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# Research and Information Strategies to Improve Population Policy in Less Developed Countries

William P. Butz

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A Report prepared for

AGENCY FOR INTERNATIONAL DEVELOPMENT

**Rand**  
SANTA MONICA, CA 90401

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# Research and Information Strategies to Improve Population Policy in Less Developed Countries

William P. Butz

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**Rand**  
SANTA MONICA, CALIF. 90406

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PREFACE

This study was undertaken for the AID Office of Population as part of a project seeking to formulate, test, and integrate the components of a theory of fertility as part of a general view of the family decisionmaking process. Since most production in developing countries is generated within families and only a modest share is initially channeled through markets, nonmarket production within families is an important source of wealth and welfare about which we know little. Earlier Rand studies of the economic and demographic determinants of fertility<sup>1</sup> argued that to account for variations in fertility over time and space and to evaluate accurately policy measures that might reduce fertility, we shall require a comprehensive framework for interpreting family economic and demographic choices.

This report reviews our current limited understanding of household economic and demographic behavior. To improve population policy in low income countries, better information is urgently required to explore the interactions between family behavior and public policy options. In addition, this report indicates specific changes in how

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<sup>1</sup>Donald J. O'Hara, Changes in Mortality Levels and Family Decisions Regarding Children, R-914-RF, February 1972; Julie DaVanzo, The Determinants of Family Formation in Chile, 1960: An Econometric Study of Female Labor Force Participation, Marriage and Fertility Decisions, R-830-AID, December 1971; Frank A. Sloan, Survival of Progeny in Developing Countries: An Analysis of Evidence from Costa Rica, Mexico, East Pakistan, and Puerto Rico, R-773-AID, November 1971; T. Paul Schultz, Evaluation of Population Policies: A Framework for Analysis and Its Application to Taiwan's Family Planning Program, R-643-AID, June 1971; T. Paul Schultz and Julie DaVanzo, Analysis of Demographic Change in East Pakistan: A Study of Retrospective Survey Data, R-564-AID, September 1970; A. J. Harman, Fertility and Economic Behavior of Families in the Philippines, RM-6385-AID, September 1970; Marc Nerlove and T. Paul Schultz, Love and Life Between the Censuses: A Model of Family Decision Making in Puerto Rico, 1950-1960, RM-6322-AID, September 1970; Y. Ben-Porath, Fertility in Israel, An Economist's Interpretation: Differentials and Trends, 1950-1970, RM-5981-FF, August 1970; T. Paul Schultz (assisted by Julie DaVanzo), Fertility Patterns and Their Determinants in the Arab Middle East, RM-5978-FF, May 1970; T. Paul Schultz, Population Growth and Internal Migration in Colombia, RM-5765-RC/AID, July 1969; T. Paul Schultz, A Family Planning Hypothesis: Some Empirical Evidence from Puerto Rico, RM-5405-RC/AID, December 1967.

social scientists should formulate models and conduct statistical estimation and inference using these improved data. The resulting guidelines for data collection and social science research in population and development make the case for explicit consideration of the interactions among different facets of family behavior, some of which constrain the effectiveness of public policies, particularly those affecting fertility and family planning.

SUMMARY

Public policies to stimulate economic and demographic change in less developed countries have frequently produced disappointing results. The process of economic development, which these policies are intended to speed, is intricately bound up with changing patterns of time allocation and resource use in families. Our ignorance of these patterns stands in the way of identifying those particular factors in families' environments that public policies must influence in order to change the behavior of individuals in directions deemed socially desirable. This report argues that policymakers' ignorance of these patterns is an important cause of disappointments in economic and demographic development.

This study stresses two fundamental reasons for our ignorance: (1) common conceptual models of family behavior and techniques of statistical inference are too primitive to identify which of the links among different forms of family behavior are quantitatively important influences on the success of government programs, and (2) available data are poorly suited to the analysis of this problem, even if the proper tools are applied. Therefore, a conceptual approach to modeling family behavior is proposed, appropriate statistical techniques are discussed, and necessary data are defined to study this causal chain linking many public policies to national objectives by way of the family.

The conceptual approach to modeling household economic and demographic behavior that is proposed has yielded refutable hypotheses about the effects on individuals' behavior of changes in their environment. This approach treats households as units that both produce and consume what they want. They react to changing external conditions by altering the amounts of their members' time and other resources used in producing commodities such as good health, schooling, farm produce, and children. Complex interdependencies exist among these activities, causing a specific change in the family's environment to influence indirectly a host of production activities, many of which are not oriented to the market, and to influence what many members of the household do with their time and resources.

This approach suggests the importance of distinguishing between two types of variables involved in family behavior: those whose values result partly from the interdependent decisions and activities of family members, and those that influence those decisions but are in no way affected by them. Among the former are people's attitudes and conduct, as well as the resulting income, consumption, migration, and size of families; among the latter are cultural, geographic, and public policy factors. An illustrative model of family contraceptive and fertility behavior is used to show several ways in which improper techniques of statistical estimation and inference ignore the important distinction between these two classes of variables and hence produce misleading policy prescriptions. A review of appropriate estimation techniques suggests four guidelines for making statistical inferences about family behavior.

1. If the particular behavior of interest is an integral part of a larger behavioral system (such as a family), account as well as possible, in both model specification and statistical estimation and inference, for resulting interactions.
2. For the end of a causal chain, seek variables that are probably closely linked to public policy choices.
3. Let the relevance and measurement accuracy of the data guide the choice of estimation procedure and the confidence attached to specific estimates.
4. Employ estimation procedures that best serve the goals of the first three guidelines. Simple two-way tables and correlations are rarely among these methods. Investigate the direction and magnitude of remaining biases and use this information to assess the accuracy of the estimates.

Explicit consideration of families' possibilities for substitution in the production and consumption of its commodities has suggested a variety of hypotheses about the responses of individuals to changes in their environment. Eleven sets of hypotheses are stated here along with summaries of their derivation from the model's basic properties.

Each hypothesis predicts particular behavioral responses to specific changes in families' surroundings.

Although the conceptual approach that yielded these hypotheses is only in an early stage of development, it has clearly overreached the power of existing data to confirm or deny its predictions. Further progress in identifying the particular interactions among family activities that influence the success of public policies therefore awaits the collection of more appropriate data. The essential characteristics of these data are suggested by the model's properties.

1. Data should describe the characteristics of family members and how they spend their time and other resources in market and nonmarket activities.

2. They should describe changes in families' behavior over their life cycle, particularly their past and present production of human and physical capital.

3. They should quantify relevant factors in the family's environment and link to program information obtained by the responsible administrative unit in which the family lives.

Because in aggregation most census data lose much individual variation required to investigate the hypotheses adequately, and because information generated within the context of particular public programs is usually obtained only for population samples that are biased in important respects, the collection of household survey data independent of program activities appears valuable. Accordingly, the appendix details the information required to improve our understanding of the family's behavior and advance our competence to evaluate the success of public policies that operate through their impacts on interrelated aspects of family formation and subsequent behavior.

Progress along these closely related fronts should help to identify the environmental variables that directly or indirectly constrain important types of individual behavior. Research into the most efficient combinations of public policies and programs to alter these variables in directions deemed socially desirable may then proceed with greater effect.

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The author is indebted to Rand colleagues Julie DaVanzo, Dennis De Tray, Alvin Harman, Sally Nerlove, Donald O'Hara, and Charles Wolf, Jr. for their constructive criticisms, which sharpened the analysis of an early draft. John Koehler and Larry Dutton contributed a great deal to a more effective presentation of the material in a later draft.

The creative effort of John Enns in culling, editing, and organizing the questions from many survey instruments into the present appendix is much appreciated. The author is especially grateful for the detailed comments and suggestions of Paul Schultz who improved the analysis and presentation at every stage. Any errors and ambiguities are the author's responsibility.

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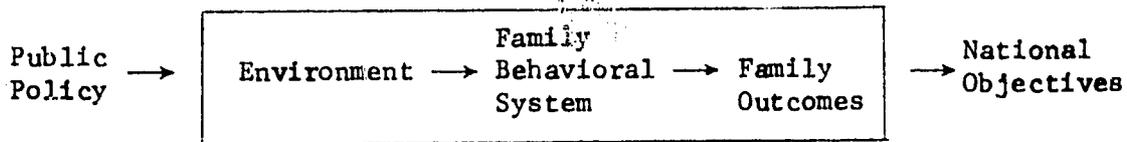
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I. INTRODUCTION

Public policies and programs that aim to alter the behavior of individuals in less developed countries have frequently produced disappointing results. For example, distribution of contraceptives and family planning information has not always proved to be quickly and continuingly effective in reducing birth rates, and migration to towns and cities continues to increase in spite of public information programs to discourage it.

There are success stories in these areas, to be sure, but the frequent disappointments suggest the possibility that unknown factors and relationships may constrain the effectiveness of many government programs. Indeed, the path from national policies concerning family planning, saving, and migration to national outcomes such as birth rates, aggregate investment, and population distribution is more complex than has often been assumed. The diagram below illustrates the steps from public policy to national objectives as viewed by policymakers: the effects of policy on the environment families face, the family "behavioral system," the outcomes of family choice, and, finally, national objectives.



A thorough understanding of the relationships between what governments do and national outcomes would require construction of this entire chain. In this report I am concerned only with a part of that task. For although each of the links may complicate any policy effort, considerable evidence indicates that interactions within the behavioral systems of families form a quantitatively important but little understood set of linkages that may cause one public policy to interact with the operation of another. As one example, this evidence suggests that many public programs other than those directly related to family planning affect the rate of population growth by influencing the choices

of individual couples for children and hence the demand for family planning itself.

This report therefore examines the subsystem around which the box is drawn, from where factors in the family's environment affect its decisions to where these decisions result in family members' marriage, fertility, labor market, and migration behavior, to name a few. Within this focus on the family and its environment, my purpose is to examine why the social sciences have often failed to identify the quantitatively important causal links between environmental factors that government programs may influence and family behavior outcomes that aggregate to the national objectives sought by governments. I argue that there are two fundamental reasons for this failure: (1) the conceptual models of family behavior and the techniques of statistical inference used cannot identify important interactions within the family system, and (2) available data have been inappropriate for the analysis of this problem, even if the proper tools were applied.

Accordingly, I suggest a conceptual approach to the study of family behavior and policy evaluation, a set of guidelines for making statistical inferences about this behavior, and a description of needed data -- all of which should enable researchers to specify more precisely this crucial part of the chain linking public policy measures to desired national goals. In Section II I summarize an approach to family behavior that is proving useful in investigating interdependencies among various family activities. This model emphasizes the alternative uses of family members' time and the interactions among their forms of behavior that may promote or impede the effectiveness of public policies in less developed countries (LDCs). These interactions may create incentives for family members to react to government programs in ways unanticipated by policymakers. Consequently, when social science research ignores these interactions -- whether in modeling the effects of a public program, estimating the parameters of such a model, or making inferences about the best governmental actions to achieve a desired result -- the resulting signals to policymakers can be misleading. In Section II I therefore describe and

demonstrate the pitfalls to which statistical estimation and inference are subject when important interdependencies in family decisionmaking are ignored.

Alternatively, explicit consideration of these interactions suggests hypotheses concerning the effects of various environmental factors on the behavior of family members. These hypotheses, some of which are enumerated in Section III, derive from the approach summarized earlier, and several have received empirical support. In most cases, however, the information required to test them -- to determine which of the many links among the activities of various family members are important aids or impediments to the success of specific public programs -- has not yet been collected in appropriate forms. My final concern, therefore, is to suggest the kinds of data needed to conduct such investigations.

To this end, Section IV recommends an information strategy that relies on independent household sample surveys that gather detailed information on family members' work, school, and migration experience and on how they use their time. These data will enable researchers to progress toward empirical consideration of family decisionmaking as the complex, simultaneously determined system it actually is. If these new data are analyzed by appropriate methods of statistical estimation and inference, the quality of information available to planners and policymakers in LDCs could be vastly improved.

A prototype sample survey instrument incorporating the guidelines in Section IV is included as an appendix. It indicates the general range of data required to investigate the questions raised in Section III using appropriate statistical methods discussed in Section II. However, this prototype instrument does not reflect considerations of question phrasing, questionnaire design, and survey strategy that are crucial in designing a survey instrument for actual use in a particular setting.

In emphasizing the importance to policymakers of research on family behavior in LDCs, I do not mean to belittle the crucial task of understanding the complex links between public policies that government officials can change and important factors in families' environment -- the first step in our causal chain. Both kinds of knowledge are necessary before policymakers can anticipate the interactions

among various public programs and accordingly choose combinations of programs that move, with the least undesirable side effects, toward social goals. Policy oriented economic and demographic research must deal explicitly with both of these links. When they are firmly identified in terms of systematic responses of individuals to changes in their environment and systematic changes in the environment due to policy choice, the estimated effects of a set of public programs on individual behavior can be aggregated to illuminate the programs' impacts on national goals. The alternative procedure is to seek direct meaningful regularities between characteristics of public policies and degrees of attainment of national objectives. This kind of research, which relates specific public programs directly to capital-labor ratios, savings rates, crude birth rates, and so on, ignores the fact that economic development is the aggregate result of behavioral responses of individuals, and that the individual variation that produces systematic relationships important to policy may be lost in the process of data aggregation.

