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The Population Problem: Theory and Evidence

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An early version of this article was prepared as a background paper for the Population Summit of the World's Scientific Academies, held in New Delhi during 24–27 October 1993, and was also the basis of the 1993 Sidney Ball Lecture at the University of Oxford, a much-shortened version of which was published in Scientific American (Dasgupta 1995a). These essays, in turn, were based on ideas that were developed in my book, An Inquiry into Well-Being and Destitution (Dasgupta 1993). In preparing this article, I have benefited greatly from discussions with Kenneth Arrow, Carol Dasgupta, Jack Goody, and Paul Seabright.

I. Introduction: *Motivation and Scope*

AS WITH POLITICS, we all have widely differing opinions about population. Some point to population growth as the cause of poverty and environmental degradation. Others permute the elements of this causal chain, arguing, for example, that poverty is the cause rather than the consequence of increasing numbers. Yet even when studying the semi-arid regions of sub-Saharan Africa and the Indian subcontinent, economists have usually not regarded population growth, poverty, and the state of the local environmental resource-base as interconnected. Inquiry into each factor has in large measure gone along its own narrow route, with discussions of their interactions dominated by popular writings (e.g., Paul and Anne Ehrlich 1990), which, while often il-

luminating, are in the main descriptive, not analytical.¹

Over the past several years, though, a few investigators have studied the interactions between the three ingredients more closely. Our approach has been to fuse theoretical modeling with empirical findings drawn from a number of disciplines. The resulting construction regards none of the three factors to be the prior cause of the other two; rather, it sees each as influencing the others and in turn being influenced by them. Focusing on people in small, rural communities in the poorest regions of the world, the work has even identified circumstances in which population growth, pov-

¹ Nancy Birdsall (1988), Allen Kelley (1988), and T. Paul Schultz (1988) are three authoritative surveys on the subject of population growth in poor countries. None of them focuses on the interactions I am concerned with in this article. Nor does a large literature on poverty (e.g., Jean Drèze and Amartya Sen 1990) address our theme.

erty, and degradation of the local environmental resource-base can fuel one another over extended periods of time. In this article I will present an outline of this work, laying stress on the arguments that have shaped it (Sections III-VII) and on the policy recommendations that have emerged from it (Section VIII). As we will see, this body of work offers something like a new perspective on what may be called *the population problem*.

A decade ago an inquiry was made into the economic consequences of population growth in poor countries (National Research Council 1986). Drawing on time-series and cross-regional data, the investigators observed, among other things, that population size and its growth can have both positive and negative effects. The investigators recognized that population growth should not be regarded as exogenously given. Nevertheless, for tractability, they treated it as a causal factor in their inquiry, and concluded that, while economic development in most poor countries would be faster with slower rates of population growth, there is no cause for alarm over the high rates being experienced there.²

That population growth is best regarded as endogenous is the hallmark of a strand in demographic theory—often called the “new economic demography” (Schultz 1988)—that had been developed earlier.³ It contains an elaborate account of the determinants of fertility behavior. One weakness of this literature is that, with relatively few exceptions, it has focused on decisions made by a single household; it has not studied in detail social mechanisms in which a myriad of individual household decisions lead to outcomes that are a collective failure. In

short, the literature has often equated private and social benefits (and costs) of having children. (“The next step is to apply . . . microeconomic models (of household behavior) to understand aggregate developments in a general equilibrium framework. But progress in this field has been slow”; Schultz 1988, p. 418.) The new perspective, in contrast, focuses on various types of externalities that could be associated with fertility decisions. It notes that a number of such externalities can, over time, lead to wide divergences between individual intentions and social realizations (Sections IV-VII). The theory also peers more closely into the character of decision making within rural households and relates fertility behavior to gender issues (Section III).

To anyone who is not a demographer, economic demography can be a most frustrating subject. It would seem that for any theoretical inference (say, on fertility matters), no matter how innocuous, there is some set of data from some part of the world over some period that is not consonant with it. Over 40 years of demographic research have uncovered that the factors underlying fertility behavior include not only the techniques that are available to households for controlling their size (Section IV), but also the household demand for children (Sections V-VI). The latter in particular is influenced by a number of factors, whose relative strengths would be expected to differ across cultures, and over time within a given culture, responsive as they are to changes in income and wealth and the structure of relative prices. Thus, the factors that would influence the drop in the total fertility rate in a society from, say, 7 to 5 should be expected to be different from those that would influence the drop from 5 to 3 in that same society.⁴

² Kelley (1988) is an excellent review of the findings.

³ Gary Becker (1981) is often regarded as the canonical formulation.

⁴ *Total fertility rate* is the number of live births a woman would expect to give if she were to live through her child-bearing years and to bear chil-

Across societies the matter is still more difficult. The springs of human behavior in an activity at once so personal and social as procreation are complex and interconnected, and empirical confirmation of ideas are always fraught with difficulty.

These observations are merely a reminder that a general theory of fertility behavior is not currently available. The findings I will be reporting here enable us to weave a narrative (Section VII) of the circumstances in which *some* people are born, what they aspire to, and the manner in which they live and die. The findings cannot be applied universally. But there are reasons for thinking that it may have a bearing in parts of the Indian subcontinent and sub-Saharan Africa. The account offers us an interpretation of the population problem in some of the poorest regions of the world. It sees the problem as consisting of unacceptable risks of maternal death for poor, illiterate women, and of new lives doomed to extreme poverty amid deterioration of the local environmental resource-base. In this sense, the new perspective regards current rates of population growth in these regions to be overly high and, so, a matter for concern. This is in marked contrast to the views expressed in both the strands of the demographic literature I have just alluded to.

II. *Population, GNP, Food Production, and the Environment*

Why did demographic writings a decade ago not regard high rates of population growth in poor countries a worrying matter? In particular, why did investiga-

tors arrive at what Kelley (1988, p. 1686) calls a "revisionist interpretation" of the evidence?⁵

It seems to me there were at least two reasons. One is the preoccupation of those who developed the new household economics. Attention was paid in great part to choices made by a single, optimizing household; and the study of a single household is not a propitious one in which to explore the possibilities of collective failure.

A second reason stems from empirical findings. As the accompanying figure suggests, richer countries on average have been associated with lower fertility rates. A regional breakdown of even the Chinese experience displays the general pattern: fertility is lower in higher-income regions (Birdsall and Dean Jamison 1983). Furthermore, barring sub-Saharan Africa over the past 25 years or so, gross income per head has grown in nearly all poor regions since the end of the Second World War. In addition, growth in world food production since 1960 has exceeded the world's population growth by an annual rate of, approximately, 0.6 percent. This has been accompanied by improvements in a number of indicators of human well-being, such as the infant survival rate, life expectancy at birth, and literacy. In poor regions all this has occurred in a regime of population growth rates substantially higher than in the past: excepting for East Asia and parts of South and Southeast Asia, modern-day declines in mortality rates have not been matched by reductions in fertility. A number of places that did experience a decline in fertility rates for a while (e.g., Costa Rica and

dren at each age in accordance with the prevailing age-specific fertility rates. The measure pertains to the number of live births, not pregnancies.

⁵ The "revision" pertains to a decided shift from an earlier view, expressed, for example, in the 1971 National Academy of Sciences report entitled *Rapid Population Growth: Consequences and Policy Implications*, which found little good in population growth.

