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Population Projections: Recipes for Action, or Inaction?

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Introduction

Population projections, for the world or for individual countries, are often cited as context for discussions of the future. The most commonly cited projections are those of the Population Division of the United Nations Department of Economic and Social Affairs (UNDESA) (2016), but some, including the International Panel on Climate Change (IPCC) socioeconomic pathways, use projections from the International Institute for Applied Systems Analysis (IIASA) (2007).

From food, water and energy security to the strength of the workforce, population projections contribute to the landscape against which various scenarios are played out. Yet oddly, despite the unreliability of past projections, current projections are usually taken as immoveable fact in such analyses. The scenarios tested rarely include any alternative population paths, and even more rarely consider that any policies or programme options might influence the population path. Where alternative paths are considered, such as the IPCC scenarios, they are viewed as outcomes of socioeconomic pathways, not as determinants of those pathways.

An analogy may be the role of day length in the yield of solar energy. There is an unquestionable link, but because we can't alter day length, it is not a variable that is given any consideration in analysis of renewable energy options. It is there in the technical calculations, but not in the discussion of determinants or strategic implications. So it is with population, in most treatments of future challenges and opportunities.

Cognitive dissonance: the fixed point that keeps moving

Last July, the United Nations announced their 2015 global population projections to a near-empty room. A few brief news items dutifully reported that the new estimate for the year 2100 was 11.2 billion people.

Nobody mentioned that this was more than a billion higher than the UN's 2010 projection, only five years ago, which was already a billion higher than its 2004 forecast (Figure 1). Nobody speculated how much higher it might be revised before we actually get to the end of the century. Nobody questioned why upward revisions have become a regular occurrence. Since 2002, each UN projection has been higher than the last.

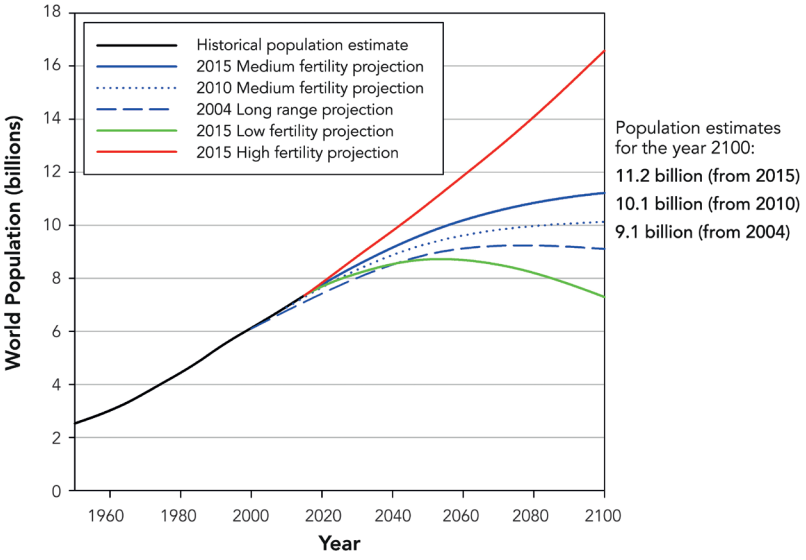

Figure 1. The United Nations population projections, estimated in the 2010 and 2015 revisions (UNDESA 2011). Prior to 2010, the projections in the UN's World Population Prospects series only extended to 2050, but a long-range forecast in 2004 gave estimates to 2300 (UNDESA 2004).

What does this tell us about where the global population is heading? Over short periods of time, trends are more visible in the annual change in population, rather than the population itself (Figure 2). Through the 1990s, the human population

increased by a smaller number each year, building belief that peak population was on the way. But from 2000, the increment started rising again. The UN's medium fertility projection expects the downward trend will resume forthwith, but annual tallies of actual population increase, published in the Population Reference Bureau's 'World Population Data Sheet' (2015), have recorded increments well above the last medium projection. The 2015 edition already raises the UN's new year-2050 number to over 9.8 billion – having increased this estimate each year for quite some time. Should we now believe they've got it right?

