

## More than half of the global population lives where fertility is below replacement level

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One of the demographic paradoxes in the world today is that the population is still growing rapidly, while fertility—the number of children women have on average—has sharply decreased. Even the experts find it difficult to realize that it is now below 2.1 children per woman in many developing countries, which have in this caught up with the developed ones. How did this situation come about, and what consequences will it have?

Around the end of 2003 the human population crossed a historic, but so far little noticed, threshold: more than 50 per cent of the world's people now live in a country or a region in which fertility is below 2.1 children per woman, the level conventionally regarded as indicating long-run replacement of the population (see boxes 1 and 2) [1]. A convenient way to illustrate this is to plot a curve that indicates for each level of fertility the percentage of the global population living in places where fertility is below this level (figure 1). In 2003 the curve cuts the 50 per cent line at 2.1 children per woman (green curve). To put it simply, one half of the human population has fertility below replacement level and the other half above.

The curves plotted in figure 1 mostly present the fertility level country by country. However, because of their huge size, China and India are treated differently. The two Asian giants make up 21% and 17% of the total world population, and each of their regions is plotted separately. Thus the provinces of China and the states of India are treated as equivalent to nations elsewhere (see box 3) [2].

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### ◆ The median fertility level has fallen from 5.4 to 2.1 in fifty years

Fifty years ago (the black curve in figure 1) only four relatively small European countries had fertility below 2.1: Luxembourg, Austria, Estonia and Latvia, with the lowest fertility in any country being 1.98 (in Luxembourg). All the countries of the developed world are found on the left of the 1950-55 curve, with fertility below 3.5 children per woman. There is then a clear discontinuity (the horizontal section of the curve) before the countries of the developing world appear. Fertility there was mostly above 5 children per woman. The median fertility level (see box 4 for the definition) for the world was 5.4, and has thus fallen from 5.4 to 2.1 in half a century.

By the late 1970s (grey curve on figure 1) the situation had already changed substantially. Fertility had fallen below replacement level in the large majority of countries in the developed world whose population amounted to about a quarter of the global total. Fertility had also declined significantly in many developing countries, and the overall median stood at 3.6 children per woman. A further 25 years of steady decline has seen us reach today's historic lows.

Several striking features emerge from a consideration of the current situation. The lowest level for any national population (1.17 children in the Czech Republic) is far below replacement level, and roughly one person in six lives where fertility is closer to one than to two. This is true for most of Southern, Central

and Eastern Europe, and for much of East Asia. The long-term demographic consequences of this situation may be very considerable. The United Nations and other organisations that make international population projections generally assume that fertility will soon rise back to replacement level or just below in all countries

## Box 1

### Fertility and inter-generational replacement

The measure of fertility presented in this article is the total fertility rate. This is a widely cited indicator of fertility and is calculated as follows. The births that take place in a country in a given year are classified according to the age of the mother. The births at each age are then divided by the number of women at that age. This produces age-specific fertility rates. The sum of these age-specific rates across all the reproductive ages (usually 15 to 50) indicates the average number of children that would be born to a cohort of women over their lifetime given current fertility. Although the measure refers to a 'hypothetical cohort' of women, and is in principle open to a range of distortions or complications, in practice it is a relatively robust measure of fertility and is well suited to the purposes of this study, especially because it has been estimated by the United Nations for all countries since 1950, thus facilitating our analysis.

A total fertility rate of 2.1 children per woman is conventionally regarded as indicating the level of inter-generational replacement. In order to ensure exact replacement, a generation of women must give birth to somewhat more than two children each. The sex ratio at birth is generally about 105 males to 100 females, and if all children born grew up to reach adult life, then 2.05 would be replacement level. However, even in the most favoured populations, there is still some infant and child mortality; specifying the level as 2.1 takes this mortality into account. Strictly speaking, a precise measure of replacement would use the exact mortality level and sex ratio at birth for each country to calculate replacement level. However, 2.1 is a convenient overall estimate. The most significant exception arises for populations in which mortality is severe. If many babies fail to survive to adult life, then the replacement level will be higher than 2.1. Since this is true for some populations in the developing world, a more exact assessment of replacement would indicate that even more countries are failing to replace themselves than is indicated by the simple cut-off at 2.1. Similarly, in some countries more than 105 males are born per 100 females, requiring women to have more than 2.1 children each to ensure replacement. In this case too, using 2.1 to indicate the replacement level is a conservative estimate of how many people have fertility below it.