## II. ALTERNATIVE PROCESSES OF INFERENCE ABOUT FAMILY BEHAVIOR

### THE FAMILY IN ECONOMIC DEVELOPMENT

The family and its legitimization through the institution of marriage are prominent features of most known human societies.<sup>1</sup> Families everywhere perform many of the same functions for their members and their communities. They help channel sexual activity into narrow and stable relationships, and they determine placement in existing class systems. They define an interpersonal network of emotional and economic security so that a person unable to support himself is provided for by relatives. They furnish a stable environment for bearing, socializing, and training children.

Within the organizational framework of families, people contribute to the fulfillment of these functions by engaging in various activities requiring their time as well as goods and services purchased from outside the family. In communities at a low level of economic development, activities carried on within the household satisfy most of families' material needs: participation in the labor market and purchases of goods and services from the market are small compared with the time worked at home and the amount of goods produced and consumed there. In economically more developed communities, on the other hand, families characteristically participate more in market activities, both by working for wages and by spending some of their wage income for goods they might be able to produce at home but have instead decided to purchase.

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<sup>1</sup>George P. Murdock (1949) defined the family as a conjugal social group with three characteristics: (1) its members live together, (2) reproduction and child-rearing occur within it, (3) its members cooperate economically. Murdock found that the family, so described, constituted a unit apart from the rest of the community in 250 societies he surveyed. Though there are societies without such conjugal families (see Spiro, 1954; Gough, 1959; Bettelheim, 1969), the characteristics Murdock defines exist everywhere in some social unit (Levy and Fallers, 1959). For some purposes, the family can usefully be defined without reference to a specific structural arrangement as a group having Murdock's characteristics, particularly the first two (Davis, 1949).

These differences among families in economies at different stages of economic development are particularly noticeable in the areas of food, clothing, housing, schooling, and health care. Families in agrarian societies commonly produce these commodities themselves, sometimes with little or no use of outside goods and services. As societies develop, specialized public or private institutions arise that are able to produce and sell these goods more cheaply than families can. With the simultaneous development of labor markets, families are able to improve their material well-being by allocating more of their members' time to market jobs and by meeting their needs with the help of goods produced and sold by specialized institutions. Family behavior relating to marriage, fertility, savings, and migration is also directly or indirectly affected in this process.

Our understanding of the interactions that link these different facets of behavior is limited. Yet these interactions affect people's responses to changing conditions and thereby influence the complex processes of behavioral change that constitute economic development. Increasing wealth probably induces some of these behavioral changes by enlarging the family's capacity to satisfy its wants. As it becomes wealthier, the family demands relatively more of some goods and services and relatively less of others; its home and market behavior patterns shift to satisfy these changing wants. Another factor inducing family behavioral change is shifts in the relative prices at which families sell their labor and home-produced commodities and buy market goods, as well as other changes in their surroundings affecting the relative costs and rewards attached to various market and nonmarket activities. Some of these factors are more specifically related to particular kinds of behavior and may be more amenable to public policy influence than is per-family wealth. Without understanding behavioral interrelationships at the family level, however, it is difficult to know which of these prices and other factors governments should try to influence in order to induce specific types of economic and demographic change.

To identify these important interrelationships requires more powerful conceptual approaches to family behavior than the demographic,

economic, and sociological models in common use. A new approach should be more powerful in three respects. First, it should take explicit account of these behavioral interactions within families. Second, some of the hypotheses it yields concerning family responses to environmental changes must not be intuitively obvious or derivable from simpler models. Third, these hypotheses should be capable of empirical refutation. That is, it must be possible to reject the conceptual approach as a useful predictor of real phenomena by showing that its propositions are inconsistent with reality; otherwise, the model is capable of explaining every possible occurrence and is useless for predictive purposes.

#### AN APPROACH TO MODELING HOUSEHOLD BEHAVIOR

Gary Becker and others have proposed a useful approach to modeling household behavior that yields a variety of refutable propositions about how individuals respond to specific changes in their environment.<sup>1</sup> Whereas conventional economic theory assumes that families supply their labor to the market and buy goods and services that directly satisfy their wants, Becker's theory emphasizes that family members must use some of their time in the consumption of these goods and services before wants are actually satisfied. Hence, by combining the time and abilities of their members with goods and services bought in the market, families produce commodities such as children, leisure, meals, and good health, which give their members satisfaction. These household production activities are the core of the model and can be analyzed with the analytical tools associated with the economic theory of the firm. Additional insights stem from peculiarities of the household as both a producing and a consuming unit, some of whose outputs cannot easily be bought or sold if the household is short or in surplus. Four broad properties of households appear in this model.

##### 1. Possibilities for substitution in the production and consumption of commodities create complex interdependencies among family

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<sup>1</sup>See Mincer (1963); Becker (1965); Becker (1967); and Lancaster (1966).

activities. A family can usually produce the same commodities in a variety of ways depending on its resources and their value in alternative uses. Older children can often substitute either for the mother's time in housework or child care or for the father's time in earning income. Market sources of intermediate goods in home production activities can release some of nearly everyone's time to other pursuits.

When a family responds to a change in its environment by devoting more of its time and resources to a particular activity, it has less to spend on others. For example, time spent in school cannot be applied to rearing children, participating in cottage industry, working for wages, or leisure. And income spent for books and transportation to school leaves less to spend on children, food, leisure activities, and everything else.<sup>1</sup>

Families also respond to external change by substituting in consumption against commodities that have become more expensive to produce at home or to buy in the market.<sup>2</sup> Both kinds of substitution effects

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<sup>1</sup>An extended example may be helpful. A public program that opens jobs to women and raises their wages will induce some women to enter the labor force and some others to work more hours in the market than they had previously worked. The amount of the wives' time and ability available for family activities is thereby reduced. Families will try to use less of the wife's time, which is now more expensive, and more of other family members' time and goods bought with income, both of which are relatively less expensive, in all family activities in which one can be substituted for the other. Hence, the husband and children may help with meals, or the family may purchase foods requiring less preparation time and ability. Young children may be cared for by older children or a neighbor. And good health may be provided more with the aid of medicines and medical services, which cost time and money, and less with the aid of a constant watchful eye, which costs only the mother's time.

<sup>2</sup>When women's wages increase, commodities that are produced using much of the wife's time relative to other inputs become more costly to produce than commodities that use little of her time. In trying to satisfy its wants as well as possible with its resources of time and income, the family begins to consume more of those commodities it can now produce relatively more cheaply and fewer of the others. The couple may forego a previously planned pregnancy since childbirth and caring for an infant require much of a resource that is now dearer. They may, in fact, spend some of their time and income in obtaining birth control knowledge and materials to insure that more of the wife's time will be available to work for wages. Alternatively, activities that use little

result in reduced household production and consumption of commodities whose relative cost has increased. Such cost changes also produce an "income effect" in that they leave the household with more or less real income depending on whether the affected cost falls or rises. If it rises, the family is not as well off because the same amount of money income can now purchase less. The balance of substitution and income effects in any situation determines the directions of net tradeoffs in the production and consumption of any specific commodity.

2. The use of each family member's time and abilities is important in determining which family wants are satisfied and in what ways. Each person divides his time among labor market work, household production of goods or services to be sold for income, or home production activities that directly satisfy current or future wants. Those factors in the family's environment that influence the relative productivities of its members' time in alternative uses can significantly affect individual behavior.

3. Family activities may serve two distinct goals -- satisfaction of current wants (consumption) and satisfaction of future wants by saving and investing. Saving and investment activities require the use of family members' time and resources that could otherwise produce commodities for current consumption. Instead, they produce assets that will yield streams of future income or satisfaction. Investment activities, then, are the means by which a family, with a given expected amount of productive resources in each year of its life, adjusts its expected income in each year so as to attain its desired time pattern of consumption.<sup>1</sup>

As with consumption activities, families may substitute in the production of a specific asset by using more of one input and less

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of her time are now relatively cheaper, so the family will consume more of them. Other family members need work fewer hours for wages in order to earn the same family income, for example, and may therefore spend more time in other family activities including leisure.

<sup>1</sup>This view of saving and investing is set out in Modigliani (1966).

of another as their relative prices change, and they may substitute among investments in their portfolio as relative rates of return shift. Schooling, for example, is an investment activity<sup>1</sup> that always requires a relatively large input of the student's time. Families may substitute public school facilities for mother's time in the production process, however, if the former input becomes less expensive or the latter more so. In addition, reductions in school cost may make schooling more attractive to some families than other investment activities and hence induce them to substitute schooling of some family members for other assets in their investment portfolios. Participation in other activities, that may be viewed as investments, such as health care, nutrition, migration, and bank savings programs may likewise be influenced by a variety of changes in families' environment.

Child-rearing activities contribute to both current consumption and asset formation since children are usually a source of both current and future satisfaction to their parents. Furthermore, children may be valued for their contribution to household chores. As such, their role is the same as that of any other resource at the family's disposal, since their value to their parents depends in part on the amount they add to the family's total stock of productive resources. This value may be considerable in societies where children enter the fields or factories at an early age and where a lack of social security and insurance programs leaves children as the primary means of parental support in illness and old age.<sup>2</sup>

4. Changes in the family's environment can have direct impact on more than one person and activity and can indirectly influence other persons and family activities through various interactions. In the first place, a change such as reduced prices of farm implements may induce families to substitute these implements for their own time in

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<sup>1</sup>Schooling may of course be enjoyable in itself as well as producing abilities that will yield both income and enjoyment in the future.

<sup>2</sup>Even where such programs are available, as in the United States, England, and Denmark, adult children nevertheless contribute both time and money to sick and aged parents in a majority of families. See Shanes (1969).

agricultural production. All individuals who farm may thereby reallocate some of their time to other activities -- perhaps school, labor market work, or leisure. The inputs and outputs of these activities will then change, leading in turn to still other repercussions.

These four properties are used in Section III to suggest refutable propositions about family members' behavior and in Section IV to define some characteristics of the data required to test and refine these propositions. I use this conceptualization now, however, to distinguish among several types of causal variables and to investigate the implications of their differences for statistical estimation and inference.

#### ALTERNATIVE PROCESSES OF INFERENCE

To distinguish among various methods of forming inferences about family behavior, I consider an illustrative model focusing on a particular facet of family activities. Assume that Figure 1 accurately portrays the causal influences at work in the family planning and fertility activities of families in a hypothetical community. I would then like to determine from data the magnitudes of the parameters associated with the links between variables in this model.<sup>1</sup> Even if the model is restricted to describing a sample of couples in which wives are of the same age and year of marriage, it ignores many other complexities. However, the sole purpose of this simple structure is to distinguish among alternative ways of making inferences from data about the magnitudes of a model's parameters. The insights so gained are applicable to any kind of approach to modeling family behavior.

The middle panel of Figure 1 indicates that the values of four variables are determined in the current period. The number of additional children desired (ADDCHDES) influences the couple's use of modern birth control methods (BRTHCNTRL) and independently affects whether the wife becomes pregnant during the period (PREG). PREG also depends on BRTHCNTRL and on the number of hours the wife works

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<sup>1</sup>By assuming a precise specification of the model, I ignore the important and difficult questions of how to find the best specification for a model and how to identify the costs of misspecification. The latter is briefly discussed on pp. 15-16. See Theil (1957, 1971).

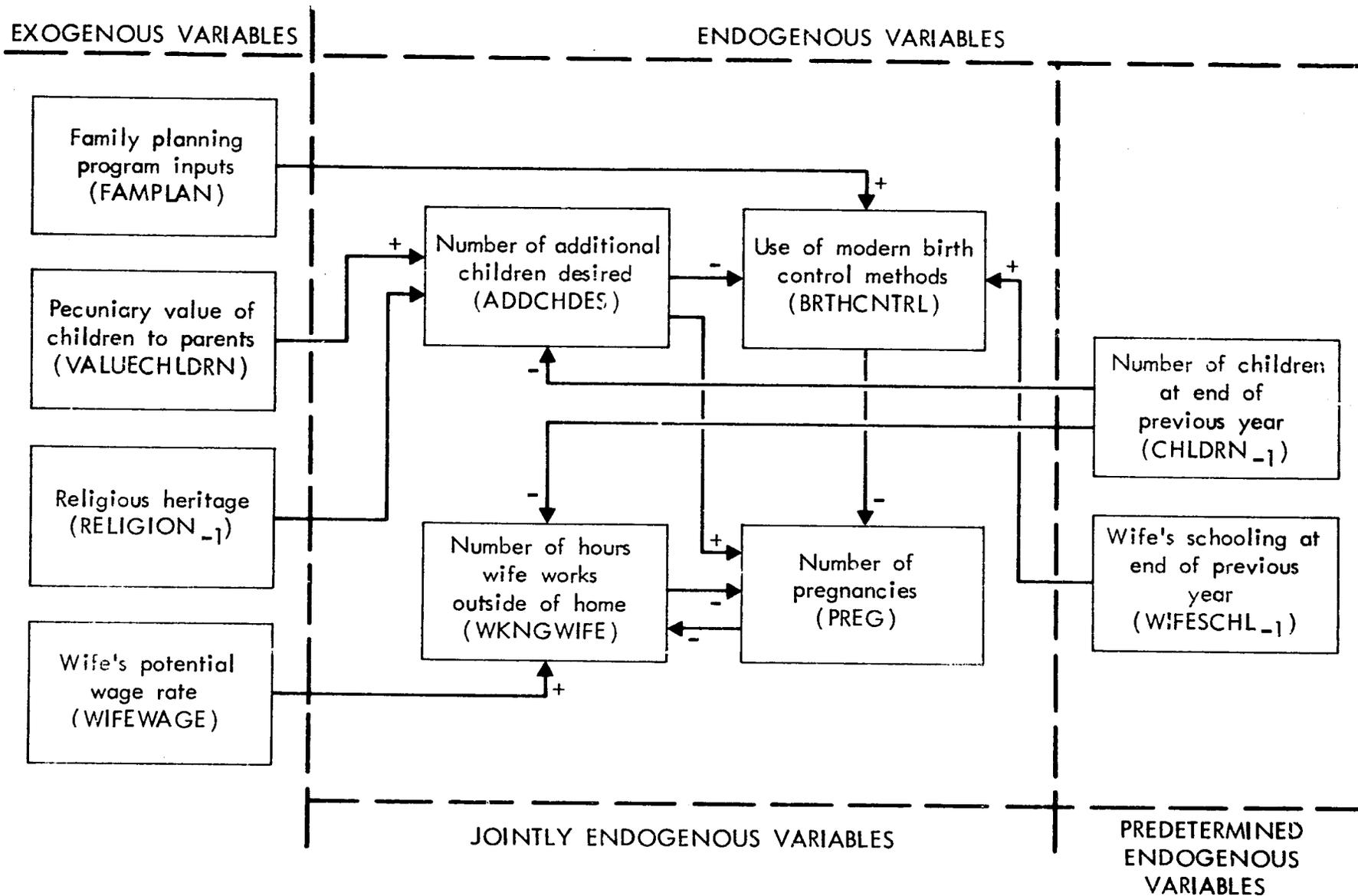


Fig.1 — An illustrative model of pregnancy behavior

outside the home (WKNGWIFE). Finally, WKNGWIFE depends on PREG. These four are jointly endogenous variables: endogenous because their values are determined within the system, jointly because their determinations occur within the same time period and are influenced by each other. Accordingly, such variables are also called simultaneously determined.

