Source: As Figure A.12.

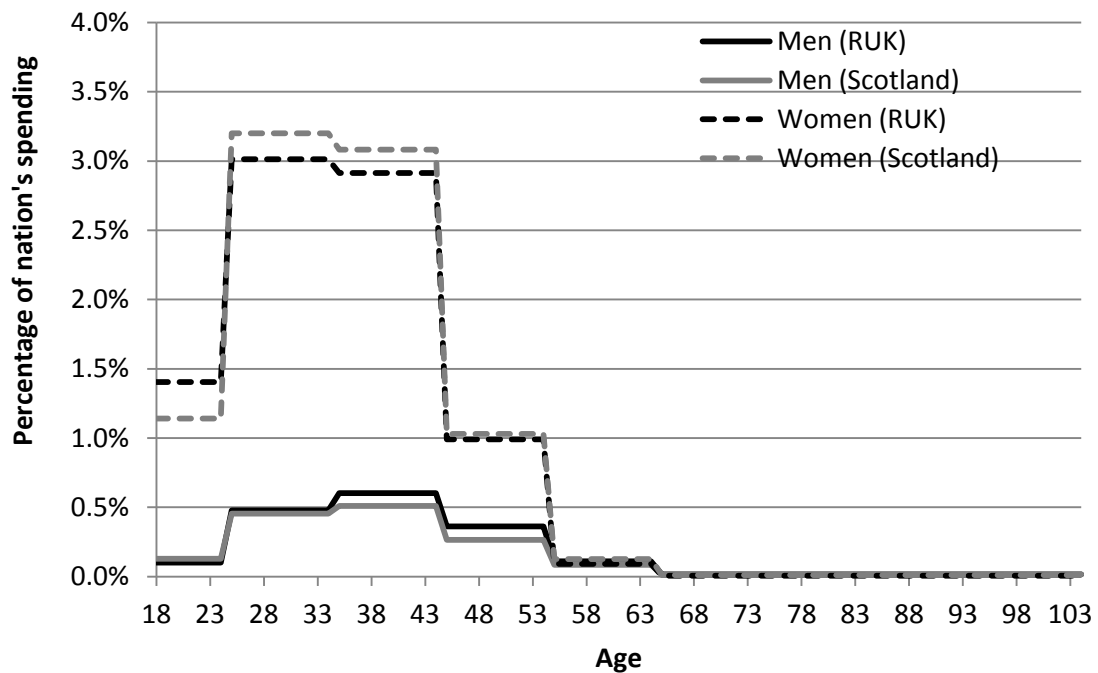
**Figure A.17. Distribution of spending on attendance allowance, by age and sex**



Notes: As Figure A.12.

Source: As Figure A.12.

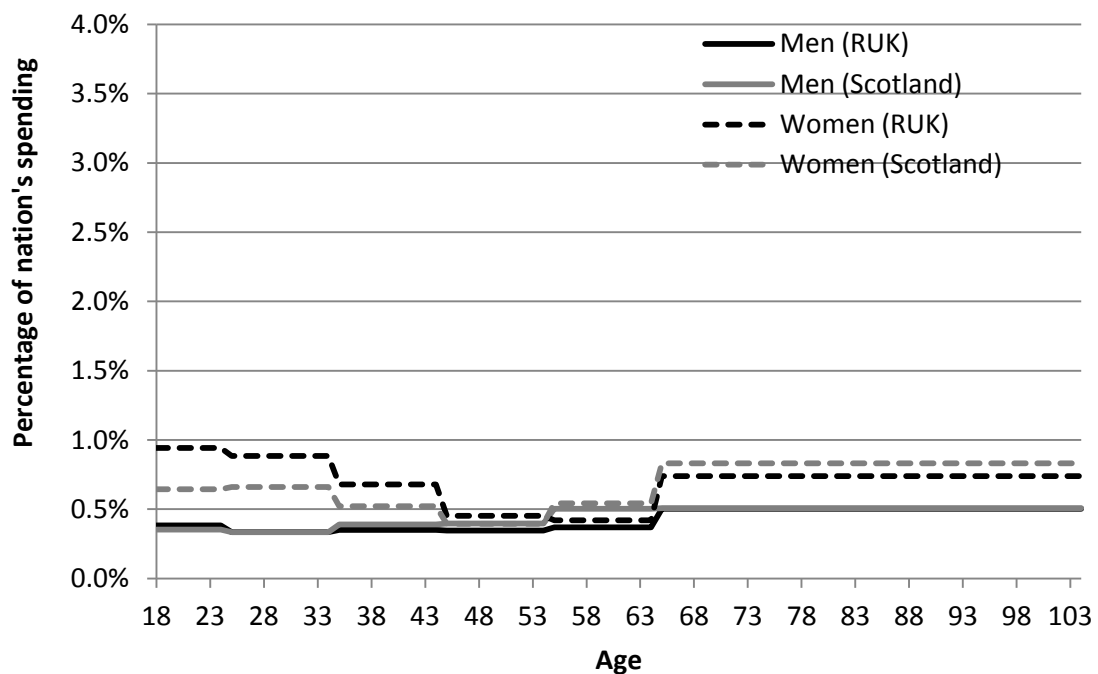
**Figure A.18. Distribution of spending on tax credits, by age and sex**



