Demography, Food Production and Famine Risks in the Twenty-first Century

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The main purpose of this article is to address the question of whether the world can feed itself during the twenty-first century. The article starts with a brief review of the chief demographic effects of famines – with special reference to their possible practical significance. It then considers so-called 'neo-Malthusian' dimensions of famines – in particular, the widespread notion that population growth may outpace growth in the global food supply. The authors dismiss such concerns for the near term future, but contend that in certain respects, population growth and population scale may be of considerable significance *apropos* the risk of future famines – especially if cognisance is taken of issues of global sustainability and the longer run. For reasons of efficiency the following arguments are largely arranged in point form.

1 Demographic effects of famines

The demographic consequences of famines are often unappreciated; indeed they are sometimes quite unknown. Accordingly it is worth noting the main effects (see also Dyson and Ó Gráda 2002).

1. Mortality usually – although not always – increases during times of famine. And, especially in environments where there is a heavy infectious disease load and/or considerable weather seasonality (e.g. as regards temperature and rainfall), famine mortality usually involves an amplification of the 'normal' seasonal distribution of deaths. Increased undernutrition is the principal underlying cause of famine mortality – reflecting lack of access to food among some (or, rarely, all) of the population. However, in many famines infectious diseases are responsible for the bulk of famine deaths. Famines and epidemics frequently interact synergistically with one another – for example, conditions of famine (e.g. mass wandering and congregation) contributing to the spread of infectious diseases, and epidemics disrupting agricultural operations. The largest number of famine deaths are generally young children. Male mortality almost always increases by more than that of females. Famine mortality tends to vary inversely with socio-economic status.

2. The build-up of famine conditions invariably causes a lagged decline (lag of about nine

months duration) in births. Social and psychological factors contribute to fertility decline in most famines; biological factors (e.g. anovulation) tend to operate only in the most severe crises. However, soon after a famine there is often a short-term increase – i.e. a rebound – in births.

3. Migration is a feature of most famines. People move in search of food and/or work. However, through various mechanisms migration can have a positive *or* a negative effect upon the level of mortality – for the migrants, for those they leave behind, and therefore for the population as a whole. For example, migrants may find food or work, or succumb to disease; those they leave behind may benefit from there being fewer mouths to feed, or they may die of an infectious disease carried back when the migrants return home. That said, as economies have tended to become more diverse over time, and transport and communications have generally improved, so in many famines migration has probably had an increasingly beneficial effect upon the overall level of mortality (i.e. it has reduced mortality below what it would otherwise have been).

4. Because famines tend to kill young children especially (and often the elderly), post-famine population age structures usually have proportionally more people aged 10–45 than applied pre-famine. Post-famine populations are usually slightly more feminine than applied pre-famine (because more males die). These considerations tend to boost the birth rate for several years following the famine – so speeding demographic recovery.

2 Some implications

1. Of course, our main concern must be with limiting famine *mortality*. In this context, it is clear that famines which do not involve major outbreaks of infectious diseases can and do occur – a well documented case being the Greek islands during the early 1940s (see Hionidou 2002).

2. However, in the contemporary 'developing' world infectious diseases are often implicated heavily in famine mortality. Therefore, in any particular situation it is important to know just what the main infectious diseases are. Relatedly, vital registration data can sometimes provide a reasonable guide as to the 'usual' seasonal distribution of mortality – and therefore such data may help efforts to limit the total volume of famine deaths. In this context, it is worth noting that in many developing countries deaths tend to peak during and soon after the rains.

3. A final point which arises clearly from the available demographic time series, is that famines often come in *pairs*. We call these '*bang/bang*' famines. Various 'knock-on' mechanisms can be involved – e.g. through synergistic interactions with epidemics, or through the eating of precious seed-corn. However, an associated practical point is to stress the importance of *vigilance*.

3 Population growth and famines

1. Famines can have several different causes, at several different levels. For example, we might distinguish between 'underlying' causes and more proximate 'triggers'. However, *apropos* the former, Thomas Robert Malthus argued famously in 1798 that if for some reason a population were to grow at a fair pace for an extended period of time – and assuming that the supply of cropland was ultimately fixed – then *one* of the ways in which some kind of *balance* between its increased size and the food supply might be restored was through the occurrence of a famine and a rise in the death rate. The role of famines in restoring some kind of rough equilibrium between the size of a population and its food supply was only one part of Malthus' argument. And it was not new – either in Europe or beyond. Indeed, many people regarded it as incontrovertible.

