On the postponement of increases in state pension age through health improvement and active ageing

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Abstract

The UK population is predicted to grow from 65m in 2015 to 71m in 2030 and 75m in 2040, with the number aged 65-plus rising to 18m. Successive governments have been reluctant to increase taxes but this looks increasingly unsustainable, if the increasing demand for health and social care is to be met. Increasing state pension age is the customary response for keeping pension contributions and benefits in balance in Pay As You Go (PAYG systems). However, this policy raises concerns about the capability of people to work to ever higher pension ages. Using newly available labour market data on health and disability, the paper finds limits to how far pension age can be increased without necessary health improvements. If improvements were forthcoming, planned pension age rises could be postponed. However, inequalities in healthy life expectancy across the UK are a major barrier to its achievement.

State pension age   activity rates   health inequalities   active ageing

1. Introduction

The term 'dependency trap' is sometimes used to describe a society that is sleep walking into a conflict between the competing needs of an ageing population for a decent pension and a working-age population that is struggling to save for retirement, with the issues compounded by inequalities in health and income. With global ageing well underway, this is a long recognised problem facing all advanced economies – being able to afford the cost of growing old whilst maintaining growth (e.g. World Bank, 1994; Disney, 1996; Mc Kellar et al, 2004; Pensions Commission, 2004; Active Age Consortium, 2006; Mayhew, 2009). This research considers how general improvements in the health of the population could enable people to work for longer and therefore postpone or stave off future rises in state pension age.

In the UK the basic state pension is part of a multi-pillar system which includes occupational and private systems, but key differences are that it is a flat rate payment and dependent on an individual's contribution record (Mayhew, 2001). Payments commence once a person reached state pension age (SPA) which from October 2020 will be 66, the same for both men and women (previously 65 for men and 60 for women). The pension rules are the same for everyone although those with higher incomes contribute more. Payments continue until death and so the total amount received in a life time varies accordingly with one's age of death. For many SPA signifies retirement age, but in the future we will be required to work for longer before we get our pension.

In a Pay As You Go (PAYG) pension system a balance must be struck between raising taxes and limiting the financial burden on working families since tax revenues must pay for today's pensioners. As the population ages and life expectancy increases, the number of working age relative to the number of older people decreases (also known as the dependency ratio). The UK population for example is forecast to grow from 65m in 2015 to 71m in 2030 and 75m in 2040, with those aged 65+ rising to 18m by 2040. This ratio was over four in 1970 (i.e. there were 4 working-age adults to each person of SPA and above). Since 2007 when baby boomers started to reach age 60, it has fallen year on year. By 2040 it will be just above two.

Already announced future increases in UK state pension age (SPA) will see it rise in stages to 68 by 2037 in the next decades. We argue that even 68 may be too low (DWP, 2016; DWP, 2017 a and b; House of Commons Library, 2017). In the absence of off-setting rises in productivity, an ageing population slows down economic growth (McKellar et al, 2004; Blake and Mayhew, 2006; Mayhew, 2009). The evidence of this research is that failing health and reduced economic activity do not begin with retirement – the seeds of decline start much earlier in adult life. Spatial inequalities in health are a particular barrier to achieving a sustainable and fair pension system (Mayhew et al, 2018).

The long term medical conditions curtailing working lives are varied but are typically life style related such as smoking, drug abuse, obesity, mental illness or lack of physical exercise (de Wind et al, 2013; DWP, 2014; Demou et al, 2017). The poorest in society are more likely to fall victim to the cumulative effects of decades of unhealthy lifestyle and income inequality (Venti and Wise, 2015; Sasson, 2016). Much of this is forced inactivity due to ill health and is a problem not confined the UK but one generally affecting all richer countries (OECD, 2017). Even if a person reaches state pension age they may not be able to enjoy their retirement if they are in poor health.

Current UK policy is that the state pension should maintain its value relative to earnings and inflation. However, a lesser known policy is that a people should spend around two-thirds of their adult life working and one third in retirement (DWP, 2017 b). These policies become incompatible if the only way to afford the former is by increasing SPA. In any case, the one-third principle is only an average and conceals huge variation among different socio-economic groups and geographically. The contention of this paper is that healthy life expectancy must increase to provide the necessary headroom to increase working lives, but such are the inequalities in health this will be a long and slow process if no action is taken.

SPA is no longer a mandatory age at which one ceases work nor is any other age deemed by an employer. The scrapping of the so-called default retirement age[1] in 2011 removes an important administrative barrier for those able and willing to work to higher ages – one commentator even calling it the 'death of retirement '(Fuller, 2015). There is strong evidence of the stimulus created by this and other recent pension reforms such as automatic enrolment into a private pension, but that SPA is still used as a trigger point for other social and labour market policies. More flexible retirement ages are hence likely to become the norm depending on personal choice but many could be forced into early retirement through ill health (Hammond et al, 2015; Lain, 2016; Gratton and Scott, 2016). [2]

[1] Before 2011 the default retirement age (DRA) enabled employers to retire employees at 65 regardless of their circumstances, but the policy now is that employers should objectify reasons for compulsory retirement.

[2] See Freedom and choice in pensions (2014), published by H.M. Treasury. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/294795/freedom_and_choice_in_pensions_web_210314.pdf

This paper argues that these reforms on their own are insufficient if they do not address work capability and the significant spatial health disparities across the UK and within different socio-economic groups. We analyse these issues using the long-standing concept of 'active ageing' because its focus combines work enablement and disease prevention over the life course (European Commission, 2005; Mayhew, 2005; Active Age Consortium, 2006; Foster, 2018). In our scenarios, we provide a practical application of active ageing to quantify its potential impact on SPA, pension values, taxes etc. resulting from health improvement and working longer.

Section 2 analyses the health of the UK population using two different measures: healthy life expectancy and disability-free life expectancy and finds huge variation between areas. Unless there are improvements especially to health, these cast serious doubt on the practicality of increases in SPA without significantly disadvantaging a large proportion of the population and increasing taxes. We argue that simply lengthening working lives by raising the SPA as a means to expand the workforce is largely ineffective against this. Improvements to health and a levelling in inequalities are needed.

Section 3 combines the PAYG principle of balancing tax inflows with pension outflows to examine their effects on SPA. Using an innovative version of the standard PAYG model (Annex A, also refers), it analyses the proportion of adult working life spent in retirement, and the old age dependency ratio for different combinations of tax rates and pension benefits. Section 4 uses the model to look ahead to 2040 using different scenarios. It finds it will be difficult to keep the SPA within current policy intentions, or in line with the one-third principle, without significant improvements in economic activity rates and health. Section 5 summarises the policy and demographic challenges ahead.

