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FERTILITY AND ECONOMIC BEHAVIOR OF FAMILIES IN THE PHILIPPINES

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PREFACE

This study is one of four population "country studies" undertaken at The Rand Corporation under the sponsorship of the U.S. Agency for International Development (CSD-2151). The primary objective of the project is to obtain a comprehensive analysis of determinants and consequences of human fertility patterns, with broad reference to the formulation of AID policy in less-developed countries. In addition to the Philippines, analysis has been undertaken on East Pakistan, Puerto Rico, and Taiwan.¹

This Memorandum reports the results of the analysis of families in the Philippines. It is based on data described in the Appendix. The main emphasis of the study is on the socio-economic influences on fertility and the interrelated effects of parents' fertility behavior on their economic activity and well-being. By estimating the desired size of Filipino families, the impact of the current use of contraceptives and of family planning programs can be measured in the future. With this information, cost-effective strategies for reducing population growth may be revealed. The research reported here is intended as a first step toward this objective.

The author would like to acknowledge with gratitude the cooperation of Dr. Mercedes B. Concepción, Director of the Population Institute of the University of the Philippines, and Dr. Tito A. Mijares, Director of the Bureau of the Census and Statistics, in making available to Rand the 1968 National Demographic Survey data tapes that provided the basis for the variables employed in this study. Also, Dr. Concepción's suggestions and comments on the preliminary research, as well as those of Dr. Thomas Hollingsworth (UNDP) and Dr. William Stinner (Visiting

¹See T. Paul Schultz and Julie DaVanzo, Analysis of Demographic Change in East Pakistan: A Study of Retrospective Survey Data, R-564-AID, October 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; and T. Paul Schultz, The Evaluation of Family Planning in Taiwan, (forthcoming).

Lecturer, Population Institute), were of considerable help. Rand colleagues Paul Schultz, Frank Sloan, Peter Morrison, John Koehler, and Susan Henrichsen, and consultant Richard R. Nelson, were very generous with their ideas and constructive criticism. The study also benefited from a recently completed study of the Philippines performed by members of the Rand research staff under AID sponsorship.¹ Julie DaVanzo, John Enns, Susan Henrichsen, and David Weinschrott provided valuable research assistance at various stages in the empirical analysis. The author, of course, remains responsible for any remaining errors.

¹See H. A. Averch, F. H. Denton, and J. E. Koehler, A Crisis of Ambiguity: Political and Economic Development in the Philippines, The Rand Corporation, R-473-AID, January 1970.

SUMMARY

Fundamental questions bearing on the prognosis of population growth for a country include the size of family sought by married couples and the effectiveness with which they prevent unwanted births. If the desired family size is small and birth control is effective, population growth will be modest. There are other important questions as, for example, such phenomena as the extent and rate of growth (decline) of illegitimacy (and its impact on the desired family size of those who subsequently marry) and the patterns of child and maternal mortality. For most nations, however, fertility of married couples is a major consideration in determining population growth rates and trends.

The empirical analysis in this Memorandum deals with the fertility of families in the Republic of the Philippines. The approach is based on a characterization of family behavior that explicitly takes into account interactions between fertility and other activities engaged in by the parents. It represents an attempt to capture indirect as well as direct consequences of the various policies that may affect population growth. Even with the accurate measures of the costs of the various policy options available, it is only with knowledge of the full impact (direct and indirect) of these policies that an accurate cost-effectiveness appraisal can be made.

Another feature of the analysis that merits specific comment is the disaggregated nature of the data. Most studies of the causes and consequences of population growth rely not only on statistical estimates of parameter values to derive inferences about the "cause" of fertility, but also on aggregate data by areas of a country to derive inferences about the behavior of families within those areas. It is thus desirable to investigate the extent to which models yielding insights into family behavior from aggregate data can be verified and further refined by analysis based on data for individual families.

The model employed in this research explicitly considers five areas of family activity -- marriage, fertility, labor force participation, income, and migration. Fertility behavior is viewed as a

process of successively reaching a family size goal and then maintaining the family size at that level. The family size that the parents seek is presumed to be related to the educational attainment of the parents as well as to alternative uses of the wife's time -- child rearing and labor force participation. Aside from cultural and religious influences, this size goal is also assumed to be related to the economic "costs and benefits" to the family of having children. On the other hand, maintenance of the size goal once it is achieved can be accomplished through some form of birth control and may require additional births if child mortality occurs.

Labor force participation by the parents should be related to the educational attainment of each; for the wife it will be related to responsibilities in the home (especially for care of young children) and to the financial well-being of the family without her assistance. Migration is an option for the family to increase its economic opportunities. The flow of income for the family will usually be related to labor force participation by each of the parents as well as to income earned by the children. A primary determinant of the income earned by the parents is the wage each can command; their education levels should reflect this attribute. Certain occupational scarcities may lead to "rents" for these occupational skills. The labor market conditions of the area in which the family lives should also help determine the prevailing wage and therefore have an effect on the income of the parents.

The determinants of age of marriage and of migration flows are not investigated in great detail in this study. The woman's age at first marriage is analyzed in terms of her education level and her labor force activity before marriage, among other variables. The recent rural to urban migration component of total migration of the husbands is investigated by considering their education and labor force participation prior to the move, their ages, and the average income differential between the area of past residence and the area to which each moved.

This model is analyzed using variables generated from the National Demographic Survey of the Philippines conducted in May 1968.¹ The variables used in this analysis are given only brief titles in the text of this Memorandum; their derivation from the survey measures is described in the Appendix. Despite any weaknesses of these retrospective histories and the variables calculated from them, the data are felt to be adequate overall to the task of providing insights into the interrelationships between economic activity and fertility as depicted by the model.

