THE DEMOGRAPHIC DIVIDEND: RETROSPECT AND PROSPECT

Robert Eastwood and Michael Lipton

The demographic transition, from high to low mortality and fertility, entails several decades during which a country’s dependency ratio falls, bringing a demographic dividend to which a third of East Asia’s late twentieth-century economic growth ‘miracle’ has been attributed. Can a similar miracle be expected in sub-Saharan Africa in the next few decades, or will relentless population pressure prevent this?

Keywords: demographic dividend, demographic transition, dependency burden, economic development, fertility decline, sub-Saharan Africa.

Introduction

How do demography and prosperity interact? For recorded history up to about 1500, the best answer to this question is the Malthusian one. Most people lived close to the margin of subsistence and economic advance was very slow: GDP per capita is estimated not to have grown at all in Europe between 500 AD and 1500 AD (Maddison, 1982). Where technological advances did occur, the result was a rise in population density that prevented any sustained rise in living standards, as for example in Ireland in the century between the introduction of the potato and the Great Famine (Livi-Bacci, 1997). In pre-industrial times, therefore, the main causal link was from prosperity to demography, and the association between prosperity and population growth – albeit temporary – was a positive one.

The acceleration of technological advance in the Industrial Revolution allowed Western European countries to escape the Malthusian trap. The Malthusian mechanisms still operated – rising prosperity led to falling mortality and rising fertility – but not strongly enough to prevent GDP growth from progressively outstripping population growth post-1820. Escape from the trap was made permanent by a reversal of the link between prosperity and fertility. Fertility peaked by the 1870s in England and Wales and then began a long period of decline.

While this decline was doubtless caused in part by the fall in infant and child mortality (fewer births would be needed to achieve a desired family size), it surely also reflected a substitution of quality for quantity of children, a view lent support by the substantial rises in years of schooling in England and Wales during the course of the nineteenth century (Galor and Weil, 2000).

The shift from agriculture to industry from 1750, together with technological advance in agriculture throughout 1600–1800 (Wrigley, 2004, p. 50), had meant that fixed land was a much weaker constraint on growth than hitherto. But the fact that reproducible capital had replaced land as the most important complement to labour in production gave rise to the possibility of a new causal link between demography and prosperity, this time running from demography to prosperity. Rising prosperity in the industrial age was largely based on capital deepening in industry – rises in the amount of capital per worker. The pace of capital deepening would be reduced, however, to the extent to which an economy’s savings had been used for the equipment of new workers, capital widening. Faster population growth would mean more capital widening, so less capital deepening. Therefore causation in the industrial age began to run from demography to prosperity, perhaps helping to create the negative association between...
In the process sketched above, the industrialising countries experienced a demographic transition during the 19th and early 20th centuries, fertility and mortality both being high at the start of the process and both low at the end. A similar, but much more rapid, transition has occurred in Asia since 1950. Because of the timing and age-specificity of the falls in mortality and fertility, the demographic transition is accompanied by substantial variation in the age structure of the population.

The transition can be divided into three phases (Lee, 2003). In the first phase mortality is falling, particularly among infants and children. So the dependency ratio (defined as the numbers of under-15s and over-65s in the population as a proportion of those aged 15–64) rises, driven by a rise in the proportion of young dependents in the population. As time passes, this population bulge travels through the age profile, a process that has been likened to the passage of a kill through a predator (Basu, 2007). Thus, in the second phase of transition, the bulge is of working age, automatically lowering the dependency ratio: prosperity-driven falls in fertility lower this still further. Finally, in the third phase, the bulge arrives at retirement age, swelling the number of old dependents, and causing the dependency ratio to rise again.

The phases of the transition may be illustrated by considering data for Asia and sub-Saharan Africa. In Figure 1, derived from UN data and projections, the three phases are clearly visible for Asia and the first two can be seen for sub-Saharan Africa (SSA). In Asia, the dependency ratio rose in phase 1 from about 65% in 1965 to about 80% in 1980, then in phase 2 fell to below 50% by 2010, with a slower phase 3 projected over 2010–45. This masks significant variation within Asia: west and south Asia are projected to remain in phase 2, with a falling dependency ratio, until at least 2025, while phase 3 was underway in east Asia by 2005.

Sub-Saharan Africa is lagging twenty years or more behind Asia. Moreover, as Figure 1 shows, its dependency ratio started at a higher level and rose more slowly to a higher peak in about 1990. It has now declined to about its level in 1950, with the projected future fall heavily dependent on optimistic UN assumptions about future falls in fertility (Eastwood and Lipton, 2011). The higher first phase dependency ratio in sub-Saharan Africa compared with Asia reflects complex population dynamics, but higher fertility in SSA – over one child per woman higher at the peak – played an important role (total fertility is still over five in SSA, while it has fallen to under two and a half in Asia, and is below two in east Asia).