2. Life expectancy free of disability and in good health

The length of retirement depends crucially on age of death measured from when your pension starts and the quality of retirement depends on one's state of health. Life expectancy and within that state-of-health expectancy are the main measures of mortality and health in a population that address this. The two measures of health expectancy in common use are healthy life expectancy (HLE) and disability-free life expectancy (DFLE). HLE is the number of years that an individual can expect to live without a limiting long-standing illness or disability. DFLE, by contrast, tests whether health or disability problems affect one's ability to carry out normal daily activities. [3]

To consider how health expectancies are linked to work and to SPA, we turn to the Labour Force Survey (LFS). This collects data on the UK labour market in which questions on health and disability are harmonised with those in the Annual Population Survey (APS). The LFS enables consistent picture to emerge of whether a person with a disability is economically active or not as defined in the Equality Act (2010).[4] A key finding is that the number of disability-free, economically inactive adults

[3] Measuring disability in the Labour Force Survey - Office for National Statistics. https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/methodologies/measuringdisabilityinthelabourforcesurvey

[4] For the definition of disability under the Equality Act 2010 see https://www.gov.uk/definition-of-disability-under-equality-act-2010

declines sharply after age 70 and that less than half are disability free. This limits the reservoir of people who are both ready and able to fill the labour gap and imply a limit to how high SPA can be sensibly raised.

Of the two measures, DFLE is better at discerning the capacity to work than HLE because it directly addresses functional capability, whereas HLE simply deals with illness and general health. In particular, the LFS distinguishes people who report a health issue, but are not classified as having a long-term health problem or disability under the Act. For example, you are disabled if you have a physical or mental impairment that has a 'substantial' and 'long-term' negative effect on normal daily activities but not if you suffer from drug or alcohol addiction. We used this distinction to separate people who are economically active and disabled from those who are just economically inactive.

Further analysis helpfully shows that the correlation between disability in the APS by single year of age and in the LFS is over 97% and so they are broadly interchangeable. This means that trends in DFLE can be used to illustrate trends in economic activity by age or, more usefully, the way in which improvements in health translate into higher economic activity. In addition, since the reasons for economic inactivity can include caring commitments, an improvement in general health, or reduction in disability, will tend to reduce the demands on carers. In other words, there is a potential double economic benefit depending on whether caring commitments are full or part-time.

Table 1 shows LE and DFLE at birth, age 20 on entering the labour force, age 50 and at 65 – i.e. pre-2020 SPA. It show that the proportion of life spent in disability increases with age as would be expected. To give an idea of the sensitivity of DFLE to changes in health, a 5% increase in the percentage from age 50 reporting good health improves DFLE by about one year to 21.3 years reducing the percentage of remaining life with disability to 35.1%. However, these are population averages and so do not tell us the expected time to death for an individual becoming disabled at a particular age.

Table 1: Life expectancy and disability free life expectancy at ages 0, 20, 50, and 65 (Source: ONS)

Age	Life expectancy	DFLE	Disability gap (years)	% of life expectancy with disability
0	81.3	62.8	18.5	22.8
20	61.8	45.1	16.7	27.0
50	32.8	20.2	12.6	38.4
65	19.9	10.5	9.4	47.2

An alternative approach using cohort-based methods shows that becoming disabled at younger ages does not foreshorten life expectancy by as much as it would at older ages.   For example, a person who is disabled at age 20 can roughly expect to die at age 63 years implying just 31% of life spent in good health. At age 50 it is 76 years (66% in good health) and at age 65 it is 83 years (79% in good health). The important implication is that delays in the onset of a limiting illness or disability significantly increases the proportion of adult life spent in good health as well as lifespan, thereby extending working lives.

2.1 A spatial analysis of disability and ill health

LFS data show that economic activity rates peak on average in a person's 50s, with a decline setting in well before the SPA of 65. We saw that a disability-free man of 50 can expect about another 20 years free of disability, but this hides a lot of variation. The data show that 81% of men and 75% of women are still in good health at 50, but that between 19% and 25% are not. Based on the current SPA, 33% of men aged 50+ have some form of disability, and for women the figure is 35%. These are averages, but disaggregated data at a district level show significant variations in life expectancy and even more variation in DFLE and HLE.

ONS aggregates these measures into age bands and groups data for adjacent years. Because of the way the data are reported, our illustration comprises males whose midpoint age was 52 rather than 50. In Figure 1, HLE is plotted against life expectancy with each data point representing a different district of the UK. A hatched best-fit line shows the average trend (R-squared = 0.553), while the solid line above it is life expectancy. The vertical line between the hatched and solid lines (AB and PQ) shows the average gap between HLE and LE at either end of the life expectancy range (12.3 and 10.6 years respectively). The larger the gap, it means the greater the number of remaining years are spent in ill health.

Figure 1: UK variations in healthy life expectancy at district level in the UK as compared with life expectancy (Data source: ONS)

With higher life expectancy the gap is smaller: not only do people live longer, on average, they spend fewer years in ill health (again as shown by the vertical lines). The general pattern of variation in male healthy life expectancy in the UK is shown in Figure 2. The map indicates a dispersion of areas with poorer health, with the greatest concentrations in Northern Ireland, central Scotland, north east England, south Wales and London. The extremes range from a male HLE at age 52 of less than 15 years in a small number of local areas including Manchester (cell H17), Blackpool (G16), Wolverhampton(H19) and Belfast (C14), to as high as 26 years in parts of Surrey (e.g. K22).

