

World  
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# The WDA – HSG Discussion Paper Series

*on Demographic Issues*

Population ageing or  
population growth:  
What should we worry  
about?

*by Lord Adair Turner of Ecchinswell*

*No. 2007/5*



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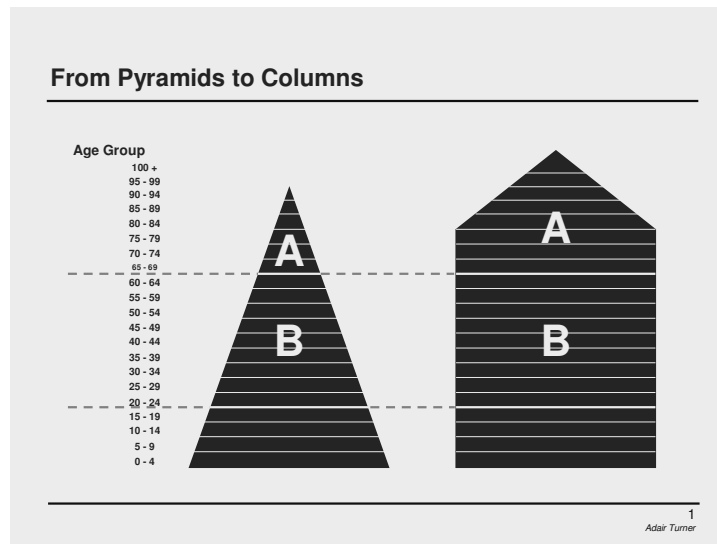
# Population ageing or population growth: What should we worry about?<sup>1</sup>

## Lord Adair Turner of Ecchinswell<sup>2</sup>

### Introduction

The topic of this conference is the challenge of aging populations but also the opportunities of aging populations. And I welcome the fact that you have stressed opportunities as well as challenges, because 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<sup>3</sup> – the combined impact of which has been 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:**



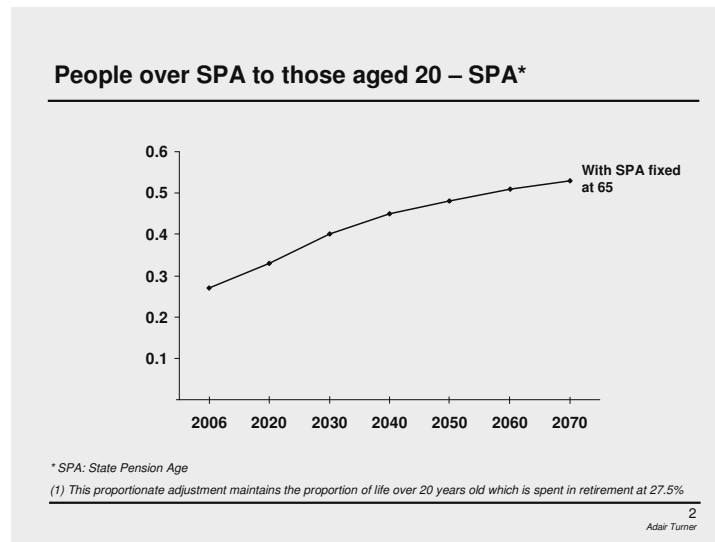
<sup>1</sup> This paper was presented at the third World Ageing & Generations Congress in St.Gallen, Switzerland, hosted by the World Demographic Association

<sup>2</sup> Former Chairman of the UK Pensions Commission, non executive director of Standard Chartered PLC, Siemens Holdings PLC, United Business Media PLC and Paternoster Ltd.

<sup>3</sup> We do not, of course, know whether the falls in fertility which 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 to 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.

It's obvious that 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 to 65), A to B, rises, so that the so called "old age dependency ratio" increases.

**Figure 2:**



And clearly that creates 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.<sup>4 5</sup>

<sup>4</sup> There are in fact two conceptually quite separate demographic impacts on funded systems: the increased longevity impact and the lower fertility. 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 P.A.Y.G. 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. See David Miles "Modelling the impact of demographic change on the economy," Economic Journal Volume 109, and James Poterba "Population Aging and Financial Markets", Federal Reserve Bank of Kansas, Jackson Hole Economic Symposium, 2004.

<sup>5</sup> Despite the fact that funded pension systems are also subject to demographic effects, there is nevertheless a crucial difference which can provide a powerful argument for a significant funded element within a pension system: this is that funding diversifies the demographic risk. Thus if e.g. 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 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 the section "Demographic projections and judgments."

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

But despite having been for three 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.

**Figure 3:**



- Most countries in the rich developed world face an important but quite manageable challenge of pension system redesign
- In some countries the problems are severe, and more radical demographic responses may be optimal
- In some rich developed countries, conversely, population growth is more rapid than optimal
- And across the world the biggest demographic challenge is rapid population growth in parts of the developing world, not the manageable problems of aging in rich developed countries

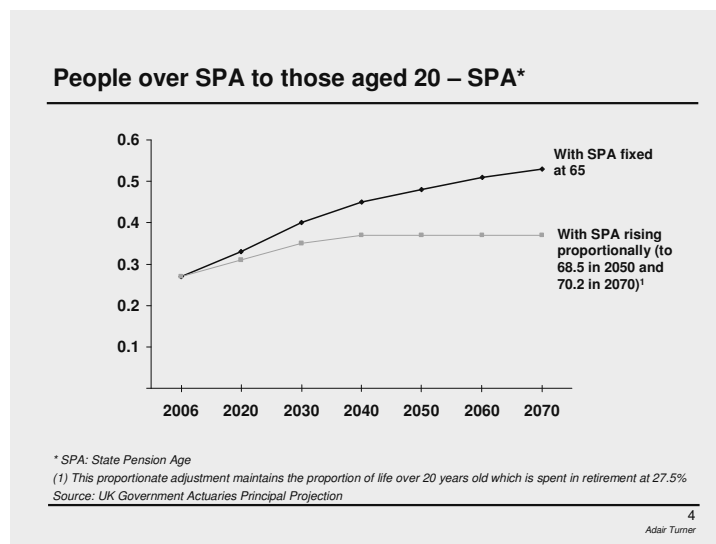
Some of these conclusions, and in particular the first three, depend on judgmental trade-offs between factors, some of which are inherently subjective matters of individual preference. As a result, some of my conclusions can be challenged if a different set of preferences is proposed. But what I do not think can be challenged is the need to make an explicit trade-off between the factors I will set out, a trade-off which 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.

# 1. 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 is implicit on the figures I've already shown, [FIGURE 2] which shows the ratio of over 65s to 20-65s and calls this "the old age dependency ratio".

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<sup>6</sup>. And when we shift to that more sensible assumption at least in the UK a full half of the apparent rise in the dependency ratio between now and 2050 disappears.

Figure 4:



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.

<sup>6</sup> Any old age dependency ratio calculation (e.g. the often used 65+: 20-64 or 65+: 15 to 64 ratios), ignores the complexity that individual people enter and leave the work force at a variety of ages, that exit can be fulltime 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 effect which would arise if all people today retired at 65 and in future at the gradually rising ages assumed.

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.

Two counter arguments to this case are often made.

- First, that people cannot retire later because they will be too old to do the jobs available.
- Second, that in actual fact people are not on average retiring later, indeed if anything the trend till 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 base on this issue is thinner than one would ideally like, the balance of available evidence points overwhelmingly and increasingly towards the conclusion that aging 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 to 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<sup>7</sup>, 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<sup>8</sup>. 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 U.S. 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<sup>9</sup>. “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. 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 aging in which declines in this tail of significant disability would not be matched by improvements in average health at each age.

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<sup>7</sup> Trends in Self Reported sickness (by age band) are for instance reported in the “*Living in Britain*” survey, and these have sometimes been used to calculate “*Healthy life expectancy*”, which on this basis has increased but not as rapidly as total life expectancy. The inherent methodological flaw in these surveys is that as people have got healthier their expectation of what constitutes healthy life has changed.

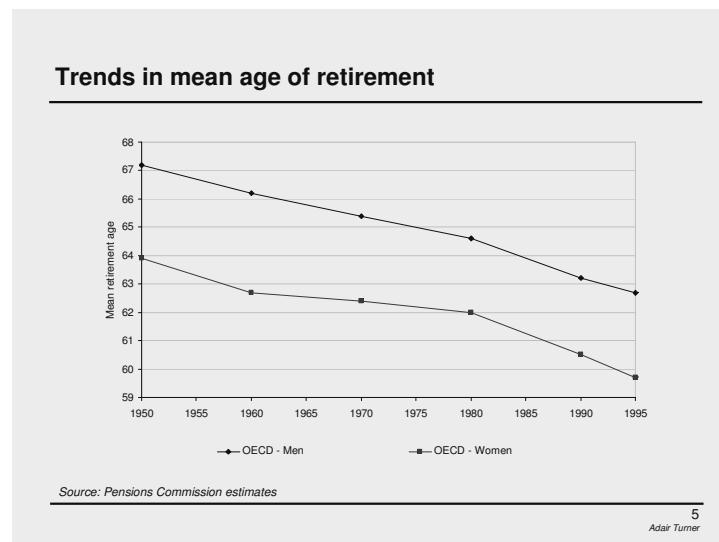
<sup>8</sup> The first year’s results of the English Longitudinal Study of Aging were produced in 2004.

<sup>9</sup> See K. Manton and X. Gu “*Changes in the prevalence of chronic disability in the United States black and white population above age 65 from 1982 to 99*”, Centre for Demographic Studies, Duke University (2001). David Cutler “*The reduction in disability among the elderly*” PNAS, June, 2001 for a survey of research findings to that date. K. Manton and V. Lamb “*U.S. mortality, Life Expectancy and Active Life Expectancy at Advanced Ages: Trends and Forecasts*” (2006).

- New theoretical understanding of the nature of aging, 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”<sup>10</sup>. 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 due to the fact that in today’s Europe older citizens are reaching advanced old age in unprecedented bodily health”. The new biological theories of aging therefore support the observation of the French historian Patrice Bourdelais, who has argued that we need to recognize the extreme elasticity of the aging 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.<sup>11</sup>

The overwhelming probability is therefore that aging is on average healthy; and it is almost certain that aging could be healthy for the vast majority of people. Very large differences between different socioeconomic 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 aging 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 aging 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 5:**



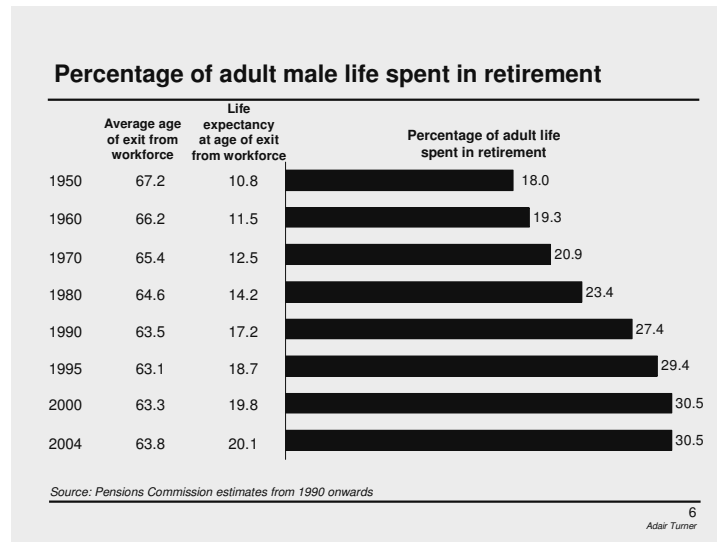
Why indeed have we seen the percentage of adult life spent in retirement, increase even more than it would have if the average retirement age had simply stayed stable?