2. In fact, there is little doubt that historically famines *did* constitute a significant check upon the growth of populations in some places at some times (Saito 2002). This was certainly true for much of Europe and Asia. That said, the degree to which increases in population contributed to the causation of famines would have been variable. Other things being equal,

however, the larger was the population the greater would have been the number of famine deaths.

3. It is ironic that scientific, technological and economic changes which really got underway during Malthus' own lifetime – i.e. in the last part of the eighteenth century and the early part of the nineteenth – made it possible to increase food availability in Europe above what was required by extended population growth, really for the very first time. However, it is sweeping – and unfair – to dismiss Malthus' arguments as 'wrong'.

4. Recently, so-called *neo-Malthusian* writers, like Paul Ehrlich and Lester Brown, have argued that the scale of demographic growth in the modern world will outstrip the capacity to produce food, and that there will be increasing famines and massive mortality as a result (see Ehrlich and Ehrlich 1990; Brown 1996).

5. So far, their predictions have not been borne out. Most analysts who have considered the situation believe that over a future time horizon of, e.g. the next 20–25 years, it should be possible to raise average levels of food production faster than the projected demographic growth in most world regions (e.g. see Alexandratos 1999; Johnson 1999; Dyson 1999; McCalla and Revoredo 2001).

   That said, when discussing famine risks in the twenty-first century, there are some very important technical, environmental and demographic considerations which – while it may sometimes be convenient to do so – cannot be ignored. Certainly, social scientists need to evince a little more humility when contemplating the issue. Several of these considerations are addressed now.

6. The challenge facing the world is *not* just a matter of food distribution (and it should not be dismissed as such). While distributional matters are important, those relating to *production* are at least as important.

   Looking at the period to the year 2025, population growth will be by far the most important reason why more cereals will be required in most of Africa and Asia. For example, population projections for India suggest that the country's population will rise by more than half a billion. Although major famines seem to be events of the past for India, it is clear that food output will need to be increased commensurately (and, of course, hopefully by more). This may be possible, but it certainly will not be easy and it will still leave the average Indian diet at a pretty dismal level, whether gauged in nutritional or culinary terms.

7. Most analyses suggest that while at the *world* level the expansion of cereal production should be able to keep pace with demand (the bulk of it coming from population growth), this will often *not* be the case at the world *regional* level.

   In other words, there is likely to be an increase in the world cereal *trade* informed, in part, by the fact that some countries will probably have difficulties in raising their cereal output at rates which match their demographically generated increase in demand. For example, many countries in the Middle East are already highly dependent upon cereal imports to make their current diets possible. This will be even more true in the future – unless dietary patterns are radically altered (e.g. if there are sharp falls in the consumption of meat).

8. Most analyses see a particularly dismal food future for most of sub-Saharan Africa (e.g. see Alexandratos 1995; Dyson 1999; Mitchell *et al.* 1997). While the problems of this region are many and complex, few believe that rapid demographic growth – with populations often doubling in less than 25 years and then doubling again – has helped the situation. While the statistical data on agriculture are poor, average cereal yields in the region have probably not increased by much, and food output has been raised mostly by increasing the harvested area (often with deleterious consequences for soil fertility and the wider environment).

   The general conclusion is that sub-Saharan Africa may do well just to maintain its current levels of *per capita* food consumption in the face

of population growth. Now, especially in the south and east of the region, most problems are being massively compounded by HIV/AIDS. Today over 20 million people in sub-Saharan Africa are HIV-positive. Though HIV/AIDS may dampen population growth, its impact on household demographic profiles and on labour productivity and the high cost of prevention and treatment will tend to reduce living standards in the region. The International Monetary Fund (2002) estimates that the pandemic may reduce income *per capita* in the region by as much as 0.7 per cent in the current decade (see also de Waal, in this *Bulletin*).

9. Water for agriculture is already a huge problem in much of the developing world and population growth will make it worse. Burgeoning urban populations and increasing water requirements for industrial and other purposes are placing increasing demands on national water supplies. Of course, policy changes can help ease the situation – for example, water is a resource which increasingly will have to be *priced*. However, while necessary, such changes can only go so far. The same applies to various technical innovations (e.g. irrigation, rainwater harvesting and water recycling).

   Ultimately, water is a resource which cannot be conjured up from thin air. In the context of the risk of future famines it is worth recalling how critical a lack of water often is in many famine situations. Poor water quality often exacerbates the problems caused by water shortages. Famine consequences – especially as they pertain to mortality from diseases like cholera and dysentery – can relate at least as much to shortages of water as to a lack of food.