In addition, other explanatory variables in the figure influence but are not influenced by these families' current fertility and family planning behavior. They are predetermined variables, that is, variables whose values are determined "prior to" or outside the family system's current operation. The number of children at the end of the previous year (CHLDRN<sub>-1</sub>) and the wife's level of schooling at the end of the previous year (WIFESCHL<sub>-1</sub>), which appear in the right panel of Figure 1, are predetermined endogenous; the subscripts indicate that their current values were determined by the operation of the family system in previous periods and cannot be altered by current action. The family can, however, affect future values of these two factors by its current activities. The remaining four variables at the left of Figure 1 are exogenous: their past, present, and future values are unaffected by family members' behavior.<sup>1</sup>

The contrasting characteristics of these types of variables can be defined more precisely in reference to Equations (1) through (4) which are an algebraic representation of Figure 1.

$$(1) \text{ PREG} = \alpha_0 + \alpha_1 \text{ WKNGWIFE} + \alpha_2 \text{ BRTHCNTRL} + \alpha_3 \text{ ADDCHDES} + t;$$

$$\alpha_1 < 0, \alpha_2 < 0, \alpha_3 > 0$$

$$(2) \text{ WKNGWIFE} = \beta_0 + \beta_1 \text{ PREG} + \beta_2 \text{ WIFEWAGE} + \beta_3 \text{ CHLDRN}_{-1} + u;$$

$$\beta_1 < 0, \beta_2 > 0, \beta_3 < 0$$

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<sup>1</sup>The wife's potential wage rate (WIFEWAGE) is probably influenced by her level of schooling and current exogenous variables and should therefore be considered endogenous. However, adding another jointly endogenous variable to the model would unnecessarily complicate it at this stage. The addition is made at a later point in the exposition.

The pecuniary value of children to parents (VALUECHLDRN) is the amount of money that children of various age-sex-health-schooling groups can earn, either in the market or producing crops and other home-made products for sale.

$$(3) \text{ BRTHCNTRL} = \gamma_0 + \gamma_1 \text{ ADDCHDES} + \gamma_2 \text{ FAMPLAN} + \gamma_3 \text{ WIFESCHL}_{-1} + v$$

$$\gamma_1 < 0, \gamma_2 > 0, \gamma_3 > 0$$

$$(4) \text{ ADDCHDES} = \delta_0 + \delta_1 \text{ CHLDRN}_{-1} + \delta_2 \text{ VALUECHLDRN} + \delta_3 \text{ RELIGION}_{-1} + w$$

$$\delta_1 < 0, \delta_2 > 0, \delta_3 \leq 0$$

These equations indicate that the causal relationships in this family system are linear and that there are random variations in individual behavior that cannot be systematically described. The random disturbance terms  $t$ ,  $u$ ,  $v$ , and  $w$  represent the latter factors.<sup>1</sup> Note first that each of the jointly endogenous variables is the dependent variable in a causal relationship containing a random disturbance term. The statistical distribution of each is therefore dependent upon the distribution of the disturbance term in one of the system's equations: such variables are defined as jointly endogenous. On the other hand, current disturbances are by definition distributed independently of all current predetermined variables.<sup>2</sup>

I now turn to the problem of determining from data the magnitudes of the parameters in Equations (1) through (4). Suppose that we are

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<sup>1</sup>These variations may arise from random variations in people's relative preferences for various commodities. Preferences may be thought of as a person's subjective ordering of his wants. As such, they affect a family's current behavior but are themselves more dependent on prior activities and influences. Certainly less is known about their formation than about the other elements of Figure 1 (perhaps excepting religious heritage). They are surely influenced somewhat by past activities -- for example, by education, which makes some things seem less and others more important, and by the past discovery of activities which are now considered valuable. Exogenous factors such as geography, weather, and cultural heritage may also leave their marks on a person's subjective likes and dislikes. And public policy, by promoting education or small families, may alter some of these subjective tradeoffs.

When all of these systematic factors are accounted for, much of the variation in preferences among persons can be attributed only to individual differences in tastes -- quirks of heredity or environment that contribute to individuality. Hence, I relegate them to the disturbance terms of the illustrative model.

<sup>2</sup>Predetermined endogenous variables may of course be distributed dependently with the disturbances of previous periods. This causes no difficulty under the assumptions of the illustrative model.

particularly interested in estimating the strength of various influences on the current pregnancy behavior of the families modeled in these equations and Figure 1. We may proceed in one of several directions, each of which exemplifies a way of making inferences about family behavior.

#### Statistical Associations Between Two Variables

The easiest approach is to examine the direct statistical relationship between number of pregnancies in the current year and one of the explanatory variables, say ADDCHDES.<sup>1</sup> Using this approach, we might poll couples at the start of the year on how many more children they desire and at the end of the year on whether they have experienced a pregnancy. We might then conclude that the effect of desiring more children on actual pregnancies is accurately reflected in a measure of association or correlation between the two variables.

But if the model of Figure 1 is correct, this conclusion is wrong. To see this, note that both ADDCHDES and WKNGWIFE are hypothesized to be correlated with the same variable, CHLDRN<sub>-1</sub>. Since  $\beta_3$  and  $\delta_1$  are negative, the estimate of  $\alpha_3$  got by simple correlation will include some of the effect properly due to variations in WKNGWIFE and will be biased toward zero. In addition, ADDCHDES is negatively correlated through Equation (3) with the other explanatory variable in Equation (1), BRTHCNTRL. In this case, leaving BRTHCNTRL out of the estimating relationship induces an upward bias in the estimate of  $\alpha_3$ , causing the apparent association between ADDCHDES and PREG to be larger than it actually is. In sum, therefore, it is not possible to say whether our estimate of the relationship between ADDCHDES and PREG is biased upward or downward and by how much.

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<sup>1</sup>Several statistical tools, including contingency tables and correlation analysis, may be appropriate for this task. Elementary and more technical descriptions of these techniques may be found, respectively, in Yamane (1964), and Brownlee (1964).

Specification bias of this type arises whenever an omitted explanatory variable is correlated with an included one.<sup>1</sup> It is in principle more serious if the explanatory variables are current endogenous rather than predetermined factors<sup>2</sup> and if the model is estimated using highly aggregated data.<sup>3</sup> There is therefore a greater need for completely specified models when using aggregate data and, conversely, greater value in using micro data when the model is thought to be poorly specified or incomplete.

Theories in the social sciences are too imprecise to imply the exact specification of behavioral relations, so the possibility of specification bias is always present. Researchers should therefore (1) avoid biases by choosing estimation techniques and data sources that allow sample variation of all explanatory variables considered important, and (2) investigate and report the probable direction of remaining biases.<sup>4</sup> Both of these guidelines are violated by the common research procedure in which one and then another explanatory variable is tabled or correlated with a dependent variable, say a fertility measure, and each separate test presented as representing the independent effect of one explanatory variable. Such estimates can contribute little or nothing to our understanding of most behavioral relationships.<sup>5</sup>

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<sup>1</sup>More technically, this bias results from the relegation to the disturbance term of an omitted explanatory variable correlated with an included one. In the present example, the resulting statistical dependence between  $t$  and ADDCHDES introduces an additional term,  $B$ , into the expectation of the estimate of  $\alpha_3$ : [expected value of the estimate of  $\alpha_3$ ] =  $\alpha_3 + B$ . In the text example, one cannot even know the sign of  $B$  without further information and therefore cannot know the direction in which the estimate of  $\alpha_3$  is "off." See the references cited in footnote 1 on p. 11.

<sup>2</sup>This is simply because current endogenous variables, being dependent upon each other as well as upon some of the same predetermined factors, have more opportunities to be correlated.

<sup>3</sup>Aggregation washes out random variations among individuals leaving higher sample correlations among variables.

<sup>4</sup>An example in the economics literature of skilled application of these guidelines, especially the second, is Griliches (1958).

<sup>5</sup>This research procedure is nearly universal in behavioral demography. Many instances can be found, for example, in the six distinguished

Estimation of Relationships Having More than One Jointly Endogenous Variable

A more promising approach to the estimation of behavioral relationships can be illustrated by joint estimation of the  $\alpha$  coefficients in Equation (1). This could be accomplished by several methods,<sup>1</sup> each of which allows the three explanatory variables to vary simultaneously with PREG. Since we assumed at the outset that Figure 1 and its associated equation system reflects the actual causal mechanisms, estimation of the correctly specified Equation (1) eliminates specification bias by definition. However, this procedure introduces another potentially serious source of bias arising from the presence in Equation (1) of four jointly endogenous variables, PREG, WKNGWIFE, BRTHCNTRL, and ADDCHDES. These variables are simultaneously determined by concurrent family activities; hence the problem resulting from directly estimating their coefficients in Equation (1) is appropriately known as simultaneous-equation bias.<sup>2</sup>

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books constituting the Princeton Fertility Study and the Growth of American Families Study. Although these studies contributed much to our descriptive knowledge of fertility trends and differentials, they revealed little about relevant causal mechanisms. Instead, separate correlations of number of children with religion, with urban background, with desired number of children, with a marital adjustment variable, with husband's occupation, with husband's earnings, with wife's feelings of economic security, and with many other variables are tabled and discussed. As the authors sometimes indicate, many of these explanatory variables are highly correlated. In the absence of causal models and estimation techniques explicitly accounting for these dependencies, and without investigation of the direction of resulting biases, these tables and correlations reveal nothing about the causal relationships which public policy must deal with if it is to affect the outcomes. The Princeton Fertility Study books are Westoff, Potter, Jr., Sagi, and Mishler (1961); Westoff, Potter, Jr., and Sagi (1963); Bumpass and Westoff (1970). The Growth of American Families Studies are Freedman, Whelpton, and Campbell (1959); Whelpton, Campbell, and Patterson (1966); Ryder and Westoff (1971).

<sup>1</sup>Partial correlation analysis, ordinary least squares, and path analysis are alternatives. See Brownlee (1964); and Land (1969).

<sup>2</sup>Christ (1966), pp. 455-464, contains an excellent exposition of the causes and statistical results of simultaneous-equation bias. Also see Bronfenbrenner (1953).

Figure 1 and Equation (2) indicate that WKNGWIFE depends upon the value taken by PREG, just as PREG depends upon the value taken by WKNGWIFE in Equation (1). Conceptually, this reflects the fact that the decision to become pregnant and the decision of the wife to work are made jointly so that the outcome of each decision depends upon the outcome of the other.<sup>1</sup> In such cases, separate estimation of one of the two relationships as if it were the only relationship results in estimated coefficients that attribute all of the correlation between the two simultaneously determined variables to only one of the cause-effect relationships. Regressing PREG on the three right-hand variables of Equation (1) accordingly produces an overestimate of  $\alpha_1$ . This biased estimate reflects all of the association between the two variables, not just that part associated with WKNGWIFE's effect on PREG. Similarly, estimating the coefficients of Equation (2) by itself would yield an overestimate of the causal influence of PREG on WKNGWIFE.<sup>2</sup>

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<sup>1</sup>The length of time sufficient for family members to act, in light of their resources and opportunities and other members' actions, influences whether particular variables should be considered as concurrently or predetermined endogenous. The length of this period, in which all jointly determined activities are planned and executed, probably varies from activity to activity. As a practical matter, the nature of the research or the availability of data usually determines the length of this period in a modeling effort. As the assumed period lengthens, formerly predetermined endogenous variables become jointly endogenous for purposes of estimation, since the time distinctions that separate them have disappeared.