<sup>10</sup> See Professor Tom Kirkword, Director, Institute of Ageing and Health, Newcastle University, “*Changing expectations of Life*”, April 2007 See Professor Tom Kirkword, Director, Institute of Ageing and Health, Newcastle University, “*Changing expectations of Life*”, April 2007.

<sup>11</sup> Patrice Bourdelais cited in Alasdair Murray “*From Boom to Bust*”, Centre Forum, 2007



Figure 6:



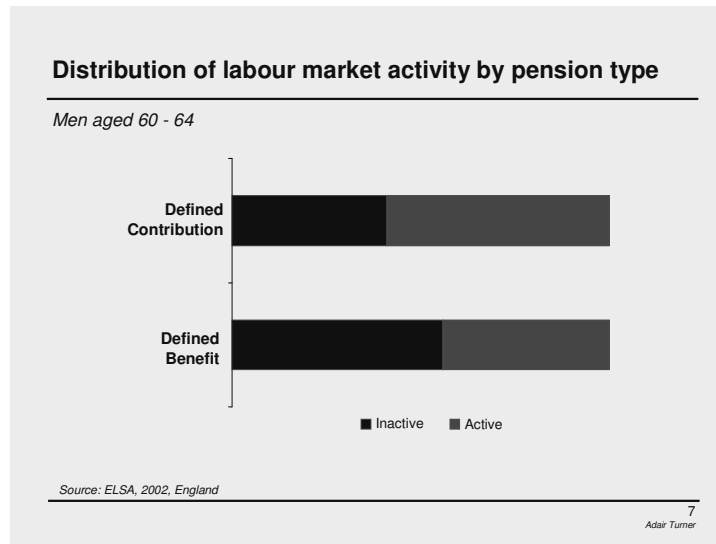
The answer seems likely to be twofold.

- The first 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%.<sup>12</sup>
  - 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. And 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

<sup>12</sup> See e.g. J. Gruber and D. Wise and “*Social Security and retirement: an international comparison*”, American Economic Review 88.

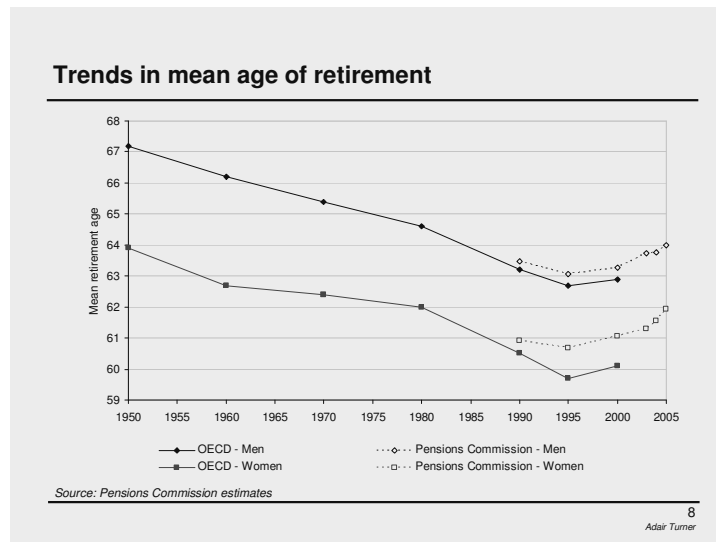
in defined benefit schemes because they face a clear incentive – work till later and achieve a higher pension.

**Figure 7:**



In almost all developed countries, therefore, there is a vital need for pension system reforms which remove barriers to later working and create attractive 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 aging. Indeed in the UK, the average retirement age, having reached a low point in the mid 1990s, is now rising rapidly.

**Figure 8:**

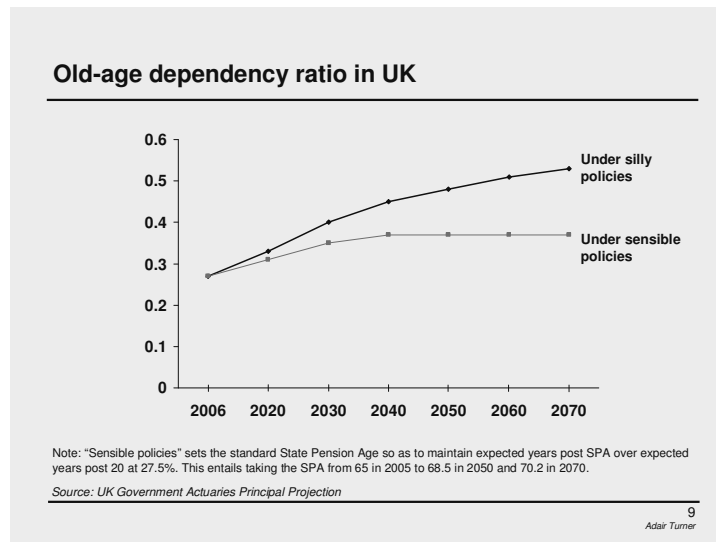


- But there is probably a second reason why people have been devoting an increasing percentage of adult life to retirement, and this reason may continue to apply in the future. It is that people may simply choose to take some of the benefit of rising productivity and rising real wages in leisure rather 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.

So I have a very specific recommendation to make to the governing council of the World Demographic Association, which is that nobody should be allowed to put up a slide of the ratio of over 65 year olds to 20 to 65 year olds, or 15 to 65 year olds, and call it “the old age dependency ratio.” The preferred language should instead be as here illustrated on the UK figures.

**Figure 9:**



- The upper line labelled “the dependency ratio which would apply if we followed silly policies.”
- And the lower one labelled “the underlying dependency ratio if sensible policies are pursued”.

### **Pension reform and manageable burdens**

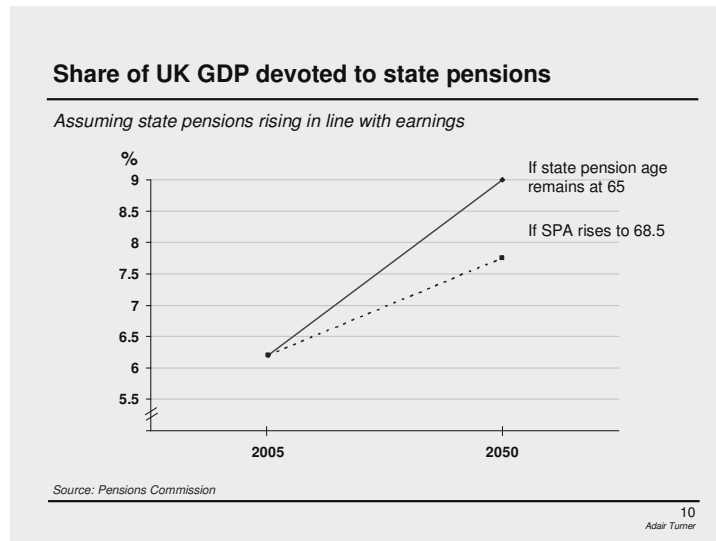
Those sensible policies including changing the parameters of state P.A. Y. G. pension systems so as to reflect rising life expectancy. This can be achieved in two ways.

- By continuing to fix a “standard age” of state pension receipt, but increasing this standard age in line with increasing life expectancy, while also allowing people the option of deferring the pension till later in return for an actuarially fair increase in pension received.
- 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 due to rise from 65 today to 68 in 2045, an increase roughly proportional to rising life expectancy. 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 (The question of how far the UK context is specific is considered later).

**Figure 10:**



- The top line on Figure 9 shows what would happen to UK public expenditure on state pensions as a percent 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<sup>13</sup>. Public expenditure increases from 6.2% to 9% 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<sup>14</sup>. 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.

But even the problem that remains is in the UK's case, clearly manageable. Faced with this potential increase in pension expenditure, the UK has two options.

- One would be to increase the state pension age 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

<sup>13</sup> At present the UK has a state pension age of 60 for women and 65 for men. This anomalous distinction was introduced in the 1940s: prior to that an age of 65 applied for both men and women. Women's state pension age will rise from 60 to 65 between 2010 and 2020.

<sup>14</sup> See UK Pensions Commission Second Report (2005) chapter 5.4, and chapter 6. Note that the estimates made in that 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 percent of GDP would be likely to reduce.

return the SPA to the same relationship to life expectancy in old age which 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.

- The other 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 on Figure 9. 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.

### **Beneficial impact of lower fertility on measured elements of GDP**

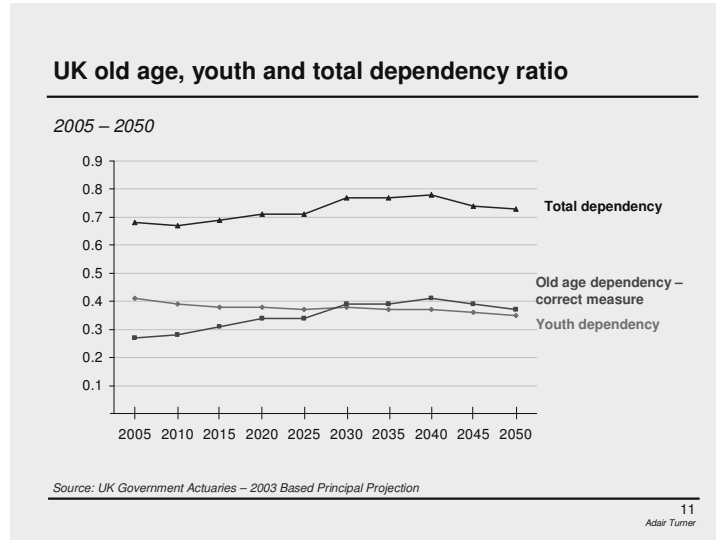
There are two ways in which lower fertility increases the economic resources available to the working generation, thus offsetting the burden of increased transfer payments to retirees.

- The first and obvious benefit is that lower fertility means a lower youth dependency rate, which partially offsets the problem of rising old age dependencies. Figure 11 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 state pension age (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.<sup>15</sup>

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<sup>15</sup> Despite the total dependency ratio shown here being lower than in 1970, however, it is likely that the costs of dependency (i.e. of nonworking members of the population) will be higher for two reasons: (i) the fact that youth dependency (childhood, education expenses) may be less expensive per capita than old age dependency (pensions and healthcare); (ii) the fact that higher education participation rates have increased considerably in the last 35 years, with young person (e.g. 16 to 22 year olds) workforce participation rates falling as a result. But the principle remains that a lower fertility rate produces a youth dependency benefit which partially offsets old age dependency disadvantages.

