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# Fertility and Economic Values

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Women and men who are mated in marriage prefer to have their own children. Their preference is strong and clear in the family behavior of parents. They sacrifice much to have their own children. Most of the costs (sacrifices) in having children and in caring for them during their infant years is borne by mothers. In an economic context, the scarce resource that matters most at this early stage in the marriage cycle is the time that mothers devote to their children. It follows that, in analyzing the economics of fertility, the economic value of the time of women is a major factor affecting fertility. I shall first present a brief economic perspective of the value of children and I shall then consider broadly the effects of the high price of human time on the number and quality of children and indicate the population equilibrium implications.

## **I. The Value of Children**

In bringing economics to bear on procreation and children, a new dialogue between data and theory has begun. The studies in this book are a part of that dialogue. Whereas Malthus assumed that the price of children would remain constant, these studies argue that the cost of children increases with the rise in price of human time. We now see that fertility is affected by prices as well as by income and by the formation of human capital in children. We also see that the human capital embodied in adults, especially in women, affects fertility and the supply of labor. Recent developments in economic analysis provide some testable hypotheses. The empirical endeavors, as expected, disclose important new unsettled questions underscoring the fact that the work has just begun in understanding the mechanisms that account for changes over time.

I am indebted to Gary S. Becker, Yoram Ben-Porath, Dennis De Tray, Gregg Lewis, Marc Nerlove, Margaret Reid, T. Paul Schultz, and Robert Willis for their helpful suggestions to gain clarity and cogency.

In assessing the contributions of these studies, it would be premature to look for policy implications. The implications that matter at this stage of this work are primarily analytical. To see the setting of the problems that are on the agenda calls for an economic perspective which entails some elementary, albeit fundamental considerations. Although these considerations might be taken for granted, I shall elaborate on them to make sure that they are not overlooked. Fertility means children, and children are an important part of the standard of living of most families. Most married couples want their own children, and they proceed to bear and rear them. What is not clear is that parents derive satisfactions and productive services from their children and that the sacrifices made by parents in bearing children and in the investment they make in the care, health, and education of their children are in substantial part deliberate family decisions.

I anticipate that many sensitive, thoughtful people will be offended by these studies of fertility because they may see them as debasing the family and motherhood. These highly personal activities and purposes of parents may seem to be far beyond the realm of the economic calculus. I repeatedly expressed the same concern about this sensitive issue when I began to apply the concept of human capital to education. It, too, could be viewed as debasing the cultural purposes of education. I pointed out with care and at length that investment in education is fully consistent in serving cultural purposes in acquiring future cultural satisfactions along with the earnings associated with schooling and higher education. The same basic logic is applicable in this endeavor in explaining the sacrifices that parents make in acquiring the personal satisfactions and productive services that they derive from their children.

The analytical core of these studies rests on the economic postulate that the reproductive behavior of parents is in large part a response to the underlying preferences of parents for children. Given the state of the birth control technology and the various classes of uncertainty associated with contraception, infant mortality, the health and fecundity of the parents, and the income and wage rates parents expect to realize over their life cycles, these preferences are constrained by the parents' resources and the associated alternative economic opportunities in using their resources. In turn, these resources imply sacrifices, measured in terms of opportunity costs that parents must be prepared to make in acquiring the future satisfactions and productive service they expect to realize from children.

It could, of course, be argued that parents are nevertheless indifferent to these and all other economic considerations when it comes to having children, on the grounds that children are in considerable part the unintended outcome of sexual activity, that parents in general do not engage in any practical family planning, and that the lifetime resource constraints are not known to parents with enough certainty to influence their decisions

at the time they bear their children. I shall not, at this point, enter upon the reasons for not accepting this line of argument because of the evidence to the contrary that emerges from these studies. I shall instead proceed on the postulate that parents respond to economic considerations in the children they bear and rear and that parents equate the marginal sacrifices and satisfactions, including the productive services they expect from children, in arriving at the value of children to them. Thus, in thinking about the economics of fertility, social cost and benefits aside, the analytical key in determining the value of children to their parents is in the interactions between the supply and demand factors that influence these family decisions.

Growth economists, to the extent that they have dealt with fertility, have featured the gross economic *effects* of population growth, leaving to biologists, sociologists, and demographers the task of explaining the increases in the size of the human population. This concentration on such gross effects is understandable in view of the fact that the factors determining population growth have been a major unsettled part of economic theory. The concept of an optimum population has not been fruitful. Modern growth theory, with some notable exceptions, treats increases in the size of the population as an exogenous variable, although in classical economics it was (following Malthus) an endogenous variable. The Malthusian assumption about bearing and rearing children in response to economic growth led, of course, to the long-standing dismal economic perspective with respect to the population consequences of the accumulation of capital and of any advances in the techniques of production. While economists no longer accept the subsistence standard of living as invariant over time in view of the widely observed rise in standards of living that has occurred with the rise in real family income associated with economic growth, the recent proliferation of doomsday literature featuring the population bomb, produced mainly by a few biologists, rests basically on the early Malthusian notions of reproductive behavior.

