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The UK State Pension System: Analyses of proposed reforms and the viability of immigration based policies in response to ageing demographics

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The UK State Pension System:

Analyses of proposed reforms and the viability of immigration-based policies in response to ageing demographics

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Abstract

This paper briefly examines the options for reform proposed by the Pensions Commission in 2004 to sustain the UK state pension system in response to an ageing population. It further explores, under various scenarios, the long-term viability of immigration as an alternative policy response by developing a population projection model to determine the replacement migration levels that would be required to maintain contributions (taxes) at current levels, using population data and assumptions in the public domain. The economic and social implications of immigration-based policies are also considered.

The results indicate that not only does each policy option proposed by the Pensions Commission require changes that are too large for the policy to be implemented on its own, but that a combination of options too is likely to require discomforting changes at the individual level when considered under plausible scenarios. Economic and social implications aside, the results also indicate that immigration is an inefficient and ineffective way of salvaging an ageing society. The required replacement migration levels are abnormally high and too volatile for it to be considered as a viable policy alternative.

[1] The author gratefully acknowledges the comments of Professor Steven Haberman

Executive Summary

The UK is at a crossroad regarding the long-term viability of its state pension system. Improving mortality and falling fertility rates cannot sustain the pay-as-you-go (PAYG) system without placing an excessive burden on future young generations.

Section 1: Introduction - The demographic challenge

Life expectancy at age 65 in the UK has risen significantly over the last half century for both males and females, averaging from just over 14 years in 1960 to 19.6 years in 2000. It is projected to further increase to 23 years by 2050. Fertility rates, on the other hand, have declined from 2.72 per woman of childbearing age in 1960 to 1.64 in 2000. The rates are projected to stabilise at 1.74 by about 2016.

The combined effect of these trends is a 60% increase in the ratio of the number of pensioners being supported by each member of the working population by 2050, thus threatening the sustainability of the UK state pension scheme funded on a PAYG basis.

Section 2: Viability and sustainability of the Pensions Commission's proposals

The UK Pensions Commission published its First Report in October 2004, "Pensions: Challenges and Choices", addressing the difficult options and policy issues faced by the Government in reforming the social security system in light of these demographic trends. Three of the four key proposals outlined include:

1. Reduction in benefits
2. Increase in taxes and
3. Increase in the State Pension Age (SPA)

Results of the brief analysis on the viability and sustainability of the three key proposals show that each policy option requires changes that are too large for the policy to be implemented on its own and that a combination of options is more likely to be required. However, even a combination, when considered under plausible scenarios, requires discomforting changes at the individual level. A common SPA of 70 would require a 40% increase in contributions or taxes to maintain the benefit increases paid over the last three years, which have been more in line with earnings growth than price inflation, to sustain the state system – and that is assuming employment at full capacity.

This paper does not consider the specific policy recommendations in the Commission's Second Report expected to be published in autumn 2005, which at the time of writing was undergoing an internal consultation process.

Section 3: Replacement immigration – An analysis

Results from the explicit analyses on the viability of replacement immigration as an alternative policy appear even less promising. The levels of replacement migration are unfeasibly high, requiring between ½ and 1½ million migrants per annum on average under various scenarios and resulting in unsustainable population growth. The year-on-year replacement migration levels are also very volatile, with peaks approaching 5 million in some cases, thus requiring an implausibly precise micro-management of policies implemented.

Neither optimistic fertility or mortality assumptions would make immigration-based policies any more suitable. Average replacement migration rates would still be considerably higher than the annual highs of 180,000 observed over the last few years.

Section 4: The Economic, Fiscal, and Social implications of immigration

The economic, fiscal and social benefits of immigration are cloudy at best. Much of the work is based on a snapshot analysis, using only easily available conventional statistics. What is needed is a critical time-series cost-benefit analysis of immigrants to formulate a more informed opinion. It is likely, however, that whatever the reality, immigration will remain an inefficient means to manage the demographic burden on the state pension system.

Section 5: Conclusions and Recommendations

The UK fertility rates would need to improve by significantly more than the official optimistic estimates and/or mortality rates would need to actually worsen to have any significant impact on the fiscal burden expected along the demographic transition.

Other than increasing the SPA, none of the options proposed by the Pensions Commission, in my view, deal with the problem of an ageing population, but simply delay it at the expense of future generations. The policies will remain exposed to uncertainties in future demographic trends, making it difficult for them to be time-consistent and exhibit intergenerational fairness. Immigration too cannot eliminate the threat of an ageing society on the UK's PAYG state pension system.

It is clear that these conclusions support the need for a radical solution that also caters for the different needs of different people. A solution that is time-consistent and independent of the uncertainties associated with changing demographics. Otherwise, reforms will amount to nothing more than just tinkering with the state pension system. The advocated course of action is a shift in focus to assessing critically the feasibility of (voluntary) private savings and the necessary actions required to make it workable – the fourth proposed key option. It is accepted that this course of action does not eliminate the threat at the macro-economic level of falling output relative to consumption caused by a diminishing workforce and expanding pensioner population. However, it would be a step in the right direction.

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1 *Introduction – The demographic challenge*

An ageing population and its implications on pay-as-you-go (PAYG) social security pensions is not a new phenomenon to most developed countries. Increasing longevity and falling fertility rates have been cited as the key drivers of this trend.

1.1 Demographic trends

In the UK, cohort life expectancy for males at age 65 has risen significantly from just over 12.0 years in 1960 to 18.1 years in 2000 and is projected to increase to 21.7 years by 2050. The comparative life expectancies for females are 16.0 years, 21.1 years and 24.4 years, respectively. These trends have been primarily driven by significant advancement in medical technology over the last half-century.

Total fertility rates, on the other hand, have declined from 2.72 per woman of childbearing age in 1960 to 1.64 in 2000. Government statisticians expect the rates to stabilise at 1.74 by 2016. Although this represents a marginal increase on the 2000 rate, it is well below the replacement rate of about 2.1 estimated by demographers to maintain a stable population in the long term. Part of this decline in fertility rates can be explained by increasing number of women participating in the labour market and choosing to defer having children. A continuing trend in the deferral of births, however, would reduce the likelihood of achieving the target rate of 1.74.

Tables 1.1 and 1.2 below compare the UK mortality and fertility indicators with other major European countries.

Table 1.1 **Mortality Indicators – UK and other EU countries**

	Life Expectancy at 65			
	Males		Females	
	1960	**2000**	**1960**	**2000**
UK	11.9	15.7	15.1	18.9
France	12.5	16.7	15.6	21.2
Germany	…	15.7	…	19.4
Italy	13.4	16.5	15.3	20.4
EU (15 countries)	**…**	**15.9**	**…**	**19.8**

Sources: Eurostat (2002) and Jollans (1997)

It should be noted that the figures in Table 1.1 relate to period mortality rates as opposed to cohort rates. As such, they make no allowance for subsequent actual or projected improvements in mortality and so provide an objective means of comparing trends within the UK and between different countries over time.

Table 1.2 **Fertility Indicators – UK and other EU countries**

	Total Fertility Rate		Mean Age at Childbirth	
	1960	**2000**	**1960**	**2000**
UK	2.72	1.64	27.8	28.5
France	2.73	1.88	27.6	29.4
Germany	2.37	1.38	27.5	28.7
Italy	2.41	1.24	29.2	30.3
EU (15 countries)	**2.59**	**1.50**	**28.2**	**29.4**

Source: Eurostat (2002)

Both the mortality and fertility indicators clearly point towards an ageing population across the listed EU countries.

1.2 Implications of an ageing population on social security pensions

Most developed countries finance their social security pensions on a PAYG basis. Under this approach, contributions paid by today's workers in the form of taxes are used to pay the benefits of today's pensioners. No funds are set aside, although some countries hold a reserve to smooth differences in cashflows arising from contribution income and benefit outgo.

A balanced PAYG system can be mathematically represented as follows:

$$Np(t) * P(t) = Nw(t) * W(t) * CR(t) \tag{1}$$

$Np(t)$ = Number of pensioners in receipt of benefits at time t
$Nw(t)$ = Number of workers contributing at time t
$P(t)$ = Average pension in payment at time t
$W(t)$ = Average wage at time t
$CR(t)$ = Contribution rate at time t

Equation (1) can be re-expressed as:

$$CR(t) = \frac{Np(t)}{Nw(t)} * \frac{P(t)}{W(t)}$$

$$\Rightarrow CR(t) = DR(t) * \frac{P(t)}{W(t)} \qquad \textbf{(2)}$$

$DR(t)$ is commonly known as the "(old-age) dependency ratio" or "1/support ratio". It is a measure of the number of pensioners being supported by each member of the working population. This ratio can be difficult to measure accurately since it will be influenced by factors such as unemployment, homecare responsibilities and varying retirement patterns. However, it is commonly defined as the population aged 65 and over as a percentage of the population aged between 20 and 64.

It is easy to see that both falling fertility rates and increasing longevity result in a shrinking working class population relative to the pensioner population, thereby of increasing the dependency ratio over time. Since the dependency ratio is directly proportional to the contribution rate required to finance the benefits on a PAYG basis (equation 2), an increase in this ratio will require an increase to the contribution rate, ceteris paribus.

Table 1.3 below shows that the UK is clearly in a much favourable position demographically and is expected to age more slowly than the other major EU countries over the next 50 years. It is also expected to age more slowly than Australia, Canada (40.9) and Japan (71.3), with the exception of the USA (34.9) (*Select Committee, 2003*). However, in the absence of any further action, an ageing population will increase the burden on future young generations, making it increasingly difficult to sustain a PAYG system in the long term. In the very long term, it could threaten the solidarity between those in work and those in retirement that forms the foundation of state benefits funded on a PAYG basis. The UK, therefore, should waste no further time in capitalising on its favourable position in reforming the state pension system.

Table 1.3 Current and projected dependency ratios – UK and other EU countries

	2000	2050
UK	24.4	39.2
France	24.5	46.7
Germany	24.1	54.7
Italy	26.7	68.1
EU average	**24.5**	**54.7**

Source: Eurostat (2002)

1.3 Reforming the state pension system

The Government has already taken remedial action to deal with the problems of an ageing society. Previous reforms included reduction in the state earnings related benefits (SERPS), equalisation of the SPA for women, promoting private provision and breaking the pensions increase link to wage inflation. However, these policies have been reactive to projected demographic trends that in hindsight have proved consistently optimistic. As such, the actions of the Government have been far from sufficient and have merely delayed the problem at the expense of future generations.

In October 2004, the UK Pensions Commission proposed four key options in its First Report to maintain a viable state pension system. Three of the four options included:

- Reduction in benefits
- Increase in taxes and
- Increase in the SPA

As mentioned, most of these reforms have already been implemented to some extent in the past. However, besides increasing the SPA, none of the proposals address the root of the problem – that of an ageing population. As such, the policies will be vulnerable to changes in the future UK demographics and may not represent viable and sustainable long- term solutions.

