Population ageing: what should we worry about?

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Approximately half the world's population now has replacement-level fertility or below. The UK experience in accommodating to a changing dependency ratio provides some generalizable insights. A mechanistic approach assuming a fixed retirement age and a need to raise fertility or increase immigration in order to maintain pensions at a fixed proportion of the gross domestic product (GDP) is overstated and wrong. It needs to be replaced by a welfare optimizing model, which takes into account the increasing years of healthy life, a slow rise in the pensionable age, capital inheritance and wider welfare considerations of population density that are not reflected in GDP measures. A combined replacement ratio (CRR) is suggested for developed countries combining the impact of the fertility rate and immigration rate. A CRR above 2 implies continued population growth. The current UK CRR of 2.48 is higher than needed for pension reasons, and it is suggested that it exceeds the welfare maximizing level.

Keywords: ageing; population structure; pensions; retirement; combined replacement rate

1. INTRODUCTION

Ageing populations present opportunities as well as challenges. All too often, the debate is dominated by a belief that developed rich societies face severe problems, some would say potential crises, as a result of demographic change. The change has two elements: a steady rise in life expectancy and a one-off fall in fertility. The combined impact of these changes is to shift the demographic pattern of rich developed countries from pyramids to columns, and in some cases to columns tapering at the bottom (figure 1). There is no way of knowing whether the falls in fertility that have occurred will be precisely maintained, partially reversed or accentuated by further falls. But a reasonable base case assumption is that the developed world has experienced a one-off permanent fall over the last century from higher levels (e.g. 3+) to a lower range (e.g. 1.3–2.1), and that neither a move to dramatically lower levels, nor a reversal to nineteenth-century levels is likely. The probability that the fall in fertility is a one-off effect makes its impact different in kind from the rise of life expectancy, which is likely to prove continuous. Within, say, a 1.3–2.1 range, a fertility rate of about 2.0–2.05 will (in the absence of immigration) produce a column demographic structure, while a rate below 2.0 will produce a column tapering towards the bottom.

When that shift from pyramids to columns occurs, the ratio of people above some given retirement age (say 65) to those of working age (say 20–65), A to B in figure 1, rises, so that the so-called 'old-age dependency ratio' increases, creating problems for pension

systems—whether they be unfunded or funded. In the unfunded case, we have fewer taxpayers per pensioner—a problem. But in the funded case, we may have people attempting to save more to support a longer time in retirement—and that too may have a self-defeating impact on rates of return. The increased longevity impact and the lower fertility have two conceptually quite separate demographic impacts on funded systems. The increased longevity impact is that if people attempt to increase savings rates to support a larger percentage of adult life spent in retirement, the capital/labour ratio (K/L) will tend to rise and, everything else equal, the return on capital will fall. This effect (as with the longevity impact on Pay As You Go (PAYG) systems can be entirely avoided if the pension receipt ages rise in line with life expectancy. The decreased fertility effect arises because the equilibrium price of already existing capital assets being sold by older people to fund consumption in retirement should logically be affected by the relative size of the selling and buying generations, so that a large generation followed by a smaller one (or by one smaller relative to the previous generation than in previous intergenerational relationships) may be adversely affected by price declines (or more limited price increases) of the assets they accumulate during working life (Miles 1999; Poterba 2004). Funded pension systems are also subject to demographic effects, but funding diversifies the demographic risk. For example, if Poland were to run a wholly PAYG-based pension system, it would be exposed to Poland's specific demography. If it runs a funded system instead, its future pensioners are exposed to demographic trends in the countries in which they make investments. If they held a diversified holding of all available global assets, they are exposed to the average demographics of all countries in the world, weighted by the share of those countries in world GDP. In actual fact, there

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Figure 1. From pyramids to columns.

is significant empirical evidence of home country bias in investment decisions, and exchange rate exposure risks can make this rational. But in a European Union of free movement of capital with an expanding coverage of the single currency, there is no logic for Polish investments to be biased towards Poland rather than spread at least throughout the European Union. The relevant demography for considering the sustainability of funded pension systems in the European Union is not therefore each country's own national demography, but at least European wide demography. The implications of this for assessment of the severity of demographic problems in European countries is considered in §7.

It is frequently argued that not only do rich developed countries have to tackle the challenge of pension system reform, but they should also consider policies that might re-expand the base of their pyramid—encouraging higher fertility through pronatalist policies, or encouraging higher immigration. Often it is argued that it is essential to do this, because otherwise a crisis of ageing exists.

But despite having been for 3 years, Chairman of the UK Pensions Commission, or indeed because of what I learned in that time, I would like to challenge the idea that the developed world in general faces a crisis and instead set out four alternative conclusions.

- (i) Most countries in the rich developed world face an important but quite manageable challenge of pension system redesign.
- (ii) In some countries the problems are severe and more radical demographic responses may be optimal.
- (iii) In some rich developed countries, conversely, population growth is more rapid than optimal.
- (iv) Across the world, the biggest demographic challenge is rapid population growth in parts of the developing world, not the manageable problems of ageing in rich developed countries.

Some of these conclusions, and in particular the first three, depend on judgemental trade-offs between factors, some of which are inherently subjective matters of individual preference. As a result, some of my

conclusions can be challenged if a different set of preferences is proposed. But what I do not think can be challenged is the need to make an explicit trade-off between the factors I will set out, a trade-off that is not seen in some analyses of these issues. My proposals therefore are as much focused on the required methodologies of analysis as on any particular set of conclusions.

