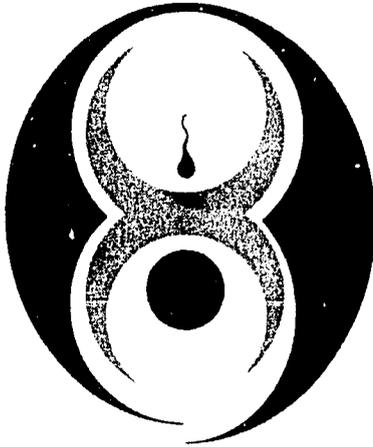


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# **The Relationship of Fertility to Income and Wealth in Rural Development**

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**Conducted by  
Research Triangle Institute  
and  
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THE RELATIONSHIP OF FERTILITY TO INCOME  
AND WEALTH IN RURAL DEVELOPEMNT

BY

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## FOREWORD

This report is part of a series of State-of-the-Art Papers called for under AID Project 931-1170, Rural Development and Fertility. The Project was designed to assist AID officials, overseas and in Washington, to comply with the mandate included in the 1975 Foreign Assistance Act, Section 104d. That section stipulates that "(1) Assistance ..... shall be administered so as to give particular attention to the interrelationships between (a) population growth, and (b) development and overall improvement in living standards in developing countries, and to the impact of all programs, projects, and activities on population growth. All appropriate activities proposed for financing under this chapter shall be designed to build motivation for smaller families through modification of economic and social conditions supportive of the desire for large families, in programs such as education in and out of school, nutrition, disease control, maternal and child health services, improvements in the status and employment of women, agricultural production, rural development and assistance to the urban poor." The amendment to the FAA continues to authorize the President "...to study the complex factors affecting population growth in developing countries and to identify factors which might motivate people to plan family size or space their children."

These papers examine the extensive literature which encompasses rural development and fertility relationships. Seven State-of-the-Art Papers (SOAPs) were produced: addressing the primary determinants of fertility. From this research base the second phase of the project will "...study the complex factors affecting population growth..." in operational settings, particularly through the medium of project implementation. Case studies will be designed to examine development in rural areas and to isolate the fertility implications of changes in the socio-economic environment. Translating the results of this investigation to decision makers in developing nations and within donor organizations is also

a primary goal of the Project. In addition to publications, a series of seminars, workshops, and intensive technical assistance in participating countries are planned as part of an outreach component of the Project.

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The SOAPS reflect the comments of the review panel: however, responsibility for content rests with the authors.

## INTRODUCTION

The backdrop for this paper of course is rapid population growth occurring in less developed countries. More recently there has been a significant decline in world fertility including that of LDCs, which, however, remains at high levels. Whether such declines will continue is a matter of some moment.<sup>2</sup>

It is commonly believed that demographic variables have important consequences for the economic growth of less developed countries. But it is also important to identify the effects of income and wealth on population growth for at least three reasons:

1. to forecast population growth,
2. to determine the susceptibility of population growth to public policy measures including those that affect the growth and distribution of income, and
3. to lay the groundwork for determining that part of the causal relation running from population to economic growth.

These are the motives for the present paper. The interrelations of fertility and income as they affect the presence, speed, and certainty of fertility change will be examined here with special attention to their implications for the design of rural development programs.

Part I will review the principal analytical approaches in use today on the effect of income and wealth on fertility followed by evidence bearing on them. This will serve as a reference point for discussion of how rural development activities effect fertility in Part II. There will also be occasion to discuss the effects of high fertility on development. Part III summarizes the findings and promising areas for further research. We have deviated somewhat from the general format specified for the present series of papers by including references to specific regions in our main sections. Most of the the theoretical and empirical formulations appear to have some relevance to all geographic regions, although in varying degrees. We shall indicate those instances where a hypothesis has been tested for only one geographic region.

<sup>1</sup>Statistical analyses of the decline are found in Mauldin and Berelson (1978) and Tsui and Bogue (1978). For other references, see Brackett et al. (1978).

<sup>2</sup>For a guardedly optimistic interpretation and forecast, see Bogue and Tsui (1979a).

## I. ANALYTICAL APPROACHES TO THE EFFECT OF INCOME AND WEALTH ON FERTILITY

The choice of models largely reflects the relationships one thinks are operative. In the case of fertility models we note a characteristic, if not desirable, communications flow that has affected research outcomes. Sociologists speak to economic theorists. Those economic theorists who do not listen speak to econometricians. Econometricians speak only to themselves. And God plays dice with their regressions. Not desirable, perhaps, but understandable. One objective of this paper will be to fill in some gaps that have resulted and provide suggested research strategies.

### A. Theories of Fertility and Income/Wealth

It is convenient to consider the demand for children (as consumer goods and as investment goods) and the supply of children in the household production function. A few studies review or synthesize more than one of these approaches (Cochrane, 1975; Robinson and Horlacher, 1971; Leibenstein, 1974; T.W. Schultz, 1974a; Razin and Ben-Zion, 1975; Fulop, 1977; and Easterlin, 1978). A summary of the different frameworks follows together with a discussion of their implications and applicability to LDCs. We state from the outset that the models we shall consider are formal, abstract, and highly simplified representations of the real world. For that very reason, however, we regard them as powerful tools for the analysis of difficult problems that would be even less tractable otherwise. In addition, most of the results can be given a reasonable commonsense interpretation.

#### 1. The Demand for Children as Consumer Goods<sup>1</sup>

Becker (1960) has been cited with pardonable, although obvious, exaggeration as "probably the first statement of an economic theory of fertility"

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<sup>1</sup>Useful statements of the theory are found in T.W. Schultz (1974), T.P. Schultz (1978a), and Keeley (1975).

(Robinson and Herlacher, 1971:20) or, at any rate, a common ground for subsequent work.<sup>1</sup> Becker treated children for analytical simplicity as consumer durables who yield a flow of services and utility to parents (at least some of the time). Parents weigh the expected utility of additional children against the cost of producing and rearing them. The distinction may be made between child quantity (the number of children parents have) and child quality (the characteristics of the child that yield utility to parents). For a given set of prices, child quality might be measured in part by parental expenditures per child, since such expenditures presumably increase the utility of the child to the parents. Parents choose the combination of child quantity, child quality, and non-child expenditures that maximizes expected utility subject to the household income constraint and externally determined prices. If children are normal goods, an increase in household income would lead to an increase in the number of children demanded by relaxing the budget constraint. The income elasticity of demand for children<sup>2</sup> might, however, be expected to be small like other durables (cars, houses, refrigerators), even as the total expenditure on children for such items as better food, clothing, housing, medical care, and education was relatively responsive to income. But rather than a small positive relation, an inverse relation was commonly found for income and fertility (or child quantity). Becker attributed this to greater contraceptive knowledge and access of higher income groups, which in effect lowered the cost of fertility control to them. In support of his interpretation, he presented a number of findings of a positive

<sup>1</sup>One significant precursor emphasizing socioeconomic relationships to fertility is Leibenstein (1957).

<sup>2</sup>An elasticity is the percentage change in one variable resulting from a one percent increase in another variable. It measures how responsive the first variable is to the second. The algebraic sign of the elasticity indicates a positive or inverse relation. In this instance the income elasticity shows how much the average number of children parents had would respond to income.

relation within groups that might be presumed to have the same contraceptive knowledge, based on, for example, education, occupation, or family planning practices. Sociologists were neither amused nor convinced (Blake, 1963). Nonetheless, it was too late to turn back.

A major contribution of the approach, which came to be called the New Home Economics, was the incorporation of fertility, now seen as a derived demand for children, into the standard economic theory of household behavior, which depended on price, income and tastes. In the economic analysis of fertility there followed an intense study of the various price effects, a revision of the income effect, and a narrowing of the unexplained residual attributable to taste.<sup>1</sup> Again the contribution of Becker was seminal (Keeley, 1975). The income constraint was interpreted more broadly as a household production function such that households produce for the market but also in the home through the inputs of their time and market-purchased resources (T.W. Schultz, 1974a). Socioeconomic factors could here be seen as affecting the household production technology and through it such non-marketed "commodities" as health, child quality, and child quantity. Households then maximize utility subject to the constraint of "full income," which includes nonlabor income, and the total value of parent time in market and non-market activities. A fruitful application of this approach was in explaining that women with higher wage opportunities might be expected to substitute market work for child quantity, given the time required

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<sup>1</sup>This interpretation of tastes appears in T.P. Schultz (1976a:94).

of mothers for raising children. Of course the income elasticity of child quantity would have to be low (enough) for the substitution effect to dominate, but this seemed a plausible assumption. Education of women might then lower fertility by raising their labor-market productivity and wage rate (T.W. Schultz, 1974a).

The concept of the household production function makes it difficult to speak of a "pure" income effect that leaves relative prices unchanged. A wage-rate change will produce substitution effects between market- and household-production as well as income effects. Nonetheless, because men in most areas of the world are primary income earners in a family and devote less time to child care than women, the simplifying assumption is typically made in the empirical literature that the husband's occupation, education, and earnings are closely related to pure income (Williams, 1976). Since other papers in the series will be concentrating on labor force participation of women and costs and benefits of children, it should be mentioned here that this paper will emphasize the "pure" income effect, or, where convenient, the gross relation between fertility and income or wealth.

Another important avenue of inquiry in the New Home Economics was the relation between the quantity and quality of children. It was recognized that child quantity and quality are in some sense substitutes, but the relation between income, quantity, and quality remained unclear until the paper of Becker and Lewis (1974), although common sense made up for much of the theoretical deficiency. The aspect of their argument that we shall concentrate on shows how an increase in income can reduce desired family size if it leads to a sufficient increase in expenditures per child. Becker and Lewis pointed out that for a child of a given degree of quality the shadow (implicit)

price per child was  $q$  times  $p_q$ , where  $q$  is the number of purchased-quality units per child and  $p_q$  is the price of a unit of quality for one child. Thus, as purchased quality per child increases, the shadow price per child ( $qp_q$ ) increases even though market prices are constant. Similarly, the shadow price of an additional unit of quality for all children is  $p_q n$ , where  $n$  is the number of children per family. Thus, if  $n$  increases, this shadow price increases. (It costs more to send two children through school than one child.) This results in an interaction of quantity and quality. Suppose quantity increases "exogenously" (due to, say, a contraceptive failure). The shadow price of quality  $p_q n$  would increase, resulting in a substitution of quantity for quality. The fall in quality would produce a further fall in the shadow price of quantity with a further substitution effect toward quantity, and so on. Similarly, an exogenous increase in quality (due to, say, a change in tastes) would produce an increase in the shadow price of quantity ( $qp_q$ ), which would result in a substitution effect against quantity. This substitution effect against quantity would lower the shadow price of quality ( $p_q n$ ), produce a further substitution effect toward quality, and so on. To summarize, then, a change in quality or quantity would produce further changes in the same direction due to the interaction.

Suppose quality per child is a normal good, that is, increases with income. Then an increase in income would increase quality expenditures per child, make each child more expensive, and raise its price. Suppose too, as seems plausible, that the "pure" income elasticity for quantity (in the sense of holding constant shadow

prices) were positive but less responsive than quality was to income. The measured child-income elasticity could still be negative, since the shadow price of quantity ( $qp_q$ ) would rise with more quality expenditures per child at higher incomes and could outweigh the pure income effect. This possible negative relation was contrary to Becker's (1960) earlier argument of a positive income-fertility relation.<sup>1</sup> It is depicted in Figure 1 by the inverse relation between children per family and income. In effect the increased cost of quality per child with a rise in income could be large enough to induce parents to have fewer children even though their income was higher.

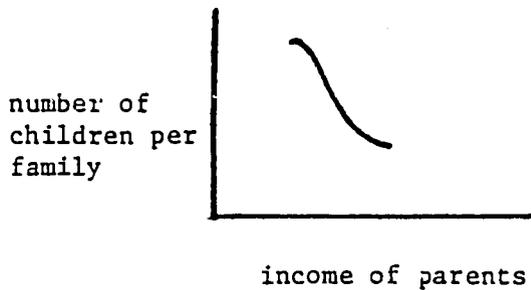


Figure 1

Becker and Tomes (1976) extended the analysis by relaxing the assumption that the quality elasticity was higher than the quantity elasticity with respect to income. The endowment per child, measured and denoted by  $e$ , is assumed to be outside the control of the parents and would include such factors as inherited ability, "luck," and public investment in children. By implication, the endowment was zero in Becker and Lewis (1974). Becker and Tomes found that with the assumption of a nonzero endowment, they

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<sup>1</sup> Becker and Lewis also offered an explanation for the U-shaped relation between children per family and income (sometimes found in developed countries). Assume that the quality elasticity per child declines as income rises as Becker and Lewis thought was plausible. The possibly negative initial effect of observed income cum-shadow-price-of-quantity on fertility would then become less important as income rose. Eventually the positive pure income effect could prevail raising child quantity with further increases in income.

could derive the same implications as before for the relation of child quantity and income even if pure quantity and quality elasticities (that is, for given shadow prices) were positive and equal. The negative portion of the curve could happen because an income-induced increase in child quality would increase the price per child but would not increase the endowment per child. Parents would have to increase their contributed portion of quality ( $q$ ) relatively faster than total quality per child ( $q + e$ ) for total quality per child to increase at the same rate as child quantity. So, there would be a substitution effect against child quantity from higher income which again could be strong enough to produce the inverse relation of family size and income.<sup>1</sup>

Becker and Tomes also considered the case where an increase in income would increase the endowment (due to, say, better public schools in wealthier communities). In effect this would make children of high-income parents relatively cheaper and make children of low-income parents relatively more expensive. As a result of such endowment-income effects, the quantity own-income elasticity would be higher than in a state where the endowment was unaffected by income. They define the latter state as one having greater intrinsic social mobility. Figure 2 illustrates the difference in

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<sup>1</sup>Nonetheless, the elasticity of purchased quality would become smaller as  $q/e$  increased and  $e$  became relatively smaller, because a given percentage increase in  $(q + e)$  could be purchased with a smaller relative increase in  $q$ . As in Becker and Lewis (1974), the pure income effect would become large relative to the substitution effect, making the observed elasticity more positive at higher incomes. Hence, an alternative explanation for the U-shaped relation mentioned in the previous footnote.

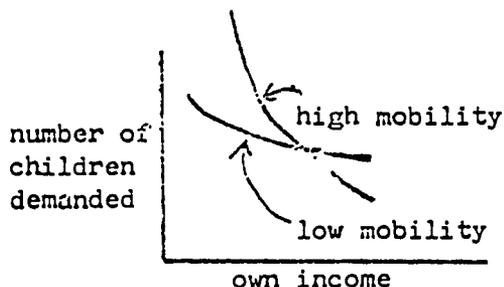


FIGURE 2

degree of mobility. The less such mobility is, the smaller the quality own-income elasticity will be, because parents will "finance" the increased non-child expenditures from their endowment.

It is not easy to draw unambiguous policy implications from the Becker-Lewis-Tomes<sup>1</sup> results, because changes in the endowment, for example through public health measures, public schooling, or free school lunches would have to be financed by someone. An analysis of tax incidence would be required to close the model. Nonetheless, the following conclusions either follow directly from their analysis, can be readily derived from it, or seem to be reasonable inferences and applications.

1. An exogenous increase in contributed quality per child, for example from better nutrition, will raise the shadow price of quantity ( $p_q$ ) and thereby produce a further substitution effect against child quantity via the quantity-quality interaction.
2. Similarly an exogenous decrease in child quantity, for example through effective birth control, would decrease the shadow price of quality ( $p_q$ ) and produce a further substitution effect toward quality.
3. Raising the endowment through public investment (health, education, etc.) would lower the parents' own contribution to quality per child.

<sup>1</sup>We forswear the obvious acronym.

Total quality per child could even fall if child quantity increased enough as a result. If the parents' contributions were tied to the endowment increase (example: school fees) or to their own fertility (free school tuition contingent on low fertility) the size of the quality increase would be larger and the quantity increase would be smaller or negative.

4. An increase in the endowment because of economic growth (child-embodied technical progress, better public health, etc.) would for the same reason lower the parents' contribution to quality and raise child quantity demanded. Thus, the growth rate as well as level of income could affect quantity demanded. One policy option would be to reduce barriers to the adoption of nonhuman capital which would increase their return relative to the return on child quantity.

5. Increased intrinsic social mobility would lower the quantity-income elasticity and raise the quality elasticity. In effect, reducing the "privileges of birth" would require that parents with rising incomes finance additional quality themselves rather than from the endowment. The increased price of quality would reduce quantity demanded (relatively) as income grew. Low-income fertility would be higher if the endowment of low-income children was relatively higher because of the high mobility.<sup>1</sup> But income

<sup>1</sup>Inssofar as increased mobility equalized the distribution of income, the impact on aggregate fertility would depend on the curvature of the fertility-income relation, discussed later. One can think of plausible cases where an increase in mobility would have this effect.

increases would lead to more rapid declines in fertility as income rose. It seems plausible, though not theoretically certain, that overall fertility would rise in the short run. It also seems plausible that income growth for the economy would lead to more rapid declines and a lower equilibrium number of children in the more mobile society.

6. Perhaps most fundamental for the analysis of the income-fertility relation, an increase in income by itself could not be expected to reduce desired family size. (Children are "normal goods" with respect to income.) Income would only have a negative effect on the number of children demanded if contributed quality rose enough at higher income levels to make the larger family too expensive. A rise in income that did result in parents substituting quality for quantity would, however, facilitate further substitutions in the same direction. With fewer children, the total cost of, for example, educating them, would be lower. Conversely, once parents go down the high-quantity road, it is harder to turn back. In countries where high population growth poses development problems, a pertinent question then becomes what incentives there are for parents to substitute quality for quantity. Income growth by itself, to repeat, would not solve the problem.

We had refrained from commenting on the theoretical and policy relevance for LDCs of the children-as-consumer-goods approach of the New Home Economics until the Becher-Lewis-Tomes analysis made this impossible. It is widely recognized and emphatically acknowledged here that the approach provides a powerful framework for analyzing fertility. But we have deliberately ignored some of its limitations as they apply to developing countries. It seems appropriate to examine such limitations in a more systematic way. These have nowhere been better described than in the introduction to the Authorized Version of the New Home Economics (T.W. Schultz, 1974b:20):

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 low 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.

He goes on to note that the assumption of economic rationality is not a shortcoming in the analysis of fertility in LDCs. On the contrary it has proved as powerful in explaining farm resource allocation in poor countries as in rich countries. But what of the household production function?

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.<sup>1</sup>

Schultz's concessions are not as devastating as they might at first appear. Some of the neglected variables mentioned, for example, high child mortality, can be easily included in the analysis.<sup>2</sup> Moreover, variables emphasized by this approach, such as income, are likely to be of interest in almost any

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<sup>1</sup>T.W. Schultz (1974b:20-21). See in the same family of remarks T. P. Schultz (1976a:104).

<sup>2</sup>T.P. Schultz (1976b).

socioeconomic framework. The other omissions indicated by Schultz are a convenient occasion for considering children as investments and the supply of children.

## 2. The Demand for Children as Investment Goods

In a certain sense the investment model of children is simply an extension of the consumption model. Considered as consumer durables, children are of course already a capital good. But the investment model further reduces the role of tastes. Everything in the consumption model of child demand continues to be valid and applicable as far as it goes, including the household production function as a constraint on child demand, the relation of market prices and household shadow prices, and the interaction of quantity and quality. The new element is that quality can now be interpreted as a source of direct utility and also discounted income. Parents are assumed to maximize intertemporal utility, subject to their intertemporal production function, market prices, and initial resources. The intertemporal dimension necessarily and to a greater degree involves expectations about the future and children as a source of income.

The simplest approach to children as investment would regard them as the only investment. In that case, parents would have children and forego own-consumption to support them. Equilibrium child quantity would be where parental consumption forgone for the last child was equal to the expected discounted value of future income from child support.<sup>1</sup> In more complex formulations, the return on alternative investments in physical capital, human quantity and quality, and financial assets would be evaluated at the margin.<sup>2</sup>

Some formal models have proved helpful in clarifying the implications of children as investment. We shall discuss three of them.<sup>3</sup>

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<sup>1</sup>Why a child would support such a parent is a good question.

<sup>2</sup>For general remarks along these lines see T.W. Schultz (1974b), Nerlove (1974), and Robinson and Horlacher (1971:23-26).

<sup>3</sup>Neher (1969), Razin and Ben-Zion (1975), and Arthur and McNicoll (1978a).

Neher (1969) considers a peasant economy where families but not individuals own land and where parents and children observe a share-alike ethic for those too young or old to work. There is no way of investing for retirement, except through children who provide old-age support. If parents are concerned with their own and their children's welfare while the parents are alive (the better to preserve the share-alike ethic) but not beyond the parent's deaths, Neher shows that with diminishing returns to labor the equilibrium population may result in overpopulation, in the sense of lowering equilibrium consumption levels. In effect, parents borrow from their children's consumption. Vesting ownership in individuals rather than families would provide an alternative to children as investment and undermine one motive for having children, since parents could now sell their land to provide retirement income. The share-alike ethic would be abandoned. Parents could sell their land to provide retirement income.

Money is also a means of transferring consumption from the working generation to the retired generation. But if the money or land market is not extended beyond the family, parents may have many children to improve the terms of trade. Even with a market, if children are good investments relative to available alternatives, parents may perceive no clear advantage in abandoning children for pension motives. With zero time-preference, the rate of return on children would be zero in equilibrium. On the other hand an interest-bearing asset would drive out children as an asset and raise per capita income as population fell. As an aside, Neher notes that risk-averting parents might overprocreate to reduce chances of starvation in old age. The extended family or social insurance could

attenuate this outcome. In sum, overpopulation could be eliminated with efficient markets and the availability of assets that yielded a positive or higher rate of return than children.

Razin and Ben-Zion (1975) extend Neher's results in a growth model context. They allow parental concern for child quality to affect population growth, introduce capital accumulation as a means of saving, and drop the share-alike ethic. Among their principal conclusions are these:

1. An increase in capital productivity tends to increase investment and lower population growth, since the return on children becomes relatively less favorable.
2. A subsidy of public investment in children will tend to increase investment in child quality with a weaker effect on the number of children. When the subsidy is financed by an income tax, consumption and population growth will decline. Income per capita will increase in the next generations because of increases in capital per capita.<sup>1</sup>
3. Technical progress embodied in labor (a common assumption of growth models to make them consistent with observed increasing real wage rates and constancy of labor's share over time) in market production will lower population growth by increasing the value of time required to raise children.
4. Increased uncertainty about the continuity of the extended family tends to increase population growth and decrease capital accumulation.

Arthur and McNicoll (1978a) consider a model of capital accumulation and intergenerational income transfers. To determine the social

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<sup>1</sup>This result may be compared with the Becker and Tomes (1976:149) conclusion discussed earlier on the endowment effect.

optimality of having children for the pension motive, they examined the effect of an increase in population growth on equilibrium life-cycle consumption. They find that the net effect, positive or negative, would depend on the sum of two factors: the intergenerational transfer effect from young to old, which could be plus or minus, depending on whether consumption transfers on balance went from young to old (plus) or old to young (minus), and the negative capital-widening effect on consumption from the increased investment that faster population growth requires to maintain a given per capita income level.

They then examine the typical life-cycle consumption and working-age patterns in developed and less-developed countries and conclude that the average consumption age is three or four years behind the average working age, which results in a negative transfer effect on lifetime economic well-being. Increased population growth therefore has an unambiguously negative lifetime welfare effect within the assumptions of their model. They note two grounds that conceivably could reverse their results. First, there is enough variation in average working ages in different countries that in a particular instance, the intergenerational effect could be positive and offset the capital-widening effect. Second, technical change that improves the quality of the new labor force could effectively lower the working age so much as to produce a positive lifetime welfare effect.<sup>1</sup> They close on the following note (Arthur and McNicoll, 1978a:246):

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<sup>1</sup>Their point is related to that of Becker and Tomes (1976) on technical progress mentioned earlier.

Grounds for intervention would of course exist if the net outcome from privately-made fertility decisions were detrimental to most of society. Typical is the situation where parents set their fertility to take most advantage of private intergenerational transfers while they pass on the capital-widening effect (for example, as under-employment) to the rest of society.

One could add that even if a positive income transfer (from young to old) occurs under existing arrangements, such transfers might be inefficient relative to alternatives that could be devised.

What can be said about these formal models taken as a whole? They add precision and rigor to arguments often made more loosely. They provide sharp partial insights into problems that might otherwise remain intractable. Nonetheless, there is an elusive quality about them. Two of the three are growth models, but they provide little insight into what Nerlove has called "the grand problem on the new home economics" the change from high- to low-fertility regimes of the demographic transition. And what of the consumer-good and investment-good models of child demand taken together? It seems clear that they leave seriously incomplete the description of fertility in LDCs, omitting as they do any mention of the supply of children. We address those two questions next.

### 3. The Supply of Children and the Demographic Transition

Some factors affecting the supply of children in LDCs were quoted earlier in T.W. Schultz's remarks. These include low life expectancy at birth, high infant mortality, endemic disease, and the unavailability of modern contraceptive techniques. Disease and life expectancy may affect fecundity and the number of years a woman is in the child-bearing ages. These also affect the likelihood that a given child will survive

through adolescence and beyond. The control of fertility and the supply of children will clearly be affected by the cost of contraceptive information and methods.<sup>1</sup> Of course, the supply of children interacts with demand to determine equilibrium. In that sense they cannot be treated independently of each other.

A comprehensive framework for considering supply and demand, is presented in R.A. Easterlin (1978), a work unusual for its catholicity in synthesizing economic and sociological theories of fertility. In it the uses of the indifference curve and budget constraint reach their zenith. We dispense with these in the interests of brevity and informality and mention only the high points as they pertain and add to the present discussion. Easterlin's model uses three concepts of child quantity: the "natural" number  $C_n$ , the desired number  $C_d$ , and the actual or optimal number  $C$ . The natural number  $C_n$  is the number of surviving children parents would have in an unregulated fertility regime, one without deliberate limitation of family size. The desired number  $C_d$  is the desired number of surviving children in a "perfect contraceptive society" where the costs of fertility regulation, both physical and psychological, are zero.  $C$  is the actual and equilibrium number of surviving children. It is determined by child mortality, by the fertility that would occur with no deliberate attempt to influence fertility (depending on health and sexual behavior), and by the costs of fertility regulation. Parents

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<sup>1</sup>Within the household production model, the supply of child services also depends on the price of inputs for child quality, but we shall neglect this more theoretically precise distinction between child quantity and quality to concentrate on the quantity aspect of child supply. We recognize that supply might be insightfully examined along Becker-Lewis-Tomes lines, although to our knowledge no one has done so.

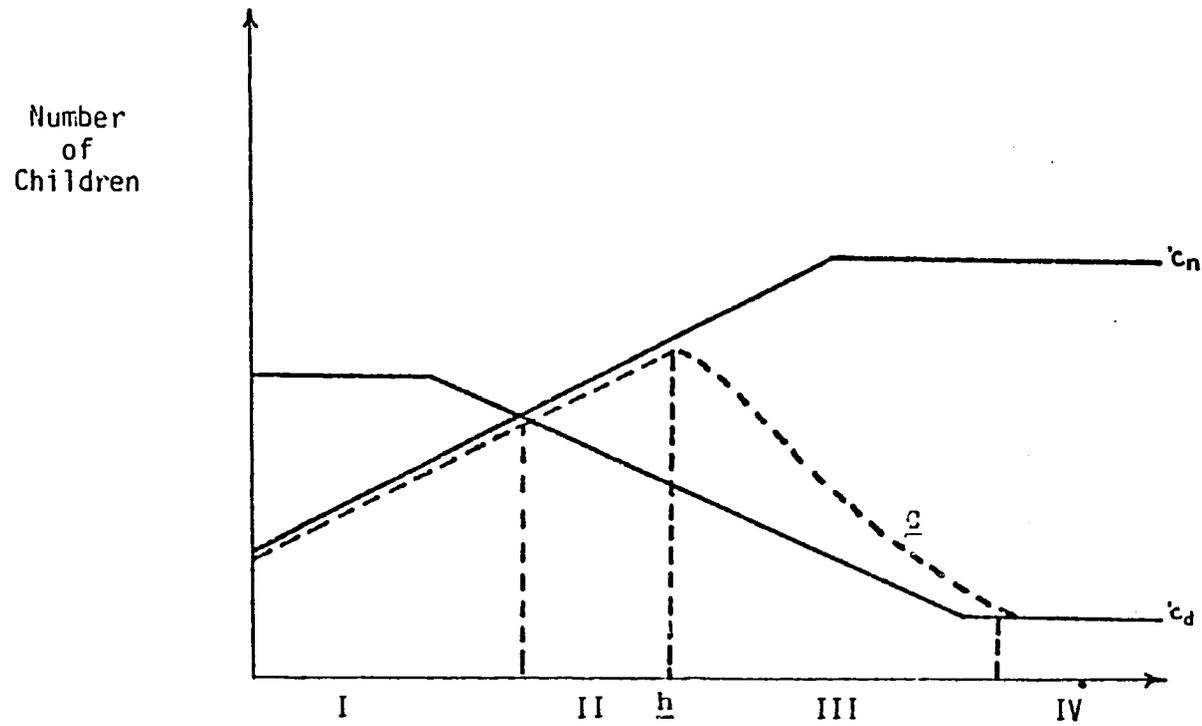
weigh such costs in determining the degree of deliberate fertility regulation they will practice. The equilibrium and actual number of children  $C$  results from maximizing utility, subject to natural fertility and the budget.

In the poorest countries poor health, poor nutrition, high mortality and sexual taboos result in a circumstance where desired number of children exceeds the natural number fertility and thus the actual number is determined by conditions of health and traditional sexual behavior. Parents have an unsatisfied excess demand for children given by the excess of  $C_d$  over  $C$ . This is Stage I in Figure 4. As development proceeds income and wealth rise along with other socioeconomic indicators.  $C_n$  may increase because of the breakdown of traditional fertility constraints and improvements in health. The resulting rise in  $C$  reduces the excess demand for children. While  $C_d$  might increase if children are a normal good (not depicted in the graph), beyond some point,  $C_d$  would be expected to decline (stage II) for a variety of reasons (Easterlin, 1978:104-18). The positive short-run income effect would eventually give way to a negative gross relation of income and number of children due to:

1. Increasing costs of education and raising children.<sup>1</sup>
2. Loss of child labor as an income source, an implicit cost of education.
3. Undermining of cultural values conducive to large family from modernization and exposure to mass media.
4. Urbanization, which would affect tastes and increase the cost of raising children.

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<sup>1</sup>T.P. Schultz (1971) and others has stressed the cost effects of education.



ECONOMIC AND SOCIAL MODERNIZATION

FIGURE 3: Easterlin's Model

- $C_d$  = children desired
- $C_n$  = natural number of children
- $C$  = actual number of children

5. Exposure to new consumer goods and techniques of fertility control, which could change tastes.

6. Fall in subjective and market costs of fertility regulation.

These negative substitution effects on child-quantity demand, according to Easterlin's analysis, eventually overcome the positive pure income effect. Why then would  $C$  (actual number of children) continue to rise in Stage II? Because of the costs of fertility control, including the fixed information cost of adopting a new contraceptive technology. Not the least of these costs might be overcoming psychological resistance to new contraceptive practices and, we might add, development of alternative social institutions and goods that would displace some traditional functions of children, such as providing old-age security and a cheap source of labor. The "excess supply" of children given by the difference between  $C$  and  $C_d$  in Fig. 3 might have to reach some threshold level of modernization (point  $h$  in Figure 3) before the fixed cost associated with contraceptive practice became feasible and fertility declined.<sup>1</sup> As Easterlin indicates, the threshold could be a function of a number of variables. In Stage III the gap between the desired and actual number of children would narrow because of the income effect in increasing contraceptive use and changes

<sup>1</sup>Kuznets (1969:163) has written, "The use of the 'threshold hypothesis' to explain this insensitivity of fertility levels to wide differences in economic and social variables may be suggestive, but... it is only that... The danger is that the hypothesis, by giving the puzzle a suggestive name, will divert our attention from the main question posed by the evidence. Why should there be a threshold and what determines its value?" For a less patient comment, see Keeley (1975:466). The advantage of Easterlin's approach is in suggesting at least conceptually the type of factors to be considered in determining the threshold.

in tastes, institutions, and price accompanying modernization, including the price of contraceptives. At Stage IV, the demographic transition would be complete. The threshold points up the paradoxical impact of modernization on population growth, with some factors tending to increase it and others to decrease it.

We digress from the main argument here to note a relation that will prove useful for the next section. In the threshold range, the simple relation between child quantity and income would tend to be concave from below in both the falling and rising portion of the curve. An important implication of the nonlinearity is that a more equal distribution of unchanged total income would raise the total number of children desired. In Fig. 4 for example, a redistribution to raise family A's income and

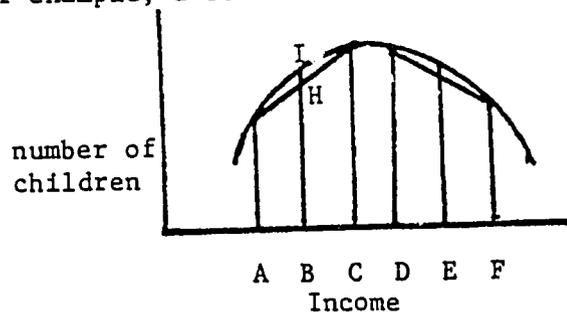


FIGURE 4

lower C's income to B would raise their combined average family size from H (the midpoint average of the cord joining B and C) to I. Similarly, a redistribution from D and F to E would raise the average number of children to the point on the curve above the midpoint cord. A partial redistribution to make income more equal would also raise average number of children but not by as much.<sup>1</sup> Of course any actual income redistribution could affect total income, either

<sup>1</sup>The same results can easily be derived algebraically (Repetto, 1976b).

positively or negatively. The effect of income redistribution on average family size depends on the existence of a nonlinearity in the relation of income and child quantity, not on the particular explanation for the nonlinearity. A relation that was concave from above would have the opposite effect with a more equal distribution of income lowering the average number of children.

For Easterlin, changes in relative prices with modernization and the fixed cost of contraception explain the threshold. In addition, he gives considerably greater weight to changes in taste in the process of modernization. This might be considered a weakness by some, but it is acknowledged by the new home economists that the static formulation of their models is itself a weakness.<sup>1</sup> Relaxing the assumption of unchanging tastes is one way of introducing dynamics into the formulation. Alternatively, attention may be focused on the substantial adjustment costs in the process of modernization. Such costs may help to explain lags in the pattern of fertility change and what can be done to accelerate adjustment.

Representatives of the New Home Economics have been mostly noncommittal on big-think theorizing such as found in the Easterlin model, preferring instead rigorous formulations at the micro level on small tractable subjects, such as marriage, children, and human capital. Two exceptions are worth noting. Again we refer to T.W. Schultz (1974b) who speculates on the factors that are or will be operative in the demographic transition in LDCs. One possibility is the Malthusian solution imposed by fixed

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<sup>1</sup>See Nerlove (1974:534-36), T.W. Schultz (1974b), and T.P. Schultz (1976a:106).

land, energy, minerals, and space. Population growth in this view will stop suddenly as a result of such constraints. In the second view the contribution of such materials is small relative to human capital. The dominant constraint is rather the scarcity of human time and the high cost of human capital. Raising children is a time-intensive activity. As the value of time increases with income, the price of children increases relative to other activities, resulting in a substitution away from children. This is the long-run limit on fertility in developed countries and the one toward which LDCs are moving, albeit slowly. Meanwhile some progress has been made in increasing the supply of modern contraceptive techniques there.

