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| | | | |
|--|----------------------------|----------------------|--|
| 1. SUBJECT CLASSIFICATION | A. PRIMARY Population | PA00-0000-0000 | |
| | B. SECONDARY General | | |
| 2. TITLE AND SUBTITLE Effects of economic development on fertility, review and evaluation of the literature | | | |
| 3. AUTHOR(S) Williams, A.D. | | | |
| 4. DOCUMENT DATE 1974 | 5. NUMBER OF PAGES 65p. | 6. ARC NUMBER ARC | |
| 7. REFERENCE ORGANIZATION NAME AND ADDRESS GE | | | |
| 8. SUPPLEMENTARY NOTES (Sponsoring Organization, Publishers, Availability) (In GE74TMP-32) | | | |
| 9. ABSTRACT | | | |

10. CONTROL NUMBER

PN-AAF-230

12. DESCRIPTORS

Developing countries
Economic development
Economic factors
Fertility

11. PRICE OF DOCUMENT

13. PROJECT NUMBER

14. CONTRACT NUMBER
CSD-2611 GTS

15. TYPE OF DOCUMENT

R2D/Cod - 2011
Tadric order NAB

CSO-2611 GTS
GE
PH-AAF-230

EFFECTS OF ECONOMIC DEVELOPMENT ON FERTILITY: REVIEW AND EVALUATION OF THE LITERATURE

GE74TMP-32

July 1974

Prepared for the Agency for International Development
by General Electric • TEMPO • Center for Advanced Studies
Santa Barbara, California • Washington, D.C.

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**EFFECTS OF ECONOMIC DEVELOPMENT
ON FERTILITY:
REVIEW AND EVALUATION OF THE LITERATURE**

Anne D. Williams

GE74TMP-32

July 1974

**Prepared for the U.S. Agency for International Development
Contract No. AID/csd 2611, Task Order No. 6**

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ACKNOWLEDGMENTS

The comments of the late Stephen Enke, and Bryan Hickman, James Johnston, Michael Keeley, Douglas Maxwell, William McFarland and John Turner at General Electric—TEMPO were most helpful during the preparation of this paper. In addition, Sylvia Forman of the University of Massachusetts, Donald O'Hara of the University of Rochester, T.W. Schultz of the University of Chicago, and Boone Turchi of the University of North Carolina kindly reviewed the paper and made many useful suggestions.

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SECTION 1

INTRODUCTION

This paper reviews and evaluates available literature on the effects of economic development on fertility. The purpose of this review is to highlight the state of knowledge on the determinants of fertility in the context of a developing society. This paper may serve to guide future work by showing where evidence is deficient, by incorporating some of the feedbacks in economic-demographic models, by testing the sensitivity of the models' implications to the specification of the feedbacks, and by going beyond existing models and considering particular aspects of the population question in detail, to name just a few possibilities.

Section 2 formulates in detail a theory of the determinants of fertility. It approaches the question from the point of view of the individual household which chooses its fertility behavior from the alternatives available in a given environment. The characteristics of the environment and their relation to economic development are discussed extensively.

The principal determinants of fertility are isolated and examined in Section 3, which summarizes the evidence on each factor. Much of the literature on fertility has come from studies in the United States and other industrial countries. While this body of literature is an important frame of reference and a source of provocative questions, the present paper concentrates on studies of developing areas where many of the conclusions from richer nations may not hold.

Finally, Section 4 summarizes the findings and notes the limitations of investigations of fertility to date. The use of the analysis for different policy questions is discussed. There is a brief discussion of how the theory and evidence might be incorporated into particular models.

SECTION 2

THEORY OF FERTILITY DETERMINANTS

This section treats the theory of the determination of fertility. Some general considerations about fertility and its analysis are raised; then the household model of fertility is outlined. Couples are first seen as deciding upon their desired number of surviving children. They then adjust actual births to achieve their goal, taking into account childhood mortality and their ability to control fertility. These parental decisions are attempts to achieve the most satisfaction possible in a given environment. Within this environment parents have limited incomes and consequently face trade offs between different choices. These choices are described in detail. Subsequently, the environment itself is analyzed, ie, those factors over which the couple has no control. These environmental factors, which may be economic, social, or institutional, change relatively slowly. The latter part of this section focuses on these changes during the process of development and their effects on fertility decisions. Figure 1 shows some of the interactions of the development process and fertility as they are considered in this section.

GENERAL CONSIDERATIONS

First, this paper consistently treats fertility as the sole dependent variable. In fact, this represents an inordinate simplification of a set of complex interrelationships. Fertility is only one endogenous variable in a simultaneously determined system of relations. For example, how many children a woman expects to raise can determine whether she will have time to take a job. Her expectations about children and future work will help determine whether it is worthwhile for her to seek more education, possibly delaying marriage. Although the variables which influence fertility are emphasized, in many cases fertility will have important feedbacks upon the variables which determine it.

Then too, it is not only fertility which must be explained, but also the determinants of fertility in order to formulate consistent policy. For example, fertility is often discussed as depending directly upon marriage, with earlier marriage leading to higher fertility. An obviously antinatalist policy is to raise the age of marriage. Yet laws passed in India in this century had little success in delaying marriage. Because there had been no change in the underlying social and economic conditions which determined marriage, the law prohibiting early marriage only led to widespread falsification of age on marriage registers. Thus the policy-maker planning to change fertility must look to the *root causes* as well as the *structure* of the relationships in order to identify the most fruitful points for intervention. If female labor force activity turns out to be the most important determinant of fertility, the inquiry must include labor force participation and means of influencing it during the process of development.

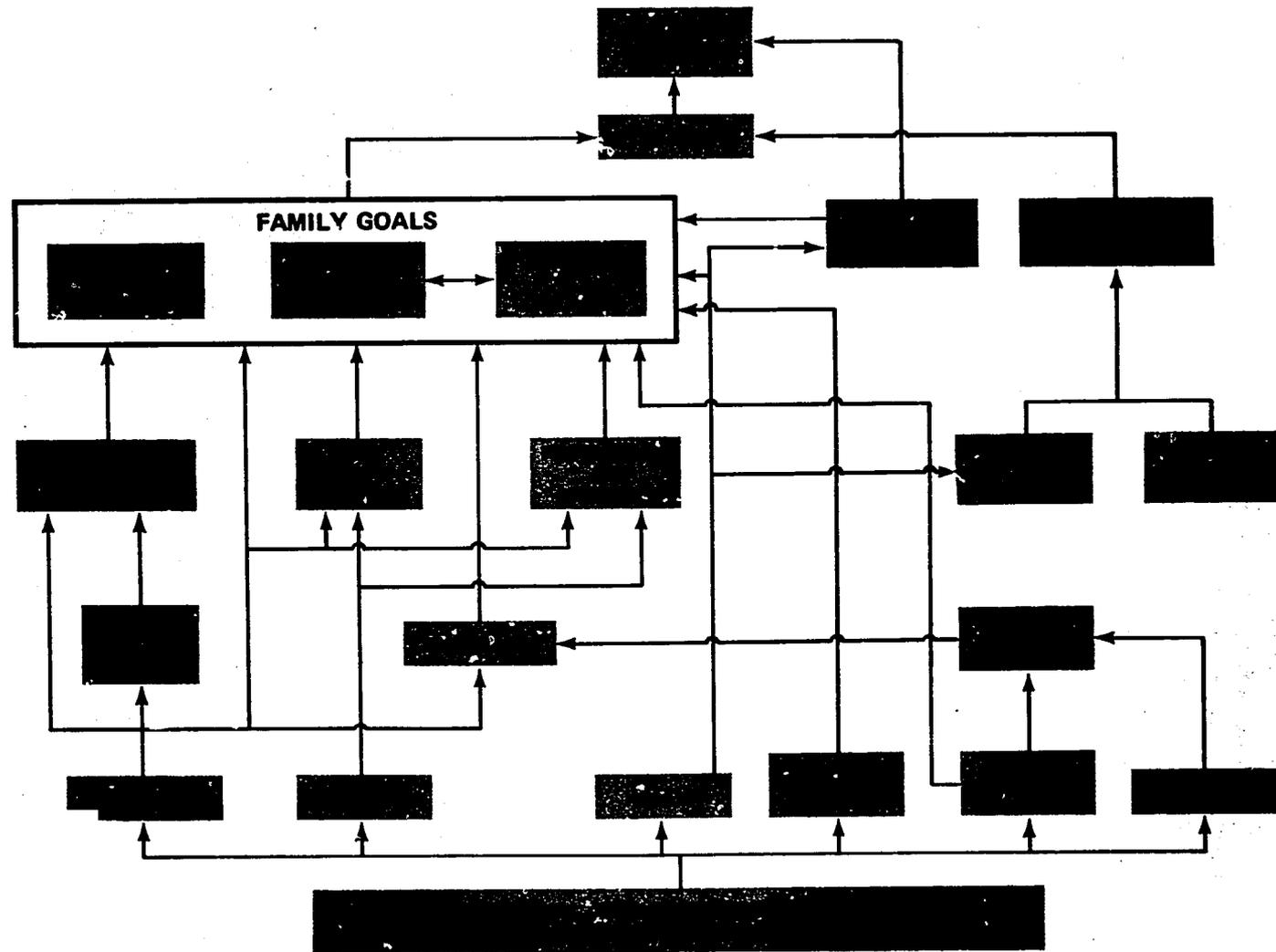


Figure 1. Some interactions of the development process and fertility.

Another general question concerns the definition of fertility. "Fertility" has several dimensions. Most attention has been devoted to the number of live births per woman. This is perhaps the most important dimension, and with mortality largely determines the rate of population growth. Shifts in the timing of births can also affect growth rates. If, for example, women delay the start of childbearing, say from age 18 to age 30, in a regime of high mortality many women will die in the intervening twelve years. They will never bear children, so the population growth rate will fall. Most of the countries in the world today have passed through such high mortality regimes, limiting the importance of this effect. Simply lengthening or shortening the average span of a generation, however, will affect population growth at any but a zero growth rate. And even in the case of a zero growth rate, changes in generation length will produce permanent changes in the equilibrium level of population. Timing shifts can also have important economic effects. If women concentrate their childbearing in a few years, rather than spreading it out, more time is available for working or other activities.

Another dimension of fertility is "quality" of children. Quality here refers to investments which parents or society make in their "human capital." [See Wray (1971), Becker (1960), De Tray (1973), and Duesenberry (1960) for an extended analysis of child quality.] Examples are investments in nutrition for health and survival, or in education for future productivity. The decision variable is not just the number, but also the investment to be made in children.

From the point of view of both the family and the society, a better measure of fertility than births would be the number of children surviving. Thus consideration of the determinants of fertility must include the factors of fetal loss, and infant and childhood mortality. However, a full analysis of population growth, which is affected by mortality and migration together with fertility, is not the subject of this paper, which deals primarily with the number of children ever born to women, taking into account the other dimensions of fertility where necessary to adequately characterize the development process.

HOUSEHOLD MODEL OF FERTILITY

The household model of fertility views individual families as trying to maximize their satisfactions from children and other commodities.* Their income (wealth) limits the total they can spend on either. The distribution of this total spending between children and other commodities depends on the relative advantages and disadvantages of each. In this section the environment in which the family lives and its preferences are assumed to be fixed. This framework can be applied to any decisionmaking unit—the nuclear family, the husband or wife alone, the extended family, or even the society as a whole. But in each case the decisionmaker is assumed to weigh the benefits and costs of children and other commodities, and to choose the best attainable mix. As the net benefits from children rise relative to the net benefits from commodities, the stock of children

* "Commodity" here refers to the output of a combination of parents' time and purchased goods. For example, parents can enjoy their children or sailing, each of these commodities being produced with different mixes of time and goods.

presumably would increase.* The model focuses on the individual couple as the primary decisionmaking unit. Where others (such as in-laws) influence fertility decisions, their influence will also be considered.

The husband and wife can be viewed as deciding at the beginning of their childbearing period on the number, quality, and spacing of their children in light of their expected permanent income and the expected benefits and costs of children.† (The analysis can also be extended to sequential decisionmaking without altering the basic process.) The fact that some of these decisions may be described by broad ranges instead of precise numbers ("four to six children," or "as many as possible") does not invalidate the analysis of how they respond to various factors. Of course, parents face the possibility that their expectations may not be realized. Income may change, prices may change, or they may find that the children do not have desired characteristics (if, for example, they want sons, but produce daughters).

Children are not like other commodities in that if they prove unsatisfactory or if circumstances change, they usually cannot be exchanged or sold. Parents maintain some capacity for downward adjustment of their goals for some years after childbearing starts since children must generally be produced one at a time. Even so, the uncertainties associated with children and the difficulty of downward adjustment after the initial desired family size is reached would probably lead to some irreducible amount of unexplained variation in fertility.