Meanwhile, demographers have done much in clarifying the complexity of population data and in examining in depth particular differences among classes of parents in their fertility behavior (Ryder and Westoff 1971, and others). Moreover, demographers know that the population projections that are based on their well-standardized data are tenuous projections even for the short run, for they know that these projections do not rest on any theory of population growth. Demographers are asking key questions, however, on which the economist would be well advised to ponder: What is the explanation of the rapid adoption of the pill? What accounts for the fluctuations in the birth rates in countries in which the economy is highly developed?<sup>1</sup> In my view, the most important question they are asking is:

<sup>1</sup> This question has been mainly on Richard Easterlin's research agenda (1968, 1969).

What is the explanation of the *demographic transition*, that is, how do we explain the economic and social processes and family behavior that accounts for the marked decline from very high birth and death rates to modern very low birth and death rates? It is obvious that the theory which treats population growth as an exogenous variable is of no help in answering these questions.

I shall restrict the rest of my comments first to the recent advances in economic analyses that have made these new approaches possible. The economic picture that emerges will then be sketched briefly, and finally, I will consider some of the implications of these studies for future economic thinking and work.

### *A. Advances in Economic Analysis*

There are four developments in economic analysis that are relevant here: the investment in human capital; the theory to treat a heretofore neglected basic attribute in the allocation of human time; the household production function; and a view of the family that encompasses both consumer choice and household production decisions, including the bearing and rearing of children.

Investment in human capital, as we know, rests on the proposition that there are certain expenditures (sacrifices) that are made deliberately to create productive stocks, embodied in human beings, that provide services over future periods. These services consist of producer services revealed in future earnings and of consumer services that accrue to the individual as satisfactions over his lifetime.<sup>2</sup>

Children are here viewed as forms of human capital. From the point of view of the sacrifices that are made in bearing and rearing them, parents in rich countries acquire mainly future personal satisfactions from them,

<sup>2</sup> Professor Harry Johnson has summarized the producer attributes of human capital succinctly as follows: "The contribution of human capital to the productive process is developed by a process of investment (which means simply the sacrifice of current resources for future returns) incurred in the formal education system and through on-the-job training, and that this investment yields its returns over the lifetime of the individual concerned. . . . The concept of human capital has tremendous integrative power, in that it provides a unifying principle for the consistent explanation of many phenomena of the labour market. Perhaps its most fundamental implication, from the point of view of social thought, is that the worker in an advanced industrial economy is typically a very considerable capitalist. . . . A second implication, which is extremely relevant to the broad question of social and economic inequality, is that the economic rewards for alternative occupations and careers need to be compared in terms of lifetime income profiles, and not in terms of the highest annual income earned in the course of the career. . . . A third implication, also relevant to the question of inequality, is that in their choices among alternative possible careers, new entrants to the labour force face the same problems of assembling information, assessing risks, evaluating returns, and obtaining the resources for investment, as do prospective investors in material capital equipment or in stocks and shares" (Johnson 1968, pp. 7-8).

while in poor countries children also contribute substantially to the future real income of their parents by the work that children do in the household and on the farm and by the food and shelter they provide for their parents when they no longer are able to provide these for themselves. Children are in a very important sense the *poor man's capital*. It is becoming clear that the investment in children is in many ways akin to the investment in home-grown trees for their beauty and fruit. A very young child is highly labor-intensive in terms of cost, and the rewards are wholly psychic in terms of utility. As a child becomes a teen-ager, the additional cost borne by the parents involves less labor intensiveness and the rewards, especially in poor countries, consist in increasing part of useful work that the teen-ager performs.

The second important advance in economic analysis is in the treatment of human time in allocative decisions with respect to both market and non-market activities (Becker 1965). The linkage between human capital and this concept of time allocation is strong and clear. The usefulness of the new concept of human time is not restricted to work in the labor market for it is also applicable to work in the household. With respect to the household the individual, predominantly the housewife, allocates her time in part in choosing and shopping for consumer goods and in part in using them in household production leading to consumption. Then, too, consumption per se also requires time. The central principle of this advance in analysis is that in reality each consumer service has two prices attached to it: (1) a money price, as in traditional theory of consumer choice, and (2) a time cost of acquiring the consumer goods and processing them in the household; and the time cost that is involved in consuming the services obtained from this household activity.

It is obvious that bearing a child and caring for the infant child are normally highly labor-intensive activities on the part of the mother. What has not been clear is the difference in the value of time of mothers in bearing and rearing children associated with the difference in the human capital of mothers. The studies that follow contribute substantially in clarifying this relationship.

There is, then, the treatment of the economics of household production. This household production function is an outgrowth of the concepts of human capital and of the value of human time. It provides a comprehensive approach to the nonmarket activities of the household, an approach that was foreshadowed by the much earlier work of Margaret Reid (1934). The distinctive merit of Becker's 1965 formulation of a theory of the allocation of human time is in accounting for the use of the time of individuals in household production activities. Clearly, the housewife is not only allocating her time in choosing among consumer goods and in acquiring them, but she also engages in altering these goods as she processes and prepares them for consumption. The household production function is for this purpose a useful

analytical tool.<sup>3</sup> A further development of the household production function is now called for. Empirical analysis indicates that the production of a child (children) differs importantly in terms of inputs of time and of the services of purchased goods depending upon the age of the child (children).

