TRAJECTORY: FROM POPULATION GROWTH TO WOMEN'S EMPOWERMENT

T. Paul Schultz

I completed my Ph.D. in economics at MIT in 1965. My thesis topic was the distribution of personal income in the Netherlands, relying on aggregated individual income and wealth tax records for half a century. I learned how income inequality had diminished in the interwar years and stabilized in the aftermath of the Second World War. I chose to look at the Netherlands because individual reports to income tax authorities included a large fraction of the economically active population, and income reporting appeared to be relatively complete. Also, income and wealth on tax returns had been summarized in publications starting in 1914 and 1894, respectively. As a graduate student, I prepared an earlier study for the U.S. Congress on U.S. income distribution data, and I learned that by 1952, U.S. income tax returns accounted for virtually all wages and salaries. But other forms of income reported to tax authorities did not account for as much of entrepreneurial and capital income as estimated in the National Income and Product Accounts; for example, farm and nonfarm self-employment income on tax forms equaled only 72 percent of this income source, rental income 59 percent, and interest merely 36 percent of what was paid to relatively rich bond holders. It was years before the United States required recipients of dividends and interest to identify themselves to facilitate audits of tax returns. Before the Second World War only a tiny fraction of the U.S. population was expected to file income tax returns. In contrast to the early and comprehensive coverage of Dutch income and wealth tax records, U.S. income inequality estimates start tentatively with a single 1937 Consumer Expenditure Survey, followed by a single question on "wages received in 1949" that was tabulated from the 1950 Population Census. Moreover, the nonresponse rates on key questions regarding U.S. personal income in the March Current Population Survey have increased markedly in recent years, especially for lawyers, doctors, politicians, and those engaged in their own business. Representative and accurate data on personal income and wealth appear sketchy in upper-income classes in the United States, and thus public references to our billionaires refer to *Forbes* as authoritative.

T. Paul Schultz, Malcolm K. Brachman Professor Emeritus of Economics, previously taught at the University of Minnesota and joined the faculty at Yale in 1975. Between 1983 and 1996 he served as director of the Economic Growth Center at Yale. He has written and edited books, including a textbook in population economics, and articles on microeconomics of individual and family behavior, primarily in developing countries, on such topics as fertility, marriage, labor supply, health, investments in children, including nutrition, schooling, and migration, with a focus on gender inequalities and the distribution of income among persons and households. Schultz worked at the RAND Corporation from 1965 to 1972, where he founded and directed the Labor and Population Program.

However, times are changing, and personal income inequality has become a hot topic. The noted increase in the U.S. concentration of income in the top 1.0 and 0.1 percent (1/1000) of the population has become a media issue, even though it is labeled "class warfare" in some Washington circles. A young French economist, Thomas Piketty, has recently published in America a 685-page monograph, *Capital in the Twenty-First Century,* which compares his estimates of the distribution of personal income and capital since about 1800, primarily for France and the United States. This thoughtful tome earned a place for twenty-two weeks on the *New York Times* list of top ten hardbound nonfiction books, a rare achievement, particularly for an economist, and I suspect for any scholar. I applaud such "class warfare" if it motivates others to refine the empirical evidence on what appears to be a relatively exceptional American development, though one that cannot be disputed after 1980, even with our highly imperfect data.

I concluded from my thesis research that existing economic theory and econometrics did not enable me to draw interesting conclusions about aggregate income inequality. Nonetheless, income inequality remains an important feature of society, one we should measure with greater accuracy to understand how policies, or lack thereof, contribute to this outcome. I reluctantly decided to redirect my postdoctoral research in another direction, toward understanding microeconomic behaviors of individuals and families, including fertility, migration, and family labor supply in low-income countries, which had not previously attracted much attention from economists. I found ample empirical puzzles to engage my interests for the remainder of my professional life. I also gradually came to the realization that gender inequality in schooling, health, or human capital appeared to be an important factor associated with the demographic transition and with the structure and pace of economic growth.[1]

