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How and Why Population Matters: New Findings, New Issues

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INTRODUCTION: THE BELLAGIO SYMPOSIUM

No social phenomenon has attracted more attention in the last half-century than the 'population explosion'—that surge of population numbers rising almost threefold from 2.5 billion in 1950 to over 6 billion at the turn of the millennium, and continuing at a diminishing pace to level out at as much as 11 billion in the middle of the twenty-second century. Given the exceptional complexity and diversity of the various impacts of rapid demographic change and rising population numbers, assessments of the consequences of the population explosion have varied widely, ranging all the way from the view that more population growth leads to more prosperity to forecasts that rapid population growth would precipitate wide-ranging catastrophes (famines, ecological collapses, wars, natural resource depletion, and the like).[1]

The range of views has spurred an outpouring of research, much of it by economists and economic demographers. Focusing on the effects of the developing countries' extraordinarily rapid population growth on their economic growth and on the economic and social welfare of their peoples, economists have addressed two big questions: has the rapid population growth of the last half-century been good or bad for these countries' economic prospects? If bad, what government policies and programs to encourage lower fertility and thus slower population growth, if any, make sense—for the economy and for individual and family welfare?

The debate about these questions has been fruitful and contentious, both among economists and between economists and other social scientists. It has been fruitful in the traditional academic sense, in contributing to increasingly sophisticated work based on a stream of new theoretical and modeling insights and on exploitation of ever-improving data. It has been contentious because of its policy relevance. Officialdom has looked to researchers, and particularly to economists, for guidance on policies in poor countries that affect the most personal and critical decisions of families—regarding marriage, women's status, and of course childbearing itself, and for guidance on programs of foreign assistance by rich countries to poor countries.

[1] For example, for the positive view Simon (1977) for the negative view, Ehrlich (1975).

While knowledge on the big questions has proceeded slowly, distinct and measured progress has been made. At various times—once or twice a decade since 1950—groups of scholars have taken stock of the research—usually at the behest of the United Nations, the World Bank, USAID, and other official organizations concerned with economic development prospects in the Third World.[2] The present volume, resulting from a Symposium on Population Change and Economic Development held in Bellagio, Italy on 2–6 November 1998, represents the first installment in the new millennium of the continuing compendia of research on population issues by economists and economic demographers.[3] It brings to the fore some notable new findings and highlights a new set of questions.

This chapter is an introduction to the volume as a whole. It draws both upon the papers prepared for the Bellagio Symposium, and equally important, on the Symposium deliberations. The deliberations were of particular value because the Symposium brought together two groups of participants. The first represented economists actively involved in various aspects of economic-demographic research. The papers they presented were assessed not only by their peers at the Symposium, but also by the second group of participants, policy analysts representing various constituencies working on development and population issues. The purpose of an exchange between these groups was to push the research community to contemplate the policy implications of new findings and to help frame the critical policy questions that new research was shaping. At the same time, it encouraged the policy community to incorporate more quickly and more effectively into new programs the implications of new research findings. The papers themselves and the deliberations allow us in this first chapter to vary from the usual format of an edited volume which typically summarizes the results of each chapter. Instead, we have chosen to organize this chapter around several key arguments and empirical results bearing on the two big questions set out above. This permits us, while assessing and updating the literature on the basis of the reported research, to also lay the groundwork for a discussion of the implications of this most recent and sophisticated research for policy. There were, however, no papers at the Symposium that focused primarily on policy and no session that systematically linked the latest research findings to policy. To rectify this gap, one of us has compiled a short concluding chapter, drawing from her previous work and integrating the insights and findings of the Bellagio participants.

Finally, while we have attempted to be faithful to the research essays and to the discussion they catalyzed, judgments on what to include and emphasize have obviously

[2] Kelley, in Chapter 2 of this book, provides an extensive review of these official reviews as well as of the research on which the reviews were based.

[3] The Bellagio Symposium was organized by Nancy Birdsall of the Carnegie Endowment for International Peace, with the support of the Rockefeller and Packard Foundations and the United Nations Population Fund (UNFPA). The sessions were chaired by Nancy Birdsall and Steven Sinding (then of Rockefeller).

been necessary.[4] Moreover, this format for an introductory chapter has the drawback that it greatly understates and downplays the richness of the individual chapters presented in the volume. We therefore hope our readers, particularly those who are scholars and researchers in this field, will give those chapters the detailed scrutiny they merit.

THEMES AND NEW FINDINGS

The chapters in this volume address four questions: what have been the effects of fertility and mortality decline and other demographic changes in the developing countries in the postwar period

- on economic growth?
- on poverty and inequality? and
- on sustainable use of natural resources in agriculture?

What are the implications for economic, social, and population policies and programs?

These are, of course, only a subset of themes that merit consideration, but they arguably represent some of the more important areas of inquiry. First, assessments focusing on aggregate economic growth have attracted attention in past debates about population growth in developing countries (some would say inordinate attention), and the results of this type of assessment are bound to affect future policy and future new research efforts. Secondly, poverty reduction and the distribution of the fruits of economic progress represent critical dimensions of welfare advancement in the Third World; yet research on the impact of population growth and demographic change on poverty and income distribution by economists has been surprisingly limited. Thirdly, the agricultural sector has dominated the activity of most Third World residents; the environment is increasingly under stress; and interactions among the environment, poverty, and population are of special importance in the rural sector. These three themes—aggregate growth, distribution and poverty, and agriculture and the environment—thus represent especially important areas in which to take stock. Finally, debate among economists about the effects of population growth has often clouded rather than clarified policy; an objective of this volume is to reflect upon the implications of new evidence for future development programs and policies.