What is the link between the age structure in a country and its economic development? As argued above, the interaction is complex and two-way, but in some circumstances it may be legitimate to regard demography as ‘predetermined’: for example, the sharp fall in the dependency ratio in Asia after 1965 was to some degree the mechanical consequence of earlier events – a very sharp prior fall in infant mortality – from 175 per thousand in 1950–55 to 107 per thousand in 1965–70 – combined with a fall in fertility that was already well under way by 1965. If this is accepted, it is methodologically valid to consider the social and economic effects of age structure change without worrying too much about reverse causation.

The demographic dividend: just a matter of age-structure arithmetic?

There is a straightforward, arithmetic sense in which a falling dependency ratio generates economic benefit in the form of a ‘demographic dividend’. Suppose our measure of economic welfare is GDP per head of population and – for the moment – suppose also that changes in the dependency ratio have no effects on: (a) productivity, measured as GDP per employed worker, (b) labour force participation, (c) the unemployment rate; (b) and (c) together mean that we can leave aside the distinction between ‘population of working age’ and ‘employment’. Arithmetic then tells us that growth of 1% in the share of the population that is of working age – and so, by assumption, growth of 1% in the share that is employed – will cause extra growth of 1% in GDP/head, simply because each worker has to ‘carry’ fewer dependents.

‘Arithmetic’ demographic dividends so calculated can be quite large. In Asia, the fall in the dependency ratio from 1965 to 2005 yielded a dividend of 0.41% per annum. For East Asia the figure was 0.52% and for China 0.58%; for sub-Saharan Africa as a whole, UN projections yield an annual dividend over the period 1985–2025 of 0.32% (Eastwood and Lipton, 2011, Table 3). Differences in such dividends may account for much of the difference in national rates of economic growth: it has recently been noted that two-thirds of the difference between growth in the US and Japan over 1992–97 can be attributed to opposing trends in their dependency ratios, which were falling in the US and rising in Japan (Krugman, 2011).

Going beyond this, the dominant view in the modern literature is that the arithmetic dividend greatly understates the economic gain which a falling dependency ratio can yield. In East Asia, GDP per head grew at an average of 6.1% per
annum over 1965–90. In a much-cited econometric study, Bloom and Williamson estimated that between 1.37% and 1.87% of this had been caused by age structure change (Bloom and Williamson, 1998, p. 23). This implies a total demographic dividend about three times as large as the arithmetic dividend.

Another finding in this study is that it is young dependency that really matters — indeed, rising old dependency is, if anything, good rather than bad for growth. In another study, also using cross-country regression techniques on data for a large number of countries, Bloom and Sachs found that it was possible to account for an otherwise inexplicable shortfall in African growth (of 2.2% per annum) by taking account of cross-country variations in age structure change and health (Bloom and Sachs, 1998). In this study, too, the total demographic dividend is found to be considerably larger than the arithmetic dividend (it, too, ranges from 6% to 35%).

An important finding in these and other studies using the same methodology is that population growth as such has no discernible effect on growth: only age structure matters. There is no evidence in the cross-country economic and demographic data to suggest that population growth is retarding economic growth by either diluting reproducible capital or — in a neo-Malthusian way — crowding land or other forms of natural capital. More exactly, if such processes have been occurring, they have either been too small to be noticeable or have been outweighed by other, positive, effects, such as the faster rate of invention that might be expected from a larger population.

The econometric findings noted above, namely that falls in the dependency ratio yield economic benefits that are far more than arithmetic, and that population growth is neutral from the growth standpoint, are based on strong assumptions and so cannot be accepted without question (for a detailed discussion see Eastwood and Lipton, 2011). As regards population neutrality, direct evidence on the dilution of capital, discussed below, points in a different direction, especially for sub-Saharan Africa. As regards age structure effects, what are the mechanisms that could yield such magnified benefits, and is there evidence for these mechanisms?

There are two main mechanisms to be considered, corresponding to assumptions (a) and (b) (see above) being relaxed. A fall in the dependency ratio, especially the young dependency ratio, may raise both savings and female labour force participation. Higher savings may lead to faster productivity growth: rising female participation means that workforce growth is faster than growth in the working age population, which will raise growth of GDP per head so long as the extra labour force participants can find employment, i.e. that assumption (c) is valid. There is potential synergy between these two mechanisms, since if higher savings are translated into faster accumulation of domestic capital it is more likely that there will be employment opportunities for the extra female labour force participants.

The conclusion that a fall in dependency will raise the aggregate savings rate follows from a life-cycle view of savings behaviour. On this view, individuals smooth out consumption through the life span, periods of dissaving early and late in life being balanced by a hump of saving in between. The aggregate savings rate therefore depends on the age structure of the population, and it will be raised by a fall in the dependency ratio, because the proportion of net savers is thereby raised.