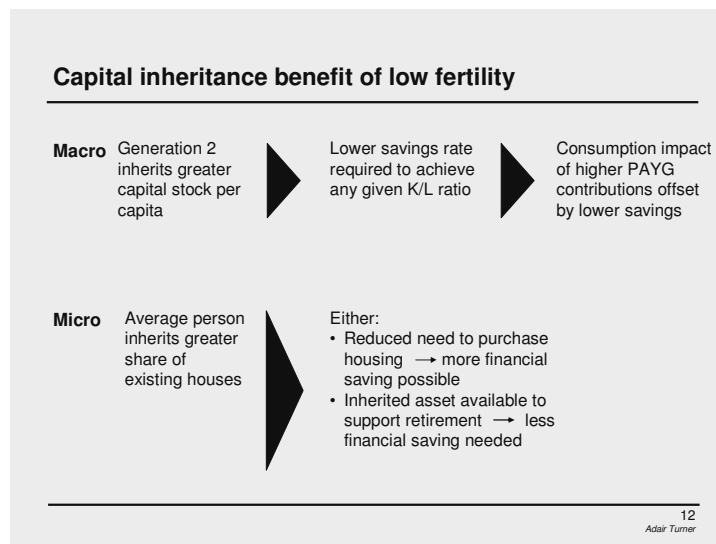
**Figure 11:**



- 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 level.

**Figure 12:**



- 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.<sup>16</sup>

- 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  $\frac{1}{2}$  of a house not  $\frac{1}{4}$ , 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<sup>17</sup>. 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<sup>18</sup> – but these complexities do not change the fundamental fact that the lower the birthrate, 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. And the figures are very significant. In the UK, at end 2003 all funded pension assets amounted to about £1.3 trillion. Net housing equity, after mortgage debt, was about £2.25 trillion pounds.

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 birthrate, the lower is the replacement rate of earnings which pension policy should aim to achieve through the combination of the P.A.Y.G. and the compulsory or encouraged funded elements of the system.”*

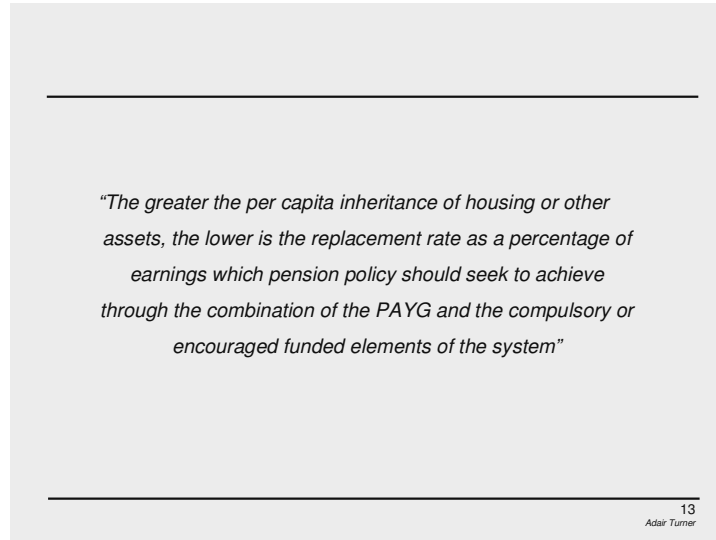
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<sup>16</sup> The scale of this benefit is likely, while significant, to be less than simple gross figures might suggest. This is because there are limits to the extent to which economy can rely on inherited capital stock without suffering a productivity penalty, since new capital investment incorporating latest technology may in some categories (e.g. much plant and equipment) be 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.

<sup>17</sup> Other possibilities include that people, especially 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 lowish fertility among those who have any children, and a significant (e.g. 20% plus) level of childlessness, this is a nontrivial possibility.

<sup>18</sup> See Appendix A for discussion of these complexities.

**Figure 13:**



The general implication of this is that 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.<sup>19</sup>

As a result, the fiscal strain on PAYG systems should in principle (i.e. in terms of welfare optimisation)<sup>20</sup> be manageable not only in the UK, but in many other countries with larger absolute pension expenditures. In the UK, starting with an expenditure of 6.2% of GDP, it is manageable simply to accept the required increase of 1.4% 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

<sup>19</sup> 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.

<sup>20</sup> 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, 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 maximising.



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.

### **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 by 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.
- And increasing population density degrades the quality of shared amenity space. The beach I like to stay at in France in the summer is already more crowded than I like; with further European population growth it will become more crowded still.

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 which impact measured GDP. Similarly, the lower price of large suburban houses in much of the US compared with the price for equivalent properties in South-East England.
- 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 km ] but are likely to become increasingly important as Colorado's population rises.<sup>21</sup>

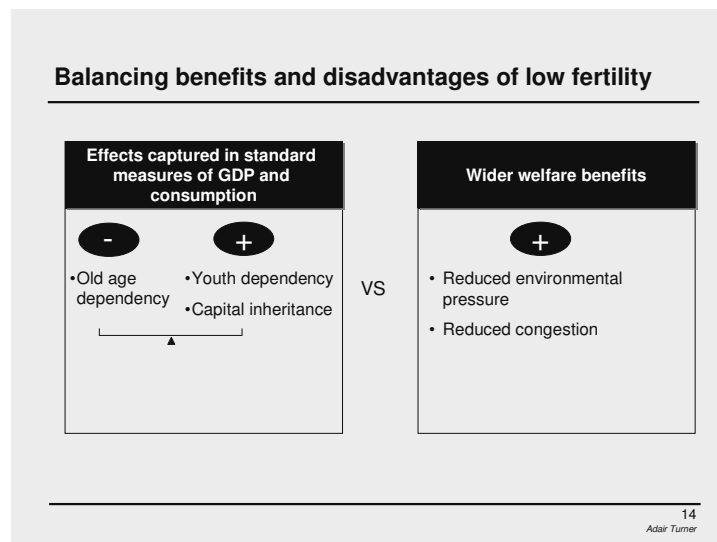
- And clearly the value placed on these effects varies greatly by individual. Some people do not mind traffic noise and have no desire to own a suburban house with a large garden or a house in or close to open countryside: for others, these factors are much more important to their perceived quality of 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 which lower fertility produces.

### 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 14:



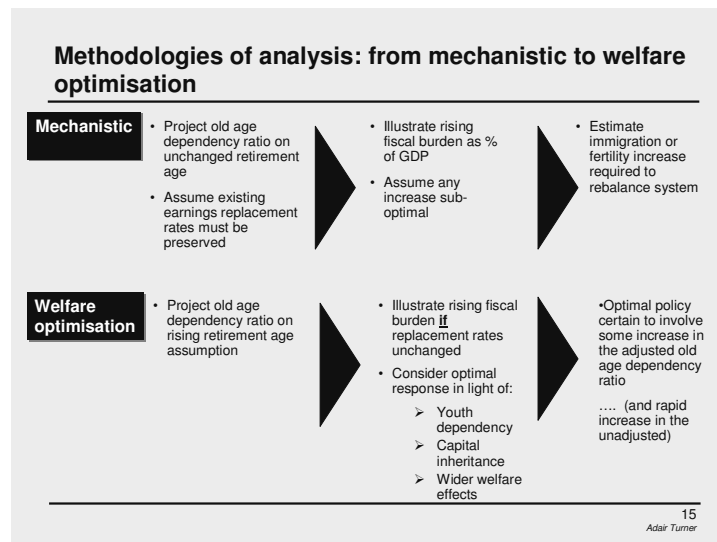
On the one hand, the analysis needs to incorporate factors which are captured and measured in standard GDP statistics. These include the problems created for P.A.Y.G. and for funded systems by higher old age dependency ratios versus the benefits of

<sup>21</sup> Note that while these adverse welfare consequences are therefore 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 which produces a welfare loss, a loss which then attenuates overtime 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.

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

**Figure 15:**



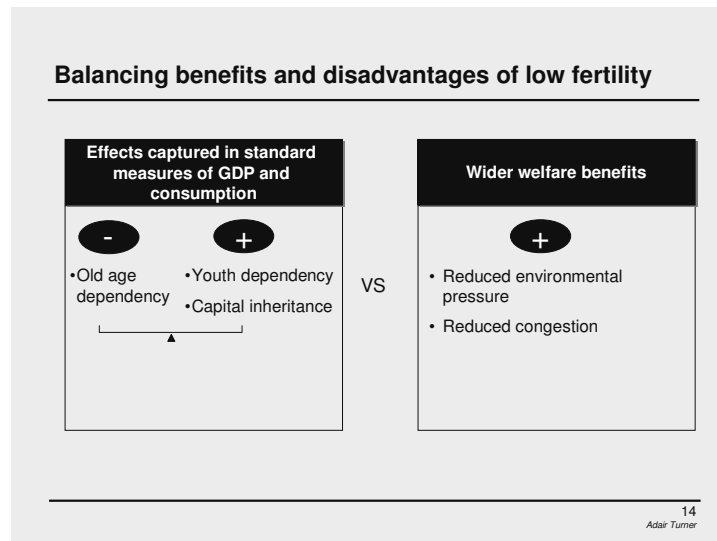
- The mechanistic approach, too often encountered in at least journalistic accounts of the demographic challenge, entails three steps:
  - Assuming that the old age dependency ratio should be measured using a fixed age of retirement, and assuming that existing earnings replacement rates need to be preserved.
  - 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.
  - 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 optimisation 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 stabilising 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.

## Demographic projections and judgments

Given that general principle, 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. Any answer depends in part upon a judgemental trade-off between the left hand and the right hand side factors in Figure 14, and thus cannot be definitive. 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.

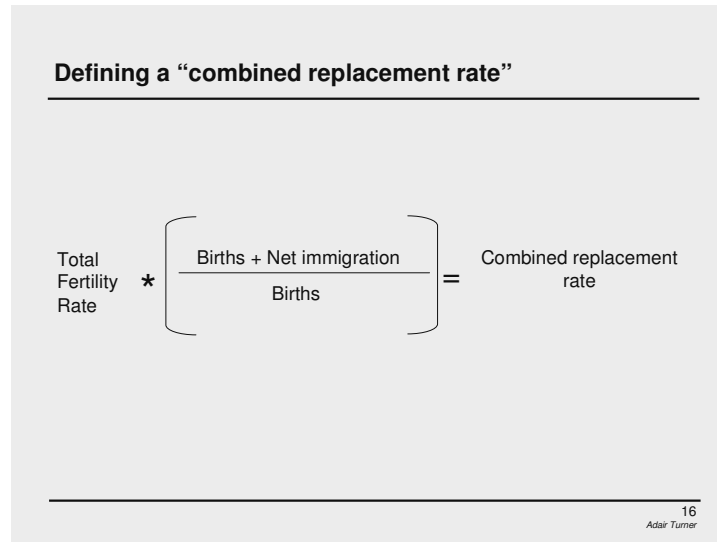
**Figure 14:**



To understand the dynamics of population growth and dependency ratios, it is to define what I have labelled the “Combined Replacement Ratio”. 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.<sup>22</sup> It is this 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 illustrated on FIGURE 16.