Like those collective research assessments that have gone before, the findings in this volume strike some new themes (in this case in the assessment of the impacts

[4] This chapter is a revision and expansion of our original report on the Symposium. Drafts of the original report were shared with each participant. Their inputs were then incorporated where we felt appropriate, and a revised document was circulated to each participant for information. The final Symposium Report, like this chapter itself, rests solely with the authors. (Allen Kelley joined as a co-editor to the present volume; he focused mainly on providing feedback to the authors.) The authors of this Introduction are especially grateful to our co-editor, Allen Kelley, for his extensive and extremely useful comments on the Symposium Report and on the original draft of this chapter.

of rapid demographic change on aggregate output growth, and on poverty), and reinforce others (in this case the impacts of population on the rural economy and the environment).

First, in contrast to assessments over the last several decades, rapid population growth is found to have exercised a quantitatively important negative impact on the pace of aggregate economic growth in developing countries. The finding, as discussed below, bodes well for the future, as population growth rates decline, even as it helps account for low economic growth in the past.

Secondly, rapid fertility decline is found to make a quantitatively relevant contribution to reducing the incidence and severity of poverty. Though an association between poverty and high fertility has long been noted, research in this area has rarely gone beyond association to causality, and has advanced slowly given the challenges of empirical assessment. The new findings suggest more strongly than before that past high fertility in poor countries has been a partial cause of the persistence of poverty—both for poor families that are large, and via the kinds of economy-wide effects that Malthus theorized about, for poor families even if they are small. As with the finding that rapid population growth affects economic growth, this bodes well for the future, since fertility is declining almost everywhere in the developing world.

Finally, the impact of rapid demographic change on the rural environment and development is found to be mixed—above all, a minor player in a much larger story about initial conditions and broad policy effects. This finding calls attention to the relevance of development policy writ large—of policies having to do with agricultural prices, rural infrastructure, the urban labor market, and the financial sector—to whether demographic change and more narrowly defined 'population policies' affect for good or ill rural residents, still the majority in the developing world.

We turn now to some specifics about these effects of demographic change, and then to the implications for policy as seen by economists through the lens of their economic analyses.

SETTING THE STAGE: DEMOGRAPHIC CHANGE AND ECONOMIC REVISIONISM

Recounting the at times fitful progress of economic research on population over many decades, Allen Kelley (Ch. 2) emphasizes the triumph of what he calls 'revisionism'. He refers not to a particular quantitative assessment of the effect of rapid population growth—positive, negative, or neutral—but to a particular approach to research. That approach emphasizes the long run, and the possibility over the long run that the initial impact of demographic change will be modified by feedback within social and economic systems. With this approach, the net impact of a demographic change depends on the period allowed for such feedbacks, the importance of the feedbacks themselves, and the extent to which feedbacks moderate or reinforce initial impacts.

Economists have tended to emphasize the relevance of *compensating* technology and institutions in *moderating* initial negative impacts of, for example, the effect of a growing population; this is a point that Pender makes in Chapter 12, and that

Ester Boserup made in her classic study of how population growth in African agricultural societies catalyzed the change from shifting fallow to higher yielding settled agriculture.[5] The attention to compensating and thus moderating factors comes naturally for economists concerned with general equilibrium effects in large markets, where for example a new scarcity due to a perturbation in one part of the system should lead to a price increase in the scarce good, leading in turn to reduced demand for that good. However, in models of the effects of demographic change, economists have more recently also noted the potential for *reinforcing effects*, where an initial perturbation such as a decline in mortality has a long-run positive impact—potentially more than offsetting any short-run negative 'crowding' effect of the initial rise in population growth. Bloom and Canning in Chapter 7 note that an exogenous increase in life expectancy can spur economic growth because longer expected life encourages private investment in education which raises country economic growth, and that additional economic growth may then induce an additional increase in life expectancy.

Moreover, economists generally expect initial negative effects of a demographic change to be moderated and initial positive effects to be reinforced, the more effective are markets, governments, and institutions. So the initial negative impact on the economy of an exogenous demographic change such as a decline in infant mortality (due to new health technology) will be greater, unfortunately, in low-income countries, where these three institutions are relatively weak. And in turn the initial positive effect of a decline in fertility (say due to increased education of mothers) in reducing local pressure on school spending is likely to be reinforced where labor markets and school systems are working well and parents are prepared to invest in their children's education. Similarly, economic models will take into account the possibility that the initial impact of a demographic change, whether positive or negative, can pale in comparison to the effect of its interaction with markets and policies, so that the strength or weakness of the latter turns out to be the critical determinant of the ultimate outcome in terms of people's well-being.

The analysis of revisionism presented by Kelley clarifies and puts in perspective the contributions of the Bellagio papers. Specifically, the key findings of the Bellagio papers are all amassed using revisionist methodologies by economists who examine demographic impacts over long time periods, who account for some feedbacks of demography within societies, and who find, contrary to some previous revisionist studies, a negative net impact on measures of economic growth and poverty reduction.

Finally, it is worth noting one additional element of the revisionist approach, namely that over the long run the different components of demographic change can have offsetting, and thus moderating effects. Change in the rate of population growth is the result of change in one or both of fertility and mortality decline, and in some settings of migration, and the aggregate change in population growth brings over time changes in the size of population, in density, and in age composition. Moreover, because demographic change occurs slowly (at least compared to economic and political change), the separate effects of these different components of

[5] Boserup (1965).

demographic change matter immensely for understanding the overall effects of population on the economy. One of the long-run changes that follows from change in fertility and mortality in a population is the gradual, gradually shifting, and computationally complicated (while essentially straightforward) working through to changes in the age composition of that population. The latter half of the twentieth century has witnessed changes in age composition of populations on a dramatic scale, in both developing and developed countries. Though the changes have come slowly in terms of the short scholarly life of individual researchers, they have been stunningly rapid in historical terms, and highly differentiated across countries—making it possible to assess the impact of those changes over time and across countries. The studies in this book reflect the new prominence of age composition as a factor in economists' latest models of long-run economic growth, after many years of relative neglect.[6]

John Bongaarts's analysis of dependency burdens in the developing world (Ch. 3) is thus a critical starting-point for much of what follows in this volume. Bongaarts emphasizes that declining fertility, now under way to one degree or another in all regions of the world, will result in substantially changed age structures and distribution, with gradually reduced proportions of the population under age 15 and enlarged proportions over age 65. As countries move through the demographic transition of falling mortality followed eventually by falling fertility, they face first a period of increasing child-dependency ratios, then of decreasing child-dependency ratios as a larger proportion of the population moves through the working ages, and eventually of increasing old-age-dependency ratios.

