

Population Futures for the Next Three Hundred Years: Soft Landing or Surprises to Come?

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SOME 50 YEARS AGO John Hajnal, in a characteristically insightful article (Hajnal 1955), considered the prospects for population forecasts. On matters other than practical procedures and techniques he argued three main points:

1. that population projections in the future as in the past will often be fairly wide of the mark—as often as simple guesses would be;
2. that, nevertheless, the frequent preparation of projections will continue;
3. that a projection can be useful as a piece of analysis even if its accuracy is low.

World Population in 2300 (United Nations 2003b), reporting on the proceedings of a December 2003 expert group meeting on long-range population projections and presenting the results of a new set of United Nations population projections,* bears out Hajnal's argument. Among his three propositions, the validity of the second is the most obvious. There has been a veritable outpouring of demographic projections during the last 50 years, prepared by various international organizations and national agencies, as well as by independent analysts. Among these, the United Nations Population Division's now biennially revised projections are by far the most detailed, best known, and most widely used. This well-deserved prominence reflects the Division's unparalleled access to national data, its in-house analytic experience and resources, and its willingness to draw on outside ex-

*For a summary presentation of these projections, see the "Documents" section of the March 2004 issue of *PDR* (pp. 181–187).

pertise whenever that might usefully complement its own. The most recent of the biennial projections, the *2002 Revision* (United Nations 2003a), is the immediate predecessor of *World Population in 2300*, and indeed the former provides the year 2000 to 2050 component for the new set of long-term projections covering the next 300 years.

This new set is not just one among the many. It is distinguished from the routine by an exceptionally brave ambition: to draw a picture of plausible demographic futures up to the year 2300 and to do so in extraordinary detail: country-by-country according to the political map of the early twenty-first century.

The wisdom of venturing so far ahead in time to obviously uncertain territory will be, no doubt, questioned by many. Most historians, including historians of demographic change, would agree that we cannot fully explain the past. How can we then tell what the remote future will bring, let alone do so in minute numerical detail? Three hundred years is a time span long in individual human terms, but short by historical standards. It is not the cosmic distance of H. G. Wells's fictional *Time Machine*, or Charles Galton Darwin's book, published in 1953, *The Next Million Years*. Backtracking 300 years would bring us to 1700—a year that may be thought of as marking the dawn of modernity—but the time elapsed since that date covers only a small fraction of recorded human history. It is a fraction, however, from which at least some relevant lessons, including demographic lessons, can be drawn for the future.

A surprise-free future?

World Population in 2300 follows the practice of earlier and less extravagant UN projections in offering a “medium” fertility variant, bracketed by “high” and “low,” and supplements that dominant trio with two additional illustrative sets. Austerity dictates that the characterization of fertility level be consistent throughout the projection period—“high” is high and “low” is low, and in between lies “medium.” With reasonably modest hypothetical differences between the paths traced by fertility over time, the deviations in terms of total population size generated by the end of a 50-year time span conveniently stay within plausible limits. What plausible limits are, of course, is in the eye of the beholder, but few would dispute that the UN's 2002 revisions for 2050—offering a global medium population figure of 8.9 billion, bracketed by a low of 7.4 billion and a high of 10.6 billion—provide a range that is sufficiently narrow to yield meaningful information. To be sure, each of these figures is the result of what, using the late Herman Kahn's label, may be described as surprise-free, and of course none more so than the one in the middle. The future time paths of the governing variables are smooth; if there are any gentle bumps in the projected population figures,

they are an inheritance from past demographic disturbances that left a mark on the age structures from which the projections start. With just three projection variants this could hardly be different: orderly and gradual change must rule.

