The future of global ageing

Robert Palacios

Humans have extended their average stay on earth dramatically in recent history, with life expectancy at birth rising by more than one-third in just the last four decades. Despite this success, there are growing concerns about the possible impact of ageing on living standards. As biologists raise doubts about the limits to human longevity, economists in demographically older countries worry about how to finance pension and health programmes.

Not surprisingly, most of the ageing literature is produced in rich countries well into their own demographic transitions. Studies published in the US and Europe focus on topics such as maximum human life span or new applications of stochastic techniques to population projections. The research is motivated by a sense that existing public policies must be changed in order to successfully cope with the projected ageing of the population.

While these topics are of great interest, most of the potential gains in average life expectancy are to be reaped in the poor, young countries of the developing world. Moreover, as argued below, convergence of long run ageing patterns is likely to be a natural by-product of policies that mitigate the pressure of ageing in rich countries. A positive approach to the ageing challenge calls for the integration of economies with staggered demographic transitions. Combined with national policies that remove subsidies for leisure relative to work, it should be possible for the world to age gracefully.

Global ageing

The reduction of mortality and fertility rates that leads to population ageing has gained global momentum only recently. Most of human history is characterized by life spans of only a few decades and even the sharp mortality decline of the 18–19th century was limited to the more advanced countries.1–3 In contrast, the reduction of mortality rates during the 20th century spread to every region of the world. In the last four decades of the century, global average life expectancy at birth increased by a third, from about 50 to 66 years. Infant mortality rates have been halved over the same period.

Life expectancy has increased faster in poor and middle income countries, where marginal changes in environment still have the most impact, especially on infant mortality rates. Reduced child mortality, in turn, promotes population ageing by encouraging lower fertility.4 Higher likelihood that children will survive, combined with advances in the availability of birth control, allow people to achieve the same objectives with fewer births. Medical interventions that reduce maternal mortality further raise female life expectancy.

On the other hand, the demand for children might increase if people expected to grow old. This effect—known as the ‘old age income fertility motive’—is offset, however, by parallel developments that typically take place during urbanization and industrialization. For example, as productivity and incomes rise, households are more willing and able to invest in education for children who in turn can make larger transfers to their parents. Female labour force participation becomes more attractive as a way to supplement household income and raises the cost of time spent rearing children. Also, new instruments may become available that can partly substitute private intergenerational transfers.

The dramatic expansion of formal pension schemes during the 20th century is an example of this last factor. These programmes originated in European countries where population ageing first became significant and were expanded after World War II. By the 1960s the vast majority of governments had introduced some form of pension system. Table 1 reports the results of a cross-section regression analysis using a sample of 118 countries. As expected, high infant mortality rates are associated with high fertility rates while the opposite is true for pension spending and coverage. Both variables are statistically significant. The fourth and fifth variables are dichotomous dummies for transition socialist countries and China, respectively. The significance of the latter variable suggests that Chinese policies have resulted in a fertility rate lower than would otherwise be predicted.

Differential ageing patterns and convergence

At the end of the 20th century, one in ten human beings was over age 60. By 2050, the ratio is projected to reach one in five. This is largely due to the fact that since 1960, global life expectancy at birth has increased by an average of 4 years per decade. Yet, this impressive statistic masks significant regional variation. Although the relative improvement is generally highest in developing countries, the gains are not strictly related to the initial conditions. The percentage increase registered in sub-Saharan Africa for example, is only slightly greater than that for the high income OECD countries. Most of the global gain in fact, is driven by mortality decline in Asia, and especially in East Asia.

Clearly, regional factors are important in explaining the observed pattern of global ageing. These go beyond changes in general mortality trends and include exogenous shocks that can affect the ageing process. Two important examples can be found in sub-Saharan Africa and China.

In the case of China, it is clear that given its size, increased life expectancy in that country explains much of the global mortality reduction. Moreover, the regression results in Table 1 suggest that reported Chinese fertility rates are lower than what would be predicted after taking into account other factors, including infant mortality rates. While there are questions about the officially reported fertility rates in China, some of the effect is
probably due to the so-called ‘one child policy’ that has prevailed for several decades. As a result, the ageing process in China, with one-sixth of the world’s population, has been accelerated. In sharp contrast, life expectancy gains have been modest in Africa. In fact, due to the impact of AIDS, they are being reversed. The increase in the mortality rate is concentrated in the working age population. As a result, the proportion of the population that is old will rise in certain parts of Africa in the short run. This effect is similar to the impact of the plague on demographic structure in parts of Europe during the 15th century.