## Box 2

### Data sources

The national data presented here for 1950-55 and 1975-80 come from the United Nations [3]. The UN only publishes estimates for five-year periods, so to have an estimate for 2003 we used data from the US Census Bureau [5]. The two sources give very similar estimates and there is no major incompatibility introduced by using them together.

Not all countries report accurate estimates of population or fertility, thus a certain margin of error must attach to any estimate of global trends. Thus the exact date at which fertility fell below replacement level can never be known precisely. However, given the relatively small degree of uncertainty that attaches to the estimates and the generality and stability of the long-run trends, we can be reasonably sure that the threshold was crossed at some point between mid-2003 and mid-2004.

## Box 3

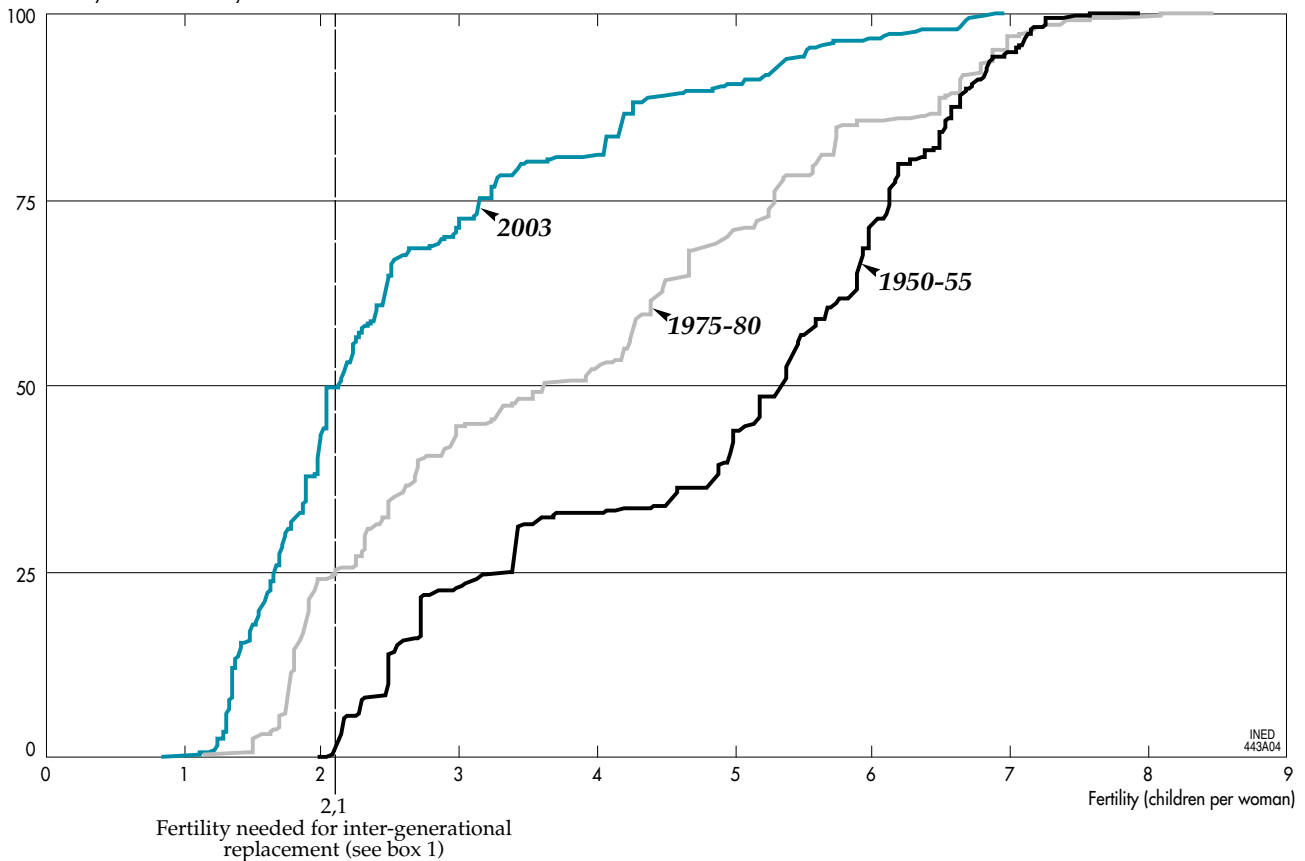
### China and India, a breakdown by regions