The investigation of fertility determinants was carried out in greatest detail in this report. The structure of the fertility equation should probably portray the determinants of fertility entering in a non-linear fashion; however linear structures have actually been explored. The time tradeoff between child rearing and labor force participation seems to be more of a short-term phenomenon associated with the younger age groups (presumably with quite young children). The educational attainment of the wife seems to be related to a lower family size goal, but the statistical significance of these negative coefficients is usually not very high. Additional births resulting from the "replacement" motivation appear to be sensitive not only to the family's own experience of the loss of a child (and especially to infant mortality), but also to its perceptions of the risk of child mortality in its community. Reported "use" of any method of birth control does not significantly lower fertility. That is, family sizes are not uniformly lower for families claiming to practice birth control, nor has recent fertility been reduced by such "use." It appears that either birth control methods are ineffectively practiced in the Philippines or responses to survey questions relating to this subject produce unreliable information.

¹ National Demographic Survey was a joint project of the Population Institute of the University of the Philippines and the Philippine Bureau of the Census and Statistics.

Labor force participation and income are each investigated separately for the husband and wife. Educational attainment is a significant influence in nearly all age groups for both participation and remuneration from such activity. Women who were still married in 1968 participated in the labor force to a significantly lower extent than those no longer married; likewise, men who were residing as members of a "subfamily," usually in the household of relatives, participated in the labor force at a significantly lower rate. A given level of educational attainment yields a higher income for older than for younger men, either because of relative scarcities of skilled workers between cohorts, or because of less experience for a given education level at a younger age. For approximately the same age, women receive less income per year of education than do men. Rural families earn lower annual incomes on the average than do urban ones.¹

Since model specification is at an early stage and the accuracy of the data and measurement of the variables are somewhat crude, the results mainly provide verification of the reasonableness of the framework and direction of the influences under investigation. One should not place too great reliance on the measurement of effects based on the values of coefficients. The microanalytic approach adopted in this analysis -- the investigation based on measurements for individual families -- has been important in confirming that this type of model, which has been employed in investigating aggregate data, is in fact an appropriate way of viewing family behavior. Well-designed retrospective surveys such as the one on which this analysis is based should be quite useful to further understanding of the causes and consequences of fertility in LDCs.

The framework for this analysis, which emphasizes the interaction between the various causes of fertility and the effects on the economic condition of the family, also allows one to trace through some of the

¹More complete summaries of the empirical results are presented at the ends of Sections IV and V; a review and discussion of some policy implications is presented in Section VI.

indirect influences of variables not usually associated with "population" policies. This is not to say that such indirect policies alone will have an important and short-term impact on population growth reduction. Rather, as programs of major proportions to reduce population growth are devised, strategies that shift away from immediate and large impact on population growth and toward longer-term objectives of both reduced population growth and further economic development will be quite desirable. A strategy of indirect as well as direct policies aimed at achieving reduced population growth may be most "cost-effective."

From the empirical results, for example, one can see that the effect of increased female education not only directly reduces desired family size but also raises age at first marriage and labor force participation, which indirectly reduce family size still further. Aside from the increased economic productivity that should result from increased education levels, education would probably also improve receptivity to the use of family planning techniques and increase the ability to use these techniques effectively.

In the Philippines in particular, where large families are quite common and recent practice of birth control has been ineffective, the most preferable policy strategy affecting population growth may be one that relies heavily on indirect policies. Such a strategy should encourage reduced family-size goals as well as include more direct policies of disseminating information about methods by which unwanted births can be prevented.

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I. INTRODUCTION

The reduction of population growth is considered by many to be an objective of the highest priority. As large-scale nationwide programs are designed, costs of the alternatives will have to be carefully weighed against the future benefit streams that are likely to result. To neglect this comparison is potentially to waste scarce resources. Take, for example, two programs of equal cost. One might exclusively affect population growth -- inducing a certain reduction in the population growth rate. The other might reduce population growth to a somewhat lesser degree, but also enhance economic opportunities of the many affected by the program. Aside from the moral issues involved, the choice between these programs should be based on our knowledge of the total net effect on the country from each of these benefit streams.

A fundamental premise of this Memorandum is that there is an added complexity to the choice of population policy design. A policy that is directed at one aspect of a family's behavior may have a longer term indirect impact on other aspects of that behavior, for there are interrelationships between the various activities that a family undertakes. As an example, a government's labor policy may encourage women to enter the labor force and increase the income of their families; the indirect effect of this may be that women may want smaller families so that they can enter the labor force sooner with fewer young dependents to care for in the home. There is unquestionably a need for more widespread information about birth control methods. But as governments move from policies of immediate and large impact to ones of sustainable levels of activity for long-term effects, less reliance on direct "population" policies may prove to be essential to the total strategy through which a government can encourage economic development.

To gain insights into the relative merits of the various options for policy affecting population growth, Section II presents a model characterizing some facets of a family's behavior. Data pertaining to families in the Republic of the Philippines are described in summary fashion in Section III. A unique feature of the empirical analyses

undertaken here is that the model is analyzed using data for individual families rather than for area aggregates as is usually the case. The attributes of individual behavior are often inferred from aggregate analyses, and these types of inferences can be checked directly through the analyses based on the individuals themselves. This is accomplished in Sections IV and V. Since different facets of a family's behavior are interrelated, simultaneous equation estimation techniques are used to obtain unbiased estimates of the direct and indirect impacts of various choices and circumstances affecting fertility and economic activity. The model and the analyses deal with the causes and consequences of fertility from the family's viewpoint, so the implications for overall population growth of the nation are not immediately discernible. The "causes" of fertility will also depend on the extent and rate of growth of illegitimacy (and its impact on the desired family size of those who subsequently marry) as well as on maternal mortality. Among the more important "consequences" not considered here are the social externalities of population growth. The final section of the Memorandum contains a review and discussion of the policy implications of this research.

