

The Projection Problem

Robert J. Wyman
Yale University

While world population has continued to increase, fertility has been falling. Projections out to the year 2050 currently assume that fertility will continue to decline to, or below, replacement. 1) Past projections have been very wrong. Estimates of population growth have alternated between being far too low and far too high. 2) Similarly, public anguish has alternated between extreme fears of over- and under-population, neither supported by eventualities. 3) We do not understand the causes of the current fertility decline and so have little reason to project its continuation. 4) Many of the Asian countries, which are exemplars of the current decline, are exceptional because of coercion and/or vast infusions of Western capital. 5) The population decline may as readily plateau at 3 children as at 2 children. With an unknowable future, an emphasis on future population is misplaced. Concerns should be for the present. Poor families and a stressed environment are struggling with current population levels right now. Complacency about the future is unjustified by the facts and may derail efforts to ensure the continuation of the fertility decline.

KEY WORDS: population projections; fertility; Asian economic miracle; coercion; environment.

The paper by John Bermingham provides part of a much needed corrective to the way the population problem is presented to the public. The problem that Bermingham points to is that, since growth rates are changing, mostly decreasing, the simple calculation of a doubling time from a single current growth rate is wrong. He is completely correct on that point. Bermingham properly argues that, since population growth is no longer expo-

Please address correspondence to Robert J. Wyman, Department of Biology, Yale University, PO Box 208103, New Haven, CT 06520; e-mail: robert.wyman@yale.edu.

nential, "doubling times" can be "grossly erroneous." Instead, Bermingham suggests the use of percentage growth for the 25 and 50 year projections.

Bermingham argues correctly that using an exponential formula based solely on the current growth rate can lead to "absurd" results. However, doubling times can be projected based on any assumptions the statistician likes. The statistician can choose growth rates that slow down, speed up, vary every year or stay the same, the last being the case of exponential growth. As long as the growth rate is positive, the computer can spit out a doubling time. So formally, Bermingham's mathematical point is only correct for the simplest type of calculation.

However, I still agree with Bermingham's thrust based on a broad set of considerations. The first reason is that, as population growth rates decrease, doubling times, however calculated, expand out into the far future. At the top of the 2000 World Population Data Sheet, to which Bermingham refers, a doubling time of 809 years is listed for the 'more developed' countries. Bermingham's term 'absurd' is apt here. Current guesses about population growth in such a far and dimly perceived future are certain to be wrong. Bermingham's suggestion to use 25 or 50 years as the maximum projection window is certainly the minimum fix. I, personally, have little faith in 25 year projections and none whatsoever in 50 year projections.

Population projections made in the past have often been far off the mark and do not provide confidence for current projections. Projections now peer 50 years into the future. Let us see how projections 50 years ago fared. In 1945 the postwar concerns over world population began with articles by Frank Notestein and Kingsley Davis. Notestein held the most influential demographic post in the US; he was Director of the Office of Population Research at Princeton. He argued (1945) "human mortality and fertility move in response to rather well-known factors, some of which are in a measure predictable." Starting from a population of ~140 million in 1945, he set as "realistic" the population of North America in the year 2000 as 176 million. Starting from ~2.2 billion in 1945, the world total for year 2000 was put at 3.3 billion. Kingsley Davis (1945), also at Princeton, repeated Notestein's numbers. Both estimates turned out to be grossly low. The actual 2000 number for North America is close to 306 million, for the world the actual number is close to 6.1 billion. The world population grew 3½ times as fast as projected; North America's grew 5 times as fast. Of course, both men were well aware of the hypothetical nature of their numbers and the uncertainties are clearly stated in their papers.

Joel Cohen (1995) provides some lovely examples of just how wrong projections can be. In 1947 the US Census Bureau forecasted a range of future US populations. Only 3 years, later the actual population was al-

ready higher than the maximum. Learning from their errors, the Census Bureau increased the projections. But reality turned in the opposite direction. The 1975 population was lower than the lowest forecast made only 4 years earlier.

Have our crystal balls improved in the last 50 years? One of the easiest jobs must be for an advanced, computerized country to estimate its own current population. Yet, the 2000 US census found 6 million more people than the Census Bureau had estimated only three months earlier (Holmes, 2000). How shall we extrapolate from that slip to put error bars on an estimate for the whole globe's population 50 years into the future?

The various agencies and organizations that currently deal with population emphasize the uncertainties in their trade and their underlying assumptions are readily available. They label their computer outputs as 'projections' not 'predictions.' The United Nations Population Fund publishes a range of projections including 'high variant,' 'medium variant' and 'low variant.' Nevertheless, the most informed estimates that we have had in the past have been very wrong and we should expect the same for current estimates. Professionals in the field understand these reservations. But, for general dissemination, any projection beyond a few decades is just too fanciful to foist upon the public.