The effect of fertility decline in the second intermediate stage (through which virtually all developing countries have passed and will be passing in the latter twentieth and early twenty-first centuries) is a one-time 'demographic bonus' or 'window of opportunity'—a period of as many as 50 years during which an initially high ratio of the working age to the dependent population gradually declines. After a country has passed through this period, it returns to a more or less stable child-dependency ratio (and a higher aged-dependency ratio), at new lower levels of both fertility and mortality.

Changes in the dependency ratio are driven mostly by fertility decline and less by changes in mortality. This is simply because mortality affects all parts of the age distribution while the fertility effect has a strong immediate impact on the child-dependency ratio, and then gradually works its way through the entire age distribution. In some developing countries, however, where the initial phase of mortality decline has concentrated on infants and youth, the mortality decline has reinforced the impact on age distribution of fertility decline.

So the duration and pace of fertility decline, and the extent to which mortality decline is disproportionately concentrated on infants and children, affect both the

[6] Of course there have been exceptions. Because age composition affects savings rates, economists have tried to assess the impact of age composition change on changes in savings. Early efforts to use cross-country data as a proxy for change in countries (e.g. Leff 1969) were unconvincing.

duration and impact of the so-called window of opportunity. The faster the decline, the larger the potential benefits of a relatively high ratio of working-age to dependent ages, but the shorter the period the window will remain open. The period of the window of opportunity is characterized by (1) more workers producing more total output, *if* they are productively employed; (2) greater accumulation of wealth, *if* savings occur and are productively invested; and (3) a larger supply of human capital, *if* appropriate investments are made in its formation.

Bongaarts traces the shift in dependency ratios that accompanies the demographic transition across the major regions of the developing world, showing that the shift occurred earliest in East Asia, followed shortly thereafter by Latin America, and considerably later by Africa. The Middle East and South Asia are at intermediate points between Latin America and Africa.

POPULATION CHANGE AND THE ECONOMY

Allen Kelley's chapter with Robert Schmidt (Ch. 4) brings together and systematically assesses the results of the major recent studies of the effects of rapid population growth on per capita income growth over the last 35 years. Referring to recent studies using aggregate country data to assess the influence of population growth in the developing world on increases in country-level GDP per capita, Kelley and Schmidt conclude: 'We arrive at the *qualified* judgment: rapid population growth, and its associated demographic components, appears to have exerted a fairly strong, adverse effect on the pace of economic growth over the period 1960–1995' (emphasis added).

Economists for a decade or more have hesitated to make strong statements about the magnitude of effects of population growth on economic development. To quote from the 1986 National Academy of Sciences report: '*On balance*, we reach the *qualitative* conclusion that slower population growth would be beneficial to economic development for *most* developing countries' (emphasis added). In his review of the history of the population debate (Ch. 2), Kelley explains why economists now have more confidence in the clearer results of more recent analyses. These more recent analyses—of the last five years or so—are based on better-specified models (in which demographic variables are now incorporated into the growth models developed by economists in the last decade). Compared to the 1980s, they exploit the longer period of time over which it has been possible to observe the effect of reduced fertility, changing labor force size, and lower youth dependency on economic growth.

These recent analyses, including those in this volume by Jeffrey Williamson (Ch. 5) as well as by Kelley and Schmidt, represent an advance over earlier analyses because they distinguish carefully among the effects of changes in the various components of demographic change and population growth—including fertility, mortality, and the dependency ratio—rather than looking only at population growth in the aggregate, and because they also take into account changes in population size and density. These analyses indicate that among demographic changes of the last three decades, increases in population density and size and increases in the relative size of the working-age population are positively associated with economic growth, while increases in the size of the age group 0 to 15 are negatively associated with growth.

Kelley and Schmidt use their statistical results to examine not only the positive or negative effects of the different components of demographic change, but the quantitative magnitude of these effects, taking into account the size of the actual demographic changes over the 35-year period 1960–95. Over that period, demographic trends have been strongly favorable to economic growth for the average country. Declining fertility and mortality, and to a much smaller extent, larger populations and higher densities, have all spurred economic growth. The only trend that has apparently slowed growth for the average country is a decline in the growth rate of the working age population. Of course many of the poorest developing countries that are still in a relatively early stage of fertility decline can look forward to increases in the size of the working-age population for many years to come.

Why should a relatively larger working-age population contribute to positive economic growth? Economists have long theorized that savings contribute to higher levels of per capita income (by financing higher investment and thus higher output per person), and more recently that higher savings and investment may contribute to sustained rates of income growth as well. In their chapter (Ch. 6) Ronald Lee, Andrew Mason, and Tim Miller, using household survey data from Taiwan on earnings, estimated savings, and fertility and mortality, simulate increases in savings rates and in accumulated wealth on the basis of a life-cycle model of savings behavior. The life-cycle model is driven by the kinds of changes in the youth-dependency ratio and the rapid increases in working-age population that Taiwan and other East Asian countries have experienced in the postwar period due to their rapid fertility declines. (It also assumes that individuals cannot rely on the kind of 'transfer wealth' that pay-as-you-go systems of retirement represent, but must save themselves to finance their own retirement.)