But a pattern of differences maintained consistently into a future far more remote than just the next five decades inevitably produces major deviations in projected population numbers. The title of the press release that announced the results of the new long-range projections highlighted the likely global population in 2300 as 9 billion. In other words, it replicated virtually the exact message that a press release announcing the 2002 revisions would have identified as the likely global total for 2050, that is to say, a full 250 years earlier. Surprise-free 2300 global population future indeed: the news broadcast by the medium projection for the two and a half centuries beyond 2050 is that there is no news; there is, *grosso modo*, homeostasis. Less comfortingly, what brackets that projected 9 billion “medium” population figure according to the “low” and “high” projections conveys information that is distressingly vague: the 2300 global population, we are told, will be between 2.3 and 36.4 billion. And this massive difference is the result of remarkably modest differences in the assumed fertility parameters. Total fertility rates, after transitory phases that by fiat are largely completed by the end of the present century, settle down at replacement level in the medium projection, bracketed by rates that are only 0.25 children lower or higher in the low and high projection variants.

Each of these variants incorporates the same—again, very much surprise-free, very much business-as-usual—assumptions as to the future evolution of mortality. Practical considerations support that choice. Complicating the picture by assuming alternative mortality scenarios would have increased the complexity of the projection results beyond levels tolerable for most users. It is evident, however, that introduction of multiple assumptions on the plausible future course of mortality would have widened the range of uncertainty signaled by the global totals, and, even more, would have left a mark on such characteristics of the projected population as structure by age and, plausibly, also by sex. There are wide disagreements among experts about how and how much human mortality might change in the next three centuries. Some hold a less sanguine view about the likely pace of progress in longevity than even the rather cautious assumptions incorporated in the UN projections. Others foresee far greater gains in survival rates. Taking these possibilities into account would have created higher “high” and lower “low” figures for 2300.

Since the UN does not designate any particular figure within the interval bracketed by its high and low projection as its best guess for 2300 (not even the 9 billion trumpeted by the press release), the global actual total in 2300 will be wide of the mark. This bears out Hajnal’s first proposition.

More gratifyingly, the projections up to 2300 also demonstrate the truth of Hajnal's third point—about analytical usefulness, regardless of ex-post accuracy. For anyone contemplating the demographic future in the next three centuries, the UN projections *are* an eminently useful device. They provide reference marks for outcomes under well-specified conditions, hence stimulate and help organize thinking about the immense variety of possible alternative scenarios and their likely results. The three major alternatives numerically worked out in the UN's set serve as a broad frame within which, and also beyond which, mental exercises can heuristically scan patterns that break with the assumption of "no surprises" and, at least qualitatively or through back-of-the-envelope calculations, trace demographic futures that could be quite different from the smooth, gently rising or falling, curves presented by the frame.

This point is well illustrated by the UN projection set itself. Beyond the basic "high," "low," and "medium" trio, a complementary projection variant provides the outcome resulting from an unabashedly counterfactual assumption: that of keeping fertility levels constant at their year 2000 value. The UN of course does not suggest that in 2300 the so-called less developed regions might contain 133 trillion persons—the figure arrived at—while the population of the more developed regions will stand at a paltry 600 million, that is, a minuscule fraction of the colossal global total. The impossibility of sustaining fertility at its present levels especially where those levels happen to be high and, equally, the glaring anachronism inherent in freezing the labels of those two "regions" would have been evident to those who computed the scenario. Presenting the numerical result of this counterfactual finger-exercise makes a point about the unsustainability of certain present-day demographic patterns. It is a point laden with theoretical as well as policy implications.

The reference above to two broad regional groups within the global total is a reminder of the special recipe through which the populations of these large aggregates were projected. Heroically, the UN proceeded to treat virtually all member states of that organization, along with some territories, as equals, whether the country's name was India (projected 2300 population in the medium variant 1.372 billion) or Tonga (projected 2300 population 112 thousand). In and by themselves these country projections can be treated similarly to the global one: they provide outcomes under a limited set of well-specified assumptions, hence can serve as a frame of reference in contemplating demographic futures country-by-country. When the countries are aggregated to yield regional and eventually global totals, one would expect that those totals are more solidly based than their component parts, since variations in the latter, up and down, average out.