Notes: The FRS only provides information on age in 5-year bands. We assume that per capita spending is uniform within these age groups.

Source: Authors' calculations using Family Resources Survey, 2005–2009.

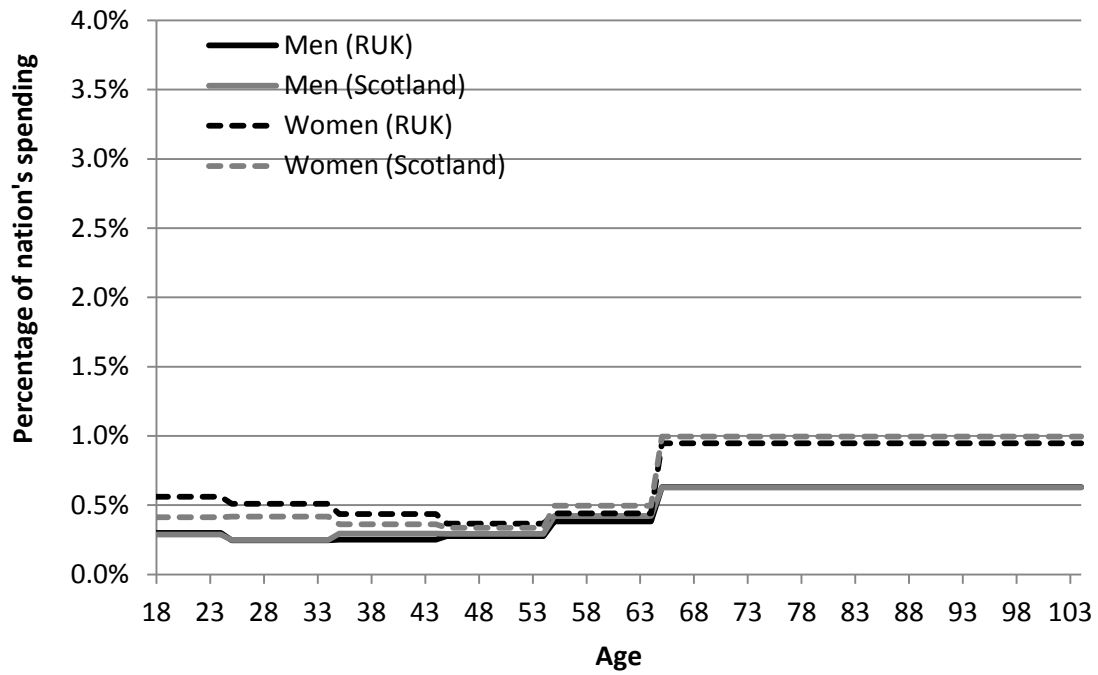
**Figure A.19. Distribution of spending on housing benefit, by age and sex**



Notes: As Figure A.18.