2. PENSION SYSTEMS AND DEMOGRAPHIC CHALLENGES IN THE DEVELOPED WORLD: THE DANGER OF OVERSTATEMENT

My first assertion is that many commentators are overstating the scale of the challenge in many developed countries, and as a result arguing that demographic responses are essential when in most cases intelligent pension system redesign is sufficient. One key cause of that overstatement arises from calling the ratio of over 65 years to 20–65 years the old-age dependency ratio (figure 2). For this is only a sensible measure and an accurate description, if we assume that in the face of gradually rising longevity, the average age of retirement stays unchanged. But that is not a reasonable base case assumption. A more sensible base case assumption is that as people live longer, they could divide the extra years of life between extra work and extra retirement leisure, so as to keep roughly stable the proportions of adult life spent working and in retirement.

Any old-age dependency ratio calculation (e.g. the often used 65+: 20–64 or 65+: 15–64 ratios), ignores the complexity that individual people enter and leave the work force at a variety of ages, that exit can be full-time or part time and that the age pension receipt may be different from the age of retirement. And 65 has often been used as an assumed retirement age in standard measures of the old-age dependency ratio, despite the fact that average ages of retirement have tended to be lower. An old-age dependency ratio calculated using a slowly rising retirement age does not therefore assume that all people will retire at that age, nor start drawing pensions at that age, nor that it is necessarily the average age of retirement. It reflects instead the assumption that over time the average effect of changes in many different pension receipt ages and retirement ages will be in proportion to the

Figure 2. People over state pension age (SPA) to those aged 20–SPA. Filled diamonds, with SPA fixed at 65; filled squares, with SPA rising proportionally (to 68.5 in 2050 and 70.2 in 2070)¹. Adapted from UK Government Actuaries Principal Projection. Note: ¹This proportionate adjustment maintains the proportion of life over 20 years old which is spent in retirement at 27.5 per cent.

effect that would arise if all people today retired at 65 and in future at the gradually rising ages assumed.

When we shift to the more sensible assumption that an ageing population can divide the extra years of life between extra work and extra leisure, then at least in the UK, a full half of the apparent rise in the dependency ratio between now and 2050 disappears (figure 7). And beyond 2050, there will be no further rise in the dependency ratio as long as we continue to apply the principle of proportionally rising retirement ages, and as long as there is no further decline in the fertility rate from the 1.74 assumed in these figures. Long-term stabilization of the ratio does not require a reversal of the shift to lower fertility, but simply an end to its decline.

So, we are hugely overstating the challenge—in the case of the UK, exaggerating the challenge by a factor of two, simply by using a dependency ratio based on the unreasonable assumption of unchanged retirement ages (Rickards 2004). Two counter arguments to this case are often made.

- (i) That people cannot retire later because they will be too old to do the jobs available.
- (ii) That in actual fact, people are not on average retiring later, indeed if anything the trend until recently was to retire earlier.

Neither of these counterarguments is convincing. In relation to the first, the crucial issue is whether ageing is healthy or unhealthy, whether we are talking about more years of frailty and infirmity, or more years of healthy life, with people not only living longer, beyond say 65 or 70, but at 65 or 70 on average enjoying the same physical and mental alertness which 50 years ago was typical for people several years younger.

While the evidence based on this issue is thinner than one would ideally like, the balance of available evidence points overwhelmingly and increasingly towards the conclusion that ageing is on average healthy. Ideally, in order to address the specific issue of the feasibility of increases in retirement age, we would look at evidence setting out trends over time

in the average health of people aged around typical past and future possible retirement ages, say 60–70. Such evidence needs to be based not on surveys asking people how healthy they feel, which are subject to the extreme methodological problem of changing expectations (as people have got healthier their expectation of what constitutes healthy life changes), but on concrete measures of physical stamina, physical dexterity and mental capacity. Newly established studies, such as the English Longitudinal Study of Ageing, will over the time deliver such insights, but it will take many years before trends can be described with confidence. However, evidence from studies of more extreme disability, together with advances in theory, make it close to certain that average age and health at any given age is increasing rapidly.

Extensive research in the US in particular illustrates that the prevalence of significant disability has declined markedly over the last several decades, at both ‘old old’ ages (e.g. 85) and ‘young old’ ages (e.g. 65), and at an accelerating pace over time (Cutler 2001; Manton & Gu 2001). ‘Active life expectancy’ at old ages is, according to Manton and Lamb’s analysis, increasing more rapidly than life expectancy, with an increasing percentage of older years spent in reasonably good health (Manton *et al.* 2006). While this research has tended to focus on the tail of clear disability, rather than on average health, and therefore on issues relating to the affordability of health and residential care expenditures rather than on the feasibility of increases in retirement age, it is difficult to imagine a theory of ageing in which declines in this tail of significant disability would not matched by improvements in average health at each age.

New theoretical understanding of the nature of ageing, meanwhile, is illustrating that neither in relation to progress towards death nor towards ill health is it a ‘strict clock-driven progress’ but one in which ‘there is plenty of scope for non-genetic factors to affect how fast or slowly the burden of molecular and cellular damage builds up during our lives’ (Kirkwood 2008). A multitude of changes in diet, lifestyle, the nature of work and healthcare technology have therefore been able to deliver rapid improvements in later life expectancy (e.g. life expectancy after 70) which arise not only from medical interventions at older ages ‘but in large part also owing to the fact that in today’s Europe older citizens are reaching advanced old age in unprecedented bodily health’. The new biological theories of ageing therefore support the observation of the French historian Patrice Bourdelais, who has argued that we need to recognize the extreme elasticity of the ageing process, with, by his calculations, the average Frenchwoman of 77 today equivalent, in terms of health and fitness, to the average woman of 62 in 1900 (Bourdelais 1999).