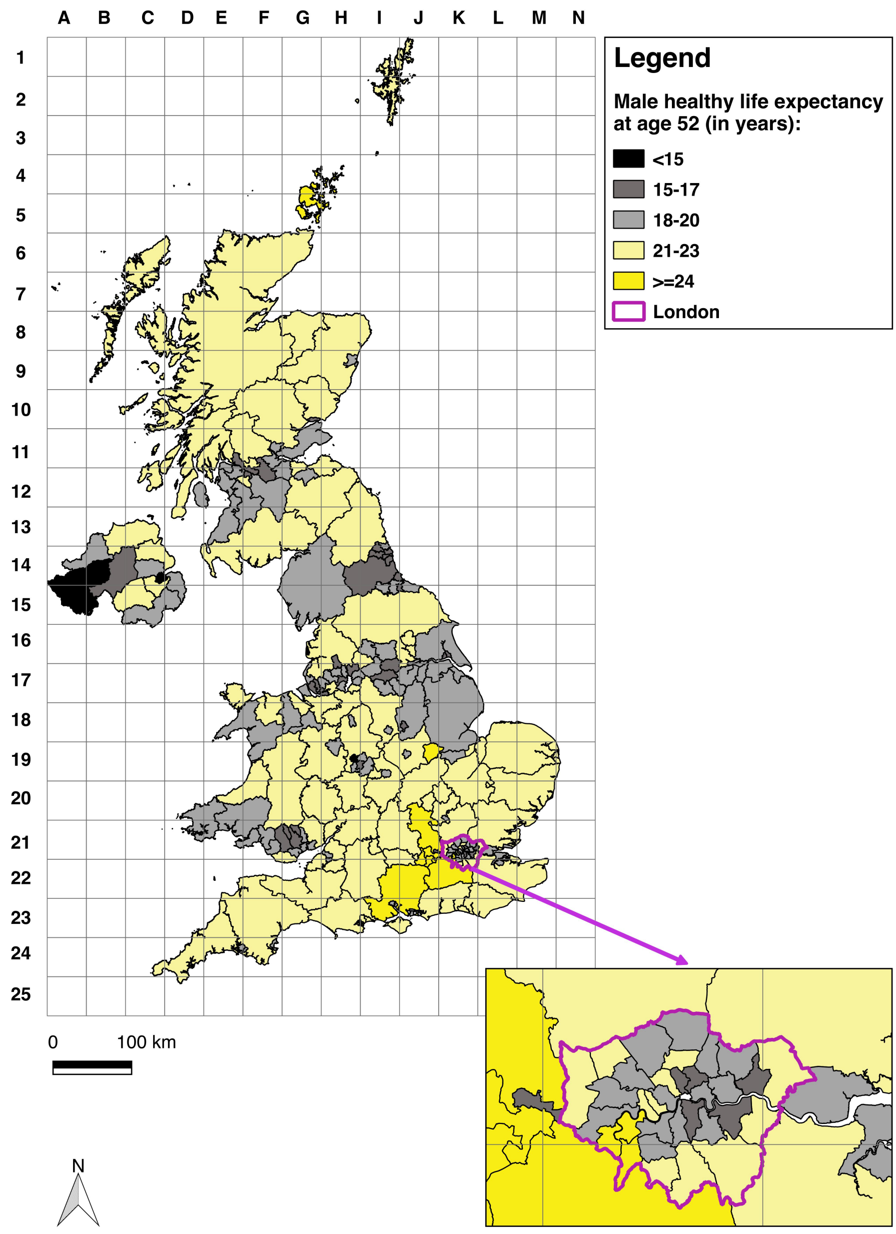

Figure 2: Map showing health life expectancy at age 52 for districts in across the UK with inset for the London area (Source: ONS [5])

[5]The data used in this map and Figure 1 can be found at: https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/healthandlifeexpectancies/datasets/healthstatelifeexpectancyallagesuk

Now assume a hypothetical SPA of 70 years: a man aged 52 would require at least 18 years of healthy life in order to be fit for work up to that age. Based on district level data, the achievement of 18 years would only be possible in 69% of districts across the UK. Women show a similar geographical pattern, but there are two key differences: life expectancy is higher but so too is the gap between healthy life expectancy and life expectancy indicating that more years are spent in ill health on average. At the extremities, AB = 14.9 years and PQ = 12.0 years based on previous analysis and so the gap is wider. In this case, the equivalent figure of 18 years or more would be reached in 74% of UK districts, 5% more than for men.

The implication is that back-to-work policies for people aged 50 plus which constitute a large proportion of the potential workforce will be less effective in areas where poor health is endemic, and that it will be difficult – or too late – to improve health to the point where a person is ready for work. This applies to between a quarter and a third of all UK districts, depending on gender. Currently for example there is an 82% correlation between male and female HLE at district level so the spatial impact is not gender neutral and also appears to depend on cultural factors including ethnicity.[6]

2.2 Variations in the proportion of working life spent in retirement

Whereas increases and a levelling in healthy life expectancy should mean that more people will be able to enjoy a longer and more fulfilling retirement, pensions are paid up to death and so Increases in life expectancy are beneficial to retirees but increase the cost to the tax payer. Originally SPA was fixed at a level much closer to life expectancy today and so many workers would not have expected to receive a pension at all. Even in 1960 a man would spend only about 22% of his adult life in retirement assuming a 45year working life from age 20 to age 65; today he can expect to spend around 32%.

If it was mandated that people should spend around two-thirds of their adult life working and one third receiving their state pension it would, in principle at least, create stability and this is roughly where the ratio currently stands (DWP, 2017 b). However, ratio values vary considerably by local area as we saw with healthy life expectancy ranging from 20% in areas with the lowest life expectancy up to 42% in areas with the highest. Clearly, the average ratio will decline to under a third if SPA increases unless life expectancy improves, but inequalities between districts would continue unless there was a disproportionate improvement in health in more deprived areas.

Under government policy SPA was increased in 2018 to 65 for women, and is now the same as for men. The equalised SPA will then rise to 66 in 2020, and to 67 in 2028. Whilst the recommendations of the Cridland Review (DWP 2017 a and b) bring forward by seven years the Government's previous intention to raise SPA to 68 from 2044, our research shows this may not be enough because increases in life expectancy have been higher than expected. Although not set in stone, it is

[6] See The Dynamics of Diversity: Evidence from the 2011 Census (2013). Which ethnic groups have the poorest health?
https://hummedia.manchester.ac.uk/institutes/code/briefingsupdated/which-ethnic-groups-have-the-poorest-health.pdf

important that the one-third and PAYG principles are consistent going forward in time and that adjustments are affordable in fairness to both taxpayers and retirees.

How is the proportion of adult life spent in retirement measured? This question was addressed by the Government Actuary's Department (GAD, 2017) which argued that the calculation should be based on life expectancy *after* SPA has been reached rather than at an earlier age. Since this varies according to mortality trends we need to factor in mortality improvements applying each new cohort of the population. We applied GAD's methodology (see Annex A (b)) using ONS cohort life tables for different SPAs ranging from 65 to 70 for a unisex population for three reference years: 2016, 2030 and 2040.

The results are shown in Table 2 in which P is the proportion of adult life spent in retirement and $e_{SPA(year)}$ is the cohort life expectancy of a person reaching SPA in any given year. For example, it shows that the life expectancy of a person with an SPA of 68 in 2030 is 21.50 years, which equates to 0.31 (or 31%) of adult life. Assuming the projected life expectancies are accurate, the results imply that to achieve the one-third goal in each year SPA would need to be between 65 and 66 in 2016, between 66 and 67 in 2030, and between 67 and 68 in 2040.

These results do not tell us whether the pensions provided on this basis would be affordable, what taxes would look like or what pension values would be. Most importantly they do not deal directly with the issue of inequalities in health life expectancy analysed above. Unless these improve in lockstep with life expectancy and their variation is reduced many more people will face a majority of their retirement in ill health. However, the results do provide us with some assurance that planned rises in SPA will not on average stray too far from the one-third principle.