DETERMINANTS OF FERTILITY

Predicting the future requires an understanding of the drivers of change. If we don't understand why fertility has fallen in the recent past, then we have no basis for predicting a continuation of current trends. Birmingham's article describes six 'drivers of population growth,' but does not mention any causes for the fertility decline that has made 'doubling times' anachronistic.

Everyone has their favorite cause for the fertility decline. Prominent among these are: economic development, family planning programs, education (or women's education), the drop in infant mortality, urbanization, small family norms popularized by the mass media, jobs for women or an improvement in some other aspects of women's status. Scholars still argue vehemently over what are the key factor(s).

Whatever the cause or causes, one should always remember that none of these things happened spontaneously. A lot of activists, at all levels and in all geographic locales, made these things happen. A more accurate view would attribute at least part of the fertility decline to the alarm generated by demographers and the activist response to the potential crisis. Surely the

national programs in India, China and almost every other country were part of the solution as well as the activities of international groups such as International Planned Parenthood and US Agency for International Development.

POPULAR PERCEPTIONS

Just as professional population projections have alternated between being too high and being too low, public concern swings between extraordinary fears about population growing too fast (e.g., Ehrlich, 1968) and extraordinary worries about impending depopulation. Polybius, in ~140BC, wrote:

In our time the whole of Greece has been subject to a low-birth rate and a general decrease of population, owing to which cities have been deserted and the land has ceased to yield fruit. . . . Men had fallen into such a state of pretentiousness, avarice, and indolence that they did not wish to marry, or if they married to rear children born to them, or at most as a rule one or two of them, so as to leave these in affluence and bring them up to waste their substance, the evil rapidly and insensibly grew. (Polybius, 140 BC/1997, pp. 875–876)

Depopulation became almost an obsession with the French who were worried at their low population growth rates compared to the rest of Europe in the era surrounding their great wars with Germany (1870–1945) (Teitelbaum & Winter, 1985). In fact, the French population increased through this period as it has continued to do. Notestein (1945) stated that “The populations of northwestern, southern and central Europe, North America, . . . , may all be characterized as those of incipient decline.” The population of both Europe and North America has instead almost doubled since he wrote. For more recent expressions of worry, see Teitelbaum and Winter (1985).

My favorite of this genre is a scare piece by Ben Wattenberg (1997) in the *New York Times Sunday Magazine*. The headline screams: “The Population Explosion is Over.” A subhead continues: “Suddenly, 650 Million People are Missing.” And then another headline to hit the heartstrings: “more lonely people, without siblings, uncles, aunts, cousins, children or grandchildren.” What was all this hype based on? The UN had reduced its

population projection for the year 2050. At the time of the new projection, global population was still increasing by over 80 million a year and the UN projected population to continue growing well beyond 2050. Since crystal balls are always cloudy, polemicists can paint the future in whatever color they please.

IS THE FUTURE THE REAL ISSUE?

Another reason for agreeing with Bermingham involves the whole issue of a fixation on the future course of population growth. From a policy perspective, should we do anything differently if the population of the world in 2050 is 7.9 billion (UN low variant) than we should do if the population is 10.9 billion (UN high variant)? Does it really matter which number eventuates when our current 6 billion is stressing the earth to a level that we cannot calculate and we do not know what will happen to the condition of the earth even if not another person was added to its numbers? One thing we do know is that population momentum will keep the global population growing for a long time to come and, if the conditions necessary to ensure a continuing decline in fertility are not made to happen across nations, then the population will reach 13 billion (UN constant fertility scenario).

The media has decided that comfortable Westerners will only be moved by population issues if it can be shown that a disaster of unimaginable proportions is going to occur. This requires a focus on an utterly horrible future population situation. The press tries hard to show us that we, rich as we are, will not be immune from the coming onslaught. Will hordes of poor migrants assault our shores? Will the new diseases of poverty attack us? Will global warming flood our cities and parch our farmlands?

The emphasis on doubling times is a symptom of this underlying misconstruction of the issue. Anyone who has traveled to poor parts of the world knows, instead, that the problem is right now. Poor families are struggling with overpopulation right now. The environment is being assaulted before our very eyes. We don't have to guess about the future to see that we have a crisis on our hands. Bermingham is completely justified in his efforts to downplay this whole doubling time emphasis. I don't know what population levels the social, technological and environmental state of the world in 2050 might be able to handle. I do know from poverty rates and from environmental degradation rates that the world is doing a poor job of managing 6 billion right now.