Despite the importance of these exogenous factors, evidence supports some demographic convergence. Demographers point to shrinking disparities between countries even during the last few decades and tend to project the same in the future. One recent study predicts convergence between Mexican and US/Canadian mortality rates by around 2035.7 Indeed, the global distribution of life expectancy has become less skewed in the last 40 years. In Table 2, the world’s population is grouped into quintiles by life expectancy at birth in 1960, and 1999. The ratio of life expectancy of the top quintile relative to the bottom quintile has fallen from 1.4 in 1960 to less than 1.2 in 1999. Convergence is also evident when comparing the last two columns that show the ratio of life expectancy in each quintile to the global average. Coupled with the data in Figure 1, it appears that there is some convergence taking place, but that it is far from uniform.

Demographic projections of population ageing such as those shown in Figure 2, anticipate continued convergence. In the next 50 years, all regions except for sub-Saharan Africa begin to converge on the global average. The process is highly differentiated however, with East Asia surpassing the average within 20 years and Latin America reaching the global average only by the end of the period. Africa’s relative ageing position does not change.

These projections are based on several assumptions including an increase to replacement fertility levels in older countries. Another important assumption—the limits of longevity has been the subject of growing interest to biologists and demographers. Current theories hold that there are natural limits to the life span of human beings and therefore, diminishing gains to life expectancy that would help lead to the convergence shown in Figure 2. However, doubts have been raised about these limits. If forecasts for rich countries are overly pessimistic, convergence will take even longer.

Evolutionary biology offers two main theoretical positions on this topic.9 The ‘mutation-accumulation’ theory posits that genetic mutations that do not reduce reproductive success but do increase mortality at post-reproductive ages accumulate over generations because they evade natural selection. Alternatively,

<table>
<thead>
<tr>
<th>Equation (1)</th>
<th>PSGPD</th>
<th>PSCOV</th>
<th>IMR</th>
<th>TRANSDUM</th>
<th>CHINADUM</th>
<th>Adjusted $R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>(obs = 118)</td>
<td>–0.249</td>
<td>0.45</td>
<td>9.92</td>
<td></td>
<td></td>
<td>.45</td>
</tr>
<tr>
<td>Equation (2)</td>
<td>–0.7273</td>
<td>0.0335</td>
<td>5.64</td>
<td></td>
<td>–1.5634</td>
<td>.63</td>
</tr>
<tr>
<td>(obs = 118)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equation (3)</td>
<td>–0.1057</td>
<td>0.0388</td>
<td>16.50</td>
<td>–0.88</td>
<td>2.31</td>
<td>.86</td>
</tr>
<tr>
<td>(obs = 118)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equation (4)</td>
<td>–0.0466</td>
<td>0.0375</td>
<td>15.66</td>
<td></td>
<td></td>
<td>.73</td>
</tr>
<tr>
<td>(obs = 91)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equation (5)</td>
<td>–0.0158</td>
<td>0.0347</td>
<td>10.95</td>
<td></td>
<td></td>
<td>.88</td>
</tr>
<tr>
<td>(obs = 91)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equation (6)</td>
<td>–0.0179</td>
<td>0.0347</td>
<td>10.39</td>
<td>–1.89</td>
<td>3.20</td>
<td>.90</td>
</tr>
<tr>
<td>(obs = 91)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: Figures in table are beta coefficients: t-stats in parentheses.
PSGDP = pension spending as share of GDP circa 1990.
PSCOV = proportion of pension contributors as share of labor force circa 1990.
IMR = infant mortality rate, 1990.
TRANSDUM = dichotomous dummy variable for transition socialist countries.
CHINADUM = dichotomous dummy variable for China.
Source: Palacios (forthcoming).