Such a link from a falling dependency ratio to a raised savings rate has been postulated in the East Asian case, although the econometric methods employed have been strongly criticised (Higgins and Williamson, 1997; Schultz, 2004). Between the mid-1960s and the early 1990s, young-age dependency rates in some East Asian countries fell from about 40% to 25% or less, while the savings ratio rose from about 20% to about 35%. However, microeconomic evidence casts doubt on the causal link described above, for it has been estimated for Taiwan, where the savings ratio rose from 10% in 1970 to 30% in 1990, that the savings propensity out of permanent income rose for all age cohorts (Deaton and Paxson, 2000). Only about one fifth of the rise in the savings rate can be directly attributed to age structure changes. We are therefore left with the possibility that the rise in savings in East Asia at the same time as the dependency ratio was falling might have been mostly coincidental rather than causal.

The effect of falling young dependency on female labour force participation has been studied using a panel of country data by Bloom et al., (2009). Their results are expressed in terms of the effect on a woman’s lifetime supply of labour of a reduction of one birth, and this is estimated at about two years. The conclusion is drawn that in the demographic transition as a whole, with fertility falling by some four births per woman, the effect on GDP/head coming through increased female participation might be about 7% (Bloom et al., 2009, p. 97). Spread over 40 years, this would account, on its own, for a magnification of the arithmetic dividend typically amounting to a factor of about 1.5, at the bottom end of the range estimated by Bloom and Sachs.

Summing up, the demographic dividend is best viewed as a potential gain from the falling dependency ratio that occurs in the second phase of the demographic transition. There is no guarantee that the dividend will actually materialise. Since the transition starts with falling mortality, with fertility falls only coming later, rising population and workforce accompany the changes in population age structure, and rising female participation gives a further impetus to workforce growth. How far the dividend will be realised rests on the availability of employment opportunities for the expanded workforce, and this depends on both the scale of capital investment and how labour-using are the activities in which new investment is made.

The scale and nature of investment in turn rest on a number of factors. Some forms of investment require the direct involvement of the state, notably education and the provision of infrastructure, for example in transportation. As regards private investment, much depends on the institutional and policy environment. Investment will be encouraged in general if contracts can be enforced and if profits are not at risk of arbitrary capture by the state (or the Mafia). The extent to which new investment is labour-absorbing will depend, for example, on whether there is state-funded support for the adoption of new labour-using techniques in agriculture, especially on small, labour-intensive, and usually higher-yielding (Eastwood et al., 2000) farms, as was the case for the Green Revolution in Asia. Political and institutional factors also have a bearing on the supply of saving from...
overseas: if this is plentiful, then domestic saving need not be a constraint on growth, although reliance on foreign savings means that some of the fruits of that growth will accrue to foreigners.

It is East Asian experience which has created most optimism that a demographic dividend may be waiting for other regions which are further behind in the demographic transition – other parts of Asia and, of course, sub-Saharan Africa. The evidence seems to show that the East Asian ‘miracle’ was largely founded in the growth of factors of production – inputs of labour, human capital and physical capital per head of population (Young, 1995), at least part of which can be linked to the demographic transition. This matters, because if instead the miracle had been due to exogenous technological advance, then there would be no reason to expect demographic change to lead to similar experience elsewhere. Whether in East Asia were very favourable to the exploitation of the opportunity presented by demographic transition: high domestic savings, high investment in education, and an institutional and policy environment that both encouraged domestic entrepreneurs and stimulated large private capital inflows from abroad all combined to this effect. That such conditions will be reproduced elsewhere cannot be assumed.

Population neutrality, capital dilution and the escape from subsistence

It cannot be disputed that there must be some limit to the carrying capacity of the planet, but the practical question is whether (and if so, where) such limits are being approached. As already noted, the modern econometric literature is neutral on this question, but its conclusions cannot be considered robust. What is clear is that population increases in the modern era, actual and projected, represent a sharp break with historical experience. This is especially true in poor countries, and among poor countries, in African ones. The population of Africa is projected to rise by a factor of 5 between 1950 and 2050: in their centuries of most rapid increase, the corresponding growth factors for India (1920–2020) and Europe (1800–1900) are 5.5 and 2.2. So it is possible, especially in Africa, that a natural resource constraint might be starting to bite (Weil and Wilde, 2009).