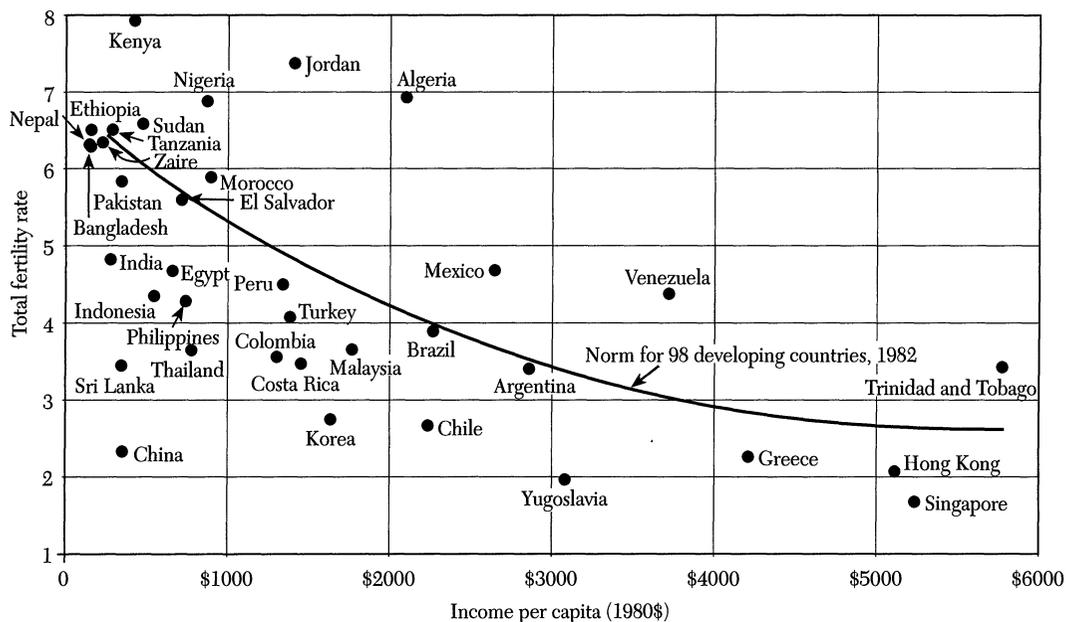


Figure 1. Fertility in relation to income in developing countries, 1982
 Source: Birdsall (1988)

India), appear to have stabilized at levels well above the population replacement rate (the fertility rate at which population size would be expected to stabilize in the long run; a figure just over 2.1).⁶

Table 1 presents (total) fertility rates in several countries and groups of countries. Toward the end of the 1980s, the fertility rate in the World Bank's list of low-income countries (excluding China and India) was 5.6. The figures for China and India were 2.3 and 4.2, respectively. (In contrast, fertility rates in western industrial countries today lie between 1.5 and 1.9.) The oft-expressed fear that rapid population growth will accompany

deteriorations in living standards has not been borne out by experience so far; at least, not when judged from the vantage of the world as a whole. Taken together, these observations suggest not only that population growth is not a serious hindrance to economic growth, but that the process of economic growth itself can be relied upon to reduce the rate of population growth. This provides a reasoning behind the revisionist interpretation.

TABLE 1
 TOTAL FERTILITY RATES IN THE LATE 1980s

	Total Fertility Rate
Sub-Saharan Africa	6-8
India	4.2
China	2.3
Japan, and Western industrial democracies	1.5-1.9

Source: World Bank (1990).

⁶ It will be noticed that the curve in the accompanying figure does not fit the data well. It will also be noticed that, among the poor countries in the sample, total fertility rates in Asia are below what the curve would predict, while those in Africa are above. Part of my intention in this article is to discuss possible reasons for these systematic differences.

But there is a problem with it. Conventional indicators of the standard of living pertain to commodity production, not to the environmental resource-base upon which all production ultimately depends. This base includes soil and its cover, freshwater, breathable air, fisheries, and forests. Statistics on past movements of gross income and agricultural production say nothing about this base. They do not say if, for example, increases in gross national product (GNP) per head are not being realized by means of a depletion of natural capital; in particular, if increases in agricultural production are not being achieved by a "mining" of the soil. By concentrating on GNP (and other current-welfare measures, such as life expectancy at birth), economists have, wrongly, by-passed the concerns that ecologists have repeatedly expressed about the links that exist between continual population growth, increased output, and the state of the environment. Dasgupta and Geoffrey Heal (1979), Henry Peskin (1981), and Dasgupta and Karl-Cöran Mäler (1991) have shown precisely how national product, if it is to function effectively as an index of social well-being, should include the value of changes in the environmental resource-base. They have also shown that, when it is properly defined, this index, which measures *net* national product (NNP), takes into account the effect of changes in stocks of natural capital on future consumption possibilities. Thus it is possible for GNP per head to increase for an extended period even while NNP per head is declining. We should be in a position to say if this has been happening in poor countries. But the practice of national-income accounting has lagged so far behind its theory, that we have little idea of what the facts have been.⁷

⁷ Attempts at estimating NNP, thus defined, are now being made at the World Bank. However, the principles underlying the construction of NNP

Conventional statistics can also lull us into thinking that human ingenuity can be relied upon to overcome the stresses that growing populations would otherwise impose on the natural environment; that, for every vanishing resource there would always be substitutes for our use. But analyses of biodiversity tell us why this would be an error. Ecologists stress that biodiversity plays a central role in the evolution of ecosystems (Wilson 1992). Not only does biodiversity provide the units through which both energy and materials flow (thus giving the system its functional properties, such as those of preserving and regenerating soil, recycling nutrients, pollinating crops, and filtering pollutants), it also provides an ecosystem with *resilience*.

Resilience is the capacity of an ecosystem to recover from perturbations, shocks, and surprises. If a system loses its resilience, it can flip to a wholly new state when subjected to even a small perturbation. (This is where threshold effects assume importance.) Thus, field studies suggest that an ecosystem that is diverse in its biota withstands stress (e.g., occasioned by violent events), in that it manages to sustain much of its functions even when the composition of species changes. (Resilience should, therefore, be thought of as functional, as opposed to structural, stability of complex systems.) This is because there are species that are "waiting in the wings" to take over the functions of those that are denuded or destroyed. Now this is reminiscent of the assumption of substitut-

that I have sketched in the text assume that production possibility sets are convex. This is a bad assumption: there would appear to be significant nonlinearities in ecological processes (e.g., threshold effects; see Edward Wilson 1992; Arrow et al. 1995). This means that NNP on its own is not an adequate index of social well-being. We need to supplement NNP with estimates of the stocks of appropriate environmental resources. On this see Dasgupta (1993, ch. 10).

ability among inputs in commodity production, an assumption that is often made in economic models of technological processes. But resilience presupposes that there *are* species waiting in the wings. So, to invoke the idea of substitutability among natural resources in commodity production in order to play down the utilitarian value of biodiversity, as is frequently done (e.g., Julian Simon 1981, 1994), is to make a mistake. The accounting price of natural capital could well be a good deal in excess of what it is implicitly taken to be. For example, Peter Vitousek et al. (1986) have estimated that 40 percent of the net energy created by terrestrial photosynthesis (i.e., the net primary production of the biosphere) is currently being appropriated for human use. To be sure, this is a very rough estimate; moreover, net terrestrial primary production is not exogenously given and fixed. But the figure does put the scale of the human presence on the planet in perspective.