The overwhelming probability is therefore that ageing is on average healthy, and it is almost certain that ageing could be healthy for the vast majority of people. Very large differences between different socio-economic classes in physical and mental health at any given age are concerning from a social equity point of view, but illustrate the large potential to

make ageing healthier via better diet, exercise (physical and mental), better occupational health practices and better preventative medical interventions during youth and middle age. This illustrates the importance of policies designed to ensure that ageing is healthy for as many people as possible, but also clearly supports the belief that there is no inherent reason why the average retirement age should not rise in line with adult life expectancy. Calculations of old-age dependency ratios should therefore make the base case assumption that such a rise can occur.

But if people can work longer, why are they not doing so? Why instead did we see in many developed countries a fall in average retirement age from 1950 to the mid-1990s? (figure 3). Why indeed have we seen the percentage of adult life spent in retirement, increase even more than it would have if the average retirement age had simply stayed stable? (figure 4).

The first reason why a higher percentage of adult life is being spent in retirement is that countries and companies have, in their pension system design, created economic incentives for people to retire early and disincentives against working later.

Most state pension systems have failed until very recently to adjust 'standard ages' of pension receipt in line with rising life expectancy. Many have failed to allow people who wish to work beyond the 'standard age' to defer their pensions and receive a higher pension at a later age. Several, in addition, have continued to levy employer and/or employee contributions on earnings after the 'standard age' even though no further pension rights are accrued. And many have provided options for people to retire early on a more than actuarially fair basis. As a result, the effective marginal tax rate imposed on earnings resulting from delayed retirement has in many systems been in excess of 60 per cent (Gruber & Wise 1998).

Where companies play a significant role in pension provision, their practices have created similar disincentives. Normal pensionable ages within defined benefit pension schemes were largely unchanged until the last few years. Such schemes did not typically allow the option of accruing further pension benefit beyond normal pensionable age or of receiving a higher pension at a later age. Also in many cases, sloppy accounting rules and actuarial practices made generous early retirement packages an apparently costless way for companies to pay redundancy; such packages were therefore used extensively in corporate restructuring.

In addition, in both the private and public sectors, people have until very recently not been given the option of working beyond 'normal retirement ages', which have discriminated against those who want to work later. Evidence from the UK Pensions Commission illustrates that the incentives people face have a significant influence on average retirement ages; people in defined contribution pension schemes, for instance, typically retire later than those in defined benefit schemes because they face a clear incentive—work until later and achieve a higher pension (figure 5). In almost all developed countries, therefore, there is a vital need for pension system reforms that remove barriers to later working and create attractive

Figure 3. Trends in the mean age of retirement. Organization for Economic Cooperation and Development (OECD) diamonds, men; squares, women. Adapted from Pensions Commission estimates.

incentives. In many countries indeed, such reforms are now in hand. Once they are in place, it is likely that average retirement ages will rise in line with the inherent potential created by healthy ageing. Indeed in the UK, the average retirement age, having reached a low point in the mid-1990s, is now rising rapidly (figure 6).

The second reason why people have been devoting an increasing percentage of adult life to retirement and this reason may continue to apply in the future, is that people may simply choose to take some of the benefit of rising productivity and rising real wages in leisure rather than increased consumption. If this preference is general, its expression will mean a slightly lower GDP *per capita* than would otherwise be attained, but if that is most people's choice, then welfare is maximized by allowing it to be expressed. In a world of growing life expectancy and growing productivity per hour worked, people can choose to take the benefit of those two positive developments in consumption or in extra leisure. But the fact that some may choose to take the benefit in more leisure, and lengthen their retirement, does not change the fact that the only sensible measure of old-age dependency—the measure of the burden of the dependency rather than of the choices people freely make, is one which assumes that retirement ages could rise in line with life expectancy and would do so but for changing income/leisure preferences.

Commentators in population ageing should stop labelling the ratio of over 65-year olds to 20–65-year olds (or 15–65-year olds) and call it the old-age dependency ratio. Figure 7 illustrates the dependency ratio that would apply if we followed silly policies and the lower one labelled 'the underlying dependency ratio if sensible policies are pursued'.

3. PENSION REFORM AND MANAGEABLE BURDENS

Those sensible policies including changing the parameters of state PAYG pension systems so as to reflect rising life expectancy. This can be achieved in two ways.

- (i) By continuing to fix a 'standard age' of state pension receipt, but increasing this standard age in line with increasing life expectancy, while also

Figure 4. Percentage of adult male life spent in retirement. Adapted from Pensions Commission estimates from 1990 onwards.

Figure 5. Distribution of labour market activity by pension type. Black, inactive; grey, active. Adapted from English Longitudinal Study on Health 2002, UK (Hyde *et al.* 2003).

Figure 6. Trends in the mean age of retirement. OECD: solid line with closed diamonds, men; solid line with closed squares, women. Pensions Commission: dashed line with open diamonds, men; dashed line with open squares, women. Adapted from Pensions Commission estimates.

allowing people the option of deferring the pension until later in return for an actuarially fair increase in pension received.

