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ON THE SUSTAINABILITY OF THE UK STATE PENSION SYSTEM IN THE LIGHT OF POPULATION AGEING AND DECLINING FERTILITY*

David Blake and Les Mayhew

As a result of population ageing and declining fertility, the UK state pension system is unlikely to continue to be able to deliver the current level of pensions without some combination of a higher state pension age and a steady inflow of young immigrant workers from abroad. However, with prudent economic management and continuing economic growth, the need for additional immigrants can be contained and modest real increases in pensions are also a possibility. Higher economic activity rates among older people, including deferred retirement, will to some extent compensate but not eliminate these pressures. If fertility picks up over the next few years, this will also help, but not until after 2030.

In 1990, there was one pensioner in the UK for every four workers. By 2030, there is projected to be nearly two pensioners for every five workers.[1] Furthermore, the projected average number of births per female in the UK, at 1.74, is below replacement rate. These two trends indicate that, if there were no other changes, the indigenous population of the UK will eventually decline. Each subsequent generation will be smaller than the previous one and this makes it much harder to sustain a pay-as-you-go (PAYG) state pension system without an excessive burden being placed on each subsequent future generation. In the medium term, according to the Government Actuary, the population is actually projected to increase from 59.6m in 2004 to 64.8m in 2031 as recent demographic trends and the effects of previous baby booms reach maturity. However, the key difference is that in 2031, 15.2m will be 65 years and over as compared with 9.6m in 2004. Meanwhile, the working age population (20–64) will be virtually unchanged at 35.6m and so we can be confident that the pension crunch will start long before any population decline.

The combination of population ageing and declining fertility creates a temporary 'demographic dividend' that lasts a generation or so, as the situation in Japan illustrates. Japan, the fastest ageing population in the world, is set to experience a decline in population after 2020 and is already facing up to the prospect of having to reform its pension system drastically in an economy that has shown little growth since 1990 (MacKellar *et al.*, 2004). However, over previous decades, Japan actually benefited from the decline in fertility. This is because it resulted in a decrease in the overall support ratio (since there were relatively fewer young dependants) and a maturation of the

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[1] Source: Government's Actuary Department (2002) assuming a joint male-female retirement age of 65. Note that this still compares favourably with certain other countries such as Italy or Germany (Roseveare *et al.*, 1996; United Nations, 2000*a*).

working age population (since there were relatively more workers in the most productive part of their careers, namely their 30s and 40s).

The result was both increased labour productivity (Gómez and Hernández de Cos, 2003), and increased labour force growth (Bloom and Williamson, 1998). The reason for this is as follows. As the supply of labour falls relative to capital, this raises wages relative to interest rates (the return on capital). This, in turn, encourages a substitution away from labour towards capital in the production process. The resulting capital creation (i.e., investment financed by borrowing or equity issuance) increases capital per worker and hence labour productivity. The higher productivity, in turn, increases the demand for labour, despite the higher wages. The demand is satisfied by both inactive workers re-entering the labour market and immigrants,[2] attracted by the higher wages.

The outcome (i.e., the demographic dividend) is higher total output and savings (Feyer, 2002) and lower inflation and interest rates (Lindh and Malmberg, 1999). While the dividend lasts, the higher total output can support a larger number of pensioners. Most 'surpluses' in a PAYG system can be traced to this demographic dividend. The shortfalls that occur as these workers begin to retire can be regarded as the 'payback' to the generation that built up these contributions in the first place. Clearly, in a PAYG system, surpluses and deficits do not count as savings and dis-savings in national income accounting terms. Instead, the sustainability of a PAYG system requires that inflow and outflow balance at current contribution rates, taking one year with another, and this definition of sustainability is the one we use below.

The demographic projections for the UK discussed above indicate that our demographic situation is a couple of decades behind that of Japan, so that we could be reaching the end of the 'dividend' phase over the next decade or two. Our aim in this article is to show that, given favourable economic conditions, the UK state pension system is manageable until around 2020, based on current Government policies. Contrary to popular perception, it may even be possible to provide real increases in pensions until that time but only if they are below real wage increases. Current Government policy is to link increases in the state pension to consumer prices but our work shows that full restoration of the link with real wages – as recommended by the Pensions Commission (2005) – could lead to severe fiscal problems. Our study also suggests that recent increases in the number of immigrant workers have been a factor in raising the level of contributions to the state pension scheme. However, since most of this immigration is a response to labour demand pressures that make the UK an attractive place to work, its effect on the state pension scheme's financial balance is moderated by business cycle factors. During economic downturns, net immigration[3] tends to decline at precisely the time contributions need to increase to pay pensions; conversely, when

[2] We live in a rapidly globalising economy with increasing capital and labour mobility. The International Organisation for Migration notes that migration flows are 'amongst the most reliable indicators of the intensity of globalisation'. At the beginning of the twenty-first century, 175m people or 2.9% of the world's population were classified as international migrants (International Organisation for Migration, 2003). Proportionately though migration flows were much larger in the nineteenth century when 10% of the world's population migrated, mainly to the New World (Hatton and Williamson, 1998).

[3] Immigration minus emigration.

the economy is expanding, labour shortages encourage higher immigration and at the same time higher tax revenues.[4]

Our analysis suggests that if economic conditions become unfavourable and real wages do not increase at their long-run rate of 2.1% per annum, the state pension system will face serious financial difficulties sooner rather than later. We show that beyond 2020, fiscal pressures will build up considerably and pension increases that might have been afforded up to that point will no longer be an option without other accompanying measures such as increasing contribution rates or the state pension age. We also anticipate that after 2020 pressures for a significant expansion in immigration will increase to unrealistic and unsustainable levels. To some extent compensating increases in the activity rates of older workers will reduce, but not eliminate these pressures. It is also conceivable that there will be some natural rebound in fertility rates when the birth cohort becomes sufficiently small (Easterlin, 1987; Macunovich, 2000). However, this possibility is not relevant for the UK over the next 25 years as far as pensions are concerned.

To help us analyse these issues, we use a simple model incorporating projected demographic changes in the UK up until 2027 to estimate the shortfall/surplus in contributions based on a range of different assumptions about key variables. We use different policy levers to track the changes that would occur over time and compare these with current Government policy. We then identify the consequences of these different scenarios for the sustainability of the UK pension system and for immigration.