<sup>2</sup>In a recent study of the determinants of fertility, contraception, and associated attitudes in Taiwan, Mueller (1971), especially Tables 17 and 19, regresses each of several fertility attitude and contraceptive use variables on lists of factors reflecting couples' age, schooling, income, and various attitudes about their well-being. The same sets of explanatory variables include some predetermined factors outside the couples' current control, such as age and school level, as well as many factors that are plainly influenced by their current activities. Income per adult, perceived utility of children, sensitivity to cost of raising children, and perceived confidence in obtaining economic assistance from sons, for example, are jointly endogenous since their current values are likely to be influenced by a common set of predetermined factors as well as by each other. In regressions that include all of these explanatory variables, several of the attitude factors have the largest Beta coefficients and are therefore judged by the author to be the most powerful determinants. But there is every reason to suspect, based on the present discussion, that these estimates attribute excessive explanatory power to jointly endogenous variables at the expense of predetermined factors.

BRTHCNTRL is also simultaneously determined with PREG, WKNGWIFE, and ADDCHDES, according to Equations (3) and (4). The important statistical implication of this joint determination is that the disturbance terms  $t$ ,  $u$ ,  $v$ , and  $w$  are not in general distributed independently. Instead, whatever random factors or idiosyncratic tastes are at work, they can be expected to have a systematic effect on all of the family's current activities. If something raises WKNGWIFE in one family well above the level predicted by the systematic factors on the right side of Equation (2), it is reasonable to expect BRTHCNTRL, PREG, and ADDCHDES also to take abnormal values. The result is that  $t$ ,  $u$ ,  $v$ , and  $w$  are correlated. This causes estimation problems because BRTHCNTRL, WKNGWIFE, and ADDCHDES, with their associated random components,  $u$ ,  $v$ , and  $w$ , are explanatory variables in Equation (1). Since  $u$ ,  $v$ , and  $w$  are correlated with  $t$ , these explanatory variables are correlated with the random disturbance term associated with PREG, and ordinary estimates of their coefficients are biased.

Hence, both specification bias of the type discussed above and simultaneous-equation bias result from correlation between the disturbance term and an explanatory variable in a causal relationship. The sources of correlation differ in the two cases, however, and different remedies are required. The bias resulting from an omitted explanatory variable arises whenever it is correlated in the sample with an included explanatory variable. Awareness of the problem plus data on the omitted variable permit direct correction of the bias. Otherwise, one can seek independent information or intuition concerning the probable direction of bias. The bias resulting from treating a jointly endogenous variable as if it were a predetermined explanatory variable, on the other hand, arises when the relationship of interest is only one part of a simultaneously determined system. In this case, simultaneous-equation estimators are often superior to methods that take no account of the presence of more than one dependent variable in the relationship.<sup>1</sup> They are superior

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<sup>1</sup>In a review of recent developments in path analysis and factor analysis, Goldberger (1971) compares these two techniques with standard econometric methods in regard to their capabilities for structural equation estimation. He finds that each method has advantages in dealing with different problems: errors in variables, unobserved variables, under and over identification, and joint determinacy.

because the coefficient estimators they yield are consistent<sup>1</sup> -- a quality not possessed by ordinary least squares, path analysis, or other techniques in these situations.

The various simultaneous-equation estimators differ in two major ways. First, each is equipped to use different amounts and types of information about the system under study. What clearly distinguishes these methods as a class is that they all make use of one kind of information that cannot be incorporated into other estimation procedures -- namely, that more than one variable in the relationship is endogenous. But one often has other information as well: a theory of how the other endogenous variables are determined or information on how the disturbance terms in the system are related, for example. Depending on the amount and quality of available information, some simultaneous-equation techniques are superior to others. Second, these methods differ in the properties of the coefficient estimators they yield, though a description of these properties is beyond the scope of the present report.<sup>2</sup>

Simultaneous-equation techniques are especially preferable to other estimation methods when the sample size is large and when the specified relationships to be estimated are accurate descriptions of the actual behavioral system under study. In any specific research situation, the choice of a simultaneous-equation estimator should be guided by the extent to which these two criteria are met.

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<sup>1</sup>In general terms a consistent estimator is one whose sampling distribution becomes closely concentrated near its population mean as the sample size becomes very large (asymptotically). An unbiased estimator is always consistent. But in a simultaneous equation framework there are no unbiased estimators; the best one can do is choose one that tends toward unbiasedness when the number of observations increases -- that is, a consistent estimator. Consistency is, however, no guarantee of good results when the sample size is less than "large."

<sup>2</sup>Yamane (1964), pp. 237-245, gives verbal definitions of the various optimal properties of estimators -- unbiasedness, minimum variance, efficiency, consistency, and sufficiency. Goldberger (1964), pp. 125-129, provides concise algebraic definitions of these properties; and Theil (1971), pp. 528-536, discusses the differences between simultaneous-equation estimators in terms of these properties and the amount of information the estimators require.

Total Effects of Public Policy Factors on Family Behavior

My concern thus far has been with biases that may arise during the estimation of a single relationship that is part of a simultaneously determined system. Even when these biases are corrected, however, another critical problem may remain. Once again, consider Equation (1), and assume that its coefficients have been estimated in a way that assures their consistency. We now know that, within certain confidence limits, WKNGWIFE affects PREG to the degree indicated by the estimate of  $\alpha_1$ . And similarly for BRTHCNTRL and ADDCHDES. At this point, the important questions are: What payoff is there to such knowledge? What do these estimates imply for public policy? The answer so far is: Very little.

Social science research that is useful to policymakers incorporates as explanatory variables exogenous factors that are as close as possible to available policy levers. The causal influence of an exogenous factor that is closely linked to policy choices should therefore be sought as the end of a causal chain. In the example of Figure 1 and its descriptive equations, this means that provision should be made to estimate the effects on PREG of FAMPLAN and VALUECHLDRN. These two variables are more closely related to public policy choices than are the jointly endogenous variables, and each affects PREG in the model, though neither appears directly in Equation (1).

Three procedures are available for investigating the combined direct and indirect effects of exogenous and predetermined endogenous factors on current endogenous variables. The first is to estimate the coefficients of structural Equations<sup>1</sup> (1) through (4) by a consistent simultaneous-equation estimator and then to compute the coefficients of this equation system's calculated reduced form equation. These reduced form coefficients are estimates of the total influence of exogenous and predetermined endogenous variables. Removing all current endogenous variables except PREG from Equations (1) through (4) and substituting terms yields

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<sup>1</sup>Such equations are called structural because they each describe a particular segment of the family system's structure.

$$(5) \text{ PREG} = a + b \text{ CHLDNR}_{-1} + c \text{ WIFEWAGE} + d \text{ WIFESCHL}_{-1} + e \text{ RELIGION}_{-1} \\ + f \text{ VALUECHLDNR} + g \text{ FAMPLAN} + h$$

$$\text{where } a = [\alpha_0 + \alpha_1\beta_0 + \alpha_2\gamma_0 + \alpha_3\delta_0 + \alpha_2\gamma_1\delta_0] \cdot [1/(1 - \alpha_1\beta_3)]$$

$$b = [\alpha_1\beta_1 + \alpha_2\gamma_1\delta_1 + \alpha_3\delta_1] \cdot [1/(1 - \alpha_1\beta_3)]$$

and so on.

Substituting the estimated values of the coefficients  $\alpha_i$ ,  $\beta_i$ ,  $\gamma_i$ , and  $\delta_i$  into this expression produces an estimated relationship between PREG and a set of factors beyond the influence of current family choices.<sup>1</sup> Other current endogenous variables do not appear in the relationship.

Since no dependent variables appear as explanatory factors in Equation (5), its coefficients can alternatively be estimated directly and consistently by ordinary least squares. This second procedure yields an estimated reduced form equation. Although reduced form estimation is the simplest in terms of data requirements and estimation procedure, two drawbacks make structural estimation and subsequent reduced form calculation preferable in many situations. First, reduced form estimation commonly does not take advantage of all the information about the system contained in the structural equations. Although reduced form estimation can be restricted to incorporate this information, these restrictions usually destroy some of the optimal properties of least squares that make it theoretically preferable to simultaneous equation methods.

Second, even though an estimated reduced form equation is a good tool for predicting the total effects of changes in current exogenous factors on family members' behavior when the structure and organization of the family and the community remain unchanged, its predictions are less valuable when these structures do change. This difficulty arises because reduced form equations, lacking a specification of the structure of the system being studied, cannot be altered to reflect known changes

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<sup>1</sup>The structural relationships and the data must meet certain conditions before one can transform reduced form coefficients back into their structural counterparts. See Fisher (1966).

in that system. On the other hand, these changes can be incorporated into a structural equation system by either altering the values of some of its coefficients or changing the specification of some of its equations. The essence of these two drawbacks is that although reduced form estimation is easier and requires less data, it yields less information upon which to base policy decisions. Nevertheless, it is often useful in conjunction with structural estimation and in its own right.

The third procedure that is useful in these circumstances takes reduced form analysis a step further by eliminating from Equation (5) even the predetermined endogenous variables. The resulting relationship is called a final form equation.<sup>1</sup>

To illustrate this technique we add to our illustrative model several equations to explain the values taken by the predetermined endogenous variables  $CHLDRN_{-1}$ ,  $WIFESCHL_{-1}$ , and  $WIFEWAGE$ .<sup>2</sup>

$$(6) \quad CHLDRN = PREG + CHLDRN_{-1} - DEATHS$$

$$(7) \quad DEATHS = \epsilon_0 + \epsilon_1 \text{ PUBHEALTH} + \epsilon_2 \text{ WIFESCHL}_{-1} + x$$

$$(8) \quad WIFESCHL = \zeta_0 + \zeta_1 \text{ WIFESCHL}_{-1} + \zeta_2 \text{ WIFEWAGE} + \zeta_3 \text{ PREG} \\ + \zeta_4 \text{ CHLDRN}_{-1} + \zeta_5 \text{ AVAILSCH} + y$$

$$(9) \quad WIFEWAGE = \eta_0 + \eta_1 \text{ WIFESCHL}_{-1} + \eta_2 \text{ MANPWRPOL} + z$$

where  $DEATHS$  = a measure of fetal and child mortality.

$PUBHEALTH$  = a measure of public health inputs in the community.

$AVAILSCH$  = a measure of the availability of schooling in the community.

$MANPWRPOL$  = an indicator of public policy's effectiveness in maintaining attractive jobs for women outside the home.

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<sup>1</sup>See Theil and Boot (1962).

<sup>2</sup> $WIFEWAGE$ , though considered exogenous in Figure 1, is probably influenced by the wife's previous schooling. Introduction of Equation (9) at this point therefore excludes all possibility of endogenous influences.

By substituting successively for the predetermined endogenous variables  $CHLDRN_{-1}$ ,  $WIFEWAGE$ , and  $WIFESCHL_{-1}$  in Equation (5), we obtain Equation (10) in which the coefficients  $j$ ,  $k_1$ ,  $l_1$ , and so on are complicated functions of the coefficients of Equations (1) through (4) and (6) through (9). Each of the summations runs from the present year back to the year of marriage or before.

$$(10) \text{ PREG} = j + \sum k_1 \text{ FAMPLAN}_{-1} + \sum l_1 \text{ VALUECHLDRN}_{-1} + \sum n_1 \text{ PUBHEALTH}_{-1} \\ + \sum o_1 \text{ AVAILSCH}_{-1} + \sum p_1 \text{ MANPWRPOL}_{-1} + q$$

Equation (10), which is the final form of our equation system, indicates the total effects of current and past variations in exogenous variables on current pregnancy behavior. No endogenous factors appear among the explanatory variables although their intervening effects are reflected in the coefficients. Such an equation cannot usually be estimated directly because of serial correlation among successive values of explanatory variables and because data for all past years are rarely available. Having estimated the structural equations or their associated reduced form equation, however, one can sometimes compute the final form coefficients and make useful inferences from them concerning the lags with which changes in public policies affect family behavior.

Reduced form and final form equations are of value in policy planning and analysis because they indicate the total magnitude of the relationships between exogenous factors and a chosen aspect of family behavior. These equations are more useful to policymakers the more nearly the exogenous factors are policy controlled. Unfortunately, these factors are rarely if ever amenable to policy in a completely predictable way. For example, governments may have to contend with many other exogenous influences when attempting to provide a certain availability of schooling (AVAILSCH), of family planning services (FAMPLAN), or of jobs for women (MANPWRPOL). Nevertheless, they certainly have more direct control over these variables than over the wife's labor force participation and use of modern birth control methods, or the couple's desire for additional children!

GUIDELINES FOR MAKING STATISTICAL INFERENCES ABOUT FAMILY BEHAVIOR

Although the model of Figure 1 is not intended as an accurate representation of influences on family activities in any particular society, it has served to illustrate some serious problems that arise out of making inferences about family behavior. The following guidelines address these problems:

1. If the particular behavior of interest is an integral part of a larger behavioral system (such as a family), account as well as possible for resulting interactions in both model specification and statistical estimation and inference.
2. For the end of a causal chain, seek variables that are probably closely linked to public policy choices.
3. Let the relevance and measurement accuracy of the data guide the choice of estimation procedure and the confidence attached to specific estimates.
4. Employ estimation procedures that best serve the goals of the first three guidelines. Simple two-way tables and correlations are rarely among these methods. Investigate the direction and magnitude of remaining biases and use this information to assess the accuracy of the estimates.