- (ii) By moving to a notional-defined contribution system (such as Sweden's) in which people choose when to convert their accumulated balance into an annuity, with the annuity rate offered at any given age falling as life expectancy rises.

In the UK, option 1 is now being pursued, with the state pension age (SPA) due to rise from 65 today to 68 in 2045, an increase roughly proportional to rising life expectancy. (At present, the UK has an SPA of 60 for women and 65 for men—this anomalous distinction will be removed between 2010 and 2020 when women's SPA will rise from 60 to 65.) After 2045, further increases in line with life expectancy are likely. This policy alone, in the UK context, deals with half of the problem of future fiscal strain (figure 7). (The question of how far the UK context is specific is considered later.)

The top line of figure 7 shows what would happen to UK public expenditure on state pensions as a per cent of GDP, if we raise the pension in line with

average earnings while maintaining an unchanged pension age of 65 after the equalization of men and women's age at 65 in 2020. Public expenditure increases from 6.2 per cent to 9 per cent of GDP. The lower line shows the impact of the new policy (reflected in the 2007 Pensions Act). With the pensionable age rising proportionally in line with life expectancy, the public expenditure burden rises from 6.2–7.7% of GDP (UK Pensions Commission 2005). Half of the fiscal strain disappears, because in the UK case half of the apparent problem arises from rising life expectancy, and rising life expectancy is not a problem unless we make it one by bad policy. It should be noted that the estimates made in the UK Pensions Commission (2005) second report were based on Government Actuary's Department's 2003-based principal projections. Using the 2004-based projections (published 2006), which project a higher rate of immigration and more rapid population growth, the estimates of future public expenditure cost as a per cent of GDP would be likely to reduce.

Clearly, the UK's pension problems are manageable, and faced with this potential increase in pension expenditure, the UK has two options.

Figure 7. Old-age dependency ratio in the UK. Filled diamonds, under silly policies; filled squares, under sensible policies. 'Sensible policies' sets the standard SPA so as to maintain expected years post-SPA over expected years post-20 at 27.5 per cent. This entails taking the SPA from 65 in 2005 to 68.5 in 2050 and 70.2 in 2070. Adapted from UK Government Actuaries Principal Projection.

- (i) One option would be to increase the SPA still further. If the SPA were increased to 72 by 2050, no increase in pension expenditure as a percentage of GDP would be required. While such an increase would be politically difficult, and create some welfare loss, it cannot be considered impossible, since it would only return the SPA to the same relationship to life expectancy in old age which it actually attained in 1990, catching up, as it were, for our failure to adjust pensionable age in line with life expectancy over the last 35 years.
- (ii) The other option is to accept either that total public expenditure as a percentage of GDP will increase or that other elements of public expenditure will be reduced. In the context of an economy likely to grow at 1.5–2.0% *per capita* per annum as a result of productivity growth, either or some mix of these variants is clearly possible.

The UK government is now committed to the rise in public expenditure on pensions shown in the lower line in figure 8. This implies either increased national insurance contributions/taxes or decreased expenditure on other possible desirable aims, costs which could be avoided if fertility (or immigration) were higher. But we cannot assume from this that welfare would be higher if fertility or immigration rose, since these potential costs of lower fertility have to be balanced against potential benefits, both those which directly affect measured GDP elements such as public expenditure, consumption and savings, and wider welfare benefits not necessarily captured within GDP measures.

4. BENEFICIAL IMPACT OF LOWER FERTILITY ON MEASURED ELEMENTS OF GDP

There are two ways in which lower fertility increases the economic resources available to the working generation, thus offsetting the burden of increased transfer payments to retirees.

The first and obvious benefit is that lower fertility means a lower youth dependency rate, which partially

Figure 8. Share of UK GDP devoted to state pensions, assuming state pensions rising in line with earnings. Solid line, if SPA remains at 65; dashed line, if SPA rises to 68.5. Adapted from the Pensions Commission.

offsets the problem of rising old-age dependencies. Figure 9 shows the correctly defined old-age dependency ratio in the UK, the youth dependency ratio and the combined dependency ratio, measured here as the sum of people aged under 20 plus those aged over SPA to those aged between 20 and SPA. In 2050, this combined ratio will be only slightly higher than it is today and will actually be lower than it was in 1970. However, it is also likely that the costs of dependency (i.e. of non-working members of the population) will be higher because (i) youth dependency (childhood, education expenses) may be less expensive *per capita* than old-age dependency (pensions and healthcare), and (ii) higher education participation rates have increased considerably in the last 35 years, with young person (e.g. 16–22 year olds) workforce participation rates falling as a result. Nevertheless, the principle remains that a lower fertility rate produces a youth dependency benefit which partially offsets old-age dependency disadvantages.

The second benefit—greater inheritance of capital stock—is less immediately obvious and is often ignored in discussions of demographic burdens and pension system reform, but is in many countries even more significant. The lower the birth rate, the greater *per capita* is the capital stock inherited from the previous generation and therefore the lower the need to accumulate capital stock via foregone consumption, i.e. savings. One can think about this effect both at the macro- and micro-levels.