For this article the data for China and India have been disaggregated into their constituent regions: provinces in China and states in India. These components are in many respects comparable with other nations. Indeed many would be among the world's largest populations if they were independent countries. For example, the Indian state of Uttar Pradesh has more people than Pakistan or Russia, and would be the fourth most populous nation on earth, with China and India disaggregated. In the form presented in this article, the United States is the most populous entity, with 6.3% of the world's population in 1950 and 4.7% in 2003.

The population and fertility for each Chinese province and Indian state were estimated using national census and registration data and secondary analysis by experts on each country. We ensured that for each of the three data series the aggregation of the sub-national elements equalled the national level given by the United Nations for 1950-55 and 1975-80 and by the US Census Bureau for 2003 [2]. For each date the disaggregation involved making a number of assumptions about regional trends and levels, for example in correcting for under-reporting of girls in the 2000 census of China. The extent of the adjustments and extrapolations, however, was small and does not pose any complications for the wider analysis.

Figure 1 - Cumulative distribution of world population by fertility level

Percentage of world population living where fertility is below the fertility level indicated



**Reading the graph:** Each curve indicates the percentage of the total global population living in countries or regions in which fertility is below that level of fertility. For example the curve for 1950-55 (black line) shows that 25% of the world's population lived at that time in places where fertility was less than 3.4 children per woman, and thus that 75% lived where fertility was 3.4 or higher. The vertical line at 2.1 children per woman indicates the level of fertility needed to ensure the replacement of one generation by another (see box 1).

Sources: UN [3], USCB [5], Wilson [1]

that currently have very low fertility. However, the United Nations has been under-estimating the scale of global fertility decline for half a century, and it may still be doing so [4]. If so, future global population growth may be much less, and population ageing much more, pronounced than is currently forecast.

◆ **Among the developing countries or regions with low fertility are Brazil, Tunisia, parts of India and most of China**

Another important point to note is that below-replacement fertility is far from being restricted to the developed nations. Europe, North America and the other countries of the developed world make up less than half of the more than three billion people whose fertility is below 2.1 and who appear on the left of the green curve in figure 1. Among the developing country populations with low fertility are most of the provinces of China; only in a few inland provinces, e.g. Guizhou, Yunnan and Tibet, is fertility still well above 2.1. Elsewhere in China fertility is already well below re-

placement level, and is less than 1.5 in the most economically advanced coastal provinces. Several Indian states (whose combined population exceeds 200 million) also have fertility below replacement: e.g. Kerala, Tamil Nadu, Andhra Pradesh, and Delhi. The global nature of low fertility is also indicated by a consideration of some of the other countries with fertility below 2.1: Brazil (2.01), Lebanon (1.98), Thailand (1.91) and Tunisia (1.90). Given the speed of global fertility decline, the United States stands out as a remarkable exception. Fertility there is higher today than 25 years ago, and at 2.07 children per woman is now only a little below the global median. The US contribution to the green curve is the sharp vertical jump just to the left of the 2.1 line. If present trends continue, within the next few years the United States will be well above the global median level.