IS FERTILITY DECLINE INEVITABLE?

We have been in a period of declining birth rates; professionals seem convinced that this trend will continue. Essentially all projections include this assumption and it underlies the projections included in Bermingham's Figure 1. Continued decreases in fertility, of course, may be what the future brings. However, I would caution against the complacency in the field that accompanies this presumption. One should always keep in mind the reasons why one's assumptions may be wrong.

Asian countries account for more than half of the world's annual population increment, hence we should focus attention there. By far, the 300 pound gorilla in the data is China. With 1/5 of the world's population, as goes China, so goes the world. China's fertility decline is, at least partly, the result of varying amounts of coercion (Bannister, 1987; Greenhalgh, 1994; Lee & Wang, 1999). While most western sources decry this coercion (Aird, 1990), it forms a large part of the statistical underpinning of complacency over the future course of population. If coercion is to be eschewed, then should we use China as an example of how the rest of the world will proceed?

Japan is unique in Asia in achieving a low and stable fertility rate in the 18th and early 19th century, at least as early as any European country did (e.g., Hanley, 1979). After a population rise during the period of industrialization, Japan was jump-started economically and remodeled politically and culturally by the US after WWII. The birth was cut in half in one decade (1947–57) (Macfarlane, 1997).

The Asian Tigers, on whose records another large portion of the data sits, are mostly very small (Hong Kong, Singapore, Taiwan, and South Korea). They have also been the recipients of vast amounts of American and European capital. Taiwan and South Korea were the beneficiaries of immense aid and influence from the U.S. as part of the cold war. Hong Kong and Singapore were similarly conduits for European capital. Are these examples likely to be repeated in the more recent areas of US and western geo-political concern? The neglect of serious development efforts for the Soviet block, Yugoslavia, Somalia, Afghanistan South Africa and the Arab countries of the Middle East do not augur well.

The future of the other 'rapidly modernizing' countries in Southeast Asia is cloudy. Indonesia is oil rich and this wealth has partly funded its partial demographic transition. Army troops accompanying family planning workers into villages was also an important parts of the picture (Hull & Hull, 1997). We do not know how the political disarray in Indonesia will affect its economic or demographic future. Is the microelectronics boom

which bootstrapped Malaysia over? We have yet to find out the demographic effects of the 1997 Asian economic debacle or whether progress in these areas will resume. Only the future will tell whether the Southeast Asian countries were good predictors of the future or temporary bright spots.

Many countries have indeed experienced an astoundingly rapid fertility drop. Brazil's TFR, for instance, was 6.15 a half century ago; it is now at 2.27. Will the widespread drop continue, and if so, to what level?

The data on the current state of the fertility decline is mixed. Sub-Saharan Africa remains the exception to most demographic rules. Two-thirds of its population lives in countries with a TFR still over 5 (United Nations, 2001). Instead of continuing the decline, a variety of countries seem to have stabilized at a TFR level above 3. Argentina's fertility has been about 3 for almost 50 years (Haub, 2000). Fertility in Bangla Dsh and Egypt has stopped falling and is level at rates between 3.3 and 3.5; similar slowdowns are seen in Paraguay and Jamaica (Haub, 2000). Vital rates from India's Sample Registration System, have just become available for 2000: fertility decline has reached a plateau (Haub, 2002). The same is happening even in Mongolia; the TFR rose after 1993 and was last measured at over 3 (Aasve & Altankhuyag, 2002). In the US, the 2000 census showed the largest decadal numerical increase ever (Pollard & Mather, 2001).

Will these plateaus hold, or will declines resume? Are these countries the true harbingers of the future? Only time will tell. If we project a future TFR of 3 children, rather than 2, for developing countries, then their population increases by 50% each generation.

All projections need some assumptions about the future and a continuation of current trends is a reasonable assumption. The UN 1998 projections were based on a continuing decline in fertility with all high fertility countries reaching replacement level fertility by 2050. This magic number (TFR = 2.1) is of course arbitrary; there are no feedback mechanisms which are known to be capable of stabilizing fertility at this level. In the 2000 Revision this assumption has been dropped, the fertility of many high fertility countries does not reach replacement level by 2050. The medium variant of the United Nations 2000 Revision projects a population of 9.3 billion for the world as a whole in 2050, a figure 413 million higher than the 8.9 billion projected by the 1998 Revision. The estimate increased by almost 1/2 billion people in just two years. Wattenberg must be doing summersaults; the people lost in 1997 were found again in 2000.