In stressing the importance of biodiversity, popular writings on the environment and population growth have taken a global, future-oriented view: they have emphasized the deleterious effects that a large population would have on our planet in the future. This slant, as we have just seen, has been instructive, but it has drawn attention away from the economic misery endemic in large parts of the world today. Disaster is not something the poorest have to wait for; it is occurring even now. Moreover, in poor countries, decisions on fertility and on allocations concerning education, food, work, health-care, and on the use of local environmental resources are in large measure reached and implemented within households that are unencumbered by compulsory schooling, visits from social workers, and so forth. The new perspective—the subject of this article—studies the interface of population

growth, poverty, and environmental degradation from a myriad of household, and ultimately individual, viewpoints. It adopts a micro-cosmic, contemporary outlook, rather than a macroscopic, futuristic one.

III. *The Household, Power, and Gender*

The *household* as a concept is not without its difficulties. It is often taken to mean a housekeeping or consumption unit. The household in this sense is the eating of meals together by members, or the sharing of meals derived from a common stock of food (John Hajnal 1982). This definition has the merit that it is in accordance with most modern censuses, but there is a problem with it: in rural communities it does not yield exclusive units.⁸ A household shares a “table” and may, for example, include live-in servants who do not cook for themselves. In many cases some meals are had in common, while others are not; and often raw and cooked food is passed to parents in adjacent cottages, apartments, and even rooms. The boundaries vary with context, especially where food is not consumed together round a table (as in Europe) but in bowls in distinct groups (as in sub-Saharan Africa). In none of these cases is the housekeeping unit the same as the consumption unit, nor is the consumption unit necessarily well-defined.

In his famous analysis of fertility differences between seventeenth and eighteenth century Northwest Europe on the one hand and modern pre-industrial societies on the other, Hajnal (1982) drew upon the distinction between “nuclear” and “joint” household systems. He observed that in Northwest Europe marriage normally meant establishing a new household, which implied that the cou-

⁸ Here I am borrowing from Goody (1990, 1991).

ple had to have, by saving or transfer, sufficient resources to establish and equip the new household. This requirement in turn led to late marriages. It also meant that parents bore the cost of rearing their children. Indeed, fertility rates in France dropped before mortality rates registered a decline, before modern family planning techniques became available, and before women became literate (Ansley Coale 1969). Hajnal contrasted this with the Asiatic pattern of household formation, which he saw as joint units consisting of more than one couple and their children.

Whether this two-way classification is ultimately fruitful for interpreting differences in fertility behavior between the two regions in question is open to doubt: it does not easily come to grips with modern fertility declines in South, East, and Southeast Asia.⁹ Across several continents the matter is even more doubtful. For example, it can be argued that the rules of inheritance are a critical factor governing interpersonal relations, and that differences in inheritance rules explain in large measure why households in sub-Saharan Africa are strikingly dissimilar to the "joint" household system that has for long been taken to be the hallmark of the Asiatic form. But inheritance rules themselves require explanation, and it is tempting to search for this in the mode and technology of agricultural production (viz. hoe versus the plough), and thereby in ecological factors (e.g., soil quality, population density, rainfall, and availability of domestic animals). These are delicate matters of historical analysis, and the causal links are not well-understood.¹⁰ Fortunately, for our

purposes here, we can by-pass such analytical problems by studying instead the underlying motivations of those agencies whose decisions most affect fertility. Rather than regard the household as the unit of analysis, it proves more fruitful to start with *individuals*, view them as agencies of action, and study their choices in the context of the personal and social ties to which they are, or they become, attached. Seen from this perspective, the relative costs and benefits of procreation to the various agencies differ much across societies, in ways that we will study in this article.

Traditionally, economists have taken households to mean *decision-units* concerned with the allocation of consumption, work, leisure, health-care, education, and fertility. In so doing, they have developed an idealized version of the concept to explore how choices made by these units would respond to changes in the outside world, such as employment opportunities, credit, insurance, health-care, and education facilities (Becker 1981; Inderjit Singh, Lyn Squire, and John Strauss 1986). The view is idealized, in that the process by which decisions are reached in the household model is taken to be a benign one. Thus, it has been customary to interpret household behavior by assuming that its choices reflect a *unitary* view among its members of what constitutes their well-being: the model is that of a utility maximizing household. This is as true of general competitive analysis (e.g., Gerard Debreu 1959) as it is of the new economic demography (e.g., Marc Nerlove, Assaf Razin, and Efraim Zadka 1987). However, if this, now traditional, interpretation were correct, household choices would be independent of which

⁹ On the Asian experience in recent years, see Richard Leete and Iqbal Alam (1993).

¹⁰ See, in particular, Goody (1976, 1990) for a searching investigation. Prabhu Pingali and Hans Binswanger (1987) have also offered an economic rationale for hoe agriculture in sub-Saharan Africa in terms of population density and soil quality. See

Mark Rosenzweig, Binswanger, and John McIntire (1988) for further analyses of the effect of population density on agrarian relations more generally.

member actually does the choosing. Unfortunately, the assumption is at variance with recent findings, which have revealed, for example, that income in the hands of the mother has a bigger effect on her family's health (e.g., nutritional status of children) than income under the control of the father (Eileen Kennedy and Ruth Oniang'o 1990). Moreover, in some parts of the world (e.g., the northern parts of the Indian subcontinent), household choices have been found to reflect allocations that favor some members (that is, these inequalities cannot be explained by differences in needs); for example, men and boys over women and girls, and the young over the elderly.¹¹ Household decisions would assume strong normative significance only if the underlying basis upon which they are made took each member's interests into reasonable account. But this may not be common; at least not when the family is impoverished and the stresses and strains of hunger, illness, and physical weakness make themselves felt. Thus, there is a case for moving from unitary to *collective* models of the household (see also Dasgupta 1993; Harold Alderman et al. 1995).

Because we know that gender inequities often prevail in education, food, and health-care allocations, it should not be surprising that they prevail over fertility choices as well. Here also men typically wield greater influence, even though women bear the greater cost. To grasp how great the burden can be, consider that in sub-Saharan Africa the total fertility rate is between six and eight (Table 1). Now each successful birth involves at least a year and a half of pregnancy and breast-feeding. On making the obvious corrections, we can then conclude that in

a society where female life expectancy at birth is 50 years, and where the total fertility rate is, say, seven, about half of a woman's adult life is spent either carrying a child in her womb or breast-feeding it. And we have not allowed for unsuccessful pregnancies.

Another indicator of the price that women pay is maternal mortality. In most poor countries, complications related to pregnancy constitute the largest single cause of death among women in their reproductive years. In sub-Saharan Africa (e.g., Ethiopia), maternal mortality rates as high as one in 50 have been recorded.¹² We may conclude that, at a total fertility rate of seven and over, the chance that a woman who enters her reproductive years will die because of complications related to pregnancies is about one in six. Producing children therefore involves playing a kind of Russian roulette. This is one manifestation of the population problem.

As the cost they incur for procreation is so high, one expects that, given a choice, women would opt for fewer children. Thus birth rates should be expected to be lower in societies where women are more empowered. Data on the status of women from 79 so-called Third World countries (Table 2) confirm this and display an unmistakable pattern: high fertility, high rates of female illiteracy, low share of paid employment, and a high percentage working at home for no pay—they all hang together. From the data alone, it is of course difficult to discern which of these measures are causing, and which are merely correlated with, high fertility. But the findings are consistent with the possibility that lack of paid employment and education limits a woman's ability to make deci-

¹¹ Lincoln C. Chen, Emdadul Huq, and Stan D'Souza (1981) is a pioneering quantitative study. Dasgupta (1993) contains references to what is now an extensive literature on these matters.