<p>| Table 1 Relationship between fertility rates, public pension provision and infant mortality rates. Regression results for a sample of 118 countries |
|-------------------------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|</p>
<table>
<thead>
<tr>
<th>Equation</th>
<th>PSGPD</th>
<th>PSCOV</th>
<th>IMR</th>
<th>TRANSDUM</th>
<th>CHINADUM</th>
<th>Adjusted $R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>(obs = 118)</td>
<td>–0.249</td>
<td>0.45</td>
<td>9.92</td>
<td></td>
<td></td>
<td>.45</td>
</tr>
<tr>
<td>Equation (2)</td>
<td>–0.7273</td>
<td>0.0335</td>
<td>5.64</td>
<td></td>
<td>–1.5634</td>
<td>.63</td>
</tr>
<tr>
<td>(obs = 118)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equation (3)</td>
<td>–0.1057</td>
<td>0.0388</td>
<td>16.50</td>
<td>–0.88</td>
<td>2.31</td>
<td>.86</td>
</tr>
<tr>
<td>(obs = 118)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equation (4)</td>
<td>–0.0466</td>
<td>0.0375</td>
<td>15.66</td>
<td></td>
<td></td>
<td>.73</td>
</tr>
<tr>
<td>(obs = 91)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equation (5)</td>
<td>–0.0158</td>
<td>0.0347</td>
<td>10.95</td>
<td></td>
<td></td>
<td>.88</td>
</tr>
<tr>
<td>(obs = 91)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equation (6)</td>
<td>–0.0179</td>
<td>0.0347</td>
<td>10.39</td>
<td>–1.89</td>
<td>3.20</td>
<td>.90</td>
</tr>
<tr>
<td>(obs = 91)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Table 2 Distribution of world population by life expectancy, 1960–1999 |
|-------------------------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Life expectancy at birth in 1960 | Life expectancy at birth in 1999 | Percentage change | Relative to 1960 average per cent | Relative to 1999 average |
| Quintile 1 | 35.9 | 53.0 | +48 | 72 | 80 |
| Quintile 2 | 39.9 | 63.7 | +60 | 80 | 96 |
| Quintile 3 | 44.5 | 68.6 | +74 | 89 | 103 |
| Quintile 4 | 59.0 | 70.3 | +19 | 118 | 106 |
| Quintile 5 | 70.1 | 76.8 | +10 | 141 | 116 |

Note: World population by quintiles according to life expectancy at birth in 1960 and 1999.
Source: Own calculations based on World Bank population data.
in the ‘disposable soma’ model, when organisms allocate limited energy away from longevity in favour of reproduction, the result is reduced viability during old age. Circumstantial evidence in the form of the limited potential for cell division that correlates with observed life spans (the so-called ‘Hayflick’ limit) is often cited in the gerontological literature.

However, some recent empirical evidence contradicts conventional wisdom. Research suggests a positive impact on survival of children due to the presence of those of post-reproductive age—a ‘grandmother effect’ observed in other species today. Experimental evidence from simpler organisms such as fruit flies and worms shows that life spans can be dramatically increased, implying a significant ‘plasticity’ to longevity. There is also evidence among human populations of accelerating mortality decline at ages 80 and above. Some researchers conclude that even if there are clear limits to longevity, even those societies with the highest life expectancies will not reach them in the near future.

The possibility that potential longevity gains are underestimated is more than an academic discussion in rich countries where inaccurate projections could jeopardize long term financing of health and pension programmes and have indirect negative consequences on the economy. Inappropriate design of programmes could lead to lower living standards, even as people live longer. The consequences of a divergence between productivity and ageing can already be seen in the failed pension schemes of the former socialist countries in Eastern Europe and the former Soviet Union. In these countries, demographic ageing outpaced economic growth.

Public policy issues

When faced with the prospect of old age, economists observe that humans look for ways to shift some of the consumption that they could afford during their most productive years to old age when physical and mental deterioration reduces their productivity. This life-cycle consumption pattern is the rationale for encouraging, facilitating or even mandating saving for old age. While public and private pension schemes are in place in rich and some middle income countries, most of the world continues to depend on informal intergenerational transfers, mostly within the family unit.

Children clearly provide support to the elderly, but the nature and amount of that support varies over time and across countries. What is less clear is why it is provided. There are at least two broad theoretical explanations for intergenerational transfers—altruism and exchange. The term altruism as used by economists dealing with intergenerational transfers has a fairly specific meaning. One-sided altruism occurs when parents are willing to sacrifice in order to increase the welfare of their offspring. This behaviour is consistent with evolutionary biology in that it fits nicely within the logic of natural selection as individuals maximize the presence of their genes and produce children who do the same. In two-sided altruism however, children also care about the well-being of their parents and are willing to sacrifice their own resources accordingly. This seems less consistent with natural selection in that allocation to post-reproductive family members might come at a cost to offspring survival. This behaviour is consistent with evolutionary biology in that it fits nicely within the logic of natural selection as individuals maximize the presence of their genes and produce children who do the same. In two-sided altruism however, children also care about the well-being of their parents and are willing to sacrifice their own resources accordingly. This seems less consistent with natural selection in that allocation to post-reproductive family members might come at a cost to offspring survival, a trait that would be discouraged through natural selection.