Parents are assumed to formulate their desired family size in terms of surviving children. Two factors may intervene between desired family size and actual live births. Family planning failures can produce more than the desired number of children (or fewer in the case of sterility or low fecundity). Child mortality means fewer expected surviving children than actual births. Both factors can be very important in developing nations where more than one-fourth of the children born die in childhood and where family planning methods are limited to the pre-industrial methods of abstinence, withdrawal, abortion, infanticide or prolonged lactation. Parents will try to plan their number of births to take these factors into account. If they expect one-fifth of their children to die, they tend to compensate by planning to have five children for every four of their surviving family size goal. (The compensation is not exact since the goal also changes. This complication is discussed subsequently.) If they expect family planning failure, they will aim for fewer births than their family size goal. In addition, both child mortality and birth control affect the costs and benefits of children and thus the family size goal itself. For simplicity each of these factors—desired family size, mortality, and family planning—is treated separately.

* Becker (1962) has shown that the assumption of rationality is not required here if prediction rather than explanation is the goal. Rationality is also not necessary as long as units which make suboptimal decisions fail to survive, such as overpopulated tribes which succumb to a famine. In this case as well as in the case of rationality, in the long run the only units observable will be those successful in the given environment.

† "Permanent income" is a concept to measure total possible income from human and nonhuman wealth. It abstracts from variations in hours of work and from unexpected transitory variation in income.

Desired Family Size

Desired surviving family size depends on the value of children and on the parents' wealth. These two factors are treated in turn.

Value of Children. As the net value of children falls relative to the utility of other commodities, parents will consume relatively more of the other commodities. The process of economic development can affect these values in various ways generally to reduce the relative value of children. The costs of children can be divided into two components: the financial cost to support them, and the time cost incurred by parents to care for them. Characteristic of economic development is the shift from an agricultural setting where household production is relatively important to a nonagricultural market economy where household production declines. The direct costs of food and housing as a rule in poor countries are higher in the nonagricultural setting, particularly in crowded urban areas.

The time cost changes most markedly in the process of economic development. Migration from the farm often brings with it the dissolution of the extended family, reducing the availability of childcare by inactive older relatives. The general increase in education with development increases the economic productivity of both husband and wife. Particularly in an urban setting new opportunities open up for the employment of women outside the home. Women are no longer able to combine childrearing and economic activity in the home as with traditional agriculture or crafts. Thus the decision to have more children is a decision to forgo the income a woman could earn outside the home, an opportunity cost which is taken into account. Even if a woman does not choose to work, the modernization of her role opens up new opportunities outside the home, but these tend to be more restricted if she has children.

The usefulness of children in production tends to fall with development. In a traditional agricultural setting even preschool children can be productive, helping with household chores, caring for siblings, herding livestock, or helping in actual production activities. Few opportunities exist for children to work off the farm, and governments curtail their activity further by child labor laws and compulsory education laws. The latter also may involve direct costs to the parents (transportation, books and clothing). Public education, on the other hand, may reduce the cost of children if parents would otherwise pay fees for private education. In traditional societies parents value children not only as producers when they are young but also as providers of old-age support. The breakup of traditional family structure and the institution of private and government pension plans in the development process reduce parental claims to future support.

Parents also derive nonmonetary advantages from children. Children can be a source of pleasure, psychological support, and social status. As monetary benefits decrease with development, these nonmonetary satisfactions become more important in decisions on children.

As development continues parents tend to invest more in their children. Thus, a trade off occurs between quantity and quality of children. Improved living standards

result in greater resource expenditures per child. Education and health facilities become more available, enabling higher quality children. Increased parental education results in higher educational aspirations and more intensive child home care and training. The quality-quantity trade off thus reinforces other tendencies for parents to have fewer children. Also, development typically brings a wide range of previously unavailable or prohibitively expensive consumer goods. The widening and deepening of capital markets and the advent of consumer credit facilitates purchase of assets which may compete with children.

Wealth. Total consumption is limited by income or wealth. If development brings not just rising average income but also a fairly even distribution of that income, individual households will find themselves with more resources to satisfy their wants. (Higher wages, of course, must be adjusted for higher prices in the cities than on farms and for unemployment of new migrants to growing urban areas.) Presumably, parents will want more of almost everything, including children, when incomes rise. This statement refers to a "pure" income effect where relative prices are held constant. The usually observed negative association of fertility and income occurs because rises in income are usually associated with price changes. An example is wage rates. If wages rise, permanent income rises. As discussed above, a large part of the cost of children is the time spent on bearing and rearing them. This time cost generally falls on the wife. Since the wage rate represents the opportunity cost of what she could be earning if she were at work instead of caring for children, a rise in the wage rate makes children more expensive, and the number of children will fall.

Another point previously referred to is the quality-quantity trade off. With a pure rise in income parents will demand both more and better children. But quality of children becomes relatively cheaper than quantity of children, so a substitution occurs in favor of fewer, more expensive children. [See Becker and Lewis (1973).]

At the same time that parents plan their optimal number of children they plan the optimal timing. The biological factors in the timing problem are somewhat responsive to economic development. To the extent that fetal and infant loss are affected by nutrition, medical care, and public health facilities, rising incomes through development will reduce this loss. Decreased fetal loss will tend to reduce the interval between live births. Where breast feeding is widespread, reduced infant loss may increase the interval and help delay conception. Income may also affect the spacing of children directly. Transitory changes in income (for example, those due to depressions or booms) can influence parents to delay or hasten births.

Other factors also play a role in the spacing of births. Perhaps most important are the wife's opportunities away from the home. If she can obtain employment or other productive activity outside the home, she has an incentive to concentrate her childrearing in as few years as possible so that she can return to these other activities. The availability of effective contraception can also encourage closer spacing. Parents need not approach their desired family size slowly because of the possibility of an unexpected conception.

Childhood Mortality

Parents make their decisions on children in a given regime of infant and childhood mortality. They respond in two ways. First, they can anticipate mortality and have more births than their desired family size in order to assure the right number of survivors. Secondly, they can have extra births as deaths occur to replace those children who actually die. This is reinforced biologically because with loss of an infant lactation no longer operates to delay conception. To the extent that the first "expectations mechanism" is more important, their expectations about mortality affect the number of births. There may be a lag in adjustment where mortality is rapidly improving because of the time required for parents to acquire and react to new information about mortality. Where the "replacement mechanism" predominates adjustment to better health conditions will be more rapid.

Mortality not only affects the number of births needed to attain a given surviving family size, but it also may affect that family size goal. In a regime of high mortality many children die. The resources spent on deceased children represent a loss to their parents. As mortality falls it thus becomes "cheaper" to produce a child and desired surviving family size may actually rise. Theoretically, therefore, births may either rise or fall because of the counterbalancing effects of more survivors desired and fewer births needed to produce them. But, the quality-quantity trade off is also affected by changes in mortality. As mortality falls, parents become more willing to make substantial investments in education and health for their children, knowing that their investment is less likely to be negated by the child's death. This shift from quantity to quality enables the population growth rate to fall with falling mortality. [See O'Hara (1972b).]

Development has the effect of reducing mortality. Public health measures improve sanitation and disease control. Private and public provision of more medical personnel and facilities spread the benefits of modern medicine to more people. Rising incomes enable people to improve their nutrition and health level, reducing their susceptibility to and the severity of disease. As educational levels rise, people learn more about health care, and turn away from traditional practices to scientific medicine. A general decline in fertility with development means that most mothers are of an age and parity more favorable to survival of their children.* As parents attain more control over births and as institutional changes reduce the preference for sons relative to daughters, the number of children who are unwanted and die because of poor care or infanticide will fall.

Some factors, however, may operate in the opposite direction. If women's participation in the labor force rises with development, the quality of childcare can deteriorate. For example, labor force participation and exposure to modern practices may encourage women to abandon breast feeding and thereby expose children to infection if adequate substitutes are not available.

Control over Fertility

Parents' achievement of their desired fertility is determined by both the capacity to have children and their success at limiting the number of children

* "Parity" denotes the number of children previously born.

The development process largely has positive effects on the capacity to bear children. The general fall in mortality means that in the early stages of development there is a significant increase in reproductive capacity, as the likelihood of a woman's being widowed before the end of her childbearing period decreases. Improvements in nutrition also reduce sterility and increase the capacity to bear children. Where certain diseases such as malaria and venereal disease reduce fecundity, public health measures and modern antibiotics can decrease their incidence. Finally, abandonment of breast feeding because other foods are available or mothers return soon to work reduces the normal period of sterility following childbirth.

Family planning activity tends to increase with development. The costs of contraception have fallen as the relatively unreliable traditional methods of contraception (eg, withdrawal) have been replaced first by mechanical means (condom, diaphragm) and most recently by the most effective coitus-unrelated methods (pill and IUD). The increasing levels of education have made it possible for more people to obtain information about contraceptives and use them effectively. Widening networks of transportation and communications also facilitate the spread of information.

The benefits of contraception also increase with development. As desired family size falls even more below the biological maximum, the benefits of preventing extra births become more apparent. As people become wealthier they are willing to spend more resources to reduce uncertainty and prevent the arrival of extra children who would require larger expenditures. Finally, even if desired family size remains constant, an increasing and continuing use of family planning may occur in order to space children in the optimal way.

ENVIRONMENT AND PREFERENCES

The preceding household model of fertility has focused on parental decisions within a given environment and preference structure. The environmental and taste factors within the structure are discussed here more explicitly. At any given point in time parents consider their native ability, their educational achievement, institutional patterns of society, cultural and social norms, and their own tastes to be fixed. Yet except possibly for native ability, all of these can change markedly during a lifetime. Thus, while for some purposes they can be taken as exogenous, in a full explanation of fertility they too must be explained.

Education

Education has already been discussed in several contexts. It is among the least exogenous of these environmental factors because educational attainment (even before adulthood) is related to the individual's goals in life, and because many adults continue to improve themselves educationally. Education has several effects. As noted above, education increases productivity both at work and in other activities. Higher wages due to education induce women to participate more in the labor force. Education raises incomes. Educated individuals are more knowledgeable about and more efficient in the use of family planning methods and in the prevention of health and nutrition problems in their children. They are more competent in educating and thus producing "quality" children.

Education also has some impact on the process of development. The spread of information about other areas and cultures can weaken the power of traditional religion and culture. Educated people are more able to assess and respond to new information and technological change. Education may also have a role in exposing people to individuals from other backgrounds, as well as to modern goods and consumption patterns.

Institutional Patterns

Many institutional patterns of society impinge upon fertility. The development of pension plans which reduce the need for children to support parents in their old age has been mentioned. The inheritance system can also be important. Where land is divided among children, parents may see that too many children will leave each without adequate means of subsistence. On the other hand, the primogeniture system may delay marriage and childbearing because children cannot support themselves until they come into a holding or establish themselves in other occupations.

The organization of marriage and the family has a similarly important effect on couples making fertility decisions. Institutional and cultural limitations on marriage age may reduce a woman's ability to choose among education, employment, and marriage. Where preliminary and temporary consensual unions are accepted, or divorce is common, fertility can be reduced because women work to maintain their ties to the labor force. Acceptance of illegitimacy can foster fertility outside marriage but by shifting from marital to single fertility may actually reduce total fertility. Polygamy may raise fertility if it increases the number of women married. If modernization is associated with weakened religious and class strictures against intermarriage, marriage rates and thus fertility can rise.

One pervasive aspect of development is the replacement of the joint or extended family where it exists by the nuclear family organization, thereby increasing childcare costs. It also may delay marriage and childbearing if couples must set up their own households at marriage. Couples freed of the influence of their more traditional elders may be more open to modernizing influences.

Cultural and Social Norms

Social norms about numbers of children and the role structure within the family also shape fertility behavior. Where parents feel pressured to behave as others in their social group do, the quality of children and expenditures on them may lose many elements of choice. In a mobile society parents may find it advantageous to curtail their fertility to advance to a higher social status. Exposure to nontraditional ideas as development proceeds may reduce fatalism and encourage new opportunities not associated with children. Religious norms in particular can affect attitudes towards family size and the use of family planning methods, and exposure to a more heterogeneous society as transportation and communications improve can change individual viewpoints.

The role structure within the family affects the nature of the couple's decisionmaking process. In some traditional societies the wife has been completely subservient to her husband's wishes. (In a few traditional societies the wife is

dominant.) The increased opportunities for women as development proceeds tend to give them more independence and thus erode the pattern of husband domination. This may be most important with respect to contraception. Where the wife has female-oriented contraceptives available she can respond more quickly to the modernizing forces which remove her from the exclusively childbearing role. Regardless of the distribution of power within the household, the extent of communication between husband and wife influences their joint goals and the achievement of them. The breakdown of traditional divided roles and increased education can facilitate such communication.