The fourth advance is envisioning the family as a decision-making unit not only in maximizing its utility in consumption but also in determining the allocation of human time and of goods in the production activities of the household. In terms of economic analysis, the family as a decision-making unit with respect to household production is here viewed as an application of theory of the firm in traditional economic theory. In this view of the family, the assumption is made that the welfare of each member of the family is normally integrated into a unified family welfare function,<sup>4</sup> that there are "overheads," and that shadow (nonmarket) prices play an important role in the family's producer and consumer activities, including the bearing and rearing of children.

### *B. The Emerging Economic Picture*

Each of the studies in this book should be viewed as a progress report on research that has been underway for some time. As studies, none has been done in splendid isolation, for there has been much communication among these economists; and, as might be expected, they all use essentially the same economic language. It is also clear from the fairly extensive list of references that a number of other economists are likewise engaged in research in this area.

Admittedly, the theory is restricted by its static economic assumptions, from which it nevertheless derives a good deal of analytical power; it cannot yet, however, cope adequately with the lifetime behavior of parents with respect to the many diverse investments they make in the health, education, on-the-job training, travel, and marriage of their children and with respect to the transfer of property via inheritance. The core of the theory is designed primarily to analyze the effects of the differences in the price of the time of parents that enter directly and indirectly into the production of children. The static theory at hand still lumps together first all expenditures on children and then all satisfactions from children that occur over the life cycle. It does not disentangle the early and later parts of this cycle in determining the relative importance of the two parts. In my thinking, important parts of the changes in fertility over time, changes that are related to the rise in the expenditures on children, are consequences of long-term developments with respect to the economic value of education, job opportunities, the incentives to migrate toward better

<sup>3</sup> The usefulness of this analytical tool is suggested by its applications in analyzing the derived demand for health, leisure, durable goods, transportation, and here in ascertaining the derived demand for children.

<sup>4</sup> I shall return to this issue in Section C.

economic locations, the opportunities to reduce infant mortality, and the improvements in contraceptive techniques and the decline in their cost, along with the secular rise in family income. The treatment of these and other secular developments, including the rates at which families adjust their fertility to these various types of disequilibria, is as yet beyond the scope of the theory.

Admittedly, also, the empirical analysis is subject to serious data limitations and to some econometric complexities that remain unsolved. Data are always hard to come by when it comes to testing economic hypotheses. Better data, however, for these purposes can undoubtedly be "made." Then, too, although there have been major advances in the development of econometric techniques, some of them are not as yet common property among economists; meanwhile new unsolved econometric problems keep cropping up.

Turning to the empirical part, the responses of parents to differences in relative prices inducing substitution are evident. Specifically, the negative effects of increases in price of the mother's time on the number of children leaves little room for doubt that there is a role for economics in analyzing fertility. When education is used as a measure of the price of her time, the task of untangling the several different influences of education presents difficulties which I shall consider presently.

The responses of parents to differences in income and to changes in income over time are very difficult to get at. There is, however, an unwarranted tendency to treat the estimates at hand as weak and ambiguous for the wrong reason. These income effects are not for theory to decide any more so than in the case of the income elasticity of the demand, say, for food. The wrong reason is in the belief that the partial effect of income must be to increase fertility.

In my view, the determination of these income effects will depend ultimately on data. But it is exceedingly difficult to determine empirically the effects of income while holding the price of time and goods constant. It is even more difficult to measure correctly the true family wealth over its life cycle. To do it using *ex post* data is up against the fact that what is needed are the *ex ante* expectations of the time path of the family income streams over the life cycle with the appropriate weights of these expectations at different stages in the life cycle with due regard for risk and discounting. Static models are unable to account for revisions of these expectations and for the adjustments that parents make to unexpected income changes along the life-cycle path. Furthermore, the effect of changes in the ratio of quality per child to the number of children may cause the relative price of numbers of children to rise as income rises even when the price of time is held constant.<sup>5</sup> My interpretation of the Becker-Lewis paper herein is that it supports this inference.

<sup>5</sup> The latter part of this paragraph owes much to a clarifying comment from Robert Willis.

More generally and fundamentally, with respect to the interaction between quality per child and number of children, is the overall constraint of family resources in the sense that additional numbers of children necessarily implies fewer resources to draw upon to invest in quality per child.

The ongoing research here under consideration presents a major challenge in untangling and isolating the various functions that the education of parents performs in household-family behavior as it influences fertility. The education of parents, notably that of the mother, appears to be an omnibus. It affects the choice of mates in marriage. It may affect the parents' preferences for children. It assuredly affects the earnings of women who enter the labor force. It evidently affects the productivity of mothers in the work they perform in the household, including the rearing of their children. It probably affects the incidence of child mortality, and it undoubtedly affects the ability of parents to control the number of births. The task of specifying and identifying each of these attributes of the parents' education in the family context is beset with analytical difficulties on a par with the difficulties that continue to plague the economic analysis of growth in coping with the advances in technology.

