Abstract

Human fertility has never been so varied. In some countries the average number of births per woman is close to one, only half the level required for long term stability of population size. In other countries the average woman is having six to seven births. The possible reasons for this diversity and the consequences are discussed. The problems of excessively high fertility are probably more easily solved than those of very low fertility. Much experience has been gained over the past 40 years in how to reduce childbearing, mainly by high quality family planning programs with accompanying publicity to legitimize the idea of small families and use of modern contraception. Conversely, successful experience at raising fertility is much less common and the future of very low fertility countries remains uncertain. The paper concludes that fertility in the range of 1.7 to 2.3 births, implying modest long term decline or increase in population is probably optimal.

Trends in Human Fertility

Introduction

The number of children born per woman and the timing of births is directly relevant to public health and human welfare in many ways. The level of childbearing, for instance, determines the demand for obstetric and child health services and has a direct effect on the maternal mortality rate. The age pattern of childbearing influences the incidence of obstetric complications, because pregnancies in the early teenage years and at ages over 35 years pose an increased risk to the mother. Fecundity also declines after age 35 years, and thus postponement of births will increase the need for assisted reproduction. The spacing of births has important health implications; conceptions occurring within 24 months of a previous live birth are at elevated risk of fetal death, prematurity, low birth weight for gestational age, and infant mortality. Unintended pregnancies may result in induced abortion, which in many countries is restricted and unsafe.

Fertility also affects socio-economic welfare. Birth rates are the crucial determinant of population growth (or decline) and the age structure of populations, and both factors have profound socio-economic implications. The links between population dynamics and economic development have been a matter of controversy for decades. On commonsense grounds it seems rather obvious that countries growing at 2% per year or more (implying a doubling in population size every 36 years or less) face greater difficulties in escaping from poverty and illiteracy than other countries, mainly because nearly half the population is aged under 15 years, thus placing a heavy dependency burden on the adult population. However economists could find little empirical evidence to support this view until recently. This more recent work has been able to exploit a longer time series of data and, by disaggregating
population growth into its components (fertility, mortality, age structure), has reached more definite conclusions. When fertility falls, an immediate benefit in terms of a reduction in the youth dependency burden is achieved. A medium term benefit then follows for several decades when the labor force is proportionately large, the dependency burden is atypically low, and prospects for making rapid socio-economic progress are specially bright. This era is inevitably followed by a return to a high dependency burden because of an increase in the elderly population, which poses a strain on governments’ health and welfare budgets.

The sequence is well illustrated by the case of the Republic of Korea (Figure 1). By 1960, mortality had already declined but fertility remained high at about six births per woman and the population was growing at 2.8% per year. At that time, 42% of the total population was aged under 15 years but only 3% were aged 65 or more. In the next 40 years, fertility fell sharply and by 2000 the number of births per woman was about 1.4 and the growth rate had abated to 0.6% per year. Between 1960 and 2000 the number of working-age adults (15-64 years) per 100 dependents rose from 120 to 250. Between 2000 and 2040 it is projected that the proportion of Korea’s population aged 65 or more will rise from 7.4% to 30.5% and the ratio of workers to dependents will have fallen from 250 to 137 per 100 dependents. All industrialized countries now face similar problems of population ageing and some face the prospect of appreciable decline in population size.

**FIGURE 1 ABOUT HERE**

Between 1950 and 2005 the global fertility rate halved from about five to 2.5 births. Under conditions of moderate to low mortality, a little over two births per woman is required to bring about long-term stabilisation of population size. Thus, the world as a whole may be approaching the end of an era of sustained growth, from one billion in 1830 to 6.5 billion in 2005 and a projected total of 9.2 billion in 2050 (United Nations 2006). However, these global figures mask huge differences between regions and countries. The level of childbearing in most industrialized countries has fallen well below the two-child mark and therefore these countries face the possibility of population decline, combined with population ageing. Conversely, many of the poorest countries in the world, mostly in Africa, still retain buoyant fertility levels and can expect substantial increases in population size.

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*Fig. 1 *Age structure in Republic of Korea: 1960, 2000 and 2040 (projected)

*Note:* Population aged 15–64 years is darkly shaded

*Source:* UN Department of Economic and Social Affairs, Population Division, World Population Prospects: The 2006 Revision. New York, United Nations 2007.
This paper addresses the implications of human fertility for the future of the planet. Today the span of national fertility levels has never been wider. In some countries the average woman still bears seven children over a lifetime. At the other extreme, very low fertility, at little above one birth per woman is found in a growing number of countries. Both extremes pose serious challenges to human welfare. The persistence of high fertility in Africa is discussed first.