II. A FRAMEWORK FOR VIEWING FAMILY BEHAVIOR

The five main sectors of family activity that I cover in the model are marriage, fertility, labor force participation, income, and migration. I will begin by structuring the interrelationships among family activities that influence fertility. This part of the model is based largely on the theoretical and empirical investigations of T. Paul Schultz.¹

SIMPLIFIED MODEL OF FAMILY SIZE

Figure 1 is a simplified scheme depicting the determinants and consequences of fertility patterns.² On the right, live births are categorized as "desired" or "unwanted." The unwanted characterization refers to a spectrum of attitudes -- perhaps a prepregnancy determination that the next child should not be closely spaced or perhaps the present family size is "large enough." In the desired category the parents' "desired family size" determines the number of these births.³ "Use of birth control" (which could include abortion as well as contraception) is the mechanism by which the "unwanted" births are prevented.

An unfortunate overtone of this terminology is that the desired family size appears to result from a conscious decision by the parents in every case. This need not be assumed for the model to remain relevant; the same incentives and constraints that would lead a family to a conscious decision will still affect its options and opportunities even if the parents are not consciously considering them. Also, from the standpoint of statistical inference, characteristics that are true of a group of families can be interpreted as the "tendencies" of individual families. Thus, the references to a "desired" birth or to

¹See, for example, his article, "An Economic Model of Fertility and Family Planning," Journal of Political Economy, Vol. 77, No. 2, March/April 1969.

²The titles for the influences considered in this figure are intentionally somewhat vague at this point so that the main features will be revealed. Figure 2 below identifies these determinants more specifically.

³I have abstracted from the sex distribution of births and surviving offspring in this analysis.

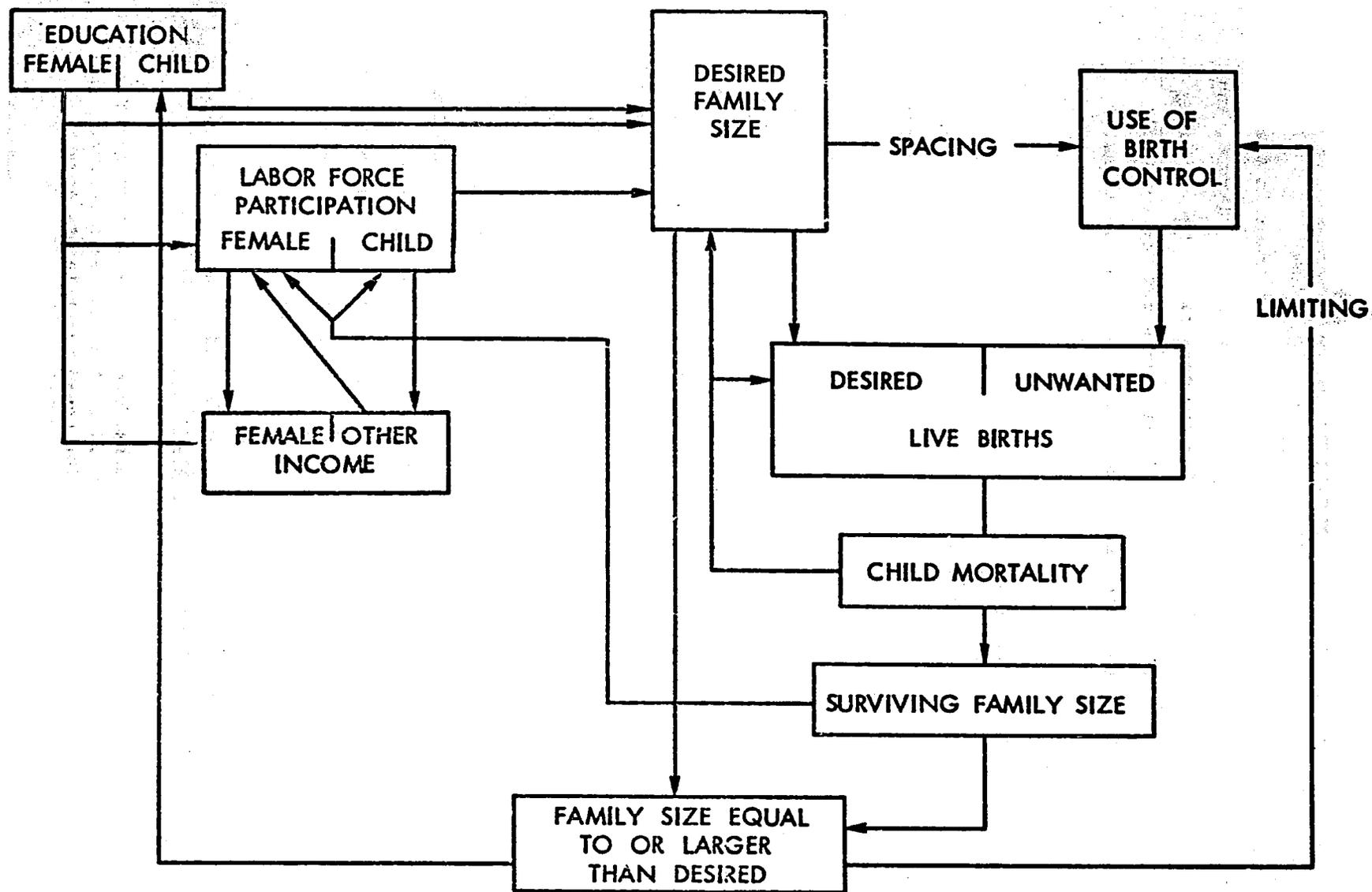


Fig. 1— Schematic fertility determinants

family "decisionmaking" are simply convenient terminology for the interdependent socio-economic influences that affect any family.