SECTION 3

A SURVEY OF THE STATE OF THE EVIDENCE

OVERVIEW OF EMPIRICAL EFFORTS TO DATE

The empirical work on the determinants of fertility has not been able to treat all the influences on fertility which are hypothesized above. In particular, the separate channels by which a variable affects fertility have not usually been identified. For example, the extended family is thought to stimulate fertility by providing resources for earlier marriage, by assuring reliable childcare for working mothers, and by maintaining traditional values through the dominance of elders. Yet the empirical work only correlates family structure with fertility without testing the strength of the different causal mechanisms. Thus, this empirical part of the paper focuses on the broad topics which have been the subject of investigation, such as family structure, education, labor force activity, and so on. Where particular channels of influence have been tested, the results are discussed. Untested hypotheses are noted.

The studies reviewed here range widely in complexity. Some are the simplest cross tabulations or correlations of fertility with one other variable. Others take into account the different effects of several variables with multidimensional tabulations, partial correlations, or multivariate regression analyses. The most complex are the studies which simultaneously explain fertility with other important endogenous variables such as labor force behavior and marriage rates. These simultaneous systems are crucial where several variables affect each other by different causal paths, such as labor force activity and fertility. An attempt to analyze only one can lead to serious biases because the feedbacks from it are not properly accounted for.

While the simplest studies are useful in pointing out areas for future research, they shed little light on causal mechanisms and thus give little information on how to change fertility. Further, if other variables are not held constant, the results may not represent the true relationship. Where two variables tend to vary together, such as income and education, it is impossible to assess the importance of one without taking the other into account. Sometimes definitional links between the variables produce spurious correlations. The simple correlation between fertility and per capita income is negative partly because population is the denominator of per capita income.

It is particularly important in discussing demographic phenomena to hold age constant. For instance, family income tends to rise through the reproductive years as workers acquire experience and skills and get promoted to higher paying jobs. It is also during these years that the parents are building their families. A

naive tabulation of family income and number of children without controls for age can show a positive relationship simply because younger families have not yet completed childbearing and also have not yet attained their highest possible income.

It is also important when comparing different age groups to separate life-cycle effects from cohort effects. If groups differed only because they were observed at different stages of the life cycle, these combined observations then would give a complete picture of fertility behavior. In reality, however, the picture is distorted because of unquantifiable factors which differ for each cohort. Parents who started their families during the depression of the 1930s or during World War II may have had different responses from those of young couples today. Although some of the causes of differences between cohorts such as education or income can be specified, many inevitably are left out.

Limiting studies to women beyond the childbearing ages eliminates some of the life-cycle effects, but not the cohort effects. Such studies may be less relevant for planners interested in the fertility of young adults in the process of building their families. Holding constant (standardizing for) age or marriage duration enables the examination of these younger groups. Standardization, although it tends to obscure cohort effects or changes in the spacing of children, is often preferred to age-specific fertility measures because it yields a single comprehensive measure of fertility.

The output of the statistical techniques can take various forms. Correlations give a measure of the direction and strength of the association between two variables either alone (simple correlations) or taking into account the effect of still other variables (partial correlations). Partial correlations can be linked to regression coefficients which show the effect of a unit change in an explanatory variable on the dependent variable. Elasticities, on the other hand, give the percentage change in the dependent variable due to a one percentage change in the independent variable (and are thus independent of the units of measurement). Both elasticities and regression coefficients are judged to be significantly different from zero (often at the 5 percent level) on the basis of their standard errors. In the case of simultaneous equation estimation techniques, either structural or reduced form measures can be estimated. Structural coefficients or elasticities give the impact of an explanatory variable on a dependent variable in a single behavioral equation. Reduced form coefficients or elasticities give the total response of the dependent variable to shifts in an exogenous variable. Indirect effects through other endogenous variables as well as direct effects of the exogenous variables are included in the reduced form coefficients.

Apart from questions of statistical techniques the quality of the data used in fertility studies is critical to the evaluation of their conclusions. Some surveys have been specifically designed to get information on fertility from individuals. They usually obtain information about the number of live births (children ever born). Other studies have relied on information already tabulated in censuses or, less frequently, in registration of vital events. These are often forced to rely on fertility indicators such as the child-woman ratio (the ratio of children age 0-4 to women of reproductive age). The child-woman ratio includes the effects of childhood mortality and of errors in enumeration and age reporting. It must be interpreted cautiously in order to draw any conclusions about fertility.

Most of the studies discussed below deal with actual fertility. Many give information on ideal or desired family size, and a few of the studies focus exclusively on this variable. Some of these results are discussed, but interpreting such attitudinal variables as desired or ideal family size is very difficult. Often the context of the question is not clear. The respondent may be referring to a vague ideal, what is ideal for the respondent, or what the respondent would like if cost were no object. Because many couples do not wish to reject existing children, they will not admit to a desired family size containing less than their own number of living children. While studies in the United States have done much to refine these attitudinal measures, their meaning across various developing countries, or even within one country as asked by different interviewers, is not well defined.

The unit of analysis thus ranges from the individual household, to aggregates for geographical or other groups within a country, to aggregates for different countries. Most of the work has dealt with cross-country studies of one of these units at a given point in time. The cross-country studies are undoubtedly the least reliable. Not only does the quality of the data vary in nonrandom ways across countries at different levels of development, but also definitions are not uniform. Adjustments to make comparable different definitions of female labor force participation or different types and qualities of schooling are crude at best.

A few studies have considered changes in fertility over time, using either aggregate time series or retrospective family surveys. The difficulties of accounting for different responses in different cohorts have already been discussed. In addition, little has been done to study the dynamic responses of families to changes during their lifetimes. This is obviously a serious problem when the explanation of the development process involves the determination of individual change.

The discussion of the evidence on fertility in the remainder of this section falls into the following eight categories:

- Income, Occupation, and Socioeconomic Status
- Education
- Female and Child Labor Force Activity and Wages
- Migration, Urbanization, and Industrialization
- Childhood Mortality
- Fecundity and Family Planning
- Marriage and Family Structure
- Attitudes, Roles, Son Preference, Tastes, Institutions.

INCOME, OCCUPATION, AND SOCIOECONOMIC STATUS

In considering the effect of a family's income on its fertility, the focus here is on the "pure" income effect, ie, the effect of a rise in income with no related change in any prices of goods and services. Because in most areas of the world men are the primary income-earners in a family and devote less time to childcare than women, the simplifying assumption is made that the occupation and status of men are closely related to pure income. Although there are some changes in incentive when men get higher incomes or status, these secondary price effects have not been separated from the income effects in the empirical work.

The literature on the effects of income in developed countries is extensive. Perhaps the best exposition is by Simon (1969). He shows that the negative association between fertility and income (often observed in historical or cross-sectional data) is not inconsistent with the positive relation observed in the short run such as the business cycle. The reason is that certain variables such as education, infant survival, and urbanization which have a negative effect on fertility are positively correlated with income. Thus the gross negative correlation of income with fertility reflects the negative influence of these variables across time or in cross section. In cyclical swings, these variables do not change much; the positive pure income effect can emerge. Analogously, higher fertility for those with higher relative income [see Freedman (1963)] simply means that other crucial variables like education and age are being held constant.

It is possible also that the "pure" income effect on fertility is positive, but not observed. If wealthier parents choose to have higher quality, ie, more expensive, children, they may correspondingly reduce the number of children. But this does not mean that children are inferior goods. The relevant measure, which may be difficult to quantify, is the increase in "quality-adjusted" children.

An example of the gross relation between income and fertility is shown in Table 1. The strong negative relation also holds when fertility is classified by occupational or socioeconomic status (Table 2), since both of these variables are closely tied to the income of the husband. A few studies have observed positive gross relations between fertility and measures of wealth [eg, Stys (1957) for land holdings in Poland], but in general it is the failure to hold other factors constant that produces the apparent negative relationship.

Table 1. Children ever born to 1959 sample of ever-married women aged 35-50 of differing incomes in Santiago, Chile.

| Income (pesos) | Children Ever Born |
|------------------|--------------------|
| Less than 9,000 | 5.9 |
| 9,000 - 14,999 | 3.7 |
| 15,000 - 20,999 | 3.0 |
| 21,000 - 26,999 | 2.6 |
| 27,000 - 39,999 | 2.2 |
| 40,000 and over | 2.4 |
| Domestic Servant | 3.3 |
| No Answer | 3.2 |
| Total Sample | 3.4 |

Source: Tabah (1963), Table 1, p 22.

Table 2. Children ever born to legally and consensually married women by occupational status of husband in Latin American large urban areas, 1963-1964.

| City | Occupational Status | | | |
|----------------|---------------------|-----------------------|------------------------|-------------------|
| | Manual Labor | Lower Nonmanual Labor | Higher Nonmanual Labor | All Three Classes |
| Buenos Aires | 1.9 | 1.7 | 1.9 | 1.8 |
| Rio de Janeiro | 3.1 | 2.2 | 2.3 | 2.7 |
| Panama | 3.4 | 3.0 | 2.6 | 3.2 |
| Caracas | 3.8 | 3.1 | 2.9 | 3.5 |
| San Jose | 4.3 | 3.4 | 3.0 | 3.9 |
| Bogota | 4.1 | 3.8 | 4.0 | 3.9 |
| Mexico | 4.6 | 3.7 | 3.4 | 4.1 |

Source: Miro and Mertens (1968), Table 8, p 108.

The results of multiple regressions, whether single-equation models or simultaneous-equation models, and whether across countries or within a given country, show no consistent effect for income. The coefficients of per capita income, male income, male labor force participation, or male wages fluctuate in sign (with positive coefficients predominating) and only rarely are significant different from zero, when other variables are held constant in the regressions. One strong result was the Adelman (1963) finding that per capita income had a strong positive effect on birth rates across countries for women aged 15-19. This is most plausible for this age group which is just starting families. The relation is also harder to establish for older groups whose current income may differ from income in the past when family size decisions were being made. There is some evidence of increasing family planning effectiveness with rising income or status. Rizk (1963) showed that in the U.A.R. in 1959 only wives of men in the highest social class had lower fertility when they attempted to use family planning methods.

The regressions of Schultz (1969b) suggest that recent changes in income have a positive effect on fertility. This result confirms the Western experience of procyclical variations at least in the timing of fertility. [See Silver (1965, 1966).] Heer (1966) found a positive coefficient across countries for change in per capita energy consumption which he used as a proxy for changing national income. Friedlander and Silver (1967) found a hint of a negative relation between changing income and fertility across countries. In justifying the negative sign they interpreted the change in income as a measure which picks up changing social and economic opportunities as well as simple changes in income.

The effects of mobility or speed of change itself, apart from any changes in income, are hard to isolate. Individual social and economic mobility is often associated with migration (discussed subsequently). But mobility due to changing social and economic opportunities is distinct in that it can take place witho

physical migration. Studies of occupational mobility are inconclusive. Boyd (1973) showed that in Latin American countries fertility of families who change occupational status is intermediate between that of their original and their new occupational groups. This result is similar to those of Hutchinson (1961) and Lutaka, Bock and Varnes (1971) for mobility of individuals and between generations in Brazil. In Mexico, however, Boyd found that upward mobility carries with it an independent effect in reducing fertility. This question must be studied further, particularly to determine the effects of development on individuals over their lifetimes.

In summary, the evidence for the effect of income on fertility is not strong when other associated factors are held constant. The suggestion of a positive effect is not consistently observed by the studies. Socioeconomic or occupational status is usually closely linked to other characteristics of development, such as education, female labor force participation, and child mortality. These variables, which often have intermediate effects in raising incomes, are discussed subsequently.

EDUCATION

The increase in educational levels associated with economic development is hypothesized to lower fertility. The several channels through which education operates are discussed before the evidence is reviewed below.

The compulsory education of children is a cost factor which tends to lower fertility. Education reduces the opportunity for a child to work and contribute to the family income. Higher voluntary educational expenses are also usually associated with a decrease in the number of children.

Education also affects the market productivity, nonmarket productivity, and tastes and attitudes of adults. Market productivity refers to the fact that educated people command higher wages and thus higher potential income. Furthermore, higher wages mean that individuals value their time more highly in other activities. Education has different effects for males and females because usually the raising of children is the responsibility of the wife. Where men share less in child-rearing, male education represents more of a "pure income" effect and is apt to have a positive effect on fertility. For the wife, education is expected to represent mainly a "price" effect, and thus encourage her to enter the labor force or other activities away from home at the expense of more children.