The simulation model generates substantial increases in savings rates and in wealth during the period of demographic transition as the working-age population increases (under the assumptions of a constant rate of interest or return to capital, and a constant productivity rate). The simulation also generates much higher savings rates and wealth–income ratios at the end compared to the beginning of the long demographic transition, implying higher sustained rates of economic growth at lower levels of fertility and mortality. The results of the simulation track reasonably well actual data on increasing savings rates in Taiwan. This result is consistent with the conclusion of Williamson in this volume and of others who, though differing on the magnitude of the demographic effect, see changes in age structure in East Asia in the least three decades as an important contributor to that region's large upward swings in savings and investment over the same period. The resulting high savings and investment levels were one of many factors that set the stage for that region's long and sustained period of historically unprecedented economic growth. Williamson concludes from cross-country statistical analysis that demographic changes, especially the increase in the working-age population and the increase in savings induced by changes in dependency, can be associated with as much as one-third of the total average annual per capita growth rate of about 6 percent in East Asia in that period.

Four issues need to be considered when assessing the relationship between demographic change and economic performance.

First, the effect is conditioned by the level of development. Kelley and Schmidt's analysis of evidence based on data for the 1980s suggests that the lower the initial level of per capita income, the greater the net positive impact of demographic changes, especially of fertility decline.

Secondly, the positive effect of the demographic changes associated with the demographic transition probably depends strongly on the economic policy which accompanies the transition. The East Asian countries were able to exploit the opportunity presented by the 'demographic bonus' because of a combination of policies including fiscal discipline, relatively open and competitive markets, and substantial public investments in basic education that ensured healthy returns to physical and human capital and to participation in the labor force. In contrast, rapid demographic change in Latin America, including rapid fertility decline in the last two decades, has not been so clearly associated with improved economic performance. Participants agreed that fertility decline and other demographic changes may encourage economic growth but are far from sufficient to guarantee growth. A sound policy regime is essential.

Thirdly, though fertility decline is the primary impetus to the change in age composition that generates the demographic bonus, the statistical results point to mortality decline as an important factor in raising economic growth rates, despite the obvious initial and partial result of higher population growth.[7] Mortality decline has long been assumed by demographers to catalyze, with a lag, a subsequent fertility decline—this is at the heart of the theory of the demographic transition. In addition, the economic models suggest that mortality decline more directly improves growth prospects—possibly by increasing the private incentives to invest in human capital, or because it is associated with morbidity declines that raise productivity.

Fourthly, it is clear from many other studies that the key components of the change in age composition highlighted above, mortality and fertility decline, are not only a possible cause of more rapid economic growth (through their effects during the transition of reducing dependency ratios) but are *outcomes* of factors associated with economic growth, including increased education, better functioning markets, and so forth. If this reverse causality is not taken into account, statistical estimates of the effect of lower or declining mortality and fertility on growth may be overstated. Recent analyses do a much better job of correcting for this possible reverse causality, but cannot fully eliminate it. (It is in part for this reason that Kelley and Schmidt refer to their judgment quoted above, regarding the effects of rapid population growth, as 'qualified'.)

[7] Debate continues about whether mortality decline in developing countries has been in part exogenous to economic growth, that is, triggered by factors such as better health technologies that were independent of growth itself, or not. This is a separate issue from the question of the effect of mortality decline on growth.

At the same time, the likelihood of reverse causality out there in the world raises another issue. Reverse causality (to repeat, meaning that fertility and mortality decline may be outcomes as well as or instead of causes of economic growth) creates a methodological problem. On the one hand, its likely presence has led careful scholars to avoid making strong statements about the size of any effect of fertility or mortality change or any other demographic change on economic growth. At the same time, reverse causality if present implies that even an initially small impact of fertility decline in raising growth prospects (by reducing youth dependency for example) could, over time, induce a mutually reinforcing process with larger cumulative effects, as the resulting economic growth contributes to further fertility decline, leading to more economic growth and so on. So while reverse causality, unaccounted for, implies that the long-run effect of an initial fertility decline and the resulting initial boost to growth is *overstated*, two-way causality with feedback implies that the effect is *understated*. (Similarly reverse causality implies that an initially small impact of mortality decline in raising youth dependency could generate a downward spiral of reduced growth, unless followed by reduced fertility, with offsetting effects in lowering youth dependency. In many developing countries, in fact, the sequence of declining mortality which once the larger cohorts reach about age 15 years actually improves dependency ratios, followed by declining fertility, has in fact meant both demographic effects have combined to produce the demographic bonus described above.

Of course these dynamics also make any specific prediction of future high or low economic growth due to demographic triggers foolhardy—because magnitudes are so sensitive to initial estimates and to the effects of elusive and multiple interactions with many non-demographic factors. Having said that, modeling of dynamic, two-way relationships has been largely absent in the economic demography literature. In Chapter 7 of this volume, David Bloom and David Canning set out the theoretical basis for these dynamics. They argue that not only do higher income (and education and other positive correlates of income) lead to lower mortality and fertility, a reasonably well-documented finding, but that lower mortality and fertility can contribute to rising income. Lower mortality and longer life expectancy for example create an environment for higher household investment, including in education, and obviously allow longer periods of productive work per person.[8] Using long time series of demographic and economic data for a large sample of countries, they explore empirically the possibility of two-way causality between economic growth on the one hand, and mortality as well as fertility decline on the other, given a consistently positive link at the country level between declines in mortality and fertility and changes in average country per capita income. Bloom and Canning illustrate the possibility of a reinforcing or 'accelerator' effect of two-way causality. However, they are not able to establish definitively the underlying causal mechanisms nor the quantitative magnitude of two-way causality; it is for the next round of research to hone in better on its quantitative relevance.