Part of the Pensions Commission's remit was to also make recommendations on a fourth option of compulsory savings beyond the existing mandatory state earnings-related second tier pension system.

2 *Viability and sustainability of the Pensions Commission's proposals*

2.1 Impact of wage and benefit growth on contribution rates

Unlike some European countries, state benefits in the UK are increased in line with price inflation instead of growth in National Average Earnings (NAE) – although the last three years have seen increases in excess of this *(HM Treasury, 2005).* This implies that contributions as a percentage of earnings can be expected to grow at a faster rate than benefits linked to retail prices, if earnings of the working class population are assumed to reflect real economic growth. This will serve to offset the increases in future contribution rates required in response to increasing dependency ratios. Equation (2) can therefore be expanded as follows:

$$CR(t) = DR(t) * \frac{P(0)}{W(0)} * \frac{1}{(1+j)^t}$$

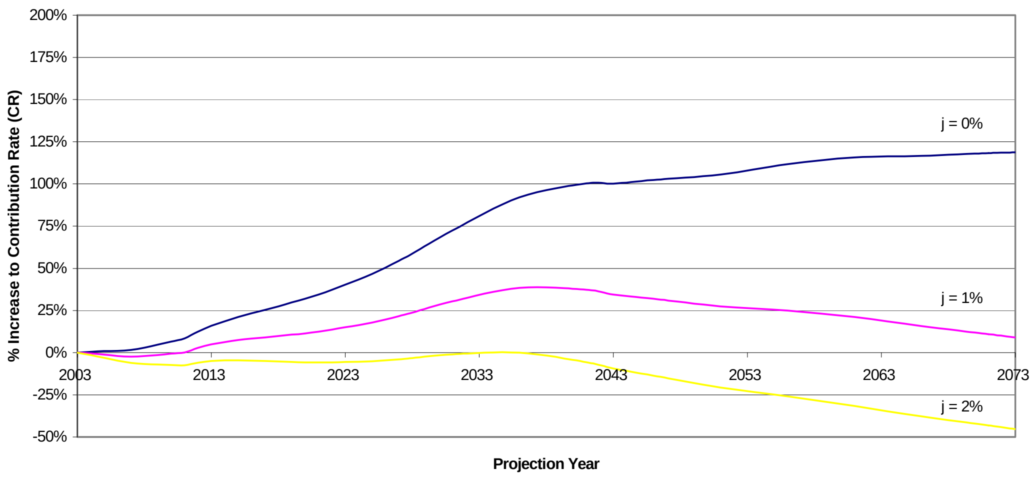
$$\Rightarrow CR(t) = DR(t) * K * \frac{1}{(1+j)^t}, \qquad \textbf{(3)}$$

where K is the ratio of the initial average pension to average wage and is assumed constant. J is the earnings net of price inflation and has averaged about 1½% pa since the early 1980's – see Figure A.1 in Appendix A.

Assuming K equals *1/DR(0)* then, without loss of generality, Figure 2.1 shows projected increases to current contribution levels (CR(t)/CR(0) –1) on various net earnings assumptions. The analysis is based on the Government Actuary's Department (GAD) natural change variant projections, which assume zero future net migration but with fertility and mortality assumptions as for their principal projections.

Strictly speaking, the denominator of the dependency ratio should be adjusted for economic activity rates, since not all persons of working age are economically active and able to support the current retired members of the population. However, economic activity rates can vary significantly between different age groups and between males and females so have been ignored for simplicity – see Figure A.2 in Appendix A. This could be interpreted as assuming all persons of working age being economically active at all times. Although this is likely to underestimate the true cost to workers of the retired population, it enables us to gauge the extent to which policies designed to improve economic activity rates will be useful. The analysis could easily be modified to allow for age specific economic activity rates but the broad nature of the results is likely to remain unchanged.

Figure 2.1: % Increase in CR on various earnings growth assumptions - SPA=65



Source: Author analysis of the GAD 2003-base natural change variant projections data

Note that for *j* equals zero the trend also represents re-based projected dependency ratios on the above assumptions. In this case, the current dependency ratio or contribution rate is expected to double by 2040. The steep rise in the ratio between 2023 and 2043 reflects the 1960s baby boomers reaching SPA.

Sections 2.2 to 2.4 discuss the three options proposed by the Pensions Commission.

2.2 Option 1 – Reduction in benefits

Reduction in benefits can take two forms, either an actual reduction to the amount of benefits to which an individual is entitled or a reduction in real terms.

In 1986, the rate of accrual for SERPS in the UK was reduced from 25% of the best 20 years' revalued earnings to 20% of average career earnings, thereby reducing the actual benefit entitlement at retirement. Similarly, the link between the basic state pension and earnings growth was broken in the early 1980s and increases were linked to price inflation instead. Although this ensures that pensioners are not worse off when it comes to consumption in real terms, breaking the earnings link will mean that they will not benefit from future economic growth.

Figure 2.1 shows that if earnings growth were to exceed price inflation by less than 2% pa in the long term, a nominal reduction in benefit entitlement would be required to help sustain the system. However, cutting benefits under these circumstances may not solve the problem. On the contrary, it could create poverty in old age and result in increased means-tested benefits given the Government's paternalistic role towards the elderly of our society.

Following the introduction of the Pension Credit in October 2003, the Government actually increased its 2004/05 spending in real terms by £5.7 bn - more than if the basic state pension had been linked to earnings since 1998 (*HM Treasury, 2005*). If this trend were to continue, Figure 2.1 clearly indicates the huge fiscal costs this would entail. The system may still not be sustainable if net earnings growth were to exceed price inflation by 2% pa or more. Benefits, although linked to price inflation, would decline considerably relative to the earnings of the working class population in these circumstances and the Government would come under increased political pressure from an expanding "grey" electorate to restore the earnings link in future, let alone be able to cut the nominal amount of benefits. Any problem-free years are therefore likely to be short lived.

2.3 Option 2 – Increases in taxes/National Insurance contributions

Based on current projections, it is apparent from Figure 2.1 that the affordability of state pensions in the long term is significantly influenced by the net earnings growth assumption. If benefits increased in line with earnings, then an ageing population would require ever-increasing contributions, doubling in 40 years by 2043. Even if benefit increases lagged behind earnings by 1% pa, a contribution increase of 40% of current levels would be required by about 2035, before the compounding effect of real earnings growth gradually reduces the rate back to its current levels. On the other hand, if earnings growth were expected to exceed price inflation by 2% pa then, on the same assumptions, the required contribution rate would be expected to remain broadly stable until 2035, falling below its current levels thereafter.

The changes to taxes/National Insurance contributions that would be required are likely to be too large to be viable in the long term if past trends in net earnings growth were to continue. The required changes are also likely to be volatile given the sensitivity of the contribution rates to long-term economic assumptions.

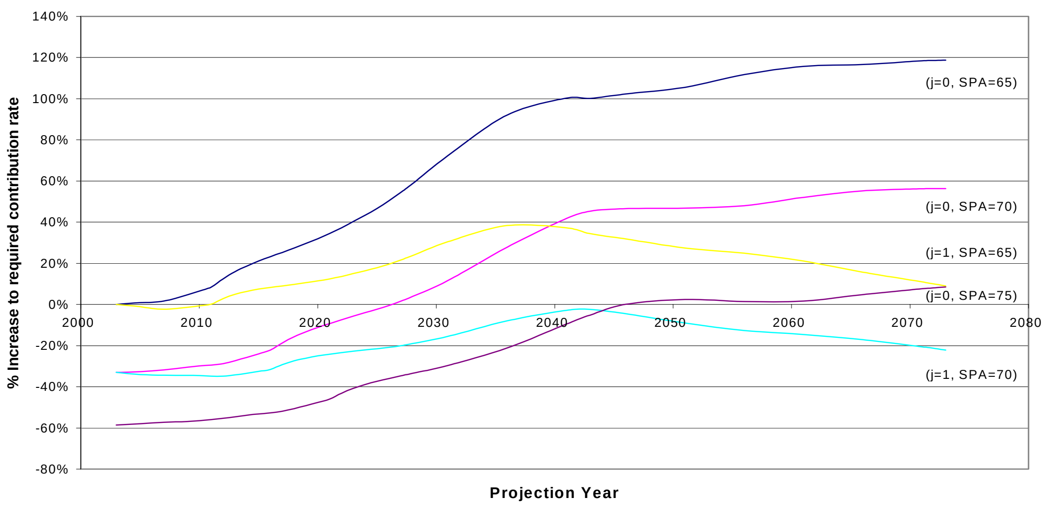
2.4 Option 3 – Increasing the SPA

The rationale for increasing the SPA is essentially to sustain the dependency ratio by increasing the number of workers relative to pensioners, thereby containing any increases in the contribution rate required to fund state benefits along the demographic transition. It reinforces the role of the state as an insurer against poverty in old age only and signals to workers the need to extend working life to keep pace with increasing longevity.

Cooper et al (2003) have shown that despite increased longevity, the proportion of time spent in poor health has not changed significantly for either males or females – i.e. gains in life expectancy are split between time spent healthy and time spent in poor health. Since the "unhealthy years" will largely occur at the end of people's lifetimes, increasing the SPA may reduce the time spent in "healthy retirement". However, projections by Rickayzen and Walsh (2002) indicate the contrary. They conclude that fewer older people will live in severe ill health in the long term – i.e. that gains in life expectancy will be weighted more towards time spent in a healthy state. However, they accept that their conclusions may be incorrect because the underlying data for model-building are inconclusive. Given the uncertainty surrounding their results they further conclude that results similar to those observed by Cooper et al may also be valid. This is clearly a controversial area. However, increasing the SPA will only really be justifiable if we are expected to live longer healthier lives.

The Pensions Reform Group (PRG) recommend that an independent body be set to recommend future increases in the SPA, analogous to the Monetary Policy Committee (MPC) for setting interest rates *(Cooper et al, 2003)*. The Confederation of British Industry (CBI) add that raising the SPA must be a policy for the medium term so that people have time to prepare and adjust and that such a move would help finance a more generous basic state pension *(CBI, 2005)*. Assuming that the average pension and wage remains constant (i.e. K remains the same in equation (3)), Figure 2.2 shows that immediately raising the common SPA to 70 or 75 would only be viable until 2025 and 2045, if benefits are revalued in line with earnings.

Figure 2.2: **% Increase to intial contribution rate_SPA = 65, 70**



Source: Author analysis using the GAD 2003-base natural change variant projections data

Even if we assume net earnings growth of 1% pa, Figure 2.2 shows that with a common SPA of 70, increases to contribution levels over the period 2030 to 2050 could be positive had we not implicitly assumed economic activity rates of 100% in our model. Achieving full employment in reality would be difficult if past trends are anything to go by. Evidence from Blake and Mayhew (2004), ONS (2004) and the Pensions Commission's First Report (2004) suggests that many people retire well before SPA and that the average age of transition from work to retirement has actually fallen significantly across most European countries over the last half-century, despite increases in longevity. The lack of availability of jobs at older ages and the preference of employers for younger and more energetic workers will require a shift in attitude before activity rates can be improved. Otherwise, a fall in retirement spending would simply be offset by a rise in unemployment benefits.