But here we encounter a peculiarity of the UN long-range projections—a peculiarity that also applies to the familiar biennial series. Once the gov-

erning assumptions are specified for each country or group of countries—in practice, whether fertility follows a high, low, or medium path—aggregating country figures into regional and eventually the global total assumes that countries go in lock-step: all follow, simultaneously, high, low, or medium trajectories. As in the choice of the number of alternative fertility and mortality assumptions, practical considerations must have dictated this procedure. It is a procedure, however, that the user should be aware of, and mental exercises in probing alternative futures should constantly challenge the assumption of trajectories that go in lock-step. Countries proceeding on the same type of path—say, high or low—however different the initial conditions and the assumed tempo of demographic change over time, is just one of the many alternative possibilities. It is also necessary to envisage patterns within which the component parts follow different trajectories: some traveling on a “high,” others on a “low” path and, of course, various such combinations. Clearly, depending on the particular mixes, the resulting aggregates will exhibit different relative weights of their country units even if the aggregate totals turn out to be similar.

A defense of the “lock-step” assumption might invoke the notion that demographic patterns are converging the world over: countries are more and more likely to exhibit similar demographic behaviors. This argument has some validity. What may be termed high fertility—say, anything above a total fertility rate of 2.5—is unsustainable in the long run under conditions of low mortality. Hence, if low mortality is to be sustained, high fertility must fall. Prospective fertility differences among countries as a result are bound to be reduced in absolute terms over time. Nevertheless, there is much empirical evidence that qualifies this loosely defined phenomenon of convergence. And such qualifications apply not only to the twentieth century, during which demographic changes occurred at an especially variegated and unequal tempo country-by-country, but also to present-day and to plausibly expected future demographic experience. For example, in 1900 the Philippines and Hungary both had a population of 7 million. One hundred years later, the Philippines had a population of 76 million and Hungary had 10 million—a spectacular combination of what the UN might describe as a “high” and a “low” growth path. Countless similar, if perhaps less striking comparisons could be cited.

The issue of course is not simply differential population growth, explainable in terms of differences in the proximate determinants of that variable, but the qualitative characteristics of the time paths followed and, in the present context, the expected pattern of future change. To illustrate the point with reference to the two countries just cited, the UN 2002 medium projections (and, by construction, also the new 300-year UN projections up to the middle of the present century) foresee a 2050 Philippines population of 127 million. The corresponding “lock-step” figure for Hungary is 7.6 million. But what if

the trajectories differed between the two countries? The Philippines might follow a “high” path (because total fertility would sink from its 2000 level of 3.43 to “only” 2.35 by midcentury) that would yield a 2050 population of 154 million, while Hungary might follow a “low” path (because its 2000 total fertility of 1.17 would *rise* only to 1.35 by 2050), yielding 6.8 million. Such a combination—and a myriad of other intermediate combinations, including the reverse variant: Philippines “low,” Hungary “high”—can by no means be excluded. But *World Population in 2300* allows for no such eventuality even though the implications for the global and regional totals with respect to the relative population sizes of the constituting units could be far-reaching. It is left for the careful user to ponder the possible effects of countries or regions traveling on different demographic trajectories.

Thus, the governing assumption of the “medium” projection—global fertility eventually settling at replacement level—is more reasonably seen as a weighted average: one resulting from a distribution of country-by-country fertility levels characterized by substantial differences, hence, over time, yielding a shift—continuous or perhaps fluctuating—in relative country population weights. Such a pattern could well occur even within country groupings that exhibit closely similar economic, political, and cultural characteristics, a fact amply demonstrated by, among other examples, persisting historical and present-day fertility differences within the countries of the European Union. Current fertility within the countries of the EU 25 is below replacement level, but, despite a high degree of cultural and socioeconomic similarity, differences in fertility levels are sufficiently marked for population growth prospects to differ substantially. The likelihood of this happening between broad regional population aggregates displaying much greater contrasts in cultural, political, and economic characteristics is correspondingly greater. For example, the plausibility of assuming lock-step progress on the same trajectory—whether high, medium, or low—by Europe in contrast to North America, or by Europe in contrast to neighboring North African and West Asian countries, or by India in contrast to China, is far from obvious. Relaxing that assumption could have major long-term consequences for relative regional population totals in the coming three centuries.