**High Fertility**

Though fertility in sub-Saharan Africa remains high on average, the sub-region is demographically diverse (Figure 2). In the Republic of South Africa and Zimbabwe (then Rhodesia), vigorous family planning promotion started before the advent of majority rule and fertility in both countries, and in Botswana, is now at a relatively low level. HIV epidemics in Southern Africa are especially severe and thus falling fertility has been accompanied by rapidly rising mortality. These countries face an exceptionally abrupt end to an era of population growth.

**FIGURE 2 ABOUT HERE**

In contrast fertility decline in most of Western and Central Africa has barely started and HIV epidemics are modest in comparison with those in Southern Africa. Niger is one of about 12 countries expected to treble in size between now and 2050. The country is desperately poor and barely able to feed its current population of 15 million. It has lost half its arable land to drought and, in 2005, suffered a potentially serious food shortage that was only prevented from developing into a famine by international food aid. If the projected increase in population to 50 million by mid-century is realized, it is extremely difficult to see any alternative but a continuation of mass poverty, illiteracy and food insecurity. Niger is unlikely to attract large inward investment because of low human capital and inherent civil insecurity. Remittances from migrants to Europe and increased uranium extraction may mitigate the situation but not on a sufficient scale to offer the country a bright future. Sharper than expected reductions in fertility and future population size surely have to be part of the solution.

![Fertility trends, 1950–2005: selected industrialised regions and countries](image-url)
In Eastern Africa, fertility decline has started in most countries, but most markedly in Kenya. In that country, a vigorous family planning effort was initiated in the early 1980s and, in the next 15 years, fertility fell from nearly eight to 4.8 births. Unexpectedly, the rate then plateaued, one likely reason being that funds and energy were diverted from family planning to HIV/AIDS. Between 1988 and 2003, the proportion of contraceptive users relying on government services dropped from 68% to 53% and the percentage of births reported by mothers as unwanted rose from 11% to 21% (Westoff and Cross, 2006). Both trends imply a deterioration of government services. In 2002, the United Nations projected Kenya’s population in 2050 at 44 million. In 2004, this projection was raised to 83 million mainly in response to the fertility stall but also to a reduction in expected AIDS-related mortality. The consequences for Kenya are likely to be severe. The fertile highlands are already densely settled and huge pressure on water resources already exists. Nairobi, the capital city, already has some of the largest slums in the region and the huge projected population increase will further fuel rural-urban migration.

This sequence of events in Kenya may be an extreme example of a more pervasive trend throughout much of the region. Rather than gathering pace in the past 15 years, the trend towards lower fertility has faltered. In West and Central Africa, fertility typically remains close to six births per woman, contraceptive use prevalence among married women remains below 10% and desired family sizes are still high. The United Nations projects that fertility in sub-Saharan Africa will decline steadily to reach 2.5 births by mid-century. Even if this projection is accurate, Africa’s population is set to rise from 0.77 billion in 2005 to 1.76 billion in 2050.

Is the persistence of high fertility throughout much of sub-Saharan Africa simply a reflection of low socio-economic development or of distinctive features of culture and social organization that set the region apart from Asia and Latin America? Certainly, standards of living for many Africans worsened in the 1990s but equally high levels of poverty and illiteracy did not stifle fertility transition in Asia, as trends in Bangladesh and Nepal since the 1980s show. It is also true that countless surveys reveal that Africans attach a higher value to large families than citizens elsewhere. According to Caldwell, the explanation for this pronatalism lies in the subordination of the nuclear family to the lineage. For lineage leaders, the patriarchs, high fertility is advantageous because it enhances their prestige, power and patronage. Thus, they see children as sources of wealth rather than as drains on emotional and financial resources. A related explanation stems from the multiplicity of ethnic and linguistic groups in Africa, with the inevitable tension and conflict over resources that this diversity implies. A buoyant birth rate and numerical strength may well have conferred advantage in these circumstances, thus engendering strongly pronatalist values.

Since the most recent International Conference on Population and Development in Cairo, in 1994, policies to reduce population growth through family planning promotion have fallen from fashion and been replaced by a broader agenda of women’s reproductive health and rights. Many reasons for this shift have been proposed. New priorities, such as HIV/AIDS, and a sense that the problem of rapid population growth was largely solved are both implicated. But in most of Africa high fertility and rapid population growth represent more of a threat to the MDGs than HIV/AIDS. Moreover, of the 76 poorest countries of the world (with populations of 5 million or more), nearly half record a rate of population growth of 2% or more together with evidence of widespread unmet need for family planning (Figure 3). Most such countries are in Africa.
A revitalization of the family planning agenda is now badly needed. This will require the re-forging of the population-poverty reduction link that was broken at Cairo. A champion is needed. Historically the USA has taken the lead but this will not happen at least until after the next election. An obvious advocacy role for China exists.