The effects of increasing the SPA on various subgroups of the population also need to be considered. Whilst it may be justified for the relatively healthy and wealthy, it could have a disproportionate negative effect on the unhealthy and those from lower income groups who are expected to rely more on state benefits and are likely to live shorter lives in retirement than average.

Increasing the SPA in response to mortality improvements may not be practical and could result in additional problems to those described above. For example, there will be issues regarding the timing of actually setting the (cohort-specific) SPA. Making the changes closer to retirement would result in frequent changes as each cohort approaches SPA, whereas fixing it early on would make the system vulnerable to further demographic changes. In addition, unless effectively communicated, setting (cohort-specific) SPA may not be viewed as satisfying either intra-generational or inter-generational fairness and could send the message that the Government cannot get its policies right. The uncertainty of not knowing when one is able to retire and be eligible for state benefits could act as a catalyst for people losing faith in the system and could result in the breakdown in solidarity between generations. Ultimately, it could trigger the need for radical changes to the system.

Having said that, Sweden introduced just such a system in 2003. It will take some time before we will be able to tell whether people have accepted the system and whether the reforms have been a success.

2.5 Comments

The brief analyses of the Pensions Commission's proposed options show that each policy option requires changes that are too large for the policy to be implemented on its own. A combination of higher taxes/contributions and higher SPA is likely to be required. However, even under the most plausible of scenarios where the common SPA is increased to age 70 and benefits are increased in line with earnings, a 40% increase in the contribution rate is required by 2040 to sustain the state pension system. The required increase is likely to be even higher if economic activity rates are taken into consideration. An increase to the SPA would need to be accompanied by higher economic activity rates post SPA nevertheless and be time-consistent for the policy to be more effective and fair – i.e. policies cannot pass the buck to future generations.

Although immigration has been widely viewed as an alternative response, the Pensions Commission makes no explicit consideration of it as a policy lever to combat the effects of an ageing population. Hence we look at this in the next section.

3 Replacement immigration – An analysis

Advocates of immigration, including the Government, view it as a means of neutralising an ageing population by increasing the size of the labour force. Despite these widely held views, it is surprising that relatively little research has been done on the (economic) viability of immigration as an automatic population stabiliser.

The suggestion of using immigration to combat an ageing and otherwise declining population seems reasonable. The supply of foreign workers is unlikely to be much of a problem since many consider the UK an attractive place to work. The crucial questions that need answering, however, are the levels of migrants required to balance the UK population to avoid the need for making other major adjustments to pensions policies discussed in Section 2, and whether the determined levels are sustainable in the long term. One approach, considered here, would be to construct an explicit population projection model consistent with official projections and use it to explore the number of migrants required year-on-year under the various scenarios depicted in Figure 2.2 that, in the absence of migration, would result in an increase to the contribution rates from current levels along the demographic transition.

3.1 Projection model

Current official projections by the GAD use the "component method" of population projections. The age-specific population is projected, from one mid-year to the next, using deterministic recursive formulae identifying the factors that contribute to the change in the size of the population; namely, mortality, fertility and migration. For each age, the starting population plus net inward migrants less the number of deaths during the year produces the year-end population, one year older. To this has to be added the survivors of those born during the year.

The GAD projections assume that migration occurs uniformly throughout the year. For calculation purposes, this assumption can be simplified by assuming half of the net migrants in a given year at a given age migrate at the beginning of the year and half migrate at the end of the year. As a result, the number of net migrants to be added to the population aged x at the end of the projection year consists of half of those migrating during the year aged x-1 and half of those migrating during the year aged x. The number of deaths in a given projection year are calculated by applying the appropriate age-specific mortality rate to the population at the beginning of the year and half of the net inward migrants during the year. The projections are performed separately for each gender.

In the absence of any additional information on the computational process of the projections the following recursive formula is proposed:

$$P_x^i(t) = P_{x-1}^i(t-1) + 0.5 * \left\{M_{x-1}^i(t) + M_x^i(t)\right\} - q_{x-0.5}^i(t-1) * \left\{P_{x-1}^i(t-1) + 0.5 * M_{x-1}^i(t)\right\}, \quad \textbf{(4)}$$

$P_x^i(t)$	=	Population aged x at mid-year t; i =male (m) or female (f)
$q_{x-0.5}(t-1)$	=	Probability that a life aged x-1 last birthday at t-1 dies in [t-1, t] assuming uniform distribution of birthdays over the calendar year
$M_x(t)$	=	Net migrants (+/-) during [t-1, t] who survive to be age x last birthday at t.

The population of females of childbearing age will change over the projection interval [t-1, t] due to mortality and migration. This will subsequently affect the number of births, calculated using a separate model, over the same period. The mean of the female population at each age at the beginning and end of the year is multiplied by an age-specific fertility rate appropriate for the projection year in question. The total number of births is then subdivided by gender assuming a male to female ratio of 105:100. A special gender-specific infant survival rate is then applied to the projected number of male and female births. To each is added half the number of respective net migrants aged 0 last birthday to determine the total number of infants aged 0 at the end of the year. On this basis, the proposed recursive formula for the number of births is:

$$P_o^i(t) = 0.5 * M_0^i(t) + (1 - {}_{0.5}q_0^i(t-1)) * \Phi^i * \sum_x 0.5 * \left\{P_x^f(t-1) + P_x^f(t)\right\} * f_x(t), \text{ where} \quad \textbf{(5)}$$

$P_0^i(t)$ = Births during [t-1, t] who survive to be age 0 at mid-year t; i = *m* or *f*

$f_x(t)$ = Fertility rate over [t-1, t] for women aged x last birthday at time of birth

$1 - {}_{0.5}q_0(t-1)$ = Special survival rate of a life born in [t-1, t]
Φ = Gender ratio – Φ^m = 105/205 and Φ^f = 100/205

The total population in a given projection year, $P(t)$, is then given by:

$$P(t) = \sum_{i=m,f} \left\{ P_0^i(t) + \sum_{x>0} P_x^i(t) \right\} \qquad \textbf{(6)}$$

3.2 Model assumptions

The assumptions adopted for the official 2003-base principal population projections are summarised in Tables B.1, B.2 and B.3 of Appendix B.

Mortality assumptions Mortality rates for the first year of the projections are based on best estimates of the numbers of deaths in 2002-03. Changes in rates thereafter are based on historic trends before 2002. In summary, the improvements in projected mortality rates by age and gender converge to a common reduction of 1% per annum at each age in 2027, halving over each future period of 25 years thereafter. Improvements to these target rates over time are not assumed to take place linearly, but more rapidly at first. In the absence of further details on the profile of mortality improvements, the model adopts an approximate scale consistent with the shape and target rates of future improvements to interpolate mortality assumptions for intermediate longer-term projections.

Migration assumptions Migration assumptions for the first year of the projections take account of estimates for the second half of 2002. Assumptions for future levels of migration are based on an analysis of historic trends from several data sources, such as the International Passenger Survey (IPS) data on international migration and advice from the Home Office on asylum claimants. In summary, a net inflow of 130,000 migrants into the UK has been assumed over all future projection years – up from 103,000 and 100,000 assumed in the 2002 and 2001 based projections, respectively.

Fertility assumptions Assumptions regarding future fertility rates have also been based on the analysis of historic trends from various data sources. The rates are calculated on a cohort basis as these are more stable and change smoothly over time than rates calculated on a period basis. In summary, the Total Fertility Rate (TFR) in the long term for the UK as a whole has been assumed to eventually level off at 1.74 children per woman of childbearing age. Model assumptions for intermediate longer-term projections are determined by linear interpolation.

3.3 Model validation

Before the model can be used to analyse the replacement levels of migration required to maintain the projected contribution rates at 2003 levels, it needs to be tested for consistency with the official projections in the public domain if we are to have any confidence as to the accuracy of the results. Table 3.1 compares the combined male and female model projections with the GAD principal projections for selected future years. The total change in population over a given projected year or period is broken down into its constituent elements of births, deaths and migration.

Table 3.1 Components of change – GAD Principal vs. Model projections

	2003-04			2010-11			2025-26			2046-51		
(000's)	GAD	**Model**	Δ	GAD	**Model**	Δ	GAD	**Model**	Δ	GAD	**Model**	Δ
Population at start	59,554	**59,554**	*0.0%*	61,166	**61,165**	*0.0%*	64,707	**64,702**	*0.0%*	66,723	**66,723**	*0.0%*
Births	706	**706**	*0.0%*	683	**683**	*0.0%*	698	**698**	*0.0%*	3,395	**3,395**	*0.0%*
Deaths	603	**602**	*(0.2)%*	578	**578**	*0.0%*	633	**633**	*0.0%*	3,980	**3,980**	*0.0%*
Migration	130	**130**	*0.0%*	130	**130**	*0.0%*	130	**130**	*0.0%*	650	**650**	*0.0%*
Population at end	59,787	**59,788**	*0.0%*	61,401	**61,400**	*0.0%*	64,902	**64,897**	*0.0%*	66,787	**66,788**	*0.0%*

Source: Author analysis and GAD 2003-base principal projections database, 2005

Based on the above results we can be confident that the model projections are consistent with the official GAD projections. The margin of error is only about 0.01% for projections up to and including 2028, the year to which year-on-year age-specific official projections and assumptions are available, and remains below this level until

2043, the last selected year of longer-term projections for which age-specific results and assumptions are available.

Having verified the validity of the model, the year-on-year replacement migration levels can now be determined.