<sup>22</sup> 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. These issues are however not covered in this lecture. 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. (see Appendix A)

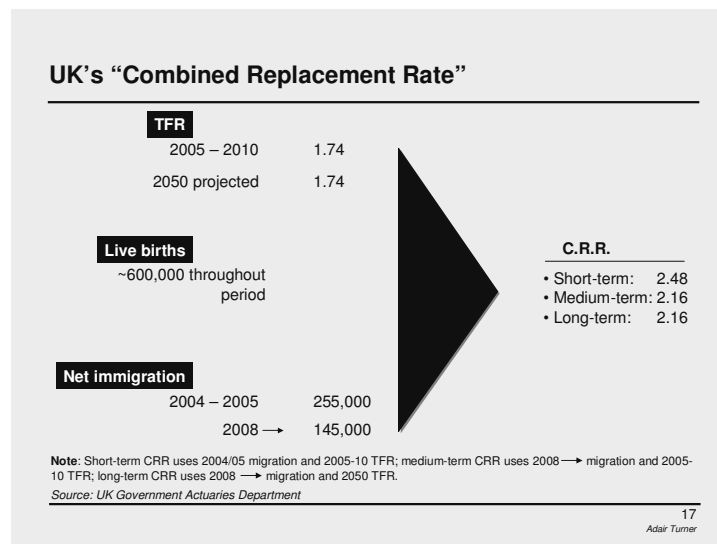
**Figure 16:**



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 with increasing longevity; even a slightly lower Combined Ratio will still produce population growth. This 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 net immigration of 255,000 in 2004-05.

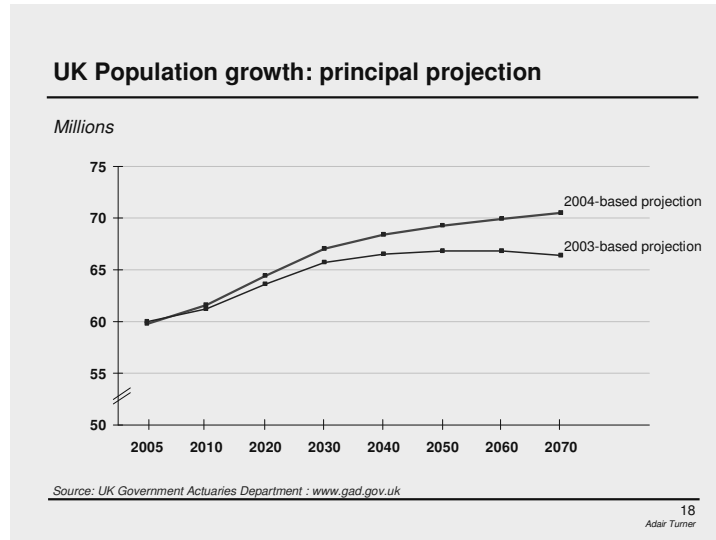
**Figure 17:**



If the UK Government Actuaries Department is right in its assumption that the long-term inflow of immigration will moderate to 145,000 per annum (with the surge of the 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 TFR of 1.74 and constant net immigration of 145,000)

That 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 18:**



A strong case can be made this level of population growth is almost certainly above the welfare maximizing level.

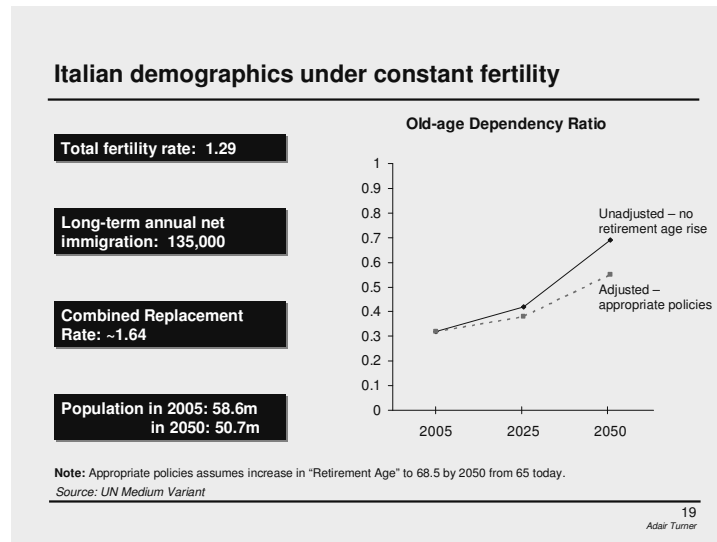
- It is certainly faster than needed to make the pension system manageable. The clearly manageable fiscal burden shown earlier [FIGURE 10] was indeed based on the lower 2003 forecast: under the new higher population forecast, the fiscal burden impact of increasing age dependency will be further reduced. And 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.
- While conversely this pace of population growth, even on the 2003-based figures let alone on the 2006-based figures, will impose welfare detriment due 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.<sup>23</sup>

<sup>23</sup> See e.g. front page of Daily Mail, August 30<sup>th</sup> 2007 "Green Belt must be sacrificed to hit Brown's house-building targets"; "The overcrowded South-east must build more houses for a soaring population". While these political reactions are often dismissed as "nimbly" ("not in my back garden") it is important to note that nimbysm 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 optimising 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 recognise 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 highly likely that the UK faces a too fast population growth, i.e. population growth which is faster than welfare optimising, not slower<sup>24</sup> (for the existing population).

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 "Combined Replacement Rate" would also be far below 2. Consider the case of Italy, with a Total Fertility Rate of about 1.3.

**Figure 19:**



If that fertility rate stays unchanged, and if immigration is in line with the U.N.'s forecast, a scenario captured in the U.N.'s Constant Fertility scenario, which implies a long-term Combined Replacement Rate around 1.5 the population will decline from 57 million today to 53 million by 2050, and the old age dependency ratio, as conventionally defined will rise from X to Y. [FIGURE 19] 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% of the problem disappearing versus half in the UK.

If that truly were the future demography of Italy, then I think it is a reasonable judgment that Italy's Combined Replacement Rate, birth-rate plus immigration is too low. In terms of the three factors we have to trade off, (as on Figure 14) Italy in this scenario would be in a very different position from the UK.

- 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

<sup>24</sup> 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 maximisation 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 health care throughout the world is as good as in rich countries). And most immigration policies are nationally selfish in favouring skilled immigrants over unskilled.

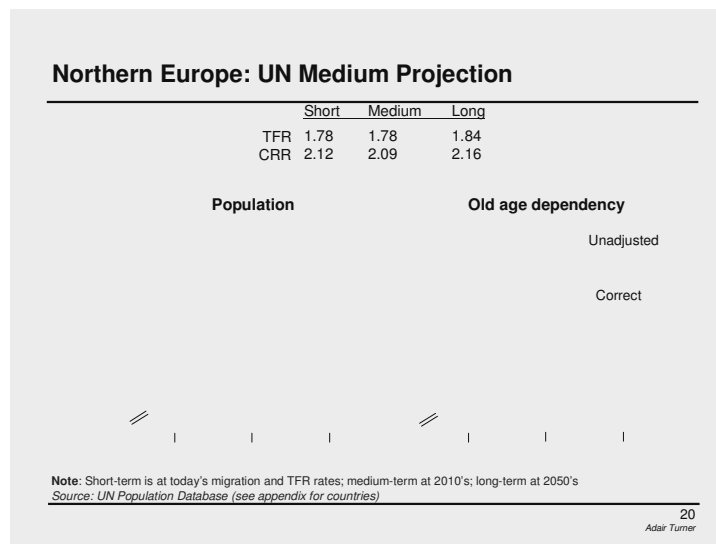
dependency is likely to be very great. Not the manageable 1.4% of GDP in the UK but something much higher.

- Second, when thinking about the benefits of capital inheritance, particularly housing, it's 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 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 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 judgment, 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.<sup>25</sup> But that is a judgment only, and of secondary importance to my main purpose in this lecture, which is to argue not so much for a particular conclusion, as for the methodology of analysis encapsulated in Figure 14.

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 which are above the optimal level as well as some below.

**Figure 20:**



The UN defined Northern Europe group of countries [FIGURE 20] is likely on the medium projection to have a CRR significantly above 2.0 throughout the next 50 years.

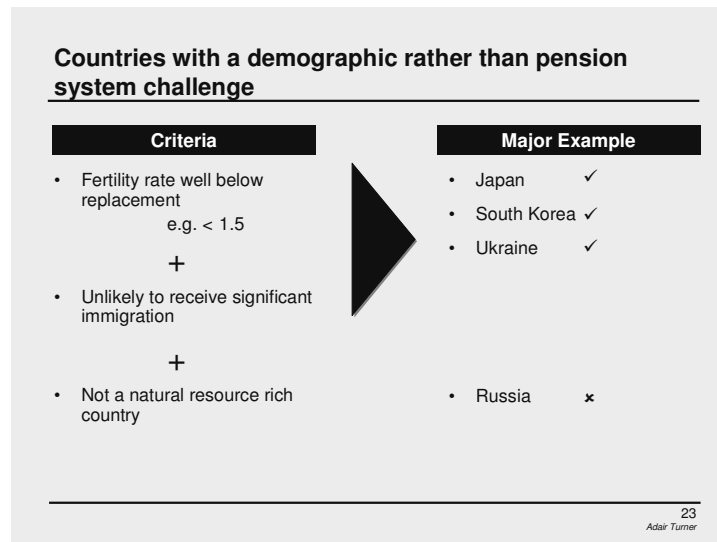
<sup>25</sup> Note that if the CCR were higher than about 1.9 – 2.0 perpetually, then, given some longevity increase, this would imply a permanently rising population and population density. Given a rising marginal welfare detriment from population growth as the density already achieved rises, at some 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.





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 23:**



These would be countries where the birthrate 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.<sup>27</sup> (Russia may also face a significant population decline, but why 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).<sup>28</sup>

The overall picture however 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 aging and low fertility in the developed world.

And in so doing, we are in danger of diverting attention from the world’s really big demographic challenges lie – which is poor countries still facing high fertility and rates and rapid population growth.

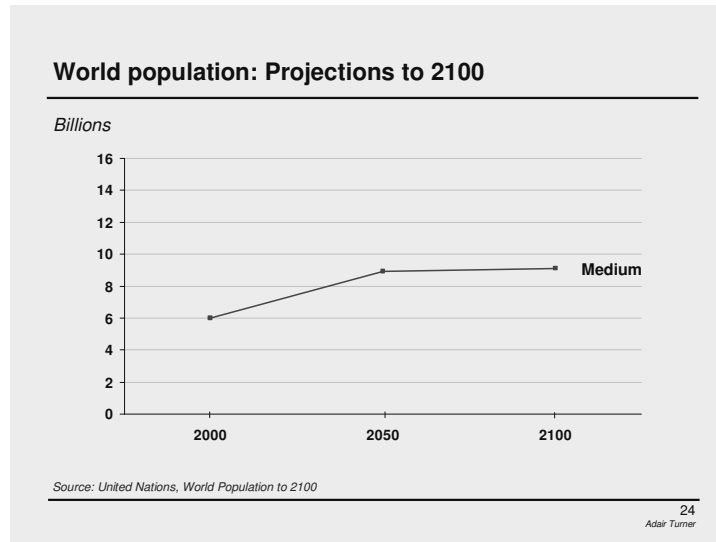
<sup>27</sup> It is possible in the case of Japan, however, that very high population density does create a welfare optimisation case for significant population decline, particularly if the disadvantages of low fertility for the pension system can be offset by investment outside Japan (which at the macro level is indeed occurring on a very large scale).