Nonmarket productivity refers to the benefits of education in improving efficiency at home. One of the most prominent factors is increased efficiency and use of family planning methods. More educated people are better able to obtain and evaluate new information. Another significant effect can be on the wife's competence in raising children. With basic knowledge of nutrition and proper childcare she can reduce mortality and morbidity. Because the mother has a large impact on the child in its formative preschool years, the educated mother is more successful in investing in the quality of her children, for example, in health and in education.

The education process has an effect on the tastes and attitudes which are vital to fertility. Students are introduced to a broader and more heterogeneous community. The educational process diffuses knowledge about new ideas and goods, and reduces the traditional value placed upon children.

Education can change fatalistic attitudes and enhance belief in one's own ability to control events. Where social mobility is related to educational achievement, individuals are encouraged to improve themselves by this route. At the same time, they may seek fewer children, in order to increase their consumption, to improve their children's lot, and to further invest in both themselves and their children. Where rising education is associated with more independence for women, it increases the wife's role in decisionmaking and her choice of activities.

Finally, there may be an association of education with fertility, not because of any causal relationship but because of the implied selection process. The fact that some people get more education than others may simply reflect the fact that they are more able and more progressive in all endeavors.

The gross association of fertility with education is strongly negative. This negative association also holds up when it is controlled for some of the other relevant variables. Tables 3 through 6 include some representative data for fertility and female education in four developing countries.

Table 3. Relationship of fertility to female education in San Juan, Puerto Rico standard metropolitan statistical area (children ever born per married woman aged 35-44, 1960 census).

| Labor Force Status of Wife | School Grade Completed | | | | | | | |
|----------------------------|------------------------|-----|-----|-----|------|-----|-----|------------|
| | 0 | 1-4 | 5-6 | 7-8 | 9-11 | 12 | 13+ | All Levels |
| All | 5.8 | 5.6 | 4.5 | 3.5 | 3.0 | 2.4 | 2.3 | 4.1 |
| Economically Active | 4.6 | 4.9 | 4.0 | 3.2 | 2.6 | 1.9 | 2.0 | 3.0 |
| Nonactive | 6.0 | 5.7 | 4.6 | 3.6 | 3.1 | 2.6 | 2.7 | 4.4 |

Source: Carleton (1965), Tables 4 and 5, pp 237-238.

Table 4. Live births to currently married women in Cairo, Egypt (1960 census).

| Marriage Duration (Years) | Illiterate | Barely Reads | Reads and Writes | Did Not Complete Intermediate | Completed Intermediate | Went Beyond Intermediate | Completed College or More | All Levels |
|---------------------------|------------|--------------|------------------|-------------------------------|------------------------|--------------------------|---------------------------|------------|
| 0-4.9 | 1.2 | 1.2 | 1.2 | 1.3 | 1.0 | 1.0 | 1.2 | 1.2 |
| 5-9.9 | 3.4 | 3.6 | 3.4 | 3.2 | 2.8 | 2.6 | 2.5 | 3.3 |
| 10-19.9 | 5.9 | 5.8 | 5.5 | 4.6 | 3.7 | 3.7 | 3.3 | 5.7 |
| 20-29.9 | 8.0 | 7.6 | 6.5 | 5.6 | 4.3 | 3.6 | | 7.6 |
| 30+ | 8.4 | 7.8 | 6.5 | 5.9 | 4.8 | 3.9 | | 8.1 |

Source: Abu-Lughod (1965), Table 1, p 237.

Table 5. Children ever born per ever-married woman in Thailand (1960 census).

| Age of Woman/ Region | Education | | | |
|---|-----------|------------------|--------------------|---------------------------|
| | None | Primary (1-4) | Secondary (1-6) | University (1 or more) |
| Age of Woman | | | | |
| 13-19 | 0.5 | 0.5 | 0.5 | — |
| 20-24 | 1.6 | 1.3 | 1.3 | 0.7 |
| 25-29 | 2.8 | 2.7 | 2.2 | 2.0 |
| 30-34 | 4.0 | 4.1 | 3.7 | 2.8 |
| 35-39 | 5.3 | 5.3 | 4.4 | 2.4 |
| 40-44 | 6.0 | 6.0 | 4.6 | 3.9 |
| 45-49 | 6.0 | 6.0 | 5.2 | — |
| 50+ | 5.7 | 5.2 | 3.4 | — |
| Region, All Women (Age Standardized) | | | | |
| Thailand | 4.4 | 4.1 | 3.3 | 2.3 |
| Bangkok | 3.6 | 3.4 | 3.4 | 1.7 |
| Other urban, nonagricultural | 4.2 | 3.8 | 3.3 | 2.7 |
| Urban, agricultural | 4.5 | 4.4 | 3.6 | 2.0 |
| Rural, nonagricultural | 3.9 | 3.9 | 3.6 | 1.9 |
| Rural, agricultural | 4.0 | 3.8 | 3.4 | — |

Source: Goldstein (1972), Table 9, p 434.

Table 6. Live births per 100 years of marriage in Turkey (1963 sample survey).

| Education | Wife Employed | | Wife Not Employed | |
|-------------|---------------|-------|-------------------|-------|
| | Urban | Rural | Urban | Rural |
| No School | 31 | 31 | 31 | 36 |
| With School | 20 | 32 | 23 | 34 |

Source: Stycos and Weller (1967), Table 3, p 214.

The rather detailed data for Puerto Rico, Egypt and Thailand show that fertility remains virtually constant at the lowest levels of education (up through four years of school or its equivalent), and then begins to fall. There is also some suggestion [in the Thai data, in other tables of Carleton (1965), and in Israeli data of Ben-Porath (1970)] that at lower general levels of education for older women, the shift to lower fertility begins with even lower educational achievement. That is, educational differentials in fertility may be partly indicative of selection of individuals who are more innovative in all respects. Holding constant for marital

status, age or marriage duration, and residence in all four countries tabulated, as well as for labor force activity in Puerto Rico, there is a difference of two to three children between the lowest and highest educational groups.

Cross-country regression studies relying on aggregate data have found a significant negative relation between various measures of fertility and education. [See Janowitz (1971), Heer (1966), Ekanem (1972), Adelman (1963), Heer and Turner (1965), Friedlander and Silver (1967), and Russett (1964).] The measures of education have usually been the percentage of adults illiterate or newspaper circulation per adult. Thus the different channels by which education has acted, and the different effects of male, female, or child education have not been clarified. These studies have in general controlled only for income, mortality, percent in agriculture or cities, and in a few cases, other variables.

Regression studies of individual countries have often employed more data for areas within countries. These studies include Farooq and Tuncer (1972), Gendell, Maraviglia, and Kreitner (1970), Drakatos (1969), Iutaka, Bock, and Varnes (1971), Schultz (1969a, 1969b, 1970, 1973a), Heer and Turner (1965), and Repetto (1972). Where data on female literacy or educational attainment have been available, the coefficient of male educational attainment has vacillated in sign and significance, eg, in the work of Schultz in Colombia (1969b) and Ben-Porath for Arabs in Israel (1970). The weakness of male education can be attributed to the relative balance of the two opposite effects of raising wages by education—the higher income leading to more children and the higher cost of those children because of the income forgone when the husband helps rear them. Because the time cost of children is borne largely by the wife, her educational coefficient is more negative than that of the husband. When only adult education or literacy is included, the stronger education effect for the wife and the positive correlation between education of husband and wife yield a consistently negative sign.

Schultz studied adult education in both Colombia (1969b) and Puerto Rico (1969a) and found strong negative effects. For Colombia the elasticity of "surviving fertility" (a measure similar to the child-woman ratio) with respect to percent of adults with some primary education is -0.08 . In these two studies, as well as in those by Gendell, Maraviglia, and Kreitner (1970) for Guatemala City, Heer and Turner (1965) for Latin American countries, and Ben-Porath (1970) for Arabs, the participation of women in the labor force has been held constant. Thus the adult education variable largely represents the channels to lower fertility via increased use of contraception and changing tastes.

A final group of studies are simultaneously determined models of fertility and other variables. These include Maurer, Ratajczak, and Schultz (1973) for Thailand, DaVanzo (1972) for Chile, Nerlove and Schultz (1970) for Puerto Rico, Harman (1970) for the Philippines, Gregory, Campbell, and Cheng (1972a) across countries, Loebner and Driver (1973) for India, and Rosen and Simmons (1971) for Brazil. When female labor force participation or wages are included in the system as dependent variables, the effect of the exogenous education variable tends to be channeled indirectly through the labor force variables to fertility. The same tendencies are found, however, for the coefficients on child and adult education as in the single-equation regressions cited earlier.

A few of the studies surveyed here have explored some of the paths from education to fertility other than through labor force activity. Education of either husband or wife is associated with more favorable attitudes toward the use of family planning methods. [See Mueller (1972), Mitchell (1972), Schumann, Inkeles, and Smith (1967), Loebner and Driver (1973), and Williamson (1970).] This survey has focused on fertility rather than contraception and thus has glossed over much of the literature on knowledge, attitudes, and practice of family planning (KAP surveys). However, some typical figures on the use of family planning by education are given in Table 7 without holding any other variables constant. The actual effect of family planning on fertility is considered subsequently.

Table 7. Percentage of Latin American legally or consensually married women ever using family planning, by education, 1963-1964.

| Area | None | Some Primary | Complete Primary | Some Secondary | Complete Secondary | Some University | Total |
|--------------------------|------|--------------|------------------|----------------|--------------------|-----------------|-------|
| Large Urban | | | | | | | |
| Buenos Aires | 42.9 | 75.6 | 81.9 | 75.4 | 83.4 | 72.3 | 78.3 |
| Rio de Janeiro | 39.6 | 47.7 | 61.6 | 70.1 | 73.9 | 73.5 | 57.8 |
| Caracas | 35.5 | 53.5 | 70.8 | 76.9 | 66.7 | 77.8 | 60.0 |
| San Jose | 45.4 | 54.2 | 69.8 | 79.0 | 66.7 | 81.0 | 65.6 |
| Bogota | 14.5 | 28.6 | 40.1 | 59.1 | 74.5 | 73.9 | 39.8 |
| Mexico | 12.4 | 28.7 | 86.2 | 57.6 | 65.4 | 59.7 | 43.2 |
| Rural-Small Urban | | | | | | | |
| Chile: Cauquenes | 3.2 | 5.6 | 20.0 | 30.6 | | | 10.0 |
| Chile: Mostazal | 25.0 | 30.2 | 48.1 | 48.0 | | | 33.3 |
| Colombia: Cartagena | 8.3 | 10.7 | 20.0 | 33.3 | | | 11.5 |
| Colombia: Neira | | 12.9 | 20.0 | 47.6 | | | 17.5 |
| Mexico: Pabellon | 2.4 | 3.9 | 25.0 | | | | 5.0 |

Source: Miro and Mertens (1968), Table 11, p 114.

In addition, some evidence suggests that education plays a part in structuring the decisionmaking of husband and wife and the wife's idea of her role. Oppong (1970) found in Ghana that as the wife's education rose relative to the husband's; their decisionmaking was more shared rather than dominated by either partner. Weller (1968a) found no such effect in Puerto Rico. The Rosen and Simmons study for Brazil (1971) set out a structure where a wife's education increased the strength of her role in the family, which in turn decreased her ideal family size and actual family size.

Research is only beginning on the effects of parental education on efficiency in the home. Results by Leibowitz (1974) for the United States show that parental education (especially that of the mother) and home instruction given by parents to their preschool children are crucial in raising children's IQ scores. This result should be more powerful in developing nations as educated parents become skilled at investing in proper nutrition at critical stages of child development. [See Selowsky (1971), Berg (1973), and Berg, Scrimshaw, and Call (1973).]

Child education has received less attention than female or adult education. Schultz (1969b) found the expected negative sign in his study of Colombia where the elasticity of surviving children with respect to the percentage of children in school is -0.05 . The strong damping effect of child education on fertility is supported by the time series results of Wat and Hodge (1972) for Hong Kong. Contrary evidence of Schultz (1970) for Jordan and that of Repetto (1972) for Morocco seems to be due to inadequate data. It must be remembered, of course, that the education of children has not only current effects on their parents' behavior, but also lagged effects on fertility. As children grow up and start their own families, they can be expected to follow a pattern of lower fertility than their uneducated peers.

In summary, education appears to be one of the most powerful and pervasive factors of development which affect fertility. The impact is largest and best documented in the case of women who find that higher education opens opportunities to them. They thus can participate in activities which are not centered on the home or childrearing and undertake new economic and social responsibilities.