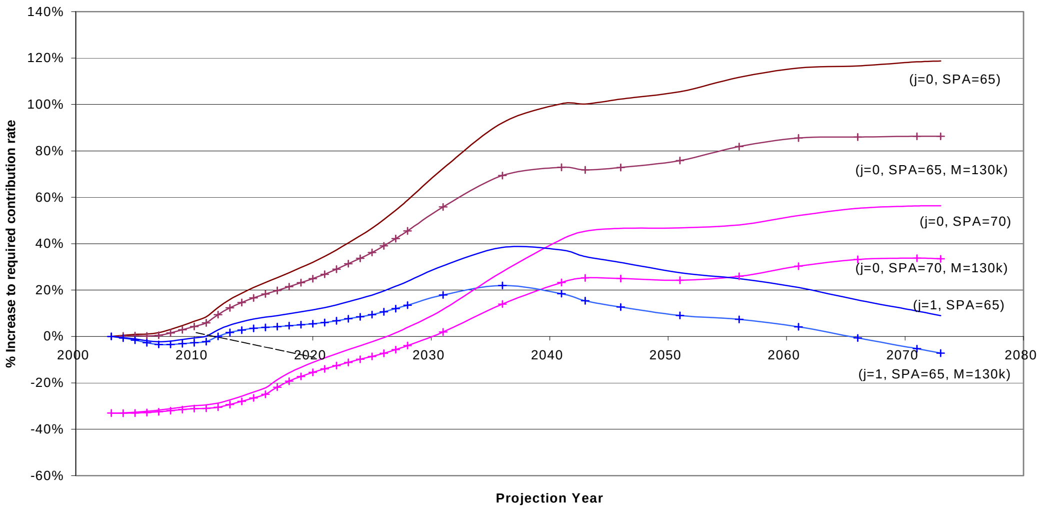
3.4 Model Results

3.4.1 GAD Principal Projections

Figure 2.2 in Section 2 highlights three scenarios under which significant increases to current contribution levels developed along the demographic transition in the absence of migration – scenario 1, (j=0%, SPA = 65); scenario 2, (j=1%, SPA = 65) and scenario 3, (j=0%, SPA = 70). Figure 3.1 below compares the contribution profiles for the same three scenarios, but assuming an annual net inflow of 130,000 migrants as per the GAD principal projections. With the exception of scenario 3 in the very long term, the results show that although the assumed levels of migration significantly offset the increases to the contribution rate, they are insufficient to eliminate the fiscal cost in the long-term. Under scenario 1, the required increase in the contribution rate reduces by a quarter from 100% to 75%, by 2040. Similarly, for scenarios 2 and 3, the required increase in the contribution rate is halved from 40% to 20% by 2040, with the gaps in rates between alternative migration assumptions maintained at about 20% thereafter.

Unlike scenarios 1 and 2, the contribution profile for scenario 3 (j= 0%, SPA = 70) need not necessarily require increased levels of migration in the long term. If actual contributions or taxes remained at current levels, any surplus built up over the period to 2025 could then be used as a reserve to cover the shortfall arising after 2025 due to rising dependency ratios. However, in an analogous manner to the recent equalisation of the SPA for women to age 65, further increases to the SPA are also likely to be phased over a period of time to enable the working class population to get accustomed to the change. As a result, any surplus arising is likely to be much smaller. For the purposes of this paper, it is assumed that no reserve is held that may subsequently affect future levels of replacement migration, which are determined from the time the projected contribution rate rises above the 2003 level.

Figure 3.1: % Increase to intial contribution rate, principle vs. zero-migration variant



Source: Author analysis of the principal and variant GAD 2003-base projections data

3.4.2 Year-on-year replacement levels

Assuming migrants enter and retire from the workforce at the same average ages with the same average wage and pension entitlements as the host population, we can retain the assumption of keeping the ratio of the initial average pension to average wage, K, constant. Using equation (3), we determine the projected contribution rate at time 1 (2004), as before. The number of migrants that need to be added to the population at the start of the projection year to eliminate the observed increase in the projected contribution rate at the end of the year is then determined. Equation (3) is reapplied to the "new" projected population at time 1 to determine the "new" projected contribution rate at time 2 (2005). The process is repeated for each scenario until replacement levels are determined for all future years.

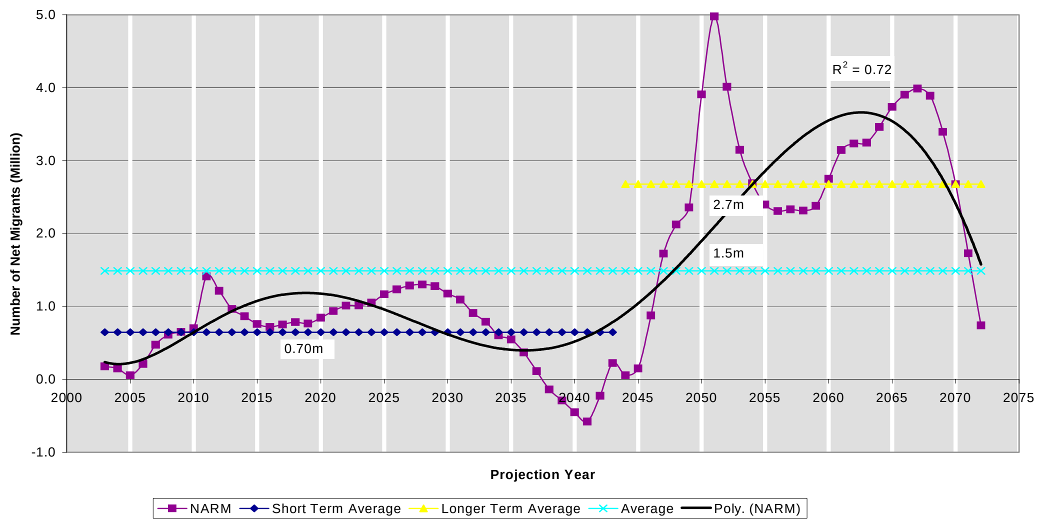
For simplicity, it is assumed that migrants enter the workforce at an average age of 25. This assumption is consistent with the migration assumptions underlying the

GAD principal projections, where the weighted average age for both male and female migrants is just below 25, with a standard deviation of about 5 years. The assumption is also consistent with actual ONS figures recorded in 2003.

The gender composition of the total net migrants is as assumed under the GAD principal projections and is marginally biased towards females. This is somewhat at variance to other data sources (e.g. *ONS, 2005*), which indicate a male predominance amongst migrants throughout the last decade.

All other assumptions remain unchanged.

Figure 3.2: Scenario 1 - Net Annual Replacement Migration (NARM), SPA=65, j=0%

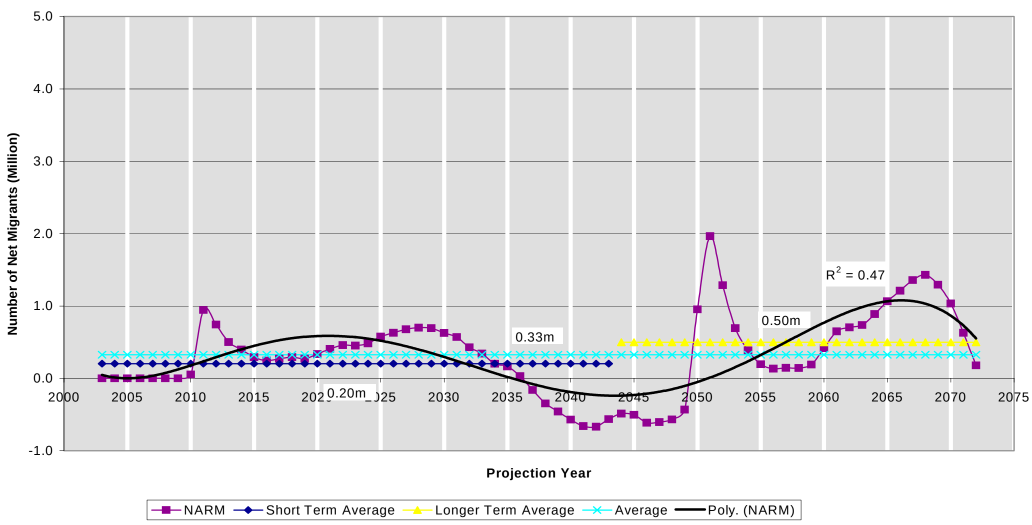


Source: Author analysis

Figure 3.2 indicates that an average of 0.7 million migrants are required over the period to 2040 to contain the increases in future contribution rates under scenario 1. What appears to be an anomaly at 2011 is, in fact, a feature of the underlying population projections and is prevalent in both the official and model projections. Subsequent falls reflect slowing growth rates in the dependency ratios, thanks primarily to decreasing rates of assumed mortality improvements. Average annual replacement levels of migration increase considerably to around 2.7 million per annum after 2040. The smooth curve represents a line of best fit to the year-on-year levels of replacement migration.

We note the volatility of the year-on-year replacement migration levels. A further interesting observation is the repeat cycle of migrant numbers in the second half of the projection horizon compared to the first, albeit more amplified. Replacement levels start rising from their previous lows from 2043 as the first generation of 25-year-old migrants in 2003 reaches SPA. The peak net inflow of 5 million migrants required in 2051 corresponds to the peak of 1.5 million required in 2011. This characteristic cyclical pattern, each successive cycle more volatile than the previous, is likely to be observed if the analysis were to be extended further into the future. It also reflects the fact that immigrants themselves age and subsequently require more immigrants to replace their numbers.

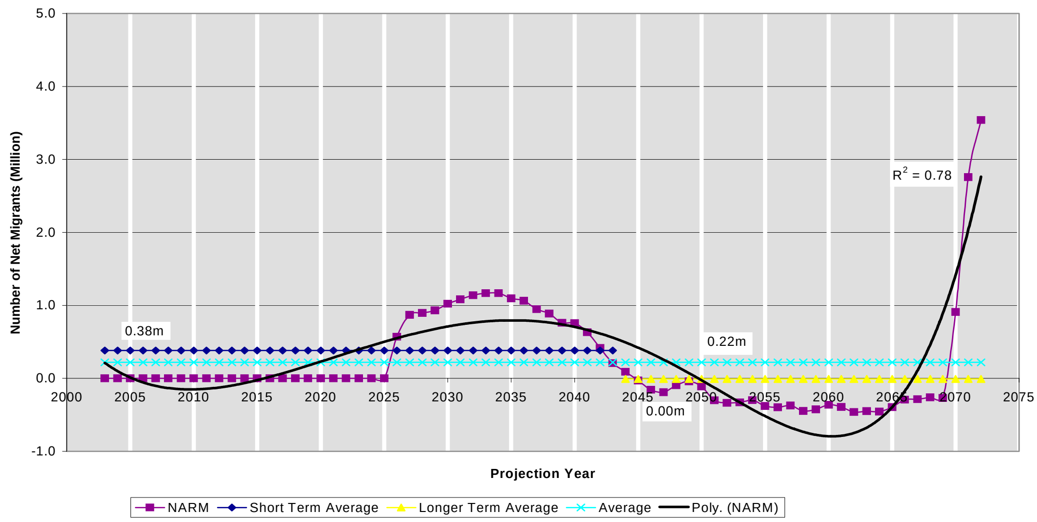
Figure 3.3: **Scenario 2 - Net Annual Replacement Migration (NARM), SPA=65, j=1%**



Source: Author analysis

As expected, the required replacement levels under scenario 2 shown in Figure 3.3 are lower than under scenario 1 since the lagged growth in benefits behind earnings requires lower contribution increases (and therefore migrants) along the demographic transition – Figures 3.2 and 3.3 adopt the same scale for ease of comparison. The long-term replacement levels are also comparatively less volatile, with both the short and longer-term averages closer to the projection horizon average of 330,000 migrants per annum. This is also expected since fewer initial migrants require fewer additional migrants to replace them in the longer term and due to the increasing dominance of the compounding effect of real earnings growth over ageing demographics.