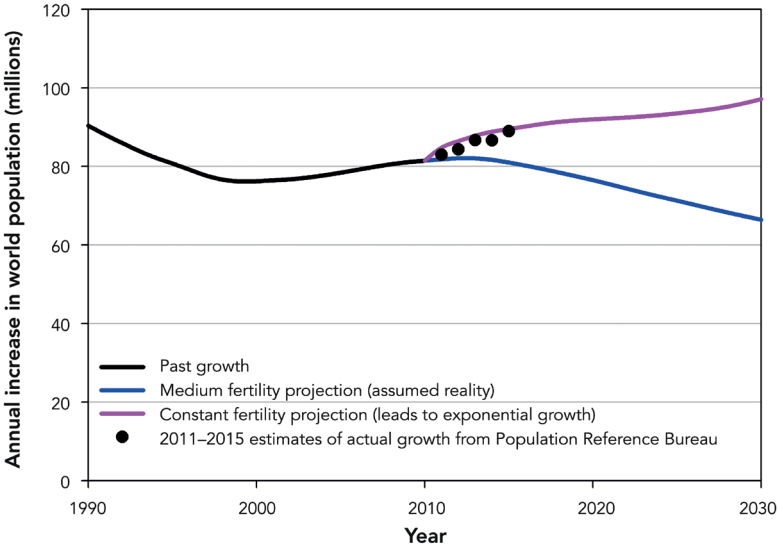

Figure 2. How have we tracked since the last projection? The annual increment of global population from 1990 to 2010 (black), and those projected in the UN's 2012 revision of the medium fertility projection (blue) and the constant fertility projection (pink) (UNDESA 2013). With the latter, in which each country's fertility is held constant, world population grows to reach 28 billion in 2100 (unless checked by famine and war). Superimposed are the estimates of actual increase from the Population Reference Bureau's annual World Population Data Sheets, from 2011 to 2015.

Indeed, these annual increments have been closer to a projection based on no change in national fertility rates. This 'constant fertility' projection would reach 28 billion this century if not checked by catastrophic mortality.

It is sobering to reflect what such a check would involve. It would require approximately 100 million extra premature deaths per year, every year for decades, to bring down the global population through more deaths rather than fewer births. In contrast, the recent Ebola epidemic killed around 10 thousand people. The AIDS epidemic has killed around 40 million over 30 years. Since a population of 28 billion is extremely unlikely to be supported by Earth's resources, catastrophic mortality is the path we are currently choosing.

The projections don't match reality

The UN's medium fertility projection has been based on an assumption that all high fertility countries will progress steadily to below two children per woman. On release of the 2012 revision, director of the UN's Population Division, John Wilmoth, noted that recent falls had been lower than expected, but the projections continue to be on the same basis as before. He concluded,

> *The medium-variant projection is thus an expression of what should be possible … [it] could require additional substantial efforts to make it possible.* (emphasis in the original) (2013 p. 1)

The UN's projections expect all countries to follow a similar smooth S-curve shape of fertility transition, if at different rates (Raftery et al. 2012). The main reason that the projections keep being revised upward is that a lot of countries are not following this story-line. Since the mid-1990s, fertility declines in most mid-transition African and Asian countries slowed or stalled. This has been attributed to a marked decline in international support for family planning programmes (Sinding 2009). Bongaarts found that "among countries in [fertility] transition, more than half are in a stall" (2008 p. 109) A number of countries, including Indonesia, Egypt, Algeria, Kazakhstan, have seen fertility rebound to a higher level. Several sub-Saharan countries have not really begun to decline. These realities are not possibilities in the model used for projections.

A few high-fertility countries, like Rwanda, Ethiopia and Malawi, are now tracking downwards faster than anticipated by the UN. They may seem unlikely candidates on the basis of the most often-cited drivers, such as wealth, women's education and industrialisation. But in each case, there have been conspicuous recent efforts from both governments and NGOs to address population pressure through family

planning programmes and women's empowerment (USAid 2012; PHE Ethiopia Consortium 2016). Like the family-planning adopting countries of the 1970s and 80s, they are finding that deliberate interventions to engage communities and increase access and acceptability of contraception can be highly effective, despite low levels of wealth and education.