Because my goal was eventually to enter academia, I knew a record of research was essential to qualify. I also imagined that if I spent full time on research, and postponed teaching, I would have more to show for my efforts. I therefore made an atypical career choice and accepted as my first job a research position at the RAND Corporation in Santa Monica. But to be candid, other factors may have entered my calculations, such as living in a simple shack on the beach in Malibu, gaining a next-door neighbor such as Dan Ellsberg (known for his contribution to game theory and willingness to xerox his copy of the Pentagon Papers to reverse our Vietnam policy), and working with economists such as Dick Nelson, whom I had admired as a summer intern with the Council of Economic Advisers during the early days of the Kennedy administration. For whatever reason, I followed this atypical, risky career trajectory. Though I ultimately taught periodically at UCLA, the flexible nonacademic arrangement at RAND allowed me to travel in low-income countries and obtain my own data and grants from USAID, NIH, and the Rockefeller Foundation that coalesced into a new Population and Development Program I directed. The program continues to evolve at RAND today, with perhaps less attention to development and more to labor economics and focused today on studies of aging, rather than on rapid population growth. A key

feature of the program continues to be collecting pioneering panel surveys in low-income countries, such as Guatemala, Malaysia, Indonesia, Bangladesh, and China. I accepted an appointment at the University of Minnesota after seven years at RAND; and I accepted Yale's offer in 1974, arriving in 1975 to start a workshop of students and postdoctoral fellows interested in economic demographic behavior.

Innovations occurring in economics at this time facilitated my research agenda: empirical labor economics was evolving rapidly, methods of microeconometrics improved for the purposes of my applied research, and the increasing public access to household surveys and census samples allowed me to examine new questions with household data. I suspected that individual and household outcomes of interest to me could be partially explained by economics, which was complicated by the coordinating role of the family in the allocation of time, the division of income between consumption and human capital investments, and related demographic behavior, including fertility. Simultaneous equation estimation methods helped to explain wage opportunities for women and men and their consequences for labor supply and fertility, first in the United States, where individual panel data were first being collected in a Survey of Economic Activity, and then in Puerto Rico, Colombia, Taiwan, and Thailand, where community data provided a basis for identifying how the economic environment and policy interventions impacted individual labor supply, child mortality, and fertility outcomes.

Statistical methods in economics progressed rapidly in the 1950s and 1960s, but were largely oriented toward the study of economic relationships observed with the passage of time, where unexplained deviations in these outcomes were attributed to "shocks" generally due to business cycles. Economic units observed were typically aggregates, such as countries, states, industries, etc. However, it took years for these statistical methods to be adapted to study discrete and continuous choices made by individuals and families. For the microeconomist, the unexplained shocks could be attributed to differences in individual preferences or abilities or luck that were assumed by the economist to be random or driven by unobserved variables from outside of our models. But some of these latent preferences or abilities of individuals were also expected to be persistent for the individual. Human capital in the form of schooling and health was conceptualized as a rational investment process with life-cycle implications. New sources of panel survey data collected repeatedly from the same individuals over their lifetimes became critical for research to refine and test these theories.

More recently, empirical studies have begun to measure external shocks inferred from historical, administrative, or satellite data on droughts, rainfall, temperature, epidemics such as the flu of 1918, or technical innovations such as the introduction of sulpha and penicillin in the 1930s and its effect on maternal and child mortality, the provision of antiretroviral therapy for those living with HIV/AIDS in Africa with consequences for family labor supply, to smaller nutritional fluctuations dated by collective events, such as the effect of Ramadan fasts from dawn until sunset on the physical development of a woman's unborn or very young child. A rapidly evolving field

at the moment is using these unexpected shocks among vulnerable segments of the population to assess how they disrupt or facilitate prenatal development and critical biological and psychological changes in early life, and then express themselves within an affected aging birth cohort. The consequences become visible in the individual's later cognitive and noncognitive achievement tests, schooling attainment, and adult socioeconomic accomplishments, including earnings, income, and health status and mortality in later life.

Development economics has recently taken the path of designing randomized control trials (RCT) as in the medical field to assess how different program treatments impact short-run outcomes, intermediate adaptive behavior, and final policy targets. I had the opportunity to evaluate one of the first large-scale randomized family transfer programs in Mexico, called PROGRESA, that gave cash transfers to poor rural mothers if they kept their children in school and took them periodically for preventive health care. School attendance increased and child health improved (2004). As an antipoverty program, it also increased human capital investments in the next generation, helping them advance their lives. My prior studies of family planning, health, and school programs tried to evaluate the introduction of new programs. By assigning communities randomly to a promising policy treatment or to a control, PROGRESA eliminated the possibility that the administrative process might favor some types of communities (e.g., those that support the governing party), or introduce a bias by focusing on individuals who chose to participate in a program or extract public services, who might behave differently from the average, even without access to the program. Similar cash transfer programs targeted to poor mothers and their children have now been introduced and evaluated in dozens of countries and appear to be a relatively effective and potentially less corruptible means to deliver social services to the poor.