Nerlove (1974) candidly acknowledges the paradoxical aspects of the household utility function. He recognizes the possibility of considerable variation in household production and utility functions over time and across cultures, whose elucidation "must surely constitute one of the central challenges to the empirical application of the new home economics."<sup>1</sup> He conjectures that "better health and nutrition lower the costs of further investments in human capital relative to those in other forms of capital and increase the returns therefrom," which in turn increase the value of time in adulthood.<sup>2</sup> In summary form his conclusion is close to that of T.W. Schultz, but he emphasizes the cumulative intergenerational dynamics of the process as a crucial unresolved issue (Nerlove, 1974:544-45):

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<sup>1</sup>Nerlove (1974:539).

<sup>2</sup>Nerlove (1974:543).

The outlines of a revised Malthusian model begin to emerge, albeit dimly, from the foregoing conjectures and speculations. In this model, the value of human time and changes in that value over time are pivotal, and the limitations imposed by natural resources are mitigated, if not eliminated, by technological progress and increases in the stock of knowledge and of capital, both human and nonhuman. The main link between household and economy is the value of human time; the increased value of human time results in fewer children per household, with each child embodying greater investments in human capital which in turn result in lower mortality and greater productivity in the economically active years. Such greater productivity in turn further raises both the value of a unit of time and income in the subsequent generation and enables persons of that generation to make efficient use of new knowledge and new physical capital. Eventually, rates of return to investments in physical capital, new knowledge, and human capital may begin to equalize, but as long as investment occurs which increases the amount of human capital per individual, the value of a unit of human time must continue to increase. It is not possible to say whether the diminishing ability of a human being to absorb such investment would eventually stabilize the number of children per household and at what level, given the satisfactions parents obtain from numbers of children as well as their quality. Nonetheless, over time the model does predict in rough qualitative fashion declining rates of population growth (perhaps eventually zero rates or even negative rates for a time) and declining rates of infant mortality. These are the main features of the demographic transition....

Finally, the conceptual foundations of the new home economics, particularly with respect to intergenerational transfers, must be clarified if we are to understand the extent to which actual growth departs from the optimal path, the reasons for such departure, and whether collective action is either desirable or necessary to correct such departures.

The last point is the one that as we have seen Arthur and McNicoll (1978a) addressed with some empirical estimates.<sup>1</sup>

The conceptual appeal and tempered optimism of the above views should be obvious. Nonetheless, one can question the speed and strength of the factors they discuss in the present context. Will

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<sup>1</sup>A thorough review and synthesis of the earlier literature in this area is found in Robinson and Horlacher (1971). An indispensable theoretical analysis is Blandy (1974).

the value of time (particularly women's time) increase rapidly enough to have significant effects in a predominantly rural low-income economy? Schultz did not gloss over the fact that such progress was gradual. The cost of education on the other hand could have more immediate effects in encouraging lower fertility. But it could also lead to a skewed distribution of educational benefits with parents investing much in some children and using others primarily as a source of cheap labor.

The Easterlin (1978) view of the demographic transition is less vulnerable to criticism, for one reason because it includes more variables. A key variable that he examined was the fixed cost of adopting modern contraceptive methods. A common criticism of this view is that where there is a will, there is a way. Availability of modern contraceptive techniques seems to have been neither a necessary nor sufficient condition for the demographic transition in the developed countries.<sup>1</sup> Easterlin recognizes this is in noting that parents in LDCs may have an unsatisfied demand for children. The relevant question then becomes, what causes child demand to fall. There is an ample supply of plausible long-run answers to this question that we listed. One factor that may merit close examination in a rural economy was emphasized by the investment models of Neher (1971), of Razin and Ben-Zion (1975), and, implicitly, of Arthur and McNicoll (1978): the availability of alternatives to investment in child quantity, particularly interest-bearing "bonds." Large families

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<sup>1</sup>Coale (1975:351-54), Kuznets (1975:393-96), Robinson and Horlacher (1971:24-25), and Neher (1971:380).

may be the most viable short-run alternative to parents where families but not individuals have property rights to land, where young adults lack access to competitive financial markets, where parents give little weight to the economic welfare of succeeding generations, or where the return on financial assets is low. Another interpretation of "bonds" is as tangible investment in high-yielding agricultural technologies that substitute for the labor of offspring. This possibility has not been ignored in the literature (T.P. Schultz, 1971a:153):

Clearly, a principal attraction of children as instruments of investment is that a child draws upon resources when they are relatively plentiful and provides a return source of support in old age when the productive capacity of parents is meager and uncertain. Since one general motivation for savings and investment is to level out one's lifetime consumption by giving up consumption in periods of abundance to assure necessary consumption in periods of low earnings, this convenient timing of child costs and returns certainly plays a role in parent demand for children in all cultures. Nevertheless, parents have uncertain claims on their children's future earnings, even in a traditional family-oriented society; therefore, parents may discount children heavily as reliable investments for their own future support. In a stagnant economic setting where there are few opportunities for parents to invest in tangible assets, children may appear attractive as a pecuniary investment for the future. Conversely, where high returns are anticipated from tangible investments, children may be sought only to fulfill nonpecuniary needs of the parents. How parents perceive the limits of the family as an instrument for investment is modified by cultural, institutional, and legal factors, such as inheritance laws, traditional family structure and values, and customs that impinge on marriage transfers and family identity, such as dowries and bride prices.

Schultz also notes two sources of underinvestment in child quality and overinvestment in quantity: lack of enforceable claims on adult earnings of offspring and the fact that the increased earning potential of adult children may come too late for parents to fully benefit from it. The "bonds"

approach complements the emphasis on investment in human capital of the New Home Economics, which may not as directly or fully benefit parents. It provides an investment alternative to large family size and a stronger motivation to adopt contraceptive practices.

Neher (1971:389) refers to pensions where we have used the term bonds:

Pensions may help explain lower levels of fertility in urban areas where parents have easy access to highly developed financial markets for pension purposes and, perhaps for that reason, family ties are loose and life is impersonal.

If a population control problem is thought to exist, a control scheme might well include the provision of pensions by means of private or social pension plans. A combination of pensions and pills might well be more effective than pills alone.

A final dimension to the demographic transition is provided in the work of John C. Caldwell (1976, 1977) who has emphasized the structure of the large extended family in preserving the economic rationality for parents accruing from high-fertility regimes. But such family structures are highly vulnerable to cultural influences, including emphasis on the small nuclear family. Such disintegrative forces could lead to the relatively rapid collapse of the large family as a viable cultural norm, even in societies with relatively low levels of development. More recently, Caldwell (1978) has argued that the change from "precapitalist modes of production" (i.e., kin-based nonmarket methods) to "capitalist modes" (the market) will decisively change the intergenerational wealth flow from the old to the young, destroying the economic advantage of large family size. A demographic transition to low fertility would result and "occur faster than in the West because of the import of ideas, ideologies, and educational systems (and child labor laws) that reduce age and sex differentials in material advantage and ultimately further make high fertility uneconomic."<sup>1</sup>

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<sup>1</sup>Caldwell (1978:573).

The "bonds" approach considered above might be considered either necessary for or contributory to that process. We shall examine it further in Part II.

#### B. Evidence on the Relation of Fertility to Income and Wealth in LDCs

As Cochrane (1978) has maintained, in deciding which research should be included in a review, a large number of studies of varying methodological standards should be included rather than limiting consideration to those studies of impeccable methodology. The advantage of not omitting studies using a very simple non-rigorous methodology or small samples arises from the need to study the relationships between income or wealth and fertility in as broad a range of countries as possible. Given that the poorest countries are the ones with the most limited data, restricting attention to studies with large samples and rigorous methodologies would tend to give an overly limited geographical distribution to our review.

In our review of the evidence on the approaches summarized above, we shall consider in turn the short-run and long-run effects of income and wealth on fertility; the tradeoff on quality and quantity; and children as investment. Development activities directly pertaining to public policy are discussed in Part II, although much of what follows has considerable relevance to the formulation of policy.<sup>1</sup>

##### 1. Short-run Effects of Income and Wealth on Fertility.

Simon (1977;1974) has fruitfully distinguished the short-run effects of income change from the long-run effects on fertility in LDCs. For our purposes,

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1. Earlier works that review empirical findings include Simon (1974; 1977) Mauldin and Berelson (1978), Birdsall (1977a), Cassen (1976), McGreevey and Birdsall (1974), T.P. Schultz (1974b; 1976a), Cochrane (1978), and Research Triangle Institute (1971). Encyclopedic treatments of population are found in United Nations (1973; 1975).

the short-run corresponds to variations in income holding constant technology, quality of the labor force, economic structure, and relative prices. In the long run with the passage of time, these may change appreciably. Short-run studies include cross-section studies within a country. Long-run studies include international cross-country comparisons and time series analysis. Examples of both types classified by geographic area are given in Table 1 on the next page.

In the short run, income may change over time or among families due to changes in the use of traditional inputs and distribution of productive resources. The effects of income changes in such an economy are of interest in themselves. With relative prices unchanged, it would be easier to identify the pure income effect on fertility and would provide a basis for distinguishing the substitution effect. Typically cross-section data from household or regions within a country are used for estimating the short-run effect, since prices and technology are relatively fixed under the circumstances.

The short-run effects of changes and differences in income in a rural setting at low levels of development show a reasonably consistent pattern. The initial effect of an increase in income is to decrease the death rate and increase the birth rate. One study on the effect of income growth on world mortality in recent decades estimated that perhaps 10-25% of the increase in life expectancy arose from income growth per se (Preston, 1975). On the fertility side of population growth Simon (1974:85-92) cites several types of data indicating a positive income effect. Historical statistics for England during the Middle Ages and Sweden in the eighteenth century show a strong positive relation of fertility to harvests and the real wage. Peasant landholdings from earlier European and twentieth-century experience of LDCs show that increased landholdings are associated with increased fertility.

In one case where information is available, child mortality is inversely related to land holdings which supports the interpretation of a positive wealth

TABLE 1. CLASSIFICATION OF RESEARCH ON THE RELATIONSHIP BETWEEN FERTILITY AND INCOME BY GEOGRAPHICAL AREA

	<u>Income Level</u>	<u>Income Distribution</u>
Time Series	Easterlin (1969) Nerlove and Schultz (1970) T. P. Schultz (1974a) Beaver (1975) Gregory and Campbell (1976a, 1976b) Conger and Campbell (1978)	
Cross-Country Comparisons	Weintraub (1962) Adelman (1963) Heer (1966) Friedlander and Silver (1967) Kasarda (1971) Beaver (1975)** Oeschli and Kirk (1975)** Chenery and Syrquin (1975) Gregory and Campbell (1976a, and 1976b)** Suits and Mason (1978) Anker (1978)* Mauldin and Berelson (1978) Tsui and Bogue (1978)*	Kocher (1973) Rich (1973) Repetto (1977; 1978) Bhattacharyya (1975; 1977) Birdsall (1977a; 1977b)
*Includes results disaggregated by continent.		
**Latin America		
Country-Specific Studies for		
Africa	Snyder (1974) Kocher (1976)	Bhattacharyya (1977)
Asia	Jain (1969), Jain <u>et al.</u> (1970) Harman (1970) Maurer et al. (1973) T. P. Schultz (1974a) Encarnacion (1975) Sirageldin et al. (1976) Hueller and Cohn (1977) Rosenzweig (1978)	Bhattacharyya (1977)
Latin America	Nerlove and Schultz (1970) DaVanzo (1972) Isibister (1973) Carvajal and Geithman (1976) Seiver (1976)	Repetto (1976b)
Near East	T. P. Schultz (1970) Ben-Porath (1973)	Bhattacharyya (1977)

effect on fertility. An ambiguity is whether in some instances the relation indicates that larger families tend to buy or rent more land and merely represents life-cycle changes, which would indicate a causation running from fertility to land use.

Although some studies have found little relation, Stokes et al. (1979) demonstrate that the weight of recent studies for India, Iran,<sup>1</sup> Bangladesh,<sup>2</sup> Mexico, and the Philippines and other countries is consistent with a positive relation of landownership or holdings to fertility. We may reasonably conjecture that with diminishing returns to labor, rising public health standards, or high enough general income levels, the positive relation would cease to hold. The availability of alternative investments in child quality or nontraditional technologies might also obviate the relation.<sup>3</sup> This may also be interpreted along the lines of Easterlin (1978).

Factors increasing the supply of children through increases in natural fertility and decreases in mortality could be expected to predominate in the early stages of development. Below the threshold income level a major effect of rising income is to enable women to acquire better health and to have greater access to medical facilities, increasing their capacity to bear more children. The biological and nutritional factors affecting fertility are discussed in Isely et al. (1979) in this series.

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<sup>1</sup>Ajami (1976) in his study of six Iranian villages unfortunately reports only (two-way) analysis of variance results and thereby fails to control simultaneously for duration of marriage. Latif and Chowdhury (1977) found that this deficiency materially affected the outcome of another study.

<sup>2</sup>Latif and Chowdhury (1977).

<sup>3</sup>Schutjer et al. (1978) found a positive direct affect of land ownership on children but the indirect negative effect through child education was found to outweigh the direct effect.

We shall concentrate here on the demand factors in the relation between fertility and income in LDCs. As the earlier discussions indicate, by itself an increase in income could be expected to increase child quantity but the number of children might increase, remain constant, or decrease depending on the magnitudes of the two income demand elasticities, one for quality of children and the other for quantity of children. Empirical findings are consistent with this theoretical ambiguity. We next present the salient results on child-income elasticities of demand for some intra-national cross-section studies of different countries.

T. P. Schultz (1974b, 1976a) reviews studies on the economic analysis of fertility for five low-income countries and Puerto Rico reproduced on the next page (T.P. Schultz, 1974:34). The statistical methodologies used were of relatively high quality and the theoretical frameworks were similar, facilitating (to some degree) cross-country comparisons. For these reasons the results are of particular interest. One of Schultz's tables (1974:34) appears on the next page. The education variables may be interpreted as measures of expected permanent income and the value of time for men and women. To the extent that the male labor supply is fixed in the short run, men's education would measure the pure income effect. The variables for adult education, women's education and women's wage had negative signs. This is consistent with the substitution effect of women's time dominating the pure income effect. It is also consistent with child quality substituting for child quantity with increasing income. The strength or existence of the quantity-quality substitution effect for the women's wage might provide a promising avenue for future research, since it is not directly tested here. The quality variable of most immediate interest might be child's education.<sup>1</sup>

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1. Some work has already been done on another quality variable, child mortality. See T.P. Schultz (1976b) and Taylor et al. (1976).

Table 1

## SUMMARY OF EMPIRICAL FINDING ON FERTILITY DETERMINANTS FOR LOW-INCOME COUNTRIES

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8a)	(8b)
Author (year, page)	Schultz (1971; 171)	Schultz (1970; 43)	Nerlove-Schultz (1970; 45)	Harman (1970, 24-30)	Schultz (1971; 61)	DaVanzo (1972; 80)	Maurer et al. (1973; 20-29)	Schultz (1972; 36)	Schultz (1972; 38)
Population (time)	Puerto Rico (1951-1957)	Egypt (1960)	Puerto Rico (1950-1960)	Philippines (1968)	Taiwan (1964-1968)	Chile (1960)	Thailand (1960)	Taiwan (1964-1969)	Taiwan (1964-1969)
Observations (number)	Regions (75*7)	Regions (41)	Regions (78*11)	Individuals (250)	Regions (361)	Regions (56)	Regions (71)	Regions (361*7)	Regions (361*7)
Equation (estimators) <sup>a</sup>	Reduced form (GLS)	Reduced form (OLS)	Structural (TSLS/GLS)	Structural (TSLS)	Reduced form (OLS)	Structural (TSLS)	Solved reduced form (TSLS)	Reduced form (OLS)	Reduced form (GLS)
Dependent variable	Births per 1000 population	Children (0-9) per women (15-49)	Births per 1000 population	Children ever born per women aged 35-39	Normalized births per 1000 women aged 35-39	Children ever born per 1000 women aged 35-39	Children ever born per women aged 35-39	Births per 1000 women aged 35-59	Births per 1000 women aged 35-39
Explanatory variables <sup>b</sup>									
1. Adult education	-1.58 (5.3) [0.15]	--	-1.95 (3.2) [0.20]	--	--	--	--	--	--
2. Women's education	--	-65.2 (4.0) [0.087]	--	-0.092 (1.6) [0.094]	0.422 (1.97) [1.8] <sup>f</sup>	--	-0.0926 [0.13] <sup>h</sup>	98.2 (9.2) [0.37]	-45.4 (2.78) [0.17]
3. Women's wage	--	--	--	--	--	-1589 (1.84) [0.35] <sup>g</sup>	-22.6 [0.16] <sup>h</sup>	--	--
4. Men's education	--	--	--	--	--	--	0.526 [0.55] <sup>h</sup>	-274 (16.0) [1.4]	-174 (7.9) [0.98]
5. Men's wage	--	--	--	--	--	170 (0.33) [0.054]	--	--	--
6. Death rate	1.18 (3.5) [0.27] <sup>d</sup>	--	0.302 (1.6) [0.082] <sup>d</sup>	5.76 (3.9) [1.0] [0.048] <sup>e</sup>	5.61 (9.3) [5.5] <sup>f</sup> [0.41] <sup>e</sup>	7.65 (2.77) [0.28]	--	432 (17.9) [3.9] [0.28] <sup>e</sup>	172 (8.2) [1.5] [0.11] <sup>e</sup>
R <sup>2</sup> (F; Jf) <sup>c</sup>	0.46	0.537	(27.3)	(3.5)	0.433 <sup>f</sup>	(14.4; 6.3)	(13.9; 7.4)	0.461	0.809

NOTE: After each regression coefficient, the absolute value of the t ratio is reported in parentheses, and elasticity at regression means is in brackets.

<sup>a</sup>Form of estimation equation such as reduced-form equations (only exogenous explanatory variables) which may be estimated by ordinary least squares (OLS); structural equations (including endogenous explanatory variables) estimated perhaps by an instrumental variable technique such as two-stage least squares (TSLS); solved reduced-form equations, derived from the simultaneous equations estimates of the related structural equations (generally without t statistics); and when a time series of cross sections are pooled for either a reduced form or a structural equation, estimates may be reported using a generalized least-squares procedure (GLS) that assumes a Nerlovian two-component stochastic structure to the disturbances. For instrumental variable estimates, asymptotic t statistics are reported.

<sup>b</sup>For definition of explanatory variables, including those not reported in table, see original studies.

<sup>c</sup>Asymptotic significance of entire equation can be evaluated with the F ratio when TSLS estimates are computed. See Dhrymes (1969). For OLS and GLS of reduced form equations, R<sup>2</sup> can be used to test the equation's overall statistical significance.

<sup>d</sup>Arithmetic sum of lagged coefficients, and averaged t statistics.

<sup>e</sup>Child death rate entered regression as the reciprocal of child survival rate. For comparability and ease of interpretation, the second elasticity estimates are with respect to the child death rate.

<sup>f</sup>Arithmetic average of regression coefficients, t statistics, elasticities, and R<sup>2</sup> from five annual cross-sectional regressions.

<sup>g</sup>The women's potential wage was estimated as a function of variables such as women's education, residence, and husband's occupation.

<sup>h</sup>The solved reduced-form equations are reported without asymptotic standard error estimates. The elasticity estimates for education variables incorporate also the effect of an additional nonlinear variable in male and female education--namely, the relative educational attainment of women to that of men.

T.P. Schultz (1974b:37) presents another table shown below with elasticity measures for these low-income countries in comparison with those of studies for high-income countries (all but one of them for the United States) as indicated below. The women's education elasticities are in general markedly closer to zero in LDCs than in high-income countries. The women's wage elasticity is also lower on the average. The obvious interpretation would be that child-quantity substitution effects become stronger along with perhaps need for specialization in production as levels of development rise.

RANGE OF ESTIMATES OF THE ELASTICITY OF FERTILITY WITH RESPECT TO THE CENTRAL VARIABLES IN DEMAND MODEL

Explanatory Variable	Per Capita Income Level	
	Low (Table 1)	High (Table 2)
Women's education	-0.17 to -0.06	-1.1 to -0.19
Men's education	-0.98 to +0.55	-0.4 to -0.06
Women's wage	-0.35 to -0.16	-0.6 to -0.17
Men's wage	+0.05	-0.11 to +0.23
Family income	--	+0.09 to +0.38
Mortality	+0.05 to +0.28	--

Note: Qualifying footnote has been omitted for brevity.  
 Source: T.P. Schultz (1974:37)

By contrast men's education for Taiwan and Thailand shows a much wider range of elasticities, positive and negative, than in high-income countries. The narrower range of elasticities for the high income countries is not surprising, since most of these studies are for the United States. But what explains the difference for Thailand and Taiwan (and, by extension, other LDCs as well) seems worth further study. Obvious variables for consideration aside from differences in equation specification include economic structure, the price of child-quantity substitutes and threshold effects. The one study that used men's wage rate, for Chile, found a small positive elasticity.

Tabah (1963) calculated an elasticity of completed fertility and income per worker of  $-.22$  for Chile which has a different sign from that cited by Schultz for the same country (McGreevey and Birdsall, 1974:41). Mueller and Cohn (1977) using household survey data for Taiwan found an income elasticity much closer to zero than that implied by T. P. Schultz (1974a). T.P.Schultz (1974a) found that the sign of his male education variable went from minus to plus when the model was put in first-difference form. The inconsistencies illustrate the commonplace wisdom that such estimates are highly sensitive to the data source and model (mis)specification.<sup>1</sup>

Krishnamurty (1966) found a per capita income elasticity for completed fertility of  $-.9$  for India. On plausible assumptions, however, this would appear to imply a positive relation of fertility to per-parent income.

Sirageldin et al. (1976) used results from a KAP study with a sample of 3088 in Bangladesh to estimate a simultaneous equation model of child quantity. Income had a significant positive effect. Perceived adequacy of income had a significant negative relation, which was interpreted as indicating that lower fertility would be required to maintain income adequacy. Male education and ownership of housing and land had no significant effect. Those with more sons were more likely not to want additional children. The female literacy variable had a nearly significant positive effect, suggesting that literacy increases the ability to achieve desired family size, a reasonable result for low income levels. Surprisingly, a dummy for urban residence had a positive sign, which was significant for the two-stage equation but not for ordinary least squares.<sup>2</sup>

Studies of individual economic mobility in Latin America have tended to conclude that upward mobility and movement reduces fertility (Williams, 1976:131), a finding consistent with the Becker and Tomes (1976) analysis discussed earlier.

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<sup>1</sup>DeTray and Khan (1977).

<sup>2</sup>Perhaps not so surprisingly, if improved public health in the city or reduced lactation increased natural fertility.

One of few multivariate regression studies of family size using household data for Africa revealed by our literature search was that of Snyder (1974) for 717 mostly urban households in Sierra Leone. He used a simultaneous-equation model. A measure of the husband's permanent income was positively and significantly related to fertility. Husband's education had a positive effect that approximately equalled the negative sign of wife's education. The wife's wage rate had a negative relation to fertility in conformity with the theory. But labor force participation of the wife had a positive relation to number of births, a surprising result which might indicate that high fertility necessitated labor force participation. If so, a reasonable conjecture might be that such families would be responsive to family planning. A rural dummy variable was not significant, possibly because the rural residents were only twenty miles from the city.

A study based on a survey from rural areas in Tanzania found little relation of children born to the proxy for income (whether the husband had a wage-paying job) or other socioeconomic demand variables (Kocher, 1976).

There are obviously inconsistencies in the above results but there appears to be some tendency for the implied income elasticity of both the male and female wage rate to fall,<sup>1</sup> becoming more negative values as the income level of the country increases. These studies do not, however, explicitly test for nonlinearities, the subject we next address.

A much-cited work by Encarnacion (1975) found evidence for a threshold-type nonlinearity using Phillipine household data with a sample size of more than 3000. For the entire sample, the relation of family income to fertility was negative but with a small absolute value and significant only at the 10 percent level. When the sample was broken down for those with peso incomes below P1500, the coefficient changed to a positive sign and was approximately 50 times larger in absolute value than for the aggregated equation. For those with incomes above

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<sup>1</sup>We consider education to be a proxy for the wage rate.

P1500, the coefficient was negative and barely significant but with a small absolute value.

The large-positive-then-small-negative coefficient for incomes held for urban and rural subsamples. Overall, then, fertility rises rapidly with income but falls only quite slowly beyond the threshold, as in the figure below.

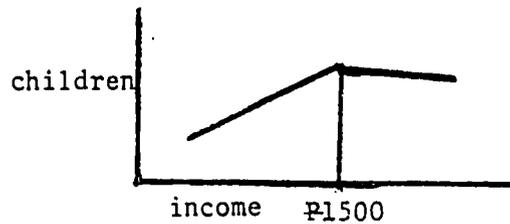


Figure 5

Education of the household head also follows an interesting pattern. For the aggregated equation, it has a positive but insignificant value close to zero. When disaggregated into place of residence, the education variable is significantly positive in the rural equation and significantly negative in the urban equation but about one-third its aggregated value. In subsamples further broken down by income level, education is insignificantly positive for urban families with incomes below P1500 and significantly negative for those above this income. For rural families education is significantly positive or (nearly so) at both income levels. To summarize, education is found to have a strong positive effect at whatever income level in rural areas. It has slight positive effect up to threshold income and then a significant negative effect in urban areas. This seems consistent with education permitting urban families to reach lower fertility goals at income levels above the threshold and permitting rural families to reach higher fertility goals.

For rural families, given that higher education is associated with more children, why does not higher income do the same beyond the threshold? Perhaps because of differential effects of education and income on health, or what seems more likely to us, substitution of child quality for child quantity at higher income levels. At higher income levels, parents may also have better investment alternatives. An equation for women's labor market participation yielded a surprising negative coefficient for women's education, the opposite of that found for U.S. data. Possibly, Encarnacion suggests, higher education and resulting wage levels produce an income effect that reduces labor participation.

Taken literally, Encarnacion's results suggest that only urban education will strongly lower fertility in the Philippines but not rural or urban income growth or rural education. One might conjecture, however, that family planning could provide a good substitute for urban education in its impact on fertility. We note that if Encarnacion's regression results for education and income in urban and rural areas are replicable for other countries (or, given the nature of the beast, even for the Philippines), they would have portentous consequences for the prospects of fertility change.

Another study using a simpler method reached a similar conclusion on nonlinear shape of the income-fertility relation (Simon, 1974:108):

A rise and then a fall with higher income has been shown in cross-section by Gupta and Malaker (1963). They classified the families in six zones of India by level of living, where level of living is indexed by the proportion of total income that a family spent for luxury items in the monthly food expenditure. Then they examined the (corrected) general fertility rate for each standard-of-living group, and found that --looking from low to high standard of living--fertility in each zone gets higher and then lower.

A quite different kind of nonlinearity is suggested by a study of Puerto Rico using simple census household data. Repetto (1976b) regressed children ever born on mother's age, household per capita income, and squared per capita

income. As a preliminary test, he disaggregated by income range. For the all but the highest income levels, (more than \$3000), he found a threshold-type concavity (that is from below) of fertility and income. Only for the lowest income levels (less than \$900) were the income coefficients significant. Not content with finding a threshold effect, he estimated the combined sample and found a relation that was concave from above, that is, the income and income squared had negative and positive signs respectively, the opposite of those observed for low income. Over the observed range, the nonlinearity occurred along a negatively sloped relation as in Figure 6.

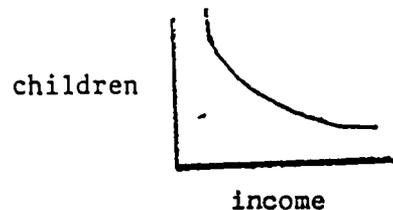


Figure 6

The nonlinearity implied that a more equal distribution of income would lower the fertility level, as indicated earlier. In particular a low-income person was found to reduce fertility twice as much as a high-income person would increase fertility if income were redistributed to achieve more equality. Repetto introduced additional socioeconomic variables. The nonlinearity effect was about cut in half but still significant. One especially ingenious variable was a neighborhood Gini coefficient, which in measuring local income inequality might distinguish whether it was absolute income inequality for the whole economy or perceived local inequality that was responsible for the nonlinearity. Neighborhood inequality had no effect.

Then Repetto overreached. He noted that the squared income term could reflect a husband's income and wife's labor participation, such as found

in U.S. studies of Sanderson and Willis.<sup>1</sup> He substituted an interaction term for the squared income term and concluded that this equation worked about as well as his original equation. An examination of the new equation, however, revealed that the goodness of fit measure  $R^2$  rose from .52 to .56.<sup>2</sup> The point is that some econometricians would give their right arms for a rise in the  $R^2$  of .04. The interaction equation seemed to explain the data better than Repetto's preferred equation.<sup>3</sup>

We have commented at length on this paper because it is a carefully reasoned test of the proposition that fertility may be reduced by greater income equality. The quality of the data used in the test was relatively good and the income levels are likely to have some bearing on the relation of fertility and income distribution in LDCs. At best, we may conclude that Repetto's study does not provide strong support for the proposition that a more equal income distribution by itself will appreciably lower fertility in the short run. The relation of fertility and wealth distribution in the form of landholdings is discussed in Stokes et al. (1979) from this series. They cite a positive relation of fertility and equality of landholdings for India (Rosenzweig and Evenson, 1977; Kleinman, 1973) and Peru (Chaplin, 1971).

Other work has found evidence of a U-shaped relation of fertility and income or education for the United States (Keeley, 1975:463; Simon, 1974:133), Israel

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<sup>1</sup>See Simon (1974:59-63; 1978:341-42) for discussion.

<sup>2</sup>He also changed some of the other variables, making the equations not strictly comparable in explanatory power for the two variables in question.

<sup>3</sup>There is another fundamental problem that Repetto (1976:25-26, 50) addressed but did not satisfactorily answer in our judgment. Repetto used per capita income coefficient downward relative to the theoretically relevant income variable, namely adult per capita income. The downward bias would occur because an increase in number of children would necessarily increase the denominator of household income per capita. Repetto ran a regression using total household income, instead of per capita income. His  $R^2$  was cut almost in half, but more importantly the t statistic of his squared income coefficient was also cut almost in half, although still highly significant.

(Ben-Porath, 1974), and Japan (Hashimoto, 1974). Indeed, such findings seem to have inspired the Becker-Lewis-Tomes theorizing. Its relevance for LDCs is, however, questionable. Available evidence, including that for Puerto Rico, points to the greater importance of the threshold relation for lower income levels. Since this tends to result in a concavity from below, the effect of pure egalitarian income redistribution would be to raise average fertility.<sup>1</sup>

Rich (1973) and Kocher (1973) provide an ample array of suggestive anecdotal material in support of income redistribution lowering fertility. These conclusions need not conflict with our findings because much of the redistribution they discuss is in kind (education, public health), which may create substitution effects in favor of lower fertility. We shall consider the long-run effect of income redistribution in the next section and in Part II.

One shortcoming of cross-section studies within a given country is that prices confronting households are the same.<sup>2</sup> This is a strength if one is interested only in how household characteristics (education, income, etc.) affect fertility given market prices. It is a drawback if one is interested in how different market prices change fertility and the income elasticity of demand. One explanation for differences in empirical results of national fertility equations is that these economies have different relative prices as well as different incomes. To understand how such prices affect fertility behavior can be important, because prices change over time as a result of changes in economic structure, demand, and public policy. Such changes distinguish the long run from the short run. Analysis of times series data within an economy

<sup>1</sup>A similar conclusion on the short-run effect of income redistribution may be reached more simply by assuming that fertility increases for low-income beneficiaries of redistributions but is little changed or high-income earners whose income is reduced (Simon, 1977:372).

<sup>2</sup>Prices may differ among regions but be difficult to measure. Or effects of migration may be difficult to allow for.

could illuminate the effects of such price changes. In practice, reliable statistics from census data might be available too infrequently or vary in too narrow range to provide an adequate data base.<sup>1</sup> Cross-country comparisons are one way of getting around these difficulties, since countries may have different relative prices.<sup>2</sup> The next section examines some of these studies.

## 2. Long-Run Effects of Income and Wealth on Fertility

Not all analysts are enamored of cross-country comparisons. T.P. Schultz (1974b) specifically excluded such studies from his survey because of difficulties in measuring relative prices, inconvertible exchange rates, cultural differences (labor force participation of women and children, for example) absence of theoretically relevant wage-rate data, and noncomparability of vital statistics, especially as to quality. In addition, he argues, the same econometric problems that plague cross-section studies within a country<sup>3</sup> "apply with greater force to cross-sectional studies which span the even greater diversity of national institutions, statistical conventions and cultures."<sup>4</sup> One could argue, however, as we have above that such diversity is an advantage because they reflect different prices, although imprecisely, and that differences in national customs are a legitimate object of inquiry in the analysis of fertility differences. For these reasons it is not obvious that the problems of using international data outweigh the potential benefits from their study.

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<sup>1</sup>Nonetheless, useful beginnings have been made in combining cross-section time-series data for Puerto Rico and Taiwan (Merlove and Schultz, 1970: T.P. Schultz, 1974a).

<sup>2</sup>See Simon (1977:326-28) for a formal reconciliation of time-series and cross-section studies as applied to fertility and income. Simon notes that including only the current value of a variable as a regressor may reflect the influence of lagged terms with which it is correlated, hence the interpretation of such coefficients as reflecting the long-run response.

<sup>3</sup>Also discussed in T. P. Schultz (1974b).

<sup>4</sup>T. P. Schultz, (1976a:99).

In his monograph on the effect of income on fertility, Simon (1974:92-93, 176-85) argues that geographical cross-section studies can tell little about the pure direct effect of income on fertility because of the danger of omitted variables, high intercorrelation of explanatory variables (which makes it difficult to estimate precisely their separate effects), and the complexity of the relation that makes it difficult to disentangle cause and effect (technically, simultaneous-equation bias). While he may be correct on some of these points, we shall examine the proof of the pudding to see what such studies can add to our understanding.

One appealing preliminary approach is to plot the relation of income to fertility as Oeschli and Kirk (1975) do in the figure reproduced on the next page. There is a wide variance of the birth rate around the curve but an unmistakable tendency for the birth rate to fall beyond a certain level of income, which is consistent with the threshold hypothesis. A logistic, rather than linear, relation seems to fit the data best. This is broadly consistent with a partial adjustment mechanism of actual fertility to desired fertility (described below). The fact that mortality falls before fertility in the two plotted curves is consistent with parents reaching the desired number of surviving adult children as income rises, an implication of the Easterlin (1975, 1978) framework described earlier. One difficulty with this approach, as Oeschli and Kirk recognize is that rising income is only one aspect of modernization and that factors other than income but associated with the rise in income might be directly responsible for the decrease in fertility.