Table 2: Cohort life expectancy at given State Pension age in 2016, 2030 and 2040

State Pension age	$e_{SPA(2016)}$	P	$e_{SPA(2030)}$	P	$e_{SPA(2040)}$	P
65	22.74	0.34	24.26	0.35	25.30	0.36
66	21.82	0.32	23.33	0.34	24.36	0.35
67	20.92	0.31	22.41	0.32	23.42	0.33
68	19.96	0.29	21.50	0.31	22.50	0.32
69	19.12	0.28	20.60	0.30	21.58	0.31
70	18.24	0.27	19.72	0.28	20.68	0.29

Source: ONS. Key: P is the proportion of adult life spent in retirement and $e_{SPA(year)}$ *is cohort life expectancy for a person reaching SPA in the given year*

3. PAYG pension systems

We have noted that In a PAYG system, pensions are funded by today's taxpayers and so both should be in balance taking one year with another, but it is expensive. Each extra million people above this age add about £7bn to the annual cost of around £100bn. We evaluate sustainability of the system using an innovative variant of the simple PAYG model to show *inter alia* how improving health could postpone future rises in SPA by increasing activity rates (Blake and Mayhew, 2006). This research accurately predicted that SPA would have to rise to at least 67 years by 2025. In this section we extend the PAYG model to show how it links to the dependency ratio and the one-third principle.

The dependency ratio is defined as the number of people aged between 20 and the SPA age divided by the number at SPA and above. From both an economic and policy standpoint, a constant dependency ratio ensures a fixed relationship between the number of working and pension age and so simplifies the conduct of social and labour market policy. We need to predict what the SPA would be if the dependency ratio were held constant based on population forecasts if this policy is applied generally to the letter. We define the dependency ratio as follows:

$$D_{SPA} = \frac{P_{<SPA}}{P_{\geq SPA}}$$

where

$P_{<SPA}$ = UK working age population less than state pension age (start age 20)

$P_{\geq SPA}$ = UK Population greater than or equal to state pension age

Figure 3 plots the dependency ratio as a function of the SPA using the population in 2016 and the projected population in 2030 for comparison. It shows that the ratio in 2016, at 3.24, is closely aligned with the pre-2020 SPA of 65, as would be expected. However, using the projected population in 2030, the chart shows that the SPA would need to increase to 68 in order to maintain the same dependency ratio as in 2016 (Point P). Because of the curvature, relatively small increases in the SPA deliver increasing improvements in the ratio.

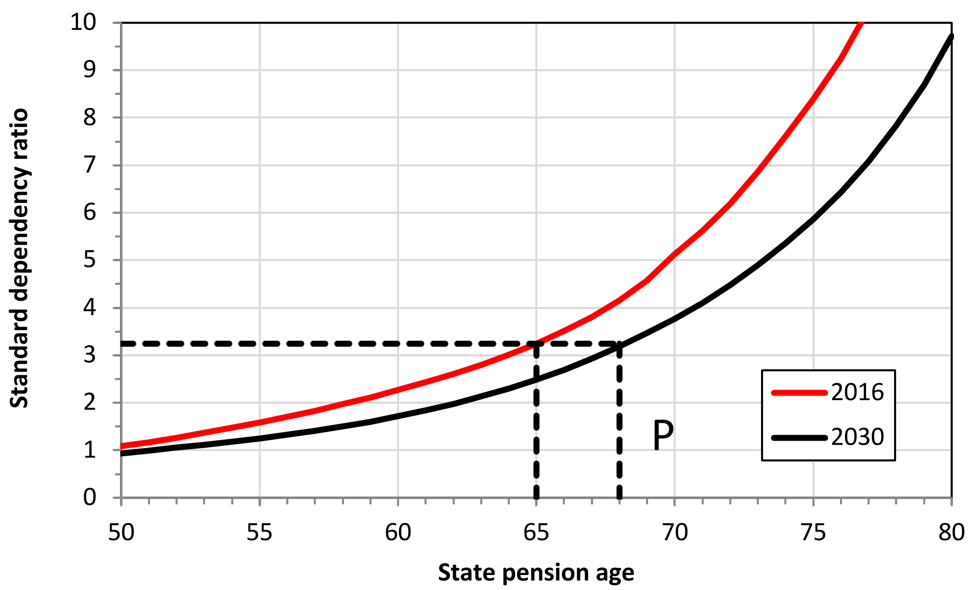

Figure 3: Implied SPA based on the standard dependency ratio in 2016 and 2030

Thus it appears that the planned rise in SPA to 67 by 2028 is in reasonable alignment with the projected increase of 68 in this chart. However, there is more than one way of defining the dependency ratio and so some caution is needed. For example, if the population in the denominator is adjusted for economic inactivity due to disability the value of the ratio falls to around 2.4 because greater numbers above SPA must be supported by fewer economic ally active people who are fit. We estimate for example that SPA would need to increase from 65 to 69 rather than from 65 to 68 in the previous case if the ratio is disability adjusted.

A further implication is since the prevalence of disability increases with age there are limits to which SPA can be raised without it becoming self-defeating. This will lead to diminishing improvements in labour supply, with the by-product of pushing more people into pensioner poverty or on to means-tested disability benefits. More aggressive and controversial policies may therefore be needed to correct for this including possibly welfare cuts. The corollary is that more proactive public and occupational health policies will be needed to tackle the factors that lead to the onset of health conditions that cause early exit from the workforce.

One solution is to increase immigration. Putting this into perspective, in 1970 there were 4 working-age adults to each person of SPA and above. It then levelled out at around 3.7 until 2007 when baby boomers started to reach age 60. Immigration has helped to prop up the dependency ratio from around 2000 onwards. Government policy is to reduce immigration in the future by introducing a more selective points based system based on skills and qualifications. To underline the dilemma of reduced migration assume zero net immigration going forward. This would lower the dependency ratio in 2020 from 3.0 to 2.8, from 2.5 to 2.2 in 2030, and from 2.2 to 2.0 in 2040.

Although economic migration is considered beneficial (Borjas, 1995), the level of migration needed to offset population ageing and health inequalities is extremely large (e.g. see United Nations, 2000; Coleman, 2002; Mayhew, 2009). The problem is therefore how to offset migration by increasing work capability so that people can work to higher ages as well as SPA. In the next section we evaluate these trade-offs using the PAYG pension model. We then consider three scenarios which are designed to show how health improvement can be used to achieve a sustainable balance between work and retirement.