The diagram displays the fundamental hypothesis that the family -- specifically the wife -- has a number of options available. Decisions on labor force participation, for example, and those concerning a family-size objective are interdependent. Aside from cultural or religious influences, the "desired family-size" objective is related in this model to the education level of the parents, and to economic (as contrasted with child-rearing) pursuits of the wife, which provide additional options for the use of her time. To some extent it is presumed that the "costs and benefits" of having children also influence this objective. For example, school attendance for the children probably imposes additional costs on the family due to the need for special clothing or provisions and to the loss of additional unpaid help at home while the child is in school. Thus, requirements of school attendance might result in lower family-size objectives. On the other hand, labor force participation of children brings additional income into the family; if opportunities for such economic activities are great, the parents might deem a large family desirable.

Actual births, then, are determined by the interplay of the family-size objective and the ability to avert unwanted births. As mentioned above, "unwanted" births may be a temporary timing phenomenon before the parents' family-size objective is achieved, or all subsequent births may be "unwanted" if the size goal has been achieved and is maintained. Births may, therefore, be "unwanted" either because they result in the family exceeding its size goal, or because they are too closely spaced.

The only other feature in Fig. 1 affecting the desired family size is child mortality. The incidence of child mortality is presumed to have a direct bearing on later births through a "replacement" motivation. Such a loss by the individual family, as well as the experience of the local community with child mortality, may affect the uncertainty with which the family anticipates future child mortality

and may thereby also influence desired births indirectly. I will elaborate on this shortly.

The actual surviving family size, then, will affect the mother's ability to engage in economic activity. It will also provide additional potential contributors to the economic well-being of the family the children. Finally, after the parents achieve their family-size objective, they may find some form of birth control useful, or if menopause has not yet occurred, they may eventually find that education of some children will have to be curtailed so that they can contribute to the support of the family.

THE COMPLETE MODEL

This basic scheme is embedded in the more detailed environment¹ depicted in Fig. 2. Some of the policy options (as well as environmental factors) that affect the decisionmaking of the family are identified in general terms in the upper part of this diagram under the heading "exogenous variables." A few of the prior decisions or activities of the parents that may affect their current family-size decisions are also identified in the lower left hand section. The unshaded, lower right hand section contains the forces bearing on fertility decisions that were shown² in Fig. 1. The one new element affecting the parents' fertility behavior directly is their "length of marriage," represented by the arrow along the very bottom of the diagram. I will discuss the connection between the parents' marriage duration and the family-size goal under "Timing Considerations Concerning Fertility" below.

¹In an effort to simplify the graphic presentation, the interrelationships depicted in Fig. 2 abstract from influences of the husband. Thus, his education level is not mentioned, and his labor force and income contributions to the family are only indirectly represented as income from "other" sources.

²The overlapping of "prior" and "concurrent" for the education box is intended to emphasize that the woman's attained education level has already usually been achieved when the fertility decisions begin