At the macro-level, if generation 2 is smaller than generation 1, it will, everything else equal, have to pay a higher tax rate to deliver any given level of generosity of PAYG pensions. But it will also, everything else equal, need to save less to achieve any given target of capital/labour ratio, and thus productivity, and this lower required savings rate offsets at least to a degree the impact on consumption of higher tax. The scale of this benefit is likely, while significant, to be less than simple gross figures might suggest. This is because there are limits to the extent to which economy can rely on inherited capital stock without suffering a productivity penalty, since new capital investment incorporating latest technology may in some categories (e.g. much plant and equipment) be

Figure 9. UK old age, youth and total dependency ratio. Adapted from UK Government Actuaries—2003-based principal projection. Filled triangles, total dependency; filled diamonds, youth dependency; filled squares, old-age dependency—correct measure.

crucial to productivity improvement. For other categories of long-lasting capital (e.g. roads, bridges, ports, power stations, water and sewage systems and residential houses), however, the capital inheritance benefit is largely undiluted by this effect.

The easier way to think about the effect, however, is probably at the micro-household level and to think about the main asset which households own directly—which is their homes. Simply put, if average family size is two children not four, people on average will inherit one-half of a house not one-fourth, and a couple will on average inherit one house not one-half of a house. People can take the benefit of this inheritance in one of two ways: either accumulating less housing assets during working life in the knowledge that they will inherit one to live in during retirement or accumulating a housing asset during working life and using an inherited housing asset to fund pension provision. In practice, the complexities are significant—there are distributional issues, issues relating to real house price inflation and issues relating to the tax treatment in inheritance. Also, those who are childless and who thus have limited bequeathal incentives may liquidate housing assets in retirement via equity release mortgages and other devices. Given that low fertility rates typically arise from a combination of low fertility among those who have any children, and a significant (e.g. 20% plus) level of childlessness, this is a non-trivial possibility.

The fundamental fact is that the lower the birth rate, the higher the *per capita* inheritance of already existing housing assets—an inheritance which on average reduces the need to accumulate savings to support pensions in old age. The figures are very significant. In the UK, at the end of 2003, all funded pension assets amounted to about £1.3 trillion. Net housing equity, after mortgage debt, was about £2.25 trillion.

It is therefore crucial to take the inheritance of housing or of other capital assets into account in optimal pension system design. In the UK, the Pensions Commission concluded that while distributional complexities make it unwise to treat housing inheritance as a complete substitute for pension provision, it is nevertheless the case that the greater the inheritance of

housing assets, which will be greater *per capita* the lower the birth rate, the lower is the replacement rate of earnings which pension policy should aim to achieve through the combination of the PAYG and the compulsory or encouraged funded elements of the system.

In general, pension policy reform should not take as given the objective of maintaining the pension replacement rates relative to earnings (often in the 65–75% range) which were set in the past, at a time of larger family size, less widespread wealth ownership and lower average inheritance. The specific implication of this for pension system reform differs between countries according to their starting point.

In the UK, which has had in the past both a very limited PAYG state pension and only a limited degree of compulsion in funded pension provision, the Pensions Commission believed that the issue was not whether this low level of mandatory/encouraged provision should be reduced, but how much it should be increased to create an adequate base load of assured pension provision. The Commission quite explicitly, however, rejected the idea that the target mandatory/encouraged replacement rate should be as high as the 65–70% sometimes set as a benchmark, recommending instead a target of 45–50%.

But in the many PAYG systems which under present rules do achieve a 60–70% replacement rate for the vast majority of the population, it may well be appropriate for parametric reform to include not only increases in standard ages of pension receipt, but also reductions in the replacement rate delivered, particularly for middle rather than low-income earners. A high replacement rate for low-income earners from the mandatory system is required both to ensure that absolute poverty in retirement is avoided, and because low-income earners are less likely on average to accumulate or inherit housing or other assets.

As a result, the fiscal strain on PAYG systems should in principle (i.e. in terms of welfare optimization) be manageable not only in the UK, but in many other countries with larger absolute pension expenditures. Nevertheless, while there is a robust welfare optimization case for target replacement rates within PAYG systems being adjusted down as capital ownership and inheritance becomes more widespread and extensive, it is realistic to assume that there may still be strong political opposition to such adjustments from groups which see themselves as enjoying accrued rights, and which do not face the costs of funding those rights. The political challenge of achieving pension reform can therefore be considerable even when in principle, reform is welfare maximizing.

In the UK, starting with an expenditure of 6.2 per cent of GDP, it is manageable simply to accept the required increase of 1.4 per cent of GDP devoted to pensions. Countries with similar demographics but starting with double the expenditure level (say about 12%) would face a more difficult increase, e.g. 2.5–3.0% of GDP, if they attempted to maintain the replacement generosity unchanged. But they can appropriately limit this increase by reducing replacement rates, without this implying a reduction in relative

pensioner living standards once capital inheritance offsets are taken into account.

5. WIDER WELFARE IMPACTS OF FERTILITY AND POPULATION DENSITY

The potential benefits of reduced fertility, however, go beyond those, such as youth dependency and capital inheritance effects, which have a direct impact on personal disposable income after PAYG contributions and savings. Reduced fertility means lower population growth and reduced or indeed negative population growth can have positive welfare benefits, some of which are not captured in measured economic components of GDP. Conversely, increased population density in already densely populated countries can have adverse welfare effects.

Greater population density, everything else equal, increases the pressure of housing development, increases the price of land, and thus decreases the average citizen's ability to afford to buy houses with large gardens or houses located in unspoiled countryside. Population density increases transport congestion, imposing welfare costs either through traffic delays or through greater environmental detriment (noise and visual) or by increasing the cost of building transport infrastructure without adverse environmental impact. Also, increasing population density degrades the quality of shared amenity space.