3.1 The fiscal challenge

In a PAYG system the challenge is to balance revenues and pensioner benefits taking one year with another. The levers available to do this are tax (or contribution rates), pension benefits, the SPA, average earnings and labour supply. The fiscal balancing equation is:

$$P_{<SPA} \times w \times c \times a = P_{\geq SPA} \times p$$

Where

$w =$ Average earnings before tax

$c =$ Tax or contribution rate

$a =$ Activity rate or proportion of people economically active

$p =$ Average value of the State Pension

The problem is to find the value of the SPA, in this case the 'unknown', such that this equation is in equilibrium for different values of tax (i.e. contribution) and activity rates**.** That is:

$$\frac{P_{<SPA}}{P_{\geq SPA}} = K = f(w, c, a, p)$$

Where K is the standard dependency ratio of the previous section.

We call the ratio $\frac{w}{p}$, i.e. average earnings divided by the State Pension, the 'earnings-pension multiple'. One divided by this quantity multiplied by 100 is more commonly known as the pension 'replacement ratio'.

A constant earnings-pension multiple indicates that pension benefits relative to earnings is unchanged over time; an increasing multiple means that earnings are increasing faster than the State Pension, and a falling earnings-pension multiple means the opposite. In a system in which pension benefits are linked to earnings, pensioners will automatically benefit from rises in productivity. Since pension benefits are currently linked to both consumer prices and earnings, whichever is the higher, the tendency will be for the earnings-pension multiple to fall over time – other things being equal.

We use the PAYG principle to predict what the SPA would need to be for different earnings-pension multiples and contribution rates. We also calculate the consequent dependency ratio and proportion of adult life spent as a State Pension recipient since these are our chosen sustainability benchmarks (for details see Annex A). [7] These results can then be compared with for different combinations of the earnings-pension multiple and contribution levels to see if they are consistent with the one-third principle and dependency ratio and so enable changes of policy to be evaluated.

A range of results are shown in Table 3(a) to (c) in which column headings represent different values of the earnings-pension multiple ranging from values of one to six. For example, a multiple of three means that average earnings are worth three times the average State Pension (i.e. roughly the current position). The row headings show the effective tax or contribution rates based on the proportion of salary in increments of 1% ranging from 10% to 20% of earnings. The tables use 2016 population data and incorporate a joint male-female economic activity rate of 80%. It can be noted that the encircled values correspond very closely to the present situation in the UK.

Table 3(a) cell values show the balancing value of the SPA based on the PAYG principle; Table 3(b) shows the dependency ratio (i.e. the population of working age to the number of pensioners based on the corresponding SPA in Table 3(a)); and Table 3(c) shows the expected proportion of adult life a person could expect to live in retirement also based on 3(a). For example, the SPA which is transitioning to 66 in 2020 is accurately shown to be 65; the dependency ratio is 3.2 and the predicted proportion of adult life spent in retirement is 0.35 (i.e. just a bit over one-third).

[7] State Pension age periodic review: report by the Government Actuary https://www.gov.uk/government/publications/state-pension-age-periodic-review-report-by-the-government-actuary

Table 3 (a) – (c): (a) Impact on SPA of different combinations of the replacement ratio and tax or contribution rates; (b) impact on the dependency ratio given the SPA in (a); and (c) impact of the SPA in (a) on the proportion of adult life spent in retirement. Column headings show the ratio of wages to pension values and row headings the tax or contribution rate. (Key: SPA = State Pension age; DR = dependency ratio; p = proportion of adult life spent in receipt of the State Pension).

(a) SPA **Earnings-pension multiple**

Contribution rate	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
0.10	80.1	76.2	73.1	70.5	68.3	66.4	64.7	63.1	61.7	60.4	59.3
0.11	79.2	75.2	72.0	69.4	67.1	65.1	63.4	61.8	60.4	59.1	58.0
0.12	78.4	74.3	71.0	68.3	66.0	64.0	62.2	60.7	59.3	58.0	56.8
0.13	77.6	73.4	70.1	67.3	65.0	63.0	61.2	59.6	58.2	56.9	55.7
0.14	76.9	72.6	69.2	66.4	64.0	62.0	60.2	58.6	57.2	55.9	54.7
0.15	76.2	71.8	68.3	65.5	63.1	61.0	59.3	57.7	56.3	55.0	53.8
0.16	75.5	71.0	67.5	64.7	62.2	60.2	58.4	56.8	55.4	54.1	53.0
0.17	74.9	70.3	66.7	63.9	61.4	59.4	57.6	56.0	54.6	53.3	52.2
0.18	74.3	69.6	66.0	63.1	60.7	58.6	56.8	55.2	53.8	52.6	51.5
0.19	73.7	69.0	65.3	62.4	59.9	57.9	56.1	54.5	53.1	51.9	50.8
0.20	73.1	68.3	64.7	61.7	59.3	57.2	55.4	53.8	52.5	51.2	50.1

(b) DR

Contribution rate	Earnings-pension multiple 1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
0.10	12.5	8.3	6.3	5.0	4.2	3.6	3.1	2.8	2.5	2.3	2.1
0.11	11.4	7.6	5.7	4.5	3.8	3.2	2.8	2.5	2.3	2.1	1.9
0.12	10.4	6.9	5.2	4.2	3.5	3.0	2.6	2.3	2.1	1.9	1.7
0.13	9.6	6.4	4.8	3.8	3.2	2.7	2.4	2.1	1.9	1.7	1.6
0.14	8.9	6.0	4.5	3.6	3.0	2.6	2.2	2.0	1.8	1.6	1.5
0.15	8.3	5.6	4.2	3.3	2.8	2.4	2.1	1.9	1.7	1.5	1.4
0.16	7.8	5.2	3.9	3.1	2.6	2.2	2.0	1.7	1.6	1.4	1.3
0.17	7.4	4.9	3.7	2.9	2.5	2.1	1.8	1.6	1.5	1.3	1.2
0.18	6.9	4.6	3.5	2.8	2.3	2.0	1.7	1.5	1.4	1.3	1.2
0.19	6.6	4.4	3.3	2.6	2.2	1.9	1.6	1.5	1.3	1.2	1.1
0.20	6.3	4.2	3.1	2.5	2.1	1.8	1.6	1.4	1.3	1.1	1.0

(c) P **Earnings-pension multiple**

Contribution rate	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
0.10	0.15	0.19	0.23	0.27	0.29	0.32	0.35	0.36	0.39	0.41	0.42
0.11	0.16	0.20	0.24	0.28	0.31	0.34	0.36	0.39	0.41	0.42	0.45
0.12	0.17	0.22	0.25	0.29	0.32	0.35	0.38	0.41	0.42	0.45	0.47
0.13	0.18	0.23	0.27	0.31	0.35	0.38	0.39	0.42	0.44	0.47	0.48
0.14	0.19	0.24	0.28	0.32	0.35	0.39	0.41	0.44	0.45	0.48	0.50
0.15	0.19	0.25	0.29	0.34	0.36	0.39	0.42	0.45	0.47	0.50	0.51
0.16	0.20	0.25	0.31	0.35	0.38	0.41	0.44	0.47	0.48	0.50	0.53
0.17	0.22	0.27	0.32	0.36	0.39	0.42	0.45	0.48	0.50	0.51	0.53
0.18	0.22	0.28	0.32	0.36	0.41	0.44	0.47	0.48	0.51	0.53	0.54
0.19	0.23	0.29	0.34	0.38	0.42	0.45	0.47	0.50	0.51	0.54	0.55
0.20	0.23	0.29	0.35	0.39	0.42	0.45	0.48	0.51	0.53	0.54	0.55

SPA can be altered by moving in any of the directions shown in Table 3(a). Hence, moving to the left pension benefits are increased so that earnings are a smaller pension multiple, and falls when moving to the right since earnings are a larger multiple. Similarly, moving down the columns, the SPA falls if contribution rates are increased and it increases if contribution rates are reduced. Table 3(b) shows consequent changes to the dependency ratio, such that as the dependency ratio increases SPA increases too (i.e. there are more workers to support fewer state pensioners), and vice versa.