1. A Simple Model of State Pension System Sustainability

For the UK state pension system to be sustainable at current contribution rates, there must be a balance between the revenues generated through National Insurance contributions (NICs) and the pensions paid out. We will measure any deficiency in revenues relative to payments in terms of 'contributor shortfall', which is defined as the number of person-contribution years that would be needed to balance inflow and outflow.

The policy levers for removing any deficiency include raising NICs and the pension age or reducing the pension amount, but the effects can also be ameliorated through wage increases relative to pension increases and through higher rates of economic activity. Hence the model we present can be used for analysing any of the interactions between:

- real pension amounts
- pensioner numbers
- pension age
- contribution rates
- growth rate in real wages (arising from improved productivity)
- rate of economic activity (i.e., the proportion of the working-age population that is economically active)

[4] So long as the wage elasticity of labour supply, for any given level of labour demand, is less than unity and the increase in net immigrants does not depress wages 'too much'.

Shortfalls can also be met through immigration – either temporary or permanent depending on the numbers involved. As already mentioned, the relationship between contributor shortfall and immigration will not be a direct one, since the latter is influenced by other factors such as the state of the business cycle. We merely highlight the possibility that a sustained deficiency in the state pension scheme could be partially met by the migration of young workers to the UK.[5] We assume that migrants who move permanently to the UK are in their 20s or 30s and so remain under state pension age at the end of the projection period, 2027.[6]

1.1. *The Static Version of the Model*

The static model assumes that there is no growth in any of the key variables. For the purposes of this study we split the working population into three age groups: 20–34, 35–49, and 50 and above. There are three reasons for considering these three age groups separately. First, the age group 35–49 is generally more productive than the other two age groups. Second, with an ageing population, it is generally older workers who may be called upon to extend their working lives up to and beyond the current state pension age. However, it is also apparent that significant numbers of people in this age bracket become long-term unemployed, leave the workforce on health grounds or take early retirement. The feasibility of measures to encourage this group to work longer is therefore a relevant consideration in judging, for example, whether more immigration is needed as an alternative. Third, it is also possible, as discussed above when considering the situation in Japan, that activity rates are higher within small birth cohorts (such as the current 20–34 age group), as their scarcity increases wages, but, as we later show, the scope for this is limited, since activity rates are already at a high level (around 80%).

In a PAYG system, such as the state pension scheme, the year-end balance in the pension scheme in year t is given by:

$$F_t = p_t N_t - c_t y_t (M_t^{20-34} a_t^{20-34} + M_t^{35-49} a_t^{35-49} + M_t^{\geqslant 50} a_t^{\geqslant 50}) \tag{1}$$

where:

F_t = the shortfall/surplus in the scheme
p_t = average value of the state pension
N_t = number of people above state pension age and drawing a pension
c_t = average contribution rate to the state pension scheme
y_t = average real wage
M_t^{20-34} = population aged 20–34
M_t^{35-49} = population aged 35–49
$M_t^{\geqslant 50}$ = population aged 50 and older
a_t^{20-34} = economic activity rate of the population aged 20–34
a_t^{35-49} = economic activity rate of the population aged 35–49
$a_t^{\geqslant 50}$ = economic activity rate of the population aged 50 and older.

[5] Immigration can also be used to sustain a country's fiscal policy, see, e.g., Storesletten (2000).

[6] This is a reasonable assumption. According to Dobson and McLaughlan (2001, Table 4) the bulk of immigrants to the UK over the last quarter century are in the 15–24 and 25–34 age groups; see also Home Office (2001).

Variables in capitals relate to populations: their values are assumed to be exogenous and derived from demographic projections. Variables in lower case are parameters.

We can convert (1) into a 'contributor shortfall/surplus' by dividing throughout by the product of the wage rate and the contribution rate:

$$S_t = \frac{p_t N_t}{c_t y_t} - (M_t^{20-34} a_t^{20-34} + M_t^{35-49} a_t^{35-49} + M_t^{\geqslant 50} a_t^{\geqslant 50}) \tag{2}$$

where $S_t = F_t / c_t y_t$ = contributor shortfall/surplus.

The contributor shortfall (+) or surplus (−) between years is given by

$$D_t = S_t - S_{t-1} \tag{3}$$

and so the cumulative shortfall/surplus in units of 'contributor years' from year $t = 0$ (the base year for the projections) to year T is $\sum_{t=0}^{t=T} D_t$.

Equation (2) implies that sustained shortfalls or surpluses over several years could require policy changes either to the pension system itself or through adjustments to the population base brought about by migration. Most likely it will require a complex mixture of both.

1.2. *The Dynamic Version of the Model*

Equation (1) does not allow for adjustments in the following parameters over time: the pension age and the growth rates in pensions, wages, contribution rates and activity rates. For reasons given above, we also wish to distinguish between workers in different age groups. The following equation allows for such adjustments through the use of growth-rate parameters and by splitting the population into the same age categories as in the static model:

$$S_t = \frac{p_0(1+\dot{p})^t N_{xt}}{c_0(1+\dot{c})^t y_0(1+\dot{y})^t} - [M_t^{20-34} a_0^{20-34}(1+\dot{a}^{20-34})^t + M_t^{35-49} a_0^{35-49}(1+\dot{a}^{35-49})^t + M_t^{\geqslant 50} a_0^{\geqslant 50}(1+\dot{a}^{\geqslant 50})^t] \tag{4}$$

where: $\dot{p}, \dot{y}, \dot{c}, \dot{a}^{20-34}, \dot{a}^{35-49}, \dot{a}^{\geqslant 50}$ = growth rates in real pensions, real wages, the contribution rate, and the activity rates for individuals aged 20–34, 35–49 and 50 and over from base year values p_0, y_0, c_0, a_0^{20-34}, a_0^{35-49} and $a_0^{\geqslant 50}$, respectively,[7] $N_{x,t}$ = the population over state pension age x in year t.

2. Calibrating the Model

In this Section, we select the variables and parameter values needed for (2) and (4). The base year for our projections is 2002.

[7] Note that this is a highly simplified treatment of the problem because growth rates are treated as exogenous. We ignore the endogenous relationship between savings, inflation, and interest rates in the demographic transition (Lindh and Malmberg, 1999). Modigliani and Cao (2004), for example, show that there is a generally positive relationship between savings and population ageing.