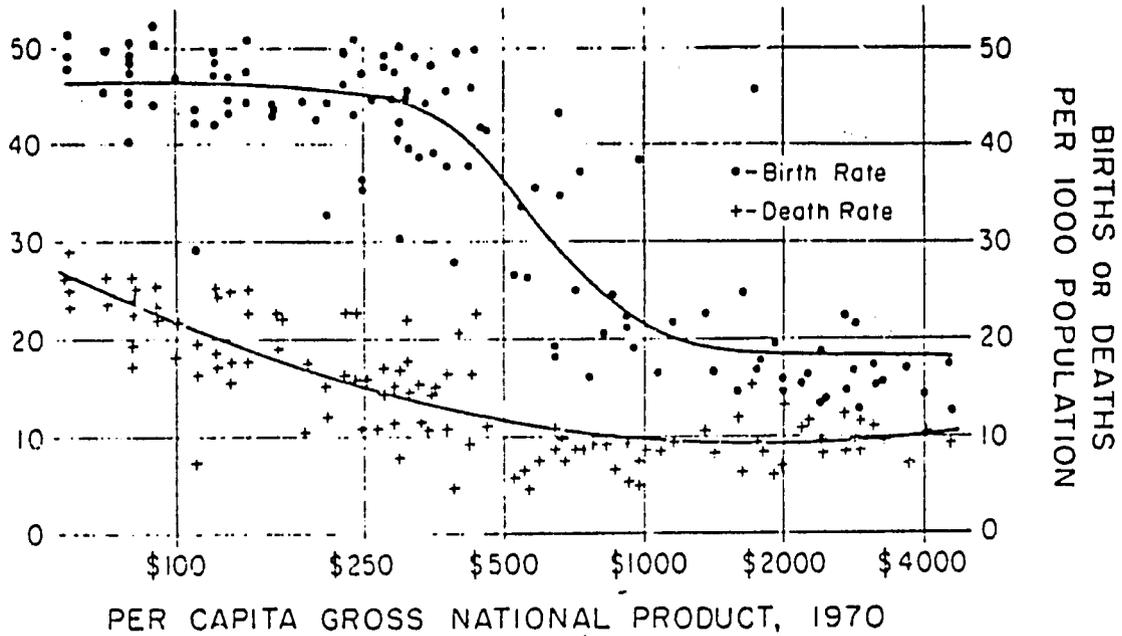
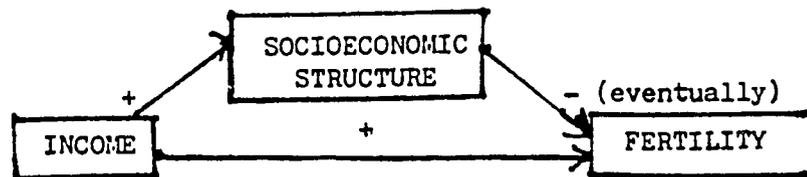


FIG. 1.-Birth and death rates vs. per capita gross national product at market prices, 116 countries, 1970.

Source: Oeschli and Kirk (1975:394)  
Figure 7

A useful schematic for distinguishing direct and indirect effects of income on fertility has been suggested by Simon (1974; 1977). The direct effect of income on fertility is positive. The relaxation of the budget constraint, fall in mortality, etc. leads parents to have more children. The positive effect prevails in the short run. The indirect effects of income increases is to change the socioeconomic structure and prices (through education, life expectancy, etc.) so as to eventually lower fertility goals. The negative indirect effects of income on fertility prevail in the long run. The overall relation is depicted below. (Other causal interactions are ignored for simplicity). Multiple regression is of course one way of attempting to separate the different direct effects.



Three recent cross-country studies of fertility reviewed below<sup>1</sup> have advantages over some earlier efforts.<sup>2</sup> First, they have relatively large samples using recent data, which tends to be of higher quality. Second, they avoid the most obvious source of simultaneous-equation bias by using either lagged independent variables or simultaneous-equation methods. Third, they explicitly consider supply factors by means of a family planning variable. Fourth, they exclude developed countries from their samples, which might have quite different fertility patterns from those of LDCs. Tsui and Bogue (1978) regress the 1975 total fertility rate (TFR) on the 1968 values of TFR, per capita GNP, infant mortality, percent of females employed in agriculture, female school enrollment, and family planning effort. Their explanation for using 1968 TFR is to adjust for the previous fertility level. The other terms are lagged because it may take time for them to have an effect on TFR.<sup>3</sup>

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<sup>1</sup>Tsui and Bogue (1978), Mauldin and Berelson (1978), and Anker (1978).

<sup>2</sup>For a convenient tabular review of 21 earlier studies, see Mauldin and Berelson (1978:133-39). Some reviewers have been impressed by the apparently conflicting results of cross-country studies on fertility and income with different studies reporting positive or negative associations (Simon, 1974: 92; Williams, 1976:131). We believe that many of the ambiguities can be resolved through proper equation specification and distinguishing between the long run and short run and between direct and indirect effects of income.

<sup>3</sup>A tolerant econometrician might with characteristic clarity describe their equation as a recursive reduced form of supply and demand factors, which may help to avoid biases in estimates that reflect two-way causation. A well-known econometric justification for using a lagged dependent variable (here TFR) is the partial adjustment model, which we shall briefly describe here. (For a discussion, see Wallis, 1969, or most econometrics texts). We can think of TFR as having some equilibrium value TFR\*. If it cost nothing to adjust actual TFR to TFR\*, they would always be equal. Suppose, however, that it does cost something to adjust. As a result TFR\* and TFR can differ and only part of the difference in TFR\* and TFR may be made up in a subsequent period. This can be represented algebraically as  $\Delta TFR = \lambda(TFR^* - TFR)$ , where  $\Delta TFR$  is the change TFR from the previous period (indicated by the -1 subscript of the righthand variables).  $\lambda$  can take on a value from zero to one, depending on how fast adjustment is.  $\lambda$  equal to one indicates that all

Tsui and Bogue's (1978) regression results are presented in Table 2 for countries in different continents and all countries combined. Equations (2.1) to (2.4) exclude the family-planning effort variable, an index constructed by Mauldin and Berelson. Beta (standardized regression) coefficients are reported rather than the (nonstandardized) regression coefficients. The

3Cont'd

of the adjustment is made up in the next period. This would indicate a rapid adjustment. A low value of  $\lambda$  (close to zero) would indicate a slow adjustment.

The above equation can be rearranged to make TFR, rather than  $\Delta$ TFR, a function of  $TFR_{-1}$ . By definition  $\Delta$ TFR = TFR -  $TFR_{-1}$

By hypothesis,

$$\Delta TFR = \lambda(TFR^* - TFR_{-1}) = \lambda TFR^*_{-1} - \lambda TFR_{-1}, \quad (1)$$

which may be rearranged as

$$TFR = \lambda TFR^*_{-1} + (1 - \lambda)TFR_{-1} \quad (2)$$

Thus, the coefficient of  $TFR_{-1}$  in the last equation is lower the faster is adjustment (that is, the larger is  $\lambda$ ). In an actual regression,  $TFR^*$  is not observable, but is presumed to be a linear function of other variables that are observable. This is the theoretical justification for using the lagged independent variables in Tsui and Bogue's regression other than  $TFR_{-1}$ . These other variables may be considered the systematic long-run determinants of fertility.

The implication of the partial adjustment model is that a once-and-for-all change in  $TFR^*$  produces a change in TFR that is spread out over time. Suppose that TFR was equal to  $TFR^*$  at 40. Now  $TFR^*$  falls to 20 immediately in period 1. Because of the lag and  $\lambda$  being less than one, adjustment over time might look like the figure below.

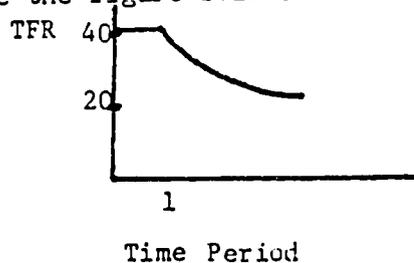


Figure 8

Adapted from	Dating of Data	Countries Included (sample size)	Fertility Measure (Dependent Variable)	Regressors	Beta Coefficients				Mode of Analysis
					(2.1) Africa	(2.2) Asia	(2.3) Latin America	(2.4) Total LDCs	
Tsui and Bogue (1978:31)	1975, 1972, 1968	89 developing (see last line)	Total Fertility Rate 1975	Demand Factors:					Ordinary least squares
				Total Fertility rate 1968	.705	.771	.752	.742	
				GNP per capita, 1968	.066	.164	-.108	.125	
				Percent urban, 1968	-.093	.181	-.169	-.017	
				Infant mortality rate 1968	.300	.152	.134	.165	
				Percent of employed females in agriculture 1968	.176	.203	.029	.074	
				Female school enrollment ratio 1968	.016	-.132	-.052	-.100	
				$\bar{R}^2$	.731	.841	.767	.813	
				Total Fertility Rate 1975	(2.5)	(2.6)	(2.7)	(2.8)	
				Demand Factors:					
				Total Fertility rate, 1968	.671	.575	.580	.626	
				GNP per capita, 1968	-.014	.086	-.122	.067	
				Percent urban, 1968	-.055	.028	-.193	-.017	
				Infant Mortality rate, 1968	.210	.207	.013	.070	
				Percent of employed females in agriculture, 1968	.078	-.048	-.082	-.003	
Female School enrollment ratio, 1968	-.030	-.016	-.046	-.089					
Supply Factor:									
Family planning effort score, 1972									
	-.187	-.370	-.360	-.308					
$\bar{R}^2$	.745	.912	.835	.860					
Number of Countries	39	30	20	89					

squared beta values may be interpreted as the fraction of the total variance of the dependent variable directly associated with each of the independent variables.<sup>1</sup> Thus, the beta squared value of per capita GNP in Eq. (2.4) is about .015, which is the fraction of the total variance of TFR directly associated with variations in per capita GNP. By far the most powerful variable according to this criterion is lagged TFR.<sup>2</sup> In other words, adjustment costs (discussed in Footnote 3 on p.46) are considerable and likely to be spread out over time. The beta coefficients of the other variables understate their long-run importance because they have embedded in them the low value of the adjustment term. That is, a variable could be important, but take a long time to have much effect because of the slow adjustment. Nonetheless, the betas give a good index of relative importance for the terms other than lagged TFR. By this criterion, income is more important than female school enrollment or agricultural employment but less important than infant mortality.

The size of the income coefficients varies in the first four equations, but the variation shows a suggestive pattern. If the continents are ranked by order of income, we note that Latin America is highest, followed by Africa and Asia (Tsui and Bogue, 1978:20). The algebraic value of the income coefficients have the opposite order with the Latin American coefficient actually negative.<sup>3</sup>

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<sup>1</sup>It is dimensionally comparable to  $R^2$ . "Directly" is used here and throughout in the sense of "proximate," not in the sense of "positive." For the above interpretation of the beta statistic, see Meeks (1976) and Duncan (1966). Indirect and interaction effects could also be important, however, as these references indicate.

<sup>2</sup>The metric value of the partial adjustment term  $\lambda$  is reported in Bogue and Tsui (1979b) as .18, which may be interpreted as indicating that 18% of the difference between the equilibrium and actual fertility is made up over a seven-year period, for example from 1968 to 1975. Their estimate is close to that of Beaver (1975:139) who calculated a value of .16 for a cross-section of Latin American countries. This suggests, quite reasonably, that a period of perhaps 40 years would be required for given change in socioeconomic structure to have most of its effect on fertility.

<sup>3</sup>In his careful study of Latin America, using cross-national and time series data Beaver (1975) also found a weak negative relation of fertility on income.

This is consistent with a tendency for the income elasticity to decline as income rises from for example the quantity-quality interaction with income. The income elasticities examined earlier for individual countries suggested the same tendency.

It should be pointed out that a variable may have a small direct effect but by influencing other variables have a larger indirect effect.<sup>1</sup> It is plausible to so interpret the effect of income. Growth of income would be expected to change each of the other variables so as to lower fertility for example by lowering infant mortality. The simple negative association of income and fertility beyond the threshold suggests that the indirect effects of income eventually outweigh the positive direct effect. But the other variables have independent influence and for that reason should not be neglected.

The inclusion of the 1972 family planning effort variable in equations (2.5) to (2.8) lowers the algebraic value of the income term in all equations, including the Latin American equation, where it becomes more negative.<sup>2</sup> One interpretation, subject to testing, would be that the direct positive effect of income on fertility in the first set of equations is overstated because family planning effort tended to vary inversely with national income levels (India and Mexico in 1972 for example). The positive income coefficients in the first equations would then result not so much from income as from neglecting family planning.<sup>3</sup> This could be because

1. The distinction between direct and total effects (including indirect) roughly corresponds to the partial correlation and the simple correlation, provided the causal chain runs from one regressor to the others.

2. Note that the order of the coefficients remains unchanged.

3. Algebraically, the coefficient of per capita GNP (Y) in the first equations include the effect of the omitted family planning variable. The derivative of TFR with respect to Y holding constant all but the family planning variable (FP) then becomes the coefficient of Y:

$$b_Y = \frac{dTFR}{dY} = \frac{\partial TFR}{\partial Y} + \frac{\partial TFR}{\partial FP} \cdot \frac{dFP}{dY} . \text{ If } \frac{dFP}{dY} \text{ and } \frac{\partial TFR}{\partial FP} \text{ are negative, the}$$

omission of FP from the regression will overstate the algebraic value of the income coefficient.

population growth is perceived to be less of a problem in higher-income countries. In addition the international flow of funds for family planning may be more to the lower-income countries.

The effect of including the family planning variable increases  $\bar{R}^2$  substantially for all of the equations except Africa, doubtless because its family planning effort was in more formative stages then. Even so, the beta for Africa was second only to infant mortality among structural (non-TFR) variables. For the other continents the family-planning beta squared value was far larger than those of the other structural variables. Inclusion of family planning also reduced the size of the lagged TRF coefficient, which suggests quite plausibly that family planning can reduce adjustment costs and speed the demographic transition.

Omitting the family planning variable would tend to understate the speed of adjustment by neglecting a variable that contributed to the adjustment.<sup>1</sup> One cautionary note should be sounded in the interpretation of these results. The effectiveness of family planning programs is surely a function of the demand for their services. A decline in fertility may be due to an increase in the demand for family planning rather than the supply of family planning, which may simply facilitate a fertility decline that would have happened with or without the program.<sup>2</sup> The family planning coefficient would then overstate its independent causal influence. It could also understate its influence if family-planning resources were applied in those areas where population growth was most troublesome. Well-designed control studies could

<sup>1</sup>The algebraic interpretation of how omission of family planning would affect the lagged TFR coefficient is similar to the previous footnote.

<sup>2</sup>For references that tend to support this conclusion, see T.P. Schultz (1974b:50). Costa Rica and Taiwan for example are countries frequently cited for the importance of family planning in stimulating fertility decline. Yet significant fertility declines had occurred prior to the effective implementation of the programs. This does not demonstrate the unimportance of the programs but only the need for caution in interpreting the results.

help to determine how important these possibilities are empirically.<sup>1</sup> Nonetheless, it is reasonable to suppose that family planning efforts would have an independent effect or strengthen latent tendencies of fertility decline by lowering the cost and motivation required for fertility control. The association of the family planning variable with fertility decline independently of the other socioeconomic variable in the regression is itself evidence of this. Moreover there have been well-designed experiments within countries supporting an effect of family planning programs on fertility (Cuca and Pierce, 1977). On the face of it then, the above results provide impressive although not conclusive support for the proposition that family planning effort has made the difference. The qualification is necessary because of the plausibility of mechanisms for reverse causation. It also seems clear that even the best organized family planning programs would fail if its "customers" lacked a disposition to use its services. Hence, our emphasis on the socioeconomic determinants of fertility.

Mauldin and Berelson (1978) in a study that preceded Tsui and Bogue (1978) conducted a similar regression analysis along with a number of other tests. They selected socioeconomic variables that had the highest simple correlations with the change in the crude birth rate (CBR) for 1965-75. The correlation matrix for these variables revealed that intercorrelation was moderately high but not apparently so high as to invalidate their use in multiple regression.

<sup>1</sup>T. P. Schultz (1974b:47-67). For other references to and discussion of family planning program effectiveness, see Brackett et al. (1978:323) and McGreevey and Birdsall (1974).

<sup>2</sup>Observing the degree of simple correlation among independent variables is, however, a rather loose test for the problems arising from high intercorrelation (multicollinearity).

Some of the important regression results are presented in Table 3.<sup>1</sup>

Equations (3.3) and (3.4) express the independent variables in change (first-difference) form from 1960 to 1970, except family planning effort, which is in level form. In the case of family planning, this distinction is probably unimportant. Its change and level would tend to be highly correlated, since most efforts in organized family planning only began in the 1960s. The effect of adding family planning to the equation is to increase substantially the explanatory power of the equation. The beta squared value of family planning is far larger than for any of the other variables. Its addition increases the algebraic value of the income term, the opposite of the Tsui-Bogue (1978) result. The difference may have resulted from more simultaneity in the Mauldin-Berelson fertility measure relative to income.<sup>2</sup> Both papers found a small positive effect of income on fertility with the family planning variable present. The sign of the coefficient is less important than its small absolute size. By contrast, family-planning effort was found to have a large negative effect on the birth rate.

Mauldin and Berelson emphasized, however, not the unimportance of the other variables, which they conclude were significant, but the importance of family planning seen as complementary to other development efforts affecting fertility.

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<sup>1</sup>Equations (3.1) and (3.2) express the independent variables in level form, whereas the dependent variable is in change form. This mixing of change and level would be appropriate within the partial adjustment framework if the equations had included a lagged dependent variable as a regressor, which they do not. The equations would then take the general form of equation (1) on p.47 above. The equations as they stand, however, say that a given level of the independent variables will lead to a given change in the birth rate. It is difficult to accept this specification as an equilibrium condition, since in theory the level of birth rates should be related to the level of those regressors. The equations might best be considered as a disequilibrium partial adjustment model from which the lagged birth rate was omitted, an error in specification.

<sup>2</sup>That is, the income term in Mauldin and Berelson is at the midpoint (1970) of their fertility change variable (1965-75). In Tsui and Bogue, it precedes the fertility variable by seven years.

TABLE 3

Adapted from	Dating of Data	Countries Included (sample size)	Fertility Measure(s) (dependent variable)	Regressors	Beta Coefficients		Mode of Analysis
Mauldin & Berelson (1978:104)	1965-1975	89 developing	Change* in crude birth rate 1965-75	Demand Factors:	(3.1)	(3.2)	Ordinary least squares
				Adults literate, 1970	-.08	-.04	
				Primary & Secondary school enrollment, 1970	.06	-.04	
				Life expectancy, 1970	-.52	-.11	
				Infant mortality rate, 1970	.13	.05	
				Percent of males aged 15-64 in non-agriculture labor force, 1970	-.28	-.11	
				GDP per capita, 1970	.28	.10	
				Percent population in cities of 100,000 +, 1970	.00	-.04	
				Supply Factors:			
				Family planning efforts score, 1972	--	-.65	
				R <sup>2</sup>	.66	.83	
Mauldin & Berelson (1978:107)	1965-1975	Yes 35 developing	Change* in crude birth rate 1965-75	Demand Factors:	Beta Coefficients (3.3) (3.4)		
				Proportion increase in adults literate, 1960-70	-.20	-.18	
				Proportion increase in primary & secondary enrollment, 1960-70	.01	.00	
				Percent change in life expectancy, 1960-70	.32	.17	
				Percent change in infant mortality rate, 1960-70	.39	.13	
				Increase in percent males aged 15-64 in nonagricultural labor force, 1960-1970.	.09	.11	
				Annual percent increase in GDP per capita, 1965-70	-.16	.09	
				Proportion increase in population in cities of 100,000 +, 1960-70	-.04	-.08	
				Supply Factors:			
				Family planning effort scores, 1972	--	-.71	
				R <sup>2</sup>	.55	.84	

Note: For ease of comparability the algebraic value of the change in fertility and infant mortality is reported here rather than the decline (taken as positive) in these variables. Correspondingly, the signs of the coefficients reported here are changed from those of Mauldin and Berelson as appropriate.

Their conclusion was supported by their regression analysis and a suggestive cross-tabulation of fertility declines by social setting<sup>1</sup> and family planning program effort. The table reproduced on the next page, is useful for gauging the success of countries (or lack thereof) in reducing fertility relative to the classifying variables.

The authors summarize the results from the table as follows:<sup>2</sup>

The record for the period 1965-75 shows that large CBR declines in developing countries were strongly associated with substantial program effort and high social setting was associated with only modest CBR declines, unless linked with significant family planning effort. Countries with both significant program effort and high social setting had an average CBR decline of about 30 percent; those with only significant program effort, a decline of about 20 percent; those with high social setting alone, a drop of 5 percent; and those with neither, a zero change.

We digress a bit here to discuss a particularly important case in point. Among 94 countries, India was one of only three with a moderate to strong family planning and a social setting below the upper middle according to Mauldin and Berelson's table. That India was able to achieve moderately large birth rate declines is therefore of interest. But the large absolute size of India's population (presently estimated at 660

<sup>1</sup>Social setting was measured by an index of the socioeconomic variables used in their regressions.

<sup>2</sup>Mauldin and Berelson (1978:127). Another helpful device for identifying special circumstances not included by their explanatory variables was their array of countries falling outside the fertility range predicted by their socioeconomic and family planning variables (p. 125). Countries with appreciably smaller fertility declines than predicted by their equation included Ecuador, Iran, Pakistan, Guatemala, and Jamaica. Countries with appreciably larger fertility declines than predicted included Cuba (by a large margin), Thailand, and Tunisia. What special factors were operative in these instances is an interesting question for case study analysis.

TABLE 12 1965-75 crude birth rate declines (in percents), by social setting and program effort: 94 developing countries

Social setting	Program effort								Total
	Strong (20+)		Moderate (10-19)		Weak (0-9)		None		
	Country	Decline	Country	Decline	Country	Decline	Country	Decline	
High	Singapore	40	Cuba	40	Venezuela	11	Korea, North	5	19
	Hong Kong	36	Chile	29	Brazil	10	Kuwait	5	
	Korea, South	32	Trinidad and Tobago	29	Mexico	9	Peru	2	
	Barbados	31	Colombia	25	Paraguay	6	Lebanon	2	
	Taiwan	30	Panama	22			Jordan	1	
	Mauritius	29					Libya	-1	
	Costa Rica	29							
	Fiji	22							
	Jamaica	21							
	Mean	30	Mean	29	Mean	9	Mean	3	22
	Median	30	Median	29	Median	9.5	Median	2	
Upper middle	China	24	Malaysia	26	Egypt	17	Mongolia	9	10
			Tunisia	24	Turkey	16	Syria	4	
			Thailand	23	Honduras	7	Zambia	-2	
			Dominican Republic	21	Nicaragua	7	Congo	-2	
		Philippines	19	Zaire	6				
		Sri Lanka	18	Algeria	4				
		El Salvador	13	Guatemala	4				
		Iran	2	Morocco	2				
				Ghana	2				
				Ecuador	0				
				Iraq	0				
	Mean	24	Mean	18	Mean	6	Mean	2	7
	Median	24	Median	20	Median	4	Median	1	
Lower middle	Vietnam, North	23	India	16	Papua New Guinea	5	Angola	4	3
			Indonesia	13	Pakistan	1	Cameroon	3	
					Bolivia	1	Burma	3	
					Nigeria	1	Yemen, P.D.R. of	3	
				Kenya	0	Mozambique	2		
				Liberia	0	Khmer/Kampuchea	2		
				Haiti	0	Ivory Coast	1		
				Uganda	-4	Senegal	0		
						Saudi Arabia	0		
						Vietnam, South	0		
						Madagascar	0		
						Lesotho	-4		
	Mean	23	Mean	14	Mean	1	Mean	1	1
	Median	23	Median	14.5	Median	0.5	Median	1.5	
Low					Tanzania	5	Laos	5	2
					Dahomey	3	Central African Republic	5	
					Bangladesh	2	Maliawi	5	
					Sudan	0	Bhutan	3	
				Nepal	-1	Ethiopia	2		
				Mali	-1	Guinea	2		
				Afghanistan	-2	Chad	2		
						Togo	2		
						Upper Volta	1		
						Yemen	1		
						Niger	1		
						Burundi	1		
						Sierra Leone	0		
						Mauritania	0		
						Rwanda	0		
						Somalia	0		
					Mean	1	Mean	2	1
					Median	0	Median	1.5	
Mean		29		21		4		2	9
Median		29		22		2		2	3

Source: Mauldin and Berelson (1978:110).

million) gives it special importance. The population of India comprises over two-thirds of the population for countries with the lowest per capita incomes in the world.<sup>1</sup>

What caused the decline in Indian birth rates? As Mauldin and Berelson suggest, both social setting and family planning programs may have played a part. Their data indicate that an 18% increase in the percent of the 15-19 age group enrolled in primary and secondary school and a 12% increase in life expectancy over the period 1960-70.<sup>2</sup> Such gains, it seems clear, may have increased the acceptance of family planning.

The studies of Tsui and Bogue (1978) and Mauldin and Berelson (1978) used lagged terms, which could be expected to help reduce the problems of statistical bias arising from simultaneity of causal relations. An alternative method of examining the effect of socioeconomic variables on fertility would incorporate their simultaneity into the model. Anker (1978) presented a simultaneous-equation model of fertility in which income did not enter the fertility equation directly but only through school enrollment. Life expectancy, school enrollment, and a family planning variable had  $t$  values approaching conventional significance levels (Table 4). School enrollment was an endogenous variable taken as a function of per capita income and other variables. We calculate that the implied reduced-form elasticity of the fertility variable and income was  $-.03$ , a relatively small absolute size. Addition of the family planning variable to the equation increased  $R^2$  only slightly, although its  $t$  value was relatively

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<sup>1</sup>India and other countries with lower per capita incomes have over 20% of the world's population.

<sup>2</sup>The attractive force of education in reallocating expenditures has been illustrated recently in the calculation of Ram and Schultz (1979:411) that the fraction of national output in India spent on education, including the value of student's time, increased from 5% to 11% over the period 1950-1971.

TABLE 4

Authors Year Page	Dating of Data	Countries Included (sample size)	Fertility Measure (Dependent Variable)	Regressors	(4.1) regression coefficient		(4.2) regression coefficient		Mode of Analysis
						t		t	
Anker, (1978:54, 67)	1968-70	69 developing	gross reproduction rate	Demand Factors: Constant Secondary school enrollment rate Labor force par- ticipation rate for women ages 15-44 yrs. Percentage of labor force in agriculture Percentage of Adult population that is illiterate Life expectancy at birth in years (LE) LE squared Supply Factors: Natural log of number of years family planning program in opcr- tion R <sup>2</sup> (based on instruments) LE turning point in fertility	.3002 -.0210 -.0039 .0038 .0023 .1102 -.001087 -- -- 50.70	.19 1.78 0.91 0.70 0.63 1.89 1.89 -- -- -- .57 -- 50.70	-.2947 -.0192 -.0027 .0037 .0050 .1164 -.001051 -.1285 -- 55.40	0.19 1.65 0.64 0.70 1.34 2.04 1.87 1.85 -- -- -- .59 -- --	two-stage least squares

high. It also increased the significance of the illiteracy variable perhaps because family planning substituted for literacy. The smaller effect of family planning does not contradict the results of the previous two studies considered for two reasons. First, Anker used an earlier time period (1968-70 instead of 1975). Much of the fertility decline observed in LDCs, which the previous studies attempted to explain, came after 1970. Second, Anker's family planning variable was measured by the number of years the government family planning program had been in existence, which is undoubtedly a cruder approximation of family planning effort than that of the other studies. The Mauldin-Berelson measure was based on a structural evaluation of the programs themselves, not merely how long they had been in place. One advantage of Anker's index is that it did not rely on judgment as the Mauldin-Berelson measure did in part, which could be inadvertently biased by ex post knowledge.

Anker found that the effect of life expectancy on fertility was significantly nonlinear, first increasing the gross reproduction rate, then decreasing it. The turning point was estimated to be between 51 and 55 years, depending on whether family planning was included in the equation. The positive part of the relation could be explained by the increases in natural fertility discussed by Easterlin (1978). The negative part would reflect parents adjusting fertility down to achieve a target level of child survivorship. Anker notes that "higher life expectancy implies fewer widows and thus a relaxation of the downward pressure exerted on fertility by dissolution of marriage by death."<sup>1</sup> That is, the pension motive would be

<sup>1</sup>Anker (1978:61).

weaker. Since the Anker did not include income in his fertility equation, he may have neglected effects of income other than those operating through school enrollment. Nonetheless, his finding of a small (implied) income elasticity and of the importance of family planning agrees with the other cross-national studies presented.

We next add a bit more to what was discussed briefly earlier on the linearity of the fertility income-relation. Chenery and Syrquin (1975:56-59) found a threshold-type nonlinearity of the birthrate and income for 101 LDCs, mostly for 1965 data. Control variables were school enrollment and infant mortality. They calculate that maximal population growth occurs early in the transition at per capita income levels of \$200.

Gregory and Campbell (1976a, 1976b) in their study using data of 18 unnamed Latin American countries for 1950 and 1960 found that the response of fertility to changes in particular economic variables varies substantially according to the degree of modernization as represented by the degree of urbanization. Their empirical findings suggest that the income effect on the quantity of children is indeed positive at low levels of economic development. In their estimation of the model which introduces an interaction function incorporating the effects of modernization, the elasticity of crude birth rates with respect to the per capita income variable changes from positive to negative at a high percent of the total population that is urban (76 percent and above). This seems to indicate a lessening of positive income effect on child quantity as high levels of modernization are achieved, possibly due to increased costs of or improved child substitutes. The nonlinearity in this case arises from the interaction of income and urbanization, rather than from the increase

in income as such. In this respect their findings are consistent with those of Encarnacion discussed above.

One anomaly that we mention is the finding of Friedlander and Silver (1967) who estimated regressions for countries at different income levels-- underdeveloped, intermediate, and developed-- at the end of the 1950s. For the underdeveloped countries, they found a moderately strong inverse relation of fertility and income or consumption for many of the various equations reported. For the intermediate countries, the income relation was close to zero. One explanation might be that their equations reflected simultaneous-equation bias from higher current or past fertility reducing current income (Beaver, 1975:31-32). A significant lag in the income term would test this conjecture. Another possibility is that they did not adequately control for urbanization. In one of their better fitting equations that used the nonfarm self-employed labor force and the agricultural labor force, which would appear to be good substitutes for urbanization, the t value of the income variable for underdeveloped countries was close to zero, although still negative.

We may summarize recent evidence on the long-run relation of fertility and income from cross-country studies at this point as much as about a small effect. The simple relation of fertility and income suggests a strong negative effect. When proper account is given to the problem of simultaneity and the other variables that are associated with but distinct from higher income, such as urbanization, education, and life expectancy, which reduce fertility beyond some point, the direct relation becomes more positive. The slope of the fertility-income relation appears to decline with income, which conforms to the threshold hypothesis, although it is unclear whether this works through urbanization (Gregory and Campbell 1967a),

life expectancy (Anker, 1978), an excess supply of children (Easterlin, 1978), a quantity-quality interaction (Becker and Tomes, 1976), income itself (Chenery and Syrquin, 1976), or a change in socioeconomic structure, prices, and tastes (all of the above; Caldwell, 1978).<sup>1</sup> The two studies using the most recent fertility data found a slight positive relation of income to fertility but this was much less important than the negative association of fertility and family planning. This suggests that countries with very low levels of modernization should not expect economic development per se to lead to reduced fertility. It may do the opposite unless offset by active family planning programs.

We next consider the cross-country evidence on income distribution. Using a simultaneous-equation model, Repetto (1978) found that the income distribution had significant effects on fertility when developed countries were included in the sample, but not when they were excluded. The relevance of the fertility-income relation for developed countries, however, seems questionable when applied to LDCs. Below the threshold income level, the relationship between income and fertility is positive, whereas above the threshold income level the relationship is negative for less-developed countries. Therefore, if the average level of income of the poorest 40 percent is still below the threshold income level even after the improvement of income distribution, the effect of equal income distribution could increase rather than decrease the national average fertility rate. The shape of the nonlinearity (concave from below) would produce this result. In effect, births would rise more for those who gained than fall for those who lost income or wealth.

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<sup>1</sup> For a useful compilation of estimated threshold values for fertility decline from different socioeconomic variables and estimates of fertility responsiveness, see Mauldin and Berelson (1978:92-93).

As Birdsall (1977a) suggests the time series evidence for ten countries with reliable income distribution statistics is more convincing. It is clearer in those cases that the ceteris paribus condition needed for proper comparisons is met. Repetto (1978) found that for the three countries whose income distributions became more equal (Costa Rica, Sri Lanka, and Taiwan), fertility fell faster than in the countries where it became less equal (Brazil; India, Puerto Rico). The argument seems especially plausible when it is considered that the first three countries spent more on social services that would make child quality a relatively better investment.

Simon (1977:370-71) calculated what might be regarded as an upper limit of fertility reduction that would occur if a large change in the income redistribution distribution (10%) in LDCs were undertaken. It is an upper limit, he maintains, because it assumes that all of the association observed runs one way from income distribution to fertility. He concludes that the reduction would not be large--only 0.21 in the gross reproduction rate.

A different type of inequality was analyzed by Bhattacharyya (1975) who estimated the difference between rural income and urban income for a cross-section of countries. He found a small positive direct effect of inequality on fertility but moderately large indirect effects. He attributes the positive direct effect to lower rural income raising fertility. Another interpretation would be that such inequality may induce more rural-urban migration, which results in a fertility rise for "insurance" by rural parents.<sup>1</sup> Such inequality was associated with higher infant mortality and lower literacy, which were positively associated with higher fertility. These were the indirect effects.

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<sup>1</sup>This possibility would be similar to the positive "replacement" effect of child mortality on fertility. A complete discussion is found in the migration Paper in this series (Findley et al., 1979).

Bhattacharyya (1977) provides another reason for the influence of income distribution on national average fertility. He found from his study on the role of rural-urban income inequality on fertility reduction for Turkey, Taiwan, and Morocco that the rural mean number of live births are higher in a high income inequality country (Turkey) as compared with a low inequality country (Taiwan). He attributes this phenomenon to the fact that dissemination of urban values and the urban lifestyle into the rural areas is less effective in a high inequality country than in a low one.

### 3. The Quantity-Quality Tradeoff

To know how income might affect the demand for child quantity through the quantity-quality interaction, it is helpful to have estimates on how strong the substitution of child quality and quantity is. The negative relation of child mortality and fertility is one such substitution effect. T.P. Schultz (1976b) summarizes the evidence and finds that the relation is especially strong for infant mortality, although empirical studies are inconclusive on whether a fall in child mortality by itself could reduce population growth. The results of Anker (1978) suggest that the negative effect on fertility begins soon after life expectancy reaches the age of fifty.

On the relation of fertility and education, the quantity-quality relation may depend on institutional arrangements at low income levels, rather than the level of income or even school expenditures. Jones (1971: 322-24) found no significant statistical correlation between educational expenditures and GNP per capita up to \$700. Stone (1976:543) found no relation of the percentage of children enrolled in school to the percentage population under 15 and the percentage of GNP spent on public education,

holding constant per capita GNP and the ratio of urban to total population. This would seem to imply that an increase in the school enrollment would cut expenditure per child proportionately. Urbanization on the other hand appears to increase school enrollment, which is consistent with quality being substituted for quantity in the city.

Simon (1977:332-34) notes cross-national studies finding a significant negative association of births with secondary school enrollment and per child expenditures but not with primary schooling. T.P. Schultz (1974b:40-41) cites studies from Latin America and Asia showing a strong inverse relation of fertility and school enrollment. The relation of high fertility and subsequent mental and physical capacity was also found to be consistent with a substitution of quantity and quality. Snyder for West Africa (1974: 623) who found a positive relation of family size and educational attainment, possibly because the extended family may reward parents with more children or older siblings may support younger ones. Alternatively, some smaller families may recruit children into the work force on a full-time basis. Hermalin cites a study finding a positive relation of family size and educational attainment perhaps for the same reasons or because the income effect outweighs the substitution effect. T. P. Schultz (1971b) used regional data for Taiwan, however, and found a strong inverse relation of enrollment of fertility.

In a survey of Ghana, Caldwell found that the percentage of parents citing the cost of education as a disadvantage of large families rises appreciably on the average with higher incomes, although not consistently (Simon, 1974:124). There is, however, a consistent positive relation between income and those practicing birth control for economic reasons

(including educational costs).<sup>1</sup> Apparently the motivation for (and means to finance) birth control becomes greater as income rises.