FEMALE AND CHILD LABOR FORCE ACTIVITY AND WAGES

Labor force participation by women not only influences fertility but is directly affected by it. Fecund women may attempt to limit their childbearing in order to work and earn away from home. Subfecund women may tend to engage in outside activity because they have fewer home responsibilities. Women with large numbers of children may feel economic pressure to work. For older women with many children, it may be easier to work when older children can care for the younger ones.

The negative effect of labor force activity on fertility varies with economic development. In traditional societies where production is oriented to the home, women can work (either paid or unpaid) in agriculture and cottage industries without leaving the home. In such a situation childbearing or childcare can be undertaken with minimum increased effort, and women have less reason to reduce fertility. Work outside the home, however, conflicts directly with childrearing activities, particularly when children are too young to attend school. Thus a woman may be forced to drop out of the labor market for 5 to 10 years or more. She not only loses the wages she would have earned, but also may have more difficulty in reentering the labor force later because of lost skills. As the economy develops and labor force opportunities arise outside the home, women sacrifice more and more earnings by choosing to stay at home.

The data support the distinction between work at home and away from home. For example, Table 3, page 18, shows that Puerto Rican married women economically active outside the home average 1.4 fewer children than nonactive women. The data in Table 8 illustrate the differential between working and nonworking Thai women. In urban areas, where female employment is largely nonagricultural, women in the labor force have fewer births. Furthermore, occupational differences in fertility are considerable, reflecting differing amounts of conflict with the maternal role. Table 9 shows that in Thailand fertility is highest for women working on farms or as salesworkers. These occupations require little training, pay low wages, are usually carried out at or near the home and, in addition,

Table 8. Children ever born to ever-married women in Thailand, by labor force status, 1960.

| Area | Percent of Female Labor Force Working in Agriculture | All Women (Age Standardized) | |
|------------------------------|--|------------------------------|-----------|
| | | In Labor Force | Housewife |
| Thailand | 87 | 4.4 | 4.0 |
| Bangkok | 2 | 3.3 | 3.7 |
| Other urban, nonagricultural | 7 | 3.8 | 3.9 |
| Urban, agricultural | 65 | 4.0 | 4.1 |
| Rural, nonagricultural | 43 | 4.0 | 4.2 |
| Rural, agricultural | 97 | 4.5 | 4.3 |

Source: Goldstein (1972), Table 3, p 424; Table 4, p 426.

Table 9. Children ever born to ever-married working women in Thailand by occupation, 1960 (age standardized).

| Area | Farm | Crafts | Professional | Service | Sales |
|------------------------------|------|--------|--------------|---------|-------|
| Thailand | 4.5 | 3.6 | 3.5 | 3.6 | 3.9 |
| Bangkok | 2.7 | 2.8 | 2.4 | 2.9 | 3.7 |
| Other urban, nonagricultural | 4.0 | 3.1 | 3.1 | 3.8 | 4.0 |
| Urban, agricultural | 4.1 | 2.2 | 2.2 | 3.3 | 4.1 |
| Rural, nonagricultural | 4.1 | 3.9 | 3.4 | 4.1 | 3.9 |
| Rural, agricultural | 4.5 | 3.6 | 3.9 | 3.7 | 3.8 |

Source: Goldstein (1972), Table 5, p 429.

children can become useful at a very early age. Jaffe and Azumi (1960) reported similar findings for both Japan and Puerto Rico where women of comparable age, education, marital status and residence in the nonagricultural work force average 0.5 to 1.0 fewer children than women in traditional sectors or women who do not work. Stycos (1965) found that women who are not employed or are employed in service occupations have the highest registered birth rates in Lima, Peru.

The multiple regression results show the same effect of paid, nonagricultural female labor force participation on fertility. The coefficient on labor force participation is consistently negative and significant. [See, for example, Heer and Turner (1965), Gendell, Maraviglia, and Kreitner (1970), Schultz (1969a, 1969b, 1970), Wat and Hodge (1972), Repetto (1972), and Kleinman (1973).] Education tends to have a stronger negative effect than labor force participation but both are significantly negative. Schultz's (1969b) estimate of the elasticity of fertility with respect to the female labor force participation rate is -0.04 , half

of that with respect to education. Gendell, Maraviglia, and Kreitner (1970) found that women employed as domestic servants have even lower fertility than other working women in Guatemala City. They suggest that as development proceeds and women shift from domestic service to other occupations family size may in fact increase if there is not a large increase in the overall labor force participation rate. The validity of this hypothesis awaits testing by more refined occupational data.

The simultaneous-equation results bear out the single-equation coefficients, although there is some fluctuation in the coefficients. Since labor force activity is the variable for which the strongest case can be made for simultaneous determination, these results merit close examination in order to evaluate any policy proposals for changing fertility. In particular, they are useful in separating out the channels from economic activity to fertility (via wages) and from fertility to economic activity (via fecundity or via economic pressure on large families), and the possibly most important double channel from education to both fertility and economic activity.

Two studies have noted that labor force activity by women increases their influence in the household and their role as decisionmakers. Oppong (1970) found in Ghana that when women contribute significantly to family income there is less male domination of decisions. Rosen and Simmons (1971) likewise found in Brazil that female participation in the labor force strengthens their role attitudes, which in turn lowers fertility. Roles would seem to be another case where the investigation of simultaneous feedbacks is important. Not only do more women with a more modern role attitude work, but also the fact of working, their exposure to the market economy, and their contributions to the household can change their role at home.

Some other indirect channels of labor force activity, such as possibly higher child mortality or morbidity when the mother works, have not been investigated in the literature.

The effect of children's labor force participation on fertility is positive in all studies [Kasarda (1971), Maurer, Ratajczak, and Schultz (1973), DaVanzo (1972), Harman (1970), and Schultz (1970)]. Where children are economically productive, parents choose higher fertility. And where parents choose to have higher numbers of children rather than higher quality children, children receive less education and are sent to work at an earlier age. The evidence with respect to all unpaid family workers is less clear, with both positive and negative coefficients appearing. One would expect a positive sign since unpaid family workers are children and women who work around the home. However, labor force data on unpaid workers seem to be very poor, whether in aggregate statistics or in sample surveys.

In summary, the negative association of fertility with female economic activity outside the home is well established. Labor force participation is closely related to women's education which trains women for nontraditional occupations. The opening up of new opportunities with education means an increase in the real cost of children as women must forgo larger potential earnings in order to concentrate on childrearing.

MIGRATION, URBANIZATION, AND INDUSTRIALIZATION

Variables for urbanization, industrialization, and rural-to-urban migration have been used as measures for a whole host of changes that take place during economic development. They are associated with the value of children and women as income-producers, cost of living, availability of goods, availability of information, income, and so on.

Where detailed statistics have been hard to obtain, the percentage of the labor force employed in agriculture has been used, generally in regressions. The coefficients tend to be positive, and are significant in studies by Adelman (1963), Ekanem (1972), Friedlander and Silver (1967) across countries, and by Drakatos (1969) for Greece. Some of the other studies [eg, Schultz (1970, 1973a), Ben-Porath (1970), Weintraub (1962), Janowitz (1972), and Heer and Turner (1965)] have produced insignificant and even negative coefficients.

There has also been an attempt to break down the modernization process into two components. Urbanization is the first and represents the move from rural areas to more concentrated ones. The second component, industrialization, is conceptually distinct and represents the shift in the labor force from traditional subsistence activity to more complicated industrial structures. Tables 5, 8, and 9 (for Thailand) and Table 6 (for Turkey) have incidentally shown urban-rural differentials in fertility even when age, education and labor force activity are held constant. (See page 19 and page 23 above.) Regression results have not confirmed these urban-rural differentials. The negative coefficient on the urbanization variables has not been significant except in the study by Heer and Turner (1965). Population density has been used as an alternate variable to mirror the effect of more crowding and higher prices in the cities. The interpretation by Friedlander and Silver (1967) that the positive coefficient on their housing adequacy variables reflects the easier use of contraceptives in homes with interior plumbing and few persons per room deserves more careful testing. Estimated coefficients are all negative but only in cross-country studies by Adelman (1963) and Heer (1966) are they significant. With respect to industrialization Zarate (1967a) found no significant relation between fertility and proportion of workers in the secondary sector in urban areas. Rosen and Simmons (1971) showed that in Brazil fertility is lower in industrial cities than in nonindustrial ones, but no variables other than male occupational status are held constant.

The process of migration away from nonindustrial rural areas has been explicitly examined in a few of the studies reviewed for this paper. One of the crucial questions is the degree to which migrants adapt to their new environment. Most of the studies compare the fertility of immigrants and natives within urban areas, but do not compare the migrants with those left behind in rural areas. Nor do any studies treat the interesting question of whether there is a critical age by which social patterns are set and after which migration has little impact on behavior.

Short-term male migration to take a job and then return reduces fertility in Indian villages by about 0.5 children, holding class and marriage duration constant. [Rele (1963, page 193)]. For permanent rural-urban migration Iutaka, Bock, and Varnes (1971) found in multiple regression that men who had migrated

to the cities had higher fertility than those who had always lived there. In addition, among migrants, those who came to urban areas before age 19 had lower fertility than those who arrived at older ages. Schultz (1969b) also found higher fertility associated with the presence of migrants. The data for Puerto Rico, however, show just the opposite. Holding labor force participation constant, except for women above age 35 Macisco et al (1969, 1970) showed that wives of recent migrants to San Juan had lower fertility, a result similar to that of Myers and Morris (1966). Part of the explanation may be that migration temporarily disrupts the family and inhibits childbearing. Or it may be that the men had married after coming to the city and thus had less time to establish a family. Finally, the Puerto Rican situation must be examined more carefully because the cities are not always the ultimate destination of migrants, but often a way station to the United States. Thus the "nonmigrants" are not representative of the whole urban population, but are those who choose not to move to the United States. Goldstein (1973) found a result similar to the Puerto Rican ones for recent migrants in Thailand. However, when comparing urban natives with others who had migrated to the city at any time during their lives, he found no fertility differences. He suggested several possible reasons—the more innovative character of recent migration, selection of people with low fertility as migrants, and family disruption—but these cannot be tested without more detailed data.

Inter-country migration has been considered by Nag (1971) and Ben-Porath (1970, 1973a, 1973c). Permanent out-migration of males has helped reduce fertility in Barbados by lowering the sex ratio and thus the availability of marriage partners [Nag (1971)]. From the point of view of the recipient country, Ben-Porath has documented the higher fertility of migrants to Israel compared to natives. Among women of Asian and African origins, the excess fertility was lower for women who migrated at earlier ages. For women migrating to Israel from Western countries, excess fertility was lower for those migrating at older ages, possibly because many of these women were affected by the disruptions of World War II.

The overall evidence for the effects of urbanization, industrialization, and migration on fertility is weak and sometimes contradictory. The separate effects have not yet been isolated from each other or from other important variables that change with development. It appears that research emphasis should shift from the aggregates of urbanization or industrialization to describing and explaining the decisions of individual households to move and the effects of those decisions on fertility.

CHILDHOOD MORTALITY

With the falling mortality that accompanies development, fewer births are needed to achieve any given desired family size. Because of declining mortality rates fewer resources are spent on children who die so the cost per surviving child is lowered. Thus, parents may increase family size, increase the investment in each child for higher quality, or both. It is even possible for desired family

size to increase sufficiently for more births to occur than before the fall in mortality.* Family size, by affecting the amount of resources available for each child, also influences mortality. In essence parents face a quality-quantity trade off. Lower child mortality is one aspect of higher quality.

The biological mechanism of lactation tends to associate higher mortality with higher fertility. Death of an infant, by terminating lactation, exposes the mother to the risk of pregnancy sooner than otherwise. This is, in effect, analogous to an increase in fecundity (discussed in the next subsection).

Although it is possible for lower mortality to raise fertility, the evidence shows the opposite. Table 10 shows the strong positive association between the number of births and child mortality for Jordan and Israel. In addition, Hassan (1966, 1967) found strong positive regression coefficients for child mortality in Egypt. In studies across countries by Heer (1966) and Weintraub (1962) the infant mortality rate had a positive coefficient in explaining births and, in fact, was the only variable which was significant in multiple regressions. In the simultaneous equation study by Gregory, Campbell, and Cheng (1972a) the birth rate had a reduced form elasticity with respect to infant mortality of 0.18, second only to literacy (0.28).