2.1. *Estimating the Population Receiving State Pension for Different State Pension Ages*

We make use of population projections to 2027 based on the Government Actuary's Department (GAD) 2002 single year projections. These make the following assumptions:

- Fertility at 1.74 per woman. The rationale for choosing this figure is that completed family size has been falling steadily from an average of around 2.45 children for women born in the mid-1930s. The family sizes likely to be achieved by younger cohorts are highly conjectural, but for this projection GAD assume that average completed family size, for the UK as a whole, will continue to decline until around the 1985 cohort and eventually level off at 1.74 children per woman.
- The long-term unadjusted net immigration assumption for the 2002-based projection was 130,000. Figure 1 shows recent trends in net immigration.[8] Although a figure of 130,000 is much higher than the average prior to 1997, the GAD does not regard this figure as exceptional going forward on account of the expansion of the European Union eastward, the migration effects of which are expected to last between 10 and 15 years (Boeri, Brückner *et al.*, 2003).
- The 2000-based and 2001-based GAD projections assumed that the annual rates of mortality improvement would converge to a common reduction of 0.75% at each age in 2025 (the 25th year of the 2000-based projections). The underlying rationale for this is as follows. The assumed improvement in mortality rates after 2002–3 is based on trends in mortality rates before 2002. Over the period 1961–2001, the average annual improvement in mortality rates has been nearly 1.4% for males and 1.3% for females. The rate of improvement over the latter half of this period was higher than over the first half, particularly so for males. (Interestingly, GAD notes that this appears to be partly due to differential trends in smoking behaviour between males and females.)

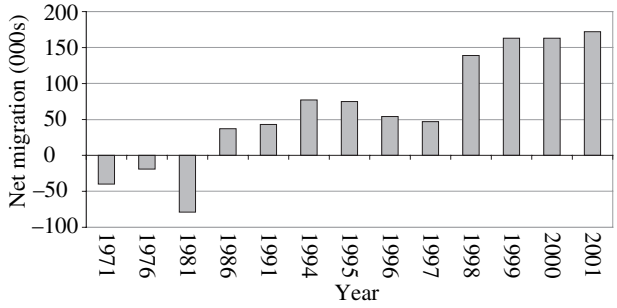

Fig. 1. *Net UK Immigration* (*All Citizenships*)

[8] A migrant is defined as someone who stays/leaves for at least one year. Figures in this graph are derived from the International Passenger Survey. Prior to 1991 they exclude certain categories of migration such as migrants between the UK and the Irish Republic, persons seeking asylum after entering the country and other short-term visitors granted extensions of stay. From 1991, the figures include all categories of migrants and therefore represent total international migration. See 'Report: Revised International Migration Estimates 1991 to 2001' in *Population Trends*, vol. 113.

To estimate the population N_{xt} above any specified state pension age x in year t, we fit a linear regression to the population aged 50 to 89 for each year from 2002 to 2025. It is easily shown using simple geometry that the population above state pension age x in year t is well approximated by:

$$N_{xt} = \frac{A_t}{2}\left[x_{mt} - x\left(2 - \frac{x}{x_{mt}}\right)\right] \tag{5}$$

where:

N_{xt} = population above retirement age x in year t

A_t = intercept with vertical axis from regression equation of UK population aged 50 to 89 against age for year of projection t

x_{mt} = intercept with horizontal axis from regression of UK population aged 50 to 89 against age for year of projection t, and interpreted as the maximum age to which anyone lives for that projection year.

Figure 2 gives examples for two years: the values for A_t and x_{mt} are 1.683m and 97.7 in 2002, and 1.946m and 101.3 in 2020. Typical values for the regression R-squared exceed 95%.[9] Equation (5), for example, yields estimates for the population aged 50 and over of 19.6m in 2002 and 25.3m in 2020, which compare favourably with 19.8m and 25.1m according to GAD. N_{xt} in (4) replaces N_t in the static model (1).

Figure 3 is a simple look-up graph based on the fitted regression model that provides an accurate estimate of the population above any specified state pension age, ranging between 50 and 100 at various years in the projection period. In 2002, the official UK state pension age was 65 for men and 60 for women, which equates to a combined average pension age of approximately 62.5 years. The arrows indicate how the state pension age would need to increase in order to keep the number of pensions in payment (shown to be 11.2 million in 2002) constant over time. Based on an average pension age of 62.5 years in 2002, Figure 3 shows that this would need to increase to 71 years by 2025. The female state pension age will gradually be raised in stages to 65 after

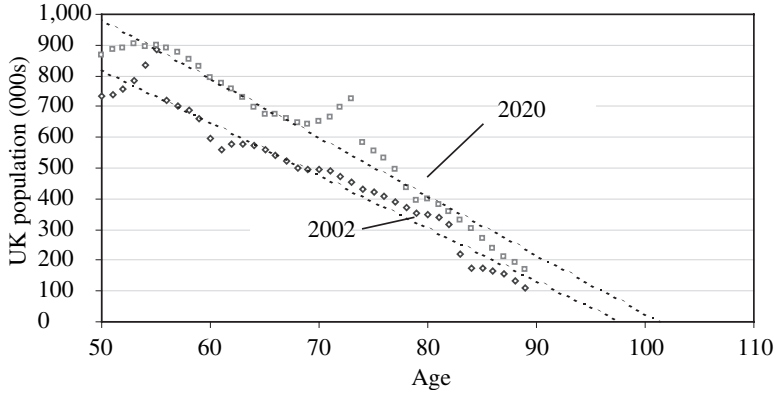

Fig. 2. *Projecting Population Using Fitted Lines from the Regression of the UK Population Aged 50 to 89 Against Age for 2002 and 2020*

[9] Although the goodness of fit falls to 94% for 2023 and to 89% for 2024 and 2025.

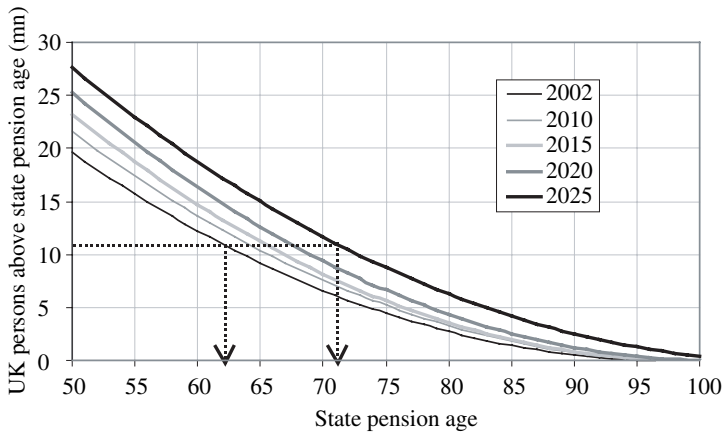

Fig. 3. *UK Population Over State Pension Age in Selected Years to 2025*

2010, a process that is not due to be completed until 2020. In the scenarios that follow, we take this transition into account.