III. HYPOTHESES ABOUT THE EFFECTS OF EXOGENOUS CHANGES ON  
FAMILY MEMBERS' BEHAVIOR

THE HYPOTHESES

The approach to modeling family behavior outlined above (pages 7 to 11) suggests a set of propositions concerning both interactions among family activities and the direct and indirect effects of exogenous changes on the behavioral pattern that results from these interactions. These hypotheses, some of which are stated in this section, are specific predictions about behavioral responses. They can be tested and, if they fail to predict well, rejected.<sup>1</sup> Testing them with appropriate data and statistical methods should identify some of the complex interactions through which factors in the family's environment directly and indirectly affect individuals' behavior. Some of these indirect effects may be of major importance to the success of government economic and population policies.

Hypothesis 1. Increasing the accessibility and reducing the cost of modern family planning information and materials reduce family size to an extent influenced by the demand of couples for family planning services and by the way the services are supplied. Resulting reductions in family size improve the relative economic position of poor families.

The success of family planning programs in reducing births depends on several characteristics of couples' demand for modern family planning services and on the strength of their underlying desire to avoid unwanted births. These characteristics may be systematically affected by individual traits and by certain exogenous variables subject to policy influence. Identifying these traits will guide family planning resources to receptive populations, and identifying the relevant exogenous variables may suggest important roles for other public programs.

If couples are relatively indifferent to an unwanted birth, reducing the price and increasing the accessibility of modern contraceptives may

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<sup>1</sup>A concise survey of empirical evidence for LDCs on many of these hypotheses is contained in Schultz (1971a). A much less selective survey of research findings can be found in Mason et al. (1971).

not greatly affect their use of these materials or their fertility behavior. Even where couples do attach great cost to an unwanted birth, however, family planning programs may not affect their fertility. In the first place, couples may find it in their interest to increase their current and future welfare by having many children and may already have access to family limitation methods that are quite effective and that they view as costing little in terms of convenience or money. In this situation, couples may see no reason to shift from their present family limitation methods to modern ones. Making modern contraceptives more accessible will fail to increase these couples' use of these materials or decrease their fertility.<sup>1</sup>

Alternatively, couples who want very much to avoid additional births may be using such family limitation methods as abortion that are effective but very costly in terms of health, convenience, or money. Increasing the accessibility of modern contraceptives may induce many of these couples to substitute modern methods for these other techniques that are more costly but nearly as effective. If so, acceptor rates will be high as couples substitute among inputs in their production of contraceptive output -- avoidance of births. But the number of births averted may not change much. Finally, some couples who also attach great cost to an unwanted birth do not have access to an effective family limitation method. They tend to adopt modern contraceptive methods and reduce their fertility if these methods are made available at low cost.

An important problem for policy research in this area is to identify the combinations of individual characteristics and exogenous variables that lead some couples to desire many children, cause them to be relatively indifferent to unwanted births, and influence their use of alternative family limitation methods. Many of the hypotheses in this section suggest exogenous variables that influence couples' desires for children.

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<sup>1</sup>Sample survey evidence from LDCs concerning married couples' desires to limit their family size indicates that these desires are sufficiently small in many areas to place severe limitations on the effectiveness of the standard family planning package. See Ridker (1969).

When these variables combine to make large families an attractive option for parents, public policy may be able to reduce fertility more effectively by changing the values of some of these variables than by altering or expanding family planning programs.

In addition, where couples are experiencing unwanted fertility and want very much to avoid it, the effectiveness of family planning programs may depend on the way information about the program is transmitted, the kinds of personnel who are hired,<sup>1</sup> the monetary incentives offered to potential participants,<sup>2</sup> and other features. Couples with different characteristics and subject to different exogenous constraints may react differently to various combinations of these factors.

Where these demand and supply factors are such that family planning programs are successful in reducing fertility, an important result is likely to be a decrease in per capita income inequality among families. Couples with little schooling and low incomes are usually the least effective contraceptive users since they often understand less about reproductive physiology and about sources of information and assistance; it is these couples, on the average, who have the most "unwanted" fertility. A publicly subsidized family planning program induces larger decreases in family size among these poor, less educated families, causing their per capita incomes to rise as the number of their young children declines.

Hypothesis 2. Increasing women's job opportunities and wages and reducing social stigmas associated with their holding jobs outside the home tend to increase women's participation in these jobs and raise the cost of additional children. The balance of income and substitution effects is likely to favor a reduction in family size.

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<sup>1</sup>Schultz (1971b), finds significant differential effects on fertility of variations in man-months of effort of doctors, nurses, and health workers in family planning programs in Taiwan.

<sup>2</sup>In a multiple regression study of the characteristics of family planning program acceptors, Cook (1971) found that a \$10 participation fee reduced participation to about 60 percent of the level when no fee was charged. Much of the evidence on the effects of family planning incentives is reviewed in Rogers (1971).

Higher wages or the availability of better jobs raise the value of many women's time and induce them to begin or increase their participation in the labor market.<sup>1</sup> The time they now spend away from home would have been used in agriculture, cottage industry, or some other pursuit more compatible with the demands of child rearing. In some households the time of others -- older children, grandparents, neighbors -- can be substituted for mother's time in child care. In others, little such substitution in production is possible. However in all cases where the wife responds to the exogenous change by increasing her hours of work outside the family, children and other commodities that result from family activities using much of the wife's time become relatively more expensive. Couples therefore tend to substitute against them in consumption, desiring less children than do those whose employment opportunities have not changed.

Opposing these two substitution effects -- both of which lead one to expect smaller family sizes in communities with superior job opportunities for women -- is an income effect inducing couples with increased incomes from the wife's work to want more children as well as more of the other commodities they consume. Therefore, where the wife responds to the exogenous change by increasing her hours of work outside the household, both family income and the relative price of children increase. Whether the net effect is to have larger or smaller families cannot be predicted from theoretical considerations alone. The strong weight of available evidence, however, is that substitution effects predominate and smaller families result.<sup>2</sup>

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<sup>1</sup>Some women who spent all their time in home production activities before the exogenous change may still remain outside the labor force if the value of their time at home exceeds even the higher wage they could now earn.

<sup>2</sup>Many studies of LDCs have found a negative association between women's labor force participation and fertility; only a few of these, however, have attempted to account statistically for the fact that these two variables reflect jointly endogenous family activities, and that nothing about direction of causation can therefore be inferred from a simple statistical association between them. The latter studies are Nerlove and Schultz (1970); Schultz (1970); Harman (1970); and DaVanzo (1971). The middle two studies include in their fertility regressions a female education variable as a proxy for the wife's potential wage

Hypothesis 3. Reducing the incidence of child mortality induces the following effects, after couples have adjusted their behavior to the exogenous change: the numbers of pregnancies and births decline, average years of schooling of children increase, and average surviving family size may decrease. During the transitional period when couples have not yet fully adjusted to the new regime of higher survival probabilities, family size increases, and either child rearing expenditures per child or saving of couples with young children decrease.<sup>1</sup>

Where parents expect most children to live to adulthood, they come to realize that fewer births are required to assure a completed surviving family of desired size. They are also willing to invest more in each child, knowing that he and they are more likely to live to enjoy the returns to those investments. In regimes of high infant and child mortality, on the other hand, parents may not only have more births but also somewhat larger completed families than they would otherwise desire. For if they fear having too few surviving children, they may hedge against the chance of too many deaths by having too many births.<sup>2</sup> As the probability of child deaths decreases and as parents adjust to this change, they will decrease their number of births<sup>3</sup> and perhaps the size of their completed surviving families as well. The speed at which couples adjust depends on, among other things, the availability of modern birth control methods and materials.

During the transitional period when couples have not yet adjusted to the exogenous mortality change,<sup>4</sup> many parents find themselves with

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in market work. DaVanzo estimates a positive effect of wife's wage and a negative effect of husband's wage on age-specific female labor force participation.

<sup>1</sup>O'Hara (1972) provides a perceptive discussion of interactions between mortality rates and family decisions involving children.

<sup>2</sup>Schultz (1969) discusses the treatment of uncertainty in the demand for children.

<sup>3</sup>This effect has been found in Harman (1970); Nerlove and Schultz (1970); and Schultz (1971b). Also see Fredericksen (1966).

<sup>4</sup>A family's incidence of child mortality is of course influenced by its endogenous health and nutrition activities as well as by exogenous factors. Reducing the cost of market inputs into these activities

more surviving children than desired or expected and may hence reduce their expenditures per child on education, nutrition, clothing, and so forth. In addition, since current expenditures are likely to be above what was anticipated, the proportion of income saved tends to decline<sup>1</sup> and the labor force participation of secondary workers to increase.

Hypothesis 4. Increasing the availability and quality of schools tends to raise children's level of schooling and reduce their labor force participation; it may contribute to reduced average family size. Children whose parents respond as predicted to this exogenous change are themselves more likely as adults to delay marriage and to migrate to regions of greater economic opportunity. Their conduct of both home and labor market activities will be affected by their schooling according to the pattern of resultant productivity increases.

When governments make schools more accessible, they in effect reduce the price (in terms of parents' and children's traveling time to school) to parents of making their children more productive in future home and market activities. When governments improve existing schools, they raise the amount of future productivity that can be expected to result from a given investment of money and children's time. In both cases, the usual income and substitution effects combine to raise the amount of time children spend in school. In the first place, both exogenous changes leave the family better off than it was -- either because the price of an investment has fallen or because the returns to that investment are expected to increase. Being better off, families increase both current consumption of commodities and investment in capital. Schooling of children, as one form of investment, therefore

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tends to increase a family's participation in them, and thereby reduce mortality. Preliminary evidence from Costa Rica, Mexico, East Pakistan, and Puerto Rico indicates that nutrition variables and female literacy are highly significant determinants of child mortality rates in LDCs. See Sloan (1971).

<sup>1</sup>Some indirect evidence on this point is the high negative associations between fertility and physical savings ratios reported in Eizenga (1961). In a study of cross-section data from developed and low income countries, Leff (1969) finds that birth rates influence savings rates by affecting population age structure.

increases. In addition to this positive income effect, parents now have an incentive to substitute formal school inputs for their own time in the production of their children's education (substitution in production) and to substitute child schooling for other assets that are also expected to yield income and satisfaction in the future (substitution in consumption).

Since time spent in school cannot be used in home or market production, labor force participation of children tends to fall as a result of such an exogenous change. Some youths will for the same reason choose to delay their marriages:<sup>1</sup> at the margin the relative attractiveness of additional schooling as a source of future income and satisfaction induces them to engage in this activity rather than in the home and market production activities required to form and maintain a family.

An increasingly evident empirical relationship is that between years of children's schooling in a community and family size. When some other factors thought to be relevant are controlled in multiple regression analysis, child schooling has been found to be strongly associated with low fertility. Economic theory does not unambiguously predict the sign of this relationship.<sup>2</sup> On one hand, an exogenous increase in the quantity or quality of schools, as we have seen, induces parents to substitute schooling of their children for all other assets as a group. Childbearing produces one of these other assets. There is an inducement for parents to engage in less of it; that is, to have fewer children so that they can invest more of their time and money in the schooling of each of them. On the other hand, this schooling must be embodied in actual children, and the more children a couple has, the more "raw material" is available for schooling. There is hence an incentive for parents to have more children so that they can

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<sup>1</sup>Harman (1970), pp. 42-46, found this relationship in Philippine data.

<sup>2</sup>De Tray (1972) analyzes the effects of various exogenous factors on parents' decisions regarding fertility and schooling of their children.

invest more heavily in child schooling. Available empirical evidence suggests that the cross substitution effect of the price of schooling on the number of children wanted is overwhelmingly dominant,<sup>1</sup> but until household data exist that can distinguish this effect from others resulting from parental education differences and variations in child-labor opportunities, the true causes will remain obscure.

Schooling is an investment activity that generally increases a person's ability to produce future income; therefore, persons with much schooling have strong incentives to locate their human capital where the rate of return to investment in human capital is higher; that is, to live in areas where the income and satisfactions generated by schooling are increased. In addition, since education, especially literacy, enables a person to gather and evaluate information more efficiently, more highly educated people are more aware of their options in other regions. For both of these reasons, an exogenous increase in the availability or quality of schools is expected to induce larger migration flows.<sup>2</sup> The direction of these flows will depend on other factors exogenous to family activities: on the availability of new, profitable agricultural inputs such as hybrid seed, fertilizer, or irrigation, which make schooling a profitable input into farming activities; on the location and attractiveness of jobs that require and reward the skills produced by schooling; on the location of cultural, recreational, and educational facilities enjoyed by persons with the knowledge and skills necessary to use them; and on the quantity and accuracy of information provided about these factors.

Hypothesis 5. Increasing migration to regions of greater economic opportunity tends to delay marriage among the migrants, increase women's labor force participation and the schooling of their children, delay the onset of childbearing, and reduce completed family size. It also affects

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<sup>1</sup>Kirk (1971), and Schultz (1971a) report statistical evidence in support of this negative relationship.

<sup>2</sup>Harman (1970), pp. 63-66, shows that level of schooling is a significant determinant of rural-urban migration flows in the Philippines.

the conduct of other home and labor market activities according to differences in exogenous factors between the regions of origin and destination.

Because migration changes a family's environment, it affects a wide range of family behavior. Since differences between a migrant's regions of origin and destination influence how his behavior will change, generally applicable hypotheses about the effects of migration are difficult to draw.<sup>1</sup>

It may be that increased job availability for women (Hypothesis 2), nearer and better schools (Hypothesis 4), fewer opportunities for child work (Hypothesis 8), and increased availability of family planning knowledge and materials (Hypothesis 1) are common attributes of more developed regions into which migrants frequently move. If so, these changed features of the family's environment can be expected to have the commonly observed effects listed in Hypothesis 5. Programs that promote migration might also weaken family ties, thereby reducing the pecuniary value of children for old-age support and inducing couples to substitute other investments for children. Such an effect would reduce family size among migrants and their parents and increase their saving in other forms of capital.