Research continues on how families (and other network institutions such as villages and subcastes) absorb, share, and transmit shocks to the lives of their members arising from, for example, health crises, weather problems, agricultural pests, and shifts in demand for a family's outputs. The goal of this research is to clarify the mechanisms by which economic, social, and demographic behaviors are coordinated at the family level to deal with risk, and then to use this information to formulate tax, transfer, insurance, and welfare program interventions that can modify social outcomes, improve overall welfare, and reduce inequality. Improving our understanding of the determinants of behavior is especially important when the behavior has indirect effects on others outside of the family, and these indirect effects are not taken into account by parents and families.

Population Growth, Individual Welfare, and Consequences for Society

As I started working at RAND in the mid-1960s, there was accumulating evidence that the rate of population growth in many low-income countries had increased to 2 to 3 percent per year after the Second World War, due to a sharp decline in child mortality. To put these population growth rates in perspective, the annual rate of population growth

averaged over a decade had probably fluctuated between -0.2 and + 0.2 percent per year in Europe, from Roman times until about 1700. Thereafter, population growth began to increase, reaching as much as 1 percent per year during and after the industrial revolution. It took no more than the arithmetic skills of a Malthus (1798) to extrapolate these unprecedented rates of contemporary population growth in the low-income world in the 1960s and draw the conclusion that this growing population would soon lack the food and scarce natural resources to sustain even its modest current level of consumption, let alone invest in new skills, equipment, and technology to stimulate sustained economic growth. I served on two National Academy of Sciences panels preparing papers on how to respond to these rapid rates of population growth and sustain the expansion of health and education programs in low-income countries.

In 1968 Paul Ehrlich, a biologist, published *The Population Bomb,* which forecast widespread famines and acknowledged only one avenue for effective policy to deal with the total fertility rates in the world of nearly five children per woman—namely, replace individual "free" choice with a system of direct compulsory reproductive quotas. Only China followed Ehrlich's advice a decade later, and China has been anxiously searching for the past two decades for a politically acceptable way to relax its one-child policy as it became clear that the Chinese labor force would soon be contracting and China's remarkable record of growth would be difficult to sustain.[2]

In Europe and North America it took about a century for the average number of children born per woman to decline from about five or six to two or three. Given the higher income levels in the United States in 1875 than in many low-income countries in 1975, it was understandably expected that high fertility would persist and very rapid population growth in low-income countries would continue into the middle of the twenty-first century.

Other scientists in an earlier era viewed rapid population growth in a somewhat different light. Benjamin Franklin in 1751 interpreted the high fertility in the United States and rapid immigration as evidence, according to Edmund Morgan's biography (2002), that people in America enjoyed higher consumption levels than in their country of origin, England. This favorable interpretation of rapid population growth was shared by Adam Smith in his classic *The Wealth of Nations* (1776). Thus, one can begin to see discordant views of how scientists respond to rapid population growth: is it a sign of unmitigated socioeconomic catastrophe without likely compensating change in behavior, or an indicator that improvements in nutrition, health, and welfare encouraged a generation of parents to have more surviving children than previous generations? In the 1950s many demographers signed up on Malthus's side of this intellectual divide, though in a more measured manner than Paul Ehrlich, perhaps to avoid being associated too closely with the eugenics movement of the 1930s and its unattractive proponents.

Malthus perceived correctly that the timing of marriage responded to wage levels in Europe and thereby influenced lifetime fertility, though he did not believe there

was effective birth control within marriage. England and Sweden both evidenced economic-induced fluctuations in fertility, not only due to the timing of the entry into marriage, but also to the rate of births within marriage, i.e., birth control. In Sweden from 1860 to 1910, the decline in fertility was closely related to the decline in child mortality and urbanization, but was also affected by international prices for Sweden's exports and imports, which contributed by raising women's wages relative to men's in the south, depressing fertility, while in the north, exports of timber became more profitable and raised male wages relatively, and sustained relatively high fertility. International trade and the industrial revolution were thus exerting their effects differentially on the economic opportunities of women and men, and thereby affected the timing of the demographic transition in Northern Europe.