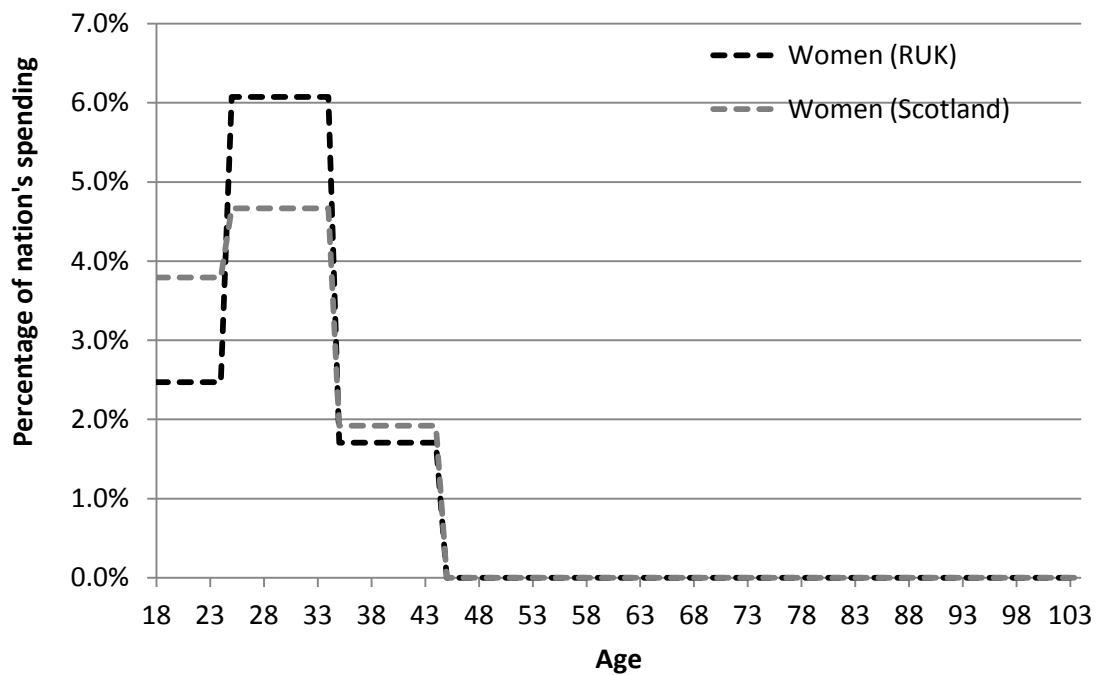
Source: As Figure A.18.

**Figure A.20. Distribution of spending on council tax benefit, by age and sex**



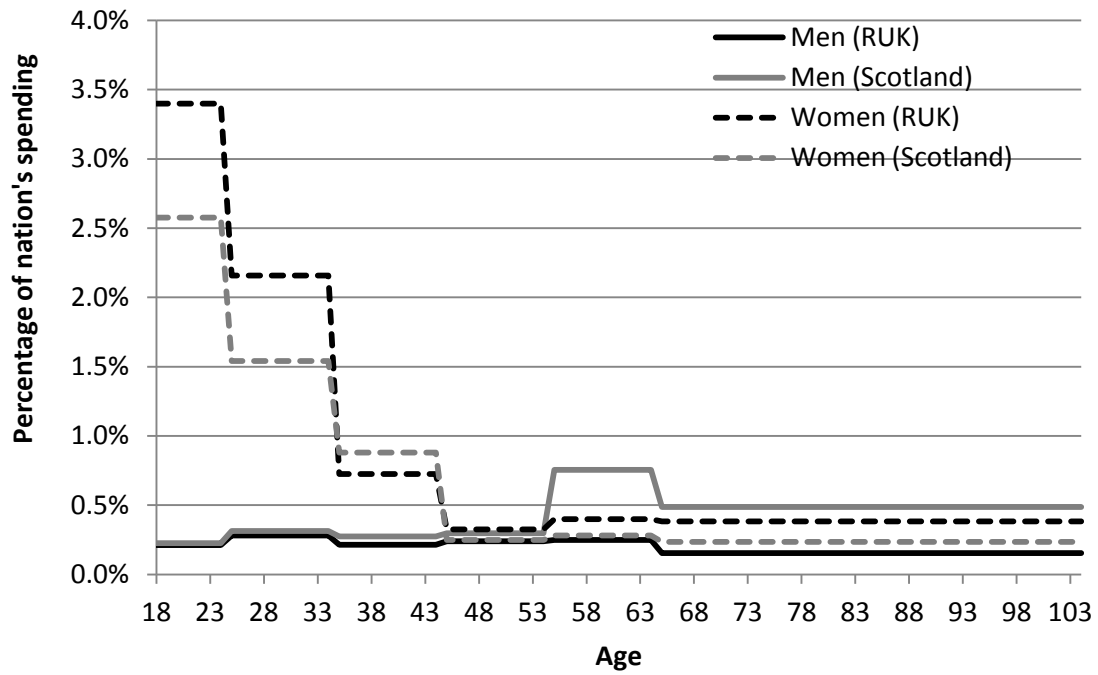
Notes: As Figure A.18.  
Source: As Figure A.18.