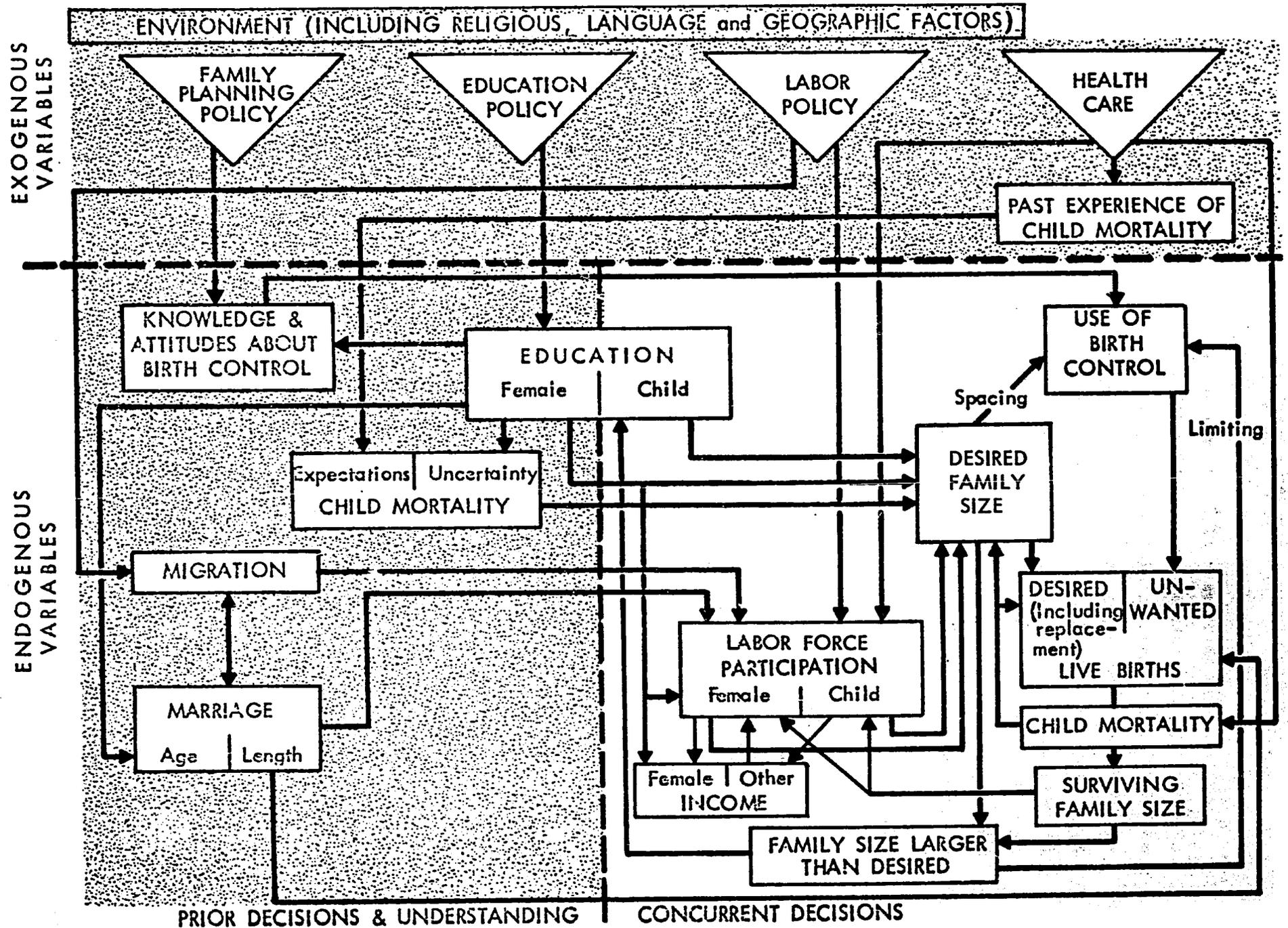


Fig.2—Environment surrounding fertility decisions

Of recurring interest throughout this Memorandum is the role of government policy instruments. Consider first the roles of family-planning activities and general or adult education. The family-planning activities are envisaged in this model as affecting knowledge of and attitudes about birth control. Education levels of the parents (only the wife's is specifically represented in the figure) may also contribute toward awareness of birth control methods. Of course, this awareness is another determinant of the family's ability to avert unwanted births. The hypothesis here is that, religious objections aside, the more "active" the program or the more highly educated the parents, the more likely it is that they will know how to use birth control effectively. Each of these programs increases the probability that the parents will be able to avert an unwanted birth (the former strategy is undoubtedly the more cost-effective way of achieving birth control effectiveness). Provision of education, of course, also affects the wife's qualifications for employment -- the "opportunity cost" of her time.

Since child rearing and employment are alternative uses for a woman's time, it is presumed that desired family size is negatively associated with employment. The woman's attained educational level may also have a direct effect on her desired family size. Higher education levels should lead to an emphasis on "quality" as opposed to "quantity" of children. In combination, one would expect the influence on family size to be negative.¹ On the other hand, education may affect the woman's decisions concerning spacing between births. A higher educational level may lead to her acquaintance with and assurance in the effective use of birth control means. So, before completing her family she could either use such means temporarily to space childbirth or have children as rapidly as possible with some confidence that she will be able to terminate pregnancies when she desires. Thus, the predicted direction of influence of the woman's attained education level during the early years of marriage is not necessarily negative.

¹It has, of course, been widely observed that education level is inversely associated with family size.

Although children are clearly not economic commodities from the parent's viewpoint, after their intrinsic social and psychic value is taken into account, the costs and benefits to the family of having more children may influence the ultimate number desired. As mentioned earlier, several factors should be considered. Labor force participation of children can account for a part of the benefit side. But as with their mother, a tradeoff for children's time also occurs; to the extent that children are in school, they are less readily available to be in the labor force. Furthermore, there are additional direct costs to the family to keep a child in school -- special clothing and supplies. Of course, there is also the additional benefit, in the extended family context, of security for the parents in their old age since a well educated child would have a higher income potential.

Health care is another activity to which a government can legitimately commit resources and talent. In the model, provision of health care may have several important effects. First, past provision in the local community will help determine past experience with child mortality, which in turn will affect the family's anticipations of child mortality. These anticipations will have an influence on desired family size. Greater uncertainty, in particular, might lead to a form of hedging by the parents -- hedging, for example, against the eventuality of too small a number of surviving children to provide for them in their old age. Thus, uncertainty alone could lead to a somewhat larger desired family size.

Another effect of provision of health care is on current child mortality. If parents who lose a child were to "replace that child" through another desired birth and also to increase their desired family size due to an increase in the hedging motive just mentioned, then the immediate increase in population growth for a community or country resulting from reduction in child mortality would be at least partially offset by reduction in fertility.

The actual method for taking account of such mortality is based on developments by Schultz.¹ Since the death of a child sets back the family's progress toward achieving its desired family size, a "safety factor" can be defined as:

$$\text{Safety Factor} \equiv \frac{1}{1 - \text{child mortality rate}}$$

that is, the reciprocal of a child survival rate. This is the number by which the characteristics determining "desired family size" in an equation would have to be multiplied to predict the number of births needed to achieve that goal.² The precise specification of the equation for the fertility aspects of this model will be taken up in Section IV.

Shifting from fertility behavior for a moment, consider the other sectors of the model portrayed by Fig. 2 -- labor force participation, income, marriage, and migration. Since they will be considered in more detail later in the analysis, I will merely sketch briefly the influences associated with each at this point.

Aside from specific government labor policies, educational attainment may have important effects on the individual's employability within the labor force, and on the remuneration for that participation. The participation in the labor force by the wife may be affected by the family's income level (without her help, of course); in particular, she may feel impelled to contribute to what would otherwise be meager family resources.³ Her participation may be constrained, on the other

¹T. Paul Schultz, The Effectiveness of Family Planning in Taiwan: A Proposal for a New Evaluation Methodology, The Rand Corporation, P-4253, November 1969. Schultz calls this variable a "death factor."

²Note that if the safety factor is based on the family's own experience with child mortality and the family experiences no deaths among its children, this factor is simply unity.

³See, for example, W. G. Bowen and T. A. Finegan, "Labor Force Participation and Unemployment," in A. M. Ross (ed.) Employment Policy and the Labor Market, Berkeley, University of California Press, 1965 (pp. 115-161); and J. Mincer, "Labor Force Participation of Married Women: A Study of Labor Supply," in Aspects of Labor Economics, Princeton, New Jersey, Princeton University Press, 1962 (pp. 63-105).

hand, by her household responsibilities and especially by the number and age of her children.

Decisions made in the last two sectors occur prior to those already discussed. Marriage, while affecting many of the other variables in the system, is itself affected by relatively few of them. Aside from being largely culturally determined, a woman's activity in the labor force may somewhat reduce the incentive to get married. Such activity will be more likely at higher education levels, and educational advancement itself may be a reason for delaying marriage. Migration to a new area also may be directly related to the woman's intention to marry or to her entry into the labor force.