<sup>28</sup> 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.

## 2. Continued rapid population growth: the bigger challenge

Because for all the talk about population decline in a few rich countries, the global population is still rising rapidly [FIGURE 24], with many developing countries seeing explosive population growth.

**Figure 24:**



The population of Uganda, 5 million in 1950 and 25 million today, is expected to reach 127 million by 2050; Pakistan, 38 million at independence in 1947, could reach 290 million by 2050.

**Figure 25**

**Population projections: Niger, Uganda, Yemen, Pakistan**

Country	1950	2000	2050
Niger	2.6	11.8	50.2
Uganda	5.1	24.3	127.0
Yemen	4.3	17.9	59.4
Pakistan	38.0	144.0	292.0

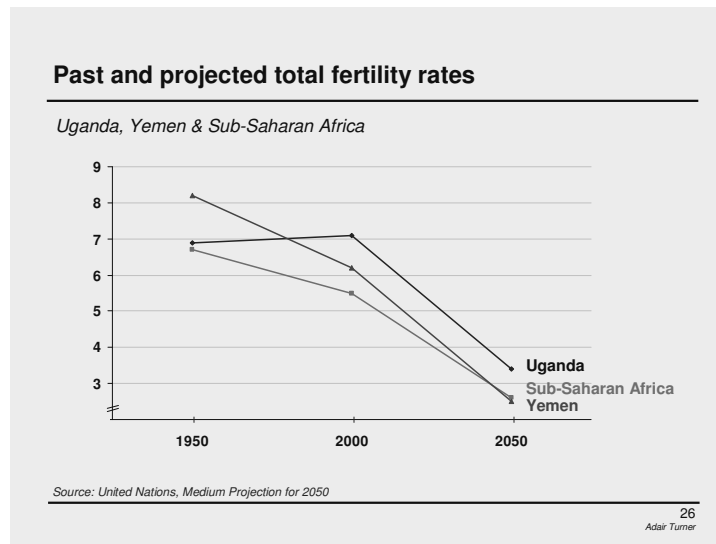
Source: United Nations, Medium Projection for 2050

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And while the U.N.'s medium forecast suggests that the world population may come close to stabilization by the end of this century, (as Figure 22 shows) with the rapid

growers slowing to more moderate growth, it's important to realize that this depends on the assumption that fertility rates will decline in countries where up until now there has been very little reduction.

**Figure 26:**



If fertility rates do not decline in those countries, not only their population but the global population will continue to grow rapidly despite stabilization in the rich developed world.

This very rapid population growth in underdeveloped countries, when it first emerged in the nineteen fifties and sixties, was seen as clearly a problem, an impediment to economic and social progress. Two adverse consequences were in particular stressed:

- First, the possibility of Malthusian limits to growth of population densities beyond the capacity of agriculture to support.
- Second, the phenomenon of capital shallowing – the fact that a higher birth rate and faster population growth meant a lower per capita stock of capital, both because the savings rate would be lower and because each generation would inherit less capital per worker from the previous generation. A low per capita stock of capital would in turn have a direct negative impact on the level of productivity, and thus on the income per capita attainable.

In the 1970s and 1980s, however, this conventional wisdom was questioned and a revisionism emerged which was more sanguine about rapid population growth. More recently what has been labelled a “Revisionism Revised” has emerged.<sup>29</sup> That “Revisionism Revised” is well founded; indeed if anything, I believe, it seems to be understating the power of its case.

The revisionist case that rapid population growth mattered little was primarily based on four propositions.

<sup>29</sup> See A. Kelly “Revisionism revised” in “Population Matters” (O.U.P. 2001) for a summary of the history of the debate.

**Figure 27:**

**High fertility not a problem? The revisionist arguments**

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- Malthusian limits overcome via technology
- High population density can be positive
  - Economies of scale and specialisation
  - Incentives to technological progress
- Capital accumulation less vital to growth than originally supposed
  - Total factor productivity (TFP) the key
- Empirical proof of causation not strong

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- First, that Malthusian limits could be overcome by technology; concerns about India's food supply in the 1950s and 1960s, for instance, overcome by the green revolution.
- Second, that increasing population density could be actually advantageous to economic growth, making possible complex modern commercial societies and specialisation of function, and creating economic incentives for improved technologies, so that technological growth becomes to a degree endogenous within the economic model. A possibility illustrated by the fact that today's rich countries experienced rapid population growth in their periods of industrial trade-off in the 19<sup>th</sup> century.
- Third, that capital shallowing is not a vital concern, because capital accumulation and growth in the capital labour ratio is less important to the growth process than originally supposed – with autonomous technological progress and rising Total Factor Productivity (TFP) more important.
- Fourth and finally, that empirical investigations using regression technique had not proved a strong correlation between high population growth and low per capita growth with high statistical confidence.

Some of these propositions were at least to a degree valid, deepening our understanding of historic growth processes by focusing attention on long-term and endogenous factors.

But as a justification for the belief that today's high fertility rates in poor developing countries are not impediments to growth, the revisionist case was both empirically and theoretically flawed.

### **Malthusian limits**

Obviously in many cases these can be overcome and have been overcome – the initial conventional wisdom overstated the constraints. But at least in some of the very poorest countries of the world, we cannot ignore them entirely. How Niger is going to feed a population growing from 11 million today to 50 million by 2050 in a semi arid country which may be facing adverse climate change, is unclear.

## Positive density effects

It is clear that these could exist and probable that they did play a role in stimulating the economic takeoff of Europe in the eighteenth and nineteenth centuries. But there are three strong reasons for believing that this historical observation does not justify a sanguine attitude towards high fertility in the poorest countries today.

- First because Europe's economic takeoff does not illustrate that population growth is always beneficial, but rather that it can be in specific circumstances, circumstances which do not exist today. In the eighteenth century, both Europe and China started on a path of rapid population growth, but while in Europe this was accompanied by productivity and income growth, in China it led to a classic process of Malthusian immiseration. Kenneth Pomeranz argues persuasively in his recent book "The Great Divergence"<sup>30</sup> that the European success was crucially dependent on the windfall of the "empty" lands of north and south America, which enabled European and slave labour to be combined with overseas surpluses of raw material and land, and that without this windfall, Europe might well have progressed down the path of rising population and falling productivity which China followed.
- Second, because the benefits or disadvantages of increasing density must change with technology and with the density already achieved. In a globalised world of easy technological transfer there is no necessity for each country to achieve the population density which stimulates de novo technological innovation: New Zealand can be a rich country with a population density below that of eighteenth century Europe.<sup>31</sup> And while it is possible that population densities in some African countries in 1950 were so low as to make economic specialization difficult, it can still be the case that further population growth today brings no further potential benefits of specialization and large adverse consequences. A Ugandan population of 25 million might be more compatible with prosperity than one of 5 million, but a population of 125 million might still be a very serious impediment to success.
- Third, it is important to note that the population growth now being experienced by many African and middle eastern countries is far more rapid than that experienced by European countries in their periods of economic takeoff. [FIGURE 28] The UK population increased about 3.5 times from 1800 to 1900: Ugandan population is likely to have increased 25 times between 1950 and 2050, even if the significant declines in fertility assumed in the U.N.'s medium scenario are attained.<sup>32</sup>

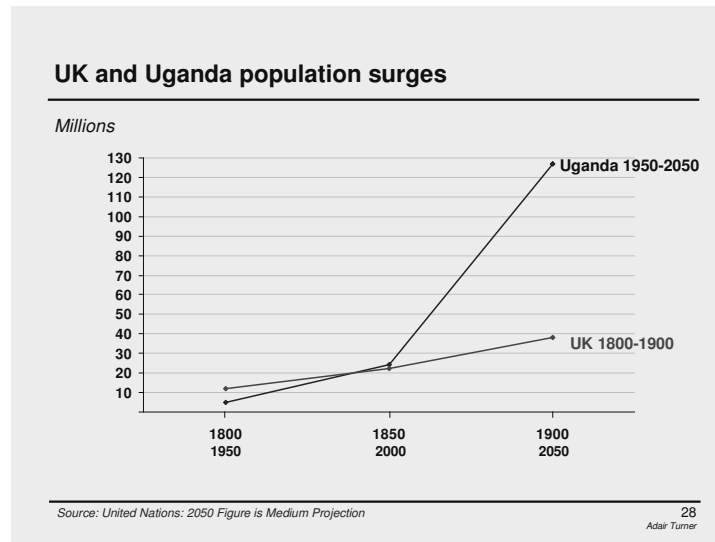
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<sup>30</sup> Kenneth Pomeranz "The Great Divergence" (Princeton University Press, 2000). In addition to the points Pomeranz makes, it is possible that emigration to America from nineteenth century Europe helped to ameliorate the problems of unemployment and low wages caused by large cohorts entering the workforce, and as a result in some countries helped to at least partially dampen social and political instability. Even with this safety valve, rapid population growth (along with the related dislocations of transition from a rural to an urban society) clearly played a major role in driving political instability and arguably in fostering nationalist responses as a device by elites to divert social tensions into irredentist claims. The extremely rapid population growth of Germany from 1870 to 1914 (from 39 million to 66 million) almost certainly played a crucial role in the rise of German irredentist nationalism.

<sup>31</sup> While high population density is therefore not essential to being a high income country, it could nevertheless be the case that reasonable population density is required to succeed with an export led economic transition from low to middle income, given the potential importance of agglomeration economics in explaining the location of manufacturing clusters. Bloom, Canning, and Malaney (see note 29 below) find that population density along the coast has a positive effect on economic growth, while population density inland has a negative effect. Effectively, the densely populated Pearl River delta region of southern China can gain benefits from population density, while Burundi, Rwanda, and Uganda cannot.

<sup>32</sup> The key reason for the lower population growth rate in nineteenth central Europe was that infant mortality was still much higher than in today's developing world. But it is possible that social changes which constrained the birthrate may also have played a role. (See e.g. J. Hajnal "Two Kinds of Preindustrial Household Formation System", Population and Development Review 8.3, 1982) And it is noticeable that in

Figure 28:



### The importance of capital accumulation

The rate of capital accumulation has not been peripheral but absolutely essential to growth in GDP per capita. Alwyn Young's work on growth accounting in the mid 1990s<sup>33</sup> showed clearly that rapid East Asian growth was not due to some magic Asian ingredient, nor to rapid growth in Total Factor Productivity, but to a large extent due to rapid capital accumulation. And the evidence since then, particularly in relation to the Chinese economic take-off, has continually reinforced that conclusion. Angang Hu illustrates that 50% of Chinese per capita growth from 1978-98 can be accounted for by increases in the per capita capital stock.<sup>34</sup> Capital accumulation per capita is thus vital to the achievement of rapid growth from low to middle income.