2.2. *The Pension, Wage and Contribution Rate Parameters*

These parameters are taken from various official statistical sources for the year 2002:

- The average pension paid to men and women in 2002 was £3,950 per year.[10] To put this figure into context a contributor shortfall of 1m persons would translate into a deficit of approximately £4bn (0.38% of 2002 GDP)[11] in the state pension fund. By the end of the financial year 2001/2 the balance in the National Insurance Fund had increased to an unusually high level of £23.6bn.[12] However, this cushion could quickly be expended following a persistent contributor shortfall over time, or if there were a return to high unemployment, or if the surplus were put to other uses such as health care.
- The average gross wage in April 2002 was £20,474 for male and female full and part-time employees.[13]
- The NIC primary threshold was £89 per week or £4,628 per year in 2002,[14] which we deduct from average earnings. NICs finance other contributory-based social security benefits and not just pensions. Hence, the full rate of NICs not only overstates the costs of providing state pensions, but also the amounts people actually contribute due to the effect of the threshold. We estimate the cost of state pensions equates to an implied contribution rate of 9.47% based on an average state pension age of 62.5 years for men and women in 2002. This value is used as a parameter in the model.

[10] Source: Department for Work and Pensions based on the average pension in payment in September 2002.
[11] GDP at market prices in 2002 was £1,043.306bn (*Economic Trends* no. 605, April 2004).
[12] Source: National Audit Office (2003).
[13] Source: *New Earnings Survey 2002*, Office for National Statistics.
[14] Source: Inland Revenue.

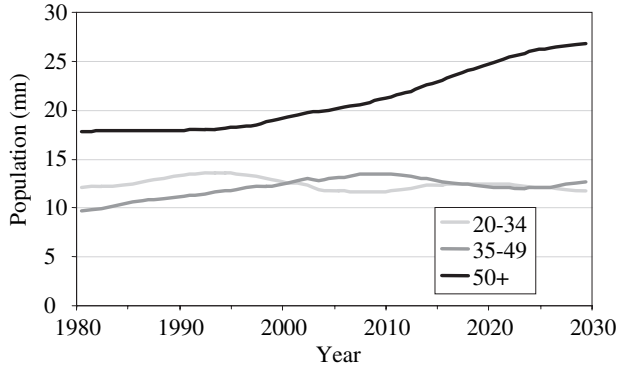

Fig. 4. *Changes in the UK Population age 20+ from 1980 to 2027*

Since contribution rates are applied to earnings, growth in earnings can also reduce the contributor shortfall, especially where, for example, the rate of growth is higher than the growth in the average pension. In the UK, average real earnings have increased more or less continuously since 1963,[15] but whether it can be assumed that earnings will continue to grow in a similar way in the future requires further analysis.

2.3. *The Productivity and Economic Activity Rates*

The largest source of uncertainty in (4) is attached to the future rate of productivity growth. A full treatment of the conditions giving rise to economic growth is complicated, involving technological, human capital and demographic factors. Workers in their 30s and 40s tend to be more productive than workers in other age groups. There is general agreement, as mentioned above, that a population that is neither too old nor too young, because it is in the throes of transition from a young to an ageing state, will reap a productivity dividend as long as these conditions last but, once the population has aged, productivity increases slow down, as has happened to Japan (Bloom and Williamson, 1998; Feyer, 2002)

The UK is one of the countries in the process of a transition to an older population, and has benefited accordingly. The question for this article is how the changes currently taking place will shape productivity in the medium term, since this will affect the tax base on which the state pension depends. It is evident that real earnings, which we use as a proxy for productivity, have increased at a rate between 1.8% and 2.1% per annum since 1963, accelerating somewhat in recent years, depending on how it is measured and over what period.[16] As Figure 4 shows[17] there has been an unbroken rise in the population aged 35–49 in the 20 years prior to 2002, a rise and then a fall in the population aged 20–34, and an increase in the population over 50. The graph also shows the 35–49 age group is due to peak in 2008, decline by 1.5m between 2008 and 2022, before increasing again to 2027, when GAD single year projections end. However,

[15] Source: Average Earnings Index, 1963–2004, Office for National Statistics.
[16] An index for real earnings is derived by deflating the standard earnings index by the consumer prices index.
[17] For 1979 to 2002 we used actual population figures and from 2002 onwards GAD projections.

by far the largest increases will occur in the 50+ age group and therefore this tranche of the population becomes important in any assessment of the UK's future productivity prospects.

Although earnings growth has been steady, it cannot be assumed that this will remain so, especially in the period after 2008 when numbers in the age group 35–49 begins to fall. Inland Revenue income statistics confirm that earnings peak between 35–49 and fall thereafter so it might be expected that fluctuations in the relative size of each age group could affect productivity and therefore earnings. The issue is further complicated by the fact that higher rates of economic activity among older less productive workers could actually *reduce* average productivity.

To investigate these issues, we examined recent changes in average earnings and population by age group. Using data from 1979 to 2000, we rescaled the size of each of the three age groups in every year by the corresponding rate of economic activity (see Figure 5). We then regressed the average real earnings index on the resulting series.[18] The results confirm that the age group 35 to 49 makes the largest contribution to earnings growth. They also show that the coefficient for the 50+ age group is negative, implying that as this group expands, it could exert a downward pressure on average earnings.

On the assumption that the relationship between earnings and the three activity-rate–adjusted age groups is stable over time, we can impute the value of the average earnings index in future years and assess how it could vary according to three different sets of assumptions about activity rates:

- no change from current levels (which we denote the 'no change assumption')
- a 0.5% per annum increase from present levels in the two youngest age groups, no increase in the oldest group (denoted the 'high activity rate assumption'). This would have the effect of raising activity rates in these age groups to an average of 90% from present levels by the end of the projection period.