Seiver found a positive relation of fertility and income for Mexico using time-series and cross-section data, contrary to some other studies of Latin America. He attributes this in part to a lack of incentive to substitute quality for quantity.

On the whole, these studies support the hypothesized negative tradeoff between quantity and quality, particularly at the aggregate level. To this extent a fall in fertility could be expected to increase per child school expenditures and school enrollment.

Relative income may affect perceived utility of children and thus the desired number as has been emphasized by sociologists and some economists.<sup>3</sup> The theory has been criticized as lacking testable implications,<sup>4</sup> but a small number of empirical studies are now available for LDCs. A brief statement of the theory is given here together with tests, including those for the U.S. (to substitute for the dearth of such studies of LDCs). One statement of the theory is by Freedman (1963) who compares the association of fertility with two income variables: (1) actual income of the husband, and (2) husband's income as a relative of that typical for his occupation, education, age and residence (for example, South or non-South in the U.S.).

<sup>1</sup>Cited in Simon (1974:124).

<sup>2</sup>Seiver (1976:350).

<sup>3</sup>Freedman (1963), Leibenstein (1974, 1975a, and 1975b), Easterlin (1969), and Conger and Campbell (1978).

<sup>4</sup>Keeley (1975) and T. P. Schultz (1976a:107).

There is evidence that husband's income does make a difference over the longer childbearing period if it is considered in relation to the average income for husband's occupational status and age. An income which is above the average for one's status is associated with more children, but being in a higher absolute income class means fewer children if the higher income is only what is usual for the husband's age and occupational status. Why should relative income affect fertility independently of actual income? Freedman (1963) suggested the following reason.

Costs of rearing children are related to the socio-economic reference group of the parents. Given the social status of a family, it has only limited control over the costs of its children. Certain expenditures for each child, for example food and housing, are set by the scale of living of the parents, and this in turn depends on the family's social status. Many of the variable costs of child rearing also will be determined by the social standards of the family. Furthermore, while a consumer can choose to own both a cheap and an expensive car, this choice is not equally possible in determining the costs of his children. In fact, if the expenditures for a child do not conform to the socio-economic standards of his family, he may be a source of disutility. Therefore, a couple whose income is low relative to the group with which it is identified may restrict its family growth, so the de-

sired standard can be furnished to a smaller number of children. Moreover, higher social status may involve the parents in interests and activities which are incompatible with a large family. Easterlin (1969) considers that the real significance of the relative income hypothesis is the fact that it provides a crude embodiment of the view that fertility behavior reflects a balancing of preferences against certain resource constraints. Here, it is interpreted in a such way that current income represents available resources whereas the reference (expected) income measure is used as a proxy for tastes.

Easterlin (1969) applied Freedman's (1963) relative income hypothesis to mixed observations on the association between income and fertility from U.S. time series data. While the relation during the business cycle has been of the expected positive sign, the secular relation has been inverse. Easterlin explains the secular trend in fertility showing the negative relation between income and fertility with the relative-income concept as follows:

Young persons currently in the childbearing ages were, a few years back, dependent members in their parents' households. It seems plausible to argue that the consumption levels experienced in the parents' households served, among other things, to shape their current preferences (for material goods). Moreover, the situation in the parents' household when the children were in their teens would seem more relevant than when the children were quite young. In a developing economy which experiences secular growth in income, the second generation's income at ages 20-24 is typically greater than the first generation's was at that age. The second generation could achieve the consumption level the

first generation had at age 20-24 and have something left over for other purposes, such as saving or increased family size. But if the desired consumption level inherited by children from their parents relates to the parents' situation not at ages 20-24, but at, say, 35-44, then it is less certain that the second generation's income at ages 20-24 will suffice to achieve the desired consumption level. In other words, there is an intergeneration effect tending to increase consumption at a given income level, provided that income is growing.

In the relative income view, per capita income growth operates through two channels. On the one hand, it has the effect, usually emphasized, of tending to increase fertility by giving the second generation more resources. On the other, it tends to lower fertility through tastes by increasing the relative desire for material goods. Since these two influences may be more or less offsetting, it no longer follows that per capita income growth tends to increase the fertility secularly. If, in historical experience, these influences have in fact been offsetting, then the cause of the secular decline in fertility must be sought in factors other than per capita income change, factors which may have shifted preferences even more strongly against children, changed the relative price of children, or encouraged wider adoption of fertility control practices.

It should be noted that even if the effects of per capita income growth are offsetting secularly, this is not necessarily the case over shorter periods. This is because the effect via the resource constraint relates to ongoing experience, while that via preferences is primarily a lagged one, deriving from the previous course of income change. Thus,

if there are long swings in the secular growth of per capita income, it is possible that a cohort brought up in a "boom" period may go through the prime family-building years during a "bust." In this case, it would have acquired strong desires for material goods which would be difficult to realize because of the adverse labor market situation, and hence would be under pressure to curtail fertility.

This is the main reason why the relation during the business cycle which reflects the effect on fertility of short-run deviations in current income from the average income by the age-occupational group has been of the expected positive sign. Easterlin's theoretical model applying the relative-income hypothesis to the exposition of the relation between income and fertility observed from U.S. time series data has been estimated rigorously by Conger and Campbell (1978). Their study used postwar U.S. time series data in a simultaneous-equation model. It endogenized the per capita income variable and revealed a significant and positive coefficient estimate for the one-year-lagged relative income variable, namely current per capita income divided by per capita permanent income in the fertility equation (crude birth rate).

Mueller and Cohn (1977) test the validity of the relative-income hypothesis using Taiwanese data. However, their conclusion is that the expectation of a positive relation between relative income and fertility is not borne out by Taiwanese data. There is no relationship between the two variables. They conjecture the reason for this unexpected result as follows:

Conceivably, in a rapidly developing and modernizing society, social status becomes fluid, so that peer groups, that is, people with the same occupation, education, location, and socioeconomic background, no longer serve as a reference group in determining consumption standards or tastes. Indeed, income may become a major determinant of status. Couples who are economically successful relative to their peer group or their own socioeconomic background may raise their sights and not feel more financial ease than less successful couples.

However, their reasoning does not explain why fertility does not decrease with income whereas contraceptive practice increases with income in their study.

Carvajal and Geithman (1976) using Costa Rican data attempt to test the hypothesis that while income and fertility are negatively related between social classes, the relationship is positive within a given social class. However, their regression model seems incapable of deriving any accurate inference from their estimation results. First, their fertility equation erroneously includes the dummy variable reflecting female labor force participation as an independent variable. Since it is widely accepted that female labor force participation is influenced by fertility, their ordinary least square estimations suffer the simultaneous-equation bias problem. Second, the other independent variable in their fertility equation reflecting the ratio of nonnuclear family members to total members in the household would have systematically biased coefficients downward because the variable is obtained by dividing number of nonnuclear family members by the dependent variable (number of children) plus two (husband and wife).

Therefore, it seems safe to say that the relative-income hypothesis is accepted for U.S. data but not accepted for less-developed countries'

data. The reason for this divergent result can be found from Chaudhury's (1977) study on Canadian data. His results of the tests reveal that the relationship between relative income and fertility is strongest among those couples who plan their life ahead and have a high level of education and occupation. The positive relationship between relative income and cumulative fertility does not hold true for low educational and occupational groups. Therefore, he suggests that the relative-income model does not apply in a society, or subgroup, where large families are considered functional for maximizing economic or non-economic utilities. The model seems to be useful in predicting fertility behavior for a select population only. Our findings thus suggest that the improved predictive power of the model does not depend on the effective practice of contraception only; necessary also are opportunities for all social strata to maximize utilities.

We venture one final note on tastes. Many economists have great misgivings about a theory that places emphasis on taste formation, because such theories may be used to explain everything and therefore nothing ("no refutable implications!"). Nonetheless, we report one statistic that caught our attention for what it is worth. Simple cross-country correlations were computed by the U.N. for fertility and various socioeconomic measures. The variable that had the highest correlation with fertility was not education, newspaper circulation, female literacy, early marriage, energy consumption, infant mortality, non-agricultural activities, urbanization, or income per capita. The variable that had the highest correlation with fertility was radio receivers per capita.<sup>1</sup> Radio receivers!

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<sup>1</sup>The table with the correlations is reproduced in Simon (1974:115).

#### 4. Children as Investment

One reason why fertility may respond differently to income across countries is the variability of the degree to which children are considered investment. What is the evidence on this? Cassen (1976:806) has aptly characterized the topic as exhibiting "perhaps the highest ratio of argument to evidence in the whole population literature." T.P. Schultz notes the theoretical and empirical difficulty of distinguishing consumer and producer durables in the refinement of demand theory but also notes a positive relation of child labor-force participation and fertility in Asia and Latin America<sup>1</sup>. This is consistent with parents making an investment tradeoff in child quantity and child quality (through education noted above), which affects fertility decisions. Since public policy can affect the terms of this tradeoff, the elasticity of substitution (responsiveness of quantity to changes in the price of quality) is a matter of policy relevance.

One of the more direct tests of the children-as-investment model was that of Rosenzweig (1978) who summarizes his results for the Philippines as follows:

The econometric results suggest that in areas where child wage rates and earnings are high parents appear to bear more children and to school them less and that children living in farm households receive significantly less schooling and engage more extensively in economic employment. The results also appear to confirm earlier findings that the schooling of the mother and infant mortality are important correlates of family size but also suggest that the former variable is significantly related to child schooling attainment and employment.

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<sup>1</sup>T. P. Schultz (1976:102). See also Cassen (1976:791).

Kasarda (1971) used cross-country data to examine this same question. He found a simple correlation of .5 for fertility and the economically active labor force of ages 10 to 14. Structural variables for urbanization, education, and industrialization became insignificant when this variable, unpaid family workers, and female salaried employees were held constant. From this Kasarda concluded that the control variables were the intervening variables through which economic structure influenced fertility. He did not perform the more direct test of entering all of these variables into the regression simultaneously to determine whether employed youth had an independent association with fertility.

Despite the above, which supports the existence of a relation between fertility and child-labor participation, Repetto (1976a:85) concludes that present evidence does not point to a particularly tight relation.

An indirect type of evidence on children as investment comes from the type of landholding arrangements in force. DeVany and Sanchez (1978) argue that the ejido system of granting rights to land on an usufruct basis encourages formation of large families to work the land and provide social security, since the land cannot be sold. They found that for Mexican data fertility was positively related to the prevalence of the ejido system. Caldwell (1977) and Ware (1978) present a qualitative discussion for Nigeria and Africa arguing that communal land ownership supports high fertility. This admittedly thin portfolio supports the theoretical conclusion of Neher (1971) discussed earlier that lack of individual property rights in land encourages high fertility.<sup>1</sup>

<sup>1</sup>A more extended discussion is found in Stokes et al. (1979).

Most calculations of the economic return on children as investment have used secondary statistical sources to estimate the relation of the return on children as productive investments. For example, Arthur and McNicoll (1978a), cited earlier, concluded that there was a net consumption redistribution from old to young, based on international labor participation data, which would suggest that children are poor investments in absolute terms. Other studies based on "plausible" assumptions using secondary data have reached the same conclusion (Mueller, 1976; Robinson and Horlacher, 1971:23; and Simon, 1974:127-31).

Cain (1977) and Nag et al. (1977) pursued the novel strategy of compiling original data to answer the question. Nag et al. analyzed data from villages in Java and Nepal. They found that children in larger Javanese families did more work, not less work, perhaps spurred on by their siblings. In that sense, large families were more "efficient." Work time in all activities from ages 5 to 12 was in the range of 4.3 - 6.5 hours a day and increased to 7.5 - 10.1 hours for ages 13 through 19. In short, the economic activity of children was substantial, although difficult to translate into money terms. Most older parents lived with (or near) their children. The assumption made by Mueller (1976) that economic activity for Taiwanese peasants did not begin until age 15 seemed inapplicable to these villages.

Cain (1977) examined data from a village in Bangladesh. He concluded that boys became net producers as early as age 12 and compensated for their own and one sister's consumption by age 22. High surviving family sizes, in the absence of alternative investments was, Cain concluded, a rational economic strategy.

As Cassen (1976:806) notes, one reason for low estimates of the return from children was the late start (age 15) assumed for the child's economic life. Cassen himself tried a variety of assumptions on Indian data and concluded that children would only yield a positive return if three conditions held simultaneously - low discount rate, early labor force entry, and high parental share of earnings. From the parents' perspective he surmised, additional children would probably result in neither large gains nor losses but would offer a convenient vehicle for regular "saving" and social security. It has also been recognized that the relevant question is not how high the rate of return on children is in absolute terms but how whether there is a better alternative. Even with a negative return on children, they may be the least negative investment return available or have other desirable "portfolio" characteristics.<sup>1</sup>

Qualitative evidence is also broadly consistent with an economic interpretation of child-bearing at low income levels. Simon summarizes the results of African surveys suggesting that parents are about evenly divided on whether they consider their children to "earn their keep." Interestingly, the percentage who agree with that statement falls as income rises.<sup>2</sup> The relative return on child quantity as investment may fall as income rises.

The pension motive, while not overwhelming in all cases (possibly because it is taken for granted) appears to have a relatively greater weight as a reason for having large families in both African and Asian survey data.<sup>3</sup>

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<sup>1</sup>De Tray (1976:203-04). These characteristics will be discussed further in Part II.

<sup>2</sup>Simon (1974:82-85, 114, 118-19).

<sup>3</sup>Bulatao and Arnold (1977:155) and Snyder (1974:615-16). For discussion see Ware (1978), Caldwell (1977), and Cassen (1976:807).

A useful research agenda has been outlined by T.P Schultz that bears on many of the points discussed for children considered as investment and consumer durables in the household production function. It is worth quoting here:<sup>1</sup>

What are the economies of scale in the production of numbers of children and child quality; how are these outputs interrelated to other household consumption activities; can production trade-offs be estimated from changes in the relative prices of these other, more nearly marketed, household activities; can one infer, directly or indirectly, more about the manner in which parents assess quality in their offspring, which ultimately must motivate their transmission to children of genetic potential, inherited wealth, education advantage, economic opportunity and culture?

A discussion of children as investment would be incomplete without a consideration of the alternatives other than child quality. We next consider saving as a substitute for child quantity.

##### 5. Savings as a Substitute for Children

At a purely theoretical level it is plausible to posit that children and savings are substitutes. As durable goods, children are a source of (partly) deferred utility. So are savings. One might further suppose that fewer children would increase the capacity to save. What is the evidence on these points?

It has been commonly assumed that per capita income places a severe constraint on the saving/income ratio in LDCs. Yet an examination of the data reveals a wide dispersion of savings rates in relation to income even for the poorest countries, as the following Figure indicates (Newlyn, 1977:18). Moreover, the emphasis on government and business saving appears overdone. In market-oriented economies, households often contribute the largest

<sup>1</sup>T. P. Schultz (1974b:21).

18 THE FINANCING OF ECONOMIC DEVELOPMENT

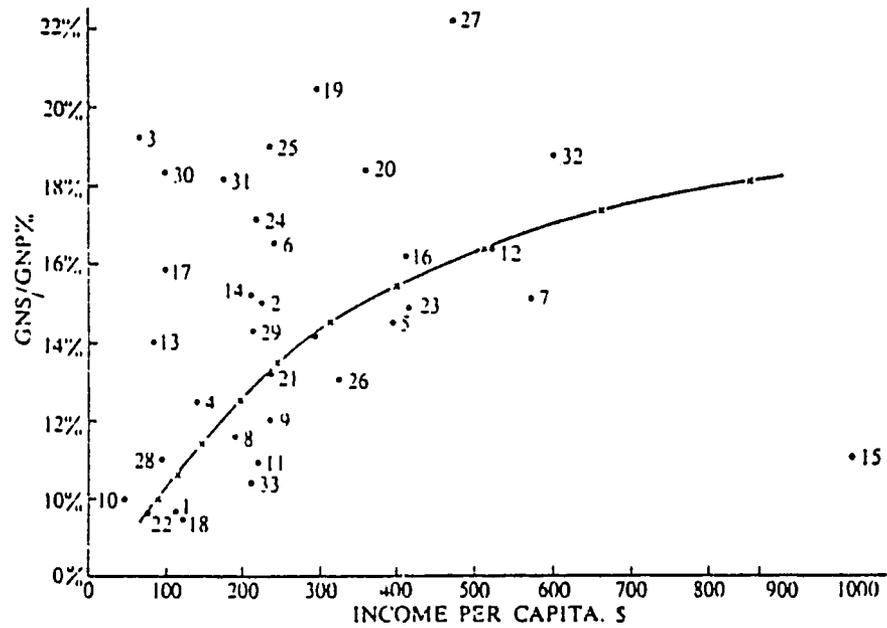


Fig. 1.2. Gross national savings rates and the Singh propensity. Sources: savings rates, *World Bank World Tables*, average 1961-7; income per capita, *U.N. National Income Accounts*, Vol. 2, average 1960-5.

Key to Fig. 1.2 page 18

- |               |                  |                      |
|---------------|------------------|----------------------|
| 1 Bolivia     | 13 India         | 25 Philippines       |
| 2 Brazil      | 14 Iran          | 26 Portugal          |
| 3 Burma       | 15 Israel        | 27 Spain             |
| 4 Ceylon      | 16 Jamaica       | 28 Sudan             |
| 5 Chile       | 17 Kenya         | 29 Syria             |
| 6 Colombia    | 18 Korea (South) | 30 Thailand          |
| 7 Cyprus      | 19 Malaysia      | 31 Taiwan            |
| 8 Ecuador     | 20 Mexico        | 32 Trinidad & Tobago |
| 9 El Salvador | 21 Nicaragua     | 33 Tunisia           |
| 10 Ethiopia   | 22 Nigeria       | 34 Turkey            |
| 11 Ghana      | 23 Panama        |                      |
| 12 Greece     | 24 Peru          |                      |

Source: W. T. Newlyn, et al. (1978).

Fig. 9

part of aggregate savings. An ECAFE study of seven Asian countries for example revealed that households contributed one-half to two-thirds of aggregate savings. A small survey of Indian farm households for 1966-70 found an average annual propensity to save or invest of 12 to 37%.<sup>1</sup> such findings suggest a potential for substituting saving for child quantity.

The usual assumption of macro models in the Coale-Hoover tradition is that lower fertility would increase per capita saving significantly, since one should expect part of the increase in per capita income resulting from lower population to be saved. This expectation has been confirmed empirically, as in for example Suits and Mason (1977), although some have found the effect to be small.<sup>2</sup>

Leff (1969) found a strong inverse relation between savings, the savings/income ratio and the dependency ratios defined to include the fractions of the population under age 15( $D_1$ ) and over age 64( $D_2$ ). In the case of LDCs the negative elasticities of  $D_1$  were nearly three times those of developed countries, which would indicate a relatively more adverse effect of the dependency ratio on savings.<sup>3</sup> As indicated earlier, these results are also

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<sup>1</sup>See Adams (1978) for this and other evidence. For a literature review of the savings function in LDCs, see Mikesell and Zinser (1973).

<sup>2</sup>For references, see Cassen (1976:702-03) and Boulier (1977:162-64). As is indicated in Part II (p.122), the demographic implications of this relation may be easily misinterpreted.

<sup>3</sup>Leff's results have not gone unchallenged. (McNicol, 1976:600; Simon, 1977:217-18; King, *et al.*, 1974:27; Gupta, 1971; and N. A. Adams, 1971). Nonetheless, substantive weight, not the number of responses is the only valid criterion for evaluating the evidence. In more than one of the above citations, significant exception may be taken to the points against Leff's study. For example, Simon argues that historically population growth has had the effect of stimulating agricultural investment. In the long run, he maintains, moderate to high population growth has stimulated and would stimulate economic development by increasing work effort and investment and achieving economics of scale (Simon, 1977:290-300).

consistent with the savings rate having a negative effect on the dependency ratio if child quantity and saving are substitutes, in which case increasing savings incentives would reduce the demand for child quantity.

The problem of large family size is easily misunderstood. If only parents are considered or if the family unit is assumed to allocate its resources efficiently (no externalities), one could conclude that there is no "population problem" as such, since parents can optimize, subject to resource constraints.<sup>1</sup> But this construes the problem too narrowly both from the children's and parents perspective. It neglects the negative externality (welfare loss) imposed on already-born children. To the extent that high-fertility regimes reduce the quality or inheritance of such children, a negative intergenerational externality results.<sup>2</sup> This is the policy

<sup>3</sup>cont'd

It is impossible to do just to the texture of his argument in this short space, but putting to the side his interpretation of the facts of economic and demographic history that need explaining, one may at least question the pertinence of his historical long run (spanning 75 years and up) to current technologies, factor scarcities, and explosive population growth; considering the narrower questions at hand, even if aggregate agricultural investment is stimulated by population growth, one might argue that this is an extremely inefficient way to raise per capita income.

Gupta disaggregated Leff's LDC data into three groups and found that only in the highest of the three income groups were dependency rates significant. Leff responded that measurement errors, especially for the poorest countries, could explain these results and that statistical tests could not reject the hypothesis that all the subsets were generated by the same regression structure. N.A. Adams criticized Leff's results because of their multicollinearity and the age of 14 cutoff for  $D_1$ , which might be too high for many LDCs. Interestingly, these points could be used to support Leff as against Gupta, since Gupta's disaggregation would tend to increase multicollinearity and since children working at younger ages would tend to be more common in the poorest countries, which would disguise the negative effect of those under, say, age 8 on saving. See also Leff's reply (1971).

<sup>1</sup>This position is stated most clearly in Friedman (1971).

<sup>2</sup>The nature of this externality has been explored most carefully by Blandy (1974). It is an essential aspect of the Neher model (1971). See also Robinson and Horlacher (1971), Cassen (1976:817-19), Bourrier (1977), and, for an empirical estimate Suits and Mason (1978).

significance of the quantity-quality tradeoff and of the effect on saving of high fertility, since they measure in different ways the importance of the economic loss to the already-born. It can also be argued that parents lose where high fertility results from deficiencies in economic and social institutions that unnecessarily restrict their range of choice. If so, a change in the institutional setting may improve the welfare of both parents and children. The "population problem" presented earlier in theoretical terms came down to a lack of socially efficient market mechanisms for transferring consumption over time. In Part II, we shall consider various development activities affecting fertility that could improve the position of both children and parents and in effect circumvent such deficiencies.

## II. THE RELATIONSHIP OF RURAL DEVELOPMENT ACTIVITIES TO FERTILITY, INCOME, AND WEALTH

It is appropriate at this point to state four propositions useful for subsequent discussion.

1. Effective parental control of fertility is a desirable objective of social policy.
2. Family planning programs are a means to this end, not an end in themselves.
3. For parents to control fertility, they must have the knowledge, means, and motivation to do so.
4. Fertility control and economic development can be mutually reinforcing.

Of these, we shall take (1) and (2) as axiomatic. The rest of the paper will attempt to demonstrate the implications and applications of (3) and (4).

Policy makers have not lacked for analytical models to explain the effects of population growth on economic development.<sup>1</sup> Perhaps best known are those in the tradition of Coale and Hoover (1958). Such models find that a significant reduction in fertility, typically 50% over 30 years, could be predicted to increase per capita income by perhaps 25-50% over the period.<sup>2</sup> This results from the growth of aggregate income being little affected even though population growth

<sup>1</sup>For useful overviews from perspectives demonstrating that economists do not always agree on these matters, see Demeny (1971) and Simon (1977).

<sup>2</sup>McNicol (1976:660).

declines. The fall in fertility has little negative impact on the labor force at first. It does, however, reduce the fraction of the population below the prime labor force age and required social overhead expenditures (such as for schools and hospitals), and increases per capita saving and investment, all of which serve to raise per capita income. Not surprisingly, if one accepts such a model, extremely favorable long-run benefit-cost ratios, much higher than for more typical development expenditures, can be derived for family planning activities that reduce fertility.<sup>1</sup> Another calculation presented in connection with this approach is the "present value of an averted birth" in raising per capita income, which is usually found to be high.<sup>2</sup> Such models have been challenged for relying too much on a priori inference and specification (rather than direct empirical estimation)<sup>3</sup> and for omitting other crucial behavioral relations.<sup>4</sup> But alternative models showing a less negative or even positive effect of high population growth on development are themselves open to serious questions on both empirical grounds and present relevance.<sup>5</sup> The recent significant fertility declines experienced in many of the developing countries may provide a more decisive test of the conclusions implied by different approaches. Indeed,

<sup>1</sup>Benefit-cost ratios of family planning expenditures ranging from 50:1 and up are typical calculations, as in Enke (1976:19). The volume in which his article appears (Keeley, 1976) is one of the more integrated expositions of the general approach.

<sup>2</sup>Suits and Mason (1978) for example use cross-country regression estimates to calculate that for a family planning program in a country comparable to that of China, the value of an averted birth is approximately \$5,000 with one third directly capturable by participating families and the rest of the benefits spilling over to society at large.

<sup>3</sup>The Suits-Mason paper referred to in the previous footnote would appear to be less open to this criticism than other models in the genre.

<sup>4</sup>Adelman and Robinson (1973) and Simon (1977).

<sup>5</sup>Cassen (1976:203-08), Johnston (1977:886-87), Arthur and McNicoll (1975), Demeny (1971:204-05).

evaluating these effects should be near the top of research priorities on economic development in our judgment. Meanwhile, it may be acknowledged that there is no monopoly on the shortcomings in the different models.

Suppose one accepts the conclusion that high fertility has a strong negative impact on per capita income.<sup>1</sup> One is left with the tantalizing question of why parents continue to have large families. Some possibilities include lack of access to cheap and effective means of birth control, uncertainty from short life expectancies, and lack of effective "bond" markets as an alternative to high fertility discussed in Part I. It will be maintained, however, that there are a number of policy interventions that could improve the situation. Some of these make eminently good sense in their own right but could also have significant demographic implications. Others would have a more direct demographic impact but might also be expected to have favorable development interactions. It is unfortunately the case that some of the more promising development activities with respect to demographic impact are not satisfactorily supported by hard research findings or widely replicated results. Our presentation will obviously be more tentative and exploratory in these instances.

Conclusions should be considered even more tentative concerning the impact of demographic changes on economic activity, which was not the primary

<sup>1</sup>Even so, it could be argued that such calculations give no weight to the revealed preferences of parents for high fertility and that such preferences should not be overridden unless it can be demonstrated that others lose more as a result of their decision (E. P. Schultz, 1971a:164-66; Enke, 1970; Leibenstein, 1970). The pertinence of this objection is, however, weakened by the losses from high fertility to society at large (Suits and Mason, 1978) and to children already born (Elandy, 1974).

objective of this series of papers.<sup>1</sup> Although it is our belief that higher spending levels on development activities could prove efficacious, we recognize that such recommendations are cheap. Rather, our emphasis will be on the type of development activity and the composition of expenditures, not so much the total amount.

If any pattern emerges from the following consideration of development activities, it is that fertility decline, equity, and economic growth can be congruent, indeed complementary, processes.<sup>2</sup> Their complementarity and mutual feasibility however, appear to depend in considerable degree on the design of development policy. If this is correct, population policy measures could fill an important gap in literature that emphasizes growth with equity, which has tended to ignore or minimize the positive effect of fertility decline on development.<sup>3</sup>

Since most of the other papers in this series concern aspects of fertility that involve policy decisions directly (for example, education), our discussion will be limited to those aspects of the subject that appear to have the greatest potential influence on income-fertility interactions. Some overlap with other papers was inevitable. The reader may in such instances find a more complete discussion of particular aspects in the relevant paper, although possibly for a different purpose.

<sup>1</sup>Rather the principle emphasis was the impact of socioeconomic variables and development activities on fertility. It may not be too early, however, to suggest that an appropriate sequel to the present series might have such a focus.

<sup>2</sup>An earlier argument along those lines was made by Kocher (1973) and Rich (1973). More firmly established today are the channels through which their argument could be correct. In Part I we cited evidence on the channels through which their argument could be incorrect.

<sup>3</sup>Chenery et al. (1974), Adelman and Morris. (1973). and Adelman and Robinson (1978).

## 1. Extension of Social Services

The social services considered in this section include family planning programs, health and nutrition, education, and social security programs. Papers in the present series that concentrate on or emphasize these include those by Isely et al., Cheng et al., and Turchi and Bryant. Helpful comprehensive earlier treatments include Ridker (1976), Cassen (1976), Coale (1976), Robinson (1975), World Bank (1975), King (1974), United Nations (1973), and National Academy of Sciences (1971).

Family planning services are the most obvious and direct policy intervention for affecting fertility. The cross-country analysis presented in Part I was consistent with family planning programs having a large (and in two of the three studies cited by far the largest) direct effect in reducing fertility, but was also consistent with a desire for smaller families both reducing fertility and increasing the demand for family planning services. This is not to assert that policy makers should be paralyzed by indecision about the desirability of strengthening family planning efforts in the absence of controlled experiments to determine the independent effect of each program. There is already a significant body of literature on experiments in family planning, much of it summarized in Cuca and Pierce (1977), that provides valuable lessons on the success of such programs.<sup>1</sup> Moreover, building a family planning infrastructure might understandably have top priority in those countries where it is presently lacking.

<sup>1</sup>See also McGreevey and Birdsall (1974) and Cassen (1976:794-97).

The mixed success of inundation campaigns of contraceptives argues, however, that more attention be given to those factors that affect the motivation to use such services. Chief among these are health and nutrition. Cassen (1976:799-801) reviews the literature indicating a much stronger combined effect of nutrition and health care on child mortality than the sum of their separate effects. Johnston and Meyer (1977) and Johnston (1977) in their review of the literature make a compelling case for the favorable interaction of family planning with health and nutrition services, which this section largely draws upon. The dramatic increases in life expectancies including those of children in Taiwan, China, South Korea, Sri Lanka, and Costa Rica in past decades have been followed by sharp decreases in fertility. The empirical results reported earlier indicate the important positive association of fertility and child mortality, although only perhaps, after a minimal threshold of mortality is reached. T. P. Schultz's survey (1976:283) found that child mortality declines were associated with more than proportionate and offsetting fall in fertility in about half of the cases surveyed.<sup>1</sup>

There is also a small but growing body of evidence that integrating health and family planning programs could result in larger fertility declines by demonstrating the benefits to the mother and child of fertility regulation as part of health and nutrition practices. Actual improvements foster further changes in attitude and motivation (Taylor et al., 1976). The Narangwal project in rural India found a threefold increase in births prevented under the integrated program compared to the standard family planning program (Taylor et al., 1975). It was also

<sup>1</sup>Population growth might still rise even with such a fall in fertility because of associated increases in adult life expectancy.

found to be cost-effective relative to separate family-planning and health-education programs. Considered purely as an effort to lower fertility, the integrated approach might well be justifiable in light of sharply increasing marginal costs for user acceptance rates that may be experienced with conventional family planning services. There may be political advantages as well in supporting a "family health program" rather than mere family planning. Finally, family planning so conceived could be integrated into community development and adult education programs. These would include providing safe water supplies and adequate latrines, campaigns against pests and infectious diseases, and improving infant- and child-feeding practices to build disease resistance.<sup>1</sup> Family planning is more likely to be accepted in such a setting because the decline in morbidity and mortality makes smaller families less risky. High fertility is less necessary to achieve social security or a given completed family size. On the contrary, it may be perceived by parents as detracting from further efforts to improve the welfare of themselves and their family.

It should be noted that the integrated approach is beyond the experimental stage in some developing countries. For example, Taiwan, often cited as a model of family planning program success and cost effectiveness, has made extensive use of the integrated approach.

An integrated family health program implies a shift from individual curative care and hospitals, where Ministries of Health in many less developed countries allocate over three quarters of their funds (Johnston

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<sup>1</sup> Johnston (1977:395-400) and Johnston and Meyer (1977).

and Meyer, 1977) to community health and preventive measures. The family planning programs by themselves could generate significant economics. Based on data from Thailand and Sri Lanka, Jones (1975: 131-32) has estimated that even a relatively modest independent effect of family planning on fertility rates would lead to savings in health costs that exceeded the cost of the family planning program, which to begin with would normally use no more than 1.5 percent of total development funds. Nonetheless the political problems of implementation are non-trivial, since they would impinge on those with vested interests in single-service programs, including, Johnston (1977:901) notes, some foreign agencies. Mounting evidence of favorable synergisms among nutrition, health care, and family planning is a strong force at work to induce institutional change.

What would the long-run demographic and economic consequences of an integrated family and community health program be? Past and present observation suggests that, starting from a high level, mortality declines are a necessary condition for fertility declines.<sup>1</sup> In the demographic transition, declines in fertility and mortality at some point become mutually reinforcing. In data for Taiwan, T.P. Schultz (1973b) has found that the lag in fertility decline in response to child-mortality declines is as short as three years. Effective family planning, particularly an integrated health program could minimize the length of the lag. Zachariah (1973) performed some illustrative simulations based on a

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<sup>1</sup>Muznets (1977) and Taylor et al. (1976).

plausible range of estimates indicating that a faster mortality decline was associated with a faster fertility decline and a lower long-run population at which the economy would stabilize.<sup>1</sup>

Measuring the economic effects of increased longevity and health has been neglected in the literature until recently. Nonetheless, preliminary calculations suggest that such effects may have been significant. Ram and Schultz (1979) were able to explain 20% of the variance in labor productivity growth rates for output and agriculture among states of India over the period 1959-64 based on differences in mortality. A 10% change in mortality was associated with a 3.5% change in output per worker. Such findings indicate the peril of neglecting to distinguish sources of population growth. Population growth arising from increased life expectancy may have quite different (and favorable) effects on development compared to population growth from high fertility. Conversely, slowing population growth by lowering fertility may have quite different (and favorable) effects from slowing population growth by maintaining low levels of life expectancy. Available evidence is fragmentary but consistent with these points.

Child deaths, which even today take more than 20% of the child population before the age of five in much of the developing world,<sup>2</sup> are an economic as well as human loss. A decline in child mortality encourages parents to invest more in nutrition and educational costs<sup>3</sup>

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<sup>1</sup>See also Taylor et al. (1979).

<sup>2</sup>Johnston and Meyer (1977).

<sup>3</sup>One such cost is the output of children lost from school attendance. Parents are more likely to support school attendance if their children (or the parents) will live long enough to recoup the cost of the educational investment.

by increasing the chance that the child will survive to adulthood. These increased costs per child reduce the demand for child quantity, causing parents to further substitute child quality for child quantity. As Turchi and Bryant's review of the literature points out, increased costs per child have been found to be the strongest economic deterrent to high fertility. The relation of health and nutrition, family planning, and education appears to be one of most promising quantity-quality interactions discussed. How strong it is in practice would appear to depend significantly on the development linkages subject to policy control.<sup>1</sup>

One weakness of the linkage is that parents benefit to such a limited extent from fertility control in the allocation of educational funds. A scheme that would increase such benefits without necessarily increasing total educational outlays has been tried out experimentally in Taiwan. It offers an educational voucher to be applied towards children's education beyond the years of free public education for those parents who limit fertility (Wang and Chen, 1973). Such a proposal might be one way to correct the pronatalist bias of free public education and at the same time to increase average expenditure per child.<sup>2</sup>

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<sup>1</sup>It is already clear that education has one of the strongest negative associations with fertility (Cheng, et al., 1979). As Davis (1977:175) has remarked of the demographic transition in nineteenth-century Europe:

The middle classes, bent on maintaining or improving their social status under the new conditions, reduced their childbearing by postponing marriage and by using contraception and abortion after marriage. In this way, they had more energy and money to invest in their own early careers and in their children's education. Today the nations in which fertility is being reduced most rapidly are those like Taiwan, Trinidad, and Venezuela where modernization is rapidly transforming the society in a similar way.