10. While it seems likely that (sub-Saharan Africa and parts of the Middle East apart) most developing countries will be able to grow most of the extra food they need to feed their increasing populations, it is worth stating that this will not be done – indeed it *cannot* be done – without significant increases in the use of synthetic nitrogen. As Vaclav Smil (1997) points out, land-scarce, high population density countries (e.g. China, Egypt, Bangladesh) already depend upon chemical fertilisers 'for their very existence'. Inevitably, this will be even more true in the future.

    Indeed, a strong case can be made that in the absence of the Haber-Bosch process for the synthesis of ammonia, famines would have been operating to restore some kind of balance between population growth and food supplies throughout the period since 1950 (the main alternative would have been much faster fertility declines). Today, approximately 2 billion of the Earth's inhabitants are alive because of the proteins in their bodies built with nitrogen coming from the Haber-Bosch process; and this will be just as true for the billions – currently put at about three – that will come during the next few decades (Smil 1997: 63).

11. Raising *average* levels of food availability is a different matter from reducing the total *number* of hungry people in the world. Most population growth in recent decades has happened – and in future decades will happen – in poor regions like South Asia and sub-Saharan Africa. These are regions where sizeable fractions of the population are undernourished. Consequently, FAO estimates that the total *number* of undernourished people in the world fell only modestly between 1969–71 and 1996–8 – from around 941 to about 826 million (Alexandratos 1995; FAO 2000), during which time the world population increased by over 2 billion. Other things being equal, this same basic fact will make it harder to reduce the total number of hungry (and poor) people in the next few decades; and these are those most vulnerable to famine.

    However distant issues of family planning may seem to those engaged in food and agricultural matters, there is no doubt that demographic growth is the most important factor underlying the growth of world cereal demand. Now that we have entered the twenty-first century, people everywhere should have access to safe, affordable and effective methods of contraception. Children should be by choice, not chance. Yet levels of 'unmet need' for family planning are often large.

12. Finally, *it would be wrong to deny that there may well be major issues of long-run sustainability for the global food system*. The aforementioned conclusion – that it should be possible to raise food production faster than population growth in most regions – is good to have, but also limited.

    Perhaps the greatest uncertainties derive from the combination of just how many of us humans there are and what many of us are doing, particularly in our use of *energy* – especially petroleum, gas and coal. Although no one knows for sure, this combination may pose massive threats, e.g. climate change and sea level rise – the consequences of which will surely be greatest for the world's poor.

    In this context, the period since 1950 has seen a considerable, long-run rise in cereal harvest variability in two of the world's major regions (Dyson 1996: 88). The first is North America – which is the main source of cereal exports for importing countries like those in the Middle East. If the trend of weather induced reductions in cereal harvests in North America continues then this could have serious implications for the grain prices which poor countries pay. The second region includes the eastern and southern areas of sub-Saharan Africa where, again, the trend towards increasing cereal harvest variability since 1950 is both marked and sustained. Recall 1983, 1984 and 1992? Perhaps no one should really be surprised by the current severe drought in the region, which is contributing to conditions of famine, for example, in Malawi and Zambia.

13. In conclusion, when we were born the world's population was about 2.5 billion. It has more than doubled since. Today, it is about 6.2 billion and rising. Birth rates are falling in most countries, but the population will be approaching 8 billion by 2025.

    The United Nations has recently revised its medium estimate for 2050 *upwards* by 413 million – because fertility rates are falling significantly *slower* than was previously expected. To quote Jack Caldwell (2002: 11): 'The immediate challenge is to maintain some of the attitudes, policies and expenditure patterns that have so far sustained the developing world's fertility decline. If this does not happen, then slow or stationary population growth may be attained not with 8 billion people, but with 9, 10, 11 or 12 billion. *The differences in long-term environmental sustainability could be huge*' [emphasis added].

14. What is the relevance of all this to famines? While they have been on the decline during recent decades, it would be foolish to rule out the chances of massive famines over the longer run. Indeed, if we adopt a sufficiently long time horizon, then a famine of this type will almost certainly occur. Continuing population growth means that the numbers of people requiring relief will be very much greater than in the past. A significant sudden alteration in the world's climate – due either to anthropogenic or other causes (e.g. a major volcanic eruption) – would probably produce major declines in food availability, with the very gravest implications for the world's poor.

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