The contrary belief that it was not vital indeed, was not only empirically wrong but also reflected a theoretically confused understanding of the nature of Total Factor Productivity growth. The concept of TFP (the residual in Solow's growth model) has been vital in helping us understand that capital accumulation is not sufficient for growth and that without progress in technology, managerial technique and "know how", capital

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Japan, which unlike China did achieve a late nineteenth century economic takeoff; there was what Angus Maddison has labelled a "*precocious demographic transition in Tokugawa Japan*". (See Angus Maddison "The World Economy: A Millennial Perspective", OECD 2006 ) The Japanese population grew only 24% from 1700 to 1870 (around the start point of economic takeoff). The Chinese population by contrast grew about 200% between 1700 and 1850 (then falling from 1850 to 1870 due to famine and the internal strife of the Taiping rebellion). The Chinese population explosion in these years, however, while fast enough to produce severe Malthusian constraints, was still far less rapid than e.g. Uganda's, Pakistan's or Yemen's today.

<sup>33</sup> Alwyn Young "Lessons from the East Asian NICs: a contrarian view", European Economic Review 38, 1994. "The tyranny of numbers: confronting the statistical realities of the East Asian growth experience", Quarterly Journal of Economics 110, 1994.

<sup>34</sup> Angang Hu, "Why has China's economy grown so fast?" in "Economic and Social Transformation in China", Routledge 2007. Hu's calculations suggest that in addition to the 50% of growth explained by capital stock increases, close to 20% was explained by improvements in human capital, and almost a third by "institutional changes" i.e. improvements in the allocation and incentive mechanisms deriving from economic reform. It is worth noting also from Hu's figures that in the period 1950 to 1978, China's GDP per capita grew at 2.9% per annum despite the huge disruptions of the "Great Leap Forward" and the cultural revolution. A reasonable interpretation is that very rapid increase in the capital stock achieved via forced savings in those years (Hu calculates 11.5% per annum growth) drove significant productivity growth despite huge misallocation.

accumulation alone would deliver ever diminishing marginal returns. But that does not mean that capital accumulation is unimportant, since most TFP growth is only achieved alongside and as a result of new capital investment. Without major accumulation of capital per capita, no major economy has or is likely to make the low to middle income transition. Though not sufficient, capital accumulation for growth is absolutely essential to economic growth.

The importance of capital accumulation is as a result one of the factors which explains the significant correlations between demographic transition and economic growth which are being revealed by latest analysis. Bloom, Canning and Malaney's recent analysis of "Population dynamics and Economic Growth in Asia" concludes that "demographic factors have played a large role in both east Asia's economic miracle and sub Saharan Africa's economic debacle", and that "growth of the total population has a strong negative effect on economic growth".<sup>35</sup> In common with other recent analysis<sup>36</sup>, this paper stresses the complex and multidimensional nature of the links between demography and economic success. Population density is introduced as an explicit variable, with both positive and negative effects depending on geographical location (coastal versus inland)<sup>37</sup>. And good policies and institutions are clearly important in ensuring that the potential of the demographic dividend is actually achieved. But at the core of the demographic dividend they describe are three direct beneficial impacts arriving from a shift to lower fertility and to lower youth dependency (i) the possibility of a higher savings rate and thus of faster physical capital accumulation<sup>38</sup>; (ii) the possibility of higher per capita expenditure on education, and thus a faster pace of human capital formation; (iii) the possibility of a higher female employment rate.

The one factor which Bloom et al do not stress, however, is that of capital shallowing per se, the simple fact that slower population growth and thus growth in the working population will inevitably increase the per capita inheritance of capital stock from the previous generation. Given the robust logical basis for believing that this must, everything else equal, have some positive effect on attainable productivity, it is unclear why this is not included as an explanatory factor behind the correlations found, though possible that it has not been a major factor until recently but will be an important one over the next few decades.<sup>39</sup>

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<sup>35</sup> D. Bloom, D. Canning, and P. Malaney "Population dynamics and economic growth in Asia"

<sup>36</sup> See e.g. Bloom and Canning "Global demographic change: dimensions and economic significance", 2007. Bloom and Canning "Contraception and the Celtic Tiger", Economic and Social Review Vol. 34, 2003. A. Kelley and R. Schmidt "Evolution of recent economic-demographic modelling: a synthesis", Journal of Population Economics, 2005.

<sup>37</sup> The fact that the coastal regions of China have probably gained from the agglomeration economies arising from high present population density does not of course carry any implication that a still higher population density would deliver any benefits. And the fact that some coastal countries of Africa might be better placed to achieve economic takeoff if they already had higher population density, does not mean that very high rates of fertility are optimal for those countries: the adverse consequences of rapid growth in population could outweigh the benefits of higher density.

<sup>38</sup> The feasibility of a high savings rate is of course created not only by a low youth dependency ratio arising from a low fertility rate today, but by a low old age dependency ratio created by high fertility several decades ago. Since almost all countries in the world have already gone through that initial high fertility stage, however, the beneficial change now required to achieve the demographic dividend is a reduction in fertility.

<sup>39</sup> It should logically be the case that the benefits of reduced capital shallowing (i.e. greater per capita inheritance of capital stock) arise a few decades after the benefits of a higher savings rate made possible by the reduced youth dependency. China's dramatic fertility reduction from the late 1970s onwards reduced youth dependency ratio from the 1980s onwards, enabling a rise in savings, but it is only in the last ten years, as the smaller age cohorts have reached working age, that the impact of greater per capita capital stock inheritance would have been felt. This effect is likely to grow in importance in future, and will

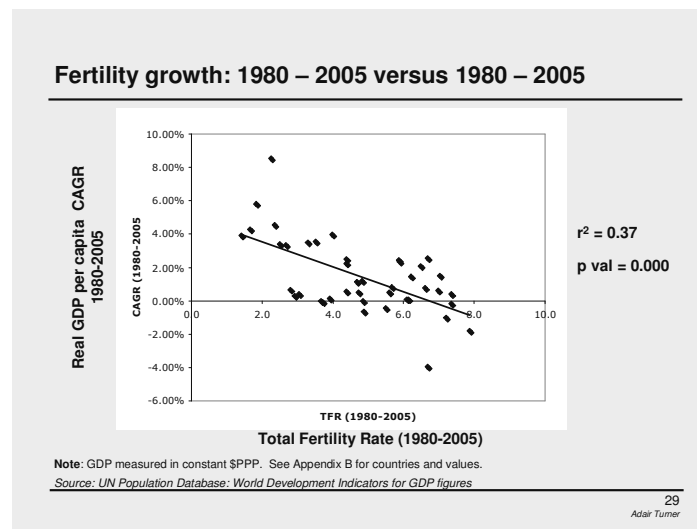


## Empirical correlations

The fourth argument of the revisionist case was that empirical regression based analysis did not prove a clear negative relationship between high fertility and economic growth. Increasingly, however, new analysis is demonstrating clearly that the relationship exists.

- In fact, almost all empirical analyses, even in the 1970s and 1980s, have suggested some adverse impact of high fertility on per capita growth. It was not that the relationship was entirely absent, just that it appeared less strong than previously assumed and that the statistical confidence of the results was low<sup>40</sup>.
- And, as more relevant data has accumulated, the relationship has become clearer. It is certainly the case that on a contemporaneous base, fertility and economic growth are negative correlated (see Figure 29 which plots average fertility over 1980-2005 versus per capita growth across the same period); but this leaves open the question whether the causation flows from fertility to growth as well as from income growth to low fertility. Increasingly, however, as additional years of available data accumulate, we are able to plot fertility in one period against growth in subsequent periods. A simple version of this analysis [FIGURE 30] suggests strongly that high fertility is an impediment to growth. More sophisticated multivariate analysis, by for instance Bloom and Canning, has confirmed that the relationship is significant and statistically robust.

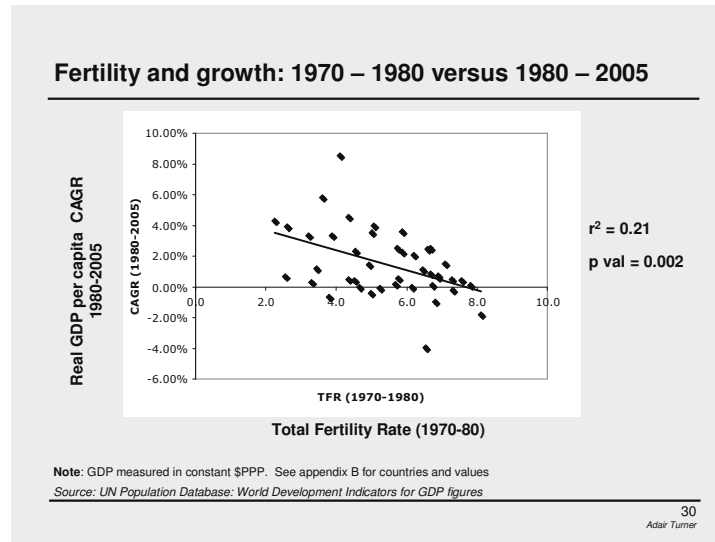
Figure 29:



help to offset the declining savings rate which at some stage will be the likely result of China's rising old age dependency ratio.

<sup>40</sup> See A. Kelley "The Population Debate in an Historical Perspective" in "Population Matters" (O.U.P. 2001). Thus for instance the 1986 National Academy of Science Report, which represented many of the revisionist arguments, still concluded that "on balance, we reach the qualified conclusion that slower population growth would be beneficial to economic development in most developing countries".

Figure 30:



- We should never, however, expect to see very strong relationships between the two variables in simple regression based analysis such as that shown on Figure 30. Nobody would ever suggest that demographics is the sole determinant of economic success, with many other factors – quality of government, institutional structures, inherited culture, geographical location and resource endowment – also important. And while one can attempt to isolate the impact of these other variables in multivariate analysis, the difficulty of putting precise quantitative parameter values to some of these factors, will always make the analysis imperfect. In this area lack of statistical proof of causation is definitively not proof of lack of causation.

This is therefore an issue where statistical analysis of correlation has to be supplemented by appropriate attention to robust theory, and by analysis of specific major countries and possible counterfactual paths of development.<sup>41</sup> China's development path in particular merits careful consideration.

<sup>41</sup> Within statistical regression analysis indeed there is an important methodological issue relating to the appropriate treatment of countries of very different size. Most of the regression analyses conducted count each country as one observation. But if there were an African Union, multiple African countries would count as one; and if Chinese provinces were separate nations, China would count as many observations, even though the economic substance of the relationship between fertility and growth would be unchanged. Thus if in the Slide 30 analysis we counted China as 20 observations, each with the same fertility and growth rate, then the slope of the best fit line becomes steeper and the  $r$  squared increases from 0.21 to over 0.8. This approach could however be misleading if there were in fact significant differences in between the provinces/states of the big countries (in particular China and India); in this case the ideal approach might be for these provinces/states to be included as observations with their own specific values. Li and Zhang "*Do high birth rates hamper economic growth*" (MIT 2007) suggest that within China variations in fertility between provinces are negatively correlated with income per capita growth. And within India there does appear to be a distinction between the lower fertility and more economically successful southern states, and the high fertility (and much poorer) northern states of Bihar and Uttar Pradesh. The correlation however may indicate a causation flow from growth to fertility rather than vice versa.