<sup>2</sup>Of course, the child in the high-fertility family would tend to be relatively disadvantaged. Whether such a child benefitted in absolute terms would appear to depend on how the program was structured. It could well be argued, however, that without such incentives, children in small families are penalized by reductions in school expenditures per child in a high-fertility regime.

What impact such a program would have is another matter. Simon (1977: 303) notes that "as of a year after the beginning of the program, administrators had the impression that the offer had affected fertility, but lack of scientific controls makes quantitative evaluation impossible."

The relation of education and fertility may omit an important element by considering only formal education. There is a burgeoning literature on non-formal education, which emphasizes such practical subjects as agricultural extension, vocational training, health, nutrition, and community improvement (Paulston, 1973). Critics of formal education maintain that these subjects have only inadequately been incorporated into the formal curriculum (Coombs and Ahmad, 1975). They are in any case especially appropriate at the level of adult education, where they offer promise of more immediate benefits and application. A number of case studies have documented the cost-effectiveness of non-formal programs, in part because they use existing educational infrastructure (World Bank, 1973). As in the case of integrated family health programs, a shift in emphasis to non-formal education would raise difficult questions about priorities. One recommendation compatible with spending more on non-formal education while not requiring increases in total public expenditures would be to have the beneficiaries of higher education pay an increasing share of their educational costs beyond the level of literacy with appropriate subsidies of the able poor at low income levels and loan programs at higher levels.<sup>1</sup>

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<sup>1</sup>Todaro (1977:251).

The distinguishing feature of non-formal education relative to fertility is that it would allow those in their child-bearing years to benefit directly from education rather than requiring investment in more children, whose education would provide only indirect benefits to parents. To the extent that non-formal education accelerated development or produced effects on fertility similar to formal education, already-born children would also tend to be beneficiaries. The diffusion of educational benefits would in this way not have to await the next generation. The potential benefits of non-formal education on development seems considerable regardless of the effect on fertility. As Cheng et al. (1979) indicate, however, the literature has not systematically examined the relative effects of formal and non-formal education on fertility. The subject warrants closer study.

Social security (old-age insurance) and bonus schemes (such as one-time payments designed to increase contraceptive use) differ from the education and health care in being transfer payments of existing income rather than directly using resources or contributing to the development process. Using cross-national data, Hohn (1975, 1976) found an appreciable negative relation between fertility and the extent of social security programs, despite notable data gaps. Kelly et al. (1976) explained Hohn's results using an index of modernization rather than social security. The evidence is thus inconclusive as to whether social security has influenced fertility. Whether a program designed to influence fertility could do so is another question. Many who have studied the question have concluded that social security would be an

administratively costly way to influence fertility (Turchi and Bryant, 1970), although Mueller (1970) has suggested social insurance administered through agricultural cooperatives or farmers associations. Alternatively, such insurance could be targeted toward women with few children, who might otherwise be especially vulnerable as widows. Social security by itself, however, would appear to have a less direct effect on fertility than bonus schemes and might have more developmental impact if implemented through a broader reform of financial institutions such as considered in Section 3 below.

Bonus schemes as incentives to reduce fertility would appear to be a reasonable response to the costs imposed on social services by high fertility and have been discussed extensively in the development literature (Ehrke, 1970; Doulier, 1977; Simon, 1977). Suits and Mason (1970) have calculated that two thirds of the economic benefits from reduced fertility would redound to those outside the family. This alone could justify government bribing parents to lower their fertility goals. Yet actual incentive schemes (described in Guca and Pierce, 1977) have fallen far short of calculated marginal benefits. One reason might be that in most instances the theoretical macro-social benefits of fertility reduction have not yet been built into a social structure that permits citizens to calculate the micro benefits to them from a change in aggregate fertility. The alternatives described in this and following sections and in the other papers in the present series could help to fill in the micro gap. In the meanwhile, bonus schemes, a favorite child of economists, may continue to have only limited application, despite their merits.

Two prime examples that support the linkage of fertility and social services discussed in this section are Sri Lanka and the Indian state of Kerala.<sup>1</sup> In both instances, per capita incomes are under \$200. Yet life expectancies exceed 60 years. In Sri Lanka it is 66, more than 10 years higher than for the eight other countries in middle south Asia, of which three have approximately equal or higher average incomes. In Kerala, life expectancy is about 10 years higher than would be predicted by income alone. Sri Lanka has a crude birth rate of 26 per thousand, compared to an average of 37 for that region of Asia. In 1970-72, Kerala had a birth rate about five points lower than the national average of 37 and lowest of the 13 Indian states. Governments in both instances have pursued vigorous policies to equalize the distribution of income and of social services in health, nutrition, and education. The relatively low level of fertility in these two states is consistent with social services having been responsible, although they should be considered more as illustrations than as proof.

In the next section, alternative rural development strategies will be considered, including measures that effect the

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<sup>1</sup>For discussion, see Coatskin (1970) and Rattcliffe (1977).

distribution of income. The extension of social services will for the purpose of analysis mostly be ignored. There is, however, a potentially important linkage of income distribution and the demand for social services, which it is convenient to discuss here.

To the extent that rural development strategies affect income distribution (or income growth), it is plausible that the demand for social services would change, for example through public health and availability of general education. This appears to be part of the underlying premise in the earlier literature that a more equal income distribution would lower fertility (Kocher, 1973; Rich, 1973). As a consequence, any program that aims at using income redistribution to reduce fertility (most likely a subsidiary consideration in any case) would also need to affect intervening social service variables. A failure to do so could result in an increase rather than a decrease in fertility.

The fact that the programs to equalize income in Sri Lanka and Kerala were closely associated with measures to provide broad access to public services may explain why income equality in those states was associated with lower fertility.

## 2. Alternate Rural Development Strategies

The extension of social services can affect the incentives parents have for high fertility, but for the sake of analysis, let us hold constant the distribution of social services. As De Tray (1976:203) notes, "That parents have chosen many children and relatively low investments per child is a fact worthy of consideration." Part I emphasized the lack of a "bond" market that would provide economic security and a high return for parents. In this section, tangible investments will be considered as an alternative to children. In the next section financial investments (the narrow use of the term "bonds") will be examined. The alternative development strategies considered will be highly selective, again focusing on income-fertility interactions. A more general discussion and review of the relevant literature is found in Stokes et al. (1970) and Turchi and Bryant (1970) of the present series, although our interpretation may not agree all points with theirs.<sup>1</sup>

The strategies to be considered are two, which may be summarized in the phrases "growth" and "growth with equity," which we shall state broadly and baldly. The "growth" strategy would attempt to maximize per capita income growth or perhaps aggregate income, regardless of the distributional consequences. The presumption is that maximal economic growth involves a tradeoff with full employment or the income of the poorest. The unequal impact of the Green Revolution might be an example, if the basic premise of this strategy is correct. The "growth with equity" strategy would argue that economic growth, especially long-term growth, is at least compatible with full employment and a significant rise in the income of the poorest. A stronger statement of the position

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<sup>1</sup>For statements of rural development options without a specifically demographic focus, see World Bank (1975), Lele (1975), Griffin (1974), and Waterston (1974).

would argue that certain actions contribute to both growth and equity.<sup>1</sup>

We put to one side the question of which is correct for the moment. What would be the demographic consequences of each strategy? The answer would seem in part to depend on the time frame considered. We consider the "growth" strategy first for the sake of completeness, although we shall conclude that it rests on a weak premise. The short-run analysis of Part I suggested that, in the vicinity of the fertility threshold, a more unequal income distribution would lower population growth (in part by raising the death rate, in part by lowering fertility). In the long-run, inequality could raise or lower fertility depending on how the benefits of modernization, which would tend to lower fertility, were distributed. Conceivably an economy could grow first and redistribute later to reach a low-fertility equilibrium. Or the trickle-down benefits of high economic growth could eventually bring fertility down. But unequal growth might so delay the benefits of modernization for the high-fertility majority of the population as to delay fertility declines. It is not possible to say anything more definite at so general a level. An important, perhaps decisive, consideration would appear to be how the after-tax distribution of social services was distributed. If high growth eventually led to high levels of education, health, etc., fertility might decline rapidly beyond some point. If the distribution of social services was more unequal as a result of the unequal before-tax income distribution, the decline of fertility would be delayed. To summarize then, the long-run consequences

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<sup>1</sup>We confine ourselves to these two development goals because we know of no one advocating "stagnation with inequity."

of the growth strategy on fertility do not lend themselves to clearcut answers without specifying how social services and the growth of absolute incomes for the largest part of the population are affected.

The "growth with equity" strategy yields more clearcut results. The limited evidence available suggests that over time a more equal distribution of income is associated with a fall in fertility (Repetto, 1976). Since the direct effect of income appears to raise fertility, the long-run negative effect may occur through a fall in the death rate and rise in the level of social services. "Equity" by itself then would tend to lower fertility in the long run. "Growth with equity" would accelerate modernization and the movement toward lower fertility. Hence, the "growth with equity" strategy if feasible, would appear to offer the surest means to long-term fertility reduction. The case is strengthened to the extent that slower population growth accelerates economic growth. Falling fertility and development would then reinforce each other.

Which is correct, the "growth" view or the "growth with equity" view? More succinctly, does growth come at the cost of equity? Kline's survey (1975), Lal's review of recent works (1976), Cohima's study of Asian data (1970), and Ahluwalia's cross-country regressions (1976) conclude that on the whole economic growth has significantly raised income levels of those at lower incomes in absolute terms. The common conclusion of Kline and Lal is especially interesting, because they examine closely the data used to support the contrary position.<sup>1</sup>

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<sup>1</sup>Significant dissent on this point remains, however (Adelman and Morris, 1976).

This suggests, Lal concludes, that "growth remains of primary importance for poverty redressal." Kline reviews a number of studies, the bulk of which find little effect of redistribution on growth. Johnston (1977) notes that there is little general disagreement on the desirability of redistributive land reform. As empirical support for this, one can cite a small but significant number of successful land reforms.

Montgomery (1974) in a survey of land reform programs, concludes that Bolivia, Chile, China, Iran, Japan, Mexico, South Korea, Taiwan, Venezuela, and Vietnam have instituted programs that have improved the income and security of the small farmer (see also Barraclough, 1970). Other countries have implemented land reform programs that did not substantially increase the welfare or income of peasants (e.g., Bangladesh, Argentina, Pakistan, Peru). Such failures, as Stokes et al. (1978) discuss at length, could be explained by the importance of agricultural extension and credit needed maintain or increase production for any actual redistribution.

Merely noting that some reform failures could have been avoided, however, understates the economic appeal of such reform. In his survey, Johnston (1977:334) refers to the considerable body of evidence pointing to the higher productivity and labor intensity of smaller holdings. These findings, Johnston notes, suggest that such reforms can be supported on grounds not only of equity but of efficiency.<sup>1</sup>

Efficiency of resource allocation in agriculture under alternative forms of land tenure (which we here distinguish from the distribution of

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<sup>1</sup>Ip and Stahl (1978) discuss the transaction costs, incentives, and linkages, that would tend to increase productivity of less concentrated landholdings. Griffin (1974b:190-91) notes some evidence that rural saving and investment have been impeded by income and wealth inequality, contrary to the usual argument.

land) is widely debated in the economic literature related to land reform and general agricultural development in less-developed countries (see Stokes et al., 1970; Ip and Stahl, 1970; Newbery, 1977; Cheng, 1980; Reid, 1973; and Bardhan and Srinivasan, 1971). It has been contended by some that tenancy (particularly sharecropping) results in not only an inefficient allocation of resources, but also reduces the incentive to improve agricultural land, and that, to a large extent, tenancy arrangements contribute to and are responsible for the persistent poverty of rural populations in less-developed countries. This school of thought contends that land reform measures, abolition of sharecropping, and institution of individual property rights (as distinct from non-separable rights of the family or usufruct) are policy measures that can improve land development prospects. To the extent that such reforms encourage agricultural investment as an alternative to family labor, they could also reduce fertility incentives. But given the varied nature of such reforms, it is difficult to generalize on their demographic impact.

From a policy point of view it is important to understand the likely quantitative relationship between the distribution of land-ownership and rural household incomes. Ahmed (1973) looks at the effect of land distribution on rural incomes in order to assess the potential of land reform. Land redistribution alone, he notes, can only partially reduce the inequality of rural income distribution. Without accompanying changes in other agrarian structures, institutions and policies, he concludes, land redistribution will not lead to a substantial change in income for the majority. Using international cross-section data

from 25 developing countries covering all three continents (Asia, Africa and Latin America), he finds that about 30% of the variation in rural income distribution is explained by the distribution of land-ownership - significant perhaps, but Lal (1976:734) suggests, not worth fighting over, at least not on cost-benefit grounds in a growing economy.

At this point, it is appropriate to ask what effect redistributive land reform would have on fertility. If it increased productivity, it could be expected to accelerate fertility decline in the long run through the "growth with equity" effect and the diminishing importance of the high-fertility agricultural sector that accompanies general development. Land redistribution by itself, however, would tend to increase fertility in the short run.

There has been less systematic investigation of how changing farm technologies would affect fertility. In contrast to land and children, which appear to be complements, a case can be made that modern farm technologies and children are, on balance, substitutes. This proposition, while highly plausible, does not appear to have been systematically tested. Its plausibility rests on the high rate of return such technologies offer relative to children, which would lead to parents investing in farm capital, rather than larger families. Evidence on its effects would come from examining rates of agricultural productivity growth and fertility. Casual empiricism suggests that in rural areas where there have been notable increases in farm productivity and mechanization, fertility has fallen.<sup>1</sup> Of course, the existence of fertility

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<sup>1</sup>Taiwan might be a case in point. Fertility has fallen there in both rural and urban areas.

threshold effects might make this a difficult hypothesis to test empirically. Important distinctions might also be made about the type of innovation. Those that make use of light labor might tend to increase fertility (new seed varieties). Triple-cropping methods and mechanization, would tend to reduce peak labor demand, including child labor (Stokes et al., 1979; Turchi and Bryant, 1979).

The uneven effects of the Green Revolution reflected in "tractORIZATION" and displacement of agricultural labor may have obscured the potential of the new technologies for broadly based advance. The literature review by Stokes et al. suggests that the Green Revolution and the new technologies have had an uneven impact because of factors subject to policy control. These include greater access of the larger farms to credit for financing the innovations (discussed later) and to agricultural extension services. The unequal access has been exacerbated by overvalued currencies and foreign exchange controls, which have required nonprice rationing. These have encouraged an uneconomic use of capital-intensive technology (tractORIZATION) by artificially lowering the price of such capital. Political influence of larger farmers has been substituted for the efficiency of competitive markets.<sup>1</sup> Since these are policy-induced effects, they can be corrected by policy means, including price rationing of foreign exchange.

The development of farm technology can itself be regarded as subject to policy influence. A literature is rapidly accumulating on economically appropriate (frequently labor-intensive) technologies for developing

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<sup>1</sup>References are found in the next section and Stokes et al. (1979).

countries which apply to agriculture and rural infrastructure as well as manufacturing (Carr, 1970). Such technologies need not be capital intensive to be efficient and provide a substitute for child labor in providing sources of water, transportation, harvesting, grain cleaners and power.

The adoption of appropriate technologies may be influenced by the complementary development of infrastructures, credit, and agricultural extension. Griffin (1974a;1976), deJanvry (1970), and Raj (1972) have maintained that concentration of ownership decisively influences the pattern of agricultural innovation, with innovations favoring the predominant type of landholder. An implication is that for technical change to favor small landholders, the distribution of landholdings must be relatively equal to begin with. Secondly, technical change may have quite different effects, depending on initial conditions. These are in part variations on the theme that government-influenced policies mentioned above favor the clientele they serve. It need hardly be emphasized that such broad generalizations would have to be tested against the experience of the particular case. The surveys on income distribution cited earlier do not suggest that a worsening of income positions of the poor as the general outcome of development, but neither do they rule it out as an outcome in a number of particular cases.

Agricultural development patterns and policies have been emphasized to this point, but intermediate technologies and rural infrastructure could also stimulate development of light industry and off-farm employment for women, with a likelihood of negative fertility consequences (Griffith

et al., 1973). Mellor (1973) has emphasized the close relation between industrial and agricultural growth, including technical change. For example, an inefficient capital-intensive industry, fostered by tariffs and overvalued currencies, may provide insufficient and inappropriate farm technology as well as stagnant employment growth. Agricultural price ceilings may slow farm mechanization needed for industrial growth or create urban unemployment.

The interaction of fertility and rural development over time has not been closely studied in the literature. Yet, an understanding of its dynamics could aid in the formulation of a coherent development strategy. There are some prominent national "success stories" that illustrate a number of the elements mentioned above, but we shall discuss a "hard case" of regional development starting from a low socioeconomic setting and lacking detailed central planning.

The state of Punjab in India thirty years ago did not appear to have provided the most promising conditions for development:

In the early 1950s, conditions were distinctly unfavorable. The large influx of refugees from Pakistan was accompanied by severe disruption of economic and social stability. We were repeatedly told by village leaders on the panchayat, or elected village council, that important as all of their other problems were, "the biggest problem is that there are just too many of us." By the end of the study period in 1980, a remarkable change had occurred. With the introduction of more irrigation canals and with rural electrification from the Bhakra Mangal Dam, and with better roads to transport produce to market: improved seed and other benefits of community development, and especially because there were increasing employment opportunities for Punjabi boys in the cities, a general feeling of optimism had developed. A common response of the same village leaders now was, "Why should we limit our families? India needs all the Punjabis she can get." During this transitional period an important reason for the failure of education in family planning was the favorable pace of economic development. Children were no longer a handicap (Taylor, 1985:432-33).<sup>1</sup>

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<sup>1</sup>Cited in Simon (1977:354).

The acceleration of population growth that occurred in the interim with the fall in death rates and improvement in living conditions well illustrates the initial stage of modernization described in Part I.

The Khanna project, a classic controlled experiment conducted in 16 villages of Punjab, confirmed that family planning services had no effect on the birth rate during the 1950s, illustrating the importance of motivation in lowering fertility.<sup>1</sup> Mandani's tract, The Myth of Population Control (1972), based on responses of Punjabi villagers, argued that large families were regarded as an economic boon, not a disaster, for example, by providing an alternative to expensive hired labor.

From 1950 to 1968 real per capita income grew by 68% in Punjab compared to 30% in all India. Its labor force in agriculture went from 70% to 50%. Cooperative agricultural credit societies tripled in membership to a large fraction of the rural population, which made up for the reluctance of commercial banks to extend agricultural credit. High-yielding varieties of food grains and fertilizers were rapidly adopted<sup>2</sup> along with irrigation methods required for their use. Unlike much of India, an effective land consolidation and reform program was implemented, resulting in efficient farm size. The distribution ownership was already relatively equal. Mechanization and multiple cropping appear to have been stimulated in part as a response to the increased peak-demand for labor and bottlenecks resulting from the increased

<sup>1</sup>A definitive firsthand account of the experiment, which lasted from 1953 to 1960, noted that remarkable improvements of health and living conditions in the follow-up of 1969 (Wyon and Gordon, 1971).

<sup>2</sup>It was alleged that the Indian government introduced some of the new strains in Punjab, where a favorable reaction was likely because of the progressive reputation of the farmers (Sorkin, 1971). We have drawn much of our economic account of Punjab from this last source.

yields. It was facilitated by tube-well technology and indigenous small-scale engineering, which responded to the increased demand for labor-saving substitutes with inexpensive small-scale reapers and threshers, mostly unassisted by outside sources.<sup>1</sup> The adoption of the new technologies was widespread and not characterized by significant economies of scale, possibly one might conjecture, because the technology of the industry responded to the initial distribution of landholdings.<sup>2</sup> The displacement of agricultural labor from mechanization has not resulted in growing inequality because the technology itself has not been biased.

From a demographic standpoint Punjab is of considerable interest today because of subsequent events. This state, whose rural inhabitants Mandani used to support the thesis that children are needed for economic reasons, has in recent years experienced rapid fertility declines and more widespread use of family planning than in the rest of India.<sup>3</sup> Income growth and structural change, which may have stimulated population growth initially, today appears to be accelerating fertility decline.<sup>4</sup>

<sup>1</sup>Child and Kaneda (1975) describe the development of agriculturally related industry in the Pakistan Punjab, but their remarks seem to apply to the Indian state as well. They wryly suggest that the agricultural sector and small-scale engineering could continue to grow in tandem but that current government policies emphasizing tractors may abort the process.

<sup>2</sup>In any case, Punjab was not unique in this respect. Raju (1976) found that adoption of the new agricultural technologies was associated with a decrease in income inequality in the West Godavari district of India.

<sup>3</sup>Its crude birth rate declined from 40 to 35 during the 1960s.

<sup>4</sup>Wyon and Gordon (1971). A suggestive account of the agricultural transformation is found in Cummings (1967). For a recent report on an integrated health services project in Punjab that some of the points above reflect, see Johns Hopkins University (1978).

Punjab illustrates not one point but several. The Green Revolution took hold there from the new agricultural strains but was complemented by water supply projects, technologies, and effective rural credit and cooperatives. It is plausible that the relatively equal distribution of land affected the breadth of subsequent socioeconomic progress, the direction and diffusion of technological change, and agricultural investment - all of which have tended to lower fertility.

To summarize some of the points in this section, economic growth as an objective seems in principle consistent with reducing rural poverty. There are policy interventions that can strengthen the tendency or avoid exceptions to its generality. In a number of instances, a case can be made that such measures to increase equity would also stimulate growth. Elements of the rural development strategy included land reform measures, expenditures on complementary infrastructure, and avoidance of pricing policies that discourage the use of economically efficient technologies. The direct development and distribution of such technologies could also be supported in ways that would complement industrialization. That new farm technologies can reduce the demand for children has been emphasized and is consistent with the longer-term experience of Punjab and other areas with rapid agricultural development. Clearly a more systematic analysis is required to determine the strength of this factor. It does, however, suggest one possible way by which rural areas in a low social setting could provide an incentive for lower family size by stimulating investment and saving propensities.

While the immediate intent of rural strategies might be to promote development, consideration should be given to how these might be expected

to affect fertility. A complete rural development strategy would include fertility as one component if only because of the potentially important synergism of fertility decline and development.

### 3. Rural Financial Markets and Marketing Systems

The life-cycle aspects of fertility and family size have been discussed in Part I. Implications for rural financial markets will be developed in this section. The negative association of the child-dependency rate and the savings rate found by Leff (1969) was interpreted as a causal relation running from the dependency rate to savings. With equal plausibility, the relation might be interpreted as running from savings to the dependency rate. A simultaneous-equation framework appropriate for determining the values of these different structural relations has not to our knowledge been tested in the literature for LDCs,<sup>1</sup> but would appear to have a high research priority in view of the importance attributed to domestic saving in development planning.

We shall here consider rural financial markets as a vehicle in transferring purchasing power over time. Their efficiency in this respect may be compared with that of tangible investments, such as discussed in the preceding section, and with parental investment in child quantity.<sup>2</sup> Our working hypothesis is that as the efficiency of the financial system increases, investment in child quantity decreases.<sup>3</sup> Parents come to rely less on children for income and security. It should be emphasized that while the efficiency of the financial system in mobilizing and allocating saving has

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<sup>1</sup>Kelley (1976) estimated a highly simplified simultaneous equation model for an 1889 U.S. survey of household heads in mining and manufacturing. He concluded that the effects of number of children on total household savings were ambiguous. A more pertinent formulation with respect to economic growth might consider the effects on per capita saving. Simon (1977) also challenges the negative impact of family size on saving. Leff (1969, 1971) found a strong inverse relation of the saving-income ratio to the dependency rate but did not test for simultaneity.

<sup>2</sup>Why does it seem implausible to suggest that empirically financial institutions would encourage investment in child quantity? Perhaps because such investment would provide very poor collateral.

<sup>3</sup>Theoretical treatments along these lines include Razin and Ben-Zion (1975) and Neher (1969) discussed in Part I.

been investigated recently, its relation to family size has been subject to empirical study (to our knowledge) only tangentially. Discussed below are some basic principles of financial efficiency à la Gurley and Shaw, the potential effects of the financial system on the demand for child quantity in LDCs, imperfections and proposed reforms of financial markets, and empirical evidence on the subject.

#### The Efficiency of Financial Intermediaries

The financial system in LDCs has received some attention in recent years.<sup>1</sup> At a level of high generality, financial institutions can be said to channel saving and borrowing in a manner calculated to maximize social product. We use "bonds" ( $B$ ) in this section as a generic term for financial assets purchased from or deposited with financial intermediaries (FIs). The FIs transform the debt of borrowers into more marketable assets. They accomplish this through portfolio diversification, which reduces the overall risk of their holdings, and scale economies to provide services to bondholders. A prototype of the FI is the commercial bank whose "bond" is the bank deposit. Other FIs include coops and insurance companies. The bond "interest rate" (which we shall interpret rather literally as the return on "bonds" in competitive equilibrium) equates supply and demand for bonds. The interest rate on the bond buyers' side of the market (that is, bond demand  $B^d$ ) reflects the opportunity cost of bond buyers' funds. The interest rate on the bond seller's side of the market (bond supply  $B^s$ ) reflects the scarcity value of loans after deducting for costs of intermediation. The figure below illustrates.

<sup>1</sup>See for example D. W. Adams (1978), McKinnon (1976), and Newlyn (1977).

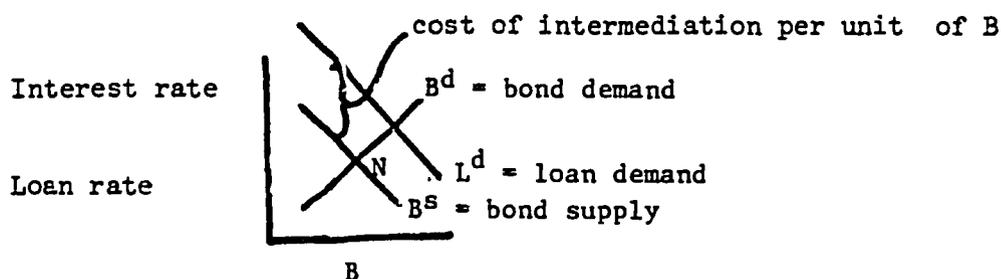
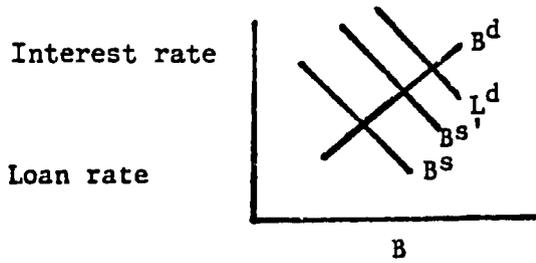


Fig. 10

The  $B^d$  schedule is drawn with a positive slope to reflect substitution away from other forms of saving, direct investment, and consumption at higher interest rates although conceivably it could be negative with target saving. The  $L^d$  curve is the demand for FI loans by borrowers. Its negative slope reflects the diminishing marginal efficiency of investment and a substitution effect toward present consumption by consumer borrowers.  $B^s$ , the bond supply curve, shows the interest rate that a competitive FI would pay bondholders for each quantity of  $B$  after deducting the costs of intermediation which are given by the vertical distance between  $L^d$  and  $B^s$ . We shall distinguish between this interest rate available to bondholders (depositors) and the loan rate charged to FI borrowers. The FI channels loanable funds into their most valued uses. The average return on investment and (quite possibly) total saving increase as a result of such borrowing, which increases output due to efficiency gains. The unit cost of intermediation falls as a result of advances in financial intermediation, reducing the difference between the interest rate charged to borrowers and available to bondholders (Fig. 11) at each volume of  $B$ . This reduces the equilibrium interest rate charged to borrowers and increases the interest rate available to bondholders as well as the volume of  $B$ . Output increases as a result of the increased scope of financial intermediation.



Reduced Cost of Intermediation from Shift of  $B^S$  to  $B^{S'}$

Fig. 11

The Demand for Child Quantity and Rural Credit

What follows is an attempt to analyze rural credit markets in terms of some factors thought to affect the demand for child quantity. Since this relation has not been spelled out in the literature, our results are necessarily more tentative than other parts of the paper.

One of the most important functions of large families, it has been argued, is to pool the changes in the productive capacities of the individuals who comprise the family to assure the stability of consumption patterns over time. The pension motive for large families is one aspect of this (Mueller, 1975:146). The insurance motive is another (Schnaiberg and Reed, 1974, Caldwell, 1977:20, 24; Kuznets, 1975:395-96; Repetto, 1976a). To the extent that the rate of return on children is relatively low, it would appear that the insurance motive should be given more weight. Bonds, including insurance, also provide a vehicle for intertemporal income transfers and risk aversion with a number of desirable portfolio characteristics compared to child quantity or alternative investments. Bonds draw on a wider pool of risk and thus may be a more efficient means of reducing risk. They can be tailored to insure against particular forms of risk, which may be cheaper than a more general form of insurance that large families can provide. Bonds are more liquid, a dimension of their value as insurance. Like additional children and unlike, say, land or

some capital transactions they do not require a large initial outlay.<sup>1</sup> Thus, their acquisition can avoid the high interest rates of private money lenders in unorganized credit markets.<sup>2</sup> The efficiency of bondholdings as a mechanism for transferring income over time depends on their interest rate relative to the return on child-quantity expenditures. Despite some lack of consensus on the rate of return from children, it is clear that increasing the interest rate on bonds would increase their relative efficiency, resulting in a substitution effect against child quantity.<sup>3</sup> It will be argued that the expansion of rural credit to young adults could reduce the return on child-quantity expenditures. This would further increase the substitution against child quantity.

The growth of FIs from reducing the costs of intermediation could be expected to have egalitarian income consequences with all of its implications for fertility by lowering loan rates and increasing credit access to small borrowers and by increasing interest rates to small savers. It is noteworthy that on both the supply and demand sides of the FI market, these interest rate effects could be expected to produce substitution effects away from child quantity and toward products that would displace child quantity, such as education, consumer durables, and labor-saving but costly technologies and inputs. Lower loan rates would reduce the future cost of such

<sup>1</sup>On this point see Repetto (1976a:86) and Mueller (1976:150).

<sup>2</sup>Interest rates in excess of 20% to perhaps 50% have been cited as typical for rural credit (Repetto, 1976a:86). A study for Malaysia reported effective interest rates of 24 to 200% even with collateral of gold, crops, and land titles (Newlyn, et. al., 1977:215-16).

<sup>3</sup>On a related point, see the Robinson-Neher exchange (1972).

expenditures. Higher interest rates to bondholders would reduce the saving (present consumption forgone) needed to acquire a claim to future consumption or durable goods. In the concrete, substitutes for child quantity could include such items as schooling expenses, housing, bicycles, sewing machines, piped water and pumps, cornmills, radios, electric fans, land, fertilizer, farm implements, or improvements in any of these. A survey of Taiwanese households provides some suggestive results. It was found that the most frequently mentioned items for saving were education (75%), housing (50%), and consumer purchases (17%). Some 76% mentioned saving for old age as an important reason for saving. Moreover those with better housing and modern consumer durables had accumulated more saving than other couples, holding constant income, age, and education, which would appear to support a persistence of saving habits. Finally, high consumption aspirations were associated with high aspirations for their children's education and smaller desired family size (Freedman, 1972: 249-52, 257-58; 1975). The most plausible interpretation for the last finding would appear to be that higher consumption and education-aspirations would come partly at the cost of child quantity. These findings do not provide direct evidence on interest rates, which we shall consider later. They are, however, consistent with the intrinsic complementarity (Hicks, 1956:162) of saving, educational outlays, housing, and consumer durables in the sense that if the demand for one changes, the demands for all of them change in the same direction. The substitution effect of a rise in the bond interest rate and fall in the loan rate resulting from reductions in costs of intermediation would work in the same direction to increase bond use and reduce

outlays for child quantity. While the income effect might be positive, the weight of demographic transition theory suggests that the substitution effects (eventually, at least) would prevail. Empirical evidence would still be required for the particular change considered here. Interestingly, Mueller and Cohn (1977) find that (for apparently the same survey as used by Freedman) the income effect is, if anything, slightly negative, which they attribute in part to the independence that income can provide.<sup>1</sup> In this case the substitution and income effects would be mutually reinforcing.

The interest-rate effect on the demand for child quantity and quality is an especially striking application of the Becker-Lewis-Tomes analysis. The expansion of FIs resulting from the fall of intermediation costs would lower the loan rate and raise the interest rate, which would as has been indicated tend to raise borrowing and saving for education because of the lower cost of education. There would be a substitution effect away from child quantity toward child quality (education). The income effect by itself could negatively influence child-quantity demand through the quantity-quality interaction. The substitution and income effects together would be more negative. In this instance equity and efficiency would both work in the same direction.

The effect of the FI on loan demand and family structure is worth further consideration here. We have offered reasons why the FI bonds would substitute for child quantity. By the same token, parents of young couples would become a less accessible source of credit for the young

<sup>1</sup>This need not conflict with the conclusion in the Part I that cross-country evidence points to a positive income effect. Self-selection of those who substitute high savings for child quantity could explain the Mueller-Cohn results. Such self-selection is especially plausible for Taiwan with the relatively high return available to savers there. Formally, their equation would be subject to simultaneous-equation bias if income was in fact endogenous. A more conclusive test of the income effect would use time series data to determine whether those with higher initial incomes subsequently had a higher desired or completed family size.

couple, which would increase the dependence of the young on FIs. Even ignoring this possibility at the level of the individual family, access to FI credit at lower loan rates would reduce the dependence of children on parental inheritance, which for the purpose of analysis might be viewed as an implicit (soft) loan, contingent on satisfactory manifestations of filial devotion.<sup>1</sup> The competition of FIs in lowering the loan rate would mean that parents could extract less of a monopoly rent from the services of young adults, especially men. In other words, the return on child quantity would fall, making it a less satisfactory vehicle for the intertemporal transfer of income. To use John Caldwell's telling expression (1976), another "prop" of the extended family would be knocked away.

Kuznets has estimated that husbands of women in the later child-bearing ages average up to nine years older than their wives in LDCs compared to about three years in developed countries and that one-third of the difference in crude birth rates between LDCs and DCs is attributable to the considerably higher births to men aged 40 or more in LDCs (Kuznets, 1975:376). One interpretation of these results is that some significant fraction of men marry at an older age in LDCs than in MDCs.<sup>2</sup> The difference in ages could give rise to husband-wife differences in optimal child-spacing for old-age support. Husbands would tend to favor having

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<sup>1</sup>See Cain (1978:435-36) for related comments and evidence from Bangladesh that land ownership delays considerably the time when sons leave the parents' household. There may of course be other explanations for filial devotion. The existence of enduring closely-knit poor families is one indication of this. The belief of poor young parents that it was in their long-term interest for such an institution to endure might nonetheless provide a partial explanation for the phenomenon.

<sup>2</sup>Kuznets notes that the median age of husbands of those in child-bearing years is slightly less than in DCs. He also found a significant increase in the gap between the ages of husband and wife in LDCs from five years for younger wives to nine years for older wives. This phenomenon was negligible for MDCs. A greater variance in the marriage age of men in LDCs could explain these results.

earlier-born and wives later-born children.<sup>1</sup> For risk-averting couples, a higher completed family size might result. If greater access to credit lowered the average marriage age of men, which would incidentally leave fewer working years of single young men available to parents, or raised the marriage age of women (because of increased education), the divergence of objectives and with it the need for high completed family size would be reduced.