Figure 3.4: Scenario 3 - Net Annual Replacement Migration (NARM), SPA=70, i=0%



Source: Author analysis

A one-off increase to the SPA to age 70 improves both sides of the dependency equation, thus requiring fewer replacement migrants initially. However, with benefits linked to earnings growth, Figure 3.4 shows that an ageing population would eventually require significant inflows of migrants under scenario 3, with levels surpassing those under scenario 2 over the medium term (¾ million compared to ½ million per annum), becoming increasingly volatile in the long term. Nevertheless, the replacement average over all future projection years is lower at 0.22 million per annum, making periodic increases to the SPA potentially a more effective policy measure.

It is not sufficient to look just at the migrant numbers in isolation. Their impact on the demographics of the UK population also needs to be considered.

3.4.3 Demographic implications of replacement migrants

Tables 3.4 to 3.6 summarise the key model demographic indicators for selected projection years for the three scenarios under consideration. Tables 3.2 and 3.3 are indicators derived from the GAD principal and zero-migrant variant projections for comparative purposes. The tabulated annual population growth refers to growth experienced over the previous year. The numbers of net migrants are those required at the beginning of the projection year to eliminate the observed increase in the projected contribution rate at the end of the year due to population ageing. The final row represents the cumulative standard deviation of replacement migration levels from 2003 up to the projection year in question and provides a measure of future migration volatility.

Demographic Indicators

Table 3.2: GAD - Zero Migration Variant

	2003	2010	2025	2051	2071
Population (000's)	59,554	60,149	60,822	56,721	51,170
Mean Age	38.9	40.2	43.3	46.6	47.0
Popn SPA^+ (000's)	9,510	10,288	13,619	16,318	15,329
Popn 20-SPA^- (000's)	35,264	35,811	34,427	29,442	26,031
Dep. Ratio	27%	29%	40%	55%	59%
Popn change p.a. (000's)	-	73	-5	-250	-272
Popn growth %p.a.	-	0.1%	0.0%	-0.4%	-0.5%
Net Migration (000's)	0	0	0	0	0
Cum. Mig. Stdev (000's)	0	0	0	0	0

Table 3.3: GAD - Principal Projections

	2003	2010	2025	2051	2071
Population (000's)	59,554	61,166	64,707	66,787	66,430
Mean Age	38.9	39.9	42.3	44.7	45.0
Popn SPA^+ (000's)	9,510	10,288	13,609	17,081	17,682
Popn 20-SPA^- (000's)	35,264	36,579	37,052	36,025	35,192
Dep. Ratio	27%	28%	37%	47%	50%
Popn change p.a. (000's)	-	232	205	13	-17
Popn growth %p.a.	-	0.4%	0.3%	0.0%	0.0%
Net Migration (000's)	130	130	130	130	130
Cum. Mig. Stdev (000's)	0	0	0	0	0

Table 3.4: Model - Scenario 1

	2003	2010	2025	2050	2071
Population (000's)	59,554	62,730	83,314	111,591	207,918
Mean Age	38.9	39.5	38.6	41.3	37.1
Popn SPA^+ (000's)	9,510	10,286	13,612	18,746	33,222
Popn 20-SPA^- (000's)	35,264	38,141	50,475	69,511	123,188
Dep. Ratio	27%	27%	27%	27%	27%
Popn change p.a. (000's)	-	817	1,606	2,670	5,310
Popn growth %p.a.	-	1.3%	2.0%	2.5%	2.6%
Net Migration (000's)	178	700	1,167	3,908	2,676
Cum. Mig. Stdev (000's)	-	258	352	762	1,337

Table 3.5: Model - Scenario 2

	2003	2010	2025	2050	2071
Population (000's)	59,554	60,148	69,222	68,797	85,158
Mean Age	38.9	40.2	41.1	46.3	43.0
Popn SPA^+ (000's)	9,510	10,286	13,612	16,374	23,293
Popn 20-SPA^- (000's)	35,264	35,811	40,551	38,036	44,344
Dep. Ratio	27%	29%	34%	43%	53%
Popn change p.a. (000's)	-	72	713	-851	1,521
Popn growth %p.a.	-	0.1%	1.0%	-1.2%	1.8%
Net Migration (000's)	0	54	577	954	1,034
Cum. Mig. Stdev (000's)	-	19	264	465	570

Table 3.6 : Model - Scenario 3

	2003	2010	2025	2050	2071
Population (000's)	59,554	60,148	60,820	81,446	69,852
Mean Age	38.9	40.2	43.3	41.2	47.9
Popn SPA^+ (000's)	6,853	7,334	10,012	13,015	12,376
Popn 20-SPA^- (000's)	37,922	38,764	38,029	48,259	45,891
Dep. Ratio	18%	19%	26%	27%	27%
Popn change p.a. (000's)	-	72	-5	-39	-473
Popn growth %p.a.	-	0.1%	0.0%	0.0%	-0.7%
Net Migration (000's)	0	0	0	-112	909
Cum. Mig. Stdev (000's)	-	0	0	464	505

Source: Author Analysis

GAD zero-migration variant Table 3.2 summarises the demographic indicators for the GAD zero-migration variant projections. The figures confirm earlier observations of rising UK dependency ratios and ultimately negative population growth in the absence of immigration, indicating a gradually ageing and declining population over time. The population size is projected to fall from 60 million in 2003 to 57 million in 2051.

GAD principal projections Table 3.3 summarises the demographic indicators for the GAD principal projections, which assume an annual net inflow of 130,000 migrants per annum. As expected, the dependency ratios are lower than in the zero-migration variant projections - 47% compared to 55% in 2051 - since the majority of migrants are aged in their early twenties. However, the dependency ratios continue to rise over future projection years implying that the assumed levels of immigration are insufficient to contain the ageing of the UK population. Under the principal projections, the population growth to 2051 induced by immigrants is roughly 10 million, of the total of 67 million.

Scenario 1 – SPA=65, j=0% As discussed in Section 2.1, the trend in contribution rates for scenario 1 represents re-based dependency ratios. The objective of maintaining future contribution rates at the 2003 level is therefore the same as preventing the dependency ratios from rising. Hence, the dependency ratios in Table 3.4 remain at 27% throughout. The volatile nature of the migrant replacement levels clearly distorts the mean age profile of the population. Nevertheless, given the assumed entry age of migrants, the mean ages remain lower than those under both the principal and zero-migrant variant projections at all durations.

The most striking observation is the significant growth rate and the marginalisation of the projected population under the GAD variant and principal projections that is induced by the migrant inflows required to maintain the potential dependency ratio. The current population of 60 million would exceed 100 million by 2050 and 200 million by 2070, the latter being equivalent to the present populations of the UK, France and Germany combined.

Scenario 2 – SPA=65, j=1%   Table 3.5 shows that the population growth implied by the replacement migration levels under scenario 2 is similar to that observed under the GAD principal projections over the short to medium term, adding only an extra 2 million people by 2050. In the long term, however, despite assuming real earnings growth of 1% p.a., the population growth is significant, adding just less than 20 million persons to the UK population by 2070.

The lower replacement levels of young migrants compared to scenario 1 in Table 3.4 (due to the contribution from the positive real earnings growth in sustaining future pension costs) is clearly insufficient to avert an ageing demographic profile. The dependency ratio is projected to nearly double from its current level of 27% to 53% by 2070. Without solving this root problem, the long-term viability of the state system under this scenario would depend crucially on maintaining the status quo regarding pension increases – i.e. paying increases of no more than price inflation.

Scenario 3 – SPA=70, j=0%   The immediate fall in the contribution rate as a result of increasing the SPA means there is no immediate need for immigrants to sustain the system. It is comforting therefore to observe that the model population, mean age and growth indicators for the years to 2025 in Table 3.6 are the same as for the GAD zero-variant migrant projections (Table 3.2). The dependency ratios are understandably lower because of the change in the definition of the SPA. Positive migration replacement levels between 2025 and 2045 followed by consistent negative levels between 2045 and 2070 distort the changes in population size over the whole projection period, peaking at 82 million in 2047.

Due to the inherent uncertainty underlying demographic projections, particularly over time-spans of 50 or more years, it is necessary to carry out a sensitivity analysis.

3.5 Sensitivity Analysis

Many of the assumptions adopted in analysing replacement migration levels can be questionable. It is therefore important to test the sensitivity of results to changes in the underlying assumptions by varying a single component at a time – i.e. under a comparative statics framework. Without further detailed research it is difficult to know the extent to which the demographic assumptions should be systematically varied to represent plausible alternatives. For this reason, variant assumptions for future mortality and fertility rates produced by the GAD are used as a basis for the sensitivity testing exercise.

Other assumptions that could be tested for sensitivity include child migration (as part of an incoming family of migrants), which will affect future replacement levels as migrant infants come of working age, or, the gender composition of migrants which can lead to significant second generational effects, influencing future births and subsequently future immigrant replacement levels.

The assumed entry age of 25 is not too critical because any change within the confidence interval will result in a horizontal shift in the required replacement levels over the second half of the projection horizon (depending on when the first generation of migrants reach SPA), with minor implications for the long-term average replacement rate. Any age outside the confidence interval is unlikely to be consistent with the fundamental assumption underpinning the objective of keeping the average wage to pension bill constant and so need not be considered.

I. *Fertility Assumptions* The GAD variant TFRs are assumed to depart from the long-term central estimate of 1.74 by +/- 0.2 – i.e. 1.54 in the case of the low variant projections and 1.94 for high variant projections.

Table 3.7 below compares the key demographic statistics of the replacement migration analysis under the three scenarios using GAD’s central (or median), low and high variant fertility assumptions for selected future years. As expected, it shows that higher/lower fertility requires lower/higher migration and results in lower/higher projected average ages, as more/fewer younger infants replace older migrants. In addition, the volatility of replacement levels in the short to medium term is expected to feed through to increased volatility in the longer term. These observations are consistent for all three scenarios and all future projection years. The tabulated replacement migration averages and standard deviations are cumulative up to the projection year in question.

An interesting observation is the lack of sensitivity to differences in fertility assumptions underlying the variant and standard results. This can be somewhat expected because of the stability inherent in the long-term fertility assumptions. However, a +/- 11% change in fertility assumptions generates a population change of only a +/- 3%. One would expect the knock-on effect of additional births on replacement levels (and subsequently population growth) of assuming significantly higher or lower fertility rates to be much more pronounced. A plausible reason is that as many migrants as required under the central estimates are also required under alternative fertility assumptions in the short term because of the twenty-year time delay in infants reaching working age before they can have any impact on the financial equilibrium of the PAYG state scheme. By this time, the immigrants already admitted to the population subsequently need to be supported by more immigrants.