Hypothesis 4 suggests that persons who possess more human capital are more likely to migrate. Migration may also be selective with respect to other individual characteristics. Consequently, it is very difficult to make inferences about the causes or effects of migration by comparing the characteristics and behavior of migrants with those of the general population in the region of origin or destination. Migrants may systematically differ from these other populations in ways that bias the inferences.

Hypothesis 6. Improving public health and elementary schooling and otherwise increasing the earning power of human capital relative

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<sup>1</sup>Ester Boserup (1970) provides fascinating insights into the changing patterns of women's work at home and in the market as well as effects on their schooling when women in a variety of cultures migrate from villages to towns.

to that of land and physical capital promote a more equal personal distribution of income.

The time of family members is an important productive resource that is quite evenly distributed throughout any society. Exogenous changes that increase the value of people's time relative to that of other productive inputs less equally distributed therefore contribute to a more equal personal distribution of income. Better public health, increased availability and quality of elementary schools, better job opportunities for women, and opportunities for adult training all increase the stock or value of human capital of those persons who benefit from the changes. Less equally distributed resources such as land and nonhuman capital will subsequently claim a smaller share of national income.

Hypothesis 7. Increasing the rate of return and reducing the risk of long-term investment opportunities tend to reduce family size by decreasing the relative attractiveness of children as a source of future income, services, and security. The proportion of current family income invested in assets other than children tends to rise.

By working in the market or at home in farming and cottage industry when they are young, or by providing daily or emergency help when they are adults, children may be a source of substantial physical and financial assistance to their parents. When alternative means of saving for the future and insuring against disability and calamity are lacking, parents have children partly as a means of obtaining this assistance and insurance. As cheaper and less risky sources of insurance and future income streams become available, however, couples tend increasingly to purchase them. Couples subject to such changes therefore reduce their completed family size. In addition, parents tend to respond to a reduction in the price of future income streams by increasing the proportion of current income invested in other (nonchild) assets.

Hypothesis 8. Reducing the home and market productivity of young children may decrease desired and actual family size and increase average years of schooling.

Exogenous changes that decrease the productivity of children reduce their relative attractiveness to parents as a source of income and home production. Constrained by these exogenous changes, parents come to find that children are a relatively less valuable asset in which to invest their time and money and hence substitute against them in their portfolio of productive and financial assets: They have smaller families.<sup>1</sup> They also come to find that alternative uses of their existing children's time are now relatively more attractive. Where public schooling is an available alternative, years of schooling of children will tend to increase in the presence of exogenous reductions in the home and market productivity of child labor. Child labor laws, compulsory elementary schooling, and government programs that reduce the relative attractiveness of cottage production may decrease young children's productivity.

Hypothesis 9. Adult training may have different effects on family behavior, depending on the specific home or market activities that directly or indirectly benefit from the acquired skills.

Other hypotheses in this section suggest that the outputs of home production activities such as farming, hygiene, and child rearing may, through various income and substitution effects, be indirectly and unexpectedly influenced by particular kinds of adult training. Some training, such as instruction in the use of birth control materials or farm implements, is quite specific to a particular family activity and can be expected to increase the productivity of a particular family member in that activity. At the other extreme is elementary schooling in reading and writing, which probably increases a person's productivity in many home and market activities and thereby affects the productivity of other family members who also engage in those activities.

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<sup>1</sup>Indirect evidence of this relationship is given in several studies by Schultz that find a positive partial association between two jointly endogenous variables, percent of active population who are unpaid family workers and fertility. See Schultz (1971b) and (1970). Harman (1970) is able to use number of children in the labor force as a jointly endogenous explanatory variable and finds that it is a significant determinant of the fertility of Philippine women over 34 years of age.

The effects of any particular public educational program therefore depend on the family members who receive instruction and the home or market activities in which these members participate or may enter as a result of their training.

Hypothesis 10. Holding constant the systematic determinants of completed fertility, couples with larger families can devote less income and adult time to each child. These parents therefore tend to spend less per child on health, and their offspring tend to experience more malnutrition and child disease with subsequent effects upon their adult mental and physical capabilities.<sup>1</sup>

For reasons of unexplained personal preference or accident, some couples have more children than is predicted by a model that accounts for systematic variation in parents' demand for children, on the basis of income, prices, and other exogenous cultural and economic variables. Because these couples have less income and time resources than others in the sample with the same number of children, these couples should have fewer of these resources per child than the model predicts. Their expenditures of time and money on health activities may hence be lower; if so, these families will have less healthy children.<sup>2</sup>

Hypothesis 11. A general mortality decline at all ages tends to decrease in the short run and increase in the long run the proportion of income saved by persons in their most productive working years.

During the transition period when couples have not fully adjusted their fertility to the lower mortality levels, the proportion of income saved by couples with children may decrease (see Hypothesis 3). When

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<sup>1</sup>In a theoretical and empirical study of the economic effects of malnourishment of children, Selowsky and Taylor (1971) estimate the links between nutrition and early ability, between early ability and attained schooling, directly and indirectly (through schooling) between early ability and later ability, and separately between schooling and later ability on one hand, and schooling and earnings on the other. In a sample of low income residents of Santiago, Chile, the authors estimate a very large rate of return to potential public investments in child nutrition.

<sup>2</sup>Wray (1971) finds larger families positively correlated with child disease and mortality in a cross-country sample.

these adjustments near completion, however, a different effect predominates. Since a general decline in the regime of mortality at all ages implies that the probability of survival to older ages increases more than that to younger ages,<sup>1</sup> both expected working years and expected retirement years increase -- but the latter relatively more. Hence, although the present value of earnings increases with the additional working years, the number of years that lifetime income must support increases even more. Therefore, as persons become accustomed to the exogenous mortality changes, they anticipate their own longer retirement period by saving a larger proportion of income in their most productive years. In effect, they adapt their lifetime income pattern to the altered pattern of desired consumption that has resulted from the additional years of life.

#### BEYOND THE HYPOTHESES

These hypotheses relate individuals' behavioral responses to changes in their environment. Nothing is implied about the existence or efficiency of government policy levers that can influence these exogenous variables. Indeed, the model discussed here is unable to suggest hypotheses about these critical relationships.

Monetary and fiscal policy, import substitution policy, manpower, health, family planning, and education programs -- all may be capable of altering various wages, prices, and other constraints on individuals' behavior. Most of these public policies, however, are hampered by inflexible social and economic institutions and circumscribed by relative scarcities in national and international markets. Factor and product prices in competitive markets or the distribution of land, for example, may limit the effectiveness of many public programs. Furthermore, just as a change in a particular variable exogenous to the household may directly and indirectly affect several types of

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<sup>1</sup>The probability of survival to a given age equals the product of the survival probabilities to all earlier ages. Hence there is a cumulative effect at the later ages during a general mortality decline. O'Hara (1972) discusses the implications of this phenomenon for fertility behavior.

family behavior, so a policy change such as restricting the scope of child labor may affect many wages and prices, thereby creating unintended indirect effects in many regions and sectors of the economy.

The research proposed in this report is logically prior to investigations into the power of particular policy instruments to achieve intended effects on variables in the household's environment. The first task is to identify those variables exogenous to family activities that are empirically important in constraining a specific aspect of individual behavior. Subsequently, research must seek mixes of public programs that will change these variables in directions deemed socially desirable and with the least deleterious side effects.

#### IV. INFORMATION STRATEGIES FOR IMPROVING POPULATION POLICY

##### INTRODUCTION

The approach to family behavior summarized in Section II (pp. 7-11), although in an early stage of development, has far overreached the power of existing data to confirm or deny its predictions. While existing information generated by censuses and public programs relating to family planning, health, and schools can help to identify the environmental factors that affect specific aspects of family behavior, some important kinds of information are not provided by these sources.<sup>1</sup> For example, data that describe the characteristics of family members and how they currently use their time and other resources in market and nonmarket activities are needed to investigate how characteristics of individuals and combinations of exogenous influences affect the way different families satisfy their wants. These data should illuminate the behavioral responses of families to current changes in their environment.

Data are also needed to describe changes in families' behavior over their life cycle -- to identify systematic differences in their activities at different stages and to relate these differences to changes in particular exogenous variables. Since past production of human and physical capital yields future streams of income or satisfaction and thereby influences a family's current behavior, household survey data should include information on families' past and current investment activities, particularly those, like schooling, that produce human capital.

In addition, we need information about exogenous variables that influence family choices and may be influenced by public policies. Some of these data are not specific to individual families and should therefore be generated by public programs or community observation.

In the remainder of this section, I describe in more detail the needed survey information on the characteristics and operation of families

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<sup>1</sup>Brown (1971) offers valuable perspectives on survey data needs for social science policy research in low income countries.

and their life-cycle behavior, turning then to data on exogenous variables subject to policy influence. Finally, I indicate ways in which existing data from censuses and public programs can supplement the information gained in independent surveys.

#### ECONOMIC-DEMOGRAPHIC SAMPLE SURVEY DATA

The prototype survey instrument in the appendix details the information needed to distinguish which of the hypothesized links among family activities empirically influence the effectiveness of public programs. Eight categories of information are distinguished.

1. Family roster indicating the basic characteristics of all persons residing in the household. This information establishes the age, sex, marital status, and fertility of all residents and reveals which of them should be interviewed separately.
2. Complete marriage and pregnancy histories of all ever-married women and other women with births.
3. Knowledge and practice of family planning. These data are useful in investigating the characteristics of family members and the combinations of policy and other exogenous factors associated with knowledge and use of different family planning methods.
4. Each household member's employment and income history. Information on the occupation, earnings, and hours of work of employed persons is recorded for the present, for three years ago, and for the year before last marriage. The survey also contains data on detailed sources of family income for the same three periods. Finally, each member's time periods in the labor force since his first job are indicated.
5. Current and past investments in human capital. These include data on the nutrition, health, schooling, and migration activities of household members at time of interview, three years ago, and, where applicable, in the year before current marriage.
6. Current and past investments in nonhuman capital. These data indicate the stock of producer and consumer durables used in specific household production activities in the same three time periods.

7. Current expenditures on nondurable consumption items. A record is needed of food, clothing, recreation goods, and other items consumed by the household, and, if purchased in the market, their prices. When combined with the record of family members' time allocation and estimates of the services yielded by producer and consumer durables, these data may reveal much about the interactions among family consumption and investment activities.

8. The uses of each family member's time. The survey records the amount of time each person recently spent in farming, cottage industry, school, cooking, child care, cleaning house, improving house or land, eating, leisure, sleeping, or working in the labor market. It also indicates the amount of time outsiders contributed to the household.

#### INFORMATION ON EXOGENOUS FACTORS, INCLUDING POLICY VARIABLES

Although the survey data described above are critically needed, they alone cannot identify the variables in families' environment that are important to policymakers. Background information on many of these exogenous variables is also needed. Knowledge about these factors is crucial for estimation of reduced form equations and calculation of final form relationships, both of which indicate the total effects of predetermined factors on endogenous family behavior. As in the case of survey information on endogenous family activities, the culture and public and private institutions of the society surveyed will influence what data are appropriate and how they should be obtained. In the interest of completeness, however, I have compiled the following list to suggest information that may be useful in investigating the hypotheses of Section III.

1. Family Planning. In order to assess the relative productivity of various family planning inputs, we must know the number of personnel of each type in the local centers and how much time each type typically spends in various program-related activities. To assess the effectiveness of alternative organizational forms, we should know the number of supervisors, the kinds and amounts of incentives offered to different

types of staff, and the incentives offered to program participants. Finally, information on the kinds of family planning services and materials supplied and on the program's advertising methods and expenditures should be recorded.

2. Public health. Prices of specific types of medical personnel and services, as well as the traveling and waiting time required of their users, should be recorded. The existence of public water and sanitation services and of medical or health training programs should also be noted.

3. Education. Number of school places, number of teachers per 100 children of school age, and population density may be good indicators of school availability. Average teacher salary, average level of schooling of teachers, or public expenditures per student may suggest the quality of local schools. Attendance regulations and their enforcement should also be studied. Differences in the school courses offered to boys and girls may create differences in their productivity in various home and market production activities as adults; such course differences should be noted. The presence of any public adult training efforts, such as agricultural extension programs, should be noted.

4. Investment and insurance. What are the relevant parameters of available social security programs and insurance on life, health, and property? What is the nominal rate of return on widely available financial assets, such as government savings bonds? What is the rate of inflation?

5. Manpower. Any legal restrictions on hiring or promoting women or children should be noted. Alternative measures of unemployment should be recorded as should the existence of any employment information programs or public subsidies to encourage migration. Average wages by education groups and for well-defined occupations should be collected by the sample survey.

6. Prices. It is important to note the provisions of agricultural price policies and import-substitution policies. Both of these may affect the relative prices of goods produced and sold at home by

families. If so, changes in these policies might induce changes in individuals' home and market behavior.

7. Other exogenous factors. Length of growing season, average rainfall, and type of soil should be recorded.

Although some of these exogenous factors vary from community to community, others, such as import-substitution policies and social security programs, may be the same throughout the country surveyed. Information on all of them should of course be gathered in ways that do not jeopardize the continuing support of public officials for the survey effort.