On some of these effects, it is at least conceptually possible to place an economic value: others are more inherently subjective. Thus, the greater cost of building the channel tunnel rail link on the English versus the French side, and the much later delivery of the project in England, is a direct and measurable consequence of the greater population density of Kent versus the Pas de Calais, which makes it more expensive to provide full compensation to affected homeowners and/or makes it more difficult to overcome political opposition to development. The lower price of equivalent village and countryside properties in rural France than in southeast England is a measurable consequence of France's lower population density, with consequences for attainable quality of life, but not ones that impact measured GDP. Similarly, the lower price of large suburban houses in much of the US compared with the race for equivalent properties in southeast England. However, the enjoyment people gain from less-crowded amenity space (countryside, beaches or historic and artistic sites) is, however, almost inherently subjective.

The implications of these potential density impacts for optimal fertility rates are complex and will vary between countries and between individuals. Logically, they should vary considerably according to the population density already achieved. The impact of new housing and transport developments on the environment are highly charged political issues in England (population density X per square kilometre) but much less so in Colorado today (population density Y per square kilometre), but are likely to become increasingly important as Colorado's population rises.

It should be noted, however, that while adverse welfare consequences are primarily a function of population density rather than of the fertility *per se*, it may also be the case that the rate of change in density is important. Thus, if people's preferences are to a significant extent influenced by processes of habituation (e.g. if mid-western Americans would be unhappy if required to live in the average Japanese living space, but Japanese are not unhappy with this space since habituated to their apartment and house sizes), then it is a significant increase in density that produces a welfare loss, a loss which then attenuates over time as subsequent generations become habituated to the new conditions.

These considerations may also imply that there may tend to be some asymmetries in the aggregate average utility function as it relates to population density. An increase in population density in an already densely populated region may impose significant welfare detriment: but an equivalent decrease in density may not deliver an equivalent benefit.

Clearly, the value placed on these effects varies greatly by individual. Some people do not mind traffic noise and have no desire to own a suburban house with a large garden or a house in or close to open countryside: for others, these factors are much more important to their perceived quality of life than reducing the rate of PAYG contributions by a few percentage points or accepting the need to increase the pensionable age slightly more than in line with life expectancy.

But the fact that taking account of these factors is complex should not lead us to ignore them. In general, lower fertility rates, particularly in the already more densely populated parts of the developed world, will tend to deliver some welfare benefits, and these will help at least to some degree to offset the adverse consequences of the rising old-age dependency ratios that lower fertility produces.

6. MOVING FROM A MECHANISTIC TO A WELFARE-OPTIMISING MODEL

Assessing whether lower fertility is a blessing or a problem, therefore, needs to reflect the overall balance of benefits and disadvantages (figure 10). On the one hand, the analysis needs to incorporate factors that are captured and measured in standard GDP statistics. These include the problems created for PAYG and for funded systems by higher old-age dependency ratios versus the benefits of decreased youth dependency and increased capital inheritance. But it must also incorporate the possible amenity disadvantages of population density above a certain level, where what matters is not just the fertility rate in the short term, but the population density already achieved at any time.

Given the complexity of this model, and the inherently subjective nature of some of the trade-offs required, it is clearly difficult to define an optimal rate of population growth or decline, or an optimal path of other variables—such as the old-age dependency ratio or public pension expenditure as a percentage of GDP. But what this model definitively implies is that the case for increased fertility or higher immigration

Figure 10. Capital inheritance benefit of low fertility.

derived from more mechanistic models is overstated and that the implicit assumption sometimes made that policy should aim to stabilize the old-age dependency ratio is wrong.

The mechanistic approach, too often encountered in journalistic accounts of the demographic challenge, entails three steps.

- (i) Assuming that the old-age dependency ratio should be measured using a fixed age of retirement and assuming that existing earnings replacement rates need to be preserved.
- (ii) Calculating the increase in public pension expenditure as a percentage of GDP which will result from projected demographics and assuming that zero increase in this percentage would be optimal.
- (iii) Estimating the increase in either fertility or immigration needed to bring the system back into balance. In essence, this implies restoring the A : B ratio in figure 1 back to its original level, restoring the pyramidal demographic structure, and thus inevitably implying perpetual population growth.

A welfare optimization model will produce significantly different results. By calculating old-age dependency on a rising retirement age basis it reduces the forecast fiscal strain, and by bringing in consideration of youth dependency, capital inheritance and wider welfare considerations, it accepts that the optimal solution can involve either a fall in the earnings replacement rates delivered by the pension system or rises in pensionable age more than proportionate with life expectancy or a rise in public pension expenditure (and thus in the related fiscal burden) as a percentage of GDP. While we cannot from this general description infer an optimal level of the different parameters, it is clear that the optimal path, far from stabilizing the unadjusted (i.e. fixed retirement age) old-age dependency ratio is bound to involve some increase even in the more appropriate adjusted ratio, and therefore quite a rapid increase in the unadjusted.

7. DEMOGRAPHIC PROJECTIONS AND JUDGEMENTS

The key question is whether the demographic developments likely to occur in rich developed countries are

likely to be optimal, or whether either faster or slower population growth would be desirable. The answer depends in part upon subjective judgements, but a reasonable case can be made that while some rich developed countries face a sub-optimal rate of population decline, in others the population is growing more rapidly than optimal.