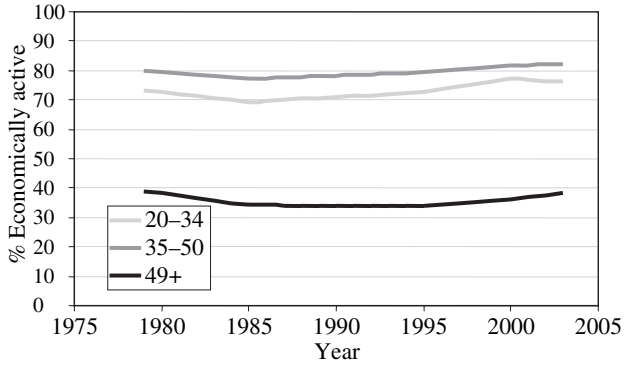

Fig. 5. *Historical UK Economic Activity Rates Based on Combined Male and Female Activity Rates, 1979–2003*

[18] $y_t = a + b_1 M_t^{20-34} a_t^{20-34} + b_2 M_t^{35-49} a_t^{35-49} + b_3 M_t^{\geq 50} a_t^{\geq 50} + u_t$, $R^2 = 0.98$; with $b_1 = 0.005389$ (t-ratio = 2.48), $b_2 = 0.01536$(t-ratio = 13.65), $b_3 = -0.004162$(t-ratio = −3.87), $a = -37.4$(t-ratio = 2.33), and where y_t = index of real wages, M_t^{20-34} = population aged between 20 and 34 etc, a_t^{20-34} = activity rate of population aged between 20 and 34 etc, and u_t is the error term in year t.

- an increase of 0.3% per annum in each age group (denoted the 'medium activity rate assumption'). This delivers smaller increases in the younger age groups, but raises the activity rate in the 50+ age group to over 40% by the end of the period.

Figure 6 shows the results and the main finding is that average earnings will tend to track changes in the size of the 35–49 age group, regardless of the specific assumption made about future activity rates. It turns out that activity rates will be one of the most interesting imponderables because 'no change' over the projection period is a highly plausible outcome. For example, if we compare the historical activity rates of people aged 20–49 and 50+ since 1980 (Figure 5), we find very little change over the period and so the potential for a significant expansion of those activity rates will increasingly become an issue.

It is, of course, debatable whether relative earnings will have such a mechanistic relationship to future earnings, as labour market conditions in future could be very different from those of the past. For example, in future people over 50 will have skills that are very different from today's over-50s and these skills might be highly valued in the labour market in years to come. To illustrate, 'old economy' manual workers are more likely to be 'burnt out' at an earlier age than workers in the new economy of similar age. Uncertainty therefore exists as to whether this group will be more productive than previous generations and whether their activity rates will rise to fill the expected labour shortfalls. This means our analysis can only be a guide to the framing of different pension scenarios and does not offer a definitive prediction.

Nevertheless, our findings suggest that a continuation of the historic rate of growth of 2.1.% p.a. will be optimistic and that, over the projection period, earnings growth may be flat or even declining (see Figure 6). To keep the illustrations that follow both simple and realistic, we therefore decided to use the following productivity assumptions: 0% per annum ('pessimistic'); 1% per annum ('medium'); and 2.1% per annum ('optimistic'). These loosely correspond to situations in which:

- ageing effectively becomes a constraining factor on earnings growth because the productivity of older workers is lower;

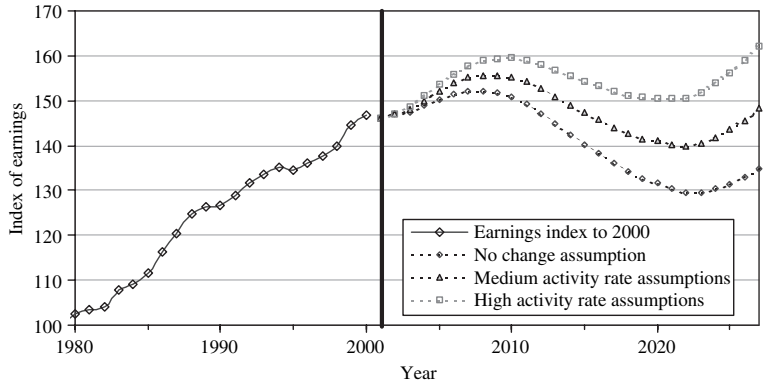

Fig. 6. *The Relationship Between Population Age Groupings and the Index of Real Average Earnings, with Projections from 2002 to 2027.*

- earnings growth falls to 1% (older workers provide only a partial replacement for the decline in younger workers);
- earnings continue to grow at their historical rate of 2.1% (older workers fill the gap left by the decline in younger workers).

3. Investigating the Scenarios

In this Section, we assess the consequences of six scenarios involving different possible assumptions about productivity growth and activity rates and different policy responses. We use graphs to show the contributor shortfall (+ vertical axis) or contributor surplus (− vertical axis) for five possible retirement ages lying between 60 years and 70 years. On the horizontal axis is the projection year starting in 2002 and finishing in 2027. To meet pensioner commitments, we assume the Government plans to maintain a balance between inflow and outflow, taking one year with another. We begin with a baseline scenario of no change in any of the variables; we then introduce a range of adjustments to extend the sustainability horizon, based on minimising the contributor surplus/shortfall. All the scenarios begin by assuming the system is in initial balance.[19] We regard these adjustments as feasible and realistic, but we also assess whether they are optimistic or pessimistic.

Scenario 1 – *No change: No productivity growth or changes to activity rates, pensions or contribution rates from 2002 onwards.*

This scenario is equivalent to the static model in (1). It paints what might be described as the 'worst case scenario' since it assumes no further productivity growth and hence increase in real wages nor any improvement in activity rates. The results indicate that there would be a persistent contributor shortfall, each year from 2002 onwards, which will build into a huge deficit if it is not corrected. In order to keep the system in balance, frequent increases in the state pension age would be required, rising to 65 years by 2015 (*A*), 67.5 years by 2021 (*B*) and 70 by 2024 (*C*), as shown in Figure 7. The Government's present policy of gradually aligning the state pension age of women to that of men between 2010 and 2020 (see the dotted line labelled 'transition 1') would not be sufficient to solve the problem. Scenario 1 is also relevant for the case where wages and pensions increase at the same rate. The often-heard demand – and one supported by the Pensions Commission (2005) – for pensioners to share in the growth of the economy through linking pension increases to wages implies a huge contributor shortfall, given the UK's demographic position over the next quarter century.