A likely consequence of such differential patterns of fertility change country-by-country would be a discernible impact on the patterns and magnitudes of international migratory flows. Those patterns and magnitudes are influenced by numerous factors, but the emergence of relative demographic vacuums and pressure points is certainly one among them, and by no means the least important. The assumption, incorporated in the long-term projections up to 2300, that beyond 2050 international migration can be disregarded is *prima facie* implausible. The UN demographers of course were well aware of this, but evidently felt helpless in arriving at numerically specifiable migration rates that could be grounded in the experience

of past patterns of international migration, hence that would withstand scrutiny. The stance is understandable within the terms of the overall construct of the long-term projections, even though it yields a jarring discontinuity as even major current, and up to 2050 projected, international migration flows fall suddenly to zero as the year 2050 arrives. Critics predictably will have a field day in objecting to that abrupt freeze of permanent cross-border population movements. Others will rightly object to the equally implausible if implicit assumption of frozen international boundary lines for the next 300 years—an assumption arguably bordering on the bizarre. The UN's likely answer to such criticisms will be that such critics would have a standing only if they could propose a more acceptable set of assumptions. That is a task not many would care to undertake.

But the point, again, is not the need for incorporating additional complications and adornments in the numerical projections that set out a no-surprise demographic future for the long term. What *is* needed is a constant insistence that the construct of the long-term projections is a stylized one: not intended to be a prediction, not even a prediction of alternative futures. What the UN offers to its clients is a way to think about coming demographic developments: a frame of reference that users must fill with substance.

Surprises: Pleasant and unpleasant

By the criteria of its basic input characteristics, the core trio of the UN projections up to 2300 could be justly characterized as optimistic to a fault. Mortality improves everywhere, but the changes, in comparison to those experienced during the last century, are supposed to be modest. Radical changes in biomedical technology that would push average life expectancy well beyond 100 years are not part of the scenario. Thus, the potential curse of populations with extreme senescence is assumed away. Also excluded, from the post-2050 future, are mortality setbacks, even temporary ones, ignoring numerous warning signs clearly present in the contemporary world. Posited fertility changes are also a model of conservatism: the medium scenario envisages convergence to replacement levels everywhere, albeit at differing speeds. This leads to a global stationary population, or, rather, one creeping up in size very slowly through an accretion of the very old, as that category is currently defined. The bracketing scenarios, in terms of total fertility rates, differ from the middle one, up or down, by only a quarter child, thus assuming away the possibility of precipitous population decline or rapid population growth. As to migration, the 190-odd territorial units of today's world are preserved for the next 300 years and their borders, past the middle of the twenty-first century, are crossed only by temporary migrants—presumably just tourists or business travelers. Changes in each of these characteristics, if

any, especially after 2050, are assumed to be slow—indeed nearly imperceptible year-after-year and even decade-after-decade, and by the twenty-third century virtually nil.

If these surprise-free long-term scenarios, especially the one articulated in the medium projection, sound too good to be true in comparison to the demographic dramas and dislocations of the twentieth century, they probably are. Paradoxically, the coming-true of their end-of-history outcomes, even if they are in harmony with a near-consensus in expert opinion, could be called a historical surprise *par excellence*.