To understand the dynamics of population growth and dependency ratios, a 'combined replacement ratio' (CRR) is useful. This ratio captures the impact of both fertility and immigration, treating immigrants as if they were newly born citizens who just happen to be born at the age of (on average) about 25. In detail, of course, there may be significant differences in the impact of higher immigration versus higher fertility. The skill mix of immigrants may differ from that of native borns with possible implications for relative wages, and there may or may not be issues relating to cultural integration, although these are outside the discussions covered in this paper. In addition, there may be an important difference because immigrants do not bring with them capital inheritance rights to the existing capital stock. As a result, existing citizens who do own such rights can benefit from the upward pressure which increasing population will place on house prices, enjoying a more than proportionate share of the existing stock.

The CRR displays what the fertility rate would be if instead of a net immigration inflow a country had an equal number of additional births. It can be calculated as

$$\text{total fertility rate} * \left[\frac{\text{births} + \text{net immigration}}{\text{births}} \right] = \text{CRR}$$

If this ratio is above 2.0–2.05, a country would in the long term have a growing population, even if longevity were not increasing. Even a slightly lower combined ratio will still produce population growth. With immigration, a country can have an expanding population even if its fertility rate is significantly below 2.0.

For the UK, the CRR is currently running at about 2.48, because in addition to 600 000 births, the UK had a net immigration of 255 000 in 2004–05. If the UK Government Actuaries Department (GAD) is right in its assumption that the long-term inflow of

Figure 11. UK's 'CRR'. Short-term CRR (2.48) uses 2004/2005 migration and 2005–2010 TFR; medium-term CRR (2.16) uses 2008 → migration and 2005–2010 TFR; long-term CRR (2.16) uses 2008 → migration and 2050 TFR. Adapted from GAD.

immigration will moderate to 145 000 per annum (with the surge of the European Union (EU) 10 accession passed), the CRR will then fall to 2.16 and remain at around that level for the next several decades (since GAD assumes both a constant total fertility rate (TFR) of 1.74 and constant net immigration of 145 000). A CRR of well above 2.1, combined with increased longevity, explains why the UK's population, far from being forecast to decline, is actually forecast to grow significantly, from 60 million today to 70 million in 2050, with the GAD forecast increased between the 2003 and 2005 projections because the net migration assumption was increased (figure 11).

A strong case can be made that this level of population growth is almost certainly above the welfare maximizing level. It is certainly faster than needed to make the pension system manageable. The clearly manageable fiscal burden discussed above (figure 8) was indeed based on the lower 2003 forecast: under the new higher population forecast, the fiscal burden impact of increasing age dependency will be further reduced. Once we take into account the benefits of declining youth dependency and of increased capital inheritance, the burden would almost certainly be manageable even if the population growth rate (and thus the fertility rate and/or the immigration rate) were significantly lower even than the 2003-based projection, let alone the 2004-based projection.

Conversely, this pace of population growth, even on the 2003-based figures let alone on the 2006-based figures, will impose welfare detriment owing to the negative effects of increased population density in an already densely populated country. Those detriments will arise in particular from the pressure of new housing and related transport development which, reflecting their significant potential impact on people's welfare, are highly charged political issues, particularly in the more densely populated south of England. While these political reactions are often dismissed as 'nimby' ('not in my back garden'), it is important to note that nimbyism is a perfectly rational expression of utility preference in a situation where,

because of higher density, one person's new home degrades another person's utility. If, as may well be the case, the population growth is at least in the short term unavoidable, it may still be welfare optimizing, for example, to build the new houses (since the benefit accruing via housing affordability to new owners outweighs the detriment suffered by existing owners). But it remains important to recognize that there is a net welfare cost of population expansion which would not pertain in a less densely crowded country.

So despite having chaired the UK's Pensions Commission for three years, I think it is highly likely that the UK faces a too-fast population growth, i.e. population growth which is faster than welfare-optimizing growth, would be for the existing population. The qualification 'of the existing population' reflects the fact that the group which undoubtedly gains from immigration are the immigrants, and thus a different assessment of the welfare effect of future possible population growth might be reached if the assumed objective were the maximization of total human welfare irrespective of nation. In other areas of policy, however, governments and societies tend to assume an aggregate national welfare objective (e.g. they do not expand overseas development budgets to the point where healthcare throughout the world is as good as in rich countries). Also, most immigration policies are nationally selfish in favouring skilled immigrants over unskilled.

But clearly the balance of pros and cons would be different if the fertility rate were not 1.74 but say 1.3 and if there were no prospect of significant immigration, so that the CRR would also be far below 2. Consider the case of Italy, with a TFR of about 1.3 (figure 12). If that fertility rate stays unchanged, and if immigration is in line with the UN's forecast, a scenario captured in the UN's Constant Fertility scenario, which implies a long-term CRR around 1.5, the population of Italy will decline from 57 million today to 53 million by 2050, and the old-age dependency ratio, as conventionally defined, will rise from 0.55 to 0.7. The old-age dependency ratio should of course be revised to reflect the rising retirement age assumption, but even after this adjustment we face a dramatic increase, with only 20 per cent of the problem disappearing versus half in the UK. If that truly were the future demography of Italy, then it would be in a very different position from the UK and I think it is a reasonable judgement that Italy's CRR is too low, in terms of trading off the benefits of low fertility versus the disadvantages.