Scenario 2 – *Nothing for pensioners: Real wages increase at the historical rate of 2.1% per annum, no change in any of the other variables.*

Scenario 2 assumes real wages continue to grow along the long-run historical trend and pensions and the other variables are held constant in real terms. The results in Figure 8 show that a substantial surplus would build up over the projection period. On present Government policies, shown in the dotted line ('transition 1'), the rate of increase in

[19] We recognise that the UK state pension scheme actually had a surplus in 2002, but we are interested in examining the longer-term implications of different scenarios and so it is appropriate to start with the system in initial balance.

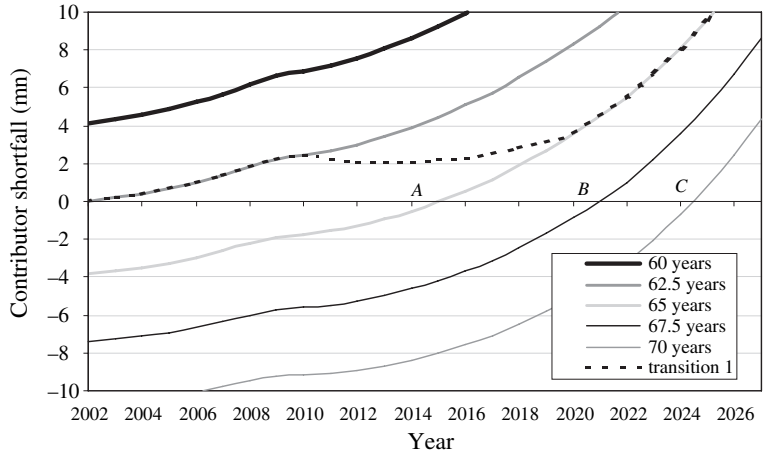

Fig. 7. *Scenario 1*

the annual surplus would start to diminish after 2020 and the surplus itself would disappear sometime in the 2030s. From our earlier discussion this would equate to an 'optimistic' scenario with regard to wage growth but with none of the benefits shared with pensioners.

Scenario 3 – *Cuts for pensioners: Real pension reduction of 1% per annum, no change in any of the other variables.*

A 1% per annum real cut in pensions would keep the system in annual balance until 2014 (point *A* in Figure 9) assuming an average state pension age of 62.5. The planned increase in the state pension age for women to 65 ('transition 1') has the effect of keeping the state scheme viable until 2023 (point *B*). Indeed, there is a contributor surplus between 2010 and 2023. In theory this could be given back to pensioners in the form of higher pensions, but the annual rate of increase in pensions would have to be

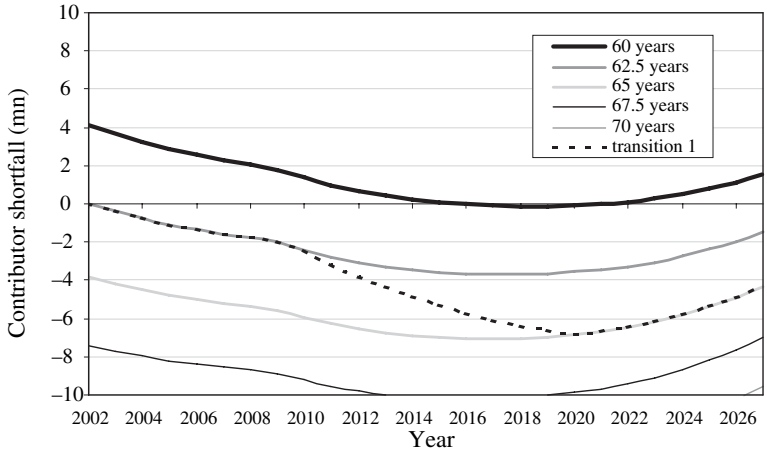

Fig. 8. *Scenario 2*

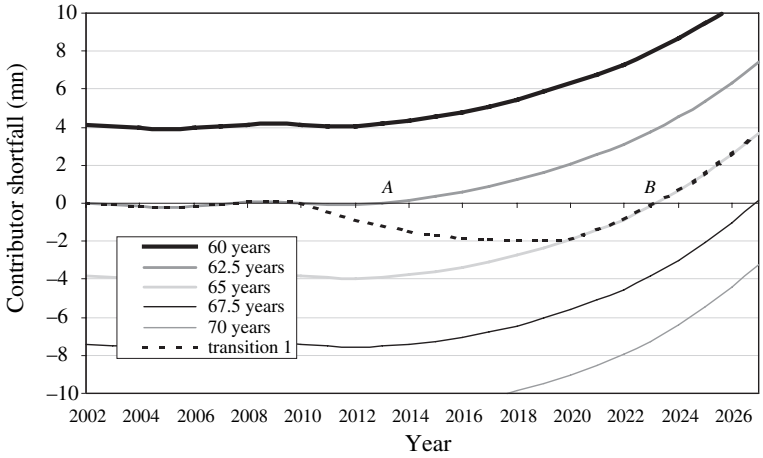

Fig. 9. *Scenario 3*

below the rate of increase in wages for the policy to work. There would need to be further increases in the state pension age after 2023 to maintain the viability of the system without, for example, additional immigration. Note that in a PAYG system, a real pension reduction of 1% per annum has a similar effect to a real wage increase of 1% per annum or a contribution rate increase of 1% per annum. Like the first example, this would be classed as a 'pessimistic' scenario in which pensioners would be required to pay for the failure of the economy to grow.

Scenario 4 – *Something for pensioners: Real wages increase at the historical rate of 2.1% per annum and real pensions increase by 1.5% per annum, no change in any of the other variables.*

Under the Government's current retirement age policy, the system could provide a 1.5% per annum increase in pensions until 2020 (point *A* in Figure 10) after which point deficits would accumulate rapidly. The small hump around 2009 is caused by the