I am impressed by the evidence that the relationship between additional schooling of mothers and the number of children is strongly negative for the early years of schooling of mothers. But, why this relationship should not continue for additional education at the higher levels is a puzzle.<sup>6</sup> In view of the importance of this relationship in determining public policy in support of elementary schooling, a special effort is called for, both in making sure of the empirical inferences and in resolving the apparent puzzle.

Analytically, I deem it to be a real advance to treat children as a heterogeneous stock of human capital. Clearly, a child less than age 3 is a very different component of human capital, both in terms of costs which consist largely of the value of the mother's time and in terms of psychic satisfactions that parents derive from so young a child, compared with an older child who has become a teen-ager. As I noted at the outset, a very young child is highly labor-intensive measured in terms of the input of the mother's time. As the child becomes older, he becomes less and less labor-intensive and more costly in terms of other family resources that are required for the schooling and other activities that enhance his acquired abilities.

The problem of determining the allocation of family resources as between quality per child and numbers of children looms large. It deservedly is high on the agenda.

There is too little explicit analysis of the investments by parents in the abilities that children acquire from education, on-the-job experi-

<sup>6</sup> Ben-Porath and Willis attempt in their papers herein to provide some possible explanations of this puzzle.

ence, travel, and other activities that enhance the capacities of children; these are investments from which the family benefits and which it can afford by drawing on family resources, in addition to the mother's time, through dissaving during the early stage of the family life cycle, especially so in the advanced, modern economies such as Israel and the United States.

The rate of child mortality in the United States is not only low, but the difference in this rate among the white families has become sufficiently small so that variations in their child mortality are no longer a significant factor in fertility behavior. But the decline in child mortality currently underway in most poor countries is in all probability an important variable to which parents are responding with lags as they become informed and are prepared to act, given the state of the information that appears relevant to their fertility decisions.

Last, one of the more important new insights pertains to the economics of the supply of and demand for contraception techniques. Would that we had estimates of the rates at which the superior and cheaper contraceptive techniques are adopted. The indications are that this information will tell a story that is in many respects comparable to that of farmers in a number of poor countries in their adoption of new, superior varieties of wheat, rice, and other crops that has set into motion the so-called Green Revolution. The responses of parents in adopting these contraceptive techniques is also further support of the economic postulate that parents are not indifferent in their fertility behavior to changes in economic conditions.

### *C. Prospects*

Are we, as Norman Ryder suggests (in Part 2), destroying the idea of a family? On the contrary, we are enlarging and enriching the role of the family as it is envisioned in the new home economics. The assumption that the family integrates the welfare of its members into an internally consistent family-utility function attributes a role to the family that undoubtedly exceeds its capacity as a social institution. Thus, one of the unsettled issues for future work is an approach for treating the individual utility functions of the husband, wife, and older children.

The family is indeed one of the basic social institutions that has been fortified legally as it has evolved culturally. Ryder is correct in noting that "society intervenes, in obvious and in subtle ways." With regard to the family's social functions, there has been a persistent concern with respect to marriage, procreation, and children. The family is for these reasons a concept that is basically in the domain of anthropologists, of sociologists, and of legal scholars, and all of them contribute to demographic studies. Can economists also contribute, in view of the advances in economic analysis made possible by concepts of human capital, the value of human

time, the household production function, and the family as a decision-making unit in consumption and in household production? What are the prospects that these new approaches will contribute significantly in explaining marriage, fertility, and the investment in children?

The prospects would not be promising if it were true that virtually all that has been and could be learned using these economic approaches is already known by scholars in other disciplines. While it would be presumptuous to proclaim that an economic theory of population is in prospect, it is not to be ruled out at this stage. The more modest prospects, which are nevertheless important, are of two parts: (1) the substantive contributions already at hand, and (2) the potentially rewarding research opportunities that these approaches afford.

The substantive contributions that I have featured in the preceding section along with others that are reported in the several papers that follow are new and important. We see that the household-family unit responds to changes in relative prices in the manner implied by the economic theory, that the most important price in the production of children during the early years of each child is the price of the mother's time, that there is substitution in the family context between the quality embodied in children and the quantity (number) of children, that the investment in the quality of children looms large as family income rises, that additional schooling at the lower level of education of mothers has a strong negative effect on family fertility, and that the response to superior and cheap contraceptive techniques is clearly subject to economic analysis.

Furthermore, these studies are a rich source of economic hypotheses that have as yet not been tested and of ideas and speculations worthy of much more economic thinking. Most of the research opportunities that I see are mentioned in the preceding section. I shall, therefore, restrict further comments to several specific ways of getting at some of the unexplored issues and at some of the long-term economic developments that may have substantial explanatory power in accounting for the observed changes in fertility over periods of two and more family cycles.