It took a century before Gary Becker expanded the reach of economic thinking to forms of family behavior beyond studies of consumer expenditures and savings, to include marriage, fertility, schooling, and health, and argued that these choices were constrained by the budget of time available to family members or full income. He summarized his views in his 1981 *A Treatise on the Family*. Meanwhile, economists, including myself, were adding to the empirical evidence that the number of children people desired and obtained were not simply a positive response of marriage to wage rates, as Malthus assumed, or due only to the arrival of modern methods of birth control, as philanthropic and development agencies appeared to believe. Conditions had changed in societies motivating parents to want and to have fewer children, and these conditions might need to change in low-income countries for fertility to decline substantially and population growth to subside.

Let me read from the summary of a report I prepared on fertility determinants at RAND on our research progress as of 1974:

> The past search for policy options to cope with rapid population growth mirrors a natural but nonetheless one-sided technocratic view of what is essentially a social problem. It seems far simpler to promote a better birth control technology than to learn why parents want the number of children they do and be prepared to promote the desirable social and economic changes that will modify those reproductive goals.

Several hypotheses were proposed and tested by empirical methods that sought to discriminate between correlations and causal mechanisms that policy makers could be confident would work as described in a simple economic model.

(1) As parents learned that their children might benefit from more nutrition, health care, and schooling, their priorities shifted toward having fewer children and providing each of their children with more human capital, measured typically by years of schooling and indicators of health and nutrition, such as child mortality and body mass index, or weight divided by height squared. Economists have called this hypothesis "substituting child quality for child quantity."

(2) A second hypothesis is that children are viewed by parents as a substitute for the accumulation of physical wealth that they acquire as insurance over their life cycle.[3] However, this intuitive conjecture has proven difficult to test rigorously, because fertility, savings, and family transfers all seemed to be choices the family might weigh at the same time, and they could all be affected by endowments, opportunities, and technology, only some of which could be observed. Correlations among such choices made by parents were thus not necessarily causal effects, because other unobserved factors could reasonably influence both, such as tastes. Causation in the reverse direction could also not be excluded. Jaqueline Oliveira in her recent Yale thesis (2013) reported that elderly mothers in China and Indonesia who had a twin on first birth enjoyed higher consumption and worked less in their old age than mothers with a singleton first birth, other things being held constant. Her analysis also confirmed that having the extra unplanned child as a twin did diminish the schooling the mother provided on average to her children, consistent with the quantity-quality substitution hypothesis. However, I do not need to report that in some high-income societies these intergenerational wealth flows often occur in the opposite direction, from elderly parents to mature children.

(3) An additional observation of Becker (1965) was that children have become a relatively time-intensive consumption/production activity. As wages of parents increased, the relative cost of producing a child also increased, and Becker expected this negative "price effect" to offset the positive "income effect" of wages on parents' demand for children that Malthus had built into his view of the world.

(4) Jacob Mincer (1963) went a step further and explicitly linked the rising wages of women to both the increasing participation of married women in the wage labor force and their decreasing lifetime fertility. I have shown in comparisons across countries that female education and wages are associated with lower fertility and, more surprising, male education and wages are often associated with higher fertility, other things being equal.

(5) The next step was to understand what forces outside the control of the family were responsible for the increase in women's wage opportunities, and how they might respond to variation in policies, natural resources, and technology. For example, Indian women allocate more of their time to the paid labor force where local crops relied more heavily on female agricultural workers, and women in these areas had lower fertility, and the ratio of female to male surviving offspring tended to be higher. Conversely, where deep plowing of the soil was the most productive form of agricultural cultivation, male weight and stamina give males an advantage compared to females that is reflected in higher fertility (Boserup, 1970). Conditions external to the family that raise the relative productivity of female labor in activities that are not readily combined with child care may be responsible for lower fertility.