**Figure A.21. Distribution of spending on maternity allowance, by age**



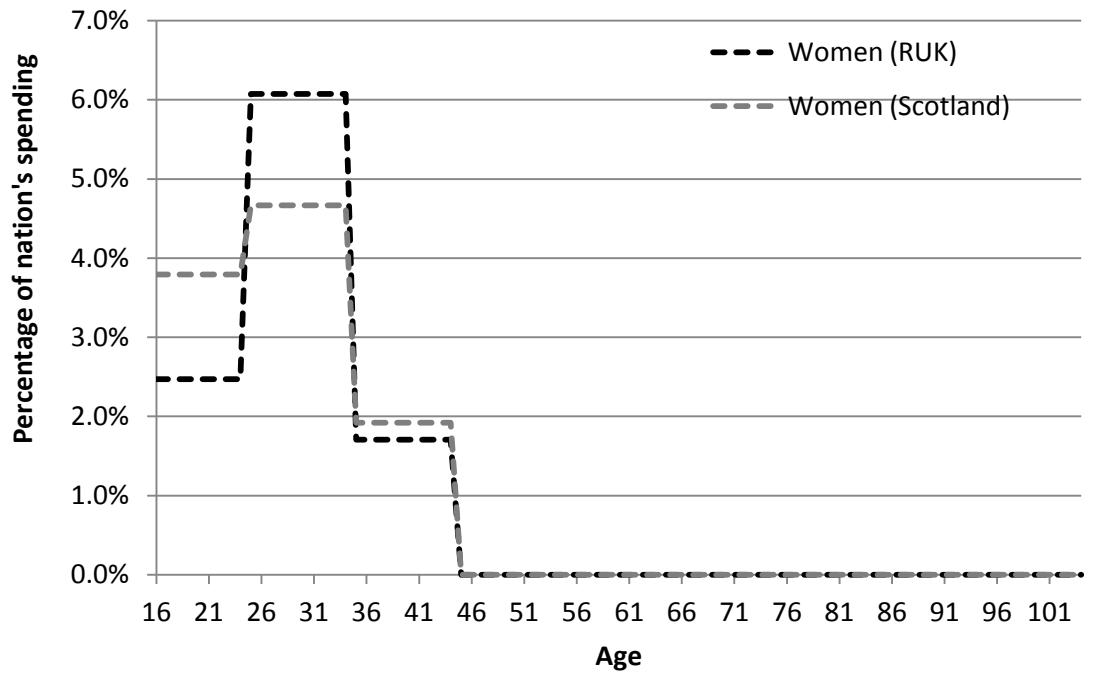
Notes: As Figure A.18.  
Source: As Figure A.18.