[8] Of course, there are also offsetting forces such as age-distribution changes, highlighted in their work, where averted infant/child deaths can attenuate or even offset, at least for 15 years, the positive impacts of extending life expectancy.

Another point: even the latest and most technically careful aggregate macro models do not take explicitly into account the potential powerful impact of female labor force participation on economic growth, and the link between declining fertility and increased female labor force participation. Declining fertility and rising female labor force participation may both be the outcome of increases in the opportunity cost of women's time in child-rearing, in turn due to rising levels of education and/or to increasing demand for labor in the formal sector. Rising female labor force participation means that the growth in total work participation increases even faster than the growth in the size of working-age population. The 'demographic bonus' thus may be realized not only through shifts in the age structure but through increases in the participation of women in the formal labor force that fertility decline encourages or at least permits.

Of course the effect of such increases on income growth is overstated to the extent that national accounts include monetary income earned by women but not the real income represented by women's work at home. This raises still another issue that needs to be considered in assessing the effects of population change on economic growth. As with the effects of increased participation in the labor force of women, measured increases in economic growth per capita exaggerate real income gains to the extent that they reflect unsustainable degradation of natural resource wealth, or fail to reflect such 'costs' associated with income growth as pollution which are not subtracted from measured gains in current systems of national accounts.[9]

With all these points in mind, and notwithstanding very important conditioning or mediating factors, there is today stronger evidence than ever before that first, reductions in the dependency ratio due to declining fertility during the demographic transition can, if policy circumstances are favorable, have a strong positive effect on economic growth; and, secondly, that lower fertility (as well as lower mortality), along with the small positive effects of greater density and a larger population resulting from earlier higher population growth, can also lead to higher economic growth rates.[10]

This conclusion, measured as it is, represents a significant departure from the typically more agnostic position of economists on this relationship over the last two decades.

FERTILITY, POVERTY, AND THE FAMILY

Malthus noted at the level of entire societies that high fertility would likely worsen income distribution and increase poverty by increasing the price of food and reducing the price of labor—economic effects in large interacting markets that need to be examined at the macroeconomic level. Along with these effects at the macro level,

[9] National accounts may also fail to measure adequately changes in knowledge, improvements in the quality of life due to new products, and so forth that work in the opposite direction.

[10] Higher-aged dependency, once the transition is complete, could eventually reduce and even offset the positive effect on economic growth during the transition. It is too soon to judge whether higher-aged dependency in Japan, Europe, and eventually in China, will reduce their rates of growth.

there may also be effects at the micro level—of lower fertility within families on the family's own economic and social welfare.

Macro Effects The literature on income growth and demographic change discussed above indicates that across countries and over many decades declines in fertility and mortality have contributed to income growth. Have these declines also helped reduce poverty and improve the distribution of income? Surprisingly little empirical work has been done on the effects of country-level fertility decline, now a fact for so many developing countries, on changes in country measures of poverty. What has been done is, less surprisingly, generally inconclusive,[11] given the lack of comparable data on country poverty until recently and the inability to test directly such key connections between aggregate demographic change and poverty as the effects of lower fertility on labor demand and wages.

These deficiencies are in part addressed in the chapter by Robert Eastwood and Michael Lipton (Ch. 9). Based on analysis of economic and demographic data for 45 developing countries, they estimate that high fertility increases absolute levels of poverty both by retarding economic growth (thus slowing growth-induced poverty reduction) and by skewing the distribution of consumption against the poor. They estimate that had the average country in this group of 45 countries reduced its birth rate by 5 per 1,000 throughout the 1980s (as in fact many countries did) the average country poverty incidence of 18.9 percent in the mid-1980s would have been reduced to 12.6 percent between 1990 and 1995.[12] The statistical work suggests that about half the estimated decline in poverty over the period in the countries studied can be attributed to increases in economic growth and half to changes in the distribution of consumption that helped the poor.

Eastwood and Lipton also show that the poorer the country and the higher its initial level of fertility, the greater the effect of declining fertility on a decline in absolute poverty. Moreover, the beneficial effects increase as the demographic transition proceeds. The effects of the transition on reductions in poverty are, as with the effects on economic growth, different at different stages of the transition—harmful to poverty reduction in the early stages as population growth accelerates due primarily to mortality decline that occurs disproportionately among infants and children, and helpful in the later stages as fertility declines and aggregate population growth slows.

It follows that during the early stages of the demographic transition, income differentials between poor and non-poor households may in fact become greater. But as the transition extends to all groups in the society, so that fertility as well as mortality begins to decline, and the fertility decline spreads to poor households, the poverty-reducing

[11] For a useful survey of work or population and poverty, see Ahlburg (1996). He concludes that there is little direct evidence using economy-wide data to tie population growth to poverty incidence; he goes on to review evidence of indirect links, e.g. through effects on education, and evidence at the family level.

[12] The authors' definition of the poor for this estimate is persons in households where consumption per adult is below that estimated as the minimum needed for adequate food-energy. This definition is a stricter one than the now-conventional definition used for example by the World Bank, of those households where income per person per day is $1 or less.

and inequality-reducing effects increase. As the dependency ratio within families declines and the cost of childbearing declines, more income is available for consumption and savings, particularly where women enter the labor force and contribute to increased family incomes.[13] The analysis (Ch. 11) of Ricardo Paes de Barros and colleagues for Brazil, a country already in the later stages of the transition to lower fertility, illustrates this point. Paes de Barros *et al.* use a series of household surveys in Brazil to study long-term changes in household size and age structure (resulting from various demographic changes, especially fertility decline) and their effects on the incidence of poverty. They estimate that with the age structure of households 70 years ago but today's average income by age of household members, 37 percent of people would be classified as poor, compared to today's actual 25 percent. Put another way, they estimate that the poverty level of the cohort born in 1970 is 12 percentage points lower than it would have been had it experienced the fertility level of the cohort born in 1900. The decline in poverty associated with what has been a dramatic reduction in fertility and thus in household size in Brazil is equivalent to what would have been produced by a 0.7 percent greater annual increase in per capita GDP.