The static household-family models can be extended to take account explicitly of the array of consumer durables that enter into the household production function and of the ready-made consumer items that save on the time of housewives. The acquisition of consumer durables by borrowing funds during the childbearing and rearing stage of the family cycle can also be made an integral part of these models. I would expect that as the education of the parents increases, we will observe a significant positive effect in acquiring borrowed funds more cheaply and in the effectiveness with which parents manage their investment portfolio, including their investment in children. Hired household help is included in some of these studies but it probably requires substantially more attention in analyzing empirically the economic behavior of parents in allocating their own time to children

who are no longer infants. I am convinced that these extensions of these models will produce additional worthwhile insights even where the empirical applications are restricted to cross-sectional data and one date in time.

Important parts of these models patently call for cross-sectional data covering in sequence several dates encompassing the family life cycle from marriage and presumably until the children are really on their own, inasmuch as most of the investment in children made by parents occurs after the childbearing period is over. In this endeavor, it will be necessary to account for the savings and the accumulation of assets by the household-family along with the borrowed funds that the family acquires, thereby enhancing the current resources it has available, resources that are used in part to purchase labor-saving consumer items and in part to finance investments in the quality of the children.

As we proceed beyond the stationary economic state, we enter an uncharted frontier. Our analytical maps do not tell us how to proceed. The typical family that we observe, especially in rich countries, lives and has lived in an economy in which economic conditions are and have been changing substantially over time. As these changes occur, thinking in terms of economics, there presumably are responses—responses in the age at which marriage occurs, responses in spacing and numbers of children, and responses in the amount of family resources devoted to investment in children. Furthermore, before these families have fully adjusted and have arrived at an equilibrium with respect to any given economic change, additional unexpected changes will have occurred. Thus, the families we observe are seldom, if ever, in a state of economic equilibrium. This uncharted frontier is beset with all manner of disequilibria. Economic theory, capable of coping with them in the family context, is very much wanted.

It is, of course, possible to improvise by endeavoring to analyze each of these major changes one at a time and, in doing so, abstract from the other changes. Admittedly, there are severe limitations to this procedure; it may, however, provide enough additional information to apply a comprehensive simultaneous economic model encompassing family decisions over the life cycle under changing economic conditions.

In my thinking, research priority should be given to the economic attributes of the following changes to determine the extent to which they influence marriage, fertility, and investment in children: (1) improvements in the technology of contraceptive goods and services reckoned in terms of their effectiveness and their cost to the family; (2) improvements and the declines in the price of labor-saving consumer items; (3) changes in the economic opportunities of investing in the education of children; (4) changes in the labor-market opportunities (*a*) for women and (*b*) for teen-agers; (5) changes in the reduction in labor-market earnings that are a consequence of the curtailment of on-the-job training during the

period when women leave the labor force to bear and to take care of a child (children); (6) the decline in the cost of reducing infant mortality, a change that currently characterizes mainly the developments underway in poor countries; and (7) the changes in the location of job opportunities associated with economic growth that require geographical migration of youth and of established families (T. W. Schultz 1972a).

As a framework to guide one's thinking in accounting for these various economic changes over time and the economic interactions among them, a model of the type developed by Marc Nerlove and T. Paul Schultz (1970) is an appropriate instrument in charting this frontier. In my view, the empirical usefulness of this model, however, is dependent upon our acquiring a substantial amount of new information with respect to each of the major changes that I have listed.

## **II. The High Value of Human Time: Population Equilibrium**

A child, as the studies in this book show, is doubly time intensive. Having and rearing a child entails much time on the part of the mother. Enjoying the pleasures derived from a child also requires much time. Thus, in the impersonal language of economics, a child is a labor-intensive entity in terms of costs (sacrifices) and also in terms of consumption time. Moreover, although modernization has contributed much to increasing the value of human time, and in spite of all the advances in knowledge and all of the new techniques used in household production, children continue to be highly labor intensive for parents and, especially so for women, whether they live in poor or rich countries. Herein lies the lesson of this part of my paper.

My aim is to develop the basic underlying propositions on which Nerlove's paper at the end of this volume rests. Since his approach to the high price of human time parallels my recent work, as he notes, my analysis complements his. I shall first consider two widely different population equilibrium concepts; in support of the second concept I shall extend the explanation of the secular increases in the value of human time. I shall then take a critical look at the usefulness of the household model in analyzing the fertility in countries characterized by high birth and death rates and by substantial increases in national income in a context where the level of the economic value of human time is very low and not increasing much.

### **A.**

The idea of a population equilibrium is here viewed strictly as an analytical concept to guide economic thinking in deriving testable propositions

pertaining to fertility. As an analytical device there is no presumption that any population ever has arrived or will arrive at a precise equilibrium. In this respect the concept of a population equilibrium is on a par with the many other equilibrium concepts that abound in economic analysis.

Two very different concepts of a population equilibrium can now be formulated. They may be viewed as types at the two extremes with respect to the state of the economy. The first rests on the proposition that the equilibrium is basically a consequence of increases in the price of the services of natural resources relative to capital and labor (wages). The underlying proposition of the second concept is that the equilibrium is determined predominantly by increases in the price of human time relative to that of materials. The per capita income implication of the first is subsistence and that of the second a high standard of living.