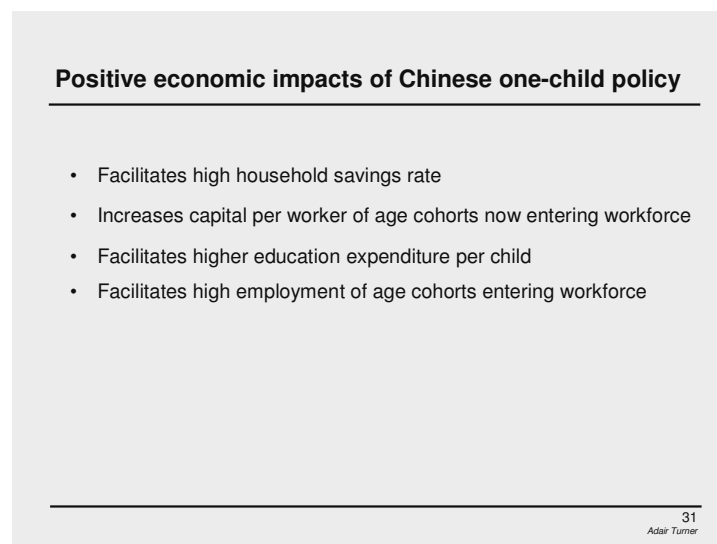
## China: exogenous fertility decline

In China, fertility decline was undoubtedly to a degree an exogenous variable, due to the one child policy, which brought forward into the demography of a low income country fertility rates usually observed only at later stages of development. That policy is, with reasonable certainty, believed to have reduced the population versus the counterfactual of no policy initiative by 300-400 million, with annual cohorts now entering the workforce about 20 million versus perhaps 40 million if there had not been fertility decline.

That reduced youthful population has made possible a far more rapid accumulation of both physical and human capital than would otherwise have been possible. [FIGURE 31]

- Chinese household savings have risen dramatically from 5% of household disposable income in 1978 to over 30% by the mid-1990s, with much of this increase directly attributable to demographic effects.<sup>42</sup> This, together with high levels of enterprise savings,<sup>43</sup> has made possible a national savings rate now reaching 46% and a gross investment rate of about 40%, making possible the rapid accumulation of capital which, as argued earlier, has played a crucial role in Chinese economic take-off. China today simply has more capital per worker – more and better roads, ports, power capacity and factory equipment – than, for instance, all African countries. And this is one crucial reason why China is less poor than Africa and getting richer quicker.

**Figure 31:**



<sup>42</sup> See e.g. F. Modigliani and S.L. Cao “The Chinese Saving Puzzle and the Life-style Hypothesis”, *Journal of Economic Literature*, Vol. 42, 2004.

<sup>43</sup> See Louis Kuijs “*How will China’s Savings and Investment Balance Evolve*”, World Bank, June 2006. Kuijs argues that while the Chinese household saving is relatively high, the still more striking factor is the very high level of enterprise savings (i.e. retained earnings), deriving in part from the peculiarities of the Chinese governance of its state owned enterprises. It can however be argued that even this may have been indirectly and partially enabled by the demographic slowdown, since if youth cohorts had been larger, and unemployment problems more severe, alternative expenditures to offset social and political tensions might have made it more difficult to sustain this high rate of savings and/or higher education expenditures would have been needed simply to prevent a fall in per capita human capital.

- China's ability to invest in human capital meanwhile has been enhanced by its low youth dependency ratio, with secondary and tertiary education enrolment rising rapidly and the average years of education of the adult workforce rising from 4.61 in 1982 to 7.11 in 2000.<sup>44</sup> And looking forward, China's ability to invest further in the upgrading of its skill base will be increased by the smaller size of its youth cohorts relative to those which would now exit in the absence of the fertility decline.

In addition, it seems highly likely that China's low fertility rate has greatly enhanced China's ability to navigate the stresses of rapid urbanisation and industrialisation without mass unemployment, or severe political and social tensions. Obviously it is not the case that larger youthful cohorts create a long term and forever insuperable problem of job creation – there is no finite number of jobs possible. But it is very difficult to create jobs fast enough to absorb the super rapid growth of the potential workforce seen for instance in Pakistan or many African countries, and that is surely why these countries have higher unemployment than China. And very large cohorts of new labour entering the workforce must tend to reduce youth wages, which therefore reduces the incentive for young people, in particular young men, to be law-abiding members of the formal economy.<sup>45</sup> If China had another 400 million young people it would undoubtedly have more of the shanty towns, and urban crime and unemployed young men, we see in for instance Brazil or South Africa. And if Pakistan's fertility rates had been lower over the last twenty years, it would be more likely to be able to provide formal employment to a majority of its young workforce, and would as a result be a less politically risky place.

There are of course very good reasons for objecting to the enforced nature of the Chinese one child policy, but those should not lead us to underestimate the positive impact which that policy has almost certainly had and will have over the next several decades on Chinese economic performance.

And there are good reasons for being reticent about telling developing countries that they must contain fertility – rich people telling poor people to have fewer babies – but that should not lead us to underestimate the severely adverse impact of high fertility rates on the economic performance and prospects of many countries in Africa and the Middle East.

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<sup>44</sup> See Finis Welch: "*Effects of Cohort Size on Earnings: The Baby Boom Babies' Financial Risk*", *Journal of Political Economy*, Vol. 87 (1979), which indicates that even the much smaller variations in cohort size observed in developed countries can have significant effects on earnings.

<sup>45</sup> See Angong Hu 2007. There is a reasonable case that China has not in fact maximised the increase in human capital (educational attainment) that could have been achieved, with state education expenditure (like health care expenditure) suffering in the decentralisation of the 1980s and 1990s and in the face of strong provincial focus on physical investment. However, it remains almost certainly true that lower fertility has enabled higher per capita education spend than would otherwise have occurred.

### 3. Population stabilisation or perpetual growth: the global picture

Let me sum up my argument so far, but also step back to look at the global picture, at demography in the developing and developed worlds combined.

Figure 32:

Analyses required for integrated picture	
Developed World	Developing World
<ul style="list-style-type: none"><li>• Old age dependency ratios adjusted for later retirement</li><li>• Benefits of youth dependency and greater capital inheritance</li><li>• Wider impacts on welfare</li></ul>	<ul style="list-style-type: none"><li>• Centrality of capital accumulation to productivity and income growth</li><li>• Social and political consequences of employment creation problems</li><li>• Avoiding wrong inferences from statistical uncertainties</li></ul>

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Adair Turner

In relation to the rich developed world, I believe we are seriously exaggerating the severity of problems created by aging and low fertility, and that for many countries it is wrong to suggest that policies to change demographic trends are essential, when intelligent redesign of pension systems is all that is needed. And I have argued that to think straight about the problems and non-problems of the developed world, we must go beyond simplistic analysis of dependency ratios in three ways.

- Adjusting dependency ratio measures to reflect healthy aging and rising retirement ages.
- Allowing for the positive effects of lower fertility on per capita capital inheritance.
- And integrating consideration of the welfare consequences of population density which are not necessarily reflected in GDP measures.

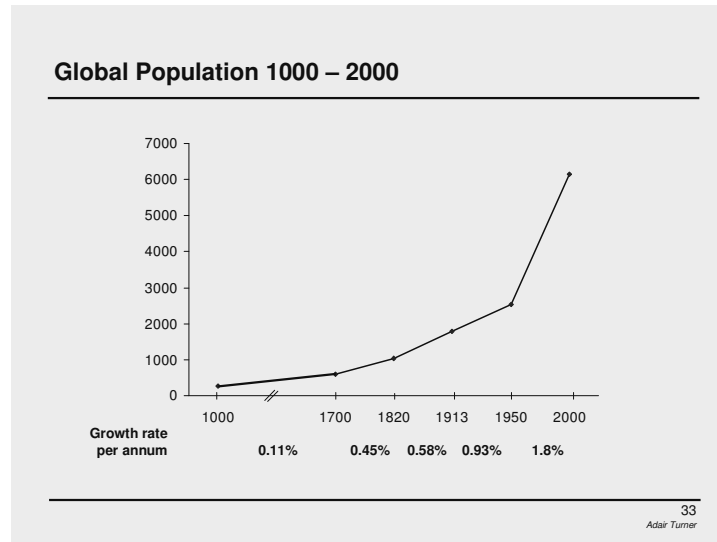
Meanwhile, I have argued that the world's greatest demographic challenges lie not in the rich developed world but in those countries where high fertility rates are serious impediments to economic and social progress. And that analysis of those problems needs to:

- Return to replacing significant weight on the challenges of capital accumulation and capital shallowing.
- Allow for the beneficial effects of an increased ability to invest in human capital when fertility rates decline.
- Allow for the negative consequences of rapid population on unemployment and on the wage rates of new labour force entrants, and the potential political and social effects resulting.

- Avoid drawing wrong inferences from inevitable uncertainties of statistical analysis.

Those thoughts in relation to the developed and developing world separately, however, also suggest the overall global issue, which is whether the world will achieve the population stabilization which is likely to be optimal, or whether the long-term pattern will be either perpetual and harmful growth or significant and suboptimal decline. While the latter threat may at some time emerge and require policy responses, the dangers of the former are clearly more pressing today, and may continue to be more pressing even in the second half of the 21st century.

The long-term path of global population growth is shown in **Figure 33**:

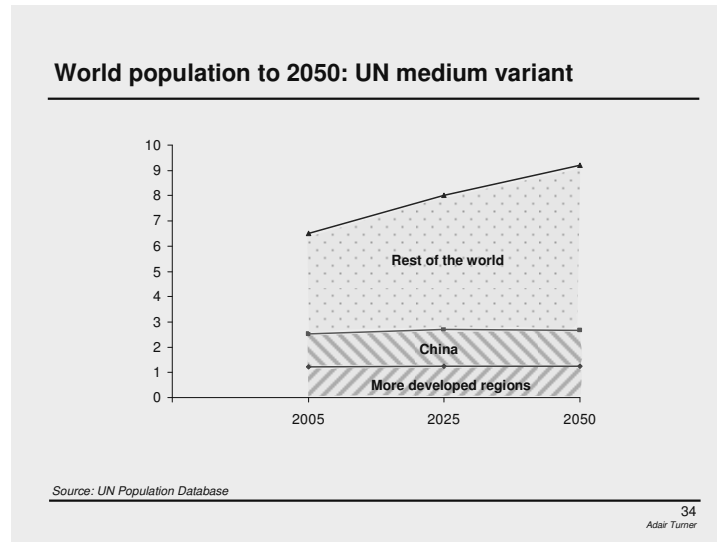


After only gradual and irregular growth from 1000 – 1700, a rapid takeoff began in the 18<sup>th</sup> century, initially concentrated in Western Europe and its offshoots and in China, and more recently in India, Africa and Latin America. That growth has been unleashed by falls in infant and child mortality, which increased “effective” fertility rates,<sup>46</sup> and by falls in later life mortality, which extended life expectancy post childhood. Those falls have been made possible by economic progress, and have interacted with that economic progress in a complex way – in some ways and in some circumstances helping to stimulate it, in others undermining it.