The dominant voices in that expert consensus foresee a peaking of the global population in the second part of the present century, followed by a slow decline—a pleasant soft-landing to a slowly decaying quasi-stationary state, underpinned by spreading and ultimately generalized economic affluence. This image corresponds, roughly, to that depicted by the UN's low variant, or to something between the low- and the medium-variant projections. The governing influence that underlies that view is the European and Japanese experience. It provides the paradigm of the demography of the postindustrial society, prefiguring the demographic behavior of those still on lower rungs of their socioeconomic transformations. Such relative backwardness is seen as temporary, since the recipes for advancement toward the yearned-for material comforts are at hand, are readily applicable, and will yield the hoped-for results. With economic gains—essentially rising incomes per capita—come the changes that reshape social values and behavioral mores in ways already observable among the pioneers in the so-called second demographic transition. Fertility settles at or slightly below replacement level. Should it have a tendency to settle well below that level, creating a top-heavy age structure to which even advanced industrial societies would be unable to adjust, policy interventions would be triggered, providing timely correction.

According to this soft-landing scenario, much of that transition to demographic decompression will take place in the present century, and much of it during the coming five decades. But before eventless demography supposedly sets in at around midcentury, much demographic turbulence will be unavoidable—indeed, turbulence not unlike that experienced in the past 50 years. It could prove to be less than benign. Population momentum virtually guarantees that 3 billion or so persons will be added to the population of the poorer countries. Absorbing this demographic growth will make the convergence to the affluent vanguard of countries more difficult and slower than what would be otherwise possible, undercutting the potency of the economic welfare ingredients expected to propel spontaneous fertility decline and rising survival rates. Thus, while the prospects for substantial economic progress are encouraging in much of the less developed world, the economic gap measured in absolute per capita terms between the rich and the poor countries is not only likely to remain wide but to further widen

in the present century. Perceived relative economic deprivation is commonly seen as just as potent a force in generating lower birth rates as is economic improvement pure and simple. Although assumptions about socioeconomic factors are not explicitly spelled out in the UN population projections, such anticipated changes may underlie the assumption that by 2050 average fertility will be below replacement level in the countries classified today as less developed, even if that category excludes China. Plausible as that assumption may seem today, it could well turn out that it underestimates the strength of countervailing cultural influences: influences inherited from the past or newly emerging as a reaction against materialistic postindustrial values. If so, fertility decline from levels still relatively high will be slower than envisaged, population growth will be correspondingly greater, and the shift in the relative population weights between the countries of high affluence and the countries of relative poverty will be sharper. In any event, demand for outmigration in relatively poor countries is likely to intensify, and the potential for demographically fueled international conflicts will increase, not implausibly going beyond the economic. And some countries and large subnational regions still characterized by high fertility, with perhaps as much as one-fifth of the global population total, may be entirely unable to travel the classic path of the demographic transition driven by economic forces. Malthusian pressures and adjustments in these parts of the world may thus darken the optimistic tableau of gradual and peaceful progress toward an affluent low-fertility world—depicted in the UN long-term projections as largely achieved by the middle of the present century.

Nor are the affluent postindustrial pioneers certain to live up to the role assigned to them in the surprise-free, soft-landing scenario. The UN medium projections implicitly assume that the trend toward lower birth rates that resulted in fertility levels well below replacement in many countries in Europe and in Japan will elicit negative feedbacks that by the middle of the twenty-first century will bring fertility back to near-replacement levels everywhere—specifically to a total fertility rate of 1.85. This may happen; it is possible to speculate about a variety of mechanisms that might bring about such a reversal. But *positive* feedbacks are equally plausible, reinforcing a tendency for further falls in fertility. As population aging progresses as a result of low birth rates and rising life expectancy, individuals—men and women alike—seeking to provide for their old-age security have an increasing incentive to accumulate human capital and savings and to acquire pension rights. The result may be longer education, greater labor force participation of women, and later and more restrictive procreation. The *deus ex machina* usually invoked as capable of tipping the uncertain balance of competing forces affecting fertility in the socially preferred direction—up, toward replacement level—is deliberate pronatalist population policy. But the experience in this domain thus far is anything but encouraging, and states already fiscally overcommitted in sustaining pension and

health care systems will have great difficulty in improving on that record. In affluent low-fertility countries, the option of allowing more immigrants will likely be preferred to costly subsidizing of the home-production of children. That solution, plausibly requiring massive migration flows, raises potentially major social and geopolitical problems of its own.