Table 3.7: Sensitivity Analysis of Fertility Assumptions

		Variant / Year								
		HighFert			Median			LowFert		
Scenario	Data	2025	2050	2070	2025	2050	2070	2025	2050	2070
65_0%	Average Age	37.8	40.4	36.2	38.6	41.3	37.1	39.3	42.2	38.0
	Dependency Ratio	27%	27%	27%	27%	27%	27%	27%	27%	27%
	Cum. Mig. Ave. (000's)	750	722	1,388	752	786	1,496	754	842	1,594
	Cum. Mig. StDev.(000s)	350	762	1,275	352	762	1,337	354	765	1,398
	Total Population (000's)	85,481	114,190	213,583	83,314	111,591	207,918	81,437	108,966	203,130
65_1%	Average Age	40.3	45.4	41.8	41.1	46.3	43.0	41.8	47.3	44.0
	Dependency Ratio	34%	43%	53%	34%	43%	53%	34%	43%	53%
	Cum. Mig. Ave. (000's)	291	80	259	293	128	324	294	171	389
	Cum. Mig. StDev.(000s)	262	490	562	264	465	570	266	444	583
	Total Population (000's)	70,851	70,244	87,246	69,222	68,797	85,158	67,750	67,160	83,555
70_0%	Average Age	42.5	40.3	46.7	43.3	41.2	47.9	44.0	42.2	49.1
	Dependency Ratio	26%	27%	27%	26%	27%	27%	26%	27%	27%
	Cum. Mig. Ave. (000's)	0	276	70	0	314	133	0	350	194
	Cum. Mig. StDev.(000s)	0	445	512	0	464	505	0	485	503
	Total Population (000's)	62,129	83,751	71,487	60,820	81,446	69,852	59,567	79,239	68,236

Source: Author Analysis

The "time lag" also explains why, despite lower average levels of migration, population growth is higher for the high fertility variant than the low variant projections. Total fertility rates would therefore have to improve by significantly more than 1.94 to limit the dependency on replacement migration and curb population growth.

Note that the official projections assume that immigrants immediately acquire the fertility (and mortality) patterns of the indigenous population. However, empirical evidence suggests that migrants typically have higher fertility, although rates do converge slowly over time (*Coleman, 2000*). With a growing proportion of the population comprising of immigrants or of immigrant descent, a more accurate projection could incorporate separate fertility rates with a select period. However, this complication is ignored at this stage on the basis of the results of the sensitivity test and left for further research.

II. *Mortality Assumptions* The high mortality variant projections in Table 3.8 assume a 0% annual improvement in mortality at 2027, with rates remaining constant thereafter. The low mortality variant projections assume a 2% annual improvement in mortality at 2027, halving every twenty-five years thereafter.

Table 3.8: Sensitivity Analysis of Mortality Assumptions

	Variant	HighMort			Median			LowMort		
Scenario	Data	2025	2050	2070	2025	2050	2070	2025	2050	2070
65_0%	Average Age	38.7	41.5	36.9	38.6	41.3	37.1	38.5	41.1	37.5
	Dependency Ratio	27%	27%	27%	27%	27%	27%	27%	27%	27%
	Cum. Mig. Ave. (000's)	682	631	1,177	752	786	1,496	802	944	1,789
	Cum. Mig. StDev.(000s)	327	723	1,110	352	762	1,337	367	793	1,543
	Total Population (000's)	80,853	98,600	171,809	83,314	111,591	207,918	85,122	124,701	240,839
65_1%	Average Age	41.2	46.3	42.6	41.1	46.3	43.0	41.0	46.1	43.6
	Dependency Ratio	34%	43%	53%	34%	43%	53%	34%	43%	53%
	Cum. Mig. Ave. (000's)	237	44	203	293	128	324	332	220	438
	Cum. Mig. StDev.(000s)	223	435	503	264	465	570	276	481	613
	Total Population (000's)	67,153	60,752	68,874	69,222	68,797	85,158	70,742	77,214	100,522
70_0%	Average Age	43.0	41.6	47.0	43.3	41.2	47.9	43.4	40.9	47.9
	Dependency Ratio	25%	27%	27%	26%	27%	27%	27%	27%	27%
	Cum. Mig. Ave. (000's)	0	185	41	0	314	133	34	446	277
	Cum. Mig. StDev.(000s)	0	381	392	0	464	505	162	563	711
	Total Population (000's)	60,318	69,952	56,681	60,820	81,446	69,852	61,200	93,002	85,954

Source: Author Analysis

As expected, heavier/lighter mortality assumptions require lower/higher migration levels and ultimately result in lower/higher population growth. Again, the volatility of replacement levels in the short to medium term is expected to feed through to increased volatility in the longer term and these observations are consistent for all three scenarios and for all future projection years.

Results from changes in mortality assumptions exhibit greater sensitivity than the previous tests on fertility, particularly over the long-term where variations from the median population are roughly of the order of 20%. With the exception of the first scenario, the implied population growth under the high mortality variant appears more acceptable and is close to the GAD principal and zero-migration variant projections, thus supporting immigration as a viable policy tool over the long term - albeit at levels higher than historic trends. However, other than the onset of new diseases or epidemics, active mortality management is self-evidently not an option. If anything, mortality rates have consistently improved by more than predicted in the past and improvement rates underlying the median (principal) projections may too be pessimistic in hindsight. The proposition that high rates of improvements seen over the 20th century as a result of medical change are unlikely to be repeated or sustainable in the future (*GAD, 2004*) could easily be challenged by breakthroughs in genetic research, for example.

If historic trends in mortality improvement were to continue into the future, the results of the sensitivity tests clearly illustrate how the support for immigration as a viable policy alternative would quickly diminish.

III. *Gender Mix* The variants consider a migrant male to female mix of 75:25 and 25:75, respectively. Over the period to 2025, Table 3.9 below shows that similar numbers of migrants are required across all scenarios, irrespective of the gender mix. However, over long-term, the low-male/high-female (25M:75F) variant requires up to 100,000 and 250,000 fewer migrants per annum than the median and high-male/low-female (75M:25F) variants, respectively. The average population age in corresponding years observed across Table 3.9 is also progressively younger but the differences become less significant moving down the table from one scenario to the next.

Table 3.9: Sensitivity Analysis of Gender Mix

		Variant / Year								
		75M25F			Median			25M75F		
Scenario	Data	2025	2050	2070	2025	2050	2070	2025	2050	2070
65_0%	Average Age	40.0	43.2	40.5	38.6	41.3	37.1	37.6	40.4	35.3
	Dependency Ratio	27%	27%	27%	27%	27%	27%	27%	27%	27%
	Cum. Mig. Ave. (000's)	754	899	1,648	752	786	1,496	751	701	1,404
	Cum. Mig. StDev.(000s)	353	771	1,388	352	762	1,337	351	771	1,338
	Total Population (000's)	79,884	105,798	186,084	83,314	111,591	207,918	85,900	114,588	221,999
65_1%	Average Age	41.7	47.1	44.7	41.1	46.3	43.0	40.6	46.0	42.2
	Dependency Ratio	34%	43%	53%	34%	43%	53%	34%	43%	53%
	Cum. Mig. Ave. (000's)	293	173	368	293	128	324	292	94	299
	Cum. Mig. StDev.(000s)	264	425	533	264	465	570	264	497	613
	Total Population (000's)	68,010	67,329	81,359	69,222	68,797	85,158	70,136	69,420	86,961
70_0%	Average Age	43.3	43.3	48.1	43.3	41.2	47.9	43.3	39.8	48.7
	Dependency Ratio	26%	27%	27%	26%	27%	27%	26%	27%	27%
	Cum. Mig. Ave. (000's)	0	320	210	0	314	133	0	310	76
	Cum. Mig. StDev.(000s)	0	460	443	0	464	505	0	468	564
	Total Population (000's)	60,820	76,585	69,982	60,820	81,446	69,852	60,820	85,104	68,188

Source: Author Analysis

These observations are entirely due to second generational effects – the higher births under the low-male/high-female variant results in a younger population, whilst lower replacement averages of migrants means they have a lesser impact on the size and age distribution of the population. However, in most cases, these advantages are offset by higher levels of population growth.

The results in Table 3.9 should be interpreted with care. If the unbalanced male to female ratio of immigrants leads to a gender imbalance in the projected total population, then the assumed median fertility rates underlying the model may not be appropriate. If all immigrants were females, for example, the projected total population may also be predominantly female, particularly under scenario 1 where the replacement migration levels induce substantial population growth. With the projected population comprising of fewer males as a result, the assumed fertility rates may not be justifiable and are likely to over-estimate the total number of births and ultimately the total population.

IV. <u>*Child Migration*</u> Table 3.10 below shows results for the sensitivity test assuming each adult migrant (male or female) brings with them a child aged zero last birthday in any given projection year. The effect of this is similar to that observed when assuming a higher fertility rate or a high female composition amongst incoming migrants – i.e. lower levels of migration in the medium term. However, the volatility due to the time lag is much greater as fewer migrants are required in the medium term due to previous infant migrants reaching working age, and this is coupled with more migrants required in the long term as the same infant migrants subsequently reach SPA.

Table 3.10: Sensitivity Analysis of Child Migration

		Variant	Year				
		Median			**1Child**		
Scenario	Data	**2025**	**2050**	**2070**	**2025**	**2050**	**2070**
65_0%	Average Age	38.6	41.3	37.1	34.1	42.8	30.5
	Dependency Ratio	27%	27%	27%	27%	27%	27%
	Cum. Mig. Ave. (000's)	752	786	1,496	1,385	528	2,133
	Cum. Mig. StDev.(000s)	352	762	1,337	660	1,512	2,966
	Total Population (000's)	83,314	111,591	207,918	96,534	101,798	254,861
65_1%	Average Age	41.1	46.3	43.0	38.6	52.1	36.0
	Dependency Ratio	34%	43%	53%	34%	42%	55%
	Cum. Mig. Ave. (000's)	293	128	324	540	-132	593
	Cum. Mig. StDev.(000s)	264	465	570	432	1,177	1,636
	Total Population (000's)	69,222	68,797	85,158	74,218	59,820	102,424
70_0%	Average Age	43.3	41.2	47.9	43.3	37.9	56.9
	Dependency Ratio	26%	27%	27%	26%	27%	27%
	Cum. Mig. Ave. (000's)	0	314	133	0	511	-123
	Cum. Mig. StDev.(000s)	0	464	505	0	1,062	1,501
	Total Population (000's)	60,820	81,446	69,852	60,820	92,598	54,061

Source: Author Analysis

The conclusions regarding the replacement levels remain much the same as for the previous tests, although it is interesting to observe the projected population size for the third scenario falls to levels below those predicted under the GAD principal and zero-migration variant projections, at 54 million. This of course depends on whether the negative levels of net migration required to sustain the contribution rates for the state system on a year-on-year basis in latter years materialises in practice, either automatically or through some policy measure implemented by the Government.

3.6 Comments

If the SPA is increased to age 75 or more then the required migration replacement levels are likely to be small enough to be manageable, possibly even if employment levels are below full capacity – refer to Figure 2.2. However, contribution rates would still be exposed to a continually ageing population in the very long term. Such a substantial increase is also likely to be unpalatable, perhaps even if implemented periodically over the medium term. A recent report from the Institute for Public Policy Research (*IPPR, 2005*) recommended increasing the SPA but only to age 67.