¹² By way of contrast, we should note that the maternal mortality rate in Scandinavia today is one per 20,000.

TABLE 2
FERTILITY RATES AND WOMEN'S STATUS

N	TFR	PE	UE	I
9	>7.0	10.6	46.9	65.7
35	6.1-7.0	16.5	31.7	76.9
10	5.1-6.0	24.5	27.1	46.0
25	<5.0	30.3	18.1	22.6

Source: IIED/WRI (1987, Table 2.3).

Key: N: number of countries
TFR: total fertility rate
PE: women's share of paid employment (%)
UE: percentage of women working as unpaid family workers
I: women's illiteracy rate (%)

sions and therefore promotes population growth.

The beneficial effects of parents' education, particularly mothers' education, on the well-being of their children have been much documented.¹³ Studies suggest also that education helps mothers to process information more effectively, and enables them to use the various social and community services that may be available more intensively. Among other things, education appears to impart a degree of self-confidence to a person, enabling her to avail herself of whatever new facilities that may be on offer. This is invaluable for rural populations living through changing circumstances.¹⁴

The links between female education,

¹³ They have investigated household consumption of nutrients, birth-spacing, the use of contraceptives, child health in general, infant- and child-survival rates, and children's height (see Dasgupta 1993, ch. 12, for references). However, not all the studies are methodologically immune to criticism. Indeed, in a few studies endogenous variables are treated as though they are exogenous. Strauss (1990) has a good discussion of such failings.

¹⁴ Here is an indication of orders of magnitude. The infant mortality rate in households in Thailand where the mother has had no education (resp. has had primary and secondary education) was found to be 122 per 1000 (resp. 39 and 19 per 1000). See World Bank (1991).

especially secondary education, and reproductive behavior are, however, varied (Susan Cochrane 1983). The acquisition of education delays the age of marriage, which would be expected to reduce fertility. Moreover, at low levels of education and contraceptive prevalence, literacy and receptiveness to new ideas would be expected to complement the efforts of family planning programs.¹⁵ Furthermore, family planning programs have been known to result in longer birth-spacing. This in turn results in a reduction in infant mortality rates. Turning to a different set of links, education increases women's opportunities for work, and thus their opportunity cost of time: the cost of child-rearing is higher for educated mothers. And finally, educated mothers would be expected to value education for their children more highly, and so would be more likely to make a conscious tradeoff between the quality and number of their children. Each of these forces would be expected to reduce fertility rates.

Set against these is an effect on fertility that runs the other way. Taboos against postpartum female sexual activity, where they exist, may well be weakened through education. In sub-Saharan Africa, where polygyny is widely practiced, postpartum female sexual abstinence can last up to three years after birth. It is also not uncommon for women to practice total abstinence once they have become grandmothers. The evidence is curious: in Latin America and Asia, increased female enrollment in primary school has had the effect of lowering fertility rates, while in many parts of sub-Saharan Africa there is evidence that the effect has been the opposite. Table 2 displays this curiosity.

Since 1960 total fertility rates in a

¹⁵ Above low levels, however, female education and family-planning outreach activities appear to be substitutes.

number of poor countries have declined by 50 percent or more. Schultz (1993) has shown that family planning outreach activities explain little of either cross-country variations in fertility or changes over time in fertility within a country. He has found that the level and gender composition of education (affecting, for example, child mortality), the extent of agricultural employment (affecting the cost of raising children), and the level of nutrition (affecting, once again, child mortality), taken together, explain most of both types of variation.

As noted earlier, there are reasons for thinking that the extent of economic dependency of women on men also plays a role in fertility decisions. This dependency is enormous in the Indian subcontinent, especially in the north (David Sopher 1980; Tim Dyson and Mick Moore 1983). In patrilineal societies women rightly perceive sons as having especially high value as insurance against personal calamities, such as widowhood and abandonment. But sons cannot be guaranteed. So one has to keep trying. In East and Southeast Asia, South India, and Sri Lanka women's economic dependency would appear to be less. Among the world's poorest countries in the early 1970s, fertility rates have fallen most dramatically there.¹⁶ In a wide-ranging essay on the old-age-security hypothesis (see below), Mead Cain (1984) used the median age difference between spouses as an index of female economic dependence in patrilineal societies to demonstrate a remarkably high correlation between this and the total fertility rate in a cross-sectional study of nations. Thus, in poor societies marked by gender differ-

ences in employment opportunities and power, women's professed reproductive goals need not necessarily differ noticeably from those of men despite the differences in reproductive costs incurred by men and women (Karen Mason and Anju Taj 1987).

Opportunities for paid employment among women would appear to empower them more than educational opportunities (Mayra Buvinic 1994). This has implications for policy. It is all well and good, for example, to urge governments in poor countries to invest in literacy programs. But the results could be disappointing. Many factors militate against poor households taking advantage of subsidized education. If children are needed for work inside and outside the home, for example, then keeping them in school (even a subsidized one) is costly for poor households. In places that are experiencing high unemployment rates among school leavers, the benefits are also uncertain. In patriarchal societies, educated girls can be perceived as less pliable and harder to marry off. We should expect a gender-bias in educational attainment. Today it is a commonplace that there is such a bias (see e.g., the World Tables in World Bank 1991). Indeed, the benefits of subsidies even to primary education are captured disproportionately by families that are better off.

In contrast, policies aimed at increasing women's productivity at home and improving their earnings in the marketplace would directly empower women, especially within the household. Greater earning power would also raise for men the implicit costs of procreation (which keeps women from bringing in cash income). One would then expect families to have fewer children. This is not to deny the value of public investment in primary and secondary education in poor countries. It is only to say that we should be wary of claims that such in-

¹⁶Perhaps the most impressive among these regions is the state of Kerala in India (where currently the total fertility rate is an astonishing low, 1.8). For a quantitative analysis of the determinants of Kerala's demographic success, see P. N. Mari Bhat and S. Irudaya Rajan (1990).

vestment is a panacea for the population problem.

The nature of income-earning opportunities influences the extent to which women are able to exercise choice, because neither the habit of taking decisions nor the confidence with which one is able to make decisions comes easily: they are both acquired. Employment as a manual worker does not involve decision making in quite the extent as does self-employment as an entrepreneur. Seen from this perspective, employment programs involving loans for commercial ventures (as, say, those developed by the Grameen Bank in Bangladesh) are more useful than public-works.¹⁷

The importance of gender inequality to overpopulation in poor nations is fortunately gaining international recognition. Indeed, the focal point of the United Nations Conference on Population and Development in Cairo in September 1994, namely, women's reproductive rights and the means by which they could be protected and promoted, is consonant with the new perspective. But the Cairo Conference came very near to treating the problems as identical. This was a mistake. There is more to the population problem than gender-inequalities, a fact that has been uncovered by inquiring into the various instruments that are available to people for controlling fertility and into the motives they have for procreation. These matters are discussed next.

IV. *Birth Control*

Except under conditions of extreme nutritional stress, nutritional status does not appear to affect fecundity (John Bongaarts 1980). During the 1974 famine in

Bangladesh the rural population lost over 1.5 million additional children. The stock was replenished within a year (Bongaarts and Cain 1981). Of course, undernourishment can still have an effect on sexual reproduction, through its implications for the frequency of stillbirths, maternal and infant mortality, and a possible reduction in the frequency of sexual intercourse.