Yet this good-news story is missing from the UN's commentary. Instead we are given a fatalistic view. Indeed, the latest communications from the UN make no reference to 'additional efforts'. It presents the medium projection as the most likely "based on an implicit assumption of a continuation of existing policies" (Gerland et al. 2014 p. 2).

What we measure limits what we do

This fatalism infects most efforts to anticipate the future. As mentioned above, a wide range of studies use the UN's population projections as the multiplier of human demands and impacts, when testing which policy options might maximise future prospects. By choosing not to vary population pathways, they provide no advice on the benefit or otherwise of addressing population growth. Indeed, they rarely discuss population growth as a factor affecting outcomes.

There are rare exceptions, and their findings are salient. O'Neill et al. (2010) estimated the difference in projected greenhouse gas emissions between scenarios assuming UN's medium population projection and those assuming the low projection, taking account of impacts of changing age structure, household size and urbanization. They concluded that achieving the low population projection could provide 16-29% of the emissions reductions needed by 2050, and could reduce fossil fuel demand by 37-41% by the end of the century. In a recent study, Bajželj and co-workers (2014) found that greenhouse gas emissions from the food system were sensitive to population outcomes by a factor of 1.9, meaning that 10% higher population would result in 19% more emissions from the food system, assuming the same wealth and dietary preferences. The World Resources Institute's exemplary series "Creating a Sustainable Food Future" (2013) found that achieving replacement level fertility (around two children per woman) in sub-Saharan Africa by 2050 would spare an area of forest and savannah larger than Germany from conversion to cropland, and in doing so save 16 Gt of carbon dioxide emissions (Searchinger et al. 2013). The Futures Group found

that a modest acceleration in contraceptive uptake in Ethiopia could completely compensate for the anticipated impacts of climate change on food security in 2050 (Moreland and Smith 2012).

Mathematical complexity doesn't necessarily improve accuracy of projections

The change in rhetoric, which saw the medium projection shift from 'what should be possible' to 'the most likely', is linked to a methodological change. The most recent UN projections adopt a Bayesian probabilistic methodology. This is a step up from the previous method, in which high and low fertility projections merely assume a fertility rate 0.5 units (children per woman) higher or lower than the medium course in every country – greatly underestimating the range of possibilities in high-fertility countries, and exaggerating them in low-fertility countries.

The new methodology makes more nuanced assessments of likely variation from the central ("medium") projection, but the medium projection itself is determined in much the same way as it was before. It finds the average course that countries have taken in the past, from whatever time their fertility started to fall in earnest, and presents this as the most likely course that each high-fertility country will follow from now on. The model forces the stereotypical S-shape of fertility transition by encoding it as a double-logistic mathematical function, and researcher judgements define the spread of each variable in the function.

Hence it is still a narrow interpretation of possible futures. The mathematical form cannot accommodate stalls and reversals in fertility decline, and the researcher assumptions do not allow for further delays before individual countries establish a downward trend. Nor does the formula consider as likely the very high rates of fertility decline that family planning countries have achieved in the past.

The narrowness can be seen in the relationship between each country's total fertility rate (TFR, average number of live births per woman) and the rate at which it falls (Figure 3). For the projection (open symbols), the rate of fall is tightly related to the fertility rate. All remaining high-fertility countries are assumed to start their fertility decline immediately and in earnest, despite their recalcitrance to date. Data from the most recent decade (solid symbols) show much wider diversity, with many countries falling faster, but also many near-stalled in mid-transition or rebounding

before reaching replacement level, and some have yet to make a start. Data from the 1980s (crosses), when family planning programmes were widely supported, show many higher rates of transition and few stalls or rebounds.