Table 10. Child deaths in Jordan and Israel by number of children ever born, 1961.

| Number of Children Ever Born | Percentage of Dead Children in Jordan by Mother's Age | | | | Percentage of Non-Jewish Children in Israel Dying before Age 5 for Mothers of All Ages | | |
|------------------------------|---|------------|------------|------------------|--|-------|-----------|
| | Ages 20-29 | Ages 30-39 | Ages 40-49 | All Ages Over 13 | Moslem | Druse | Christian |
| 1 | 7 | 10 | 11 | 9 | 6 | 4 | 5 |
| 2 | 12 | 15 | 18 | 15 | 9 | 5 | 3 |
| 3 | 15 | 16 | 24 | 19 | 10 | 16 | 4 |
| 4 | 18 | 19 | 22 | 22 | 13 | 11 | 8 |
| 5 | 22 | 21 | 27 | 26 | 14 | 14 | 9 |
| 6 | 25 | 22 | 28 | 28 | 18 | 19 | 12 |
| 7 | 29 | 24 | 29 | 30 | 19 | 22 | 16 |
| 8 | 32 | 26 | 31 | 33 | 20 | 25 | 17 |
| 9 | 35 | 28 | 30 | 35 | } 29 | 25 | 25 |
| 10 | 39 | 45 | 33 | 38 | | | |
| 11+ | 49 | 31 | 32 | 37 | | | |
| All Children | 19 | 27 | 30 | 31 | 21 | 21 | 16 |

Source: Schultz (1970), Table 9-7, p 420; Table 9-10, p 423.

* The exact condition for births to rise when quality is held constant is that the price elasticity of demand for children exceed unity. The result of falling mortality on the overall growth rate of population depends not only on whether parents reduce fertility but on the strength of this response. O'Hara (1972b) has shown that unless there is substitution of quality for quantity, the population growth rate must rise.

In the absence of reliable data for childhood mortality several studies have used overall mortality rates or life expectations instead. These variables reflect not only infant and childhood deaths but also adult mortality. If a fall in mortality significantly increases the number of couples who complete their reproductive years, family size will rise if not controlled by contraception. In fact, the sign and magnitude of the coefficients on overall mortality are similar to those for infant mortality. These results suggest either that adults in developing nations already have high survival rates through their reproductive years or that family limitation prevents a rise in fertility. [See Janowitz (1971), DaVanzo (1972), Schultz (1969a), and Nerlove and Schultz (1970).]

There is some evidence on the mechanisms by which parents adjust to infant mortality. Harman (1970) for the Philippines, Schultz and DaVanzo (1970) for East Pakistan, and Schultz (1973a) for Taiwan found in explaining age-specific birth rates that the older women (in the late thirties) have the strongest response to infant deaths. This suggests that parents try to replace children who die rather than to anticipate future deaths with extra births. In the Philippines and Pakistan strong coefficients for the fertility of the youngest age groups as a function of infant mortality may be due to the young wives' eagerness to produce offspring and gain status.

Harman tested infant versus total reproductive mortality (including fetal, childhood and young adult losses). He found the stronger response for infant losses. It may be more difficult either biologically or emotionally for parents to replace older children than infants. Friedlander and Silver (1967) found that infant mortality fluctuated in sign, but that childhood mortality (up to age 14) had a strong positive effect on fertility.

Harman also found that individual families had a positive and strong response to the infant mortality rate of their community of residence. Thus their expectations and consequent reproductive behavior were shaped not only by their own experience but also by the experiences of others in the same environment. The data for Puerto Rico [Nerlove and Schultz (1970) and Schultz (1969a)] suggest that the lag in adjustment to changing mortality is not long. They found the strongest results when fertility was regressed on death rates of the preceding one to four years. Frederiksen (1969) also used lagged death rates to explain fertility in a highly simplified model of population growth. His results were an improvement over naive projections but represented an extremely simplified function with no attempt to specify the relationship of fertility to other variables.

In summary, the response of births to child mortality is strongly positive; ie, families appear to adjust their fertility behavior quickly to changing mortality situations through the replacement mechanism.

FECUNDITY AND FAMILY PLANNING

Control of fertility depends on both fecundity and family planning. These two factors with mortality determine the ease of attaining desired family size. They also affect the family size goal. For example, a woman who wants a large family may modify her goal if she is prone to miscarriages and must incur larger medical expenses and substantial periods of ill health in order to have more than

one or two children. Couples who want small families may have extra children where effective contraception is unknown, rather than sacrifice sexual pleasure by methods such as abstinence. The following discusses fecundity and family planning in turn.

Fecundity

The general rise in the level of health may be very important in raising fertility at the initiation of economic development when populations are first provided with minimal health care facilities. Not only are couples in the childbearing ages more likely to complete the reproductive period, but they will also have a faster rate of childbearing.

Very few studies have related fertility to fecundity. Heer (1967) studied the hypothesis that fecundity is lower at high altitudes. His study found a significant negative relation between altitude and the child-woman ratio in Ecuador but not in Bolivia or Peru. There is some scientific evidence of reduced fecundity at higher altitudes. Heer, however, did not control for the distribution of medical care or income levels which could produce the same correlation. Friedlander and Silver (1967) found no strong evidence for another biological hypothesis: that fecundity falls as the percentage of animal protein in the diet rises.

Perhaps the most detailed studies are those by Henin (1968, 1969) for the Sudan. He compared women in nomadic tribes with women in tribes which had recently settled down to agricultural pursuits. With retrospective surveys he found that the settlement led to large increases in fertility, by up to two children in those tribes which had been settled longest. He discusses only generally the basic reasons for the change—rising income, higher value of children in a settled environment, less difficulty for women in bearing children than when they are nomadic. As for the immediate cause, he found that changes in marital structure explained less than 50 percent of the rise. The rest he attributed to health improvements which he detailed with scattered statistics. He found that nomadic women had twice the incidence of miscarriage of settled women. Venereal disease and malaria affected at least 20 and 88 percent, respectively, of the adult nomads and were associated with fecundity impairments. The percentage of childless women was almost twice as high for nomads as for the longest settled tribe. Furthermore, it was only when tribes settled in one spot that they had access to regular health care, adequate sanitation, and regular food supplies. Barlow (1967) mentions a similar initial rise in fertility in Ceylon after the eradication of malaria.

A final factor that may operate to increase fecundity is lactation. Jain et al. (1970) found for IUD acceptors in Taiwan that higher education and urban residence were significantly associated with a reduction in breast feeding by mother. The extent of the increased fertility due to reduced lactation is not clear, although historical studies such as Wrigley (1966) and Knodel and Van de Walle (1967) suggest that lactation is an important factor delaying conception.

Family Planning

The use of family planning methods helps parents control fertility. The spread of more effective contraceptives or availability of abortion makes it easier

for them to exercise this control. Yet it must be noted that the transition to lower fertility took place in many industrialized countries even before modern mechanical contraceptives were available. Thus, the crucial element in reducing fertility is changing the family size goal. Provision of contraceptives can assist, but not substitute for, this all-important element. Furthermore, it is possible that contraceptive use will increase without any effect on family size. As couples become aware of the reliability of modern contraception they may use it simply to space children in a better way without changing the total number of children.

While this survey has not made an extensive study of family planning programs, some evidence has been accumulated. Schultz (1973a) found that in Taiwan government provision of family planning and health workers was associated with lower overall fertility. There was also some indication of higher fertility for women aged 15 to 24, suggesting that when reliable contraception was made available women chose to space children closer together without fear of errors in later years. Schultz also found that the impact of the family planning programs fell off over time. Reynolds (1973) for Costa Rica and Wat and Hodge (1972) for Hong Kong show that family planning programs, while helping to meet increased demand for smaller families, had little or no independent effect in creating that demand. These results support the contention by Raulet (1970) that family planning programs have only a once and for all effect in informing people about methods of control. Adoption of the methods can enable them to avoid excess fertility but do little to reduce their desired family size in the absence of important economic and social changes. Hickman (1972) has also expressed concern about this issue.

Studies by Rele (1963) and Harman (1970) showed positive association between individual use of family planning and fertility. This result need not imply that family planners have more children, but may simply indicate that the first adopters of family planning are women who have been excessively fertile in the past because of higher fecundity or other reasons.

Western studies have shown that effectiveness in the use of family planning methods increases as a couple approaches or exceeds their desired family size. This conclusion should also hold in developing nations, although no supportive evidence has been found in this survey.

The influence of health improvements on fecundity and family planning is probably unimportant for most nations today, though it may loom large for countries at very low development levels. Family planning programs are important in allowing people to limit their family size. But they do not have much impact on desired family size, which is still high in most areas. Thus they are not a panacea for population problems.

MARRIAGE AND FAMILY STRUCTURE

The organization of households has important effects on fertility. Most of the fertility throughout the world occurs within marriage, either legal or consensual. Since one of the reasons people marry is to have children and since marriage brings exposure to pregnancy, marriage is associated with higher fertility. Because marriage is determined together with such variables as desired fertility

and labor force activity, it is responsive to many of the same factors which affect them. A full explanation of fertility must explain marriage also as part of this simultaneous system.

The marriage variable is tied in with the whole question of household structure. The type, stability, and prevalence of marriage have important implications for fertility. Consensual marriages, which are prevalent in Latin America, are associated with transitory arrangements and more family instability. Women tend to maintain closer ties to the labor market in order to reduce their dependence on their husbands. Without the long-term commitment of legal marriage with support for themselves and their children, women may try to hold down fertility and maintain more independence than in traditional legal marriages. The prevalence of consensual versus legal marriages tends to change over the life cycle. Young adults may enter several temporary unions as a form of trial marriage before settling down to raise a family in a permanent legal marriage. Marriage stability is also affected by customs and laws concerning divorce. Where divorce is easily obtained average marriage duration falls, with a negative impact on fertility. The proportion of adults married rises, however. People marry earlier and more frequently and search less for the optimal partner, knowing that they can change partners later.

Polygamy, which is prevalent in Moslem countries, is another form of marriage affecting fertility. It tends to increase the proportion of women married and thus boosts average fertility. It can lower the number of children born per married woman if there is less exposure to pregnancy (due, for instance, to more frequent visits of the wife to her parents or lower coital frequency). Thus the total effect of polygamy on average fertility of women (married and unmarried) is of ambiguous sign. The prevalence of marriage is also substantially affected by the ratio of men to women in adult ages. Differential migration patterns of men and women usually connected with employment opportunities, alter the sex ratio and thus marriage and fertility.

Finally, the structure of the household, apart from the individual couple, should affect fertility. Extended families are thought to encourage high fertility by reducing the costs to the couple of an extra child, by providing housing and other resources so that couples can marry earlier, and by delaying response to changing conditions because of the influence of older generations in the family.

The evidence reviewed here concerns first marriage and then family structure.

Marriage

When marriage (or the ratio of males to females, a proxy for marriage) is entered as an explanatory variable in fertility equations, it has a strong positive effect. The impact tends to be larger for women in the early years of marriage. It tapers off in later years when couples begin to limit their fertility. Between legal and consensual marriages, the regression results have clearly shown lower fertility for consensual marriages, as expected, when other factors are held constant. [See DaVanzo (1972), Kogut (1972), and Nerlove and Schultz (1970).] DaVanzo finds an elasticity of 0.75 for the response of the birth rate of women 45-49 with respect to legal marriage, compared with a 0.12 elasticity with respect

to consensual marriage. Miro and Mertens (1968) and Myers and Morris (1966) found higher fertility in consensual marriages in some Latin American countries, but failed to hold constant factors like age, labor force activity, or education. Unstable marriages may reduce fertility through less exposure to pregnancy. Van de Walle (1965) cites evidence from Africa that once-married women have almost 30 percent higher fertility than women married five or more times. Van de Walle is also the sole source of evidence on polygynous marriages. Fertility of African women in polygynous unions is lower at all ages than that of women in monogamous unions. He attributes this to men with infertile first wives seeking second wives in order to have children. Because fertility determines marital status, rather than vice versa, the most fecund women have monogamous marriages. Goldschmidt (1973) makes the point that where first wives are fertile, second and later wives are acquired in order to display wealth more than to produce large families. Even though the fertility of married women is clearly lower in a polygynous situation, the data are insufficient to determine whether average fertility of all women is higher or lower than in a nonpolygynous situation.

Family Structure

Studies of fertility in relation to family structure have been rather inconclusive. The gross data, such as that for India in Table 11, show lower fertility, if anything, in joint families. A study by Nag (1967) found uniformly lower coital frequency for all ages and castes in joint families and suggested it was due to lack of privacy and stronger pressures for traditional behavior. Rele (1963) and Palmore (1972) suggest that couples with high fertility who live in joint families may be forced out of them because of conflicts and limited resources within the household. The data for West Malaysia in Table 12 show that past as well as current residence is an important determinant of fertility. Those who previously lived in extended families have the highest fertility.