Suppose it can be assumed, as discussed earlier, that the pre-industrial era was characterised by a Malthusian equilibrium between natural resources and population. Escape from the Malthusian trap entailed rapid accumulation of reproducible capital and a steady rise in capital per head. Whether a country will relapse into the trap depends on four factors: (a) its rate of population growth, (b) its rate of capital accumulation, (c) the substitutability between reproducible and natural capital, (d) the pace and nature of technological change. So, irrespective of substitutability, it might be that capital accumulation is not fast enough to prevent a country from slipping back towards subsistence as a result of population pressure. Even if that is not happening, it might be that reproducible and natural capital are not sufficiently substitutable that capital accumulation compensates for the crowding of natural capital, over relevant time scales. Possible thresholds, e.g. for water availability, should be noted here.

Each of these risks is reduced to the extent that technological advance is, respectively, rapid or biased towards saving natural capital.

The most optimistic assumption about substitutability is that reproducible and natural capital are perfect substitutes. In that case, and if technological advance is neglected, then one is led to ask whether a country’s wealth (reproducible plus natural capital) is keeping up with its population. In practice, this question is hard to answer, because of the difficulty of measuring and valuing natural capital. Nevertheless it has been addressed by the World Bank, with results foreshadowed in our earlier discussion. It is found that in East Asia, savings have generally been high enough to ensure that wealth per capita has been rising: Indonesia, an oil producer, is an exception. However in the fast-growing countries, the assumption is true: except in South Africa itself, wealth per capita has been falling, and stopping this process at current rates of population growth would require increases in savings rates that in many cases exceed 20% of national income (World Bank, 2006, Eastwood and Lipton, 2011, Table 4).

The conclusion is that, at least for sub-Saharan Africa (excluding South Africa), the proximity or otherwise of a neo-Malthusian limit is largely beside the point. The immediate problem is one of capital dilution: economies in the region are not saving nearly enough to maintain wealth per capita given current rates of population growth. The sustainability of consumption per capita is therefore under threat, quite independently of limitations on the supply of natural capital. As we have seen, the other aspect of low saving is its implication for investment and employment generation. To the extent that capital inflows are small and investment is directed to capital-intensive sectors (or to the expansion of capital-intensive production within, say, agriculture), the expanding workforce in the region will face higher constraints on growth, although reliance on foreign savings means that some of the fruits of that growth will accrue to foreigners.

1. Adverse demographic shocks such as the Black Death raised prosperity for the survivors, but – in line with Malthusian ideas – this gain was only temporary.
2. Crude birth and death rates typically start at 35–45 per thousand, falling to below 10 in mature industrial economies (Coale, 1973; Montgomery, 2009; Eastwood and Lipton, 2011).
3. Age-structures changed much faster in Asia and Africa in the twentieth century than in nineteenth-century Europe, because the mortality fall was more, faster, and above all much more concentrated on under-lives.
4. The UN uses a simple methodology for its fertility projections, based on the idea that all countries follow similar fertility trajectories. If, as structural modelling suggests, child mortality falls are the main single driver of fertility falls (Conley et al., 2007), then the UN projections for sub-Saharan Africa greatly overstate future fertility decline, because they embody global (mainly Asian) assumptions about falling mortality trends; such assumptions for Africa are too optimistic (Eastwood and Lipton, 2010).
5. Phase 2 is projected to be relatively slow and longlasting for sub-Saharan Africa: the high starting value for the dependency ratio there means that the cumulative dividend will be typically larger than in Asia.
6. Contrasting effects of young and old dependency are also found by Kelley and Schmittle (2005; 2007); they find no significant role for old dependency.
7. To some degree this is the ‘flip side’ of the Bloom-Williamson result, since explaining unusually slow growth in non-African countries is the same as explaining unusually slow growth in Africa.
8. This framework has also been applied to the acceleration of growth in Ireland in the 1990s (Bloom and Canning, 2003). Progressive liberalisation of laws restricting access to contraception was associated with a sharp fall in the dependency ratio after 1970 and a rise in female participation after 1980.
9. For a pessimistic view on capital inflows, see Casielli and Feyrer (2007).
References


Robert Eastwood is a Senior Lecturer in economics at the University of Sussex (r.k.eastwood@sussex.ac.uk).

Michael Lipton is Research Professor at the Poverty Research Unit at the University of Sussex (mlipton@onetel.com).
AUTHOR QUERY FORM

Dear Author,

During the preparation of your manuscript for publication, the questions listed below have arisen. Please attend to these matters and return this form with your proof.

Many thanks for your assistance.

<table>
<thead>
<tr>
<th>Query References</th>
<th>Query</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>q1</td>
<td>AUTHOR: To match the reference list, should Coale, 1973 be changed to Coale and Hoover, 1958? Please advise</td>
<td></td>
</tr>
<tr>
<td>q2</td>
<td>AUTHOR: Eastwood and Lipton, 2010 has not been included in the Reference List, please supply full publication details.</td>
<td></td>
</tr>
</tbody>
</table>