Migration for men may be primarily due to relatively greater economic opportunity in a new area. Also, a man's education level may make it easier to find a job in a new area. On the other hand, the motivation for migration may be somewhat dampened if the person is already employed in his present area. Language barriers may also constrain migration or regionally contain migration flows.

TIMING CONSIDERATIONS CONCERNING FERTILITY

The specific model of fertility -- measured by the total number of live births -- will be derived fundamentally from three interrelated aspects of a family cycle: biological constraints on fertility, actual fertility, and desired surviving size of the family. The relationships are presented schematically in Fig. 3 for marriage at a particular age level for the woman.

The diagram simply illustrates that there is biologically an upper envelope (λ_1) under which actual fertility (within a marriage) must lie.¹ Desired family size (d) on the other hand, can be a vague

¹The survey used as the empirical basis for this analysis included only ever-married women, so the model has been designed to be applicable to this group. One might view this "biologically obtainable upper envelope" as exemplified by the Hutterites' experience; see J. W. Eaton and A. J. Mayer, Man's Capacity to Reproduce: The Demography of a Unique Population, Glencoe, Ill., Free Press, 1954.

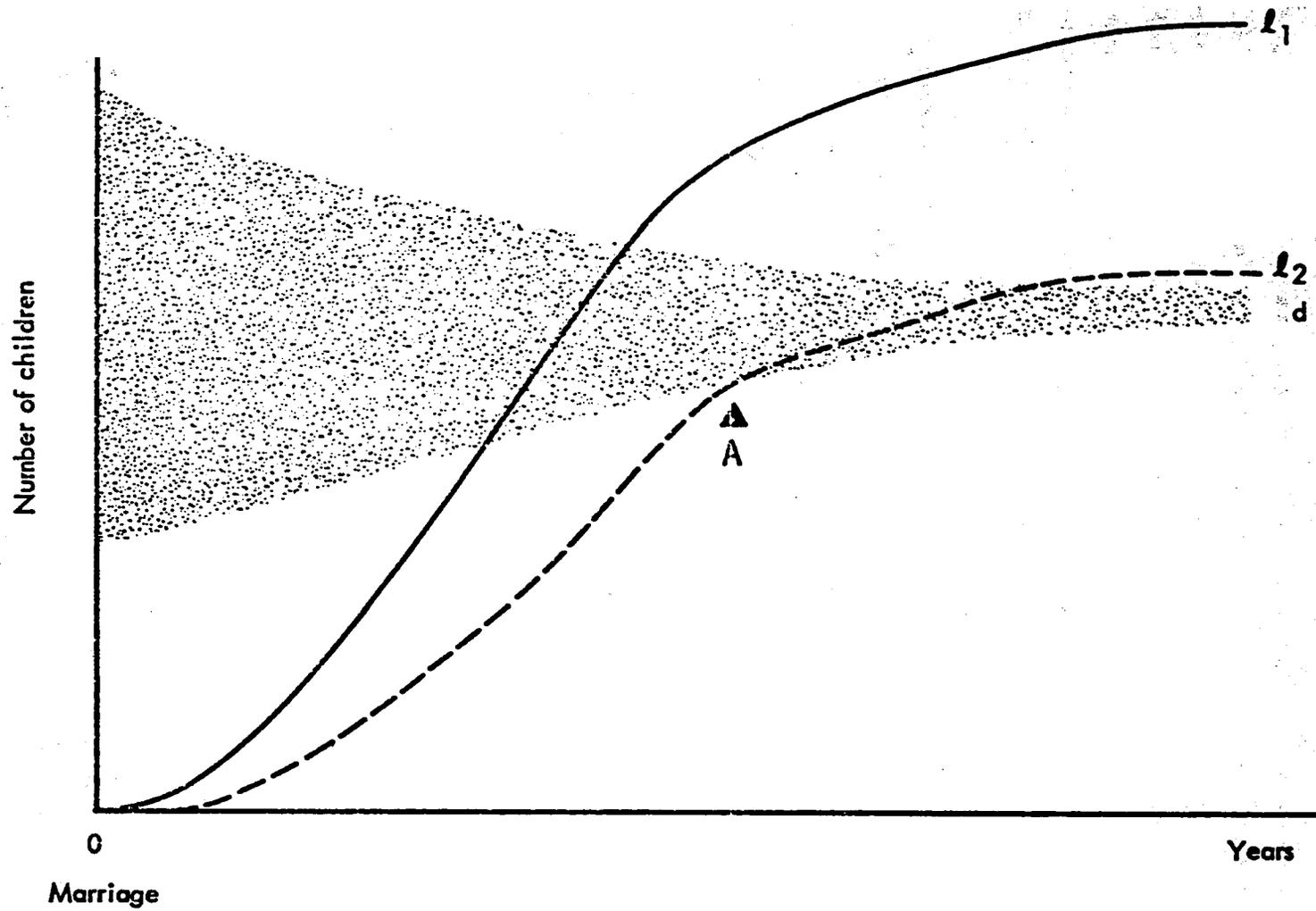


Fig. 3—Family fertility cycle

desire for a number of children at the time of marriage and can vary and become more precise throughout the course of the marriage according to external influences on or concomitant decisions by the parents. The main hypothesis of the present approach is that actual fertility (ℓ_2) will be related to these two influences, and that the importance of these influences will vary over the duration of the marriage.

Family planning in less developed countries most often takes the form of limiting the size of a family rather than spacing children. This observation leads to the presumption that actual fertility is essentially proportional to the biologically attainable rate of procreation through the early years of marriage and only later dampens its rate of increase to attempt to hold achieved family size to desired levels. This behavior is represented by the rapid rise in ℓ_2 through time until point "A," and a much slower (or even zero) rate of increase after that. As an indicator of this "switching point," some form of birth control should begin.