A most obvious determinant of fertility is the available technology for birth control. Cross-country regressions (e.g., Lant Pritchett 1994) confirm that the fraction of women of reproductive age who use modern contraceptives is strongly and negatively correlated with total fertility rates.¹⁸ So it should not be surprising that family planning programs are often seen as a prerequisite for any population policy. But these regression results mean only that contraception is a proximate determinant of fertility, not a causal determinant. They could mean, for example, that differences in fertility rates across nations reflect differences in fertility goals, and thereby differences in contraceptive use. Nevertheless, it is frequently held that high fertility is a consequence of an unmet need for modern birth-control devices, as in the claim "contraceptives are the best contraceptive" (Bryant Robey, Shea Rutstein, and Leo Morris 1993, p. 35).

To social scientists, this is altogether too mono-causal an account for comfort. It is also at variance with recent findings (such as those of Schultz, 1993, mentioned earlier) which suggest that, even in poor countries, it is parental demand

¹⁷ The case of sub-Saharan Africa (especially West Africa) is, as in many other matters, different. Women do most of the (subsistence) agricultural work there, but have little control over their reproduction (see Section V).

¹⁸ For example, in East Asia over 65 per cent of married women in the age range 15–49 years use contraceptives as against somewhat under ten per cent in sub-Saharan Africa. In South Asia as a whole the figure in the early 1980s was about 25 percent, but in Sri Lanka it was a high 55 percent. Sri Lanka has one of the lowest fertility rates in Asia (see World Bank 1984, Table 7.1).

for children rather than an unmet need for contraceptives that in large measure explains reproductive behavior. We will inquire into the various reasons why parental demand would be expected to be high in those regions where fertility rates are high and low where the rates are low. But it is useful to bear in mind that people in all societies practice some form of birth control: fertility is below the maximum possible in all societies. Even in poor countries, fertility is not unresponsive to the relative prices of goods and services. As we noted earlier, extended breast-feeding and postpartum female sexual abstinence have been common practice in Africa. In a study on !Kung San foragers in the Kalahari region, Richard Lee (1972) observed that the nomadic, bush-dwelling women among them had an average birth-spacing of nearly four years, while those settled at cattle-posts gave birth to children at much shorter intervals. From the viewpoint of the individual nomadic !Kung San woman, it is significant that the social custom is for mothers to nurse their children on demand, and to carry them during their day-long trips in search of wild food through the children's fourth year of life. Anything less than a four-year birth interval would, therefore, increase mothers' carrying loads enormously, impose a threat on their own capacity to survive, and reduce their children's prospects of survival. In contrast to bush dwellers, cattle-post women are sedentary, and are able to wean their children earlier.

Traditional methods of birth control have included abortion, abstinence or rhythm, coitus interruptus, and prolonged breast-feeding.¹⁹ These options

¹⁹ Anthropologists have, however, argued that in sub-Saharan Africa prolonged breast-feeding is not a birth-control measure, but a means of reducing infant mortality: traditionally, animal milk has been scarce in the region.

TABLE 3

	A (years)	B (%)
sub-Saharan Africa	18.9	40
Asia	21.3	26
Latin America	21.5	19.8

Source: Cochrane and Farid (1989).

Key A: average age of marriage for women
B: proportion of women aged 15–19 years who are married

are often inhumane and unreliable: modern contraceptives are superior. Nevertheless, successful family planning programs have proved more difficult to institute than could have been thought possible at first. In a wide-ranging commentary on the findings of the World Fertility Survey, Cochrane and Samir Farid (1989) observed that in parts of sub-Saharan Africa modern contraceptive methods have been used by households for altering the spacing of births, not so much the number of births. The authors remark that the high levels of fertility in sub-Saharan Africa are a consequence of early and universal marriage, allied to little reliance on contraception. As Table 3 shows, the average age at marriage for sub-Saharan women is 18.9, and the proportion of those 15–19 years of age who are married is 40 percent. The corresponding figures for Asia are 21.3 and 26 percent, respectively, and for Latin America, 21.5 years and 19.8 percent, respectively. But the proximate determinants identified by Cochrane and Farid are themselves in need of explanation, and we will look into it. Sub-Saharan Africa's population growth rate has increased during the two decades 1960–80 from about 2.5 percent per year to something like 2.9 percent per year. We will see below that the absence in Africa of a strong conjugal bond (in particular the practice of

polygyny²⁰) has something to do with such high rates, as does the concept of the *self* and its ties with kinship (Goody 1976; Meyer Fortes 1978). But it is not clear if any of this has much to do with the fact that, barring a few countries, fertility rates there have not shown any significant decline in recent years, despite a decline in infant mortality rates. The importance of women in farming has often been adduced to explain, in part, sub-Saharan Africa's marriage patterns. But, as we observed in the previous section, differences between the genders in the net benefits of having children are a key ingredient in the population problem facing both the Indian subcontinent and sub-Saharan Africa, not just the latter.

Households would be expected to adopt new methods of birth control to satisfy unmet needs. However, over time it is the net demand for children that would be expected to dominate household decisions. We should not be surprised, therefore, that, in those regions where family planning programs have had an impact, it has occurred mostly in the initial stages. Here is a substantiation: Starting in 1977, 70 "treatment" villages were serviced by a program of birth control in the famous study in Matlab Thana in Bangladesh, while 79 "control" villages were offered no such special service. The contraceptive prevalence in the treatment villages increased from seven to 33 percent within 18 months, and then more gradually to a level of 45 percent by 1985. The prevalence also increased in the control villages, but only to 16 percent in 1985. By 1980 the difference in total fertility rates between the two groups reached a figure of 1.5 (Kenneth Hill 1992). The question is whether the Matlab experiment should be viewed as an exception, or whether it

could be replicated easily in other places.

In a notable paper, Pritchett (1994) has argued that it would be unrealistic to use the Matlab program as an indicator of the effectiveness of birth-control programs, for the reason that it was both massive and expensive. The fertility response was certainly large, but he estimates that the cost of each prevented birth was about 120 percent of Bangladesh's GDP per capita, a very high figure.

Pritchett (1994) also analyzed data from household surveys conducted by the World Fertility Survey and the Demographic and Health Surveys programs, which included women's responses to questions regarding both their preferences and their behavior on fertility matters. Demographers had earlier derived several indicators of the demand for children from these data. One such indicator, the "wanted total fertility rate" (Bongaarts 1990), can be compared to the actual total fertility rate for the purpose of classifying births or current pregnancies in a country or region as wanted or unwanted. Regressing actual fertility on fertility desires on a sample of 43 countries in Asia, Africa, and Latin America, Pritchett found that about 90 percent of cross-country differences in total fertility rates are associated with differences in desired fertility. Moreover, excess fertility was found not to be systematically related to the actual total fertility rate, nor to be an important determinant of the rate. The figure 90 percent may prove to be an over-estimate, but it is unlikely to prove to be greatly so.²¹ Even in poor households, the use of modern contraceptives would involve only a small fraction (one percent or thereabouts) of income.

²⁰ In West Africa between 40 and 50 percent of wives are in polygynous marriages (John and Pat Caldwell 1990).

²¹ I am grateful to John Bongaarts for helpful conversations on this matter.

It is reasonable to conclude, then, that even in poor countries fertility rates today are dependent mostly (perhaps 70–80 percent) on the net demand for children and not on the extent of family planning outreach activities. The importance international agencies continue to place on family planning programs as a way of eliciting lower fertility rates is at odds with these findings. We should instead be seeking to understand the determinants of the demand for children. This is taken up next.