Low Fertility

In most of Europe and in North America fertility decline started in the late nineteenth century (well before the development of modern contraceptives) and birth rates fell to low levels in the Great Depression of the 1930s, giving rise to concerns about population decline. These concerns were short lived because, following the end of World War II, fertility rose in most industrialized countries and in some it continued to rise throughout the 1950s. This post-war baby boom was most pronounced in the USA where fertility climbed from 2.9 births in 1946 to peak at 3.7 births in 1957. Japan is the clearest exception: this country experienced a dramatic decline from 4.5 births in 1947 to 2.0 births a decade later, partly in response to a shift from pro-to anti-natalist policies and liberalization of abortion laws.

The mid-1960s marked the start of a second and unforeseen phase of fertility decline. By 1980, fertility in most countries had fallen below the replacement level of two births (Figure 4). In 2005, childbearing was below 1.5 births in Italy, Spain, Germany, Austria, the Russian Federation and much of Eastern Europe and also in the economically advanced East Asian states and territories (Japan, Hong Kong, Singapore, Republic of Korea). Some of this decline can be attributed to increased efficiency in the prevention of unintended births. The advent of oral contraception in the 1960s represented a decisive break of the sex-reproduction nexus. Access to legal abortion was also made easier in many countries. In 2000, about 20% of known pregnancies were legally terminated in France, Norway, Denmark, Italy, the United Kingdom and Sweden. This percentage exceeded 40% in many countries of the former Soviet Block and the Russian Federation itself (United Nations 2005). In the USA, the fraction of births reported by women as unwanted fell from 20% in the early 1960s to 7% by the late 1970s and the same trend no doubt occurred in many industrialized countries, though is less well documented.

FIGURE 4 ABOUT HERE
However, most commentators have sought explanations in more fundamental changes than improved birth control. The fertility decline in many industrialized countries has been accompanied and partly propelled by postponement of marriage and parenthood, rises in cohabitation, non-marital births and divorce, increased acceptance of diverse sexual lifestyles, and a growing independence of women. These interwoven features, dubbed the "second demographic transition", represent an appreciable departure from marriage and parenthood as the central pillars of adult life. The key underlying cause is identified by some as the changing roles of women in society, together with the sluggish adaptation of men to this emancipation.

| High (5.0 or more) | Mozambique [5.52] | Senegal [5.22] | Kenya [5.00] |
|--------------------|-------------------|----------------|-------------|
|                    | Nigeria [5.85]    | Togo [5.37]    | Cote d’Ivoire [5.06] |
|                    | Niger [7.45]      | Zambie [5.65]  | Madagascar [5.28] |
|                    | Nicaragua [8.00]  | Ethiopia [5.78] | Tanzania [5.66] |
|                    |                   | Rwanda [6.01]  | Guinea [5.84] |
|                    |                   | Yemen [6.02]   | Benin [5.87] |
|                    |                   | Malawi [6.03]  | Somalia [6.43] |
|                    |                   | Burkina Faso [6.36] | Chad [6.54] |
|                    |                   | Sierra Leone [6.50] | Angola [6.75] |
|                    |                   | Mali [6.70]    | Burundi [6.80] |
|                    |                   | D R Congo [6.70] | Afghanistan [7.50] |
|                    |                   | Uganda [6.75]  |             |

| Medium (3.0—4.99) | Egypt [3.17] | Sri Lanka [3.02] | Syria [3.48] |
|--------------------|-------------|------------------|-------------|
|                    | India [3.11] | Bangladesh [3.22] | Laos [3.59] |
|                    | Paraguay [3.48] | Nepal [3.68] | Cambodia [3.64] |
|                    | Jordan [3.53] | Tajikistan [3.81] | Nepal [3.68] |
|                    | Philippines [3.54] | Bolivia [3.96] | Pakistan [3.99] |
|                    | Zimbabwe [3.56] | Haiti [4.00] | Papua New Guinea [4.32] |
|                    | Honduras [3.72] |                    | Ghana [4.59] |

| Low (1.0—2.9) | Romania [1.29] | Ukraine [1.15] | Bulgaria [1.26] |
|---------------|----------------|----------------|-----------------|
|               | Cuba [1.63]    | Belarus [1.24] | Serbia [1.75]   |
|               | China [1.70]   | Azerbaijan [1.67] | Myanmar [2.25] |
|               | Thailand [1.83] | Tunisia [2.04] |                |
|               | Korea, Dem Rep [1.92] | Kyrgyz Republic [2.50] |                |
|               | Kazakhstan [2.01] | Morocco [2.52] |                |
|               | Vietnam [2.32] | Algeria [2.53] |                |
|               | Indonesia [2.38] | Peru [2.70] |                |
|               | El Salvador [2.35] | Uzbekistan [2.74] |                |
|               | Colombia [2.47] | Ecuador [2.82] |                |
|               |                | Dominican Republic [2.95] |                |

| Low (<10%) | Medium (10%—19%) | High (20%+) |
|------------|-------------------|-------------|
| Unmet Need for Family Planning |                |             |