**Figure A.22. Distribution of spending on social fund payments, by age and sex**



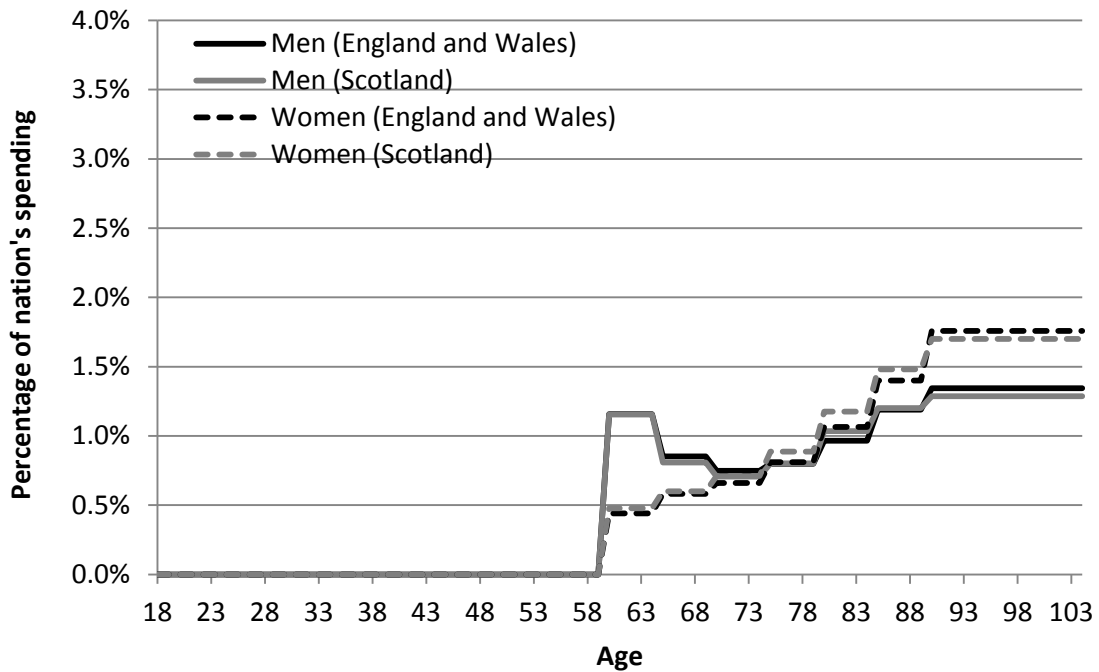
Notes: As Figure A.18.  
Source: As Figure A.18.

**Figure A.23. Distribution of spending on statutory maternity pay, by age**



Notes: As Figure A.18.  
Source: As Figure A.18.

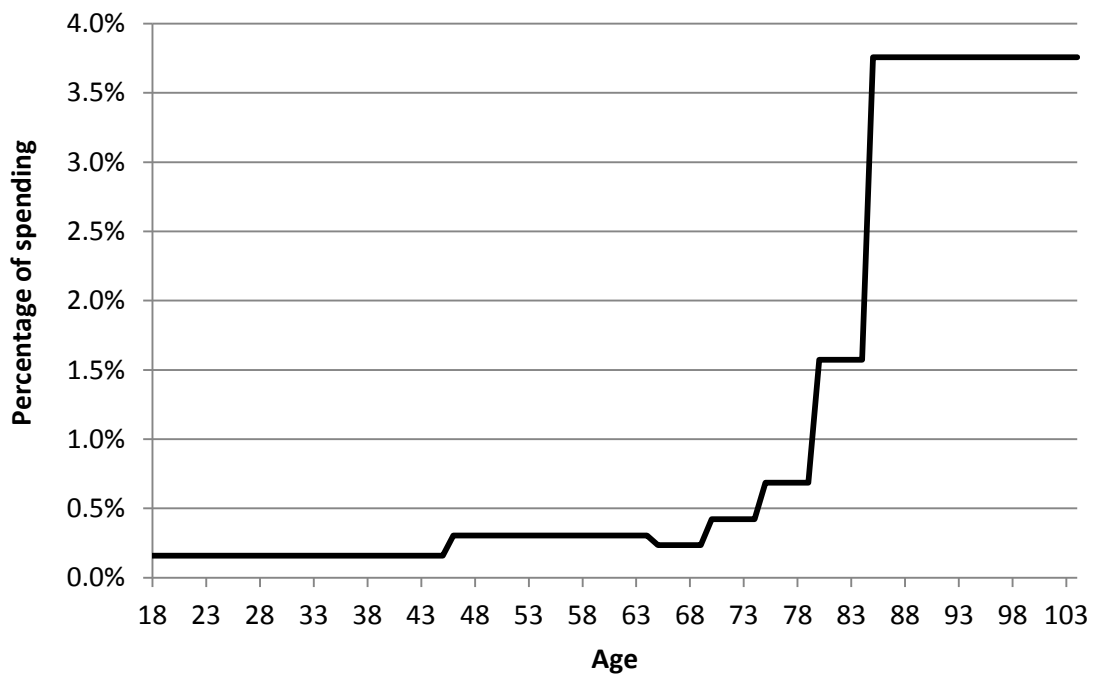
**Figure A.24. Distribution of spending on pension credit, by age and sex**



Notes: As Figure A.18.

Source: As Figure A.18.

**Figure A.25. Distribution of spending on long-term care, by age and sex**



Source: Office for Budget Responsibility (private correspondence).