#### Institutional Aspects of Rural Finance and FI Markets

Perhaps the most important characteristic of rural credit markets in connection with demographic variables in LDCs is their ability to provide satisfactory alternative to the large family for saving, borrowing, and consuming over the life cycle. The persistence of high-fertility regimes is one indication that credit markets, along with other institutions, have in general been unsatisfactory substitutes for the large family. Rural credit markets are notoriously fragmented and unorganized. Yet, despite the imperfections, the volume of capital transactions is significant. Repetto (1976a:86) states that "Both firsthand observers and survey researchers report that a substantial fraction, perhaps a majority, of peasants have debts. Most of this indebtedness is to noninstitutional lenders ..." Clearly FIs would only better be meeting an existing demand, not creating a new one.

There are reasons to believe that both the equity and efficiency FIs could be significantly improved through the removal of regulatory restrictions. Interest-rate ceilings well below competitive market levels

<sup>1</sup>In this connection, see Mueller (1976), who offers old-age insurance for women as one solution. Cain (1978:432) notes the keen awareness of Bangladesh women of the importance of sons to their future welfare and the adamance of wives in postponing contraception until at least the birth of a second son.

are common in LDCs. A shortage of credit is the predictable result. Typically the shortage is managed by denying institutional credit access to small farmers, tenants, and landless workers because of the high administrative costs of such loans, high collateral requirements, and, it is said, the political influence of larger borrowers (Johnston, 1977:894; McKinnon, 1973:32, 73-75; Development Digest, 1978:9; Pearse, 1970; Streeter, 1973; Owens and Shaw, 1972; and Lele, 1974). The low interest rates discourage institutional saving even as informal credit markets flourish. The credit that does flow through FIs is likely to go into "safe" and low-return investments because of their low administrative costs and the inability of FIs to capture the return on more productive activities. The constrained equilibrium solution is illustrated in Fig. 12 by points C (the constrained loan rate) and E (the ceiling interest rate on bonds). Equilibrium quantity there is determined by the short side of the market on the bond demand curve at the interest rate ceiling.<sup>1</sup>

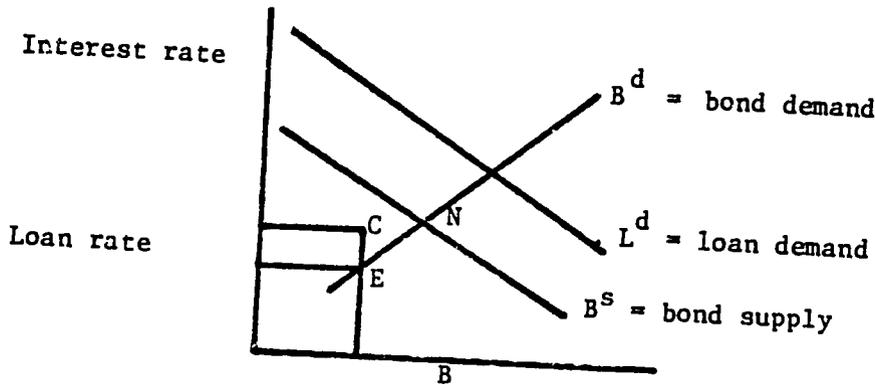


Figure 12

The policy solution to this impasse is immediate: remove the ceilings on loan and bond interest rates (Adams, 1978; McKinnon, 1973; Development Digest, 1978:6-14; and Newlyn, 1977:61-63). In effect, permit (or require) FIs to act more like competitive profit maximizers. The impact on FIs would be equivalent to a reduction in the costs of intermediation. A new equilibrium would be established at N in Fig. 12. There would be gain in efficiency from FI borrowers at the margin obtaining more credit at a cheaper loan rate than unorganized markets could provide. The nominal loan rate at the FI at the new equilibrium might be higher than before, but the loans would now be going into their most productive (highest return) uses and a larger loan volume would likely result. It is important to emphasize that a credit shortage resulting from artificially low interest rates has strongly tended to reduce rather than increase access to credit by small borrowers. They have been unable to compete with large borrowers in low administrative costs of the loan but could compete on the basis of the overall loan rate. The best evidence for this is the much higher loan rate small borrowers pay on the unorganized credit markets. The lack of credit access has been described as perhaps the principal obstacle to adoption of new technologies by the small farmer (Lipton, 1978). Removing interest rate ceilings could thereby remove one important barrier to modernization in agricultural methods and as the previous section argued, ultimately accelerate the demographic transition by encouraging adoption of alternatives to child labor.

On the bond demand side, the higher interest rate at point N would provide an alternative to low-yield investments, possibly including large families.

Some other recommendations culled from the literature on rural credit include: indexing interest rates on savings instruments in countries with

<sup>1</sup>For a brief theoretical treatment of the real effects, see McKinnon (1976:19-20).

high inflation rates; nationwide deposit insurance; adjusting laws to permit greater integration and less fragmentation of financial institutions (for example, through life insurance options tied to savings deposits); more incentives for successful organizations and managers (Adams, 1978; McKinnon, 1973:68-79); lending to small groups, coops, or private money-lenders to reduce costs of information or administration; making loans contingent on accumulated savings or community efforts; using high school graduates to market and supervise small FI accounts, for example by bringing the FI representative to the rural residents, which may reduce total transportation costs including travel time (Carroll, 1973, Development Digest, 1978:15-20, 31-33; McKinnon, 1973:78; Repetto, 1976a: 87); and supervised credit and technical assistance to small farmers to reduce total risk (Gillette and Uphoff, 1973; Streeter, 1973). The demonstration effects of the last-mentioned reform could be as important as the credit itself. Reserve requirements on deposits might also be lowered in those instances where they have acted as an unnecessary impediment to credit expansion. A comprehensive and simple proposal that might accomplish most of these would be to denationalize FIs wherever feasible.

#### Interest-Rate Sensitivity of Savings and Demographic variables

There appears to be no direct evidence on the relation of FIs and demographic variables. Nonetheless the indirect evidence is suggestive. As indicated above (pp.79-80), Leff (1969) found that a high dependency ratio was associated with a low saving rate. To the extent that investment in child quantity substitutes for inadequate savings outlets, an improvement in the incentives for saving through higher interest rates at FIs could reduce the demand for children.

But would raising interest rates increase total saving? The evidence is ambiguous on this point and its relation to fertility is subject to misinterpretation. For example, if savings/income is the dependent variable, a rise in interest rates could have no measured effect on it and yet still reduce fertility if both per capita income and per capita savings increased proportionately from a fall in fertility. Even an increase in savings per parent is not a necessary pre-condition for fertility decline if increased future interest income from higher interest rates is a substitute for future income from children, hence, for current child quantity.

Most of the quantitative studies on the relation of interest and savings for LDCs are based on Asiatic countries. Gupta found a relation for Indian data similar to that described above. Household saving was not significantly related to the interest rate, but the relation for per capita saving with income held constant was significantly positive. Gilbert Brown found that for Korean data interest rate changes "explained" 92 percent of the variation in the average private saving rate.<sup>1</sup> A larger group of studies is addressed to the narrower question of whether the demand for savings deposits, as distinguished from total savings, is positively related to their own-rate of return. Interest-rate reforms in Korea, Taiwan, and Indonesia have been accompanied by such sharp increases in deposits as to leave little doubt on this question. There is also evidence that they have contributed

<sup>1</sup>The results are summarized in Mikesell and Zinser (1973:17-18).

significantly to economic growth<sup>1</sup> As examples of financial repression slowing intermediation, a number of countries in Latin-America provide a useful contrast.<sup>2</sup>

Despite the potential, financial reform is obviously only one tool in development planning. Its relation to demographic variables has been too little studied to be considered more than an extremely promising lead. By the same token, it should not be considered less than that.

<sup>1</sup>For whatever it is worth, these countries also appear to have made progress in the acceptance of family planning programs. Again, it may be noted that empirical research on the relation is lacking.

<sup>2</sup>See McKinnon (1973:98-116), McKinnon (1976), and Mikesell and Zinser (1973:18-19). One study of Mexico by Reynolds (1974) concluded that interest rate controls reduced saving by lower income groups in Mexico (cited in Kline, 1975:383). For a study of Africa that finds little relation between economic development and monetary institutions but that ignores interest rates, see Bhatia and Khatkhate (1975).

#### 4. Participation of the Rural Poor

Much of the previous discussion has addressed the question of how low-fertility incentives might be strengthened to promote development, which population impinges on at important points and which is closely related to the status of the rural poor. Why then is a separate section needed on the participation of the rural poor? The most important reason is that such participation appears to be an efficient and necessary means of implementing development objectives. It is efficient because it enlists the support and resources of the rural poor. It is necessary because fertility is obviously affected by actions that are among the most personal and least subject to direct policy control.

Perception seems especially important for explaining fertility patterns. As Coale (1975) notes, the highly varied patterns of the demographic transition for nineteenth century Europe, particularly in the initial stages, seem to have been mediated at least as much by cultural traditions and norms as by other social and economic conditions. The cost-effective influence that mass media seem to have had on fertility in some instances (Rogers, 1973; Freedman, 1976) suggests that perceptions can be influenced through policy interventions to some extent. For perceptions to change further, it would be appropriate that those affected have the opportunity to determine or learn how a fall in their own fertility and especially that of their community could benefit them as part of an overall development effort.<sup>1</sup> A perception

<sup>1</sup>Without a linkage to the community, such participation would be pointless, since parents would already be in a position to determine what is in their private interest. We put to one side the possibility of pure ignorance about the consequences of private decisions as being not especially relevant to the subject of this section.

of the benefits from such a change would likely engender greater community support for effective public policy measures intended to change fertility incentives.

The relation of private fertility decisions and provision of social services (education, etc.) is perhaps the most obvious area where decisions of the community and parents interact. The discussions in Turchi and Bryant (1979) and King (1974) indicate the difficulty of devising measures that raise the cost of high fertility without penalizing the poor. An alternative would focus on the public benefits that could accrue to parents who maintained low fertility, for example through greater access to public schooling. Salaff and Wong (1978) note that such incentives (which are fertility disincentives) are not seen as coercive in Singapore, where they have been tried out most extensively, because of the perception that high fertility imposes costs on society at large. Admittedly, Singapore is not typical of the developing countries, but the negative spillover effects of high fertility are a general problem. To the extent that it is recognized and treated as such, community support for measures to lower fertility incentives may be more forthcoming.

There are "prisoner's dilemma" aspects of fertility disincentives, as Demeny (1971) notes. While it may not be in the interest of any parents to be individually subject to such disincentives, parents may decide that such measures are in their collective interest and support them. The likelihood of support would appear to depend on whether the collective and individual benefits were built into the supply of social services. For example, if fertility fell in a community, how could it be assured that more educational outlays would be spent per child? This

would not appear to be a serious problem if the formula for funding had alternative fertility outcomes built into it. But for such a formula to be put into effect, a clear understanding of the relevant tradeoff between social services and fertility would be required. Hence, the need for community participation and understanding of the relation. Once such acceptance of the social interest of

promoting lower fertility was present, the principle of providing incentives for lower fertility might gain support across a wide range of policies.

As one alternative or complement to strategies emphasizing importance of the direct relation between government and households, McNicoll (1975) presents rural nineteenth-century Japan and to a lesser extent contemporary China. In these instances, village communities rather than individuals are the basic client of government. One advantage of organizational structure, he argues, is that the community through social pressures may be able to internalize the social costs of population growth more equitably than trying to work directly through the individuals. For such an approach to work, the community would have to exercise tighter control over its members than where households deal directly with government. But as a result, the village might be able to solve its problems and exercise more autonomy at the local level, including community self-help, than if households had to deal with a government farther removed from their immediate control.

It is certainly the case that population policy in the People's Republic of China represents, to use the polite term, a highly

disciplined effort. Even those not given to unnatural enthusiasms on the subject concede that policy of China in this area has been effective, although the precise extent of its success remains in doubt.<sup>1</sup> What lessons it can offer to other countries may depend on the relative effectiveness of various alternatives such as have been discussed above. An advantage of less tightly controlled societies is in being free to consider a wide range of options to determine the least socially costly way to meet given population objectives.<sup>2</sup> As Johnston and Meyer (1978) observe, the market economy of Taiwan, like China, has achieved high rural participation, a high rate of capital formation, narrowing-income differences, and fertility reduction simultaneously. Thus, similar outcomes are possible under quite different institutional settings.

At another extreme, it is possible to learn from failures as well as successes in rural participation. Bangladesh offers an example of social fragmentation, uncertainty, and risks to health such that children and the family may be considered the best investment and social insurance (against the loss of land, for example) available in an otherwise nonprotecting and threatening world. What is needed there, Arthur and McNicoll (1978b:67-68) note, is an "intermediate level" strategy directed at a level between the national government and the individual:

<sup>1</sup>Aird (1978). See also Goodstadt (1978).

<sup>2</sup>For detailed discussions of population programs, incentives and controls used in China, see Salaff (1972) and Chen (1976).

Much could be done to provide security at the local level-- economically, through surer access to employment, credit, agricultural inputs, and irrigation; and demographically, through measures that prolong the lives of husband and children and reduce the gap in age between husband and wife. But more important than specific measures, if the new local system is to help break down the uncertainties that preserve high fertility and stifle individual initiative, it must provide a setting in which the individual looks to the community and his position within it for support and security, and less to the capricious favors of landlord and patriarch.... What is missing at present in Bangladesh that would greatly ease such a task is a coherent development style -- an overall strategy that works toward a single purpose, that aligns interests in the same direction, and cuts through conflicting objectives. The present array of loosely organized programs and ad hoc incentives is more a complex reaction to the pressures of urban interest groups, international agencies, and the rural power structure than a singleminded instrument of development.<sup>1</sup>

Rural participation in this context is not so much an activity as a vivifying principle, the means by people are drawn into the development process, giving shape and coherence to what would otherwise be a mere collection of programs. The implementation of the programs would of course be done through the functional administrative units responsible for them. But those units would be charged with making operative the relevant mechanisms by which the demand for public services could be met most efficiently given the limited availability of such services. Social services would reflect the final goals of development, including a component for influencing fertility. The goal of education would be to educate a higher percentage, not simply a larger number of children. The goal of public health would be to improve public health, not simply to add more hospital beds, and so forth.

<sup>1</sup>See also Cain (1977, 1978).

For some important classes of development activities, rural participation should be considered as a way to increase output directly, for example, through building transportation infrastructure, rather than merely efficiently dispensing the use of existing resources. Nonetheless, without a shared community of interests, an effective organization for mobilizing the labor, or an ability to tax would-be "free riders," the project might not be undertaken.<sup>1</sup> Some such activities might have little direct effect on fertility, but by stimulating community development and laying the basis for adoption of new technologies, they could accelerate the displacement of the household as the primary unit of production. Making direct use of such relations for population would be impractical unless their impact on fertility could be accurately measured. Policy makers, who would need such information to determine the feedback effects of population on the rest of the economy. This of course would not deny the usefulness of the activity, but it would suggest that there are limits as to what the population component of development activity can usefully say. Such disarming humility is an appropriate way to close this section.

<sup>1</sup>For an example of a community irrigation project where such problems were overcome, see Kikuchi et al. (1978).

## 5. Area/Regional Development

In a related vein, a good, if not the best, reason for emphasizing regional development is the failure of national programs. Zeidenstein (1977) suggests that in some instances the failures were due to integrated programs being so overloaded with functions that they were impossible to administer effectively at the national level. The solution in those instances might be to regionalize or localize their administration in order to reduce their complexity without sacrificing organic integrity. This would represent a "shift of attention and emphasis from the results of particular development programs to the search for better structures for going about the business of development."

It could also be argued that regionalization by planning from the bottom up rather than the top down would result in more cohesive and responsive administrative structures. It might help to avoid building errors into the national system. Regionalization would permit different regions to learn from each others' successes and failures. Given the significant fact of imitation in the spread of fertility declines (Coale, 1975:353) permitting regional differences could accelerate the evolution of viable institutional alternatives to high fertility.

Development of marketing towns or cities is an aspect of integrated rural development. Central to this argument is the assumption that the role of urban areas is important in the development of the

rural areas they serve, and that creation of market towns, which would act as servicing centers for the agricultural lands surrounding them, would aid in increasing the production of rural areas (Johnson, 1970). A by-product of the market town concept would be to alleviate the influx of rural migrants from rural areas to already existing, larger urban areas. When combined with a comprehensive rural development program marketing centers will contribute to the overall economic development of the rural region. Such an hierarchical approach to development recognizes the necessity of linking rural areas to service centers where commercialization of agriculture, off-farm employment, and access to service oriented industries can be found, and where the availability of jobs may provide the employment for the human capital so often idle in rural areas.

By encouraging group involvement and cooperation within the rural sector, it is hoped that an appropriate distribution of services and opportunities will be achieved (Owens and Shaw, 1972 and Streeter, 1973). Such an approach reaches a maximum number of individuals while also spreading risks among groups rather than among individuals. Administratively, this technique results in a more efficient allocation of resources. At a maximum, such integrated rural development strategies encourage local initiative and responsibility. While government assistance and guidance is available, rural areas are, through increased knowledge and resources, able to help direct their own development.

Comprehensive rural development strategies then, by increasing job opportunities through labor intensive technology and through jobs in the

non-agricultural as well as the agricultural sectors, raise incomes and introduce some of the services so often found only in urban areas.

Comprehensive rural development not only stresses increases in agricultural technology and output, but also has as a basic goal the vitalization of the lifestyle of rural residents. Rural development strategies should seek to establish social and physical infrastructures which allow rural residents to share in the benefits derived from the country's more general economic and social development. It is necessary, therefore, to establish such physical improvements/creations as roads, electrification, and water supplies and such social efforts as schools, clinics, marketing facilities and general housing and community buildings.

Physical infrastructure improvements are particularly important. Without roads, for example, access to the markets and supplies of other economic areas is limited and therefore incentives for increased productivity may be lacking. Johnson (1970) suggests that three forms of roadways are necessary to link rural areas with the specialization or centralization which usually exists in urban areas: "commuter routes" allowing for daily traffic to and from work; "farm-to-market" linking district markets to the rural areas and permitting concentration of buyers and sellers; and "truck" roads allowing goods and services to flow from one economic area to another. Several countries have road

building programs which incorporate such a farm to market strategy: Nigeria, Malaysia, Israel and Yugoslavia (see Poleman, 1972: and Johnson, 1970).

Water supply is another physical infrastructure improvement with both its quality and availability being important to rural development. Many countries have programs to assist self-help development of such water facilities as well, village water supplies, ponds, etc., such as Bangladesh (Choldin, 1972), Malaysia (Kulp, 1970), and Colombia (Adams, 1969). Primarily these projects are designed to increase productivity in agriculture and to attract industry to rural areas, but they have the added quality of upgrading water quality and indirectly improving sanitation and health conditions of rural residents. Together the provision of roads and water make it possible to diversify the production base and generate more employment and thereby increase the incomes of the rural poor.

#### 6. Off-Farm Employment

In general, two major avenues are available for the creation of off-farm employment: decentralization of small-scale labor intensive industries and farms and the creation of public works projects. Construction of public works projects may offer one solution to the unemployment and income problems in rural areas caused by high off-season unemployment. Such projects not only increase the availability of jobs, but may, in many cases, provide the much needed infrastructure (as previously discussed) so necessary for rural community development. As cited in Findley (1977),

rural public works programs have additional benefits for rural development. Jackson and Turner's evaluation of the Moroccan "Promotion Nationale" finds that 60,000 man/years of employment have been created each year and income has been redistributed to poorer families, while achieving an estimated rate of return on investment of 9 percent.

While creation of seasonal/temporary jobs may not be the only solution to the problems of the rural poor, they do act as a short-term solution to raising farm incomes and may contribute to rural community advancement.

Creation of permanent jobs for the rural poor offers a long-term solution: decentralization of labor-using industries would offer such employment.

Johnson (1970) cites one of the best examples of decentralization of industry in his analysis of the Puerto Rican "Operation Bootstrap" program. Puerto Rico has designed their program to match industrial location with resource and employment needs and has reported that such a program has had substantial multiplier effects on this rural development. Findley (1977) lists examples of such programs to induce industrial decentralization which would support rural employment needs as:

- assistance in feasibility studies;
- construction of infrastructure and industrial estates;
- tax waivers;
- special training programs for entrepreneurs;
- low interest loans for the establishment of small-scale firms;
- research supporting small-scale, labor-intensive technology;
- assistance in developing domestic and export markets;

With the creation of an industrial base in rural area, it can be expected that stimulation of rural development will occur by providing incentives and channels for local entrepreneurs to invest their savings. In the long-run, decentralization of industry will provide the infra-structural changes necessary for continued advancement in other rural development activities.

### III. SUMMARY AND CONCLUSIONS

Paradoxes abound in the relation of fertility to income and wealth. The sign of the relation (positive or negative) appears to depend largely on whether one is considering the long or the short run, the direct or indirect effect, the pure income effect or the substitution effect from economic development. Given the important effects of population growth on development, one should like to know whether and how the level and distribution of income are necessary, sufficient, or merely coincidental factors in changing fertility.

The empirical findings reported<sup>1</sup> are broadly consistent with a threshold relation of fertility to income in which fertility first increases, then decreases as the level of income and development rises (Easterlin, 1978). Even at the higher levels of development, however, the inverse relation is small relative to the total variation in fertility. Factors other than income are able to explain directly much of this variation in fertility.<sup>2</sup> Income growth by itself then does not seem to be necessary for significant fertility decline at higher levels of income nor sufficient at lower income levels. The observed relation of income and fertility also supports the proposition that an increase in income would lower the demand for children to the extent that parents have an incentive to substitute quality for quantity of

<sup>1</sup>Tsui and Bogue (1978), Chenery and Syrquin (1975), Encarnacion (1975), Simon (1974:108).

<sup>2</sup>Mauldin and Berelson (1978), Tsui and Bogue (1978), Anker (1978).

children with their higher incomes. The high-quality route would make further substitutions more likely by increasing the cost of children.<sup>1</sup>

Most studies have found a positive relation of fertility to agricultural landholdings, suggesting that children and land are in some sense complements. Parents with land may be able to afford more children or children may be more useful to parents for working or acquiring land.<sup>2</sup> The few studies available (in Asia) indicate that by itself equality of land distribution is associated with higher fertility (Kleinman, 1973; Rosenzweig and Evenson, 1977). By contrast it has been argued that equality of income distribution is conducive to lower fertility (Repetto, 1978; 1976b; Kocher, 1973; Rich 1973). This may be true at the higher income levels or for all countries combined, but for less developed countries the evidence that equality of income by itself lowers fertility is quite weak. Nonetheless, a good case can be that a more equal distribution (and higher level) of social services, which could accompany the change in income distribution, would lower fertility or hasten a fertility decline, even at the lower income levels.

The persistence of high fertility in low-income countries does not require the assumption of irrationality or shortsightedness of parents for its explanation. On the contrary, parents may be quite rational in preferring large families, given their social and economic milieu, including uncertainty and a low return on alternative investments.<sup>3</sup>

<sup>1</sup>Becker and Lewis (1974), Becker and Tomes (1976), T.P. Schultz (1974b: 40-44). For a detailed survey, see Turchi and Bryant (1979).

<sup>2</sup>Summarized more extensively in Stokes et al. (1979).

<sup>3</sup>Schnaiberg and Reed, Caldwell (1977), Ware (1978), Nag et al. (1977), Bulatao and Arnold (1972), Arthur and McNicoll (1978b), Mamdani (1972), Cassen (1976), Simon (1974).

One way of describing the conditions that give rise to high fertility is a pervasive failure of markets in both the private and public sector to provide a menu of alternatives that would make low fertility attractive (Neher, 1971; Blandy 1974). Such failures do not seem to be inevitable.

In the extension of social services, reforms would include not merely larger expenditures on family planning, health, and education but an optimal mix of such services. There is good evidence for favorable synergisms of public health and nutrition measures with the combination producing better health than the sum of the parts. There is also evidence that family planning is more readily accepted where health standards are higher. An integrated program of health nutrition and family planning then might provide more effective service at lower cost than the separate components.<sup>1</sup> How much fertility might be reduced as a result would seem to have a high priority on the research agenda.<sup>2</sup> It seems plausible that such a family health program synergisms would be strongest where life expectancy and health conditions were lowest.<sup>3</sup> If so, integrated programs might yield the highest benefits where population problems have been particularly intractable and have had the most deleterious consequences for development.

<sup>1</sup> Johnston and Meyer (1977) and Cassen (1976).

<sup>2</sup> For evidence, see Taylor et al. (1975), Johns Hopkins University (1978), and T. P. Schultz (1976b).

<sup>3</sup> For example, infant mortality has a much smaller estimated effect in Latin America than Asia or Africa in the Tsui-Bogue equations (1978), corresponding to the difference in life expectancy.

Improved health might also result in measurable productivity gains (Ram and Schultz, 1979). Increased life expectancy and productivity would both give parents further incentive to substitute quality for quantity in their fertility decisions as income rose.

Another quality-quantity tradeoff might be effected through educational expenditures if parents with low fertility could be provided with increased access to educational facilities for their children to match the lower costs that they imposed on the educational system.<sup>1</sup> Increased emphasis on non-formal education might also provide more immediate benefits to adults. A conjecture worth further study is the such nonformal education opportunities would lead them to substitute investment in themselves for the marginal child.

Rural development strategies offer a number of ways that growth and equity might be promoted. There is a considerable body of literature supporting the efficiency of less concentrated landholdings Johnston (1977). As Stokes et al. (1979) note, however, development is more likely to follow if the smaller farmers have adequate access to extension services, rural infrastructure, credit, and appropriate technology, all of which policy can significantly influence. Conversely, it has been argued that the distribution of landholdings may influence the direction of public policy (Raj, 1972; de Janvry, 1973; Griffin, 1974a, 1976).

The direct effects of rural development strategies on fertility are not well established. The limited evidence available suggests that by itself a more equal distribution of land would raise fertility. A plausible case can be made that agricultural modernization would lower fertility, more certainly in the long-run, by raising the return on alternative assets. By this view,

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<sup>1</sup>Salaff and Wong (1978); Wang and Chen (1973).

nontraditional farm inputs and children would be substitutes, unlike land and children. The hypothesis is virtually untested for low-income countries. Nonetheless, it is consistent with the view that appropriate technologies (Carr, 1976) and pricing policies (Mellor, 1976) could accelerate agricultural and industrial development. The policymaker is presumably already concerned with rural modernization. Estimation of the strength of the modernization-fertility relation might be of interest because of positive feedbacks from lower fertility to development, for example through increased saving.

Financial institutions provide another vehicle for raising the return on non-child assets for "bond" holders. They can increase credit access and net return on investment for borrowers at loan rates lower than on unorganized markets. Lack of credit access seems to have been a major obstacle to adoption of new agricultural technologies and mechanization by smaller farmers (Lipton, 1978). The security of higher-yielding financial assets and the higher return on modern farm technologies provide plausible alternatives to investment in larger families. Lifting ceilings on interest rates and loan rates could help to accomplish both of these objectives. Casual empiricism supports these demographic implications, but they have not yet been subjected to a more direct test. Such reforms, however, could have substantial advantages for other reasons (McKinnon, 1973).

Participation of the rural poor beyond the areas already mentioned is likely to be effective to the extent that social mechanisms can be devised that are perceived to be in their direct interest. Even negative social controls may be accepted if they are seen as working toward the general interests of those in the community (Salaff and Wang, 1978; McNicoll, 1975). Effective social organization may be consistent with a

wide range of institutional settings to reach the same end, but effective "intermediate level" organization seems especially important for internalizing the social benefits of community and regional action and the social costs of individual actions, for example, the costs of high fertility on social services (Arthur and McNicoll, 1978b). Success is more likely where organizations are able to concentrate on the ends of community action (mass literacy, etc.) rather than simple aggregates (number of schools, etc.). In connection with fertility, this would give a sharper focus to the real social tradeoff between quantity and quality.

As has been indicated, there remain a number of promising but inadequately tested areas for further research on fertility determinants. Many of the prospective policy reforms, however, could improve development prospects and allocative efficiency quite apart from their effect on fertility. Their demographic impacts would merely strengthen motivation for policy adoption. In this connection a high research priority would be to establish more secure empirical grounds for the effects on economic development from fertility decline and the factors associated with fertility decline. Recent world-wide experience of fertility change may provide the necessary data for this purpose. Such knowledge could provide motivation for a closer integration of development policy and population policy, to their mutual advantage.

An important aspect of modernization is the shift in specialization of production (broadly interpreted) from the household to the general economy. Becker (1960) has noted that there are no good substitutes for children but there may be many poor ones. As part of the great institution of reciprocal caring<sup>1</sup> that is the family, this is undoubtedly true of children. But as a source of material advantage, there may be adequate substitutes for the

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<sup>1</sup>To use the phrase of Griliches (1974).

large family. A key to the demographic transition consistent with enhancing development prospects of present and future generations may be to find such substitutes. Given the low absolute return on children estimated in a number of studies (Cassen, 1976), the development of substitutes might not be as distant a possibility as it first appears, if properly pursued.

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Full annotated listing to follow around Jul. 4.

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1975 "Family income, education, labor force participation and fertility." In Wilhelm Flieger and Peter C. Smith (eds.), A Demographic Path to Modernity: Patterns of Early-Transition in the Philippines. Quezon City: The University of the Philippines Press.
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1978 Integration of Family Planning and Health Services: the Narwagwal Experience. Baltimore: Johns Hopkins University, Department of International Health, School of Hygiene and Public Health.

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1974                    Population Policies and Economic Development. Baltimore:  
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1973                    "Fertility variation and resources in rural India."  
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1973                    Rural Development, Income Distribution, and Fertility  
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1978                    "Inter-farm, inter-regional and farm-non-farm income  
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1972                    The Myth of Population Control: Family Caste and Class  
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1978                    "Conditions of fertility decline in developing countries,  
1965-75." Studies in Family Planning 9(5):90-147.
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1973                    Money and Capital in Economic Development. Washington,  
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1972                    "Mechanisation of agriculture in India and Sri Lanka  
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1974 "Risk, uncertainty and family formation: the social context of poverty groups." Population Studies 28(3): 513-533.
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1978 "Are disincentives coercive? The view from Singapore." International Family Planning Perspectives and Digest 4(2):50-55.
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**ANNOTATED BIBLIOGRAPHY**

Note: Referenced in the text were other State-of-the-Art papers in this series. They were prepared, as was this one, for the South-East Consortium for International Development, the Research Triangle Institute, and the U.S. Agency for International Development as part of the Rural Development and Fertility Project, contract #'s SECID 1-U-15, RTI 1-516-1650, and AID/ta-BMA/CA #1. The authors and titles are listed below:

Findley, Sally, James Gundlach and Richard Rhoda  
"Rural Development, Migration and Fertility: What Do We Know?"

Cheng, Benjamin, William Lawson, and William T. Levine  
"Rural Development, Education and Fertility."

Griffeth, Janet, Gloria V. Javillonar, Susan Thompson, and  
Laurie Zivetz  
"Rural Development, Women's Roles and Fertility in Developing  
Countries: Review of the Literature."

Isley, Raymond B., Hetty Banatte, and Roland Norman  
"Relationship of Rural Development Strategies to Health and  
Nutritional Status: Consequences for Fertility."

Stokes, Shannon C., Wayne A. Schutjer, Terry L. McCoy, and  
Charles H. Wood  
"Rural Development, Land and Human Fertility."

Turchi, Boone A. and Ellen S. Bryant  
"Rural Development Activities, Fertility, and the Cost and  
Value of Children."

- Adams, Dale W.  
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1971 "Dependency rates and savings rates: comment." American Economic Review 61(3):472-475.
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1974 Social Equity and Economic Growth in Developing Countries. Stanford, California: Stanford University.
- The authors make a detailed case that growth of income and equity are not incompatible but may require a sequenced combination of policies to pursue both objectives simultaneously. They present a statistical case that income growth unaccompanied by human resource development (education, etc.) may lead to the absolute deterioration of the poorest in the lowest-income countries.
- 1975 "Distribution and development: a comment." Journal of Development Economics 1:401-402.
- A comment on Kline's 1975 remarks about their work.
- Adelman, Irma and S. Robinson  
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- The interactions between demographic and economic effects are examined with the aid of a computable general equilibrium model. Reductions in population growth do not improve the lot of the poor. On the contrary: their model estimates that moderate rates of population growth appear optimal for society, using both equity and absolute income levels of the poor as criteria.

Ahluwalia, Montek S.

1976

"Inequality, poverty, and development." Journal of Development Economics 3:307-342.

This exploratory regression analysis is "best viewed as a useful documentation of empirical regularities -- the so-called 'stylized facts' of cross-country experience." It also provides clues to the links of development and inequality. Among more important findings are that relative inequality first increases, then decreases but that absolute incomes of the poorest rise with income growth. Population growth is inversely related to income inequality and the incomes of the poorest. Education is associated with a more equal distribution of income, which suggests that lower fertility and higher educational levels are complementary processes in reducing income inequality.

Ahmed, Iftikhar

1976

"Reduction in rural income inequality through land redistribution: a quantitative estimate." Bangladesh Development Studies 4(4):499-502.

In this study the effect of land distribution on rural incomes is analyzed with the viewpoint that for policy, the implications of the land ownership/household income relationship have an important bearing on the assessment of potential land reform policies.

Aird, John S.

1978

"Fertility decline and birth control in the People's Republic of China." Population and Development Review 4(2): 225-254.

"The aggressive promotion of family planning in China is unique among national efforts to control population growth. The program seems to be having a significant impact. But there is no reliable evidence as to the degree of success achieved or the means actually employed. Atypical units cited for domestic propaganda constitute no basis for sound generalizations. Some of the fragmentary data available appear to be defective, and the nature of the records or investigations that produced them is obscure. It is too early to draw firm conclusions about China's achievements or to commend the Chinese example for consideration by other countries."

Ajami, I.

1976

"Differential fertility in peasant communities: a study of six Iranian villages." Population Studies 30:453-463.

From Turchi and Bryant (1979):

Reports findings from interviewing 250 couples in a first marriage living in a 1974 sample of 6 Iranian villages in rural districts north of Shiraz. About 75% of all households are included. Rejects the assumption -- generally prevalent in sociology -- that rural households are essentially homogeneous, and points out that this assumption is not well founded in empirical research. Found that in

these villages there is a direct association between family size and socioeconomic status. Introducing control factors (duration of marriage, contraceptive use) failed to change this association. There was a strong desire for large families and efforts to limit births were not initiated until their demand for children had been satisfied.

Anker, Richard  
1978

"An analysis of fertility differentials in developing countries." *The Review of Economics and Statistics* 60(1):58-69.

This paper analyzes fertility differences between developing countries in the late 1960s and investigates the extent to which they can be explained by differences in socioeconomic conditions and government family planning programs. Cross-national data are employed in a simultaneous equation framework.

Arthur, W. Brian and Geoffrey McNicoll  
1975

"Large-scale simulation models in population and development: what use to planners?" *Population and Development Review* 1(2):251-265.

Not much, the authors conclude.

"Large scale simulation modeling has recently emerged as a widely supported approach to policy evaluation in population and development. More than a dozen large computer models, multipurpose, disaggregated, and highly endogenous, now exist; others are being built. This paper examines the thinking behind these models and assesses their potential use to development planners. The model builders claim to provide a valuable tool for policy evaluation by tracing out both qualitatively and numerically the long-term implications of policy decisions. This claim is disputed. Specific faults identified include inappropriate accounting structures, oversimplifying of issues behind a superficial complexity, and a lack of concern with validation. Smaller issue-specific models are preferred."

1978a

"Samuelson, population and intergenerational transfers." *International Economic Review* 19(1):241-246.

A formal model is employed to trace the effect of population growth on lifetime consumption. Empirical estimates of the model parameters suggest that higher population growth lowers lifetime economic welfare.