Table 3 (c) calculates the proportion adult life spent in retirement based on any of the above changes. Here, it is seen that the proportion moves in the opposite direction to the dependency ratio. This makes sense because a lower SPA implies there are more state pensioners and hence a greater proportion of adult life is spent in receipt of that pension (and vice versa). A higher proportion also results if contribution rates are increased or if pension benefits are reduced relative to earnings. In the next section we use these relationships to construct different scenarios to determine changes to SPA, the dependency ratio and the proportion of working life spent in retirement.

4. Policy scenarios

At the outset, we defined the 'dependency trap' as describing a society that is sleep walking into a conflict between the competing needs of an ageing population for a decent pension and a working age population that is struggling to save for retirement, with the issues compounded by inequalities in health and income. However, to increase their supply, the adult population must grow by natural increase or migration, or economic activity rates must improve – although we have previously argued that there are limits to what is achievable.

The Government would like to avoid both tax increases and a reduction in pension benefits. Its preferred mechanism for the moment is to increase the SPA, while maintaining the pension relative to earnings and inflation. This is justified as long as rises in life expectancy keep within the one-third principle and earnings increase over time. If we take 2040, projections show that the dependency ratio would only be 68% of its level in 2017 assuming the SPA remained at its historical pre-2020 level of 65. In this case, there would need to be an approximate 50% increase in contribution rates or activity rates would need to be over 100%!

The implications are that improvements in activity rates will be needed especially at older ages, although higher immigration could be a lifeline. For reasons previously given this source of labour cannot be relied upon as much as it was in the past. With improvements in health, higher activity rates may be achievable as we shall shortly show. This would result in increases in the earnings of older workers, allowing more money to be set aside for a private pension to supplement the State Pension. If this does not happen, SPA will increase faster with the danger that the one-third principle is compromised.

To generate different scenarios, we combine data on population projections by single year of age with policy inputs which consist of three components. How these combine with the model is shown in the flow diagram in Figure 4 starting with underlying demography and ending with the outcomes.

The first of three policy levers is the desired earnings-pension multiple or equivalently the replacement ratio between average earnings and the State Pension. It is current government policy to maintain that link in real terms going forward. For our scenarios, we will therefore assume a constant earnings-pension multiple or replacement ratio. The second policy lever is adjustments to the contribution rate or level of taxation. This is defined as the average amount to be deducted from wages to finance the forecast stream of pension benefits. We compare the effects of a 13% and 14% contribution rate on the SPA, the dependency ratio and the proportion of adult life in retirement.

The third policy lever involves increases in activity rates. We call this the 'active ageing' scenario and its enablement depends both on policy changes such as the notable example of the scrapping of the default retirement age in 2011. This has already led to increased levels of activity post-SPA but greater health enablement will allow them to increase further (see section 2 earlier). The model uses this information and solves for the value of the SPA that would exactly balance contributions and pension benefits for any policy horizon. The tabulated results include not only pension age but also the dependency ratio and proportion of adult life spent in receipt of the State pension.

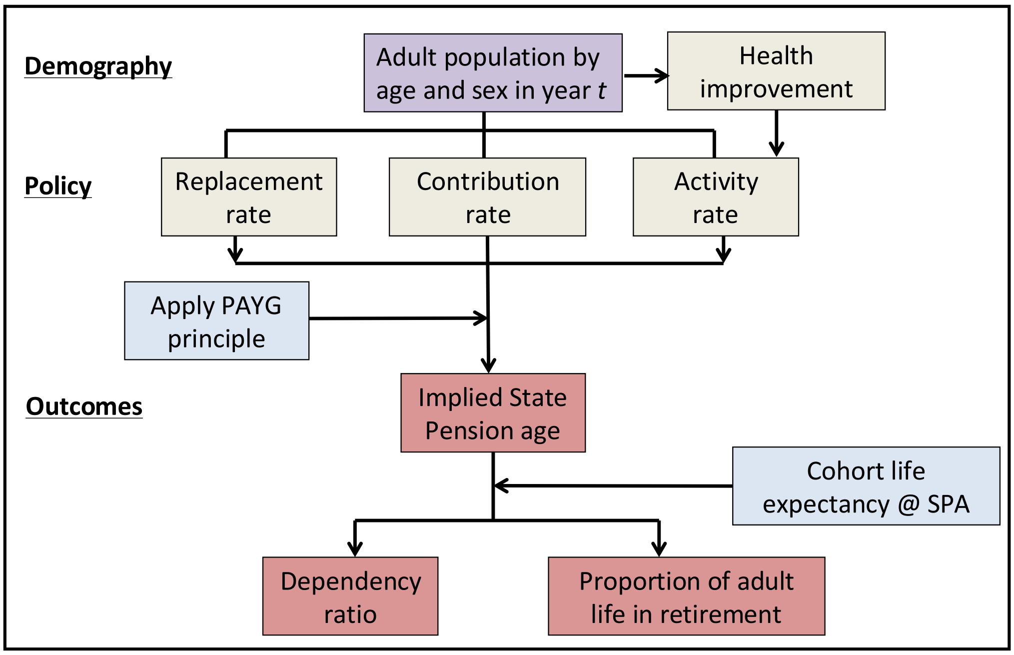

Figure 4: Flow diagram showing how the SPA, dependency ratio and proportion of life spent in retirement is determined

4.1 Scenarios A, B and C

We test three scenarios, all of which are well within the range of plausible outcomes using the PAYG model:

A. Average activity rate remains at 80%. Workers aged 20+ retiring at the former SPA adjust to the new one by working for longer with no change in average activity rates. This outcome would be regarded as a partial success.

B. Average activity rate falls to 75%. Workers do not adjust to higher pension age and activity rates fall. This would be seen as a policy failure especially if accompanied by no improvements in health.