V. *Children as Ends*

One motive for procreation, common to humankind, relates to children as ends in themselves. We are genetically programmed to want and to value them. It has also been said that children are the clearest avenue open to “self-transcendence” (David Heyd 1992).²² Viewing children as ends ranges from the desire to have children because they are playful and enjoyable, to a desire to obey the dictates of tradition and religion. One such injunction emanates from the cult of the ancestor, which, taking religion to be the act of reproducing the lineage, requires women to bear many children.²³ This latter motivation has been emphasized by Caldwell and Caldwell (1990) to

²² Note that in evolutionary biology phenotypic costs and benefits of reproduction are important only to the extent that they are correlated with reproductive measures. Offspring in this theory are valued in terms of the end of increasing fitness. This is not the point of view in economic demography.

²³ Writing about West Africa, Fortes (1978, pp. 125–26) says “a person does not feel he has fulfilled his destiny until he or she not only becomes a parent but has grandchildren . . . [Parenthood] is also a fulfillment of fundamental kinship, religious and political obligations, and represents a commitment by parents to transmit the cultural heritage of the community . . . Ancestry, as juridically rather than biologically defined, is the primary criterion . . . for the allocation of economic, political, and religious status.” See also Goody (1976). Cochrane and Farid (1989) remark that both the ur-

explain why sub-Saharan Africa has for the most part proved so resistant to fertility reduction.

The problem with this argument is that, although it explains why fertility rates in sub-Saharan Africa are high, it does not explain why the rates have not responded to declines in mortality. The cult of the ancestor may prescribe reproduction of the lineage, but it does not stipulate an invariant fertility rate. Even in sub-Saharan Africa, total fertility rates have been below the maximum possible rate; so they should be expected to respond to declines in mortality, a matter I shall come back to in Section VI, and in Section VII I will offer one possible explanation for the resistance that sub-Saharan Africa has shown to reductions in fertility rates.²⁴

The view that children are an end in themselves provides several pathways by which reasoned fertility decisions at the level of every household could lead to an unsatisfactory outcome from the perspectives of all households.²⁵ One such pathway arises from the fact that traditional practice is often perpetuated by

ban and rural, the educated and uneducated in sub-Saharan Africa have more, and want more, children than their counterparts do in other regions. Thus, even the younger women there expressed a desire for an average of 2.6 more children than women in the Middle East, 2.8 more than women in North Africa, and 3.6 to 3.7 more than women in Latin America and Asia.

²⁴ Between 1965 and 1987 the infant mortality rate in a number of the poorest countries in sub-Saharan Africa declined from about 200 per 1,000 live births to something like 150 per 1,000 live births (World Bank 1989). Caldwell, I. O. Orubuloye, and Caldwell (1992) suggest that the declines in fertility rates that have been observed in recent years in Botswana, Kenya, Zimbabwe, and parts of Nigeria are due to further declines in mortality rates that these places have recently enjoyed.

²⁵ Reproductive externalities have not been much studied in the “new economic demography” so far. Surveying the field, Schultz (1988, p. 417) writes: “Consequences of individual fertility decisions that bear on persons outside of the family have proved difficult to quantify, as in many cases where social external diseconomies are thought to be important.”

imitative behavior. Procreation in closely knit communities is not only a private matter, it is also a social activity, influenced by both family experiences and the cultural milieu (Goody 1976, 1990; Fortes 1978; Richard Easterlin, Robert Pollak, and Michael Wachter 1980; Susan Cotts Watkins 1990).

Formally speaking, imitative behavior would occur if every household's most desired family size were an increasing function of the average family size in the community.²⁶ This is, of course, a "reduced form" of the concept (Dasgupta 1993, ch. *12), and the source of a desire to imitate could lie in reasons other than an intrinsic desire to be like others. It could be that similar choices made by households generate mutual positive externalities, say, because people care about their status, and a household's choice of actions signals its predispositions, and thereby affects its status (B. Douglas Bernheim 1994).

Whatever the basis of imitative behavior, there would be practices encouraging high fertility rates that no household would unilaterally desire to break. Such practice could well have had a rationale in the past, when mortality rates were high, rural population densities were low, the threat of extermination from outside attack was large, and mobility was restricted. But practices can survive even when their original purpose has disappeared. It can then be that, so long as all others follow the practice and aim at large family sizes, no household on its own wishes to deviate from the practice; however, if all other households were to restrict their fertility rates, each would desire to restrict its fertility rate as well. In other words, imitative behavior can be a reason for the existence of multiple equilibria.

²⁶ This is an instance of "strategic complementarities." See Russell Cooper and Andrew John (1988).

This said, it must also be acknowledged that testing for multiple equilibria is a most difficult matter. For the moment it is analytical reasoning that tells us that a society could in principle get stuck at a self-sustaining mode of behavior, characterized by high fertility and low educational attainment, even when there is another, potentially self-sustaining, mode of behavior that is characterized by low fertility and high educational attainment (Dasgupta 1993, ch. *12).

This does not mean that society would be stuck with high fertility rates forever. As always, people differ in the extent of their absorption of traditional practice. There would inevitably be those who, for one reason or another, experiment, take risks, and refrain from joining the crowd. They are the tradition-breakers, and they often lead the way. Educated women are among the first to make the move toward smaller families (see e.g., Ghazi Farooq, Ita Ekanem, and Sina Ojelade, 1987, for a commentary on West Africa). Female education is thus a potent force for creating tradition-breakers, as are earning opportunities for women. A concerted social effort toward furthering these ends could help dislodge such a society from the rapacious hold of high fertility rates and low educational attainment to a mode of behavior where fertility is low and educational attainment high. A more direct route would be social coordination through education and public exhortation, aimed particularly at men if the society is strongly patriarchal. In this context, the role of television and radio in transmitting information about other life styles can be especially important (Ronald Freedman 1995).

VI. *Children as Productive Assets*

Still other motives for procreation involve viewing children as productive as-

sets. In a rural economy where the avenues for saving are highly restricted, or where public support for the elderly are weak, parents value children as a source of security in their old age. Cain (1981, 1983) has studied this aspect extensively on the basis of data from Bangladesh, and Jeffrey Nugent and Thomas Gillaspay (1983) have used Mexican evidence to argue that old-age pension and social security do act as a substitute for children. One way of formalizing this is to assume that parents are interested in household welfare, subject to the requirement that the chance of there being an offspring to care for them in old age (i.e., providing sustenance, time, and attention) is no less than a certain amount. In many regions (e.g., the Indian subcontinent) this translates itself to a requirement that the chance of there being a *son* alive when the parents are old is no less than a certain amount. As a numerical example, we may consider the simulation study by David May and David Heer (1968), who estimated that an average Indian couple in the 1960s needed to have 6.3 children in order to be 95 percent sure of having a surviving son when the father reaches the age of 65. This is a high figure, about the same as the total fertility rate in India during the decade of the 1950s.²⁷

Old-age security provides a potentially strong motive. In 1980 people aged 65 and over in South Asia formed about four percent of the total population. The sex composition among the aged is far from even, being of the order of 80–85 men for every 100 women among the elderly. In South and Southeast Asia female life expectancy at birth is 59 years, while that of males is about 54 years; at age 60, however, they are approximately 15 and 14 years, not much less than the

life expectancy at age 60 in advanced industrial countries. In the Indian subcontinent the proportions of the elderly who live with their children (for the most part, sons) is of the order of 80 percent or more. (In the United States the corresponding figure is about 15 percent.) Sons are a necessity in these circumstances. A poor widow with no sons in northern parts of the Indian subcontinent is faced with the prospect of destitution.²⁸

Related to this is a phenomenon that has been observed by Jane Guyer (1994) in a Yoruba area of Nigeria. In the face of deteriorating economic circumstances, some women are bearing children by different men so as to create immediate lateral links with them. Polyandrous motherhood enables women to have access to more than one resource network.