Table 11. Children ever born to women in Bengal India by family type and caste, 1960-61 (age standardized).

| Caste | Simple Family | Joint Family |
|---|---------------|--------------|
| Hindu Brahmin | 4.3 | 3.9 |
| Hindu Satchasi and Ghose | 4.0 | 4.0 |
| Other Hindu | 3.3 | 3.3 |
| Sheikh Muslim | 4.7 | 4.5 |
| Non-Sheikh Muslim | 3.0 | 2.8 |
| Muslim Fishermen | 2.3 | 2.4 |
| Source: Pakrasi and Malaker (1967), Table 1, p 455. | | |

Table 12. Children ever born to women in West Malaysia by family type and age (standardized for residence, age at first marriage, times married, female education, and race).

| Age of Wife | Now In Extended Family | Formerly in Extended Family | Never in Extended Family |
|-------------|------------------------|-----------------------------|--------------------------|
| All, 15-44 | 3.2 | 4.7 | 4.2 |
| 15-24 | 1.6 | 2.2 | 1.9 |
| 25-34 | 3.9 | 4.9 | 4.3 |
| 35-44 | 5.6 | 6.4 | 5.6 |

Source: Palmore (1972), Table 26.

There is scattered evidence for other mechanisms by which family structure affects fertility. Harman (1970) found that in the Philippines residence in a joint family was associated with delayed rather than earlier marriage. Presumably joint family residence was due to lack of means to set up an independent household as well as the postponement of marriage. Palmore (1972) cites evidence from Korea that couples in extended families are less receptive to the use of birth control, particularly induced abortion. Van den Ban (1967) cited a comparison of extended and nuclear farm families in Brazil showing that they did not differ with respect to adoption of new farm practices. He cited similar results for some Western countries showing that the presence of elders in the household did not inhibit innovation or modern attitudes. As Burch and Gendell (1970) have pointed out, a more detailed investigation is needed of the exact mechanisms by which family structure and fertility interact.

In summary, marriage is a very powerful variable influencing fertility. There is some, but as yet very limited, evidence on different forms of marriage. The work on family structure has so far been inconclusive and lacks adequate distinction among different types of extended family situations.

ATTITUDES, ROLES, SON PREFERENCE, TASTES, INSTITUTIONS

This subsection presents evidence on a number of speculative topics about which few facts have emerged.

Attitudes and Roles

Perhaps the most important is the effect of attitudes and roles on fertility. Williamson (1970) found evidence in Nigeria, Chile, East Pakistan, India and Israel for more favorable attitudes to birth control where subjective efficacy (belief in one's ability to influence events) was high. Friedlander and Silver (1967) found that an index of achievement motivation was negatively related to the birth rate. Studies by Weller (1968a), Mitchell (1972), and Rosen and

Simmons (1971) attempted to measure not just general modern attitudes, but the specific roles of husband and wife. Weller found for Puerto Rican working women a negative relation between children ever born and the strength of the wife's role in decisionmaking. When he controlled for marriage duration, however, the relationship evaporated, suggesting perhaps that the decisionmaking variable was just a proxy for cohort, with older wives being less active in decisions and having higher fertility. Rosen and Simmons in Brazil found that fertility fell along with ideal family size as families adopted modern views of the role of woman in society and egalitarian decisionmaking. Mitchell found that when couples asserted they wanted no more children, the use of family planning methods was greater by couples who had either better husband-wife communications or more delegation of authority to the wife. In addition, where partners disagreed about whether to have more children, the husband's view was more important for the use of birth control. His findings are similar to those cited by Michel (1967) for Puerto Rico.

While some evidence exists on the importance of attitudes and roles for fertility, only Rosen and Simmons did a multivariate study. More work is needed where the other determinants of fertility are held constant.

Son Preference

Most families in developing countries want children, either sons or daughters, to provide for them in their old age. In some countries, however, women as yet are not very active in market activities (for example, Middle Eastern countries), and in others sons are indispensable for religious reasons (such as India, where the population is largely Hindu). It is in these countries that some authors have tried to test the effect of the ratio of male to female children on fertility. Repetto (1972) has found no relation between children ever born and the sex ratio of the first three children (or of all children) in India, but an unexpected and puzzling positive correlation in Morocco and East Pakistan. He tentatively concluded that families with an unusually high proportion of sons have higher incomes and thus do not feel the economic pressures of large families as soon as families with many daughters.

The work of Ben-Porath (1973b) and Ben-Porath and Welch (1972) examined the propensity to have another child, or the interval to another child, holding parity constant, for East Pakistani women and some Israeli women of Asian and African origin. They found that families with balanced sex ratios tend to have fewer children or longer intervals to the next child than families with large proportions of either boys or girls. They also found some evidence that families with a predominance of daughters tried to have more sons, particularly at the lower parities.

Schultz and DaVanzo (1970) found in Pakistan that the positive response of fertility to infant mortality was stronger on the death of a son than for the death of a daughter. Chandrasekhar (1972) reported that female infant mortality is 205 per thousand in the Indian Khanna study and 170 for males, the opposite of mortality experience in most industrialized nations.

Tastes and Institutions

Religious differentials have been explicitly analyzed in some studies. Gregory, Campbell, and Cheng (1972a) and Russett et al (1964) found that the Catholic variable had a small and insignificant coefficient, contrary to expectations. Friedlander and Silver (1967) had the same result, along with a positive but insignificant sign for the dominance of non-Western religions. Day (1967, 1968) argued that the Catholic religion promotes fertility only in highly developed countries and only for political reasons, ie, where Catholics see themselves as an important but not dominant part of the population. The institution of the Catholic Church has been important in determining the availability of family planning services and abortion, which affects control over family size rather than desired family size itself. The Moslem religion has also been associated with higher fertility, but the evidence is inconclusive. [See Kirk (1966) for a general discussion, Table 11 and Loebner and Driver (1973) for India, Yaukey (1963) for Lebanon, and Hassan (1967) for Egypt.]

Tastes for consumer goods have been analyzed by Freedman (1972), who found that couples who had successfully planned their families differed significantly from others. They were more modern in their economic behavior and had more saving and consumer durables, even when other variables were controlled. Friedlander and Silver (1967) found that radio ownership and contacts with other countries (measured by foreign mail) were associated with reduced fertility but were not significant. Friedlander and Silver have also done the most extensive analysis of institutions. The extent of a social security system and the number of years of compulsory education were negatively related to fertility as expected, but the results were not strong. The existence of a communist political system was negative and sometimes significantly associated with fertility. This result may indicate that communist provision of social security, female education and employment opportunities, and birth control information outweigh pronatalist policies like free education and childcare. Further work appears to be needed on these and other institutional questions, especially in individual countries where institutions change only slowly over time. The hypothesis of Ohlin (1961) that forms of inheritance affect fertility has not yet received any empirical treatment.

SECTION 4

CONCLUSIONS

This section reviews the state of knowledge about the determinants of fertility. It points out the strengths and weaknesses in the empirical work and, finally, looks beyond the present work to outline some possible uses and lines of future research.

STATE OF KNOWLEDGE

This brief review of the literature has pointed to the association of several factors with declining fertility. Table 13 (see pages 38 and 39) summarizes the results found for developing nations in the order that they are considered in Section 3. The results tabulated represent partial effects, that is, the effect of a given variable when all other variables are controlled.

It is possible for some of the variables to give some numerical estimate of the effect. Precise numbers are not presented here, however, for several reasons. First, because of the availability of data, different studies have used different indicators to measure the same basic variable. Thus it is difficult, for example, to express coefficients of female education on a comparable basis when the indicators have variously been mean education, median education, percent literate, percent ever attending school, or percent with a certain number of years of school completed. Even if the same indicator were used in all studies, it might not measure the same thing. Educational attainment must be adjusted for the quality of the schooling. It is sometimes easy to take account of differing lengths of the school year (as between farm and nonfarm communities). But it is very difficult to measure the quality of the teaching (highly variable even within a single developing nation) or the type of education. Traditional education by rote may have a very different impact on the development process from education which stresses independent reasoning by students. Finally, specific numbers are not given because the range of many coefficients is very wide across different countries. Since policy decisions are taken within a single country, what is relevant for the policymaker is study of the particular magnitude for that country. Table 13 suggests the broad range of the results and thus points to the variables which should be investigated first in any specific setting.

Ranking the Independent Variables

In assessing the importance of different variables for fertility, at least three possible rankings must be considered. The first ranking would be to look first for the variable which explains the most variance, then hold it constant and look for the second, and so on. This is the approach frequently taken when one or

two-dimensional tables are prepared to describe fertility. It can be very misleading, however, where two independent variables are related, such as is the case with education and income. In the stepwise procedure described above, income may enter before education because higher education is associated with higher incomes and lower fertility. But when both are entered together, income has very little effect compared to that of education. To fully characterize the determinants of fertility one must rank them when all are considered together rather than one after another in turn.

The second type of ranking therefore examines which factors have the great impacts when all the others are held constant. This is a simple question of, for example, evaluating the response elasticities for each variable. In such a ranking marriage would be the most powerful factor followed in order by female education, female labor force participation, and child mortality. Urbanization, agricultural activity, education or productive activity of children, income, tastes, and institutional factors have small influences which have not yet been adequately documented or distinguished from the major factors.

From the point of view of the policymaker this second type of ranking, though useful, is not enough. It is necessary to know not only which variables are the most important determinants of fertility, but also which are most easily changed during the development process. Marriage has perhaps the most powerful influence on fertility, yet it presents very few opportunities to planners to bring about fertility changes. Child mortality is another important variable since parents adjust their fertility to achieve their family size goals. Yet development strategists have little scope for using mortality as a tool to affect fertility.

In a third ranking which measures the factors most susceptible to conscious change, the most powerful are clearly those relating to family planning activities and the general status of women. Family planning programs seem to be very important as enabling forces for a fertility decline, but as yet have not been shown to have any independent effect in the reduction of family size goals. The opportunities of women, however, as reflected in their education and labor force behavior, have been critical in the adoption of Western family size norms. The effects of education have been documented most precisely through the channel to labor force participation and higher wages. Education also facilitates use of contraception, helps families invest in higher quality children, fosters greater opportunities for women in other nonworking roles, and has an as yet unquantified impact on tastes.

The other variables are considerably weaker in magnitude, in significance, and in potential for intervention. Variables to measure urbanization have not stood up well when the major factors are held constant. The extent of agriculture is sometimes, but not always, positively related to fertility. A more precise variable seems to be the education or labor force activity of children, which measures the productive value of children in both agricultural and industrial settings. Children's education and work is generally of strong concern to policymakers in developing nations. Income generally has a small coefficient of indeterminate sign in explaining fertility, suggesting that the shift to higher quality children may be an important part of the development process. The scanty evidence on institutional and taste factors suggests predictable influences, but ones which must be studied in the specific environment which surrounds decisionmaking.