There are any number of factors which could rapidly and drastically increase the fertility rate. High on this list is economic collapse as happened

in Asia in 1997, and which could even happen in the US as we see by the recent stock market fall which is notable as much for its unexpectedness as for its extent and rapidity. If economic development is important in fertility decline, then economic decline should have the opposite effect. If the spread of contraception is important, then religious fundamentalism, on the rise throughout the world, may prevent that spread. If family planning programs are critical, then, led by US government policy, international support for family planning programs may decline. As China changes rapidly, will its government maintain control over population growth? Wars and ethnic conflicts keep reversing decades of social progress. Overpopulation itself could lead to a vicious spiral of population growth. The most fragile thing that humans make is our political and social arrangements. If countries come under so much population stress that they can no longer provide for the basic needs of their people—then chaos may ensue and all progress may be lost. In any country, if population, or the attendant environmental degradation, put too much stress on the social system, then it may collapse. Environmental degradation itself may destroy the basis of many people's lives and eliminate the conditions which have led to a decreasing birth rate. Under these, and many other scenarios, the declining fertility story could turn around on a dime and population growth could start accelerating again.

I do not intend to be a doomsayer, just to emphasize that the future is unknowable. The corollary is that the future does not happen by chance, it is influenced by actions we take now. A complacent assumption that fertility rates will continue falling can remove the impetus for activists to continue working toward the conditions that have fostered lower birthrates. This just might be the precondition which ensures that the assumption will be wrong. Some prophecies are self-fulfilling; others are self-defeating.

REFERENCES

- Aasve, A., & Altankhuyag, G. (2002). Changing Patterns of Mongolian Fertility at a Time of Social and Economic Transition. *Studies in Family Planning*, 33, 165–172.
- Aird, J. S. (1990). *Slaughter of the Innocents: Coercive Birth Control in China*. Washington, DC: American Enterprise Institute Press.
- Banister, J. (1987). *China's Changing Population*. Stanford, CA: Stanford University Press.
- Cohen, J. E. (1995). *How Many People Can the Earth Support?* New York and London: W.W. Norton & Co.
- Davis, K. (1945). The World Demographic Transition. *Annals of the American Academy of Political and Social Science*, 237, 1–11.
- Ehrlich, P. R. (1968). *The Population Bomb*. New York: Ballantine.
- Greenhalgh, S., Zhu, C., & Li, N. (1994). Restraining population growth in three Chinese villages, 1988–93. *Population and Development Review*, 20: 365–95.

ROBERT J. WYMAN

- Hanley, S. B. (1979). The Japanese fertility Decline in Historical Perspective. In L. Cho, & K. Kobayashi, *Fertility Transition of the East Asian Populations*, pp. 24–48. *Monographs of the Center for Southeast Asian Studies, Kyoto University*. Honolulu: The University Press of Hawaii.
- Haub, C. (2000). Flat Birth rates in Bangladesh and Egypt Challenge Demographer's Projections. *Population Today*, October 2000. Washington, DC: Population Reference Bureau.
- Haub, C. (2002). Report on the United Nations Population Division Expert Group Meeting on Completing the Fertility Transition, 3/11–14/02. Population Reference Bureau Website (www.prb.org), March 2002.
- Holmes, S. A. (2000). After Standing Up to be Counted, Americans Number 281,421,906. *The New York Times* December 29, p. A17.
- Hull, T. H., & Hull, V. J. (1997). Politics, Culture and Fertility: Transitions in Indonesia. In G. W. Jones (Ed.), *The Continuing Demographic Transition*, pp. 383–421. Oxford, UK: Oxford University Press.
- Lee, J. Z., & Feng, W. (1999). *One Quarter of Humanity*. Cambridge, MA: Harvard University Press.
- Macfarlane, A. (1997). *The Savage Wars of Peace: England, Japan, and the Malthusian Trap*. Oxford, UK: Basil Blackwell.
- Notestein, F. W. (1945). Population—The Long View. In T. W. Schultz, *Food for the World*. University of Chicago Press, pp. 36–57.
- Pollard, K., & Mather, M. (2001). U.S. Population up 13 percent, Largest 10-Year Increase Ever. *Population Today*, February/March. Washington, DC: Population Reference Bureau.
- Polybius (~140BC/1997). *The Histories*. Trans. in *Population and Development Review*, 23, 875–876, repr. from W. R. Paton, Loeb Classical Library, 1927.
- Teitelbaum, M. S., & Winter, J. M. (1985). *The Fear of Population Decline*. Orlando, FL: Academic Press.
- United Nations Population Division (2001). *World Population Prospects: The 2000 Revision*. New York.
- Wattenberg, B. J. (1997). The Population Explosion Is Over. *The New York Times Magazine*, November 23, 60–63.