1978b

"An analytical survey of population and development in Bangladesh." *Population and Development Review* 4(1):23-80.

"The economic and demographic situation in Bangladesh is described and analyzed on the basis of existing data and research findings. First an aggregate picture is drawn—historical background, natural environment, and broad trends in economy and population. This is followed by a more de-

tailed examination of the local context of development, covering land dynamics and rural social organization, and by a systematic treatment of demographic behavior at the family and individual level. A final section assesses development prospects for Bangladesh, given present patterns of social change and possibilities for government intervention."

Bardhan, P. K. and T. N. Srinivasan  
1971

"Cropsharing tenancy in agriculture: a theoretical and empirical analysis." *American Economic Review* 41:48-64.

This paper looks at cropsharing and tenancy in agriculture and gives a theoretical and empirical analysis of the relationship between these forms of land tenure and allocative efficiency.

Barraclough, Solon L.  
1970

"Rural development and employment prospects in Latin America." In A.J. Field (ed.), *City and Country in the Third World: Issues in the Modernization of Latin America*. Cambridge, Massachusetts: Schenkman Publishing Company, Inc.

This paper had three objectives: to review some of the current theories of the role of agriculture in economic development and to examine their relevance to the Latin American situation; to analyze the employment and income prospects of the rural population; and to consider alternative rural development strategies.

Bean, Frank D. and Charles H. Wood  
1974

"Ethnic variations in the relationship between income and Fertility." *Demography* 11(4):629-640.

The effects of husband's potential and relative incomes on completed fertility, as well as their effects on certain parity progression probabilities, are examined within samples of Anglos, Blacks and Mexican Americans.

Beaver, Steven E.  
1975

*Demographic Transition Theory Reinterpreted*. Lexington, Massachusetts: D.C. Heath and Co.

From Stokes, Shannon (1979):

An empirical study of the theory of demographic transition in Latin America. The author develops a series of propositions from transition theory and tests these with lagged variables for 24 countries from 1950 to 1969. Land availability was strongly related to fertility in a multiple regression analysis containing a series of demographic and social variables.

Becker, Gary S.  
1960

"An economic analysis of fertility." In *Demographic and Economic Change in Developed Countries*. Universities National Bureau Conference Series 11. Princeton, New Jersey: Princeton University.

This paper employs an economic framework to analyze the factors determining fertility. Children are viewed as a durable good, primarily a consumer's durable, which yields income, primarily psychic income, to parents. Fertility is determined by income, child costs, knowledge, uncertainty and tastes. An increase in income and a declining price would increase the demand for children although it is necessary to distinguish between the quantity and quality of children demanded. The quality of children is directly related to the amount spent on them.

Becker, Gary S. and H. Gregg Lewis

1974

"On the interaction between the quantity and quality of children." In T.W. Schultz (ed.), *Economics of the Family: Marriage, Children, and Human Capital*. Chicago: University of Chicago.

This paper argues that it is not necessary to assume either in the utility function or in household production, that quantity and quality are more closely related than any two commodities chosen at random in an attempt to understand data on the interaction between quantity and quality.

Becker, Gary S. and N. Tomes

1976

"Child endowments and the quantity and quality of children." *Journal of Political Economy* 84(4):S143-S162.

The earlier article by Becker and Lewis (1974) showed how full income would understate the theoretically appropriate income elasticity of demand for the quantity of children. On the assumption that income elasticity of quality was greater than income elasticity of quantity, they also showed that the observed quantity elasticity might be negative, although the true elasticity was positive. This extension of the earlier article uses the assumption that child endowments (that is, units of child quality that are independent of parents' expenditure on child quality) are positive to derive the same implications as earlier. They find that as a result the earlier assumption about relative elasticities is unnecessary. Their analysis has implications for measured income-fertility elasticities as they are affected by the income level, income growth, and social mobility.

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"Economic analysis of fertility in Israel: point and counterpoint." *Journal of Political Economy* 81 (2, Part II): S202-S233.

This article looks at cross-section evidence on fertility in Israel through a hypothesis which links education, the cost of time of women, and the price of children.

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1975 "Financial intermediation, savings mobilization, and entrepreneurial development: the African experience." International Monetary Fund Staff Paper 22(1):132-58.
- Little relation is found between economic growth and financial intermediation. Interest rates are omitted from the analysis.
- Bhattacharyya, Amit Kumar  
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- Evidence is presented from cross-national data that urban-rural income inequality raises fertility mostly through higher infant mortality and educational disparities.
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- This study is based on survey data for Turkey, Taiwan and Morocco and examines the impact of rural-urban income inequality on the spread of modern fertility values and the associated lifestyle to the rural population.
- Birdsall, Nancy  
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- Blandy, Richard  
1974 "The welfare analysis of fertility reduction." The Economic Journal 84(1):109-129.

A penetrating analysis of fertility spillover effects and critique of cost-benefit calculations from reducing fertility. The author nonetheless presents a qualified case for bonus schemes to reduce fertility, in effect to bribe the current generation so that the economic lot of the next generation might be improved.

Bogue, Donald J. and Amy Ong Tsui

1979a

"Zero world population growth?" *The Public Interest* 55:99-113.

Presents an argument that if appropriate policy actions are taken, the problem of rapid population growth can be largely ameliorated in coming decades.

1979b

"The role of family planning in reducing fertility in developing countries." *Family Planning Resume 2: forthcoming*.

The statistical underpinning and a more detailed argument of Bogue and Tsui (1979a) is presented.

Boulier, Bryan L.

1977

"Population policy and income distribution." Pp. 159-213. In Charles R. Frank, Jr. and Richard C. Webb (ed.), *Income Distribution and Growth in the Less Developed Countries*. Washington, DC: Brookings Institution.

A thorough survey that analyzes the way population policies (or lack thereof) can and do affect fertility. The paper concludes that rapid population growth slows per capita income growth and impedes most other goals such as health education. The feasibility and desirability of various measures to limit fertility are discussed, emphasizing effects on income distribution.

Brackett, James W., R. T. Ravenholt and John C. Chao

1978

"The role of family planning in recent rapid declines in fertility in developing countries: some findings from the world fertility survey." *Studies in Family Planning* 9(12):314-23.

From Cheng, Lawson and Levine (1979):

In this paper, data from the World Fertility Survey are examined to measure the impact of family planning and socioeconomic development factors on fertility control in ten developing countries -- Columbia, the Dominican

Republic, Fiji, South Korea, Malaysia, Nepal, Pakistan, Panama, Sri Lanka and Thailand. The analysis of the data revealed that, despite broad differences in geography, culture, religion, race and socioeconomic development, a large proportion of women in every country do not desire any more children.

This desire was found to be strong among rural, poor, and not very well educated women in all countries. The authors conclude that socioeconomic development is not a dominant factor in terms of the desire for fertility control by the populations, except among the poorest where the sheer survival of the existing family dictates the need to control further fertility. The role of family planning in at least eight of the ten countries is considered to be a prime factor accounting for fertility control and ultimately the declining rate of fertility in these countries.

Bulatao, Rodolfo and Fred Arnold

1977

"Relationships between the value and costs of children and fertility: cross-cultural evidence." Papers from the International Population Conference, Mexico 1977 1:141-56. Liège, Belgium: IUSSP.

From Turchi and Bryant:

This article analyzes data from the Value of Children study for Korea, US and Philippine families. Relative to completed or desired family size, money costs were consistently a key factor in limiting further births. Opportunity costs were found to be only important in the US. Economic value did not seem to be an important motivation for increased fertility in any of the three countries. The results generally suggest the household economic model of fertility has some value but needs to consider psychosocial value as well as interaction effects such as the desire for siblings or children.

Cain, Glen G. and Adriana Weininger

1973

"Economic determinants of fertility: results from cross-sectional aggregate data." Demography 10(2): 205-223.

Census data are used to test hypotheses and estimate parameters on the influence of various socioeconomic variables on fertility rates.

Cain, Mead T.  
1977

"The economic activities of children in a village in Bangladesh." *Population and Development Review* 3(3):201-28.

From Turchi and Bryant (1979):

This paper explains a study of the economic value of children in farmwork and housework made in a typical agricultural village in Bangladesh. Data are presented on the hours put in by children in the various activities. Although no cost-of-children estimates are made, considering only caloric intake, males are net producers by age 12, compensate for their total consumption by age 15, and additionally compensate for a sister's total consumption by age 22. Other cost figures are not analyzed, as food is the most salient, and opportunity costs are negligible. Economic contributions to parental old-age are not considered here either. In sum, the paper shows that high fertility is rational, particularly for sons.

1973

"The household life cycle and economic mobility in rural Bangladesh." *Population and Development Review* 4(3):421-438.

"The ways in which variations in the household life cycle affect economic mobility are examined for rural Bangladesh. Evidence is drawn primarily from data collected between 1976 and 1978 in a single village in Mymensingh District. In the current social and environmental setting, the course of a household life cycle determines the supply of household labor, conditions the resilience of households during periods of economic crisis, and influences the vulnerability of surviving members to economic decline following a patriarch's death. The implications of the relationships between household life cycles and economic mobility for parental reproductive strategies, for the welfare of different household constituents, and for the process of economic class formation are discussed.

Caldwell, J. C.  
1976

"Toward a restatement of demographic transition theory." *Population and Development Review* 2(3, 4):321-366.

Caldwell argues that massive social change will lead to low levels of fertility even in countries with low income and low economic growth rates.

- 1977 "The economic rationality of high fertility: an investigation illustrated with Nigerian survey data." *Population Studies* 31(1):5-26.

Caldwell maintains that the importation of Western cultural values, weakening of land tenure, modern health measures, better communications, and a strong central government will undermine the profitability of the high-fertility regimes.

- 1978 "A theory of fertility: from high plateau to destabilization." *Population and Development Review* 4(4):553-578.

Caldwell contends that the transition from high to low fertility will result from economic, social and cultural change. The economic change results in a shift of the intergenerational wealth flow from parents and toward children. This is accelerated by the import of Western ideas, ideologies, and educational systems.

Carr, Marilyn  
1976

*Economically Appropriate Technologies for Developing Countries.* London: Intermediate Technology Publications Ltd.

A guide to the literature on choosing or developing the appropriate technologies to provide a suitable base for future economic growth. This volume is concerned with the hardware aspects. The volume is divided into sections on agriculture, housing, manufacturing, infrastructure, handbooks and technical publications and bibliographies. Includes indexes by author, country, and subject.

Carroll, Thomas F.  
1973

"Group credit for small farms." *Small Farmer Credit: Analytical Papers*, 19, June.

This paper looks at the viability of credit extension to groups rather than through individuals as a means through which credit may become more available to small farmers and through which risks may be lessened for both the borrower and the lender.

Carvajal, Manuel J. and David T. Geithman  
1976

"Socio-economic fertility determinants in Costa Rica, 1963-1973." Pp. 95-162 in *New Perspectives on the Demographic Transition. Occasional Monograph Series Number Four, Interdisciplinary Communications Program, the Smithsonian Institution.*

In this paper, an economic model of fertility is used to help explain the decline in fertility in Costa Rica between 1963 and 1973. Data are provided by both Costa Rican censuses and a mid-1960s CELADE fertility survey.

Cassen, R.H.  
1976

"Population and development: a survey." World Development 4(10, 11):785-835.

This comprehensive survey of the English-language literature on population and development in developing countries discusses most of the major interrelationships on the subject. The survey also covers the analysis of economic-welfare and policy implications and concludes with suggestions for further research.

Chaudhury, Rafiqul H.  
1977

"Relative income and fertility." Demography 14(2):179-195.

The relationship between relative income and fertility is examined using 1967-68 data from the Canadian Family Growth study.

Chen, L. C. and R. F. Chaudhury  
1975

"Demographic change and food production in Bangladesh, 1960-1974." Population and Development Review 1(2): 201-227.

The study presented here is a descriptive analysis of the food and population situation in Bangladesh over the period 1960-1974. Trends in food production and population growth are examined and compared; and the relationships of food production and land utilization to population density and distribution are analyzed.

Chen, Pi-chao  
1976

Population and Health Policy in the People's Republic of China. Interdisciplinary Communications Program, Smithsonian Institution.

Detailed examination of combined population and health program initiated in China in the 1960s, including what lessons may be gleaned by other countries from the successes and failures of the Chinese birth-planning and health model.

Chenery, Hollis B., M. S. Ahluwalia, C. L. G. Bell, J. H. Duloy, and R. Jolly  
1974

Redistribution with Growth. New York: Oxford University Press.

Essays developed from an investigation by members of the Institute of Development Studies at the University of Sussex and the Development Research Center of the Bank. Part One: Reorientation of Policy. Describes the existing inequality in incomes in developing countries and proposes a reorientation of development policy aimed at achieving a more equitable distribution, focusing on separate target

1974 "The reorientation of policy." In Hollis B. Chenery et al., *Redistribution with Growth: An Approach to Policy*. London: Oxford University Press.

This paper approaches policy recommendations from a new perspective and argues that development may lead to greater income inequality.

Chenery, Hollis B. and Moises Syrquin  
1975 *Patterns of Development, 1950-1970*. London: Oxford University Press.

A comprehensive interpretation of the structural changes that accompany the growth of developing countries, using cross-section and time-series analysis to study the stability of observed patterns and the nature of time trends. A uniform statistical procedure measures variations in different aspects of the economic structure.

Cheung, S. N. S.  
1968 "Private property rights and sharecropping." *Journal of Political Economy* 76:1107-1122.

This paper looks at allocative efficiency and sharecropping as a form of land tenure and argues that differing land tenure forms lead to the same resource allocation.

Child, F. C. and H. Kaneda  
1976 "Links to the Green Revolution: a study of small-scale agriculturally related industry in the Pakistan Punjab." *Economic Development and Cultural Change* 23(2).

From Carr (1976):  
Describes how the small-scale engineering industry in the Punjab responded in the fifties and sixties to the needs of agriculture by supplying tube-well equipment, and setting the stage for the Green Revolution. Development occurred spontaneously without undue resort to loans or other assistance, and few economies of scale have been apparent, with small firms co-existing with larger ones, and producing a competitive product by similar methods. Rising agricultural productions has created bottlenecks and imbalances which provide new opportunities for capital formation through backward linkages. There is thus great scope for the development of small-scale threshers, inexpensive reapers, on-farm storage equipment, etc., which could be produced by the indigenous labour-intensive, small-scale engineering industry. If permitted to interact, the agricultural sector and the small-scale engineering industry would grow in tandem, but the authors suggest that because of current Government policies which emphasize tractors, this process will be aborted.

Choldin, Harvey M.

1972

"An organizational analysis of rural development projects at Comilla, East Pakistan." *Economic Development and Cultural Change* 20(4):671-690.

The hierarchy of rural development projects and their organizational interrelationships and the implications for rural development are analyzed for a village in East Pakistan.

Cline, William R.

1975

"Distribution and development." *Journal of Development Economics* 1:359-400.

A survey of the literature with sections on theories of income distribution, theories relating distribution and development, empirical patterns of income distribution, simulations of income redistribution effects, and factor pricing and redistribution.

Coale, Ansley J.

1975

"The demographic transition." In *United Nations, The Population Debate: Dimensions and Perspectives, Vol. 1.* New York.

Discusses the lessons of the demographic transition in Europe for developing countries today.

1976

*Economic Factors in Population Growth.* New York: John Wiley.

Proceedings of an International Economic Association Conference. The 19 papers by leading international and demographers considered optimum population growth, micro and macro questions on the interrelation of population and development, employment, education and migration.

Cochrane, Susan H.

1974

"The effect of income on the demand for children." Paper presented at the Annual Meetings of the Population Association of America, New York, April.

This paper discusses the issues involved in the definition of three critical variables, namely, the demand for children, income, and the cost of children.

1975

"Children as by-products, investment goods and consumer goods: a review of some micro-economic models of fertility." *Population Studies* 29(3):373-390.

This paper provides a review of the application of the more traditional micro-economic models to the analysis of fertility. Four models of family size are developed and applications of traditional micro-economic analysis to fertility is explained.

1978 "Fertility and education: what do we really know?"  
Paper for the Population and Human Resources Division,  
Development Economics Department, July. Mimeo: World  
Bank.

This paper reexamines existing literature on the relation-  
ship between education and fertility in order to gain  
insight into the causes of the general inverse relation-  
ship between the variables and to explain the deviant case.

Cohn, John M.  
1974

"Rural change in Ethiopia: the Chilalo agricultural  
development unit." Economic Development and Cultural  
Change 22(4).

This paper looks at the effects of land reform recipients  
and the needed concurrent policies which must accompany  
land reform in order to prevent land reform recipients  
from leaving agriculture.

Conger, Darius J. and John M. Campbell, Jr.  
1978

"Simultaneity in the birth rate equation: the effects of  
education, labor force participation, income and health."  
Econometrica 46(3):631-642.

This paper takes a step toward resolving specification  
error in single equation models of fertility behavior  
by estimating the fertility equation within a simul-  
taneous system and by tracing the time path of fertility  
determinants via Boot and Theil multipliers.

Coombs, P. H. and M. Ahmed  
1975

Education for Rural Development. New York: Praeger.

Emphasizes practical education, which includes subjects  
such as personal and family health, occupational training,  
functional literacy, agricultural extension, and com-  
munity development.

Cuca, Roberto and Catherine S. Pierce  
1977

Experiments in Family Planning. Baltimore: Johns  
Hopkins.

Summarizes experiments on the effectiveness of family  
planning programs. The book contains a comprehensive but  
concise summary and overall evaluation of different types  
of experiments. The last two-thirds of the text is a  
reader's guide to the literature for each experiment in  
some 28 countries. The format for each experiment described  
includes objectives, research design, interventions and  
results.

- Cummings, Ralph W., Jr.  
1967      Pricing Efficiency in the Indian Wheat Market, New Delhi, Impex.
- Examines how pricing and politics have affected the supply and demand for wheat in India.
- DaVanzo, Julie  
1972      The Determinants of Family Formation in Chile, 1960: An Econometric Study of Female Labor Force Participation, Marriage, and Fertility Decisions. Monograph prepared for AID, Rand number R-830-AID, August.
- The objective of this paper is to formulate, test and integrate the components of a theory of fertility as part of a general view of the family decision making process.
- Davis, Kingsley  
1977      "Population policy and the theory of reproductive motivation." Economic Development and Cultural Change. In Manning Nash (ed.), Essays in Chicago: University of Chicago Press.
- Analyzes Malthusian, family-planning, and economic theories of fertility and suggests that they suffer from a failure to treat the goals of childbearing as objects of analysis.
- deJanvry, A.  
1973      "A socioeconomic model of induced innovations for Argentine agricultural development." Quarterly Journal of Economics 87(3):410-435.
- From Stokes (1979):  
The socioeconomic model is used to understand the stagnation of the Argentine agricultural sector. This is done through the discussion of the topics of: inducement of innovations, decision process in the inducement of innovations, the adoption of new technologies, the adjustment path of actual and latent demand, and induced innovations and Argentine agricultural development. The paper presents data that shows that the adoption of new technologies by some farmers raises the price of land and depresses the income position of nonadopters. The impact of this is immediate on those wishing to buy land and tenants who have to rent lands. Also, a strong bias against small farmers in access to credit, information and education was found to exist. This made it impossible for them to adopt new technologies.
- Demeny, Paul  
1971      "The economics of population control." Pp. 199-221 in the National Academy of Sciences, Rapid Population Growth. Baltimore: Johns Hopkins.

A survey article that considers the economic effects of reducing fertility and the economic arguments for fertility control.

DeTray, Dennis N.  
1976

"Population growth and educational policies: an economic perspective." In Ronald G. Ridker (ed.), *Population and Development*. Baltimore and London: The Johns Hopkins University Press.

Suggests that adult education may not be the most promising way to influence fertility. Alternatives would include influencing the wife's wage, contraceptive behavior, and the early health and nutrition of children. Tentative evidence points to an important tradeoff between quantity of children and quality of children. Lower fertility might then be the least costly means of achieving higher quality.

DeTray, Dennis and Zubeda Khan  
1977

"On the care and feeding of regression specifications in fertility research." *Pakistan Development Review* 309-324.

Discusses econometric aspects and problems in estimating models of fertility behavior.

Development Digest  
1978

Prepared by the National Planning Association for Agency for International Development, US Department of State. 16(3):3-50.

Excerpts, summaries, and reprints of six papers on credit for small borrowers.

Duncan, O.D.  
1966

"Path analysis: sociological examples." *American Journal of Sociology* 72(1):1-16.

Exposition of a statistical tool for distinguishing direct, indirect, and interaction effects of regression and correlation analysis.

Easterlin, Richard A.  
1969

"Towards a socioeconomic theory of fertility: a survey of recent research on economic factors in American fertility." In S. I. Behrman, (ed.), *Fertility and Family Planning: A World View*. Ann Arbor: University of Michigan Press.

This paper presents a review of postwar research on economic factors in American fertility as well as an analytical framework embracing economic and sociological disciplines.

1975 "An economic framework for fertility analysis." *Studies in Family Planning* 6(3):54-63.

A briefer version of Easterlin (1978). The more technical aspects of the theory are omitted.

1978 "The economics and sociology of fertility: a synthesis." In Charles Tilly (ed.), *Historical Studies of Changing Fertility*. Princeton: Princeton University Press.

Full exposition of a model to show how supply and demand factors interact to affect fertility. The model is especially useful for incorporating factors likely to be operative in the demographic transition from high fertility to low fertility that historically has accompanied modernization.

Easterlin, Richard, Robert A. Pollack and Michael L. Wachter

1976 "Toward a more general economic model of fertility determination: endogenous preference and natural fertility." Prepared for NBER Conference on Economic and Demographic Change in Less Developed Countries, Philadelphia, September 30 - October 2.

This paper creates a model of fertility determination using three concepts of fertility: natural fertility, desired fertility, and optimal fertility and attempts to explain increases in fertility which are often observed prior to demographic transition.

Encarnacion, Jose, Jr.

1975 "Family income, education, labor force participation and fertility." In Wilhelm Flieger and Peter C. Smith (eds.), *A Demographic Path to Modernity: Patterns of Early Transition in the Philippines*. Quezon City: The University of the Philippines Press.

This paper reports regression results pertaining to fertility and labor force participation of married women in the Philippines. Pervasive nonlinearities consistent with the threshold hypothesis were found for the fertility equations.

Enke, Stephen

1976 "Leibenstein on the benefits and costs of birth control programmes." *Population Studies* 24(1):115-116.

A comment on Leibenstein (1969), which concedes some points critical of Enke's earlier analysis and disputes others.

- 1976 "Economic consequences of rapid population growth." In Michael C. Keeley (ed.), Population, Public Policy, and Economic Development. New York: Praeger Publishers.

Presents benefit cost calculations from reducing fertility in LDCs, where the benefit is increased per capita income and the cost is for birth control programs. The benefit cost ratio ranges from 50 to 1 and up over 35 years depending on assumptions. Not examined is the question of why parents do not limit their fertility even in the absence of birth control programs.

- Findley, S.  
1977

Planning for Internal Migration: A Review of Issues and Policies in Developing Countries. US Department of Commerce, Bureau of the Census.

This monograph addresses the problem of rural development and its implications for rural to urban migration.

- Fleisher, B. M. and G. F. Rhodes, Jr.  
1979

"Fertility, women's wage rates and labor supply." The American Economic Review 69(1):14-24.

This paper specifies a multiple equation model, outlines its theoretical underpinnings, describes the data base and variables used, and discusses the econometric properties of the estimation procedure. Summaries of the estimates and comparisons are given with those reported in previous research on fertility and the labor force participation of married women.

- Freedman, Deborah S.  
1963

"The relation of economic status to fertility." The American Economic Review 53:414-426.

This paper explores the relationship of several economic variables to fertility with a unique set of data for the national population.

- 1972 "Consumption aspirations as economic incentives in a developing economy -- Taiwan." In Human Behavior in Economic Affairs. Essays in Honor of George Katona.

The results of a household survey indicate that high aspirations for consumption are associated with lower desired family-size and higher savings and aspirations for education of children.

- 1975 "Consumption of modern goods and services and its relation to fertility: a study in Taiwan." Journal of Development Studies 12(1):95-117.

This extends Freedman (1972) by showing that ownership of modern goods is not achieved at the expense of savings or educational aspirations, suggesting that new wants may encourage limitation of family size.

1976 "Mass media and modern consumer goods: their suitability for policy interventions to decrease fertility." Pp. 356-386 in Ronald G. Ridker (ed.), *Population and Development: The Search for Selective Interventions*. Baltimore: Johns Hopkins.

From Cheng, Lawson and Levine (1979):  
The author explores the possibility that programmatic changes in exposure to mass media and consumption of modern goods and services can have an impact on fertility decline in less developed countries. The nature and strength of these assumed relationships are reviewed and consideration is given to policy implications for governments in less developed countries.

Freedman, Ronald and Lolagene Coombs  
1966-67 "Economic considerations in family growth decisions."  
*Population Studies* 20:197-222.

This paper advances the hypothesis that in a large American metropolis family income is more closely related to the time when a family is formed and has its children than to the number of children it has or expects and that a family's evaluation of its economic position and the choices it makes about family expenditure have a relation to fertility apart from the family's objective current income level.

Friedlander, Stanley and Morris Silver  
1967 "A quantitative study of the determinants of fertility behavior." *Demography* 4(1):30-70.

This paper uses a multiple regression equation relating the crude birth rate to various measures of illiteracy and has introduced per capita income into the regression as well as other control variables. It was found that in the most developed and the least developed countries fertility is often lower in the more illiterate countries.

Friedman, David  
1972 *Laissez-faire in Population: The Least Bad Solution*. Occasional Paper, Population Council. Bridgeport, Conn.: Key Book Service.

The title says it all. The author argues that the family internalizes spillover effects of fertility decisions, so that there is no population problem as such, or at least not one that is uniquely amenable to policy solutions.

Frisch, Rose E.  
1978

"Population, food intake, and fertility." *Science* 199:22-30.

The purpose of this article is to show that under-nutrition and "hard living" may be an explanation of the lower than expected fertility of mid-19th century English and Scottish populations.

Fulop, Marcel  
1977

"A survey of the literature on the economic theory of fertility behavior." *The American Economist* 21:5-13.

From Turchi and Bryant (1979):

This is a discussion of the three main microeconomic models of fertility: the Chicago model, Leibenstein's model, and Easterlin's theories. The crux of the differences according to the author, is in the role of opportunity costs. All of the models try to explain the apparent contradiction between rising income and declining fertility which occurs empirically.

Gillette, Cynthia and Norman Uphoff  
1973

"The credit connection: cultural and social factors affecting small farmer participation in credit programs." *A.I.D. Spring Review of Small Farmer Credit* 19 Analytical Papers, 19, June.

This paper analyzes the social and cultural factors affecting the participation of the small farmer in credit programs.

Goodstadt, Leo F.  
1978

"Official targets, data, and policies for China's population growth: an assessment." *Population and Development Review* 4(2):255-275.

"The apparently casual attitude of Chinese officials towards release of precise population figures and the scarcity of conventional demographic data make it difficult to analyze population trends in China. Fragmentary statistics on growth rates are presented here for 17 provincial-level administrations. With few exceptions, however, these represent atypical figures that have been highlighted by the news media, presumably because they are models of remarkable declines in natural increase rates that are worthy of emulation. While these glowing reports cannot be taken literally, they retain some credibility as examples of the success of official campaigns to encourage later marriage and smaller families, to uproot Confucian traditions of contracted marriages and son preference, and to provide equal pay for women workers."

Gregory, Paul R. and John M. Campbell, Jr.

1976b

"Fertility interactions and modernization turning points." *Journal of Political Economy* 84(4):835-47.

A refinement of Gregory Campbell (1976a) but which omits the simultaneous equation model that endogenizes per capita income.

1978

"Fertility and economic development." In Michael C. Keeley (ed.), *Population, Public Policy, and Economic Development*. New York: Praeger Publishers.

This paper demonstrates that the economic and sociological explanations of the interaction between economic development and fertility reduction actually can complement each other if each is interpreted in a flexible and comprehensive manner.

Griffin, Keith

1973

"Policy options for rural development." *Oxford Bulletin of Economics and Statistics* 35(4):239-274.

This extensive paper examines various policy options for rural development with the assumptions that (a) technical change is different from progress; (b) the range within which policies can be varied is restricted; (c) that little progress has occurred in the agricultural regions of most LDCs; and (d) that those groups which do not benefit from technical changes will attempt to protect their interests.

1974a

*The Political Economy of Agrarian Change*. Boston: Harvard University.

From Stokes, et al. (1979):

This work is concerned with the process of technological innovation and its effect on the distribution of income and the growth of agricultural output. It is argued that the most important element that affects inequality is factor prices. A land reform is necessary but will not suffice to counter effects of distorted factor prices. Scale neutral innovations will always favor the prosperous at the expense of the poor, unless they are given equal access to knowledge, credit and new inputs.

1974b

"Rural development: the policy options." In E. O. Edwards (ed.), *Employment in Developing Nations*. New York: Columbia Press.

Provides some evidence that the factors contributing to income inequality also slow development.

1976 Land Concentration and Rural Poverty. New York:  
Holmes and Meier.

From Stokes et al. (1979):

The theme of the book is that the distribution of income in the agricultural sector and the standard of living of the majority of the rural population are greatly affected by the degree of land concentration. The argument consists of a series of case studies in three continents, giving special emphasis to North Africa and Latin America with some attention given to Asia.

Gujarati, Damodar  
1978

Basic Econometrics. New York: McGraw-Hill Book Company.

An introductory text.

Gupta, K.L.  
1971

"Dependency rates and savings rates: comment." American Economic Review 61(3):469-471.

Gupta reestimates the equations for Leff (1969) by disaggregating LDCs into three subgroups and finds no significant effect of the dependency rate on the savings rate in the lowest income subset.

Gwatkin, Davidson R.  
1978

Nutrition Planning and Physical Well-Being in Kerala and Sri Lanka. Interiencia/AAAS Symposium. Washington, DC: Overseas Development Council.

Concludes that egalitarian nutrition policies can explain some, though not all, of the long life expectancies experienced in Kerala and Sri Lanka, despite low income levels. Nutrition programs are part of a general orientation of government in those states to provide widespread benefits of development to its populations.

Harman, Alvin J.  
1970

"Fertility, manpower and economic behavior of families in Philippines." Santa Monica: The Rand Corporation.

From Cheng, Lawson and Levine (1979):

This is an empirical analysis of the interrelationships between fertility and socioeconomic behavior of families, designed to give insight into the relative merits of various policies affecting population growth. Results show that education and income for all age groups, and increased female education correlate with smaller family size, higher age at first marriage, and employment, which indirectly reduces family size still further.

Hashimoto, Masanori

1974

"Economics of postwar fertility in Japan: differentials and trends." *Journal of Political Economy* 82:170-99.

From Turchi and Bryant (1979):

This paper seeks to analyze the importance of economic variables in the fertility decline in Japan. Postwar time-series data show a correlation of fertility decline with increased contraceptive and abortion use. However, the author argues that these were partially caused by rising opportunity costs of the female's time. This hypothesis is tested via regression of 1960 cross-sectional data and shown to be significantly correct, with female education used to measure opportunity cost. Gary Saxonhouse's comments point out some problems with the regression analysis.

Hermalin, Albert I.

1976

"Empirical research in Taiwan on factors underlying differences in fertility." In Ansley J. Coale (ed.), *Economic Factors in Population Growth*. New York and Toronto: John Wiley.

A review of trends and patterns in Taiwanese fertility with attention to their connection with economic behavior and attitudes.

Heyer, Judith, Dunston Ireri and Jon Moris

1971

*Rural Development in Kenya*. Nairobi: East Africa Publishing House.

This volume looks at various aspects of rural development in Kenya and their implications for growth in both the rural and urban areas in light of national development goals.

Hicks, J.R.

1956

*A Revision of Demand Theory*. Oxford: Clarendon Press.

The author elaborates on some themes of his earlier *Value and Capital*.

Hohm, Charles F.

1975

"Social security and fertility: an international perspective." *Demography* 12:629-44.

From Turchi and Bryant (1979):

This article presents an analysis of Social Security programs and fertility in 67 countries. A model is developed wherein increased Social Security coverage and benefits should cause (or be related to) subsequent fertility declines, due to the intermediate mechanism of a decline in the potential value of children as old-age supporters. 1960 data are used for SS programs

and 1965 fertility data are used. A multiple regression is run, controlled for economic development variables, and the author finds the effect of SS on fertility to be as important as traditional explanations such as infant mortality, education and income.

1976 "Reply to Kelly, Cutright, and Hittle." *Demography* 13(4):587-589.

The author presents additional data to support the proposition that social security can lower fertility.

Hull, Terence H. and Valerie J. Hull  
1977

"The relation of economic class and fertility: an analysis of some Indonesian data." *Population Studies* 31(1):43-57.

Presents evidence from a number of recent studies conducted in Indonesia and shows that for the majority of the Indonesian population fertility is related positively to economic and social class.

Ip, P. C. and C. W. Stahl  
1978

"Systems of land tenure, allocative efficiency, and economic development." *American Journal of Agricultural Economics* 60(1):19-28.

This paper discusses comparative efficiency of resource allocation under alternative forms of land tenure -- sharecropping, fixed rental, wage cultivation, and owner cultivation. It shows that when transaction costs, the role of entrepreneurship, and economic incentives are explicitly introduced and analyzed within the framework of intersectoral interactions and linkages, then land reform measures redistributing land to the peasants tend to improve agricultural production efficiency, resource allocation between farm and other sectors, and contribute to economic development of less-developed countries, contrary to conclusions reached by writers of the "equal efficiency" school.

Isbister, John  
1973

"Birth control, income redistribution, and the rate of saving: the case of Mexico." *Demography* 10(1):85-98.

A simulation of Mexican economic growth is run with different hypothetical birth rates. The birth control regime is found to generate more savings over the first several decades but resulting eventually in a lower saving rate at the higher standard of living.

Jain, Anrudh K.  
1969

"Socio-economic correlates of fecundability in a sample of Taiwanese women." *Demography* 6:75-90.

This study estimates fecundability by the length of time between marriage and first birth for 2190 women who had not been premaritally pregnant and had not used contraception during this interval. Multiple classification analysis shows that after controlling for wife's age at marriage, those of the highest education group had higher probabilities of contraception than those with least education, but the relationship was not always uniform for adjacent educational groups.

Jain, Anrudh K., T. C. Hsu, R. Freedman and M. C. Chang  
1970

"Demographic aspects of lactation and postpartum amenorrhea." *Demography* 7:255-271.

This article, using Taiwanese data, looks at the relation between education/urban residence and lactation and its influence on amenorrhea. Findings indicate that better education (or urban residence) goes with a shorter period of lactation and these in turn shorten the period of amenorrhea and this increases the period of childbearing risk.

Johns Hopkins University  
1978

Integration of Family Planning and Health Services: the Narwangwal Experience. Baltimore: Johns Hopkins University, Department of International Health, School of Hygiene and Public Health.

A sequel to Taylor, et al. (1975), which finds that integrated family health and family planning programs increase contraceptive usage.

Johnson, E. A. J.  
1970

The Organization of Space in Developing Countries. Cambridge, Massachusetts: Harvard University Press.

This volume looks at spatial organization in developing countries and its relationship to infrastructure development in rural sectors.

Johnston, B. F.  
1977

"Food, health, and population in development." *Journal of Economic Literature* 15(3):879-907.

The recent development literature is surveyed and alternative approaches to the reduction of poverty are examined with special reference to food, health, and population.

Johnston, B.F. and A.J. Meyer

1977

"Nutrition, health, and population in strategies for rural development." *Economic Development and Cultural Change* 26:1-23.