The first concept, as it was envisaged by the early English economists, has long been a standard part of economics. It assumes that the supply of land is fixed and that diminishing returns gradually increase the price of food as a consequence of population growth. Gains in productivity from capital are exhausted by this process. This concept can, of course, be extended to encompass the results of the recent macrosystem models that purport to show the limits of the earth in accommodating population growth. These models are not restricted solely by the availability of land to produce food, since they also include the physical limits set by the availability of minerals, energy, and space for people. The fertility behavior of people in these models is crudely Malthusian; population growth stops (suddenly) as a consequence of the inevitable food, energy, and space crisis. Within the Ricardian framework, this concept is a logical conception of a population equilibrium. It is a dismal view of human behavior that has long been an important idea in social thought.

The foundation of the second concept is the high price of human time relative to the price of the services of material factors and goods. The concept rests on the proposition that the state of the economy is such that the economic role of the services of natural resources and of intermediate material products is small relative to the role of the services of human agents in production and in consumption, in the sense that the value of the contribution of materials to human satisfactions is small compared with that of human agents. In the context of such an economy, the opportunity costs of bearing children is high and the investment in their human capital is large. The welfare implications of this concept are unmistakably optimistic because the gains in productivity from the accumulation of human and nonhuman capital are transformed into high standards of living supported by high per capita income. Advances in useful knowledge, embodied in human and nonhuman capital, have gradually destroyed the assumption of the fixed supply of the "original properties of the soil." In the process, it is the scarcity of human time and its high value that dominate, and it is the "fixed supply of human time"

consisting of 24 hours per day and of a man's lifetime that becomes the critical factor in analyzing the economic behavior of people, including their fertility.

Empirically, there is an abundance of evidence which shows that the price of human time accounts for most of the costs in a modern economy. The upward tendency of real wages and salaries, including fringe benefits, of earnings foregone by mature students, and of the value of the time of housewives relative to the price of materials is well documented.<sup>7</sup> Economic theory implies, and we observe, that material goods are substituted for human time by firms and by households. Received theory, however, is silent on the effects of the high and rising price of human time on pure consumption, although consumption obviously entails time. In my thinking, the ultimate economic limit of affluence (economic growth) is not in the scarcity of material goods but in the scarcity of human time for consumption.<sup>8</sup>

Theoretically, the critical postulate assumes that there is a dynamic process that determines the increases in the price of human time relative to the price of the services of the nonhuman factors and that this process tends toward an equilibrium. The dynamic part is the economic key to the following four issues: (1) the relative increase in investment in human capital augmenting the quality of human beings, (2) the relatively high price of all labor time-intensive goods and other sources of labor-intensive satisfactions, including children, thus leading to the substitution of quality for numbers of children, (3) the relatively cheap material goods that are not labor-intensive, and (4) the scarcity of the time for consumption, setting the ultimate limit to the satisfactions that can be derived from materials provided by economic growth.

Although it is obvious that the economic value of human time is high in the affluent countries that have a modern economy, it is not obvious why these economies have developed the demand for and supply of human abilities that have such a high value in terms of earnings and satisfactions that people derive from them. I shall elaborate on these developments (see T. W. Schultz 1972*b*, 1973) and examine some of their basic aspects.

My approach to the persistent secular increase in the economic value of human time consists of a highly simplified framework to get at the supply and demand developments that appear to be determining the rise

<sup>7</sup>Evidence, for example, on long-term changes in wages and salaries relative to rent paid for the services of farmland in the United States shows that the total real compensation per hour at work of all manufacturing-production workers increased between 1929 and 1970 more than twice as much as did the rent on farm real estate per acre, similarly adjusted, under the assumption that rents tended to parallel the changes in the price of farm real estate per acre (T. W. Schultz 1972*b*).

<sup>8</sup>The approach outlined in this paragraph and a considerable part of the argument that follows appear in my Woody Thompson lecture to the Midwest Economics Association, "Explanation and Interpretations of the Increasing Value of Human Time" (T. W. Schultz 1973).

of the price of human time in the context of the modernizing processes. The developments explaining the increases in the supply of the quality attributes of human agents are fairly clear, whereas the developments underlying the increases in the demand for these quality attributes are still not clear. Recent advances in economic analysis (summarized in T. W. Schultz 1972a) provide the major parts of the theory for determining the supply of these quality attributes. They treat the useful abilities that people acquire as forms of human capital. The investment in these abilities is taken to be in response to favorable investment opportunities, and thus the increases in the supply depend on current expenditures (sacrifices) made by individuals, by families, and by public bodies on education, health, job training, the search for information, and geographical migration to take advantage of better jobs or of better consumption opportunities. These expenditures (sacrifices) are presumably made deliberately with an eye to future satisfactions and earnings. The theory of the allocation of time and the household production model are of special importance in analyzing the incentives and responses of people in acquiring education and job training, in enhancing their health, in searching for information, and in altering their fertility, including the substitution of quality for numbers of children. Thus, these supply responses to the increases in the economic incentives associated with modernization are not hard to comprehend. The human capital literature abounds with studies dealing with aspects of these supply responses.