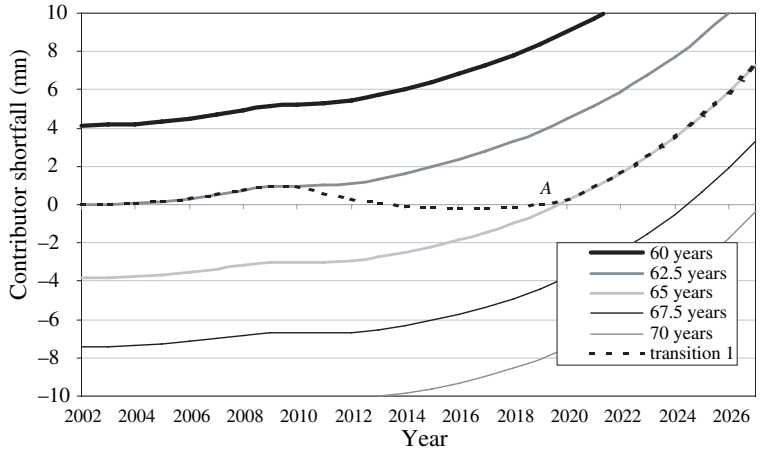

Fig. 10. *Scenario 4*

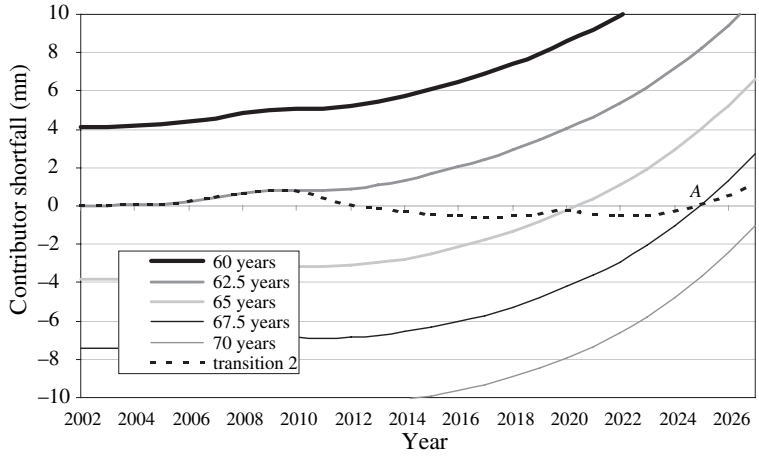

Fig. 11. *Scenario 5*

retirement of baby boomers. This is a plausible scenario especially over the first part of the projection period when the 35–49 age group peaks, but increasingly becomes 'optimistic' as this group declines in influence. Figure 10 shows that difficulties rapidly accumulate and there is some doubt that the high level of productivity is sustainable without increases in activity rates.

Scenario 5 – *Something for pensioners on the one hand, something taken away on the other: Real wages increase at the historical rate of 2.1% per annum, real pensions increase by 1.5% per annum, transition to pension age 70 after 2020, 0.025% per annum rise in activity rate in the 50+ age group, no change in any of the other variables.*

This scenario keeps the system in balance until 2024 after which immigration pressures could re-appear (point A in Figure 11). While the increase in pensions would be very popular, this would be counterbalanced by the rise to 70 years in the state pension age between 2020 and 2030 ('transition 2'). The activity rate of the 50+ age group at the end of the period would have risen to 41% compared with 38% in 2002. This could be the result of some people working beyond retirement age and greater participation at younger ages. Without the increase in the activity rate, the pressures would start to build up in 2022 instead of 2024. As with the previous scenario the issue is whether it will be possible to sustain a high rate of productivity growth through a policy of relying on older workers: again this must be considered an 'optimistic' scenario.

Scenario 6 – *A little for pensioners on the one hand, something taken away on the other: Real wages increase at a more moderate rate of 1.0% per annum, real pensions increase by 0.5% per annum, transition to pension age 70 after 2020, 0.025% per annum rise in activity rate in all age groups, no change in any of the other variables.*

This 'medium' productivity growth scenario shown in Figure 12 keeps the system in balance until 2025. The more moderate growth assumptions appear to fit better with our previous analysis of average earnings especially if looked at over the whole projection period. The assumed increase in activity rates among 20–49 year olds is

potentially challenging as rates are already high, and at the assumed rate of growth, they would need to increase from 83% to 88% over the period. Nevertheless, we would consider this to be a realistic scenario.

4. Raising the State Pension Age and Immigration as 'Solutions' to the State Pension Problem

Our main conclusion from the scenarios is that a combination of productivity growth, modest pension increases and improvements in activity rates, combined with an increase in the state pension age to 70 could keep the UK state pension system viable until 2024 or 2025, but without the increase in the state pension age to 70, the difficulties would emerge earlier. Although the results differ in the detail, it is noteworthy that regardless of which productivity scenarios are used the results suggest that increases in the state pension age after 2020 look more likely than not. Any proposal to increase the state pension age will be politically challenging, but it seems inevitable that as people live longer, the length of the working life should increase to maintain a constant relationship between working and retired lives, as recommended by the Pensions Commission (2005).

Another way of looking at the potential 'contributor shortfall' is to plot changes in the support ratio between 2002 and 2025, where this is defined as the ratio of the number of persons between age 20 and state pension age to the number of persons above state pension age. Figure 13 shows this ratio at different state pension ages in 2002 and 2025. At point *A* in 2002 when the average state pension age was 62.5, the support ratio was 3.1 workers per pensioner. This would decrease to 2 (point *D*) by 2025 without any change in state pension age, and increase to 2.5 when pension age equalisation at 65 is completed (point *E*). The same ratio as in 2002 could be maintained in 2025 if there were a permanent addition of 10m migrant workers, once the state pension age equals 65 (point B on line 2025(*a*)), or, without any further immigration, if the state pension age