C. Average activity rate increases to 85%. Activity rates increase by 5 percentage points at every age to SPA, or there is an approximate 17.5 percentage point rise in activity rates in adults aged 50 or over, where there is greatest unused labour capacity. Implied in this scenario are improvements in health and the implementation of policies that are effective in encouraging older workers to work. This would be a very good outcome.

The scenarios use three policy horizons, 2016 (our baseline), 2030 and 2040. Each assumes that the earnings-pension multiple or replacement ratio is unchanged so that the relative financial position of state pensioners is unaltered. By including an increase in the contribution rate, the government has another lever it can use should rises in the SPA become unacceptably high. Details for each scenario are given in Table 4.

Table 4: Scenarios showing the effect of changes in activity and contribution rates on the SPA, the dependency ratio and the percentage of adult life spent in retirement (Key: SPA = state pension age; DR = dependency ratio)

Scenario	Description	Activity rate	Effective contribution rate	outcome	2016	2030	2040
A	Activity rate unchanged	80%	13%	SPA	65.0	67.8	69.3
				DR	3.21	3.21	3.21
				% adult life	0.35	0.32	0.31
			14%	SPA	64.0	66.9	68.2
				DR	2.98	2.98	2.98
				% adult life	0.35	0.32	0.32
B	Activity rate falls	75%	13%	SPA	65.8	68.6	70.2
				DR	3.42	3.42	3.42
				% adult life	0.34	0.31	0.31
			14%	SPA	64.8	67.7	69.1
				DR	3.17	3.17	3.17
				% adult life	0.35	0.32	0.32
C	Activity rate improves	85%	13%	SPA	64.2	67.1	68.4
				DR	3.02	3.02	3.02
				% adult life	0.35	0.32	0.32
			14%	SPA	63.2	66.1	67.3
				DR	2.80	2.80	2.80
				% adult life	0.35	0.34	0.33

Our results are based on the principle that the State Pension system is in balance in accordance with the PAYG principle. They show that any decrease in activity rates causes the SPA to increase and any rise causes it to decrease. It is noteworthy that even with a growing older population, the SPA in the next two decades is always below 70 in any of the scenarios, with the notable exception of scenario B in 2040 which assumes a fall in activity rates to 75% and a contribution rate of 13%.

This is because even small rises in the SPA potentially reduce the percentage of adult life in retirement. Scenario B, for example, shows that the proportion of adult life spent in receipt of the State Pension will decrease from a high of 0.35 in 2016 to as low as 0.31 in 2030, although the results also show that this can be partially offset by raising contribution rates from 13% to 14%. SPA would still need to be 69 or 70 in 2040.

For any given scenario the dependency ratio is unchanged and is an outcome of the PAYG principle as long as the ratio of earnings to pension benefits is a constant, as is the case here reflecting government policy. If pension benefits are increased from, say, a third of average earnings to a half, the SPA and the dependency ratio must increase since more workers would be needed to support higher pension benefits.

Scenario C, which results in the smallest increases in the SPA, depends on improvements in activity rates. This scenario is also a good, but not exact, fit with the one-third principle. The key point is that it allows for a lower dependency ratio and means that the system is sustainable with fewer workers per retiree. This is why we call Scenario C the 'active ageing scenario'.

Finally, it is worth noting that under C where higher activity rates are the result of fewer people being long-term sick or disabled, there is, as previously mentioned, potentially a double benefit because fewer unpaid carers are needed to look after them. This will have the effect of boosting activity rates, increasing the proportion of people in work and reducing the cost of disability benefits.

5. Discussion and conclusion

Although the UK population is predicted to grow to 75m by 2040, the ratio of working age adults to state pension recipients will shrink considerably as the number aged 65+ increases to 18m over the same period. Net immigration, totalling around 3m since 2000, has helped to maintain the ratio higher than it would otherwise be, but the government's plan to limit immigration will change this.

To date the government's preferred response to population ageing has been to increase the SPA rather than increase taxes or reduce pensioner benefits. A higher SPA also produces a more favourable dependency ratio, but only on paper. For example, increasing SPA from, say, 66 to 67 would save about £5 billion a year, but the net saving is only 25% because of a consequent rise in those receiving working-age disability benefits.

In answer to the question 'Is the current system is fair' it is clear that Government reforms have tried to make it fairer over time with the full implementation of unisex pension age from 2020, although this has not been universally popular. Government policy is to link the state pension to both wages and inflation with a minimum increase of 2% per annum. This ensures pensioners share in the benefits of economic growth which previously they were unable to do. The basic state pension is also taxable and so it is progressive.

However, the Cridland recommendation for a rise in SPA from 67 to 68 from 2037 is already seven years earlier than previously timetabled (DWP, 2017 b). Indeed, our results indicate an even tighter timetable; scenario B for example suggests that if activity rates fall an SPA of 69 or 70 in 2040 might be needed. Our analysis suggests that maintaining the one-third principle is precariously balanced in all cases except for scenario C which requires increased activity and contribution rates.

To achieve the higher activity rates needed to avert higher increases in SPA and sustain the one-third principle there need to be improvements in health – especially in health and disability-free life expectancy. This is not a question of spending even more on health care but essentially a public health issue –particularly that of mitigating the strong association between poor health and deprivation (van den Berg et al, 2010; Robroek et al, 2013; O'Donnell et al, 2015; Mayhew et al, 2020).

In a quarter to one third of all UK districts healthy life expectancy already falls short of planned rises in SPA. Even if most of their populations reach SPA, less of their retirement would be spent in good health. It has therefore been suggested that one possible policy approach is to have separate SPAs for regions or disadvantaged groups or occupations.

The Cridland Review rejected this idea, noting that: "…the principle of having a State Pension age that is the same for everybody has a fundamental place in the UK's model of social insurance. It has the merit of simplicity and clarity, and provides an important trigger moment for planning purposes."

If this path were followed health disparities within and between areas and occupations would create winners and losers. Behavioural effects would include internal migration patterns being distorted as people seek to take financial advantage. The present system of targeted working age disability benefits, though not perfect, is fairer basis but it needs to be dovetailed with other policies to level up health.

Evidence suggests that long term ill health is latent in the population but it may be triggered or exacerbated by job loss, job insecurity and lack of money in more deprived areas. Although labour market effects of ill-health are evident from age 50, most chronic diseases develop from life styles adopted in early adult years.

Smoking for example shortens adult lifespan expectancy by an average of ten years (Doll et al, 2004; U.S. Department of Health and Human Services, 2014). [8] Employment policy must therefore adapt to the work capabilities of an ageing population and also adverse health behaviours with government policy fully supporting the direction of travel.