If certain future economic conditions are also satisfied, such as real earnings growth exceeding 1½ % p.a., then this could help moderate the increase to the SPA to help sustain the system without depending too much on immigration. However, if real earnings growth remains at or below 1½% p.a. or benefits continue to increase in line with average earnings, the problem of sustainability becomes an acute one.

Any projection regardless of its size is likely to be proved wrong. Annual migrant numbers represent just over 0.2% of the current population size and any variation in the actual future experience from that assumed, no matter how minor, can be expected to influence replacement migration levels significantly. As a consequence, the results must be interpreted in the context of the assumptions underlying the model, particularly the premise that the ratio of the average wage to pension bill remains constant. This is a crucial constraint underpinning the model and implies that migrants enter and retire from the workforce at the same average ages and have the same distribution of skills to earn the same average wages and pension entitlements as members of the host population. Recent evidence, however, suggests an increasing trend in the proportion of low skilled migrants entering the UK to work on below average wages. The economic implications of this are considered in Section 4 but, in so far as the numerical analysis is concerned, the results could represent an underestimation of the true levels.

The model assumes that all migrants admitted to the UK population are effectively economic migrants, ready to work on entry. It assumes that jobs are available and that immigrants have the necessary skills to fill in those jobs. In reality, this may not be true. In fact, the vast majority of legal migrants to the UK over the last two or three decades did not enter primarily for the purposes of work but as dependants, students or more recently as asylum claimants. Only a minority have entered through any job recruitment process, although, of course, that does not preclude their working and many do (*Coleman, 2002a*).

Importing migrants can preserve any population that enjoys increasing expectations of life, coupled with reducing fertility. However, replacement rates under the more plausible scenarios analysed above are significantly higher than the recent annual inflows of around 180,000 - which themselves are very high by historical standards. With the increased likelihood of reinstating the earnings link to benefits and the apparent difficulty in increasing the SPA by a significant amount, the replacement levels required to sustain the state pension system appear unfeasibly high, averaging between ¼ million and 1½ million per annum, with spectacular effects on population growth. The year-on-year required migrant numbers are also significantly volatile, with peaks approaching 5 million in certain cases, thus requiring an implausibly precise micro-management of immigration for it to be considered as an effective and efficient policy tool.

The difficulty in controlling immigration in such a fine-tuned manner is exacerbated by the fact that both supply and demand of migrants depend on economic circumstances. The supply of immigrants is low when economic conditions of the host country are poor - precisely when the demand for them is likely to be at its highest due to the need for increased contributions in order to fund state benefits. Furthermore, migration is easier to start and more difficult to stop. The reality of this is evident from the successive upward adjustments to migration assumptions in official projections over the last few years.

The model analysis and sensitivity tests clearly show that immigration is an inefficient and ineffective means to solve the problems of an ageing population associated with the UK PAYG state pension system and only delays it at the expense of future generations. The required levels are abnormally high and too volatile for it to be considered as a viable policy alternative.

4 The Economic, Fiscal, and Social implications of immigration

In addition to numerical analyses, policymakers also need to consider the economic, fiscal, social and cultural implications of immigration, which are more subjective and difficult to incorporate in a model but are nevertheless crucial to the success of the policies implemented. Much of the literature on this argues against immigration, but an attempt has been made to provide a balanced view.

4.1 Economic and Fiscal considerations

The analyses of those who consider immigration as a "population stabiliser" for an ageing society focus primarily on demographic indicators as opposed to the maintenance of "financial equilibrium" of the PAYG scheme – i.e. considering immigration as a means of increasing the taxable wage base to maintain equality between contribution income and benefit outgo. However, as previously mentioned, supply and demand of immigration depend on the economic circumstances of the host country and responds to employment opportunities and wage differentials. Although an increase in the supply of immigrants increases the taxable wage base, it could dampen real wages, which, although advantageous to employers, could result in a fall in total tax revenues and therefore total contribution income - particularly if larger proportions of immigrants comprise of low-skilled workers. As discussed in Section 2.2, the resulting fall in real earnings growth could have significant fiscal implications for the Government in the long term.

In addition to considering the benefits of immigration, one must also consider its implications on public finance. Like members of the host population, immigrants too require access to healthcare, housing, education and other benefits, which evidently are costly to deliver. The crucial question is how these costs compare to revenues from taxes? Unfortunately, data on immigrants is not detailed enough to enable a fully comprehensive cost-benefit analysis to be undertaken in the UK. Nevertheless, a recent Home Office study found that immigrants made a positive net fiscal contribution of about £2.5 billion in 2000. This represented about ¼% of the UK's GDP of £1 trillion at the time. Incidentally, this was marginally less than the 0.3% growth in population due to immigration observed over the same period. In essence, although the overall UK GDP in 2000 increased as a consequence of immigration, the GDP per capita actually fell. Coleman (2003) further argues that if education grants directed at schools with high proportion of immigrant pupils to overcome language difficulties, remittance of funds to home countries and sums spent on asylum procedures are taken into account, the fiscal contribution made by immigrants falls below £ ¾ billion.

Detailed studies carried out in the US and Scandinavian countries draw similar conclusions. Fehr et al (2003), for example, have demonstrated (in the context of an ageing population) that a significant expansion of immigration across groups other than the highly-skilled would do remarkably little to alter the major capital shortage, tax hikes, and reduction in real wages that can be expected along the demographic transition in the US. This seems reasonable since most countries adopt a progressive tax system and so higher-skilled migrants are likely to contribute more than their fair share compared to their lower-skilled counterparts. However, the model has a weakness in that taxes cannot be increased forever, with or without immigration. The economic reasons for this are simple. Firstly, consistent tax hikes are likely to act as a deterrent for prospective immigrants of working age (irrespective of whether or not they make a positive fiscal contribution) and possibly even promote emigration amongst the local working class population across the skill spectrum. This would be counterproductive to the Government's efforts to sustain an otherwise shrinking labour market. Secondly, a combination of workers paying higher taxes and the aged population increasingly owning and supplying the capital, again with or without immigration, will limit the capital holdings that successive generations bring into retirement. This could result in each successive generation being poorer than the former and becoming increasingly reliant on inheritance or, in light of increasing longevity, temporary reliant on the Government. The system of consistent tax increases therefore has to break down at some point in time.

Recent studies (e.g. *Dobson et al, 2002*) show a disparity in the economic activity rates amongst natives and foreigners, the latter experiencing higher unemployment than the national average in more recent years. This result somewhat weakens the case of using immigration as a means of meeting labour shortages. However, averages conceal a lot of the detail. The UK's current policy on work permits, for example, has generally been to issue fixed quotas across the labour market spectrum irrespective of the skill level, as long as those skills are deemed to be in short supply amongst the native population. With demand for cheap labour playing a key role in migration economics, such policies are likely to understandably attract more low-skilled migrants who are more prone to unemployment than high-skilled migrants who are already relatively better off in their country of origin, ceteris paribus. This does not necessarily mean that immigrants in general are any less productive. One only has to look as far back as the 1960's to observe lower employment rates amongst the immigrants compared to the native born. The counter argument also applies currently in the case of Australia, which adopts a points system based on minimal level of skills and/or amount of capital, which could be one of the reasons for immigrants enjoying a lower unemployment rate than the national average.

Those in favour of immigration, on the other hand, have cited studies that support the view that immigrants, by their self-selecting nature, tend to be amongst the most dynamic, economically rewarding and enterprising members of any society and that immigration could be a way to revive entrepreneurial spirit and prevent the loss of vigour that might otherwise accompany an ageing society (*Jollans, 1997*).

4.2 Social considerations

Integration and social cohesion are paramount if policies on immigration are to be successful. Otherwise, there is the risk that segregation of migrant populations could result in social divisions that could potentially give rise to social tensions and conflicts of interest. The UK Government's 2001 White paper cited this as one of its key policy aims on immigration, which was also recently echoed in a report from the Commission for Racial Equality. Whilst some evidence suggests immigrants with high-level skills and/or those from high status backgrounds, who place greater emphasis on social advancement and economic progress, find it easier to integrate, there is also evidence to the contrary. Promoting integration can be difficult for many reasons. Immigrants may migrate for economic reasons but many hang on to their much-valued cultural traditions. Prospective immigrants are naturally inclined to settle in regions where their fellow countrymen or women or people with the same cultural backgrounds have already settled. This naturally creates ethnic displacement and may hinder the Government's aims in promoting integration and social cohesion. Some Governments, for example Australia and more recently the US, have incorporated additional criteria to their immigration policies in order to encourage the dispersion of immigrants. Whilst such criteria are more likely to be designed to meet the different economic needs of different regions, they may help to attenuate the ethnic displacement increasingly apparent in some of the regions in the UK – e.g. parts of London and the South East. Some locals may view this cultural diversity as a good thing, whilst others, fair to say, may not.

The consequences of immigration on the workforce are also likely to have social implications. If the problem were a shortage of people of working age then the emotional argument that immigrants were "taking our jobs" would hardly be relevant (*Jollans, 1997*). However, despite having a record of low unemployment amongst most European countries, the UK has spare capacity at the domestic level, particularly at older ages (*ONS, 2005*), which it could seek to utilise before focussing more on immigration if it were to dampen such feelings amongst some in the host population. Having said that, if the Government's policy on immigration is to fill in the immediate skills gap in the labour market that would otherwise be left unfilled (e.g. medicine), then immigration is likely to form a key part of the solution in addition to, for example, long-term investment in education. Interestingly, Coleman et al (2002) also suggest that ethnic segmentation in the workforce is apparent amongst the foreigners themselves, with Pakistanis, Bangladeshis, and West Indians, for example, over represented in lower grade jobs and amongst the unemployed, and the Indians and East Africans over represented in high status occupations. Whether this exacerbates the difficulty in promoting social cohesion is questionable and there is little written evidence to suggest that it does.

4.3 Other considerations

If majority of the Western countries are facing similar problems as regards an ageing society, it seems logical that future policies will place greater emphasis on curbing emigration of the young and the working class population. If immigration forms a common key policy response, an interesting question that then arises is where will all the migrants come from? The most-likely answer is the developing countries. However, attracting (highly-skilled) migrants will be counter-productive to the UK's efforts in abating the brain drain from developing countries on moral grounds.

There is also the issue of illegal immigration and the fiscal costs of the associated illegal employment on which there appears to be no consensus between the Government, academics and other official organisations. Better policing of the unofficial economy, which of course does not comprise only of immigrants, could help alleviate the fiscal pressures on the Government and implement policies that are more palatable than would otherwise be the case.

4.4 Comments

It is evidently difficult to formulate a clear opinion on the economic and fiscal benefits of immigration. Whilst immigration has shown to make a positive contribution to economic growth, whether it increases the GDP per capita or imposes fiscal costs is debatable. Much of the analytical work is limited to a snapshot analysis, using only easily available conventional statistics. It is also difficult to fully appreciate the social and cultural implications of immigration, since much of the material on this is one-sided – against immigration. Nevertheless, the reader is referred to the expert debate on whether Britain needs more immigrants in which both the contributors, Coleman and Harris (2003), put forward equally strong arguments substantiated by historical facts.