(6) Parents are hypothesized to compensate in their fertility for their actual and expected child mortality, perhaps to insure that they have at least a certain minimum number of surviving children (or boys). The correlation is clear, but the causal interpretation is more nuanced than I believed in my first study of Puerto Rico. For example, a woman's schooling was also a better predictor of her lower child mortality than household income or access to health care; one more year of a mother's schooling was widely associated with a 5 to 10 percent reduction in her child mortality rate in both low- and high-income settings.

Many labor market studies from 1970 onward have found that the years of schooling of women are positively associated with their wage rates, just as schooling of men accounts for men's increased wages. Proportionate increases in wage rates associated with the worker's years of schooling can be viewed as an approximation for the rate of return to the student's time invested in schooling. These wage returns to schooling are often estimated to be slightly larger for women who work for wages than for men, at the same level of schooling. This empirical regularity in wages implies that although women are generally paid substantially less than men with the same schooling, as women and men obtain more schooling, women's wages increase at a faster rate than do those of men, and consequently the relative gender gap in wages falls. In the United States after about 1980, women began to attend school longer than men, perhaps because of their higher wage returns to schooling than men. This pattern of women overtaking men in terms of years of schooling is now evident in numerous high-income countries and is surfacing as well in a number of countries in Latin America and East Asia, where fertility has fallen the most. Though the relative gender gap in schooling is closing in virtually all countries, the absolute advantage in number of years of schooling of males compared to females remains substantial in many sub-Saharan African and South and West Asian countries, which tend to be countries where child mortality and fertility remain among the highest in the world. These are the countries where I have recently focused my research — Bangladesh and West Africa, for example. These empirical regularities in women's schooling, wages, and labor force participation suggest to me that women's schooling plays a decisive role in women's productive contribution to society, and ultimately in their empowerment relative to men, which is then associated with their fertility decline.

I would like to try and avoid the controversy interjected by Lawrence Summers at a conference on women at Harvard, when he suggested that women and men might bring different capabilities to different intellectual pursuits. However, empirical research is discovering more about the production of physical, cognitive, and noncognitive skills of women and men, possibly channeled by the norms and institutions of society into gender-specific occupations and careers. Anthropologists and sociologists have richly described these distinctions in numerous cultural contexts. Ester Boserup in her book *Women's Role in Economic Development* (1970) summarized how women have been occupied at different tasks in a wide variety of low-income

societies. Her pioneering book suggested that physical strength and dexterity for some agricultural production tasks might affect the time allocation by gender of adults, and if the climate and soil conditions prevalent in an agricultural area made these tasks more or less profitable, the wages of females relative to males might be affected. Although most societies encourage gender segregation in the workplace, women specialize in different occupations in different parts of the world. This suggested to me that gender specialization may stem from local social institutions and religions as well as the economic environment, and may not be dictated by innate productive capacities of men and women.[4]

Outside of agriculture there are also indications of gender segregation of workers into different industrial activities, due perhaps in part to complex aspects of comparative advantage. Where natural resources lead to a greater reliance on employment in mining, for example, women's employment opportunities are diminished relative to men's, and mining regions tend to report fewer women working in paid employment, lower wages for women, and higher levels of fertility. This empirical regularity is confirmed historically across regions in America or Europe, or today in low-income countries. On the other hand, where a larger segment of the population engages in the provision of services, women tend to hold a greater share of these paid service jobs, and women are more likely to participate in the paid labor force in these regions.

Indirect Consequences of Population Growth

People are thought to be the best judges of their own welfare, including reproductive goals, but rapid population growth may impose some burdens or benefits in society beyond those taken into account by parents. How can tax, transfer, social welfare policies, or subsidies equitably influence reproduction and improve social outcomes? First, there is a strong justification for providing women, who bear the lion's share of the risks and burdens of childbirth and child care, with safe and reliable means to control their reproduction. Nonetheless, policy makers need to have evidence that providing access to such birth control allows women voluntarily to have fewer births and to attain a higher level of welfare, and that the women's children also benefit.