Economic growth has in turn, however, stimulated social changes which brought a decline in fertility in the developed rich countries of the world, which on average are now approaching population stability. In addition one developing country, [FIGURE 34] China, has pursued an active policy to accelerate birth rate decline, and is as a result also approaching stability.

<sup>46</sup> By “effective fertility” rate I mean the fertility rate times the percentage survival to child-bearing age, which therefore determines long-term population growth.

**Figure 34:**



The global population, however, continues to grow rapidly due to high birth rates in many developing countries: birth rates which are in many countries impeding economic progress and in turn therefore delaying the transition to lower fertility. There is therefore no certainty that the global population will approach stability in the late 21<sup>st</sup> century as the UN's medium forecast assumes.

This continued rapid growth in global population has major and adverse consequences for the global environment, increasing the pressure on natural habitats and scarce resources (such as water). In particular it greatly increases the long-term challenge of achieving adequate CO<sub>2</sub> emission reductions to mitigate potentially harmful climate change, given the simple arithmetic that total global emissions are equal to the global population times emissions per capita, so that the higher the level at which the global population eventually (if ever) stabilizes the lower the level to which emissions per capita need to be reduced. To achieve both economic progress in poor developing countries and global environmental balance, rapid reductions in fertility rates in the high fertility countries would be highly desirable.

Despite rapid global population growth, however, a significant body of writing has emerged, which argues that fertility rates in the developed world are too low to sustain an aging population, and that birth rate increases would be desirable. If these policies were pursued, the total population of the developed world [which on current trends will stabilize but not reduce] would increase. And while the rates of population increase likely to arise from feasible increases in developed world fertility rate are much lower than those seen in developing countries, they would still, in order to make a significant difference to dependency ratios, be non trivial. If for instance it was argued that the whole of the developed world would be better off over the very long term if it shared the UK's current demographic outlook, this would imply population growth (as in the UK) of 10- 16% over the next 50 years, and perhaps 20- to 30% each century.<sup>47</sup> Even if the whole developing world achieved economic success and as a result converged to developed world fertility levels by 2050, this would still imply a global population growing

<sup>47</sup> The 10-16% range represents the impact of either the GAD 2003-based scenario (10% growth) or the 2004-based scenario (16% growth).

from 9 billion in 2050) to 11 - 12 billion by 2150, with 20-30% growth each century thereafter.

This consequence of still significant population growth would follow inevitably if the “mechanistic” logic outlined in Figure 15 were pursued. This logic in its extreme form assumes that the ratio A to B must be preserved (or at least any increase minimized) and thus that it is essential to re-expand the base of the demographic pyramid. For the reasons set out in section one of this paper, I believe the case for this expansion has been greatly overstated, and that many developed countries face a quite manageable challenge of pension reform rather than a demographic crisis, given present combinations of fertility rate and immigration and their likely medium term evolution. Broad population stability in the developed world in general, consistent with Combined Replacement Rates at or slightly below 2.0, and thus with fertility rates significantly below 2.0 (e.g. 1.7), is not only manageable in economic terms but likely be preferable to a scenario of more rapid population growth. Some specific countries with very low fertility rates and little prospect of significant immigration, may face serious problems if neither fertility nor immigration rises, but in general population stabilization in the developed world is surely to be welcomed rather than decried.

What is possible, however, is that in the very long-term developed countries might face a more general problem of sub-optimally low fertility. Thus while I have argued that most European countries, and the European Union in total, probably face manageable old age dependency burdens given the likely combination of fertility and immigration rates, the story would be different if no net immigration were possible. A long term TFR of substantially below two, combined with no immigration, would likely to be suboptimal even once youth dependency, capital inheritance, and wider welfare benefits were taken into account.

If and when the whole (or at least the greater part) of the developing world does achieve economic prosperity and lower fertility rates, the potential for net immigration to the developed world will fall and eventually disappear. A whole world of below 2.0 fertility will not be able to replenish the base of its demographic pyramid through immigration from other planets. There is therefore a long-term issue of whether fertility rates in rich developed countries will tend towards the sort of values which would be manageable without immigration (e.g. the 1.85 which the UN's medium variant assumes), or whether they will settle substantially below two.<sup>48</sup>

The study of the determinants of very low fertility rates is therefore important.<sup>49</sup> And the possible policy responses to very low fertility, for which today there is a pressing need in

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<sup>48</sup> The biggest challenge of a TFR far below 2.0 combined with minimal immigration may well arise not in Europe but in China. One of the biggest demographic uncertainties for the mid 21st century is the long-term path of Chinese fertility. There is a significant chance that this might move far lower than today's 1.8, and could stay very low even if and when the one child policy is relaxed. China is a densely populated country which is rapidly concentrating its population in high-rise and very densely packed cities, with small average size of apartments. It seems unlikely, even when they have free choice, that China's increasingly rich and urban population, aspiring to western standards of consumption and perhaps of living space, will revert to large families, and possible that China's birth rates will fall towards the very low levels (e.g. about 1.0-1.1) seen today in Hong Kong and Singapore. While China's high population density means that even a TFR of significantly below 2.0 might be optimal (the welfare benefits of a slightly declining population offsetting the higher old age dependency ratio) there is a risk for the long-term that the TFR may be so low as to be severely sub optimal.

<sup>49</sup> The study of the determinants of low fertility can also provide important insights about individual fertility preferences and constraints, quite separate from the issue of optimal fertility rates at the overall society level (e.g. why do surveys reveal that preferred/intended fertility rates at the onset of adult life are often higher than actual completed family sizes.) And policy measures to enable parents more easily to combine work



only a few countries, may in the long-term be more generally important. In today's world, however, the greater problem is rapid population growth in many developing world countries, not low fertility in the developed world.

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and child rearing can be justified in themselves rather than by reference to a supposed national need for higher fertility.

## APPENDIX A: COMPLEXITIES RELATING TO THE CAPITAL INHERITANCE EFFECT

In general, the lower the birth rate, the higher is the per capita inheritance of capital stock, including in particular housing. And this greater inheritance, as discussed in the main text, creates resources which reduce the need for individuals to rely on pensions (whether unfunded or funded) to support consumption in retirement. In practice, however, there are multiple complexities which need to be taken into account before deciding how much weight to attach to housing inheritance in pension system design. Three in particular are covered here.

1. Distributional issues. The UK Pensions Commission key task was to recommend whether Britain should introduce, in addition to its basic PAYG state pension, a tier of compulsory funded pension provision. In fact, it concluded in favour of strong encouragement (automatic enrolment with the right to opt out) rather than full compulsion, but the issue still remained: to what level, expressed as a replacement rate relative to earnings, should this encouragement apply. The Commission recommended in favour of a system which would strongly encourage people to achieve at least a 45-50% earnings replacement rate, which falls short of the 65-70% rates (two-thirds) often used as benchmarks in discussions of pension adequacy. This lower proposed target reflected in part the importance of housing asset inheritance, where both its aggregate level and its distribution are important.
  - It is possible to imagine a hypothetical distribution pattern which would almost entirely remove the need for a pension system tier beyond basic flat rate PAYG provision. If all family sizes were roughly the same; if all families owned houses (or if the ownership of houses was negatively correlated with the ownership of voluntarily accumulated pension rights); and if people held housing assets in proportion with their income; then provided the aggregate value of the capital stock to be inherited were sufficiently large, housing inheritance could be considered a close to complete solution to retirement provision.

In fact, the Pensions Commission observed that (i) housing assets are more widely distributed than any other class of asset, but not all people own them; (ii) housing assets are held roughly, but not precisely, in proportion to income, except at low income levels, with about 20% of the population owning no housing assets; (iii) housing assets are neither negatively nor positively correlated with other asset holdings. The Commission therefore concluded that while it could not consider housing ownership and inheritance as removing the need for any mandatory/encouraged pension provision beyond the poverty avoidance minimum, house ownership and inheritance meant that the optimal level of mandatory/encouraged pension provision was lower than it would otherwise be; and that if mandatory/encouraged pension provision were set so as to achieve traditional benchmarks (e.g. 65 to 70% of earnings replacement rates) many people would be mandated/encouraged to over-save relative to an optimal level. See UK Pensions Commission Second Report (2005, chapter 1.3.)

2. Inheritance Tax. On inheritance tax note that in theory different tax regimes do not change the conclusion that wide ownership of housing (or other assets) combined with reduced fertility offsets the adverse impact of lower fertility on the affordability of P.A.Y.G. provision. The greater the impact of inheritance tax, the lower reliance that individuals can place on inherited assets to fund retirement, but the higher the government's tax revenues, which, everything else equal, could allow any given level of P.A.Y.G. pension provision to be funded with a lower pension contribution rate.
3. Real house price inflation. The complexities arising from real house price inflation are numerous. More rapidly rising population will tend to produce more rapid house price inflation, which might seem to beneficially increase the capital inheritance effect. But it is important to understand that a rise in the price of existing assets such as housing represents simultaneously a windfall gain for those who already own housing assets and a windfall loss for those who do not, and thus is quite correctly not included in national savings aggregates (see W. Gale and J. Sabelhaus "*Perspectives on the household savings rate*", Brookings Papers on Economic Activity, Vol. 1, 1999, for a discussion of this issue). Thus for an individual the fact that he or she may inherit a more valuable asset which can be used to fund retirement, is offset by the fact that he or she will have to make greater consumption sacrifices to buy a housing asset during working life. Specific individuals, depending on their preferences, could however gain from increased house price inflation induced by rising population, and could do so in ways which avoid the welfare detriments of rising population density. For instance, people who do not feel emotionally attached to living in their country of origin, and who feel that their utility would be diminished by rising population density in that country, can nevertheless gain welfare from population growth by accumulating a housing asset in a region of high density and rising population (e.g. Southeast England) and selling it to move to a lower house price region (e.g. Spain) in retirement.

## APPENDIX B: UN COUNTRY GROUPS

Eastern Europe	Belarus Bulgaria Czech Republic Hungary Poland Republic of Moldova Romania Russian Federation Slovakia Ukraine
Northern Europe	Channel Islands Denmark Estonia Faeroe Islands Finland Iceland Ireland Isle of Man Latvia Lithuania Norway Sweden United Kingdom
Southern Europe	Albania Andorra Bosnia and Herzegovina Croatia Gibraltar Greece Holy See Italy Malta Montenegro Portugal San Marino Serbia Slovenia Spain Former Yugoslav Republic of Macedonia
Western Europe	Austria Belgium France Germany Liechtenstein Luxembourg Monaco Netherlands Switzerland

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**World Demographic Association**

P.O. Box 2239  
CH-9001 St.Gallen, Switzerland

phone: +41 (0)71 242 79 79  
[www.wdassociation.org](http://www.wdassociation.org)

fax: +41 (0)71 242 79 78  
[info@wdassociation.org](mailto:info@wdassociation.org)