But these human capital studies have not explained the secular increases in the demand for these quality attributes of human agents. The clue to this unresolved puzzle is concealed in two basic factual issues. The first of these is that diminishing returns to capital have not occurred generally, despite the vast accumulation of capital in the advanced economies. The second is the relatively high rate at which the formation of human capital has occurred. Of the two, the first is fundamental, and the resolution of it provides a solution for the second. In my thinking, the key to both is in that part of the economic process that increases the stock of useful knowledge.<sup>9</sup> It is the acquisition, adoption, and efficient utilization of this knowledge that have provided *the decisive new sources of investment opportunities* that have maintained the growth process and have kept the returns to capital from diminishing over time. Furthermore, these additions to the stock of knowledge have been relatively more favorable in increasing the investment opportunities in the quality at-

<sup>9</sup> Simon Kuznets in his Nobel Prize lecture, which appeared in the June 1973 *American Economic Review* under the title "Modern Economic Growth: Findings and Reflections" (Kuznets 1973), also attributes a major role to the additions in knowledge in this context. He argues that the last two centuries have been periods during which there has occurred "enormous accumulation in the contribution to the stock of useful knowledge by basic and applied research" (p. 251).

tributes of human agents than in the quality components of material agents of production. The investment incentives that are revealed by the inequalities in these investment opportunities, as they occur over time, are the mainspring in this process.

In an all-inclusive view of these investment opportunities, the knowledge-producing sector must also be included. It is not a trivial sector in modern countries, nor is it exogenous. Research is an organized activity that requires specific, expensive, scarce resources. Although research is costly, recent studies, most of them devoted to analyzing the rates of return to investment in organized agricultural research, show very high social rates of return.

With respect to this investment process, economists could have been spared much aimless wandering had they perceived the implications of the concept of capital as Marshall sketched it for us. His predecessors had formulated the concept of the "state of the productive arts," and they then proceeded to develop the core of economic theory under the assumption that these arts remained constant. It was an ingenious simplification, and their theory was in general relevant to a wide array of problems of their day. But industrialization undermined this simplifying assumption, and Marshall saw it clearly and cogently. In his treatment of the agents of production, he extended the concept of labor to include work with our hands and our heads. It should be noted with care that his concept of capital "consists in great part of knowledge and organization; and of this some part is private property and the other part is not. *Knowledge is our most powerful engine of production. . . .* Organization aids knowledge. . . . The distinction between public and private property in knowledge and organization is of great and growing importance: in some respects of more importance than that between public and private property in material things."<sup>10</sup> In not seeing the implications of Marshall's remarkable insights, economists have wandered for years in the wilderness of capital confined to material goods.

Thus, in a nutshell, the persistent increase in the demand for the high-quality services of human agents is a function of the additions to the stock of useful knowledge.<sup>11</sup> The complexities of the additions to this knowledge have been much greater in recent, modern economic growth than during early, relatively simple industrialization. The rate at which the stock of useful knowledge has increased has also been higher than the rate at which it grew during the early stages of modernization.

This approach has broad integrative power in that it provides a unifying

<sup>10</sup> Marshall (1930, bk. 4, chap. 1, pp. 138-39); the italics are mine.

<sup>11</sup> The argument in support of this summary statement appears in previous works (T. W. Schultz 1972b, 1973). It is anticipated in chaps. 1 and 2 in my *Investment in Human Capital: The Role of Education and Research* (1971). Chapter 12 treats the "Allocation of Resources to Research."

principle for a consistent explanation of the allocation of investment resources encompassing both human and nonhuman capital as modernization proceeds. From it we derive important empirical implications that can be tested against data. It implies that the value of human time increases relative to the cost of investment resources.<sup>12</sup> It implies that the relative share of national income accruing to labor increases over time.<sup>13</sup> It implies that there is a special premium for the allocative ability of both males and females in managing firms<sup>14</sup> and households and in allocating their own time, including investments in themselves. It also implies that as the value of the time of mothers increases, fertility declines.<sup>15</sup> These implications are derived from the dynamic process, not from a model of the economy that has arrived at a general equilibrium.

The concept of a general economic equilibrium in this context is necessary, however, as an analytical guide. It is an assumed economic state toward which this modernization process tends. Given this state, there would be no inequalities among investment opportunities. The high price of human time would be stable in the sense that it is no longer increasing relative to other factor service prices. There would be no incentive to make additional investments in human capital or in the knowledge-producing sector, as a consequence of the completion of the modernization process, and advances in knowledge would no longer augment the productivity of human time within firms and households; presumably, virtually all of the value added in production would be contributed by the input of human time. The basic economic constraint that determines the upper limits of modernization (economic growth) in this equilibrium model is the increasing scarcity of human time for consumption. The underlying logic can be put very simply: modernization increases the consumption stream; consumption requires human time; advances in knowledge, whether they are embodied in material capital or in human capital, are severely limited in the extent to which they can alleviate the scarcity of human time for consumption.

For the purpose at hand, the bearing and rearing of children is a very labor-intensive activity; the satisfactions that parents derive from their children is a large part of their "standard of living," and the process of

<sup>12</sup> A simplified approach to this implication is to treat the cost of investment resources as constant under the assumptions that the "normal" long-term real rate of interest remains constant and that, from an increasing amount of capital embodied in human beings, people derive earnings and satisfactions commensurate with the going rate of interest.