Another model involves an implicit contract between generations to exchange support during childhood for support during old age. This exchange can benefit both generations, especially when mechanisms for long term saving and longevity insurance in the form of annuities are not available, unreliable or involve high transaction costs. Children borrow from parents, including for education, and repay them with emotional and financial support during their old age. The question remains however, as to how this bargain is enforced.

One explanation involves property and inheritance. The ‘strategic bequest motive’ theory relies on the threat of parents withholding bequests when children do not provide them with support. An alternative explanation is that cultures evolve group mechanisms that reinforce the contract with older generations by penalizing those younger people that deviate from rules such as filial piety.

Whatever their cause, intergenerational transfers will be an important source of old age income for most of the world’s current adult population. Survey data reveal high dependency on family transfers in most poor and many middle income countries. In India, home to one-eighth of the world’s population over 60, more than two-thirds of old women reported depending on transfers from children in the early 1990s.

Informal private transfer arrangements have certain advantages, but they suffer from a concentration of risk in a small unit—the family. A natural disaster or other localized shock
will affect all generations if they have not diversified in some way (e.g. migration). Also, the systems that may be in place to enforce intergenerational contracts may be fragile, especially in the context of urbanization and migration and other dynamics that make enforcement of the contract even more difficult. Some individuals, such as those who do not have surviving children or whose children are simply too poor to help, inevitably fall through the cracks.

In the industrialized world, the response was to introduce pension plans. The early schemes in Germany at the turn of the century, or in the US after the Great Depression, had modest targets that sought to protect the elderly from destitution. Originally, funds were to be put aside in advance to cover a significant part of the projected costs. After World War II, benefits were raised and financing on a pay-as-you-go basis was accepted. These schemes, in one form or another, were later imported by developing countries. By the end of the century, practically every country in the world had some formal pension scheme.

In the last two decades however, the pendulum has swung back and public pension schemes around the world are being downsized. Despite benefit cuts, there is great concern about projected ballooning of public pension spending. A recent European Union (EU) forecast predicts an increase of 3–5 percentage points of GDP over the next 50 years. These figures are based on the baseline demographic projections that tend to assume slowing mortality decline.16

In addition to this direct fiscal impact, indirect effects of unfunded, defined benefit schemes are believed by many economists to have reduced productivity. While the debate continues, a growing number of countries are shifting toward a mixed model in which public transfers are aimed at preventing poverty, while funded schemes managed by competing private actors help individuals smooth consumption over the life cycle.

The implications of population ageing for health spending (and vice versa) are more complex. As pointed out in a recent OECD study, although per capita health spending is observed to be 2.5 to 5 times higher for people over 65 than for younger people, resources may be allocated inefficiently. Some technologies are overused and may even be harmful (e.g. ‘polypharmacy’). By targeting services and encouraging functional independence of the elderly, long run costs could be controlled. Nevertheless, the same EU study projects that health care spending and long term care costs would increase by 1.7 to 3.9 percentage points of GDP in the baseline scenario.17

Unlike pensions, health spending does not automatically increase with the extension of life. This relationship depends on whether morbidity declines in concert with mortality. To the extent that healthier old people need less medical intervention, the increase in costs could be muted. On the other hand, strong demand for the kind of life-extending technologies that might emerge in the coming years could lead to pressure to subsidize these interventions at the expense of lower morbidity.

Disability spending usually takes place through the pension system. Despite evidence of declining rates of disability among the elderly, projections show that ageing will result in increased spending on disability in the industrialized world. In less developed countries, disability is projected to increase at all ages. (Mayhew L. Disability—Global Trends and International Perspectives. Department of Geography and Centre for Pensions and Social Insurance, Birbeck College, unpublished.) Limiting disability would, like postponing retirement, increase the productive capacity of the population.

Productivity and ageing

Population ageing could be associated with higher productivity for several reasons. First, to the extent that it is due to reduced fertility, more capital is available per worker. In addition, fewer resources may be dedicated to child rearing, allowing for more production (if not necessarily higher average production). Cross-country econometric evidence supports the idea that an exogenous reduction in fertility would increase growth.18

Another interesting link has been cited between factors that extend life expectancy and economic growth. Fogel and Costa contend that the ‘technophysio evolution’ that led to a sharp and prolonged decline in mortality in Europe, also resulted in a more robust and productive human organism. The authors trace as much as 50% of economic growth in England since 1790 to the ‘effect of the increase in dietary energy available for work and the increased human efficiency in transforming dietary energy into work output’.