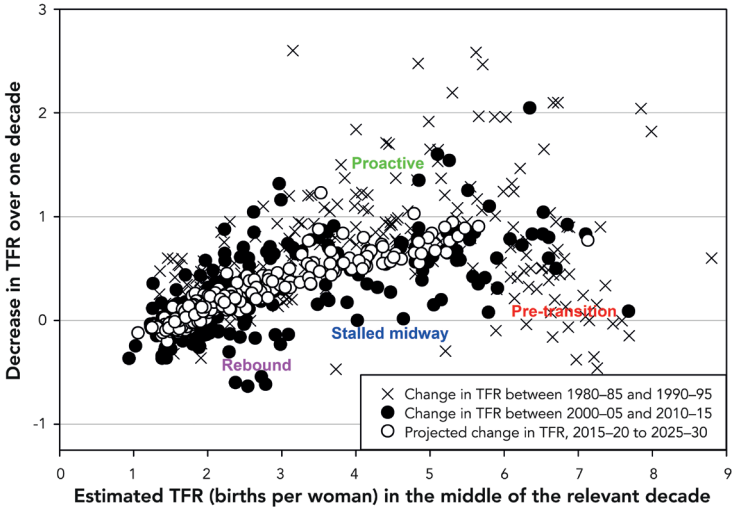

Figure 3. The relationship between the fertility rate of each country and the rate at which its fertility falls, for the most recent decade (black dots), compared with the first projected decade (open dots) and with the 1980s (crosses). Over time, the fertility of individual countries undergoing fertility transition moves from right to left. The projections depend on what is anticipated to be the average pathway, the variation around that average pathway, and when each country embarks on their transition.

History's lessons unheeded

The UN's deterministic approach to projection overlooks the role of choices, rather than chance, in the different paths each country has followed.

It was programme choice which saw Thailand's fertility fall rapidly in the 1970s, Iran's pull abruptly away from those of its neighbours, Costa Rica lead the pack in Central America, and Rwanda now diverging so strongly from neighbouring Burundi and Uganda. These choices are not being talked up by the UN. Indeed, by presenting the projections as "probabilistic", the impression is given that direct action is futile. There are no policy levers attached to model, determining

whether fertility rate is higher or lower than the average – only unidentified external factors acting randomly.

For lack of volition, most of the highest fertility countries do not yet have fertility falls as fast as the medium projection expects. Why, then, does the medium projection assume that all remaining high fertility countries will commence steady fertility decline immediately, when history tells us that these abrupt starts have depended on policy change? Since these countries have the greatest influence on future global population, we can only expect that the next revision will also be upwards.

This is the crux of the matter: *assuming a continuation of existing policies*, the UN's methodology poses that it is *most likely* that the highest fertility countries, which have seen the slowest fertility reductions to date, will show the fastest reductions from now on. Moreover, despite many mid-transition countries having stalled or increased fertility in the past decade, it finds that none are likely to do so in the coming decade, without any change of policy.

I am reminded of the saying, probably wrongly attributed to Albert Einstein, that "the definition of stupidity is doing the same thing over and over again and expecting different results." By reapplying the same model for each revision, does the UN Population Division expect its next projection to be any more reliable than the last?

The future will be shaped by our choices

We could choose a different result, but it would require doing things differently. Much faster fertility transitions are possible, if family planning and small family norms are promoted alongside women's health and rights. Many developing countries have successfully achieved below-replacement or near-replacement fertility in this way. Figure 4 shows the time course of fertility for some of them. In each case, the abrupt start to fertility decline coincided with initiation of voluntary family planning programmes. Rates of fertility decline have been two to three times those expected in the UN projections. No economic or educational trigger was evident, but in each case economic development, including improvement in educational and health outcomes, followed as a consequence of lower population growth (O'Sullivan 2013).