Perhaps what is needed to help formulate an informed opinion is for the UK to implement a person-number registration system similar to that adopted by the

Scandinavian countries to provide exact information on the taxes paid by and the amount of public expenditure imputed to immigrants. This would help to perform a critical economic and fiscal time-series assessment of the expansion of immigration across different skill groups and its effects on total population growth. Such an analysis for the UK would, of course, need to allow for one significant additional fiscal cost - that of the publicly funded National Health Service.

Whatever the outcome of this assessment, the conclusions regarding the volatility and inefficiency of using immigration to manage the demographic burden on the state pension system drawn in Section 3 are likely to remain.

5 Concluding remarks and recommendations

An ageing population undermines the original demographic underpinnings of a PAYG state pension system. The Government has taken a series of remedial actions in the past to deal with the problem. The Pensions Commission has also recently proposed further options on reform in its First Report, with detailed recommendations expected to follow towards the end of this year.

Other than increasing the SPA, none of the options, in my view, deal with the root of the problem, but simply delay it at the expense of future generations. The objective is not to focus, as many do, on maintaining the level of the working population as a proportion of the total population, but to look at maintaining the financial equilibrium of the PAYG state pension system. Under the increasingly likely scenario in which pensioners are allowed to benefit from future economic growth, contributions/taxes would need to increase by a further 40% of their current levels by 2040, even if the common SPA was increased to 70 and workforce participation rates assumed at full capacity.

Fertility rates would need to improve by significantly more than the official optimistic estimate of 1.94 per woman of childbearing age and/or mortality rates would need to actually worsen to have any significant effect on the fiscal burden expected along the demographic transition.

Immigration would not help ameliorate the problems either. Other than perhaps covering the immediate skills gap in the labour market, it is an inefficient means of dealing with the problems specific to social security pensions. Economic, fiscal, social and cultural implications aside, the required replacement levels are unfeasibly high and too volatile for immigration to be considered as a sustainable long-term policy alternative, averaging between ¼ million and 1½ million per annum under the most plausible scenarios, with spectacular effects on population growth. The strong dependence of migration flows on prevailing economic circumstances, and the fact that not all entrants are economic migrants, makes it even more difficult to implement and subsequently manage immigration-based policies.

It is clear that a more radical solution is required. A solution that is time-consistent and independent of the uncertainties associated with changing demographics, positive or negative. Otherwise, reforms will amount to nothing more than just tinkering with the state pension system. There is no “quick-fix” solution to PAYG state pension provision undermined by an ageing society that also caters for the different needs of different people. Efforts should, therefore, be geared more towards assessing the feasibility of (voluntary) personal retirement savings and the actions required to make it workable. This option too is part of the Pensions Commission’s remit to ensure adequacy of retirement provision so it will be interesting to see whether it forms an integral part of its recommendations, due this autumn. Other sources of literature on the merits of the advocated method of reform include expert papers by Daykin (2003), Jacobson (1997), Harris (2004) and Peaple (2005).

Despite its problems, means testing enables the Government to fulfill its paternalistic role towards society. However, this should extend in so far as keeping a check on retirement poverty. The whole thrust of pension reform should be to educate and persuade people to make private provision and instill in them that the responsibility for ensuring an adequate retirement is theirs.

It is accepted that the advocated course of action of increased voluntary savings does not eliminate the threat at the macro-economic level of falling output relative to consumption caused by a diminishing workforce and expanding pensioner population. For this, wider economic reforms are required, such as improvements in productivity. This paper, however, concentrates on the effects of and responses to an ageing population in the context of state pension provision only, and private provision would be a step in the right direction.

Such radical reforms may be extremely difficult to implement. One only has to look at the unrest in Italy and France and the political turmoil in Germany provoked by modest reforms proposed over the last few years. However, the UK is still at an early stage along the demographic transition and already has an established private market on which to build on. The UK's pension costs as a percentage of GDP are also lower than most of its European neighbours. Delaying the necessary reforms any longer is only going make decisions more difficult in future.

Perhaps the time has now come to shift from an era of paternalism to one of personal responsibility.

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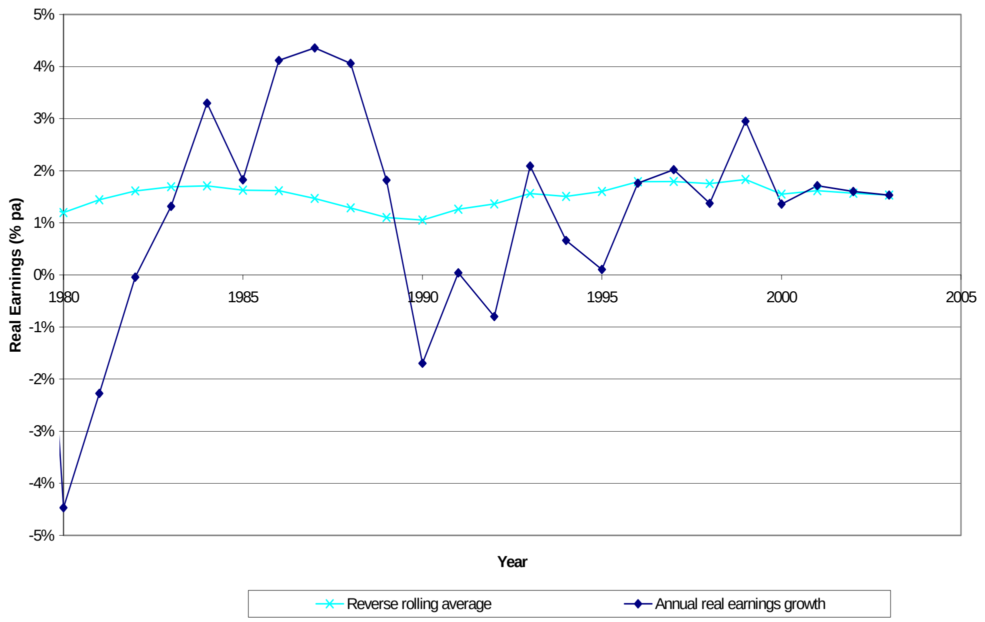
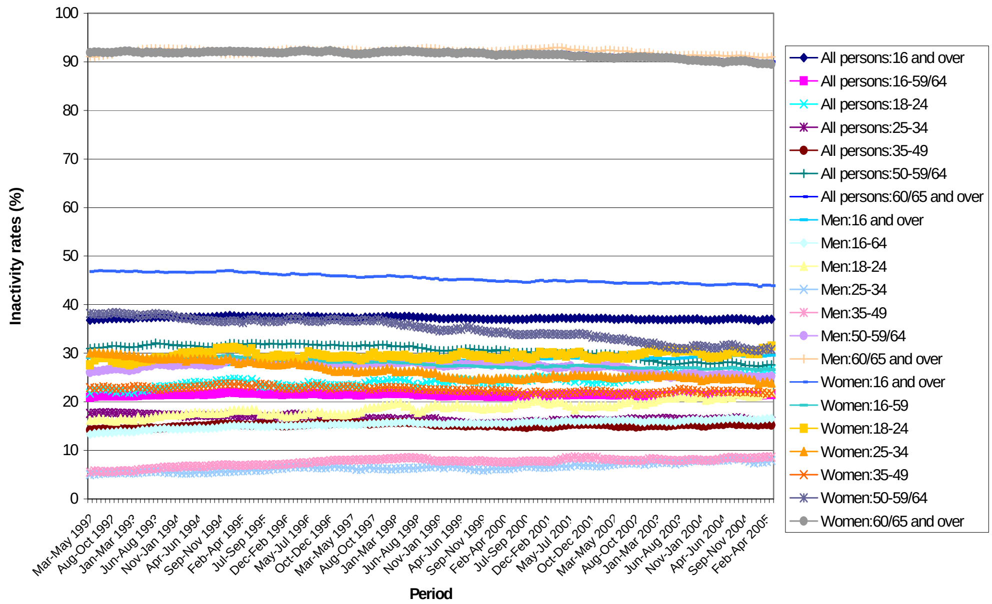
Appendix A: UK earnings and age-specific employment trends

Figure A.1 Historic Trends: UK real earnings, 1980 - 2003



Source: ONS Database, 2005

Figure A.2 Economic Inactivity Rates by Age, Mar 92 - May 05



Source: ONS Database, 2005

Appendix B: Summary of GAD principal projections assumptions

Table B.1 Assumed mid-year to mid-year Mortality rates per 100,000 for selected years

Age l.b.	Males				Females			
	2003-04	2010-11	2025-26	2050-51	2003-04	2010-11	2025-26	2050-51
0	97	83	67	56	84	75	62	52
10	13	10	8	7	9	7	5	4
25	90	82	68	56	33	29	23	19
50	392	361	306	253	270	244	203	168
75	4,913	3,877	3,096	2,568	3,234	2,542	1,995	1,654

Source: GAD 2003-base projections database, 2005

Table B.2 Assumed mid-year to mid-year Migration rates for selected years

Age l.b.	Males				Females				Total
	2003-04	2010-11	2025-26	2050-51	2003-04	2010-11	2025-26	2050-51	Long-Term
0	752	754	754	754	768	772	772	772	1,526
10	200	200	200	200	292	292	292	292	492
25	4,070	4,070	4,070	4,070	4,354	4,352	4,352	4,352	8,422
50	70	70	70	70	118	118	118	118	188
75	72	74	74	74	2	2	2	2	76
Total	60,470	60,472	60,472	60,472	69,530	69,528	69,528	69,528	130,000

Source: GAD 2003-base projections database, 2005

Table B.3 Assumed mid-year to mid-year Fertility per 1,000 Females for selected years

Age l.b.	Females			
	2003-04	2010-11	2025-26	2050-51
20	62	61	61	61
25	82	75	75	75
30	108	107	108	108
35	71	74	76	76
40	19	21	23	23
TFR	1,743	1,723	1,740	1,740

Source: GAD 2003-base projections database, 2005

Appendix C: Glossary

Cohort rates Rates, e.g. mortality or fertility, for persons born in a specified period – i.e. a cohort.

Means-testing Method of assessing a person's income and/or wealth to decide whether they are eligible to receive certain Government benefits.

Pay-as-you-go (PAYG) This is a type of an unfunded scheme where benefits for current pensioners are financed by taxes paid by current workers. No fund is set aside to pay for future pension benefits.

Period rates Rates, e.g. mortality or fertility, for persons of different ages at a given point in time – i.e. a period.

Select Period Initial period over which different (mortality or fertility) assumptions apply.

SERPS The UK State Earnings Related Pension Scheme (1978-2002). The scheme provided a second pension for those without occupational or personal pension schemes, paid for through taxpayer's National Insurance contributions. It is currently known as the Second State Pension (S2P).

Total Fertility Rate Sum over all ages of the age-specific fertility rates.