#### MAKING BETTER USE OF EXISTING DATA

Much of the information described above is not generally collected in LDCs. Some of it, however, could be obtained by appropriate additions to standard survey instruments. Other parts might be culled from existing survey data or generated in family planning, health, and education programs. Data collected in national censuses, for example, may be particularly useful for measuring community exogenous variables such as unemployment rates, school availability, and public health and sanitation. In addition, governments should be strongly encouraged to consolidate a 1 percent or 0.1 percent sample of household data from their national censuses, as the Philippine government did with its 1960 census. These household observations may by themselves be valuable research inputs; at the least, they could provide prior observations on some of the variables included in subsequent special surveys, thereby facilitating study of families' life cycle behavior.

Information generated in family planning programs and other public services should be linked to data obtained from independent surveys of randomly selected households, but program information is no substitute for these independent data. The problem with program information is not necessarily that it is too aggregated or not sufficiently extensive -- it may consist of many questions asked in reference to individual families -- but rather that the sample excludes

important segments of the population.<sup>1</sup> In family planning programs, for example, the sample of participants excludes couples who either have no knowledge of the service or for whatever reason feel they do not need it. Such a sample is likely to be biased with respect to some important explanatory variables. Alternatively, independent survey data include control observations, which facilitate estimation of behavioral relationships in the absence of program inputs. Without knowledge of these independent effects, excessive explanatory power may, as indicated in Section II, be attributed to the family planning program.

Considerable research on economic and demographic development has relied on data aggregated to the regional or national level. Aggregate capital-labor ratios, saving rates, crude birth rates, dependency ratios, and others have served a generation of national planners. I have argued here that economic development is the aggregate result of behavioral responses of individuals, and that we know but little of the intra-family interactions that condition these responses. Rather than seeking meaningful regularities among national aggregates, it therefore makes sense to identify systematic responses of individuals to changes in their environment and then to calculate aggregate responses on the basis of these micro-estimates. Much of the individual variation that produces systematic relationships important to policy may be lost in the process of data aggregation.<sup>2</sup>

Of course, the appropriate survey data described above and in the appendix may be difficult to collect. Seasonality is a particularly important problem since much of the needed information concerns allocation of time or expenditure of money during a recent period. In families that adjust their activities to planting and harvest cycles

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<sup>1</sup>Koehler (1970) illustrates the need for nonprogram data in the Philippines by comparing knowledge and use of contraceptive methods in a national sample.

<sup>2</sup>Orcutt (1962) has forcefully made this last point as part of a comprehensive brief for the formulation and testing of micro-models of economies. The classic and still essential analysis of estimation and inference problems associated with data aggregation is Theil (1965).

or the school year, there may not be a typical or average week about which to ask questions.<sup>1</sup> A solution here may be to administer the seasonally sensitive parts of the survey to the same panel of families at two or three times during the year. Alternatively, families might be asked retrospective questions referring to their activities during particular important periods.<sup>2</sup> The accurate reporting of systematic seasonal variations in behavior will be influenced in particular cases by the sources of these variations, available survey funds, and various social and institutional constraints.

Accounting for seasonality may complicate what is already a difficult survey task. Collecting accurate information on family members' time allocation and expenditures, for example, may require intensive interviewing and observing. Fortunately, the resources required for intensive surveying might be more than offset by the smaller sample size that is required when both the sample and the questions are carefully selected to conform to the requirements of a specific empirical model.

Finally, household survey data should always be placed in the public domain as quickly as possible. The same body of data can often serve many research purposes, and there is little justification for restricting cooperation and competition among them. Prompt release of survey data will enable policymakers to benefit from the insights of researchers asking a variety of questions relevant to public policy and using different conceptual approaches.

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<sup>1</sup>Using Egyptian household survey data on daily hours worked by rural people in agriculture and the labor market, Hansen (1969) demonstrates great seasonality in hours worked in the market. The average range of hours worked in the market during eight days ranges from 58 (June) to 40 (January) for men, 25 (September) to 16 (February) for women, and 35 (June) to 16 (December-January) for children.

<sup>2</sup>A recent study of East Pakistan suggests that retrospective pregnancy data may be more accurate than commonly assumed. See Schultz and DaVanzo (1970).

## V. CONCLUSIONS

Public policies to stimulate economic and demographic change in less developed countries have frequently produced disappointing results. The process of economic development, which these policies are intended to speed, is intricately bound up with changing patterns of time allocation and resource use in families. Our ignorance of these patterns stands in the way of identifying those particular factors in families' environments that public policies must influence in order to change the behavior of individuals in directions deemed socially desirable. This report has argued that policymakers' ignorance of these patterns is an important cause of disappointments in economic and demographic development.

This study has stressed two fundamental reasons for our ignorance: (1) common conceptual models of family behavior and techniques of statistical inference are too primitive to identify which of the links among different forms of family behavior are quantitatively important influences on the success of government programs, and (2) available data are poorly suited to the analysis of this problem, even if the proper tools are applied. I have therefore suggested a conceptual model of family behavior, appropriate statistical techniques, and necessary data required to study this causal chain linking many public policies through the family to national objectives.

I first summarize a conceptual approach to modeling household economic and demographic behavior that has yielded refutable hypotheses about the effects on individuals' behavior of changes in their environment. This approach treats households as units that both produce and consume what they want. They react to changing external conditions by altering the amounts of their members' time and other resources used in producing commodities such as good health, schooling, farm produce, and children. Complex interdependencies exist among these activities, causing a specific change in the family's environment to have indirect influences on a host of production activities, many of which are not oriented to the market, and to influence what many members of the household do with their time and resources.

This approach suggests the importance of distinguishing among three types of variables: jointly determined endogenous, predetermined endogenous, and exogenous. Using an illustrative model of family contraceptive and fertility behavior, I demonstrated several ways in which improper techniques of statistical estimation and inference ignore the important distinctions among these three classes of variables and hence produce misleading policy prescriptions. A review of appropriate estimation techniques suggested four guidelines for making statistical inferences about family behavior.

1. If the particular behavior of interest is an integral part of a larger behavioral system (such as a family), account as well as possible, in both model specification and statistical estimation and inference, for resulting interactions.

2. For the end of a causal chain, seek variables that are probably closely linked to public policy choices.

3. Let the relevance and measurement accuracy of the data guide the choice of estimation procedure and the confidence attached to specific estimates.

4. Employ estimation procedures that best serve the goals of the first three guidelines. Simple two-way tables and correlations are rarely among these methods. Investigate the direction and magnitude of remaining biases and use this information to assess the accuracy of the estimates.

Explicit consideration of families' possibilities for substitution in the production and consumption of its commodities has suggested a variety of hypotheses about the responses of individuals to changes in their immediate environment. Eleven sets of hypotheses are stated here along with summaries of their derivation from the model's basic properties. Each hypothesis predicts particular behavioral responses to specific changes in families' surroundings.

Although the conceptual approach that has yielded these hypotheses is only in an early stage of development, it has clearly overreached the power of existing data to confirm or deny its predictions. Further

progress in identifying the particular interactions among family activities that influence the success of public policies therefore awaits the collection of appropriate data. The essential characteristics of these data are suggested by the model's properties.

1. Data should describe the characteristics of family members and how they spend their time and other resources in market and nonmarket activities.

2. They should describe changes in families' behavior over their life cycle, particularly their past and present production of human and physical capital.

3. They should quantify relevant factors in the family's environment and link to program information obtained by the responsible administrative unit in which the family lives.

Because in aggregation most census data lose much individual variation required to investigate the hypotheses adequately, and because information generated within the context of particular public programs is usually obtained only for population samples that are biased in important respects, the collection of new household survey data independent of program activities appears valuable. Accordingly, the appendix details the information required to improve our understanding of the family's behavior and advance our competence to evaluate the success of public policies that operate through their impacts on inter-related aspects of family formation and subsequent behavior.

With improved data and proper estimation techniques, researchers can more efficiently pick the particular exogenous variables in families' surroundings that affect important facets of individual behavior. Subsequent research must seek the mix of public programs that will change these variables in directions deemed socially desirable and with the least deleterious side effects.



Appendix

A PROTOTYPE HOUSEHOLD SURVEY INSTRUMENT FOR USE IN  
LOW INCOME COUNTRIES

This prototype household survey instrument consists of eight sections corresponding to the text discussion (pp. 41-42) of eight categories of survey data required to test the hypotheses in Section III. The only purpose of this instrument is to describe these data needs in detail. Some of the information detailed here will be difficult to collect. Many problems relating to specific kinds of survey information have been discussed in the professional literature and must be squarely faced in the process of drafting an actual survey instrument for use in a particular society. For the purposes of this study, however, it has not been necessary to consider these important matters or to phrase and order the questions in appropriate ways.

FAMILY ROSTER

Please furnish the following information concerning your family. [Ask head of household; verify with head's wife]

Line No.	Name of all persons usually residing in this household including those temporarily absent.	Relation-ship to head of household	Sex		Date of Birth		Age Completed (years)	Current Marital Status 1-Regular Married 2-Consensual Married 3-Divorced 4-Living Apart 5-Not Now Married 6-Never Married	Year of Most Recent Marriage	For All Women With Births All Children				Residency Status		
			M	F	Year	Month				Still Alive		Ever-Born		Temporarily Absent	Visitor	
										Sons	Daught.	Sons	Daught.			
1		Head														
2		Spouse														
3																
4																

**MARRIAGE HISTORY**

Please furnish the following information concerning your marriage history.  
[Ask all ever-married women]

No. of Marriage	Date of Marriage		Age at Marriage (Completed Years)	Date Marriage Ended		Reason Marriage Ended		
	Month	Year		Month	Year	Divorce	Death	Separation
First								
Second								
Third								
Fourth								

**PREGNANCY HISTORY**

Please furnish the following information concerning your pregnancy and fertility history.  
 [Ask all ever-married women and other women with births]

Details	First Woman							
(a) Age of women and year of most recent marriage if ever married								
(b) Is the husband alive?								
(c) If not alive, year of death								
(d) No. of pregnancies including current (Register multiple births as additional pregnancies)	Live birth, still birth, miscarriage, abortion, etc.	Sex of the child M or F	Date of Birth		Age of complete weaning	Alive or dead; if not alive date of fetal loss or death	Cause of loss or death	Is the child living with family or not?
			Month	Year				
First								
Second								
Third								
Fourth								
Fifth								
Sixth								
Seventh								
Eighth								
Ninth								
Tenth								

KNOWLEDGE AND PRACTICE OF FAMILY PLANNING

[Ask all ever-married women and other women with births]

Now we want to ask about families and their welfare. For example, in your case do you expect to have any (more) children?

Wants more \_\_\_\_\_ Uncertain \_\_\_\_\_ Does not want any more \_\_\_\_\_

[IF WANTS MORE, ASK:]

How many more do you expect to have?

\_\_\_\_\_ More children  
Number

Among these children, how many boys and how many girls would you like to have?

\_\_\_\_\_ More boys  
Number

\_\_\_\_\_ More girls  
Number

\_\_\_\_\_ No preference

Are your children helpful to you in earning a living? \_\_\_\_\_  
Boys only? \_\_\_\_\_  
Girls only? \_\_\_\_\_

Do you expect them to support you in your old age? \_\_\_\_\_  
Boys only? \_\_\_\_\_  
Girls only? \_\_\_\_\_

A. Do you know about any methods that are used by couples to delay or prevent pregnancy?

Yes \_\_\_ No \_\_\_

[ IF YES, ASK: ]

What methods have you heard about?

B. Here are some additional methods married couples use to delay or prevent a pregnancy. Which ones have you heard about?

C. Have you just heard of these methods or do you know how they are used?

Method	Answer to A	Answer to B	Answer to C
Abstinence or living apart			
Rhythm (safe period)			
Withdrawal			
Douche			
Breast feeding			
Condom			
Diaphragm			
Foam			
Jelly or Cream			
Suppositories			
Tampon or sponge			
IUD (Loop)			
Pill			
Injection			
Male Sterilization (Vasectomy)			
Female Sterilization (Tubal Ligation)			
Others			

Have you heard anything about any specific method of family planning from

Friends or relatives?	Yes	___	No	___
Family planning workers?	Yes	___	No	___
A doctor?	Yes	___	No	___
A pharmacy?	Yes	___	No	___
Other medical personnel?	Yes	___	No	___
A teacher?	Yes	___	No	___
Newspapers, magazines?	Yes	___	No	___

Is there anyone among your friends, neighbors, or relatives of your age doing something to delay or prevent a pregnancy?

Yes \_\_\_ No \_\_\_ Don't know \_\_\_

[IF YES, ASK:]

How many would you say are doing something to delay or prevent a pregnancy?

more than half? \_\_\_  
less than half but more than 10%? \_\_\_  
less than 10%? \_\_\_

Would you personally like to learn more about specific methods to delay or prevent a pregnancy?

Yes \_\_\_ No \_\_\_

Have you and your husband ever used any one of the methods we have talked about to plan the spacing or to limit the number of your children?

Yes \_\_\_ No \_\_\_

What was the first method you and your husband ever used? What was the second? the third? any other?

First Method \_\_\_\_\_  
Second Method \_\_\_\_\_  
Third Method \_\_\_\_\_  
Fourth Method \_\_\_\_\_  
Fifth Method \_\_\_\_\_

When did you start using the first method? Was it right after marriage, before the first pregnancy, or after which pregnancy was it?