Children differ in their potential. One would expect parents in a poor household to develop the most promising of their children, even if this were to mean that the remaining ones are somewhat marginalized. This is confirmed by both economic theory and evidence (Becker and Nigel Tomes 1976; Caroline Bledsoe 1994). Daughters are a net drain on parental resources in the Indian subcontinent (dowries can be bankrupting). This goes some way toward explaining the preference parents show for sons there (Sopher 1980; Cain 1984). It also helps explain why daughters receive less education and are expected to work relatively harder for their parents, a matter we come to next.

²⁷ Samuel Preston (1978) is a useful collection of essays on the effects that have been observed on fertility rates of reductions in rates of infant mortality.

²⁸ Urbanization tends to break households down into "nuclear" units, thereby raising the parental costs of procreation (Coale and Edgar Hoover 1958; Schultz 1993). Urbanization in a growing economy also offers children better employment prospects, which improve their bargaining strength relative to their parents. This in turn lowers the return on children as investment, because children become less dependable as a source of income to their parents in their old age.

In poor countries children are also useful as income-earning assets. This provides households in these parts with another motive for procreation. It has consequences that have only recently been explored in theoretical analyses (Dasgupta and Mäler 1991, 1995; Nerlove 1991; Nerlove and Anke Meyer 1993).

Poor countries in great part are biomass-based subsistence economies. Rural folk there eke out a living from products obtained directly from plants and animals. Production throughput is low. Much labor is needed even for simple tasks. Moreover, households there do not have access to the sources of domestic energy available to households in advanced industrial countries. Nor do they have water on tap. In semi-arid and arid regions, water supply is often not even close at hand. Nor is fuel wood near at hand when the forests recede. This means that the relative prices of alternative sources of energy and water faced by rural households in poor countries are quite different from those faced by households elsewhere. In addition to cultivating crops, caring for livestock, cooking food, and producing simple marketable products, members of a household may have to spend as much as five to six hours a day fetching water and collecting fodder and wood. These are complementary activities. They have to be undertaken on a daily basis if the household is to survive. Each is time-consuming. Labor productivity is low not only because capital is scarce, but also because environmental resources are scarce. From about the age of six years, children in poor households in poor countries mind their siblings and domestic animals, fetch water, and collect fuel wood, dung, and fodder. Children are then needed as workers by their parents, even when the parents are in their prime. In their study of work allocation among rural house-

holds in the foothills of the Himalayas, the Centre for Science and Environment (C.S.E 1990) recorded that children between 10 and 15 years work one-and-a-half times the number of hours adult males do, their tasks consisting of collecting fuel wood, dung, and fodder, grazing domestic animals, performing household chores, and marketing.²⁹ Indeed, children can add so much to household income that, in some places, they are costless to rear by the time they reach adolescence. Cain (1977) studied data from the village Char Gopalpur in Bangladesh. He estimated that male children become net producers at as early an age as 12 years, and work as many hours a day as an adult. Using a zero (calorie) rate of interest, he calculated that male children compensate for their own cumulative consumption by the age of 15. This may not be typical in Bangladesh. I cite it, nevertheless, to show the vast difference in the motivation for having children between households in rich countries and poor households in poor countries. Each household would appear to need many hands, and it can be that the overall usefulness of each additional hand increases with declining resource availability, at least over some range.³⁰

VII. *Positive Feedbacks and Poverty Traps*

The need for many hands can lead to a destructive situation, especially when parents do not have to pay the full price of rearing their children but share those costs with their community. In recent years, mores that once regulated local resources have changed. Since time immemorial, rural assets such as village ponds and water holes, threshing grounds, graz-

²⁹ See Julia Falconer and J. E. A. Arnold (1989) for a similar investigation for sub-Saharan Africa.

³⁰ This can happen if households discount the future at a sufficiently high rate. See Nerlove (1991).

ing fields, and local forests have been owned communally. This form of ownership and control enabled households in semi-arid regions to pool their risks. James Howe (1986), Robert Wade (1988), Kanchan Chopra, Gopal Kadekodi, and M. N. Murty (1990), Jean-Marie Baland and Jean-Philippe Platteau (1995), and others have shown that, traditionally, communities have protected local commons from overexploitation by relying on norms, imposing fines for deviant behavior, and other means. But the very process of economic development can erode traditional methods of control, say, by way of increased urbanization and mobility (Dasgupta 1993, ch. 10). Social norms are also endangered by civil strife and by the usurpation of resources by landowners or the state. As norms degrade, parents pass some of the costs of children on to the community by overexploiting the commons. Indeed, even a marginal decline in compliance in agreements can trigger a process of cumulative causation. Over time the effect could be large. If access to shared resources continues, parents produce too many children, which leads to greater crowding and susceptibility to disease as well as to more pressure on local environmental resources. But no household, on its own, would take into account the harm it would inflict on others when bringing forth another child. This is another instance of a demographic free-rider problem.

Parental costs of procreation are also lower when the cost of rearing the child is shared among the kinship. In sub-Saharan Africa, "fosterage" within the kinship is a commonplace: children are not raised solely by their parents, the responsibility is more diffuse within the kinship group (Goody 1976; Bledsoe 1990). Fosterage in the African context is not adoption. It is not intended to, nor does it in fact, break ties between par-

ents and children. The institution affords a form of mutual insurance protection in semi-arid regions. There is some evidence that, as savings opportunities are few in the low-productivity agricultural regions of sub-Saharan Africa, fosterage also enables households to smoothen their consumption across time.³¹ In parts of West Africa up to half the children have been found to be living with their kin at any given time. Nephews and nieces have the same rights of accommodation and support as do biological offspring. There is a sense in which children are seen as common-responsibility. However, the arrangement creates yet another free-rider problem if the parents' share of the benefits from having children exceeds their share of the costs. From the point of view of the parents, taken as a collective, too many children would be produced in these circumstances.³²

³¹This latter motivation has been explored by Renata Serra in a graduate thesis at the University of Cambridge.

³²To see that there is no distortion if the shares were the same, suppose c is the cost of rearing a child and N the number of couples within a kinship. For simplicity assume that each child makes available y units of output (this is the norm) to the entire kinship, which is then shared equally among all couples, say in their old age. Suppose also that the cost of rearing each child is shared equally by all couples. Let n^* be the number of children each couple other than the one under study chooses to have. (We will presently endogenize this.) If n were to be the number of children this couple produces, it would incur the resource cost $C = [nc + (N - 1)n^*c]/N$, and eventually the couple would receive an income from the next generation equaling $Y = [ny + (N - 1)n^*y]/N$. Denote the couple's aggregate utility function by the form $U(Y) - K(C)$, where both $U(\cdot)$ and $K(\cdot)$ are increasing and strictly concave functions. Letting n be a continuous variable for simplicity, it is easy to confirm that the couple in question will choose the value of n at which $yU'(Y) = cK'(C)$. The choice sustains a social equilibrium when $n = n^*$. (This is the symmetric non-cooperative Nash equilibrium of the social system.) It is easy to check that this is also the condition which is met in a society where there is no reproductive free-riding. It is a simple matter to confirm that there is free-riding if the parents' share of the benefits from having children exceeds their share of the costs.