There is growing concern however, that ageing, combined with flawed public policies, could reduce long term growth. For example, Cutler et al. estimate that ageing in the US would reduce consumption per capita by 4.2–9.4% by 2060.19 This could happen through several channels. First, there is mixed evidence that unfunded pension schemes may reduce saving rates. The idea is that individuals will respond to these transfers by saving less for their old age. If true, this would reduce the ratio of capital to labour and reduce productivity, but the empirical evidence is far from definitive.

There is stronger evidence of the second negative effect on productivity—incentives to stop working. Figure 3 shows the average number of years spent in work for males in OECD countries based on actual experience and projected into the future. Most of the decline has come at the older ages. Despite improvements in health, labour force participation rates of males aged 55–64 have dropped precipitously in the last three decades throughout the industrialized world. Micro-level studies confirm that people respond to higher explicit and implicit taxes by reducing labour supply. Pension schemes are a significant part of these incentives.

![Figure 3](image_url)  

Figure 3 Years spent in and out of work, OECD countries 1960–2030
While the debate continues over whether introducing funded schemes is likely to have important positive effects on saving and growth, there is less doubt about the need to raise labour force participation rates of older people. A recent OECD report emphasized the need to eliminate policies that penalize later retirement and proposed more flexibility that would allow phasing out work gradually.

Another ‘pathway’ to retirement is disability. Rates of disability have risen even as the health of workers has improved and the workplace has become safer. As mentioned above, health policy aimed at reducing morbidity at older ages, combined with stricter eligibility criteria and a focus on redeployment and rehabilitation would increase the average fraction of life spent working. Changing the ratio of active to inactive years in an ageing population makes pension systems of any kind more sustainable and increases the pie that is to be shared between old and young at any particular moment.

It appears that individuals in older countries will have to work longer in order to maintain living standards during longer lifetimes. But there are limits to domestic policy changes in dealing with population ageing. Differential rates of ageing around the world provide some intriguing opportunities that could supplement these measures.

Convergence, integration and ageing

After taking other factors into account, there is strong evidence that economies that begin with lower initial income levels tend to grow faster. Convergence is not automatic, however, depending on savings rates and government policies, among other things. When the phenomenon is observed, it is driven by diminishing returns to capital that leads to lower growth in countries with a high capital-labour ratio. Since demographically older countries are generally capital intensive countries, flows of capital and labour between countries have important implications for dealing with population ageing.

Migration from younger to older countries, for example, would move workers from economies with relatively low to those with higher capital stocks. In some cases, this would mitigate a projected decline in the labour force with positive economic effects. For example, Borsch-Supan finds that a modest increase in migration would significantly ease financial pressures on Germany’s pay-as-you-go pension scheme. In his model, net wages actually rise despite increased labour supply because payroll taxes for pensions and health are reduced.

There is also scope for an increase in capital flows from older to younger countries. The impact of additional investment on productivity should be higher in emerging markets as opposed to countries that already have a large stock of capital. Barriers to such flows and weak capital markets to channel them effectively in younger countries limit these opportunities. There exists significant potential therefore, for improving conditions to take advantage of differential population ageing. Funded pension schemes in older countries could then pursue higher returns in developing countries. While recent studies have found the potential gains to be modest, the impact may be underestimated if deeper financial markets and qualitative improvements in capital markets (including corporate governance) trigger a virtuous circle. Admittedly however, removing the bottlenecks that prevent efficient capital flows into many developing countries is a major challenge.

Summary

After impressive reductions in mortality and fertility during the last century, global ageing is now inevitable, despite the uncertainty underlying demographic projections. Yet the process is uneven with some regions expected to converge much more rapidly than others.

The oldest and most rapidly ageing countries, especially many former socialist countries where demographics and productivity have not moved in tandem, are concerned about the anticipated large increase in the ratio of old to working age people. The threat is twofold: first, the direct financial impact on public pension, health and other programmes and second, the potential for indirect negative effects on productivity. In the richest countries, research suggests that current projections are likely to err on the conservative side in terms of longevity gains. It is increasingly accepted that as people in richer countries live longer, they will have to work longer in order to avoid a public finance crisis.

In sharp contrast, poor countries have vast, untapped mortality gains to exploit, even within the confines of known potential longevity. While there has been significant progress over the last few decades, economic stagnation compounded by human immunodeficiency virus (HIV)/AIDS, especially in Africa, threatens to prolong or even stall the demographic transition.

Nevertheless, differential ageing may also be an opportunity to take advantage of the complementary needs of older and younger countries in terms of the global distribution of labour and capital. Policies that facilitate better allocation of both factors can raise overall productivity, benefiting everyone and leading to faster economic and demographic convergence.

References