In summary, recent evidence, which exploits improved data on poverty changes at the country level, as well as the fact that a larger number of countries are experiencing some fertility decline, indicates that reductions in fertility may well be contributing to a decline in poverty rates and intensity. Whether this result is robust and whether the impacts are large depend critically on other factors, for example how changes in wage rates affect labor force and fertility decisions of the poor, that need to be studied at the country and at the family level. This brings us to the next topic.

Effects of Large Family Size on Family Welfare There is little debate that poverty and large family size go hand in hand. Eastwood and Lipton's study and Thomas Merrick's (Ch. 8) refer to dozens of empirical analyses confirming that in today's developing countries larger households have higher poverty incidence. Moreover, among poor households, those that have more children invest less in children's education and health, and systematically see worse health outcomes associated with pregnancy for mothers.[14]

But scientists have long cautioned that the associations observed do not in themselves indicate causality. High fertility in poor families may reflect parents' sensible

[13] Lipton points out that this distribution effect of declining fertility can itself be due to two factors. First, there may be a dependency effect—if a reduction in country-level fertility is associated with a greater reduction in the dependency ratio of poor households than of rich households (usually in the later stages of a country's fertility decline—as in the Brazil case above). Secondly, there may be an 'acquisition' effect whereby a decline in fertility improves the ability or willingness of poor households to raise their consumption levels (per non-dependent) for example by raising their labor supply or by raising their savings rate (if their own household size declines with lower fertility) or at the level of markets by reducing the demand for land and increasing the scarcity of labor—both Malthusian-style benefits for the relatively poor whether their own fertility declines or not.

[14] The size of the impact on education enrollment and attainment is typically small, but does not take into account the likely reality that poor families, particularly in rural areas, probably have access to lower quality schooling.

decisions to trade off current consumption for greater future family income when children begin work, or for greater old age security, or it may simply reflect parents' decisions to enjoy children rather than other forms of consumption. The fact that large families tend to have lower incomes should not be construed as meaning that they either are, or that they regard themselves as being, objectively 'worse off'. Indeed, Ricardo Hausmann and Miguel Székely (Ch. 10) emphasize that the fertility decision is embedded in a set of decisions at the family level which are influenced by many aspects of the economic environment, and which make sense given that environment.

On the other hand, studies over the last decade raise several countervailing arguments, increasingly shifting the burden of proof from those who argue that high fertility is chosen (implicitly if not explicitly) by poor couples and should be assumed to reflect optimal levels of welfare for the family, to those who argue that at least some fertility among the poor may not be optimal to family welfare. Many of the arguments are summarized in the chapter by Merrick. They include:[15]

- Severely (indeed often tragically) limited choices of very poor parents. The very poor (the approximately 1 billion households—20 percent of the population of developing countries—that subsist on $1 per day per person or less) have severely constrained choices. For the very poor, the alternative of fewer but 'higher quality' children who might have better prospects does not really exist. The risks—that a child will fail in school, suffer poor health, or even die—are too great, and the rewards too few in an uncertain future. The resources to finance good health and schooling, even to finance a healthy diet, do not exist. In the face of poor capital and other markets, poor households cannot borrow against the future earnings of better-educated children, and ironically therefore cannot afford to choose few children, even recognizing that their fewer children might face a better future.
- A lack of critical information available to the poor. Given the poor state of markets for information, poor households are likely to lack information on the changing probability of infant mortality, on increasing returns to schooling, on improving financial markets as a mechanism for old-age security—that is, on a variety of changing conditions that would lead them to choose fewer children. Such information is in a real sense more costly to acquire for the less educated, and very poor parents are usually without much education. (And of course, whatever information is available, from government officials, for example, on improvement in mortality rates or in the trustworthiness of banks, might reflect an average state of affairs which the poor might reasonably discount as applying to them.)
- The fact that men may dominate in the choice of number of children, while not fully sharing the costs—a kind of intra-familial externality that is assumed away in traditional unitary household utility functions.[16] Cultural and institutional factors

[15] The following discussion also reflects the authors' own analyses, including Birdsall and Griffin (1993), Chomitz and Birdsall (1991), and Birdsall (1994). The possibility that men and women have different interests in fertility decisions was raised frequently in the deliberations at the Bellagio Symposium.

[16] Models with individual utility functions and bargaining among household members would better reflect the underlying mechanisms leading to the intra-household allocation of resources.

may lead to differing interests among household members and unequal capacity to participate in household decisions, particularly for women. The reality in many low-income settings may be one of gender imbalances in decision-making regarding whom and when to marry, who in the household gets access to health care and education, when and what kind of contraception to use, and the power to negotiate safe sex when the risk of sexually transmitted diseases and HIV/AIDS infection is high.[17]

- The evidence of higher prevalence of unwanted pregnancies among the poor,[18] combined with evidence that when births are not planned, investments in children, for example in their education, are systematically lower.[19]
- The evidence that in the last decade, fertility has fallen (and contraceptive use risen) even among very poor, uneducated women in Bangladesh and Kenya, who had good access to health and family planning information and services.[20]

In short, on the one hand it is altogether likely that household poverty is a cause as much or more than a consequence of high fertility (or that poverty and high fertility do not cause each other but are both caused by other factors such as poor education). On the other hand, as was the case with aggregate demographic change and aggregate economic growth, it is also likely that there is two-way causation, with poverty and high fertility unfortunately reinforcing each other in a vicious circle. In fact, both theory and improved and expanded empirical efforts support the likelihood that high fertility of poor parents is contributing to their and their children's poverty. In Chapter 14 below Birdsall sets out the implications for policy of this new evidence linking demographic change to poverty decline.