To briefly summarize, then, desired family size is determined in the context of a spectrum of other family decisions as portrayed in Fig. 2. The extent to which these influences have an impact depends on the length of marriage as in Fig. 3. The empirical analyses that will be presented in Sections IV and V are based on further simplifying assumptions. However, before taking up these analyses, Section III considers the empirical information concerning the Philippines which was used for this research.

III. DATA ON FAMILIES IN THE PHILIPPINES

The empirical analyses presented in Sections IV and V are based on data that deal with families in the Philippines.¹ In this section I will discuss details of the population of the Philippines in the context of the variables that have been generated for this study. These variables were calculated almost exclusively from data obtained by the National Demographic Survey (NDS), conducted jointly by the Population Institute, University of the Philippines, and the Philippines Bureau of the Census and Statistics in May 1968.² The full survey included data on a nationwide sample of 7254 women and their families.³ The NDS consists of retrospective family histories along with extensive information on family planning knowledge, attitudes, and practices as well as more general social, economic, demographic, and geographic information. I will not discuss the survey measures or their exact transformations into the variables employed in the analyses in this section (see the Appendix).

Although the information obtained by the survey is not flawless,⁴ retrospective histories such as these are relatively low-cost means of

¹There are a number of interesting in-depth studies of the Philippines; see especially H. A. Averch, F. H. Denton, and J. E. Koehler, A Crisis of Ambiguity: Political and Economic Development in the Philippines, The Rand Corporation, R-473-AID, January 1970. For an overview of the country and its population-related activities, see the country profile on the Philippines issued by The Population Council, New York, June 1970.

²I am indebted to Professor M. B. Concepción, Director of the Population Institute, for making available the tapes of survey results and for interpretation and guidance on aspects of the available information.

³These data provide an opportunity to draw inferences about individual behavior from data on individuals rather than area aggregates. For a discussion of the possible difficulties of inferences based on various levels of aggregation compared with the individual data, see the experiments reported by G. H. Orcutt, H. W. Watts, and J. B. Edwards, "Data Aggregation and Information Loss," The American Economic Review, Vol. LVIII, No. 4, September 1968, pp. 773-787.

⁴As reported by M. B. Concepción and W. Flieger:

A post-enumeration survey performed in Manila and some Luzon provinces one month after the [NDS]...revealed that

obtaining a broad range of information that should be quite useful for policy-relevant analysis. This survey in particular contains much information of which this research has no more than scratched the surface.

SAMPLES

The various relationships outlined in Section II have been analyzed using age-stratified, subsampled data sets. For the detailed study of fertility and female economic behavior, I obtained a random sample for each 5-year interval age group of females (over 19 years old) of around 300 observations. For each group of males, under and over 30 years old, random samples were obtained of about 500 observations each.¹ In addition, for the 35-39 female age group I have obtained a second random sample of the data to use in verifying the final forms of the equations obtained during the analysis. Because the data in this stratum were used to explore various structural specifications, it was most desirable to check the reliability of the final equations for deriving inferences about the entire population between those ages by reference to equation estimates based on this independent data sample.²

a good number of "respondents" for whom completed questionnaires had been handed in, had never been visited, that 17 percent of the households had not been asked fertility questions, and that there were sizable disagreements even in answers to rather simple questions, e.g., kind of cooking fuel used.

See their "Family Building Patterns of Young Manila Couples," Philippine Sociological Review, Vol. XVI, Nos. 2-4, July-Oct. 1968, pp. 162-183. See also W. P. Mauldin, "Estimating Rates of Population Growth," in B. Berelson et al., Family Planning and Population Programs, The University of Chicago Press, 1966, pp. 635-653, for a discussion of the limitations of retrospective histories and other types of demographic information.

¹The only group in the data that has been eliminated from the analysis is the "under 20" age group of females. There was a relatively small sample for this age group with a proportion of omissions of survey information much larger than for the other groups. Since "desired family size" is not likely to be revealed very clearly in such a young age group (recall, for example, Fig. 3), the loss of results based on such a data set is minimal.

²For more information about the survey and subsampling procedure, see the Appendix.

As a brief overview of families in the Philippines, consider Table 1 in which characteristics relating to marriage, fertility, birth control knowledge and use, education, labor force participation, income, and migration are reported. These measures are averages from the various samples; the last columns at the end of the table indicate that about 70 percent of households are located in rural areas (and that the age distribution of the spouses in rural areas is not greatly dissimilar from that in urban areas).¹ The data set of females 35-39 years old referred to as (1) in this table is the one used in the exploring structural specifications for the model in statistical analyses reported with the other age strata in subsequent tables. Results using the independent sample (2) of this age stratum are discussed in Sections IV and V as a means of verifying the reliability of the results.

MARRIAGE AND FERTILITY

Since the data consist only of women who have been married at least once, almost all those less than 35 years old are still married rather than widowed, separated, or divorced (the last of which is, of course, a highly unusual occurrence in this predominantly Catholic country). The 35 and older age strata indicate that these women average more than six pregnancies over their fecund years but have about 5 percent fewer live births due to pregnancy wastage or abortion. The total loss during the family-building process -- characterized as "child mortality"² -- is estimated for the oldest age strata at about 15 percent.³

¹The urban-rural dichotomy is actually an approximation to any of several demographic or geographic distinctions; the residents of chartered cities and administrative centers of municipalities are classified as "urban." See also, UNESCO Research Center on Social and Economic Development in Southern Asia, Urban-Rural Differences in Southern Asia; Some Aspects and Methods of Analysis, New Delhi, Allied Publishers, 1964.

²"Child mortality" is defined rather broadly in this analysis; it is the proportion of pregnancies that were no longer alive as of 1968. It should therefore include pregnancy wastage, infant mortality, and the usual child mortality (from ages 1 to 15, for example) plus deaths of older children of women in the oldest age group.