First, Italy's dependency ratio increase would in this scenario be so large that even with an appropriate retirement age adjustment, the fiscal strain of increasing dependency is likely to be very great. Not the manageable 1.4 per cent of GDP in the UK but something much higher. Second, when thinking about the benefits of capital inheritance, particularly housing, it is important to realize that there is a declining marginal benefit of fertility decline beyond a certain point. If a generation inherits not just one house on average per couple (consistent with the birth rate of two) but two per couple (with a birth rate of one), it does not get twice the benefit. Third, because while there may be

Figure 12. Italian demographics under constant fertility. Appropriate policies assume increase in 'retirement age' to 68.5 by 2050 from 65 today. Solid line with diamonds, unadjusted: no retirement age rise; dashed line with squares, adjusted: appropriate policies. Adapted from UN medium variant.

Figure 13. Northern Europe: UN medium projection. (a) Population and (b) old-age dependency (diamonds, unadjusted; squares, correct). Short-term (TFR: 1.78; CRR: 2.12) is at today's migration and TFR rates; medium-term (TFR: 1.78; CRR: 2.09) at 2010's; long-term (TFR: 1.84; CRR: 2.16) at 2050's. Adapted from UN Population Database (see its appendix for countries).

amenity benefits not only from avoiding a growing population but from an actually declining one, there will again be declining marginal benefit from additional marginal decline. Thus, while it is difficult to specify a precise CRR/welfare function, it is obvious that as we move down from a CRR of 2, the problems increase and the benefits are of declining marginal value, and at some point, the balance must become negative, and at some still lower point severely negative.

My own judgement, if forced to arrive at one, is that in general a combined CRR of a bit but not much below 2.0 might be optimal (say in the 1.90–2.0 range, consistent with a broadly stable rather than either a rising or falling population) and that only with a CRR below, say, 1.7 would it be right to talk of a demographic 'crisis' rather than simply a more significant challenge. Note that if the CRR were higher than about 1.9–2.0 perpetually, then, given some longevity increase, this would imply a permanently rising population and population density. Given a rising marginal welfare detriment from population growth as the density already achieved rises, at some time the detrimental effect of rising density

must overwhelm the benefits of a higher CRR for dependency ratios. Logically, therefore in the very long-run, a CRR level of about 1.9–2.0 must be the upper limit of possible optimality. But that is a judgement only, and of secondary importance to my main purpose in this paper, which is to argue not so much for a particular conclusion, as for the methodology of analysis.

If, however, a CRR of something like 1.9–2.0 is optimal, and only below 1.7 a crisis, it is clear that the developed world includes many countries that are above the optimal level as well as some below. The UN defined Northern Europe group of countries (figure 13) is likely on the medium projection to have a CRR significantly above 2.0 throughout the next 50 years. Southern Europe (figure 14), which particularly in Spain is currently facing high immigration levels, has a short-term CRR of 1.87, well above the crisis level, and while this is forecast to fall to 1.68 on the UN's projection of reduced immigration, there is a significant probability that this will understate the immigration which Italy and Spain in particular could face, whatever their policy preference.

Figure 14. Southern Europe: UN medium projection. (a) Population and (b) old-age dependency (diamonds, unadjusted; squares, correct). Short-term (TFR: 1.43; CRR: 1.87) is at today's migration and TFR rates; medium-term (TFR: 1.43; CRR: 1.68) at 2010's; long-term (TFR: 1.79; CRR: 2.15) at 2050's. Adapted from UN Population Database (see the appendix for countries).

Figure 15. European Union countries: UN medium projection. (a) Population and (b) old-age dependency (diamonds, unadjusted; squares, correct). Short-term (TFR: 1.26; CRR: 1.17) is at today's migration and TFR rates; medium-term (TFR: 1.26; CRR: 1.1.21) at 2010's; long-term (TFR: 1.65; CRR: 1.57) at 2050's. Adapted from UN Population Database (see its appendix for countries).

Figure 16. Countries with a demographic rather than pension system challenge.

Within the European Union it is only in the eastern countries (figure 15) that the CRR is likely to run long term at a level clearly below the optimal level, and clearly in crisis territory, with very low fertility rates being combined with net outward migration and

with the likelihood of significant inward immigration low (though not impossible). However, it may be possible for Eastern European countries within the EU at least partially to avoid the consequences of their own demography, by running funded pension systems

that invest across the EU, and for which therefore the EU's aggregate demography is relevant rather than the national demography.

Generally, therefore, we can define the conditions where it might be legitimate to talk of a severe demographic challenge or even a crisis, rather than simply a challenge of pension system reform (figure 16). These would be countries where the birth rate is far below replacement level and where there may be cultural barriers to accepting significant immigration, or where there is unlikely to be significant immigration because people are unlikely to be attracted there. Japan and South Korea may be in this category; so too may Belarus and Ukraine—each is forecast to face not population stabilization but significant decline. It is possible in the case of Japan, however, that very high population density does create a welfare optimization case for significant population decline, particularly if the disadvantages of low fertility for the pension system can be offset by investment outside Japan (which at the macro-level is indeed occurring on a very large scale). Russia may also face a significant population decline, but which would not necessarily be in the crisis category, because its status as a natural resource-rich country means that the adverse dependency ratio effects are offset by rising *per capita* rents from natural resource production. Conversely, in a country whose economy is highly dependent on natural resource rents, income *per capita* is directly adversely affected by rapid population growth, e.g. Saudi Arabia.

In summary, the overall picture is not how many countries face crisis but how few. I therefore believe that we are in danger of overstating the severity and generality of the problem of ageing and low fertility in the developed world. And in doing so, we are in danger of diverting attention from where the world's really big demographic challenge lies—which is poor

countries still facing high fertility rates and rapid population growth.

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