Fig. 4 Classification of low income countries, by fertility rate (2000—2005) and unmet need for family planning

Note: Figure in parentheses show the fertility rate
for instance by reluctance to shoulder a more equal share of the burden of housekeeping and child-rearing. The shift away from marriage and motherhood has been called “the revenge of women on men”. Paradoxically, however, the level of childbearing is lowest in countries where women’s labor force participation is also very low: Japan, Greece, Italy and Spain. It is also of note that these same countries have low proportions of non-marital births. Other experts, such as Ronald Lesthaeghe and Dirk van de Kaa, have sought an explanation in the development of broader ‘post-modern’ values of individualism, secularism and the desire for self-fulfillment. Compelling region-specific explanations abound. For instance, the turbulence and insecurity caused by the break-up of the Soviet Block coincides with the period of sharpest decline in these countries. Given the economic, social and cultural diversity of the very low fertility countries, it seems unlikely that there is a single underlying cause.

A sustained fertility rate of 1.5 births implies a halving of population size approximately every 65 years. At a life expectancy of 80 years it also implies an age structure where 28% of populations are aged 65 years or more and a ratio of workers (conventionally defined as ages 15-64) to old and young dependents of 1.5, compared to a ratio of about 2.0 in most industrialized countries today. A rise in life expectancy to 87 years changes the ratio to 1.4. While this prospect of population shrinkage is welcome to some environmental groups, it is regarded with alarm by many European and Asian governments. International migration on a sufficient scale to offset low birth rates and prevent population decline does not appear to be politically feasible. Hence, the main policy responses have been aimed at stimulating reproduction and have included generous maternity/paternity allowances (Sweden), child allowances that increase with parity (France), and cash payments at birth (Australia, Italy). Many other countries have shunned explicit pronatalist policies but have attempted to make family-building and work more compatible, for instance by better provision of infant care centers. None of these policies can claim long-term effectiveness at raising birth rates and the demographic futures of industrialized countries is uncertain (Gauthier, 1996). While most experts foresee the continuation of very low fertility, the United Nations envisages a slight but steady increase over the next 40 years. One factor favoring an increase concerns postponement of births which depresses period rates but may not affect the number of children that women have over their life course. Sooner or later, the trend towards delayed childbearing must end and, when this happens, period fertility rates will increase typically by an average of 0.2-0.4 births per woman (Lutz et al. 2003). It is also true that a two-child family remains a widespread aspiration despite downwards shifts in some countries (Goldstein et al. 2003).

The anticipated decline in the number of workers to dependents is perhaps exaggerated as a problem. Even if fertility remains as low as 1.5 births per woman, raising retirement ages from 65 to 70 work bring the ratio back to its current level of 2.0. The effect of ageing on health and social support costs is likely to be more severe. Family support systems are a crucial consideration. In Europe the State bears much of the cost of caring for the elderly who are no longer able to live independently. Is this also the prospect for Asia or will strong tradition of family support endure?

Conclusions

For millennia, the human population grew at a miniscule rate because moderate fertility was matched by high, albeit fluctuating, mortality. The scientific and technological revolution of the past 200 years broke this demographic balance and gave rise to an unprecedented surge in human numbers. The past 50 years has seen a necessary and welcome return towards balance; fertility has fallen in most countries and world population may stabilize in the latter half of this century. Thus, the prospect of the Malthusian nightmare of famine and warfare, so prominently proclaimed in the 1960s by Paul Ehrlich and others, has receded.

No consensus on the ideal level of fertility exists but a range of 1.7 to 2.3 births per woman has much to recommend it, as it implies modest growth or decline. As shown in this paper, the world is still far away from such a benign outcome. Fertility rates in many industrialized countries have plunged well below 1.7 while many poor countries have rates well above 2.3. Indeed, the fertility of nations has rarely been so diverse. Our demographic future is still uncertain. Will birth rates in Africa fall as fast and pervasively as in Asia and Latin America and will fertility edge steadily up in countries such as Japan and Italy? What happens in Africa is partly a matter of political priorities because a large body of successful experience at reducing fertility has accumulated. Policies to raise fertility do not have a successful track record and so trends in low-fertility countries are particularly difficult to predict.
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