In sub-Saharan Africa, communal land tenure of the lineage social structure offers yet another inducement for men to procreate. In addition, as conjugal bonds are weak, fathers often do not bear the costs of siring a child. Anthropologists have observed that the unit of African society is a woman and her children, rather than parents and their children. Often, there is no common budget for the man and woman. Descent in sub-Saharan Africa is, for the most part, patrilineal and residence is patrilocal (an exception are the Akan people of Ghana). Patrilineality, weak conjugal bonds, communal land tenure, and a strong kinship support system of children, taken together, are a broad characteristic of the region. In principle they provide a powerful stimulus to fertility. Admittedly, patrilineality and patrilocality are features of the northern parts of the Indian subcontinent also. But conjugal bonds are substantially greater there. Moreover, as agricultural land is not communally held, large family sizes lead to fragmentation of landholdings. In contrast, large families in sub-Saharan Africa are (or, at least *were*, until recently) rewarded by a greater share of land belonging to the lineage or clan.

The perception of both low costs and high benefits of procreation in sub-Saharan Africa induces "couples" to produce too many children. Theoretical considerations suggest that, in certain circumstances, a disastrous process can thereby begin. As the community's natural resources are depleted, more hands are needed to gather fuel and water for daily use. More children are then produced, further damaging the local resource base and in turn providing the "household" with an incentive to enlarge. When this happens, poverty, fertility, and environmental degradation reinforce one another in an escalating spiral. By the time some countervailing set of factors—

whether public policy or diminished benefits from having further children due, say, to a scarcity of land—stops the spiral, millions of lives may have suffered through worsening poverty.³³

Kevin Cleaver and Götz Schreiber (1994) provide some evidence for this thesis in the context of rural sub-Saharan Africa. They report positive correlations between poverty, fertility, and deterioration of the local environmental resource base. Such data cannot reveal causal connections, but they are not inconsistent with the idea of a positive-feedback mechanism such as I have described. Over time, this spiral would be expected to have large effects, as manifested by battles for resources (William Durham 1979; Thomas Homer-Dixon, Jeffrey Boutwell, and George Rathjens 1993).

And there is evidence that is more indirect. The victims of such a process as we are discussing would be born and raised in poverty. A large proportion would suffer from undernourishment. They would remain illiterate and would often be both stunted and wasted. Undernourishment would retard their cognitive (and often motor) development and compromise their future capacity to work. Labor productivity would be dismally low. For the most part investment credit would be unavailable to them so that savings would be severely constrained. Stunting and wasting would have a tendency of begetting stunting and wasting down the generations of a dynasty (Dasgupta 1993, chs. 14–16). Among those who would survive, the victims hit hardest would be society's outcasts—the migrants and dispossessed, some of whom in time would become the emaciated beggars seen on the streets of large towns and cities in poor countries. Nutritional findings (John Waterlow

³³ Nerlove (1991) has provided a formal analysis of such positive feedback processes.

1986, 1992), historical studies (Robert Fogel 1994a, 1994b) and theoretical explorations (Dasgupta 1993, ch. 16; 1995b), when taken together, show that the spiral I have outlined here is one way in which destitutes are created. Emaciated beggars are not lazy; they have to husband their precarious hold on energy. Having suffered from malnutrition, they cease to be marketable.

Families with greater access to resources would, however, be in a position to limit their size and propel themselves into still higher income levels. I have not been able to locate published data on the matter, but my impression is that among the urban middle classes in north India the transition to a low fertility rate has already been achieved. This does not mean there is an inexorable "vicious circle of poverty." People from the poorest of backgrounds have been known to lift themselves out of the mire. Nevertheless, there are forces at work which pull households away from one another in terms of their living standards. India provides a possible example of how the vicious cycle I have described can enable extreme poverty to persist amid a growth in well-being in the rest of society. The Matthew Effect ("For unto everyone that hath shall be given, and he shall have abundance; but from him that hath not shall be taken away even that which he hath") would appear to work relentlessly in poor countries.

In this background, it is hard to make sense of the oft-expressed suggestion (e.g., Simon 1981) that there are cumulative benefits to be enjoyed from increases in population size even in poor countries; that human beings are a valuable resource. To be sure, they are potentially valuable as doers of things and originators of ideas, but for this they require the means for personal development. Moreover, historical evidence on the way pressure of population led to

changes in the organization of production, property rights, and ways of doing things, which is what Ester Boserup (1981) studied in her far-reaching work, also does not seem to speak to the population problem as it exists today in sub-Saharan Africa and the northern parts of the Indian subcontinent.

VIII. *Public Policy*

The analysis presented here suggests that the way to reduce fertility would be to break the destructive spiral where such a spiral is in operation. Because parental demand for children, rather than an unmet need for contraceptives, in great measure explains reproductive behavior in poor countries, we should try to identify policies that would so change the options men and women face that their reasoned choice would be to lower their fertility.

In this regard, civil liberties, as opposed to coercion, would appear to play a particular role. In Dasgupta (1990) I showed, by the use of statistical analysis of data pertaining to the decade of the 1970s from 51 of the then poorest countries, that political and civil liberties are positively and significantly correlated with *improvements* in income per head, life expectancy at birth, and the infant survival rate. Correlation is not causation, but there are now reasons for thinking that such liberties are not only desirable in themselves, but also have instrumental virtues in empowering people to flourish in the economic sphere. The causal chain may well be that political and civil liberties provide sustenance to the rule of law, and thereby to security of property and the enforcement of contracts. In fact Adam Przeworski and Fernando Limongi (1995) have shown that fertility, as well, is lower in countries where citizens enjoy more civil and political liberties. (An exception is

China, which represents only one out of some 100 countries in their sample.)

The most potent solution in semi-arid regions of sub-Saharan Africa and the Indian subcontinent is to deploy a number of policies simultaneously. Family planning services, especially when allied with health services, and measures that empower women are certainly desirable. As social norms break down and traditional support systems falter, those women who choose to change their behavior become financially and socially more vulnerable. So a literacy and employment drive for women is essential to smooth the transition to lower fertility. But improving social coordination and directly increasing the economic security of the poor are also essential. Providing infrastructural goods, such as cheap fuel and potable water, will reduce the usefulness of extra hands. When a child becomes perceived as expensive, we may finally have a hope of dislodging the rapacious hold of high fertility rates. Neither evidence nor analysis has yet disproved the notion that the poor in poor countries know, at least in a rough manner, what is in their self-interest. But each of the prescriptions offered by our new perspective is desirable by itself, and not just when we have the population problem in mind. It seems to me that this consonance of means and ends is a most agreeable fact in what is otherwise a depressing field of study.

Admittedly, in saying all this we are looking at matters wholly from the perspective of the parents. This is limiting.³⁴ But developing the welfare economics of population policies has proved to be ex-

³⁴ Stephen Enke (1966) is a notable exploration of the value of prevented births when the worth of additional lives is judged to be based entirely on their effect on the current generation. As a simplification, Enke took the value of a prevented birth to be the discounted sum of the differences between an additional person's consumption and output over the person's lifetime.

tremely difficult (Dasgupta 1994): our ethical intuition at best extends to actual and future people, we do not yet possess a good moral vocabulary for including potential people in the calculus. What I have tried to argue in this essay is that there is much that we can establish even if we were to leave aside such conceptual difficulties. Population policy involves a good deal more than making family planning centers available to the rural poor. It also involves more than a recognition that poverty is a root cause of high fertility rates. The problem is deeper, but as I have tried to show, it is possible to subject it to analysis.

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