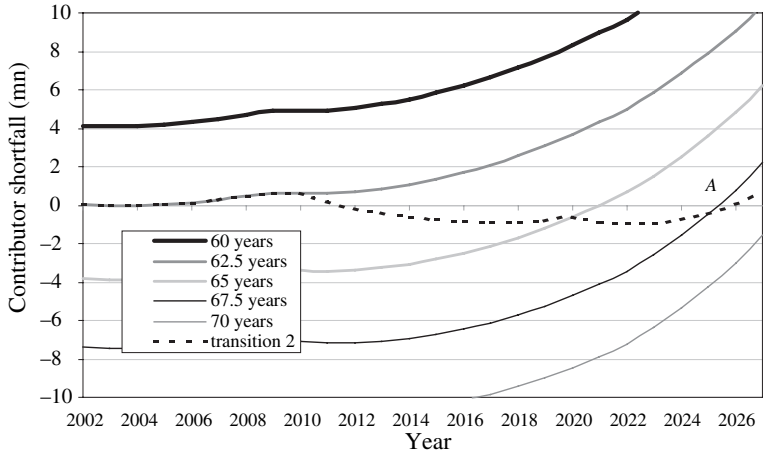

Fig. 12. *Scenario 6*

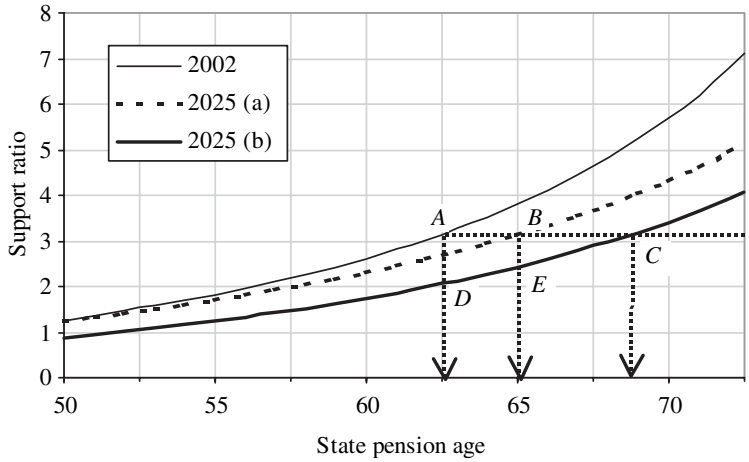

Fig. 13. *The Relationship Between the Support Ratio and State Pension Age in 2002 and 2025*

were raised to 69 years (point *C* on line 2025(*b*)). Point *B* requires approximately 500,000 additional migrants a year in order to maintain the support ratio at its 2002 level.

However, the scenarios also demonstrate the sensitivity of the pension system to small changes in assumptions and so any direct translation of 'contributor shortfall' into additional immigration needs to be treated cautiously. Nevertheless, our analysis suggests that no single policy measure is capable of 'solving' the pension crisis without creating significant distortions and it is therefore probable that a range of measures involving increases in state pension age, higher contribution rates, and additional immigration will be necessary (as suggested in the Pensions Commission's 2004 Report). Any package of options will also depend on future economic growth and on long-run fertility trends.

There are other factors that need to be taken into account in a fuller treatment of the immigration issue:

- A key assumption underlying the above calculation is that the immigration is demand-led and brings in qualified immigrants with needed skills (Borjas, 1995). This is the policy followed by countries such as Australia and the US and is one that has been successful in maintaining a high degree of social cohesion in a way that an influx of low-skilled immigrants who would be competing in the labour market with the incumbent workforce might not be (Ben-Gad, 2003).
- The rapidly changing nature of the global economy also needs to be considered. Even key services can now be provided internationally, e.g. Barclays Bank, Prudential Insurance and British Telecom have set up call centres in India (so-called 'off-shoring'). So, with the spread of information technology, the 'immigrant workers' do not necessarily need to move from their home country. We should not forget the failed attempt to save the UK textile industry in the 1970s by bringing in low-wage immigrants to the northern industrial cities.
- The impact of immigration on domestic wages also needs to be considered. Estimates from the US (Borjas, 2002) suggest that 'an immigrant influx that

increases the supply of workers in a particular schooling-experience group by 10% lowers the wages of natives in that group by 3 to 4% and reduces weeks worked by 2 to 3%.

- Confirmation that immigration is not a long-term solution to population ageing is given in Coleman (2002, p. 586). He argues: 'there can be no "solution" to population ageing and low PSRs[20] without a resumption either of the high death rates and high birth rates of the pre-transitional regime, or at least of high birth rates alone. This would generate exceptional and unsustainable population growth, bringing its own nemesis. The consequences of population ageing might – given reasonable birth rates – be ameliorated or managed by non-demographic responses, but not "solved"'. Coleman (2002, p. 583) continues: 'Although immigration can prevent population decline, it is already well known that it can only prevent population ageing at unprecedented, unsustainable and increasing levels of inflow, which would generate rapid population growth and eventually displace the original population from its majority position'. Wallace (2001, p.36) makes a similar point: 'A new era of immigration may have begun, but current inflows cannot prevent the agequake ... A crucial point to grasp is that higher inflows would have to be sustained indefinitely. The new immigrants arriving in the 1990s will themselves age as inevitably as the existing population. So without a meaningful long term recovery in the birth rate, they too will inevitably become a burden. While immigrants do tend to have higher fertility initially, it tends to converge on the national average and thus only helps to limit the extent.'

5. Conclusion

An ageing society which is also declining in numbers because its birth rate is too low faces stark choices if it is going to have a credible and sustainable pay-as-you-go state pension policy. Credible pension policies have to be time consistent, and time consistent policies cannot pass the buck to future generations (i.e., they have to exhibit intergenerational fairness) (Gordon and Varian, 1988). This implies that the ratio of a society's pension bill to its wage bill cannot increase systematically. If the next generation is smaller in number than the current generation, the current generation has to:

- accept a cut in its real pensions or
- contribute more whilst in work or
- work harder or
- work longer and retire later or
- accept more immigration.

Our analysis has shown that it is highly likely that demographic factors will increasingly dominate economic factors over next 25 years and beyond in the UK. Based on our model any realistic increases in labour productivity, in work effort or in pension

[20] Potential support ratios, defined in Coleman's case as population aged 15–64 divided by population over 65.

contributions by the indigenous population will not be sufficient to compensate for the combined problems of population ageing and declining fertility in the long run. It is therefore also highly likely that pensions, retirement age and immigration issues will increasingly dominate the political agenda on national resource allocation over the next quarter century, both in the UK and, indeed, the rest of Europe.[21,22]

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[21] Many continental European countries are in a more serious position than the UK since they are ageing more rapidly and tend to have more generous state pensions. Germany, for example, will need at least three million immigrants a year and Italy at least two million to sustain their pension systems without major structural changes (United Nations, 2000*b*).

[22] Some commentators predict a turbulent future: 'The demographics of the next 30 years may be written in our stars, but the agequake will still come as an enormous shock when it erupts in earnest. Around 2020, tremors will give way to shockwaves. The agequake will hit Richter nine, shaking western economies to their foundations' (Wallace, 2001, p.171). Not all commentators agree with this pessimistic conclusion, however. Disney (1996), for example, argues that there is no 'crisis of ageing' – no adverse effect of ageing on productivity. He concedes that there are serious crises in pay-as-you-go social security systems and in health care programmes in developed countries, but these, he argues, have little to do with ageing. We should also bear in mind that Japan which is running about 20 years ahead of the UK in ageing terms, is still one of the richest countries in the world in per capita terms, despite registering very little growth since the early 1990s. If anything some respite from rising house prices and interest rates may benefit a country that is ageing.

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