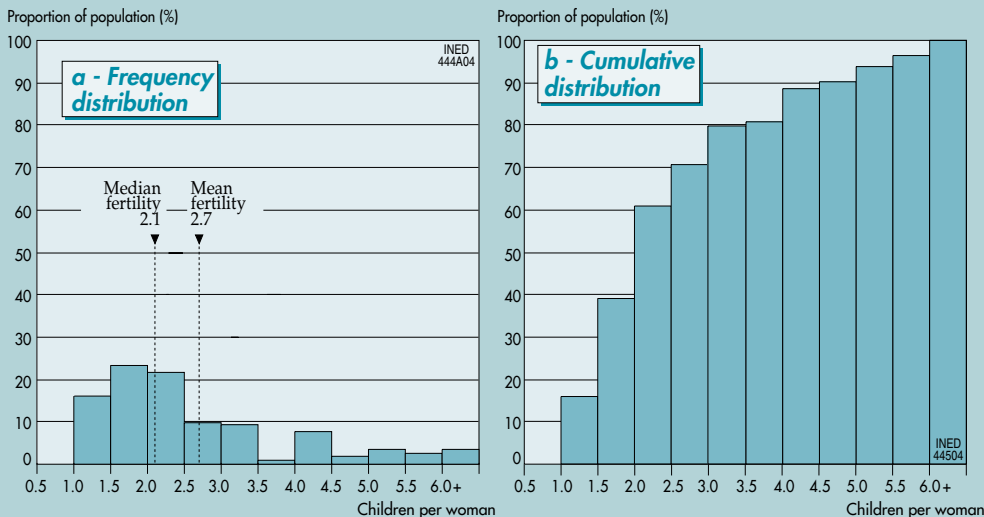
The truly global nature of fertility decline raises a number of important questions concerning the causation of change and the nature of development because fertility around the world is converging more rapidly than any other dimension of development [2]. There is

## Box 4

## Mean and median fertility

The mean and the median are two different measures of central tendency. The median is the value that divides the human population into two halves, one half with higher fertility than the median, the other half with lower than median fertility. In contrast, the mean fertility is the arithmetic average of the different national and regional (for China and India) estimates, weighted according to the size of each population. The mean fertility level for 2003 is 2.7, well above 2.1. This is because the distribution of fertility levels is asymmetrical (see the figure). The half of humanity with fertility below 2.1 averages 1.6 children per woman, being largely concentrated between 1 and 2. However the half with fertility above the median averages 3.6. This arises because some countries have fertility of 4 or more, indeed the maximum is above 6. In short, there is greater diversity above the median than below it, and the right-hand tail of the distribution affects the mean but not the median.

## Distribution of global population by fertility level in 2003



**Reading the graph:** Figure a shows the percentage of the global population at each level of fertility. Figure b shows the cumulated values, adding up the values for each level of fertility shown in a. It thus indicates the percentage of the global population living in places where fertility is below a given level.

Sources: UN [3], USCB [5], Wilson [1]

still a huge gulf in levels of income per head between developed and developing countries, and while education and urbanisation are converging, they are doing so at a slower pace than fertility. Demographic trends are generally regarded as consequences of more 'fundamental' changes in the socio-economic character of countries. However, what we see is that the 'consequences' are converging more rapidly than the 'causes'. This strongly suggests that rather than being driven by conventionally measured indices of development, fertility trends are influenced to a great deal by less tangible ideational factors.

A final feature of the current situation deserves to be pointed out: there is a great deal of diversity in fertility within the developing world. Almost 20% of the world's people still have fertility of 4 children per woman or higher. These high-fertility populations are mostly found in two large geographical zones, one running from Northern India into Pakistan and Afghanistan, the other embracing most of sub-Saharan Africa and the Arabian Peninsula. Future population growth will be to a large degree concentrated into these regions.

## REFERENCES

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- [5] United States Census Bureau – "International Data Base" (<http://www.census.gov/ipc/www/idbnew.html>)

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