From Cheng, Lawson and Levine (1979):

This paper examines some of the interrelations between socioeconomic development and the reduction of fertility and considers priorities among the various components of a strategy for rural development. One of the major conclusions of this study is the need to give a higher priority to rural development and to the expansion of agricultural production in a strategy involving broad participation of the farm population in the process and improvement of nutrition and health and to foster wide diffusion of family planning in rural areas.

Jones, Gavin W.

1971

"Effect of population change on the attainment of educational goals in the developing countries." In *National Academy of Sciences, Rapid Population Growth*. Baltimore: The Johns Hopkins Press.

The author presents a case for considering different fertility projections to better recognize the tradeoff between high fertility and educational goals. A description is provided of how high fertility affects the use of educational resources.

1975

"Population growth and health and family planning." In Warren C. Robinson (ed.), *Population and Development Planning*. New York: The Population Council.

Discusses the impact of rapid population growth on the level and composition of health expenditures. Health service strategies are considered. The author concludes that in the case of Thailand a family planning program that is modestly effective in reducing fertility could lead to savings in health costs that would exceed the cost of the family planning program itself.

Kasarda, John D.

1971

"Economic structure and fertility: a comparative analysis." *Demography* 8:307-317.

From Cheng, Lawson and Levine (1979):

This study investigates empirically the relationship between the economic structure and the level of fertility, using data from censuses recently conducted in some 50 nations. Findings show that high rates of female labor force participation outside the home and low rates of economic activity of children depress the fertility level.

Keeley, Michael C.  
1975

"A comment on 'An interpretation of the economic theory of fertility.'" The Journal of Economic Literature 12(2):461-468.

This comment on Leibenstein (1974) is a useful, concise defense of the new home economics approach to fertility.

1976

Population, Public Policy, and Economic Development.  
New York: Praeger.

An integrated collection of articles most of which are based on research associated with GE TEMPO's population studies group under the leadership of the late Stephen Enke. The book analyzes the causes and long-term consequences of rapid population growth and growth changes. The final chapter considers bonuses and social security as means of reducing fertility.

Kelley, A. C.  
1976

"Savings, demographic change, and economic development." Economic Development and Culture Change 24(4):683-93.

Kelley contends that population growth need not adversely affect total saving, since the additional children could reduce other kinds of consumption expenditures and increase work effort. An examination of data from an 1889 US survey of households headed by workers in mining and manufacturing indicates that the effect of family size on total saving is ambiguous.

Kelly, William R., Phillips Cutright, and David Hittle  
1976

"Comment on Charles F. Hohm's 'Social security and fertility: an international perspective.'" Demography 13(4):581-586.

An index of modernization is used to dispute Hohm's (1975) contention that social security programs lower fertility.

Kikuchi, Masao, Geronimo Dozina, Jr., and Yujiro Hayami  
1978

"Economics of community work programs: a communal irrigation project in the Philippines." Economic Development and Cultural Change 26(2):211-255.

This study attempts a case study of a communal irrigation project organized by a village in Central Luzon of the Philippines and analyzes the economic incentives for the organization of the community work program in terms of the profitability of the project and the rate of return to labor mobilized.

King, D.V. and P.D. Weldon  
1977

"Income distribution and levels of living in Java, 1963-1970." Economic Development and Cultural Change 25:4.

This study presents data from Indonesia and shows that economic growth in Indonesia has been accompanied by an increase in income inequality.

King, T.  
1974

Population Policies and Economic Development. Baltimore: Johns Hopkins.

The main focus of this work is on the relation of population growth, economic development, and government policies required to reduce fertility. It concludes that slow economic development and high population growth are mutually reinforcing unless policy actions are taken to counteract them.

Kleinman, David S.  
1973

"Fertility variation and resources in rural India." Economic Development and Cultural Change 21:679-696.

From Stokes, C. Shannon, et al. (1979):  
A 17-variable model of fertility is examined for 315 districts in India. Cultivated acreage per household was positively related to fertility. Land concentration was more weakly related to fertility, but in the negative direction.

Kocher, James E.  
1973

Rural Development, Income Distribution, and Fertility Decline. New York: The Population Council.

From Cheng, Lawson and Levine (1979):  
This work examines the process of rural development with special emphasis on the relationship between components of the rural development and fertility behavior and population growth in low-income countries. The author advances a major hypothesis that "the greater the extent to which the rural population is participating in development, the earlier and more rapid will be the decline in overall fertility and population growth rates." Included among the broad topics discussed are the meaning of development, population prospects, the record of rural development in low-income countries, and rural development and fertility decline.

1976

Socioeconomic Development and Fertility Change in Rural Africa. Development Discussion Paper No. 16. Harvard Institute for International Development. Cambridge, Massachusetts: Harvard University.

Regression analysis from survey data of households in rural Tanzania finds that socioeconomic variables (roughly measured in some cases) have little effect on fertility, while supply-type variables are significant.

Krishnamurty, K.  
1966

"Economic development and population growth in low-income countries: an empirical study in India." *Economic Development and Cultural Change* 14:7-77.

From Cheng, Lawson and Levine (1979):  
This study estimates the impact of economic development, as reflected in per capita income and other related variables, on birth and death rates in India for the period of 1922-60 and the results confirm the theoretical expectations.

Kulp, Earl M.  
1970

*Rural Development Planning: Systems Analysis and Working Method.* New York: Praeger.

This book deals with rural development planning and the viability and feasibility of various rural development strategies.

Kuznets, Simon  
1969

"Economic aspects of fertility trends in the less developed countries." In S. J. Behrman, L. Corsa and R. Freedman, *Fertility and Family Planning.* Ann Arbor: The University of Michigan Press.

The author gives estimates of how fertility affects economic development.

1975

"Fertility differentials between less developed and developed regions: components and implications." *Proceedings of the American Philosophical Society* 119(5):363-396.

Comparisons are made between developing and developed countries demonstrating a markedly larger age difference between husbands and wives in LDCs. It is found that much of the difference in birth rates is attributable to high fertility of the early and late years of child-bearing in LDCs. Kuznets suggests that the large extended family may be rational in LDCs in the absence of alternative forms of security.

1977

*Recent Population Trends in Less Developed Countries and Implications for Internal Income Inequality.* Yale University: Economic Growth Center.

The author notes that higher mortality imposes a much higher economic burden on the poor; that mortality decline may be a necessary condition for fertility decline and modernization; that in the short-run even with a full offset of fertility to a decline in mortality, population growth may accelerate; and that effects of mortality decline on income distribution would depend on the source of mortality decline or other changes that accompany it such as provision of education opportunities.

Lal, D.  
1976

"Distribution and development: a review article."  
World Development 4(9):725-38.

Consideration of data on which is based the assertion that development leads to greater income inequality is given. The conclusion is that such a position is untenable.

Latif, Abdul and Nuimuddin Chowdury  
1977

"Land ownership and fertility in two areas of Bangladesh."  
Bangladesh Development Studies 5:239-246.

From Stokes et al. (1979):  
Mixed results are reported for a simple three-variable model relating size of holding, marital duration, and fertility. Size of holdings were significantly and positively related to fertility in a northern Bangladesh village, but no relationship was found in a southern village. Small sample size and few control variables limit generalizability of findings.

Lee, Bun Song, Richard E. Paddock and Beverly F. Jones  
1978

"Development of an econometric fertility model for less-developed countries: the new home economics approach to female status and age at marriage and fertility." Interim Report, Research Triangle Institute, under AID contract number AID/PHA-G-1185.

The objectives of this study are to specify a simultaneous equation model that takes into account the interactions between various economic aspects of less-developed countries and fertility; to estimate the major parameters of the model; to identify various means of modifying relationships among endogenous variables to achieve fertility reduction; and to perform cost-benefit analyses for these measures of government's intervention in family fertility decisions.

Leff, N. H.  
1969

"Dependency rates and savings rates." American Economic Review 59(5):886-896.

Using cross-national data, Leff found that per capita income was not an important determinant of savings/income, while the dependency ratios of those under age 15 and those over age 64 to total population were important. His results were substantiated for subsets of more developed and less developed countries as well.

1971 "Dependency rates and savings rates: reply." American Economic Review 61(3):476-480.

Leff replies to Gupta (1971) and N. A. Adams (1971) challenging some results of Leff (1969).

Leibenstein, Harvey

1957 Economic Backwardness and Economic Growth. New York: John Wiley.

Malthus updated.

1969 "Pitfalls in benefit-cost analysis of birth prevention." Population Studies 23(2):161-70.

A critique of Enke's benefit-cost calculations from raising per capita income by reducing births.

1970 "More on pitfalls." Population Studies 24(1):117-120.

A rejoinder to Enke (1970).

1974 "An interpretation of the economic theory of fertility: promising path or blind alley?" Journal of Economic Literature 12(2):457-479.

A brief survey and analysis of the Hicksian micro-theory and its applicability to current research are presented.

1975a "The economic theory of fertility decline." The Quarterly Journal of Economics 89(1):1-31.

This article shows that economic development implies and is accompanied by conditions that induce fertility decline to a sufficient degree so that enough fertility change is explained for the theory presented to be meaningful and of interest to an understanding of the process of development.

1975b "On the economic theory of fertility: a reply to Keeley." The Journal of Economic Literature 13(2):469-471.

Reply to Keeley (1975).

Lele, Uma  
1975

The Design of Rural Development. Baltimore: Johns Hopkins.

From Cheng, Lawson and Levine (1979):

In this book, the author discusses rural development perspectives and practices in Africa and draws on evidence from seventeen rural development programs in sub-Saharan Africa to examine the impact of development programs on low-income rural populations. Also, the author identifies some of the more basic issues such as land distribution policies, pricing and marketing, manpower, and credit policies that demand attention in order to reduce the gap between overall rural development objectives and actual performance.

Lipton, Michael  
1978

"Inter-farm, inter-regional and farm-non-farm income distribution: the impact of the new cereal varieties." World Development 6(3):317-337.

From a forthcoming book, provisionally to be called The Fear of Knowledge. The author examines the effects of new high-yield variety cereals on income distribution. A detailed analysis is given of how their benefits are distributed on purely economic grounds and from political decisions of who gets which inputs at what prices. The conclusion is reached that the benefits have been skewed toward larger farmers, richer areas, and less-poor urban consumers as a result of public policy actions on prices, credit, irrigation, mechanization, and crop-breeding.

Lobstein, Peter  
1970

"Prerequisite for rural employment policy in French-speaking black Africa." International Labour Review 102(2):171-199.

This study looks at rural employment in Africa and the role that various social and physical infrastructure improvements may play in rural development.

Mamdani, Mahmood  
1972

The Myth of Population Control: Family Caste and Class in an Indian Village. New York: Monthly Review Press.

From Stokes et al. (1979):

A critical analysis of the Khanna Study in India. The author argues that children are valuable in acquiring, holding on to, and farming land in India. Thus high fertility is a rational response to the economic circumstances of Indian farmers.

Mauldin, W. Parker and Bernard Berelson

1978

"Conditions of fertility decline in developing countries, 1965-75." *Studies in Family Planning* 9(5):90-147.

This paper is a macro analysis of the correlates of fertility decline in developing countries for the period 1965-1975. The analysis focuses on how much fertility decline is associated with such socioeconomic variables as health, education, economic status and modernization/urbanization.

Maurer, K. M., R. Ratajczak and T. P. Schultz

1973

Marriage, Fertility, and Labor Force Participation of Thai Women: An Econometric Study. Santa Monica: The Rand Corporation.

From Cheng, Lawson and Levine (1979):

This joint study seeks to formulate, list, and integrate the components of a theory of fertility as part of a general view of the family decision-making process in Thailand.

McGreevey, William and Nancy Birdsall

1974

Policy Relevance of Recent Social Research on Fertility. Occasional Monograph Series Number Two, Interdisciplinary Communications Program, The Smithsonian Institution.

This monograph is a review and analysis of selected research findings on socioeconomic and ecological variables and demographic variables with respect to policy relevance.

McKinnon, R. I.

1973

Money and Capital in Economic Development. The Brookings Institution. Washington, DC

McKinnon presents a case for freeing financial markets in developing countries to permit interest rates to reflect the scarcity value of capital and presents evidence that such reforms have been crucial for overcoming inflation and stagnation in some developing countries.

1976

Money and Finance in Economic Growth and Development. New York: Marcel Dekker.

This collection of essays examines the national and international implications of financial markets in developing countries.

McNicoll, Geoffrey  
1975

"Community-level population policy: an exploration."  
Population and Development Review 1(1):1-21.

"The central problem of population policy is how to bring the private demand for children into line with social demand. Many proposed direct measures to lower fertility in dense rural populations would strain administrative capacities and have adverse distributional implications. An alternative, indirect strategy is designed to internalize costs of excessive fertility at the community (specifically, the natural village) level and to strengthen social controls of demographic behavior within communities. Government policy would regard communities rather than individuals as clients. The social and administrative structure that might underlie such an approach is examined in the light of the Japanese and Chinese experiences."

1976

"Economic demographic models." Reprint No. 75.  
Honolulu: East-West Population Institute.

Discusses the uses and limitations of Coale-Hoover models, more abstract optimal-growth models, and labor transfer models. Concludes that they provide an ample supply of hypotheses, or raise important questions about the impact of public policy on population growth and development. Reprinted from Population Growth and Economic Development in the Third World, Leon Tabah (ed.), published for IUSSP by Ordina Editions, 1976.

Meeks, Thomas J.  
1976

"A method of measuring the direct, indirect, and interaction effects in multiple correlation: an example from macro policy." Paper presented at the Virginia Association of Economists. Petersburg: Virginia State College.

A masterful exposition of path analysis and a distinction between its uses, partial correlation, and simple correlation.

Mellor, John W.  
1976

The New Economics of Growth: A Strategy for India and the Developing World. Ithaca: Cornell University Press.

Considers the interrelations of agricultural and general development with policy implications.

Mikesell, R. F. and Zinser, J. E.  
1973

"The nature of the savings function in developing countries: a survey of the theoretical and empirical literature." Journal of Economic Literature 11(1):1-16.

This article surveys the standard macro-space theories of saving and consumption and the empirical evidence on them for developing countries. Capital inflows, exports, taxation, and interest rates are also considered.

Montgomery, John D.  
1974

"Allocation of authority in land reform programs: a comparative study of administration processes and outputs." Research and Training Network. New York: Agricultural Development Council.

This paper surveys land reform programs in a number of countries and identifies those programs which have resulted in the improvement of income and security for the small land-holding farmer.

Mueller, Eva  
1976

"The economic value of children in peasant agriculture." Pp. 98-153 in Ronald G. Ridker (ed.), Population and Development: The Search for Selective Interventions. Baltimore: Johns Hopkins.

From Turchi and Bryant (1979):  
This article summarizes data on consumption and production differential literature and presents a model for comparison. It is shown conclusively, using aggregate and life-cycle models, that the economic value of children is actually negative in peasant agriculture. This study, unlike many others, does not discount future values. Housework is not included in the value or cost assumption.

Mueller, Eva and Richard Cohn  
1977

"The relation of income to fertility decisions in Taiwan." Economic Development and Cultural Change 25(2):325-347.

This paper is concerned with the income-fertility relation in Taiwan in 1969 by using alternative income measures and combinations of income measures in an attempt to clarify how income influences the demand for children. An attempt is also made to isolate the "pure" income effect after taking account of the indirect impact of fertility via attitude differentials.

Nag, Moni, Robert C. Peet, and Benjamin White  
1977

"Economic value of children in two peasant societies." International Population Conference, Mexico 1:123-139. Liège, Belgium: IUSSP.

From Turchi and Bryant (1979):

Presents findings of two studies on hours worked by children in a Javanese and a Napalese village. The anthropological field investigations collected data regularly over periods of several months. Contrary to what was found by Eva Mueller, these studies indicate that there is a net economic gain from children in peasant economics, in addition to support in old age. Children spent increasing amounts of time at work as they grew up; girls worked more hours than boys (possibly because of time spent at school for boys). True of both productive and nonproductive labor. Also, average work inputs are greater for larger than for smaller families.

National Academy of Sciences

1971

Rapid Population Growth. Baltimore: Johns Hopkins.

A comprehensive treatment with a 100 page Summary and Recommendations followed by 17 chapters of individual authors. This volume, prepared with the support of AID, summarized the state of knowledge at that time on rapid population growth in developing countries. Topics included the prospects for changes in population growth, world food supplies, urbanization interactions of economic change and population growth, ethical and welfare-economic considerations, and impacts on health, education and resources.

Neher, P.A.

1971

"Peasants, procreation, and pensions." American Economic Review 61(3):380-89.

A theoretical intertemporal-consumption model is presented in which children are a source of old-age support for parents. Overpopulation can be a problem if parents give less than a "Golden-Rule" weight to their children's consumption levels. In effect each generation could reduce the consumption level of the next generation by high fertility. The difficulty could be reduced through provision of financial assets or pensions to induce a fertility fall to the benefit of the next generation.

1972

"Peasants, procreation, and pensions: reply." The American Economic Review 62(5):979.

Neher replies to Robinson (1972).

Nerlove, Marc  
1974

"Toward a new theory of population and economic growth."  
In Theodore W. Schultz (ed.), *Economics of the Family: Marriage, Children, and Human Capital*. Chicago and London: The University of Chicago Press.

Summary and critique of the new home economics along with some conjectures on its uses for explaining economic growth and the demographic transition.

Nerlove, Marc and T. Paul Schultz  
1970

"Love and life between the censuses: a model of family decision making in Puerto Rico, 1950-1960." Rand Corporation Report RM-6322-AID prepared for AID, September.

This study is the first of four undertaken at Rand on the family formation process in Puerto Rico. A simultaneous equation model is developed and tentative empirical results are offered on the feasibility and potential usefulness of comprehensive analysis of the system of family behavior that surrounds reproductive decisions.

Newbery, David M. G.  
1977

"Risk sharing, sharecropping and uncertain labour markets." *Review of Economic Studies* 44(3):585-594.

This paper is concerned with the risk-sharing explanation of sharecropping. Ignoring incentive aspects, it asks whether the risk-sharing properties are sufficient to account for the existence of sharecropping or whether incentive aspects are essential. Two results are presented which clarify the conditions needed for sharecropping to be a viable institution.

Newlyn, W. T.  
1977

*The Financing of Economic Development*. Oxford: Clarendon Press.

The present volume "consolidates and integrates the growing empirical knowledge of various aspects of this subject and attempts to fill in as many gaps as possible." An overview of financial institutions as they affect the private, foreign and government sectors in developing countries is presented followed by case studies of countries in Asia and Africa.

Oechsli, F. W. and Dudley Kirk  
1975

"Modernization and the demographic transition in Latin America and the Caribbean." *Economic Development and Cultural Change* 23(3):391-420.

Confirms the view that the demographic transition is an integral part of modernization that is related in a coherent way to the structure and sequence of development.

Ohlin, Goran  
1976

"Economic theory confronts population growth." In Ansley J. Coale (ed.), *Economic Factors in Population Growth*. New York: John Wiley.

Focuses on what recent contributions in economic theory can contribute to an understanding of fertility and its economic consequences.

Oshima, Harry T.  
1970

"Income inequality and economic growth: the postwar experience of Asian countries." *Malayan Economic Review* 15(2):7-39.

Presents statistical evidence that the poorest have benefitted from economic growth in Asia.

Owens, Gene M. and Wayne Weiss  
1975

"Institutionalizing local participation for agrarian development: the ASIP model and new Latin American experiences." Chicago: Prepared for the Annual Conference of the American Society for Public Administration.

The authors deal with the incorporation of the participation of the rural poor into general rural development strategies and especially into the availability of policies (i.e., credit, loan) which would enable the rural poor to benefit from any comprehensive program in the rural sector.

Paulston, R. G.  
1976

*Non-formal Education: An Annotated Bibliography*. New York: Praeger.

Summarizes a growing literature that emphasizes practical aspects of education likely to be of more direct use in social and economic development.

Pearse, Andrew  
1970

"Urbanization and the incorporation of the peasant." Pp. 201-212 in A. J. Field (ed.), *City and Country in the Third World*. Cambridge, Massachusetts: Schenkman.

This essay is concerned with the relations between urbanization and the structural-cultural changes connected with land reform and rural development.

Poleman, Thomas T.

1972

"Employment, population and food: the new hierarchy of development problems." Food Research Institute, Studies in Agricultural Economics, Trade and Development 11(1), Stanford, California: Stanford University.

This research paper looks at the relationship between employment, population size and agricultural production and the policy options and development strategies which affect them.

Preston, Samuel H.

1975

"The changing relation between mortality and level of economic development." Population Studies 29(2):231-247.

The author uses cross-country relations of mortality and income over time to argue that most of the decline in mortality experienced in recent decades has not been directly attributable to income increases.

Quinn, J. E.

1975

The Use of the LRPM and PDM Models for Structural Analysis and Development Planning. Washington, D Socio-Economic Analysis Staff, International Statistical Bureau of the Census.

Discusses the uses of long-range planning models as a tool for planning or structural analysis in developing countries. The paper includes a discussion of what output from the models would look like on a given subject.

Raj, K. N.

1972

"Mechanization of agriculture in India and Sri Lanka (Ceylon)." International Labour Review 106(October): 315-334.

From Stokes et al. (1979):

In India and Sri Lanka, where labor is abundant and poverty widespread among the underemployed, mechanization of agriculture can be justified in terms of development objectives only if the required increases in output cannot be achieved otherwise. The author finds that in certain cases there was perhaps no alternative to mechanization for achieving increases in production, in some cases it has taken forms that have had no obvious beneficial effects on production or has been used as a means for reducing the dependence of large landowners on tenants or casual labor. Raj argues that the cause of mechanization is found less in terms of under-pricing of scarce resources (capital and foreign exchange) and more related to concentration of land ownership which removes the resource constraint.

Raja, V.T.  
1976

"Impact of new agricultural technology on farm income distribution in West Godavari District, India." American Journal of Agricultural Economics 58(2):346-50.

This paper looks at the effects of agricultural technology on the distribution of income for farmers and finds that the introduction of new technology not only produces an increase in income levels but also reduces the level of income inequality.

Ram, Rati and Theodore W. Schultz  
1979

"Life span, health, savings, and productivity." Economic Development and Cultural Change 27(3):399-421.

Using regional data over time from India, the authors argue that increases in health levels and life expectancy have substantially increased investment in education and labor productivity. Thus, considering only population growth but not the source of population growth may ignore an important source of economic growth.

Ratcliffe, John W.  
1977

"Poverty, politics, and fertility: the anomaly of Kerala." Hastings Center Report 7(1):34-42.

Despite per capita income levels and per capita food consumption well below the national average, Kerala, India has a life expectancy more than ten years above the national average. Ratcliffe analyzes how the emphasis on egalitarian social programs in Kerala has affected this outcome and the relatively low fertility levels that now prevail. He argues that Kerala's rapid social and economic development has resulted from a program of social change with equity.

Razin, A. and U. Ben-Zion.  
1975

"An intergenerational model of population growth." The American Economic Review 65(5):923-933.

This theoretical treatment of intertemporal utility maximization has the following implications: an increase in capital productivity increases investment and lowers population growth; subsidizing investment in children will tend to increase investment in child quality with a weaker effect on child quantity. A subsidy of investment financed by an income tax is found to lower population growth and raise investment.

Reid, J. D., Jr.  
1975

"Sharecropping in history and theory." *Agricultural History* 49:426-440.

This study looks at the historical and theoretical aspects of sharecropping and finds that the cost of negotiating and enforcing share contracts in the post-bellum South and Iowa was significant and that southern land owners monitored their tenants work.

Repetto, R.  
1976a

"Direct economic costs and value of children." Pp. 77-97, in Ronald G. Ridker (ed.), *Population and Development: The Search for Selective Interventions*. Baltimore: Johns Hopkins.

The author finds the evidence shaky but compatible with the economic value of children influencing fertility. He concludes that there is nonetheless little room for policy influence of their costs and benefits except through education, public health, and possibly social security.

1976b

"Inequality and the birth rate in Puerto Rico, evidence from household census data." *Harvard Center for Population Studies Research Paper #14*.

Using Puerto Rican data, this study demonstrates the plausibility of the redistribution of new and existing wealth as policy, and shows that a more equal income distribution is compatible with a decline in overall fertility.

1977

"Income distribution and fertility change: a comment." *Population and Development Review* 3(4):486-88.

Disputes the validity of Birdsall's (1977a) criticisms of research findings (subsequently published as Repetto, 1978) linking greater income equality and lower fertility.

1978

"The interaction of fertility and the size distribution of income." *Journal of Development Studies* 14(4):22-39.

This study looks at fertility and its relationship to the size distribution of income and presents an empirical argument in favor of greater income equality as a means of decreasing fertility.

Research Triangle Institute

1971

"Social and economic correlates of family fertility: a survey of the evidence." Report prepared for the Asia Bureau/Office of Population Programs under AID Contract NES/460.

The aim of this report is to acquaint decision makers with the research literature on individual level determinants of fertility behavior; its focus is a rather broad review of the literature.

Reynolds, C.

1974

The Recent Evolution of Savings and the Financial System in Mexico in Relation to the Distribution of Income and Wealth, Mimeo. Stanford, California: Stanford University.

This study calculates that redistributing income toward lower income groups would increase total saving by decreasing dissaving.

Rich, W.

1973

Smaller Families Through Social and Economic Development. Washington, D.C. Overseas Development Council.

This volume presents an analysis of the interrelationships of demographic factors and income distribution and concludes that equalizing the distribution of income may reduce fertility.

Ridker, Ronald G.

1976

Population and Development: The Search for Selective Interventions. Baltimore: Johns Hopkins.

A collection of essays focusing on varying hypothesized socio-economic determinants of fertility that are amenable to policy manipulation.

Robinson, W. C.

1972

"Peasants, procreation, and pensions: comment." The American Economic Review 62(5):977-978.

In criticizing Neher (1971), Robinson presents calculations suggesting that children are a poor means of old-age support on a cost-benefit basis, which argues against the "pension" motive for high fertility. Rather, current externalities are the real problem, which may require effective family-planning services.

1975

Population and Development Planning. New York: Population Council.

A summary of the state of knowledge on the subject by ten specialists. Subjects include macro-planning and population, manpower and employment, housing, health and

family planning, income distribution, international trade, resources and the environment, demographic measurement and data collection, and population projections for development planning.

Robinson, W. C. and David E. Horlacher

1971

"Population growth and economic welfare." Reports on Population/Family Planning No. 6. New York: Population Council.

This paper presents a thorough and critical review of its subject up to that date, including cost-benefit analysis of population growth, the economic theory of family formation, and welfare implications.

Rogers, Everett M.

1973

Communication Strategies for Family Planning. New York: The Free Press.

Presents a detailed analysis of what is known about the effectiveness of communications for successful family planning programs.

Rosenzweig, Mark R.

1978

"The value of children's time, family size and non-household child activities in a developing country: evidence from household data." In Julian L. Simon (ed.), Research in Population Economics. Greenwich, Conn: JAI Press.

"The 1968 National Demographic survey of the Philippines is used to test the hypothesis that parents in developing countries respond to economic incentives, particularly those related to the economic value of children, in forming decisions involving a number of dimensions of child investment. The econometric results suggest that, in areas where child wage rates and earnings are high, parents appear to bear more children and to school them less and that children living in farm households receive significantly less schooling and engage more extensively in economic employment. The results also appear to confirm earlier findings that the schooling of the mother and infant mortality are important correlates of family size but also suggest that the former variable is significantly related to child schooling attainment and employment."

Rosenzweig, Mark and Robert Evenson

1977

"Fertility, schooling, and the economic contribution of children in rural India: an econometric analysis." *Econometrica* 45:1065-1079.

From Stokes et al. (1979):

Authors studied relationship of child-woman ratios with land quality, measured by value per acre sown, mean landholding, and landholding inequality. Land size was positively related to child-woman ratios as was the land quality measure. Inequality of landholdings was negatively related to fertility. The study included 189 districts in India for 1961.

Salaff, Janet W.  
1972

"Institutionalized motivation for fertility limitation in China." *Population Studies* 26:233-262.

From Turchi and Bryant (1979):

A report drawn from the literature and from data given by refugees from China in Hong Kong. Describes change from a situation when children were valued for economic utility, religious and ceremonial functions and social and power opportunities (for women) to one where reforms in the marriage system, land tenure and organization and religion reduced the productive and ceremonial utilities of children and turned them into an economic drain. Fertility behavior changed accordingly (contraceptive usage).

Salaff, Janet and Aline K. Wong  
1978

"Are disincentives coercive? The view from Singapore." *International Family Planning Perspectives and Digest* 4(2):50-55.

From Turchi and Bryant (1979):

In 1965, one year after gaining independence, this republic of 2.3 million people inaugurated its Family Planning and Population Board. Its population was growing at 2.3% a year. Dissatisfied with its progress, the government in 1969 liberalized its abortion law and set up a disincentive program. These disincentives consisted of: (1) increased accouchement fees, (2) restricted choice of schools for children of 3rd parity or higher, (3) withdrawal of two-month paid maternity leave for third parity for women holding civil service jobs or jobs in unionized enterprises, (4) withdrawal of priority in public housing for large families, and (5) no income tax allowance for children of fourth or higher parity. The government that formulated these regulations is still in power. The population is now growing at a 1.3% a year rate. The pervasiveness of government in housing, medical employment, etc., makes it easier to get compliance, but implementation is far from completely enforced. However, a survey of about 100 couples indicates that "because the government seems to have persuaded" the people "that development is possible only if population growth is slowed, and that they will prosper only if family size is cut, its disincentive program is not seen as coercive."

Coercive measures did not fare as well in India, perhaps because they exceeded limits. Overzealous officials were reported to have forced unwilling men to undergo vasectomies and even shooting at resisters. Said to have been one factor in toppling Indira Gandhi's movement.

Schultz, T. Paul  
1970

"Fertility patterns and their determinants in the Arab Middle East." Santa Monica: The Rand Corporation.

From Cheng, Lawson and Levine (1979):

This paper attempts to sketch the economic consequences of rapid population growth. The author presents multivariate statistical analysis of factors affecting fertility in Egypt.

1971a

"An economic perspective on population growth." In National Academy of Sciences, Rapid Population Growth. Baltimore: The Johns Hopkins Press.

This microanalytic approach describes the return to parents from children, the economic factors that influence fertility, evidence on the family planning hypothesis, and economic consequences of population growth.

1971b

Evaluation of Population Policies: A Framework for Analysis and its Application to Taiwan's Family Planning Program. R-643-AID, June.

Statistical framework for evaluation of a family planning program.

1974a

"Birth rate changes over space and time: a study of Taiwan." In Theodore W. Schultz (ed.), Economics of the Family: Marriage, Children, and Human Capital. Chicago and London: The University of Chicago Press.

Uses regional and time series data from Taiwan to measure the economic determinants of fertility.

1974b

"Fertility determinants: a theory, evidence, and an application to policy evaluation." Rand Corporation Report R-1016/RF-AID:1-98.

From Turchi and Bryant (1979):

This report presents a comprehensive literature review of studies made in less developed countries about the economic theory of fertility demand. The author analyzes these data to gain more conclusive evidence on points which had been obscured in past theoretical discussions. A statistical model is presented, as is a method for testing the efficacy of Family Planning Programs. Data from Taiwan

in the 1960's are then used as an example of the methodology. Of the data surveyed in the literature, women's wages were found to have the largest negative regression coefficients relative to fertility, for low income levels.

- 1976a "Determinants of fertility: a micro-economic model of choice." In A. J. Coale (ed.), *Economic Factors in Population Growth*. New York and Toronto: John Wiley.

Summarizes the new home economics model of fertility together with empirical and policy applications. Much of this appears in T. P. Schultz (1974b).

- 1976b "Interrelationships between mortality and fertility." In Ronald G. Ridker (ed.), *Population and Development*. Baltimore and London: The Johns Hopkins University Press.

A survey of the subject which finds some evidence that fertility may adjust downward as early as two to five years after a decline in child mortality. There is no agreement on how complete the adjustment is, although the fertility decline appears to make up for at least half of the mortality decline.

Schultz, Theodore W. (ed.)

- 1974a *Economics of the Family: Marriage, Children, and Human Capital*. Chicago: The University of Chicago Press.

A collection of articles using the new home economics approach, originally published in issues of the *Journal of Political Economy*, 1973-74.

- 1974b "Fertility and economic values." In Theodore W. Schultz (ed.), *Economics of the Family: Marriage, Children, and Human Capital*. Chicago and London: The University of Chicago Press.

An overview of the new home economics, including its applications in developing countries.

Schnaiberg, A. and D. Reed

- 1974 "Risk, uncertainty and family formation: the social context of poverty groups." *Population Studies* 28(3):513-533.

This study compares risk, uncertainty, costs and benefits of high-fertility and low-fertility regimes. Contrasts are drawn between the perspective of the family planner and the parents in the LDC.

Schutjer, Wayne A., C. Shannon Stokes and Gretchen Cornwell  
1978 "Relationships among land, tenancy and fertility among Philippine Barrios." Paper presented at the annual meeting of the Population Association of America, Atlanta, Georgia, April.

The purpose of this paper is to examine the relationships among agricultural production patterns, tenancy and socio-economic conditions, and fertility in a developing nation.

Seiver, Daniel A.  
1976 "Recent fertility in Mexico: measurement and interpretation." Population Studies 29(3):341-354.

The author uses regional data from Mexico to analyze fertility. He finds a strong positive income effect that outweighs the negative effect of education and urbanization and education and explains high fertility.

Simmons, George B.  
1971 The Indian Investment in Family Planning. New York: Population Council.

Employs a cost-benefit framework to analyze family planning in India during the 1960s.

Simon, J. L.  
1974 The Effects of Income on Fertility. University of North Carolina at Chapel Hill: Carolina Population Center.

Simon examines a wide range of evidence on the effect of income and other socio-economic variables on fertility. He considers the short-run and long-run effects for developed countries and LDCs.

1977 The Economics of Population Growth. Princeton, New Jersey: Princeton University.

Much of Simon's 1974 monograph is summarized in this comprehensive work. But he goes well beyond it in analyzing the effects of population growth on economic development. For LDCs, he concludes that "moderate" population growth (say, 1.4% per year) produces a higher per capita income in the long run than either slow growth (close to zero) or rapid growth (say 2%). His long run is defined as 120 to 180 years. The short-run effect of higher fertility on per capita income is only slightly negative. His results depend crucially on a combination of factors neglected or denied in the earlier population literature, including the effect of fertility on work effort, economies of scale, an accelerator investment function, and depreciation. The final section considers population policy.

- Sirageldin, Ismail, M. Ali Khan, Farida Shah and Ayse Arirturk  
1976 "Fertility decisions and desire in Bangladesh: an econometric investigation." Bangladesh Development Studies 4(3):329-350.
- Uses household survey data to test a simultaneous equation model of fertility.
- Snyder, Donald W.  
1974 "Economic determinants of family size in West Africa." Demography 11:613-27.
- From Turchi and Bryant (1979):  
The article analyzes data from a sample of households in Sierra Leone to test the economic model of fertility behavior. A regression model is presented and the variables used are justified. The results show the opportunity cost to be negatively related to fertility in a significant manner. The data show no trade-off between child quality and quantity possible because children are valued as a social security.
- Sorkin, Alan L.  
1971 "In Punjab: the green revolution." Growth and Change 2(3):36-41.
- Describes the increases in agricultural output in Punjab, India that have raised it to the highest per capital income levels in India. The increases seem to have resulted from a confluence of public and private factors, including irrigation, new seed varieties, land consolidation, mechanization, and a shift in cropping patterns.
- Stone, Richard  
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