POPULATION, AGRICULTURE, AND NATURAL RESOURCE USE

Of all the possible effects of population size and demographic change on natural resource use, effects on land use in agriculture are probably the most relevant for the developing world. It is in use of land for agriculture that a syndrome of high population growth interacting with poverty to generate pressures for natural resource degradation is most likely.[21]

[17] There is evidence that in some cultures women have little autonomy in sexual and reproductive decision making. See e.g. Mane *et al.* (1994).

[18] See e.g. Bongaarts (1990). The evidence of unwanted pregnancies is ample—based not only on more than two decades of surveys but even more convincingly on the continuing high incidence of abortion, including among the poor, even where abortion is illegal and dangerous. For a skeptical view on measuring unmet needs, see Behrman and Knowles (1998).

[19] The latter evidence is from studies of outcomes for twins (where the extra birth is presumably unanticipated) and of outcomes for children of parents with high biological propensity to conceive. See e.g. Rosenzweig and Wolpin (1980); Rosenzweig and Schultz (1987).

[20] Cleland *et al.* (1994) for Bangladesh; Cross *et al.* (1991) and National Research Council (1993), for Kenya.

[21] An emphasis on land use, particularly farming systems and forest use, was implicitly supported by the 1986 National Academy of Sciences report, which concluded that any problem of population is

In his chapter on this issue John Pender (Ch. 12) reviews the growing empirical literature and provides an example from Honduras of the kind of new study needed. He concludes that though rapid population increase may encourage technological innovation that leads to increased output, such population increase can also have a negative impact, especially in the absence of an adequate policy and institutional environment—that is, an environment that creates incentives for individuals and societies to manage natural resources in a sustainable manner. On the one hand, the potential negative effect of population growth has been and can be mediated by policy and practices. This is particularly the case with respect to output and land productivity.[22] On the other hand, as Pender puts it, *without* collective action, population density can make things worse in terms of agricultural output, land productivity, and most important in terms of human welfare. (Pender also notes that even where population increases catalyze increases in production and land productivity,[23] the outcome in terms of labor productivity and thus consumption and income per person may not be in net terms positive.)

Collective action includes in this instance the capacity of societies to develop the necessary policies, for example protection of property rights and appropriate pricing of water, and the necessary institutions, including rules for sustainable use of common property resources. There remains the question of whether collective action is itself catalyzed or undermined by rapid increases in population in local settings—a question which also seems to depend on many other factors. And as Pender notes, if population increase does raise the likelihood of collective action, it does so necessarily at some cost, administrative and organizational as well as financial, if extant welfare levels are to be sustained. The costs will be particularly high in settings where land is sparsely populated in area terms, so that a society cannot take advantage of the positive effect of a denser population on say the cost of infrastructure, and at the same time densely populated in terms of effective productive land, so that there are negative effects on output per worker as population increases. This combination of a sparse population over space with a dense population per effective agricultural unit prevails in many parts of Africa.[24]

In the end, though the theory and the concepts are clear, in the absence of a richer body of empirical work, in many different settings and over substantial time periods, a simple and general conclusion about the effect of population on natural resource use and sustainability remains elusive. This is unfortunate. Estimates of the costs of environmental damage in developing countries often reach several percentage points

more likely to be associated with unsustainable use of renewable resources such as land, rather than with non-renewable mineral resources.

[22] Pender emphasizes the lack of any convincing evidence that even with favorable (Boserupian) technological change, labor productivity and thus income per worker has also been sustained or increased.

[23] This is the effect that Boserup (1965) outlined.

[24] A possible net negative effect of density in some settings is not inconsistent with the Kelley and Schmidt (Ch. 4) finding that, over many countries and several decades, size and density of population have positive but rather small effects on economic growth.

of GDP, thus qualifying the record of economic growth in developing countries.[25] To the extent that population does play a role in environmental damage, it represents another kind of demographic bonus from reductions in its growth rate, and a further externality far from the calculus (implicit or explicit) affecting individual couples' fertility behavior.

Moreover, there is evidence of a close link between *poverty* and environmental damage; to the extent population growth adds to the difficulty of reducing poverty, it is implicated, if only indirectly, as a factor in environmental degradation.[26] Quite aside from population change, the poor are often driven by lack of options to unsustainable exploitation of natural resources, and in turn, households and entire communities are less able to escape poverty where environmental damage has reduced their access to natural resources. Worse, the vicious cycle may start and is often sustained not because the poor damage the environment, but because their poverty impedes their political ability to resist unsustainable exploitation by others of resources on which they depend.

Still, a simple conclusion about the effects of population change on natural resource use, and the role of poverty interacting with population change, is not warranted. The problem is that the necessary empirical work is unusually challenging. To tease out any effect in a particular setting requires observations over a long time period, if only because changes in population size proceed slowly (at least compared to changes due to natural disasters, price changes, and so on). Over a long time period, of course, the possibility of confounding compensatory or reinforcing adjustments increases, disguising any population effect or confusing its apparent magnitude. For example outmigration may serve as a safety valve out of agriculture if natural resource problems constrain production, or in-migration may occur where resources are managed well. Similarly government investments and interventions may be reinforcing or compensating—an apparent result in Pender's Honduran setting. In this area, there seems to remain no alternative to more detailed and probably more country-specific studies over longer periods of the type the Pender chapter represents. Meanwhile, the one point that is clear is the following: the effects of markets and institutions—sometimes good, sometimes bad—can easily swamp the effect of population change on resource use, degradation, and depletion. The implications for policy thus go far beyond the traditional 'population' arena.