Thus, the base from which population trends will continue beyond 2050 may look quite different from the one depicted by the UN medium projection, with repercussions not compatible with the presumed business-as-usual demographic patterns of the following 250 years.

Finally, factors not connected with or only remotely related to individual demographic behavior or population policy intent may also upset the quietude depicted in the UN long-term projections. In trying to take account of such forces when drawing up population futures, demographers would of course venture on territory beyond their professional expertise. But at least acknowledging them is necessary because doing so provides a much-needed cautionary note in taking business-as-usual population projections even remotely at face value.

On this score, calamities of nature come first to mind. The kind of celestial collisions that extinguished the dinosaurs and could well do the same to humans occur so rarely—apparently there were three such instances in the last 300 million years—that they perhaps would not deserve even a footnote in an exercise presenting 300-year projections. But, given its documented past frequency and severity, the possibility of abrupt climate change certainly would rate a mention in speculating about population trends over three centuries. The major concern here is not gradual global warming, to which modern industrial societies could adjust at a tolerable cost, and from which even net benefits for world agriculture might ensue, but possible major temperature drops, such as occurred some 12,000 and 8,000 years ago, lasting many decades or even centuries. These occurred *without* the involvement of human agency. In the future they might, additionally, be triggered by human-induced global warming affecting oceanic currents and causing a chain reaction of adverse weather changes. This could lead to a major reduction in carrying capacity through diminished food production, water shortages, disruption of energy supplies, global conflicts in competition for scarce resources, and ultimately to massive population loss. This last possibility, with or without climate change, may also be the consequence of unforeseen worsening of the epidemiological environment—causing peaks analogous to those associated with the Black Death, the Spanish influenza epidemic, and HIV/AIDS, but writ even larger.

Heavy losses of life could also be the result of major disruption of global trade flows and of wars waged with weapons of mass destruction. The lethality of modern weaponry, nuclear, chemical, radiological, or biological, may make wars between major countries less likely, as the results would be correctly perceived as mutually devastating. But technological changes

tend to make such weapons potentially accessible to rogue states and even to small groups of terrorists, creating enormous risks. Research advances may render synthesizing viruses and creation of enhanced pathogens feasible relatively cheaply. Such work may soon be carried out by small groups of scientists or even a single curious or disgruntled researcher, amplifying the danger of accidental or malevolent release of extremely lethal substances, with incalculable consequences.

Spontaneous and unforeseen changes in the cultural-spiritual domain might also radically alter the long-term near-stationary character of the global population endorsed by prevailing expert opinion and depicted in the UN medium and low projections. If continuing scientific and technological advances create truly affluent societies in much of the world—surely a realistic long-term prospect if international peace can be preserved, terrorist dangers can be controlled, and the energy problem can be solved—the force of material incentives keeping fertility very low may weaken. Devoting 20 or 25 years in a leisure-rich, century-length average life span to the adventure of rearing children may become attractive, not because it is encouraged by governments shuffling money from one pocket to the other, but as an option freely chosen by individuals for its own expected nonmaterial rewards. A return to above-replacement fertility, now dismissed by most demographers as implausible in a high-income, postmodern society, but kept alive in the UN's high-fertility projection, perhaps more as a gesture toward symmetry than expected relevance to the real world, could then come into its own. That projection assumes convergence by 2300 to an average total fertility rate of 2.35 and to an annual population growth rate of 0.5 percent. Both these rates are low by twentieth-century standards, and presumably both rates could be supported, year after year, by a technologically advanced society that wished to shy away from crass interference with individual liberties. But those assumptions yield a global total of 36 billion souls in 2300. Welcome to the world of growth, preserving historical continuity. Good-bye to the brave new world of stasis and depopulation.

Note

This is a slightly abbreviated version of an article that will appear in the forthcoming United Nations publication *World Population to 2300*.

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