Table 13. Summary of the effects of variables on fertility.^{a,b}

| Variables | Empirical Results | | |
|--|-------------------|-----------|---|
| | Sign | Magnitude | Consistency |
| Income^c | | | |
| Pure income effect on number of children | + | weak | mixed |
| Pure income effect on quality of children | + | strong | consistent |
| Income effect through increased fecundity | + | weak | mixed; depends on cultural setting |
| Male wage rate as proxy for pure income effect | + | weak | mixed |
| Pure income effect on marital patterns | ? | | mixed |
| Income effect on migration away from agriculture, and urbanization | + | strong | consistent |
| Education^d | | | |
| Female education on number of children | - | strong | consistent |
| Female education on quality of children | + | strong | consistent |
| Female education on contraceptive efficacy | + | strong | consistent in U.S.; little evidence in developing countries |
| Female education on age at marriage | + | strong | consistent |
| Child education on fertility | - | moderate | consistent |
| Both male and female education on own wage rates | + | strong | consistent |
| Labor Force Activity and Wage Rates^e | | | |
| Female work away from home | - | strong | consistent |
| Female work at home | ? | weak | mixed |
| Female wage rates on participation | + | strong | consistent |
| Female wage rates on fertility | - | strong | consistent in U.S.; some evidence in developing countries |
| Male wage rates on participation | + | strong | consistent |
| Male wage rates on fertility | + | weak | mixed |
| Female wage rates on marriage | - | strong | consistent |
| Male wage rates on marriage | + | strong | consistent |
| Male wage rates on female labor force participation | - | strong | consistent |
| Migration from Agriculture, Urbanization, and Industrialization | | | |
| Urbanization on fertility | - | moderate | mixed; depends on how soon migrants alter behavior |
| Industrialization on fertility | - | mixed | little evidence |
| Migration on fertility | ? | ? | contradictory evidence |
| Childhood Mortality | | | |
| Childhood mortality on fertility | + | strong | consistent |
| Childhood mortality on quality of children | - | strong | consistent |
| Fecundity and Family Planning^f | | | |
| Increased supply of contraceptives | - | weak | mixed; depends on relation of actual to desired fertility |
| Fecundity on fertility | + | weak | mixed |

(continued)

Table 13—Continued

| Variables | Empirical Results | | |
|--|-------------------|-----------|------------------------------------|
| | Sign | Magnitude | Consistency |
| Marriage and Family Structure^g | | | |
| Age at marriage on fertility | — | strong | consistent |
| Fraction married on fertility | + | strong | consistent |
| Form of marriage: fraction in consensual unions on fertility | — | strong | consistent |
| Marriage on female labor force participation | — | strong | consistent |
| Effect of stricter divorce laws on marriage | — | moderate | consistent |
| Extended family structure on fertility | ? | weak | mixed |
| Polygamy on fertility | —? | ? | scanty evidence |
| Attitudes, Roles, Son Preference, Tastes, Institutions^h | | | |
| Modern attitudes and roles on fertility | — | weak | scanty evidence |
| Modern attitudes and roles on contraception | + | strong | scanty evidence |
| Proportion of sons among children | +? | weak | mixed; depends on cultural setting |
| Religion on fertility | 0 | weak | consistent |
| Modern consumption patterns on fertility | — | weak | scanty evidence |
| Institutional setting on fertility | ? | ? | scanty evidence |
| Notes: | | | |
| ^a The author wishes to thank Dr. Michael C. Keeley, General Electric—TEMPO, for preparing the original version of this table. | | | |
| ^b While not considered explicitly, age and marriage duration have a positive effect on fertility in cross sections at a given point in time, though not on ultimate completed family size. Age is difficult to separate from cohort which does represent secular change in fertility over time. | | | |
| ^c Income is likely to increase as a country develops. | | | |
| ^d Education of both males and females is likely to increase as a country develops. Changes in relative education of males and females will depend on the development strategy. | | | |
| ^e The labor force participation and wage rates of women may rise as a country develops. Male wage rates will very likely rise. Whether male wages rise relative to female wages depends on the particular development strategy followed. | | | |
| ^f Fecundity will probably rise as a country develops, depending on current health of the population and whether desired fertility is greater than actual fertility. Contraceptive use will probably increase. | | | |
| ^g Effect of development on marriage is unclear and will depend primarily on how the relative wages of men and women change over time. | | | |
| ^h These factors will tend to become more like those in the West as development progresses. | | | |

Unanswered Questions

The study has left several broad questions unanswered. One is the question of the timing of fertility. The works examined here have focused almost exclusively on completed fertility. Even where age-specific birth rates have been the dependent variable there has been little analysis to separate the changes in the timing of births from changes in different cohorts of women.

Secondly, because of data limitations, almost all of the studies in developing countries have been of cross-section rather than of time-series data. Researchers have been unable to tackle the effects of slow secular changes on fertility. This omission has been particularly important with respect to environmental and taste factors which may be relatively constant in a cross section and change only slowly with the process of development. There has been some improvement recently with the gathering of retrospective data in fertility histories [see, for example, Harman (1970), Henin (1968, 1969), and Schultz and DaVanzo (1970)]. If these studies can be combined with the collection of socioeconomic variables as well as demographic ones, some of the dynamic processes in fertility will be investigatable.

A related unanswered question is the response of individuals to the changes of economic development. For example, several studies have compared migrants with natives in urban areas. But they have not examined the changes in migrants which took place as they moved and adapted to the new urban environment. Nor have there ever been sufficient studies of migrants compared with nonmigrants who remained in rural areas. Until such studies are made, it is only possible to compare different individuals with different characteristics. It is difficult to predict what will happen when a given individual's characteristics (such as residence, labor force status, income, etc) are changed over time.

Another question deals with the existence of "thresholds." Several writers [eg, Kirk (1971)] have suggested that fertility will not decline until certain absolute levels of modernization (measured by education, social services, etc) are reached. The question of modernization thresholds, however, is linked with the question of distribution. If higher average income or education simply means more for a small upper class group, it is unreasonable to expect any change in the behavior of others. Since the upper classes tend to have the lowest fertility, changes which are limited to them and not distributed to the broad majority will have little impact on fertility. Thresholds which are expressed in terms of percentage of a country's population with a certain education, income, or occupation, for example, may simply indicate the extent of the effects of development, and thus how many people will begin to alter their behavior.

A somewhat different interpretation of the word "threshold" is as a crucial level for individual family behavior. An example would be the statement that fertility behavior shifts dramatically only when a given level (say, four to six years) of education is reached. Few of the studies examined here have been organized to test such statements. Most of the studies have used statistical techniques which assume that the response of fertility to explanatory variables is either linear or log-linear. Only the study by Gendell, Maraviglia, and Kreitner (1970) allowed for discontinuities in any given effect or interactions between two different effects. The testing of these more complicated hypotheses requires more observations than aggregate data usually allow. With the growing use of either longitudinal or retrospective information for individual households, the question of thresholds can be addressed. The most likely threshold may be education. Tables 3 through 6 indicate a minimum of female education before fertility changes. But once the minimum is attained, the effect of education on fertility appears quite smooth with no abrupt shifts for increasing educational levels. Further testing must be made with other variables held constant to substantiate this result.

The evidence of fertility studies has clearly shown the importance of modern activity of women in education and in the labor force. The broadening of opportunities for women leads them to center their lives less on the household and more on other activities which compete for time and resources once devoted to children. Information about the exact magnitudes or functional forms of this relationship is still regrettably sparse. For some individual countries, however, progress has been made in investigating the relationships peculiar to them.

POSSIBLE USES AND FUTURE WORK

For a nation which is trying to predict and influence its future path, the better it understands the causal relationships involved the more it will succeed. But since each factor that is accounted for requires more effort, more research and more complexity, the policymaker must make trade offs according to what he is trying to do. For some purposes a very simplified description of the determinants of fertility may be all that is needed. On the other hand, where the policymaker is trying to influence fertility decisions, he must know the exact points at which intervention is most likely to be successful. In the following paragraphs several questions are considered in which the determinants of fertility might enter. They concern general planning models, general demographic-economic models, and specific models to program a reduction in fertility.

General Planning Models

The general planning model uses established economic relationships to predict the outcome of changing certain exogenous variables. Countries typically try to plan expenditures on both economic and social goals. Yet many of these expenditures are made without thought to their long-run consequences for fertility. Examples are easy to find. In the case of economic policies, developing countries are faced with a choice of different modes of industrial development. They can opt for heavy industry, light industry, or cottage industries. While the main criteria on which these decisions are made are usually contributions to national output, planners should recognize that they have important effects on other social and economic variables. Light industries which offer employment to women will tend to draw women out of the home and give them incentives to reduce fertility. Heavy industry which relies primarily on male labor will not have the same impact. Cottage industries, by enabling women to combine work at home with family responsibility, may serve only to encourage existing high fertility patterns.

With respect to social policies, long-run planning models which simply project trends in fertility and mortality ignore the consequences and interactions of different policies with respect to education, labor force behavior, health, and other social services. An understanding of the determinants of fertility allows planners, for example, to justify education not just for the training of skilled workers but also for the fertility behavior changes which it sets into motion. With opportunities for children's education parents today will have fewer children. As the children reach adulthood, they too will have smaller families. In the field of labor policy [as Schultz (1970) has pointed out] wholesale adoption of Western labor codes may produce unintended consequences. For example, employers

who must pay maternity benefits and child allowances to women will prefer to hire men, perpetuating the home-centered role of women. The list of policies which have indirect and sometimes very important consequences for fertility decisions could be extended almost indefinitely [see Hickman (1972)].

Demographic-Economic Models

The case is strong, therefore, for models such as those developed by General Electric—TEMPO [McFarland et al (1973) and Brown (1974)] which incorporate demographic as well as economic factors. As yet these models have not been used as general planning models, but have been applied to a number of developing countries to demonstrate the potential for faster growth of per capita gross national product when fertility is lowered. For this latter objective a more complicated model incorporating development feedback effects on fertility, although more realistic, would not affect the basic conclusion. The rise in income due to an endogenous decline in fertility would have few immediate feedbacks to reduce fertility even more. Over a relatively short period of years, however, the larger expenditures on health and education as well as the higher wages and more extensive female opportunities will have substantial impacts on fertility. The endogenous feedbacks from development almost uniformly tend to lower fertility. The exceptions seem to be at the very lowest and perhaps at the very highest ends of the development scale. At the lowest end of the scale, such as for the nomads of the Sudan, development has appeared to raise fecundity and change the lifestyle to increase fertility. The share of tribal groups, however, in the total world population is so small that even very large changes in fertility could take place without being noticed, although an individual nation could be seriously affected if tribes form the bulk of its population. At the highest level of development there is some evidence that in the United States fertility is higher for families in the highest income and education groups, but this is not completely substantiated, and the magnitude of the relationship is small. From the point of view of developing nations this problem is far in the future and probably not important even then.

Systems Models for Fertility Reduction

The analysis of the determinants of fertility presented above is particularly important for the planner facing the problem of how to reduce fertility. He must be aware of the precise interactions of the relationships specified in this analysis as well as others which have not been treated in detail (the most important of which are probably the determinants of labor force activity and marriage). The planner in this case should not be thought of as a family planning minister with limited objectives and control of only part of the overall government budget. A family planning minister, for example, has no control over educational policy or budgets even though they may have important interactions with the success of family planning activities. The planner envisioned here should be at the highest echelon of government and should evaluate policies and goals within a *national* framework, not within the constraints of a specific ministry. The planner must ask questions such as: "How much is it possible to reduce fertility by the provision of family planning services? How much fundamental social and economic change is necessary before people reduce the number of children they

want?" Perfect family planning may be worthless if every couple wants and produces six children. The planner using a complete model of fertility has the tools to evaluate the implications of different policies. For example, if government childcare services are provided, will the potentially lower fertility due to drawing women into the labor force be offset by decreased costs of raising children?

For this type of analysis the planner must, of course, look both to general relationships and to specific ones germane to the individual country. This study has described some of the relationships and data which will be crucial to a model of fertility. Attention must also be given to the choice between aggregate and microanalytic models. The aggregate model does not isolate individuals, but only their average characteristics. The microanalytic model follows individuals and families through time as they make decisions. It can be used to measure the distribution of, as well as the average benefits of, development. The micro model clearly has more complicated data and functional form requirements. At present only Orcutt and Rivlin (1960) and Guthrie et al (1972) have applied microanalytic models, and these only to the United States. Their use in developing nations still awaits better data and more detailed analysis.

This section has only begun to outline the possible use of fertility analysis. It is important to stress two basic points. First, the fertility decision is one of a group of decisions taken simultaneously. Analyses of fertility must also consider these other decisions, particularly those of labor force participation and marriage. Finally, countries concerned with population growth must seek to explain not only fertility but also migration and mortality. Although fewer relevant policy choices may be available with respect to mortality and migration, accurate planning and prediction requires an understanding of their determinants and of their interactions with fertility.

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REPORT DOCUMENTATION PAGE

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|---|---|---|--|
| 1. Report No. | 2. | 3. Recipient's Accession No. | |
| 4. Title and Subtitle Effects of Economic Development on Fertility: Review and Evaluation of the Literature | | 5. Report Date July 1974 | 6. |
| 7. Author(s) Anne D. Williams | | 8. Performing Organization Report No. GE74TMP-32 | |
| 9. Performing Organization Name and Address General Electric--TEMPO P.O. Drawer QQ, Santa Barbara, CA 93102 777 14th Street, N.W., Washington, D.C. 20005 | | 10. Project/Task/Work Unit No. Task Order No. 6 | 11. Contract or Grant No. AID/csd 2611 |
| 12. Sponsoring Organization Name and Address U.S. Agency for International Development Office of Population Rosslyn Plaza East Washington, D.C. 20532 | | 13. Type of Report Research Evaluation | |
| 15. Supplementary Notes | | | |
| <p>16. Abstract</p> <p>Surveys the literature on the determinants of fertility, with emphasis on the developing nations. Concludes that policies to raise the education and labor force activity of women have the most potential for reducing fertility. To implement such policies, detailed studies of the interactions of fertility, education, labor force participation, family planning and other variables are needed for individual countries.</p> | | | |
| 17. Originator's Key Words Economic-Demographic Studies Economic Development Demography Fertility Population Growth | | 18. Availability Statement Available from USAID and Performing Organization | |
| 19. U.S. Security Classif. of the Report UNCLASSIFIED | 20. U.S. Security Classif. of This Page | 21. No. of Pages 61 | 22. Price |