CONSEQUENCES OF RAPID POPULATION GROWTH: A NEW BOTTOM LINE

While over the last several decades major scholarly assessments have generally concluded that rapid population growth has an adverse impact on economic growth in the

[25] In addition, high population growth in developing countries for given greenhouse gas emissions per person implies a negative global externality, if emissions contribute to global warming. Of course, any increases will be small relative to accumulated emissions of the rich countries. Birdsall (1993) notes that there are multiple routes for reducing the potential contribution of population growth to global warming.

[26] World Bank (1992).

Third World, especially in the poorest countries where markets are relatively underdeveloped and government policies too often ill advised, previous studies have for the most part been cautious about providing a *quantitative* assessment. The Bellagio Symposium breaks from this tradition. The Symposium studies expose more clearly than before some of the linkages between components of demographic change and economic growth, and indicate that the size of the impact of rapid population growth may be larger than that attributed to it in the past. The Bellagio results also bring more closely into focus the impact of demographic change on poverty reduction, and underscore the potential (but as yet by no means fully revealed) impacts, both positive and negative, of rapid demographic change in the rural environment.

ECONOMICS AND DEMOGRAPHY: POLICY IMPLICATIONS

We noted at the beginning of this chapter that debate about the effects of population growth on economic growth in poor countries has been particularly contentious. The reason is straightforward: if the effects of the extraordinarily rapid population growth of the last half-century in developing countries have been to constrain their growth and hamper their development, then it is easy (indeed, as we discuss below, too easy) to conclude that government policies to induce people to have fewer children, in the interests of society, make perfect sense. A conclusion that population growth has been harmful seems to invite government to intervene to affect fertility, a sensitive and highly personal arena of family behavior. (The alternative mechanism of slowing population growth via higher mortality is not on the table because it is so obviously not in the interests of individuals or society. Moreover, as the studies in this volume indicate, lowering infant and child mortality is not only an objective in itself and a means to lower fertility as parents seek a desired family size, but also with some lag, a factor in increasing the proportion of the working-age population, with the potential benefits to the economy and on poverty reduction discussed above.)

Along these lines, economists have long emphasized that a finding at the macro level that high fertility impedes economic growth does not necessarily justify public intervention to alter individual micro-level behavior, unless it can be shown that individual childbearing preferences are consistent with lower fertility in the aggregate. In the same spirit, Bellagio participants noted that economic growth is not an end in itself but a means to the larger objective of improved well-being.[27] Thus, it is likely to be counterproductive to push for lower fertility against the wishes of families even if there is a benefit in terms of growth. Economists thus find absolutely no justification for policies that *coerce* people toward specific fertility outcomes.

More formally, as emphasized by Behrman in Chapter 13 of this volume, the central justification for a policy intervention is the *difference* between the private and the social costs (net of benefits; or benefits net of costs) of high (or low) fertility. Any

[27] Sen (1999) is most eloquent on the point that an objective of development as well as a means to development, is individual freedom.

difference between private and social costs in whatever realm is usually the outcome of some market failure—for example in the case of pollution, where the polluter passes on costs to others. High fertility may or may not represent a gap between the private and social costs of having children: parents may not only be choosing children over other consumption and investment options; they may also be fully absorbing the costs of those children. If parents absorb fully the cost of children, the resulting reduction in their household per capita income (and thus in aggregate per capita income) does not necessarily justify public intervention. Where parents either cannot or will not absorb the full cost of their children, or where they are bearing children in excess of their desired fertility goals, there may be justification for non-coercive policies that encourage—or make it easier for parents to attain the goal of—smaller families. In any case, the new and more convincing evidence that high fertility constrains growth does not *in itself* provide a rationale for public interventions to reduce fertility.

Behrman's chapter thus provides a link between the conclusions from the earlier chapters regarding the consequences of population change, and the issue of whether and how to intervene in order to improve people's lives. Indeed, all of the 'macro' as well as 'micro' chapters are rooted in 'micro' models of human behavior: in Lee *et al.* about savings decisions at different ages; in Eastwood and Lipton about effects on consumption and work of changes in family size; in Pender about farmers' behavior, and so on. Policy interventions need to be justified and shaped by an understanding of those 'micro' choices people make, and of how public policies and programs affect those choices. As Birdsall suggests in the concluding Chapter 14, the essays in this volume do point to a conclusion which links concern about population growth and change more directly to concern about the welfare of millions of people in the developing world. In their entirety they put together a newly compelling set of arguments and evidence indicating that high fertility exacerbates poverty or, better put, that high fertility makes poverty reduction more difficult and less likely. Given new evidence about the potential benefits of declining fertility for reducing poverty and about the effects of declining mortality and fertility on growth, itself a critical factor in reducing poverty, she argues that a set of policies—ranging broadly from sensible macroeconomic regimes to public financing for certain education, health, and family planning services—are likely to make sense. They make sense because while reducing fertility (and mortality), they also have broad social and economic benefits for relatively low costs, and pose no trade-off in terms of improving individual well-being.

In summary, the chapters in this volume, almost all of which focus on the consequences of demographic change without direct allusion to specific policy implications, strengthen the proposition that the demographic transition and the reductions in rates of population growth throughout most of the developing world in the last few decades have contributed and are contributing to improvement in the lives of that world's poor. Along with some simple application of welfare economics and common sense about the goals of development, they also strengthen the argument for policies that will further improve the lives of the poor in developing countries. Those policies can contribute to development in many ways; we show in this volume that they do so in part by reinforcing the social and economic changes that are speeding the demographic transition.[28]

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[28] This statement remains true even for those developing countries, including China, which will face new challenges associated with the increasing aged-dependency burden, the result in part of past fertility decline. A 'birth dearth' will not in itself justify public interventions any more than a seeming birth glut did in the past.

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