But beyond these benefits from access to birth control within a woman's own family, there may also be indirect effects from avoiding unwanted births to the community and country. These "spillovers" may be represented as Malthusian population pressures downward on wages due to the increasing supply of labor to work with a relatively fixed supply of land or other productive factors. Health externalities may also be important where infectious and parasitic diseases can be spread more readily if neighbors have more unwanted children, other things being equal. Schooling resources may not keep up with the rapid growth in school-age youth, leading to a decline in the quality of schooling. These spillovers both within the family and in the wider community are not easily measured and causally linked to an effective family-planning program intervention. Family-planning education and subsidized supplies have undoubtedly contributed to declines in fertility in many places, but shifts in

program supply of birth control methods do not necessarily reduce the number of unwanted births enough to justify the cost and other social welfare programs foregone to fund family planning. In some environments, public funds could have greater value to women and their community if allocated to the extension of birth control rather than local health clinics, health personnel, and specific technical health inputs, such as antimalarial bed nets, Artemisinin combination therapy for malaria, or maternal and child vaccinations, micronutrients where they are deficient such as with Iodine or vitamin A, or water filtration systems or tube wells where there is no nearby potable source of water. However, the social ordering of these programs in terms of their total benefits to the community for the same cost may differ in many parts of the world. One needs to collect evidence to evaluate how to allocate these scarce health subsidies.

Changing Technology of Birth Control and Women's Empowerment

The development and dissemination of improved birth control techniques reduce the cost and narrow the uncertainty of when women bear children, and they are thereby expected to improve the opportunities and welfare of women. As already noted, this is not only because the personal health burdens of childbearing fall disproportionately on women and the time devoted to child rearing is predominantly that of the mother. In addition, the developments of birth control after the 1950s, such as the steroid-hormonal-based pill, injectable, and implant as well as the intrauterine device (IUD), are all methods managed by women and deployed by them separately from sex, and thus do not necessarily involve the cooperation of their partner. These new forms of birth control are thus likely to elevate women's bargaining power over their reproduction, perhaps their choice of marital partner, and the subsequent allocation of resources in their household. Public programs that subsidize learning about birth control and its adoption and continued use are expected to enhance women's welfare at least as much as men's welfare. Nonetheless, few studies have reported clear evidence that family-planning programs achieve this change in the gender gap in welfare, behavioral independence, or empowerment.[5]

The political endorsement of public family-planning programs as a social welfare policy in much of the world since the 1960s was justified in many people's minds by the presumed contribution of improved contraception to slowing population growth and thereby increasing the potential for economic development. This Malthusian rationale for "preventive" birth control as a means to promote economic growth has gradually been superseded by the belief that family planning contributes to society by adding to the reproductive rights and welfare of women. This viewpoint was first endorsed globally by the controversial UN International Conference on Population and Development in Cairo in 1994. But in my view, neither the Malthusian nor the women's health and welfare argument for family planning programs has been sufficiently documented to satisfy the increasingly high statistical standards sought today to determine the cost-effectiveness of alternative social welfare programs.

The evaluation of social welfare policies is ideally assessed by the design and execution of a randomized control trial, as employed in the biomedical field. A

promising program is phased into randomly selected communities to confirm first "balance," or in other words, that the treated and control populations are statistically the same in their endowments and behavior before the program. Second, a divergence in outcomes emerges between the treatment and control communities after the program, as hypothesized, and it is statistically and socially significant. Family-planning programs have been promoted in the world for fifty years, but why have they not been adequately evaluated? I see two possible explanations. First, there is the ethical problem of withholding a service that is widely viewed as beneficial for at least some members of the control population. This ethical dilemma raises complex issues in many areas of medicine and public health, which might be set aside when the expected knowledge gained from the evaluation promises to be transferable to a large number of additional settings and thereby benefit many more people than in the control population. Second, the anticipated effects of the family-planning program are potentially longer-run than most randomized control trials; ten or twenty years may be needed in order to capture the potential lifetime benefits realized by a woman, her children, her husband, and her community. Can one justify the cost and delay to obtain evaluations that may not improve fundamentally the design of this and subsequent programs? Because of the ethical and long-run cost issues, family-planning programs, when they are assessed at all, are subject only to short-run evaluations of the adoption of a specific new improved contraceptive, or of the delay in the timing of births, or of the extent of schooling among adolescents.