<sup>13</sup> As the earnings from the increasing stock of human capital rise relative to income acquired from property assets.

<sup>14</sup> As a consequence of the dynamics of the economy, the premium for allocative ability, distinguished from the ability of people to do useful work, is substantial (see Welch 1970; Fane 1972; Huffman 1972; Khaldi 1972).

<sup>15</sup> Nerlove's subtle and incisive treatment of the interactions between the high value of time and fertility lays the groundwork for new thinking with respect to this important implication.

enjoying these satisfactions requires much time, the economic value of which, in this context, is very high.

### *B.*

Turning to fertility behavior in the low-income countries, the household model as it now stands has not been developed to treat the particular classes of circumstances that constrain the household in these countries. These are countries in which illiteracy abounds, human time is cheap, and the income opportunities that women have outside the home are mainly not jobs in the labor market. Furthermore, infant mortality is high, life expectancy at birth is low, debilitation during the adult years is substantial for reasons of inadequate nutrition and endemic diseases, and the availability of modern contraceptive techniques, including information about them, is, in general, wanting. These classes of circumstances are not as yet at home in the household model.

The difficulty here is not that economic theory is pointless in explaining fertility behavior in the low-income countries. On the contrary, in principle basic economic thinking is fully as applicable to the poor as it is to the rich countries. As a case in point, I have long argued (T. W. Schultz 1964) that the theory of the firm is analytically as powerful in the allocation of resources of poor, small, illiterate farmers in the less-developed countries as it is in determining the allocative efficiency of farmers, say, in Iowa. The usefulness of this theory is now widely recognized because of many recent successful applications. The same argument holds for a fully developed theory of the household. As yet, however, the part of this theory that has been applied to the United States, Israel, and Japan is a special and narrow part of what I envisage as a general theory of the household. Once the additional parts of this theory have been formulated, its usefulness in analyzing household activities in low-income countries will not be in doubt, assuming that it is also extended to treat the effects of economy-wide dynamic development.

Households in low-income countries perform, in fact, a substantially larger economic role than they do in high-income countries. The value of home production is not only large relative to the total family income, it is also produced predominantly by family labor and only in small part by purchased inputs, because in low-income countries the purchased material goods that households can acquire are very high in price relative to the economic value of the time of members of the household. With regard to the costs of children, children are labor-intensive during their infancy regardless of the country's level of income. In low-income countries, however, the mother's time is cheap in a context where health services, nutrition, and education for the children are dear. The satisfactions and producer services that parents derive from their children are in large

measure from an assured number of children to provide help for household work and for family endeavors consisting mostly of farm work and to provide food and shelter for the parents during their old age and only in small measure from human capital that enhances the acquired quality of children. These particular economic constraints on the household are not treated in the part of the theory that has been applied in these fertility studies restricted to rich countries.

As an overview, the interactions between the changes in the economy and the economic role of the household including fertility are probably more important in most of these developing countries than in the advanced countries. With respect to which of the two concepts of a population equilibrium is the more relevant in guiding our economic thinking in explaining the fertility behavior in the low-income countries, my view is that it is the second concept. My reason for opting for this concept is that the now-popular doomsday literature is not a valid characterization of the direction toward which the economy of such countries is moving. The crude Malthusian view of fertility does not apply; these countries are not headed toward a population equilibrium that is being imposed on them by diminishing returns from natural resources. Per capita income is in general not falling in these countries. Measured in terms of living conditions, there are appreciable gains, as is evident from improvements in health and from longer life expectancy. Moreover, birth rates are falling and substantially so in an increasing number of low-income countries. Although they are far from arriving at the second type of population equilibrium, they are moving toward it, and it is therefore analytically the relevant concept.

In the first part of this paper I expressed my concern that our estimates of the price and income effects on fertility may be subject to considerable error for reasons of changes in the economy over time, changes that are not taken into account in these studies. The changes that are taking place in the low-income countries appear to me to be even more important than those in the developed countries, and if this is true, it will be imperative to extend our economic approaches in ways that will make these changes an integral part of the theory and its application. The most pervasive change is in the improvement of health. Estimates of life expectancy from time of birth are rising at a high rate relative to the further rise in the rich countries. The decline in infant mortality must have important fertility implications. Along with somewhat better nutrition, the marked decline in debilitating diseases during adulthood must have some price and income effects on household activities, including fertility. The fact that in some parts of poor countries, in the Punjab of India, for example, many girls are now enrolled in schools is an important change in this context. Then, too, there is some progress in increasing the supply of information about modern contraceptive techniques and in subsidizing the supply of contra-

ceptives. While all of these changes are occurring, the quality of the labor force is slowly rising as is the value of human time.

One measure of the fruitfulness of these studies is in the agenda of unfinished research that the papers and comments produce. There is a couplet by Robert Frost bearing on research. Let me paraphrase it:

We sit around the circle and suppose  
The Secret sits in the middle and knows.