Right after marriage \_\_\_\_\_  
Before the first pregnancy \_\_\_\_\_  
After first, second, etc. pregnancy \_\_\_\_\_

Are you currently using a method?

Yes \_\_\_ No \_\_\_ No, currently pregnant \_\_\_

[IF NO, ASK:]

Have you used any method since your last pregnancy?

Yes \_\_\_ No \_\_\_

What method is that? \_\_\_\_\_

Is there any other method that you are using now?

Yes \_\_\_ No \_\_\_

[IF YES, ASK:]

What methods are you using?

\_\_\_\_\_  
\_\_\_\_\_

Is there any other method that you have used since your last pregnancy?

Yes \_\_\_ No \_\_\_

[IF YES, ASK:]

What methods have you used?

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If the respondent is not currently using any contraceptive method or has never had an operation to keep from becoming pregnant, ask the following:

Do you expect to use any of the methods we talked about sometime in the future?

Yes \_\_\_ Uncertain \_\_\_ No \_\_\_

[IF YES, ASK:]

How many (more) children do you think you will have before you start using contraception?

Number \_\_\_\_\_

Expect to begin right away \_\_\_\_\_

Some women have something done, either by a doctor, a midwife, or some other way to end a pregnancy early. Has this ever been the case with you?

Yes \_\_\_ No \_\_\_

[IF YES, ASK:]

Which pregnancy did you end early?

---

Did you end any other pregnancy early?

Yes \_\_\_ No \_\_\_

Which one? \_\_\_\_\_

[ IF YES, ASK: ]

Any other?

Yes \_\_\_\_ No \_\_\_\_

Which one? \_\_\_\_\_

[REPEAT QUESTION UNTIL RESPONSE IS "NO"]

**EMPLOYMENT AND INCOME**

Please furnish following information concerning the employment status of each member of your family:  
 [Ask of each head of family]

	Roster Line Numbers			
	1	2	3	4
1. If this person is currently employed:				
a) What is his wage or salary per hour/day/wk?				
b) How many months has he held this job?				
c) How many hours did he work last week?				
d) How many hours a week did he work on the average during the past month?				
2. If this person is currently unemployed:				
a) When was he last employed? (If looking for first job, report never)				
b) At what wage or salary per hour/day/wk?				
c) How many weeks has he been unemployed?				
d) How many weeks has he been looking for a job?				
3. If this person is employed, which of the following best describes his position?				
a) Employer or self-employed				
b) Employee, salary or wage				
c) Employee, on commission				
d) Employee of family enterprise, for pay				
e) Employee of family enterprise, without pay				
f) Temporary or seasonal employee				
g) Other, specify				
4. If this person is employed, what type of industry does he work in?				
a) Agricultural				
b) Mining				
c) Construction				
d) Fishing or forestry				
e) Manufacturing				
f) Clerical services				
g) Domestic services				
h) Professional; doctor, lawyer, accountant				
i) Other, specify				

	Roster Line Numbers							
	1		2		3		4	
5. Was this person employed 3 years ago?								
a) If so, which category in question 3 best described his position?								
b) Which industry listed in Question 4 did he work in?								
c) What was his wage or salary per hour/day/week?								
6. Was this person employed in the year before his present marriage? (Ask about ever-married persons only.)								
a) If so, which category in question 3 best described his position?								
b) Which industry listed in question 4 did he work in?								
c) What was his wage or salary per hour/day/week?								
7. Since his first job, please identify the periods in which he has been in and out of the labor force?								
	Date In	Date Out	Date In	Date Out	Date In	Date Out	Date In	Date Out
1st period in labor force								
2nd period in labor force								
3rd period in labor force								
etc.								

Please give following details concerning your family income last year. [Ask each head of family]

Total Annual Income Derived From:	This Year	3 Years Ago	Year Before Present Marriage
Salary or wages of all family members:			
a) in money; include bonuses, tips			
b) in kind; imputed value of			
Net income from sale of farm-produced commodities:			
a) Crops			
b) Livestock			
c) Other, specify			
Net income from sale of nonagricultural home-produced goods			
Net income from nonagricultural family-owned enterprise			
Pensions			
Net Rent			
Dividends on shares			
Gifts:			
money			
food			
other, specify			
Interest on deposits, securities, etc.			
Interest on lendings			
Regular remittances from relatives or friends			
Public assistance			
Other			
<b>TOTAL NET INCOME</b>			

**HUMAN CAPITAL**

Please furnish following information concerning your family's health status:  
[Ask ever-married women concerning their family members]

	Roster Line Numbers			
	1	2	3	4
No. of visits with a doctor during past year?				
No. of visits with a nurse during past year?				
No. of visits with other medical person during past year?				
Has this person ever had a major operation? Yes or No				
Does this person have impaired hearing or sight?				
Is this person currently suffering from a prolonged illness? Yes or No				
(If yes, specify)				
Does this illness restrict person's ability to work on a job?				
Does this illness restrict person's ability to work at household tasks?				
Has this person ever been treated by medically trained personnel for this illness?				
If yes, how often during past year?				

[Ask all women with births]

At about what age (months) did you begin weaning most of your children?

At about what age (months) were they completely weaned?

During weaning what kind of milk did you feed your children:

- (a) Cow
- (b) Buffalo
- (c) Goat
- (d) Other -- specify
- (e) Processed -- dry skim
- (f) Processed -- dry whole
- (g) Processed -- evaporated

How many feedings did your children receive per day at the time they were completely weaned?

Did you give the child after weaning any special foods or juices that are not in the family's regular diet?

If yes, what?

How often per month did your weaned children less than seven years of age receive:

- (a) Milk
- (b) Gruels and cereals
- (c) Vegetables
- (d) Fruits
- (e) Meat, fish or fowl
- (f) Eggs
- (g) Pulses

When you were pregnant did you avoid any special foods? \_\_\_\_\_  
If yes, what foods? \_\_\_\_\_

When you were pregnant did you eat any special foods or supplements not in the family's regular diet? \_\_\_\_\_ If yes, what foods or supplements? \_\_\_\_\_

When you were lactating did you avoid any special foods? \_\_\_\_\_  
If yes, what foods? \_\_\_\_\_

When you were lactating did you eat any special foods or supplements not in the family's regular diet? \_\_\_\_\_ If yes, what foods or supplements? \_\_\_\_\_

[Ask head of household]

How many rooms are there in your dwelling unit? \_\_\_\_\_

Is running water available? yes \_\_\_\_\_  
no \_\_\_\_\_

If yes, is water supply  
within the dwelling unit \_\_\_\_\_  
within the building \_\_\_\_\_

If no, is water taken from  
cistern \_\_\_\_\_  
artesian well \_\_\_\_\_  
river, ravine, or spring \_\_\_\_\_  
public fountain \_\_\_\_\_  
other \_\_\_\_\_

Are there toilet facilities  
within the dwelling unit  
private \_\_\_\_\_  
shared \_\_\_\_\_  
  
within the building  
private \_\_\_\_\_  
shared \_\_\_\_\_  
  
outside the building  
private \_\_\_\_\_  
shared \_\_\_\_\_

Is there a latrine  
within the dwelling unit  
private \_\_\_\_\_  
shared \_\_\_\_\_  
  
within the building  
private \_\_\_\_\_  
shared \_\_\_\_\_  
  
outside the building  
private \_\_\_\_\_  
shared \_\_\_\_\_

Please furnish the following information concerning education received by members of your family.  
 [Ask heads of families]

	Roster Line Numbers			
	1	2	3	4
Years of primary school completed				
Years of secondary school completed				
Years of vocational school completed				
Years of university education completed				
Number of days of school attendance in last full school year				
Years of schooling completed as of 3 years ago				
Years of schooling completed at time of present marriage				
Apprenticeship or on-the-job training: months of training and time since last training				
Professional training (doctor, lawyer, engineer, etc.): months of training and time since last training				
Military Service: months of service and time since last service				
Type of training received (other than Basic) during military service				

Have you or members of your family ever lived in a place other than this? If yes, please furnish the following information for each move. [Ask heads of families]

	Move 1	Move 2
Place of origin		
Place of destination		
Distance of move		
Date of move		
Family members making move (Give Roster Line Numbers)		
Method of transportation		
Reason for move (indicate priority if multiple reasons given)		
to be near relatives or friends		
to get married		
to attend school		
to retire		
for health reasons		
for military service		
seasonal or temporary move		
to take permanent new job		
to look for new job		
if so, how long unemployed before move		
how long unemployed after move		
job transfer		
other (specify)		
Wage, salary or estimated earnings before move		
Wage, salary or estimated earnings after move		



Please furnish following information about your business investments. [Ask each head of family]

	Amount Now Owned	Amount Owned 3 Years Ago	Amount Owned in Year Before Present Marriage	Amount Purchased or Inherited in Past Year	Value of Purchases or Inheritance in Past Year	Amount Sold in Past Year	Value of Sales in Past Year
If you or any member of your family have owned, purchased, or sold any land, please give amount and value of land involved.							
If you or any member of your family have owned, purchased, or sold any equipment, please give number and value of items involved: Buildings, other than family dwelling Tractor Machinery Tools, i.e., plough, cart, drill Other, specify							
If you or any member of your family have owned, purchased, or sold any livestock, please give number and value of livestock involved: Bullocks Horses Cattle Fishery Hogs Poultry Beekeeping Other, specify							

Please furnish following information about your agricultural purchases.  
 [Ask each head of family]

	Value of Purchases
Did you or any member of your family purchase any of the following items during the past year? If so, give total value of purchases.	
<u>Feed grain</u>	
<u>Seed</u>	
<u>Fertilizer</u>	
<u>Manure</u>	
<u>Pesticides, insecticides     or fungicides</u>	
<u>Other agricultural     supplies</u>	

Please furnish following information concerning improvements made during past year:  
 [Ask each head of family]

Type of Improvement	Total Cost of Material	Hired Labor		Family Labor Days Worked
		Days Worked	Wage Paid	
Fencing				
Dwelling				
Reclamation of land				
Building additions				
Others, specify				

Please answer the following questions concerning your financial assets:  
 [Ask each head of family]

	Value at Present Date	Value Three Years Ago	Value in Year Before Present Marriage	Purchase Value of Additions During Past Year	Sale Value of Subtractions During Past Year
Have you or any member of your family had deposits in any of the following institutions? If so, give value of deposits.					
Commercial Bank					
Cooperative Bank					
With money-lenders or traders					
Other, specify					
Have you or any member of your family purchased or owned any of the following assets? If so, give market value.					
Shares of stock in company					
Shares of stock in cooperative					
Government securities					
Gold, silver, jewelry					
Other, specify					
Have you or any member of your family owned any life insurance policies?					
a) If so, what is total face value					
b) What are total annual premium payments					

Please furnish following information on your debts. [Ask all heads of families]

What is the total amount of your present debt? \_\_\_\_\_

What was the total amount of your debt three years ago?

\_\_\_\_\_

What was the total amount of your debt in the year before your present marriage? \_\_\_\_\_

EXPENDITURES

How much did your household spend during the past week on the following items? [Ask head of household or his wife]

Food Items	Purchased In Market		Home Produced
	Qty.	Price	Qty.
Rice			
Wheat			
Maize			
Pulses			
Edible oils			
Milk			
Milk products			
Sugar			
Spices			
Vegetables			
Fruits			
Meat			
Fish			
Eggs			
Beverages			
Intoxicants			
Cigarettes			
Others (specify)			
Total food items			

How much did your household spend during the past week (month)  
on the following items? [Ask head of household or his wife]

Nonfood Items	Amount Spent Last Week
Fuel and lighting	
Clothing	
Footwear	
Toiletry	
Education (including purchase of books, stationery, etc.)	
Medical services	
Medicines	
Services (barbers, priests, lawyers)	
Domestic servants	
Travel	
Entertainment	
House rent	
Total nonfood items	
Marriages	
Religious functions	
Funerals	
Total of others	

TIME ALLOCATION

Please furnish following information concerning your family's activities during the past week.  
 [Ask all ever-married females]

	Roster Line Numbers			
	1	2	3	4
How many hours during the past week did this family member work for pay outside the home?				
How many hours during the past week did this family member work for pay in the home?				
If this family member works outside the home, how many hours did he spend traveling to and from work last week?				
How many hours did this family member spend looking for work during the past week?				
How many hours did this family member work outside the household without pay during the past week (helping friends, relatives)?				
Approximately how many hours during the past week did this person spend performing the following activities at home?				
Sleeping				
Cooking meals				
Cleaning				
Shopping				
Repairs or improvements				
Child care (in home)				
Child care (outside home, i.e., transporting children to school, hospital, etc.)				
Cottage production				
Farm work				
Leisure				
Recreation				
Other, specify				

Please furnish following information. [Ask wife of head of household]

Did you employ anyone last week to perform any of the following duties in your home? Is so, how many hours did they work?	
Cooking	
Cleaning	
Shopping	
Repairs or improvements	
Child care in home	
Child care outside home	
Other, specify	
How many weeks last year did you employ someone to perform these duties?	
How much did you pay for this help?	
In money (weekly or daily)	
In food or kind	
In room and board	
Other	
Did any friends or relatives living outside your household perform any of the following activities in your home during the past week without pay? If so, how many hours did they work?	
Cooking	
Cleaning	
Shopping	
Repairs or improvements	
Child care in home	
Child care outside home	
Other, specify	
During the past year did any friends or relatives living outside your household provide temporary help during a period of emergency (death or illness)? If so, how many hours?	

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