Even when birth rates dip after a program is launched, parents are presumed to want a specific number of births over their reproductive lifetime, and the change in age-specific birth rates over a few years may overstate, or understate, the program's long-run impact on lifetime fertility. The most serious limitation of short-run evaluations of family-planning and family health programs is that important consequences of the control of fertility and improvements in family health may not occur without the time to make behavioral adjustments in the family. Only when families can reallocate their resources saved by having fewer children, can women begin to reallocate their time to alternative activities, and children can attend school longer and possibly work less at home. There may be a dynamic interplay of behavioral adjustments over time that changes lifetime objectives.[6] One cannot assess how program services increase the schooling of a woman's children, compared to the completed schooling of an observationally equivalent woman's children in control villages, unless one follows both sets of women and their families for a decade or two. It also requires following all of the women and their children, not just those who remain in their initial location. Attrition of a panel sample can bias evaluation comparisons in well-designed, but long-term, social experiments.

The reality is that there are virtually no long-term follow-up studies of randomized control trials of family-planning and family health programs in the poorest countries for which these programs are thought to be relatively underfunded. Let me therefore

conclude by illustrating one case study where the consequences of the program are reasonably clear.

An Illustrative Evaluation: Matlab Surveillance Area in Bangladesh

A social experiment was designed to provide women in their homes with modern birth control and family health inputs in the Matlab subdistrict (Thana) of Bangladesh over nearly twenty years. Matlab was a demographic surveillance area of 180,000 people across 141 relatively homogeneous poor agricultural villages, which was first established in 1966 to follow a population of sufficient size to evaluate cholera vaccines. But the vaccines proved ineffective. The area was then divided into two equal-sized contiguous blocks. Married women of childbearing age in one block, called the treatment villages, received visits every two weeks from a community health worker starting in October 1977. The health worker explained and supplied a variety of birth control methods. After five years, in 1982, birth control usage had increased markedly in the treatment villages. The community health workers were then assigned the additional task of promoting the use of a variety of family health products that were thought to have the highest payoff: maternal tetanus inoculations, measles and other immunizations for children, oral rehydration therapy for diarrhea, and prenatal and postnatal health care for mothers and children. Women in the other half of the villages, called comparison villages, could obtain at no cost similar services and health inputs, but only by going themselves to the regular government community clinics. In other words, these services were not delivered regularly and explained personally in their homes, as in the treatment villages.

I have not seen any claims that the treatment and comparison villages were selected randomly, but the two blocks of villages are very similar, and according to a 1974 census, surviving fertility and adult and child schooling levels were not statistically different between the treatment and control areas. Age-specific birth rates declined more rapidly in the treatment than in the comparison villages, and with time so did child mortality rates. By 1982 surviving fertility, a crude measure of population growth, was 16 percent lower in treatment areas than in comparison areas, and after nineteen years, in 1996, surviving fertility was 15 percent lower in treatment than in comparison areas. The more rapid and continuing decline in fertility in the treatment villages is remarkable because the total fertility rates had at the same time declined in the comparison villages by 1996, from more than six children per women to 3.6 children (Joshi and Schultz, 2013).

The expected Malthusian effect of the slower population growth in the treatment villages was not associated with an increase in wage rates among either young males or females aged fifteen to twenty-four, or for adult males aged twenty-five to fifty-four. But women aged twenty-five to fifty-four, who on average had one less child in the treatment villages than similar women had in the comparison villages, also reported monthly earnings that were, significantly, 40 percent greater. The Matlab family planning and health program appears to have functioned like a human capital investment for reproductive-age women, raising their market wage rates to as much as the wages

paid to comparable women in Matlab who had three more years of schooling (Schultz, 2012).

Another possible consequence of reducing the number of surviving children might be for parents to save and accumulate other assets for their support, if their number of children and physical savings were substitutes. Indeed, by 1996, mothers in treatment villages reported 25 percent more physical assets per adult residing in their household than did comparable mothers in comparison areas. The composition of household assets also shifted perceptibly from those assets that rely on child labor, such as live-stock and fishing, toward housing, consumer durables, jewelry, financial assets, fish ponds and orchards, agricultural equipment, and buildings. Specific investments that relieve women of household chores, such as tube wells, were also more frequently installed in the treatment residential compounds than in the comparison villages. The program is also associated with improvements in women's health and nutrition, as reflected in their body mass index (BMI), whereas no difference in husbands' BMI is observed between the treatment and comparison villages in 1996.