What are the prospects for change? Here, the news is basically depressing with research showing that improvements to life expectancy have stalled. Despite the remarkable decline in tobacco consumption, its success today is being overshadowed by increases life threatening conditions such as obesity and diabetes. As a result many more can expect to spend more of their lives in poor health.

[8] For heavy smokers Statistics Netherlands finds that lifespan is cut by 13 years (2017). For details see: https://www.cbs.nl/en-gb/news/2017/37/heavy-smokers-cut-their-lifespan-by-13-years-on-average

This disproportionately affects the poorest in society, causing the health gap to grow between wealthy and deprived areas (Marmot, 2010 and 2020; Mayhew and Smith, 2019). The main glimmer of hope is that we know that most long term health conditions are preventable and so avoidable in large measure. Prevention is therefore the best way of avoiding the 'dependency trap'.

This research advocates an 'active-ageing' approach over the life course combining health improvement with work enablement and a comfortable retirement in which prevention of ill health is central to achieving this (Scholes et al, 2012; Islami et al, 2017; Roth et al, 2017).

As the former Chief Medical Officer, Dame Sally Davies, notes (DHSC, 2018: Chapter 1, p.2.): "I believe we need to reposition health as one of the primary assets of our nation, contributing to both the economy and happiness."

It is encouraging to note that the debate on health inequalities has finally led the government to set a target to improve healthy life expectancy by five years by 2035. The scale of this challenge should not be underestimated especially as research shows that the gap between life expectancy and health life expectancy is actually increasing, albeit slowly. Increases in the gap feed directly through into higher health and social care costs and reduced levels of economic activity.

There are four wider economic messages from this paper:

- First, if the UK is to succeed economically in the coming decades, increases in life expectancy need to be balanced by improvements in working life expectancy and disability-free life expectancy. The lead times to achieve improvements are significant but are not dissimilar to the time frames for announced increases in SPA.

- Second, higher productivity may offset these pressures to some extent. But since earnings peak in middle age, an ageing workforce needs to be more productive and the earnings of older workers need to increase relative to the average. Since older workers are less productive than younger workers this cannot be guaranteed.

- Third, while a growing population will lead to greater GDP it may not translate into improved GDP per capita, and under some scenarios living standards could fall. Higher earnings are needed to deliver improved standards of living if pensions are to continue to be linked to earnings and to uphold the one-third principle

- Failure on any of these counts could lead to even greater migration pressures in order to deliver essential services at a time when the government is seeking to reduce migration from the record highs that have typified the last two decades.

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Annex A: Determining the State Pension age in a Pay As You GO (PAYG) system

In our scenarios it is required to solve for SPA so that the system is fiscally in balance with tax revenues matching pension payments for future populations. The key parameters are contribution rates, earnings, pension payments and activity rates. Besides the SPA, outputs include the dependency ratio and the proportion of working life spent in retirement.

(a) Determining the SPA under conditions of fiscal balance

Consider Figure A.1 which is a stylised diagram of the UK population showing the number of adults by age. To determine State Pension Age (SPA), the dependency ratio age and the proportion of adult life spent in retirement, only three demographic parameters are required: Q, N and x_m.Q is defined as the 'pivot age' which can be thought of as the age of onset of mortality in the population, N is the age at which adulthood is assumed start (in this case age 20), and x_m is the oldest age to which anyone survives with respect to Q.

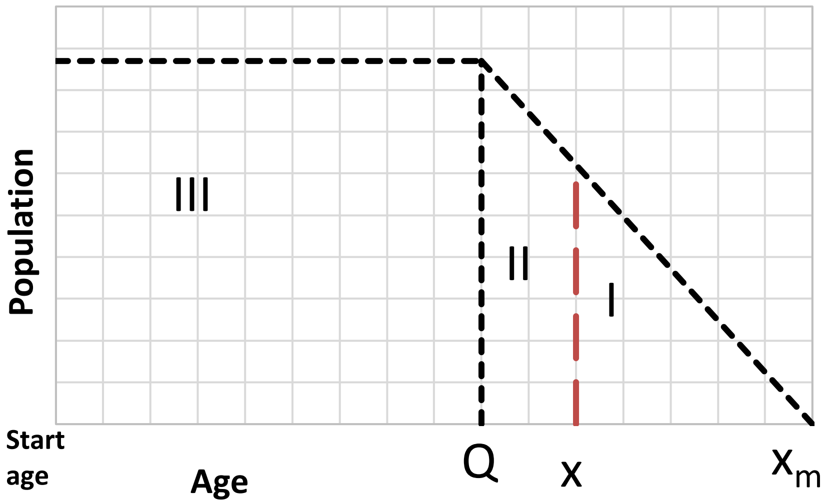

Figure A.1: Stylised chart of the UK population showing adult population

In PAYG terms, the inflow of funds equals the population contained in areas (III) and (II) of the chart which are under SPA multiplied by the average wage, activity and contribution rates. The outflow of funds is given by the population above SPA denoted by x contained in section (I) of the chart multiplied by the average value of the State Pension.

Although it is assumed that the start of adulthood is fixed at age 20, Q and x_m can change over time usually as a result of improvements in mortality although they are not in lockstep. We estimate Q and x_m using linear regression in combination with single year of age ONS population projections. These provide accurate and efficient replacements for the population quantities (I), (II) and (III) in each projection year and so simplify the calculations.

Based on this reduced number of parameters, we determine fiscal balance occurs i.e. outflow equals inflow, when:

$$(x_m - x)(1 - \frac{x}{x_m}) = \left[(2 - \frac{x}{x_m})x + 2N \right]\theta$$

Where $\theta = a \times c \times \gamma$

$a =$ Economic activity rate, a parameter which can used to adjust for disability

$c =$ Contribution rate or tax

$\gamma =$ Average earnings as a multiple of the State Pension

And

x_m = maximum age which varies by year

N = is the number of years from when adult age is assumed to begin to pivot age Q

x = SPA

Balance is achieved when SPA age x is equal to:

$$x = x_m \left[1 - \frac{1}{(1+\theta)} \sqrt{\theta(1+\theta)(1+\frac{2N}{x_m})} \right] + Q$$

Using the above we can determine the SPA, which balances inflows and outflows for any combination of contribution rates, pension benefits and wages.

(b) The proportion of adult life spent in retirement

We need to know the cohort life expectancy of an individual taking into account future improvements in mortality rates. We use unisex ONS forecasts of cohort life expectancy by single year of age to determine what proportion of an individual's future adult life will be spent in receipt of the State Pension post SPA.

The approach adopted follows closely that of the Government Actuary (GAD, 2017) as follows.

$$p = \frac{e_{spa}}{e_{spa+} + SPA - a}$$

Where

e_{spa} =Life expectancy at SPA

$p =$ Proportion of adult life in retirement

SPA = State Pension age

$a =$Assumed adult start age