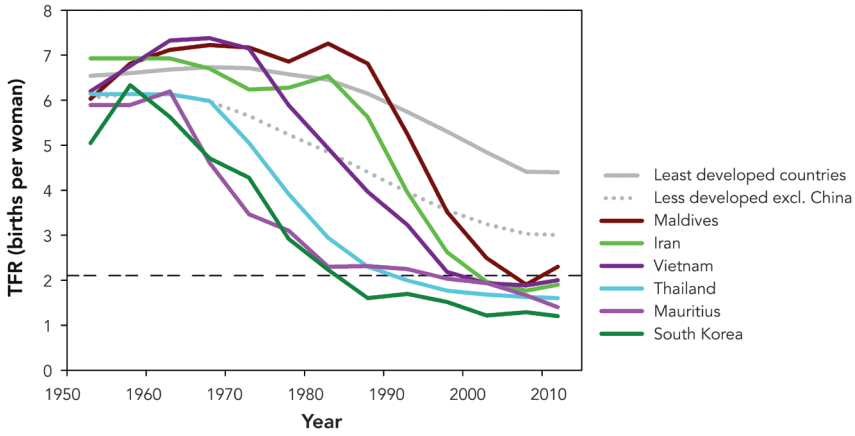

Figure 4. Time course of total fertility rate (TFR, births per woman) for selected countries which implemented population-focused voluntary family planning programmes at differing times, showing rapid change in fertility, compared with aggregate TFR for less developed and least developed nations. Data from UNDESA (2011) and Population Reference Bureau World Population Datasheet (2013).

These programmes involved providing access to family planning information and services to all citizens, through culturally appropriate channels. They also involved addressing barriers to women exercising their reproductive choices, such as child marriage, women's access to education and economic autonomy, and attitudes of men towards women and their roles. They did not rely on coercion, such as China's one-child policy. Indeed, China's fertility decline was also driven by a voluntary family planning programme, which preceded the one-child policy by a decade. By the time the one-child policy was rolled out in 1979, the job was largely done. However, over the past two decades concern about coercive fertility control has been heightened to the extent that merely discussing the benefits of fewer children is treated as coercive. It is assumed that access alone is sufficient, and women will make the 'right' choice about family size without being given any information on which to base that choice. Yet the main reasons given by women for not using contraception are not related to access or affordability (Ryerson 2010). The successful voluntary family planning programmes of the 1970s and

80s were generally characterised by widespread promotion of fewer, more widely spaced children, and sound information about contraceptive options, dispelling myths of their dangers.

Recently, Population Health and Environment (PHE) programmes, which integrate family planning with livelihood, public health and environmental management interventions, are showing that coherent cross-sectoral programmes can greatly increase community acceptance of, and even enthusiasm for, family planning, overcoming cultural resistance (PAI 2015). New contraception technologies, including implants and injectables, are making family planning delivery much cheaper, more reliable and less dependent on medical personnel. New communications technologies and more literate populations exposed to cultures beyond their own allow information and attitudinal change to spread more easily. These advances could mean that the next generation of family planning programmes is even more effective than in the past. Nor are such interventions costly: a UN study estimated that "for every dollar spent in family planning, between two and six dollars can be saved in interventions aimed at achieving other development goals" (UNDESA 2009 p.1).

It's still possible for the world population to peak under 10 billion. Each year such action is deferred increases the achievable peak by around 100 million people. Time is of the essence, but if political will could be rallied quickly enough, perhaps a peak around 9 billion could yet be achieved.

Such an outcome would ease many challenges, particularly food security, climate change mitigation and adaptation, and biodiversity loss (Speidel et al. 2015). It could head off mass mortality on a scale humanity has never seen. But first we have to care how many people there will be.

Conclusion

Projections should arm us to prepare for the future and take pre-emptive action to avoid threats. Recent population projections have had the opposite effect. By failing to acknowledge the impact of choices, they have undermined pre-emptive action. This fatalistic approach has probably already contributed to a global slow-down in fertility decline over the past two decades, which has already added billions to the likely peak population. By giving little weight to the recent

slow-down, projections have recently over-estimated fertility decline. In turn, by presenting overly optimistic expectations of fertility decline, they have given false reassurance that population growth will end within decades regardless of what we do, allowing legitimate concern about overpopulation to be dismissed as naïve and pointless paranoia. Partly to avoid such condescension, many researchers avoid treating population as a variable. They consequently fail to measure its profound impact on so many of the challenges now faced by humanity and by the many other species we are crowding out. A new narrative is urgently needed, to reinstate the importance of population policies and programmes for human development and environmental sustainability (Bongaarts 2016).

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