Finally, intergenerational investments in the health and schooling of children are greater in treatment villages than in the comparison villages, as predicted by the quality-quantity substitution hypothesis. For girls aged one to fourteen, BMI increased more in the treatment than in comparison villages, as it did for their mothers, whereas program-associated increases in years of schooling are larger for boys than for girls aged nine to fourteen and aged fifteen to twenty-nine, although in this case the gains for girls are not statistically significant.

It is interesting that I identified at RAND the Matlab surveillance area as the most reliable source of vital statistics for a poor South Asian agricultural population. I there-fore went to Matlab in 1968 to explore a possible joint analysis of their data to deter-mine how economic conditions, mortality, and access to birth control might influence fertility. My collaborative proposal was rejected, unless I was willing to spend a year or two on site first working on their research agenda. Thirty years later NIH funded the Matlab 1996 survey I used in the described study, and I have since encouraged my Ph.D. and postdoctoral students to further study this exceptional social experiment.

My interpretation of the evidence from the Matlab social experiment confirmed that poor farmers in this community benefited in many ways from a program that home-delivered birth control and family health inputs to women over a period of nineteen years. Accumulation of more household assets, women's improvement in health (BMI), and greater off-farm earnings, as well as reduced child mortality, all reflect plausible and significant program effects.

The program was intensive and sometimes criticized as too costly, but it was an innovative research investment in female human capital and empowerment in a part of the world where women might have been expected to benefit from greater opportunities. The challenge is to determine where one could expect a similar payoff from a more modestly scaled program in low-income countries where fertility and

child mortality remain relatively high. Conversely, the macroeconomic Malthusian mechanism linking population growth to declining wages was not evident in this medium-term, nineteen-year social experiment. A longer-term evaluation of the program treatment (thirty-seven years) should be possible when a resurvey funded by NIH of the 1996 sample of households is completed and released to the public for study.

Notes

1   I had also outgrown my earlier undergraduate fascination with the blunt and inefficient tools of central-ized planning in the Soviet Bloc, after I studied economic and political problems of energy dependence in Poland in the 1950s. I almost went to Russia on a Ford Foundation dissertation fellowship to write a thesis on the imminent price reforms in the Soviet Union. In a span of five years I had reoriented my research goals twice, but as I suggested above, this third iteration of my research agenda lasted longer.

2   In 2016 the Chinese Communist Party finally ended the one-child policy that had sanctioned forced abortion, common among the rural poorer segments of the Chinese population.

3   Paul Samuelson (1957) advanced a stylized model in which children functioned as a substitute for money (and savings), allowing parents to stabilize their consumption, investing in children when parents are more productive and receiving transfers from children in their less productive later years.

4   Boserup's one exception, however, was the need for male stamina to plow deeply the loamy soil in some agricultural areas of South Asia, whereas in parts of sub-Saharan Africa, slash-and-burn or shifting cultivation was more common with the more plentiful supply of land, and agriculture then relied to a greater extent on "hoe cultivation," which was performed to a greater extent by female workers.

5   The analytical framework that economists initially brought to the study of the determinants of fertility in the 1960s and 1970s was ill-designed to identify fertility effects on the personal distribution of resources within the family. Consumption and production decisions were assumed to be made by a unified family, when in fact this simplifying unification relied on there being a dominant decision maker who managed to take into account the welfare of his or her spouse and children, if any (Becker, 1965, 1981). Only as more complex but realistic bargaining models of marriage began to replace the unified model of family decision making was it clear that our analysis should distinguish between women's wage opportunities, individual's support from the welfare system, and ownership of assets, relative to men, as potential determinants of gender empowerment that could influence fertility and child welfare (*Journal of Human Resources* 80[2], 1990).

6   A woman who can delay the arrival of the birth she wants but does not want at this time may then decide to keep her younger children in school longer, and provide them with more systematic health care, and thereby substitute toward a higher "quality" standard for her children. Eventually, she may use birth control to forego that final birth, shifting her goals over time from "birth spacing" to "birth stopping," as she becomes more confident that the birth control technology has no deleterious side effects on her health and as her appreciation of child quality grows stronger. As her health and nutrition improve, the mother may be able to engage in physically more demanding work and be paid accordingly a higher wage rate for the time she does work outside of her family.