³These figures must be considered lower bounds due to the under-reporting of both pregnancies and subsequent pregnancy wastage and early infant mortality which is especially characteristic of retrospective surveys.

Table 1

AVERAGE VALUES OF SOME OF THE VARIABLES DESCRIBING FILIPINO FAMILIES

Age Group	Marriage		Fertility			Child Mortality ^a	Birth Intervals ^b	
	Av. Age at First Marriage	Proportion Still Married (1968)	Pregnancies	Live Births	Mean Closed Birth Interval		Open Birth Interval	
	20-24 Years Old	17.7	.993	1.93	1.89	.056	21.0	14.7
25-29 " "	19.2	.974	3.47	3.33	.101	21.7	23.2	
30-34 " "	19.5	.962	4.98	4.81	.101	25.3	28.1	
35-39 " " (1)	20.4	.917	6.06	5.83	.103	25.9	42.5	
35-39 " " (2)	20.5	.929	6.03	5.76	.121	27.4	37.8	
40-44 " "	21.0	.896	6.63	6.27	.148	30.6	69.3	
Over 44 " "	22.0	.705	6.29	6.00	.167	36.1	89.4	

Age Group	Birth Control			Education			
	Knowledge		Use ^e		Attainment (1968) ^f	Participation of Children ^g	
	Proportion with Knowledge of Any Method ^d	Number of Friends or Relatives With Knowledge	Any Method	IUD			Female
20-24 Years Old	.310	1.06	.086	0	.009	6.00	.052
25-29 " "	.371	1.27	.146	.006	.023	6.19	.173
30-34 " "	.318	1.21	.150	.008	.026	6.37	.604
35-39 " " (1)	.403	1.36	.170	.011	.022	5.96	.817
35-39 " " (2)	.367	1.07	.144	.010	.025	6.21	.796
40-44 " "	.341	.858	.112	.011	.017	5.16	.836
Over 44 " "	.180	.563	.084	.006	.006	3.22	.561

Age Group	Labor Force Participation Rate ^h		Average Income ⁱ (1968)		Proportion Migrated Since Birth		Sample ^j			
	Female	Male	Female	Male	Female	Male	Size		Rural Proportion	
							Female	Male	Female	Male
20-24 Years Old	.185	.938	157	1065	.262	.224	287	532	.710	.715
25-29 " "	.216		248		.257		334		.732	
30-34 " "	.303	.933	403	1608	.263	.278	265	514	.716	.701
35-39 " " (1)	.278		404		.278		250		.692	
35-39 " " (2)	.311		388		.332		289		.668	
40-44 " "	.283		296		.302		296		.669	
Over 44 " "	.362		364		.271		250		.688	

Notes:

^aChild mortality is defined in a rather special way for this analysis: it is the proportion of pregnancies that were not alive in 1968, when the survey was taken. It therefore includes pregnancy wastage, infant mortality, and the usual child mortality (up to, say, age 15) plus even older deaths of children of women in the oldest age group.

^bBirth intervals are measured in months. The "mean closed birth interval" is the average length of time between pregnancies, including the time between marriage and the first pregnancy. The "open birth interval" is the length of time between the last pregnancy and the survey date. For the "over 44" age group, the open birth interval is measured between the last pregnancy and age 45.

^cTwo independent random samples of the women in the 35 to 39 age group are used in this study. See the discussion in this section and in the Appendix.

^d"Knowledge" as used here implies knowing how to use at least one method of birth control.

^eTo be counted as having "used" a method, the family has to have found the use "effective."

^fEducational attainment is measured as years of school completed. However, there is a gap in this count; primary school is measured from 1 to 7 but secondary school and college extend from 11 to 18.

^g"Educational Participation of Children" is measured as the proportion of school-eligible years in school averaged over all school-aged (7 to 18 years old) children in the family. The same gap between primary and secondary school was used in calculating this variable [see note f]. Also, for the 1968 values of the variable reported here, only children 10 years of age or over are included [see the Appendix].

^hA family member is classified as a "labor force participant" in this study if he responded to the question of "class of worker in 1968 (May-June)" by: (1) working for a private employer for wage, salary, commission, tips, etc.; (2) working for the Government or a government-owned or controlled corporation; or (3) in own business, profession or trade for profit or fees with or without paid employees. A survey respondent would not be in this group if he gave no response, was not working, or if he worked without pay on a family farm or enterprise.

ⁱIncome is measured in Philippine pesos per year. The 1968 official exchange rate was about 4 pesos to the U.S. dollar; the 1970 rate is about 6 pesos per dollar.

^jSince the sampling scheme of the National Demographic Survey involved choosing one in every 400 households in urban populations and one in every 1200 households in rural populations, the calculations of all statistical results in this analysis are based on weighting rural observations three times as heavily as urban ones. Thus, the "rural proportions" reported here are the estimated rural proportion of households in the population having one spouse in the appropriate age group. The corresponding rural proportion in the sample can be determined by dividing the reported rural proportion by 3 minus 2x reported rural proportion. For example, for the 20-24 female age group the rural proportion in the sample is:

$$\frac{.710}{3-2(.710)} = .449.$$

The age stratified categories listed are for samples of females. Male age groups considered were "Under 30" and "30 or over." For each sex the subsample of all observations of each stratum was designed so that all strata for each sex would be approximately equal in size.

Not all observations could be employed in all sectors of family behavior under investigation. Thus, where age at first marriage was not reported or the open birth interval could not be calculated, those observations had to be eliminated from the analyses reported below and for some of the averages reported

The other measures in the first group of rows of Table 1 can be best understood by considering the following identity:

$$\text{YRS} \times 12 \equiv \text{MCBI} \times P + \text{OBI}$$

where

YRS = years of marriage

MCBI = mean closed birth interval [the average number of months between (termination of) pregnancies including the months between marriage and the first pregnancy]

P = number of pregnancies

OBI = open birth interval [months from the (termination of the) last pregnancy to survey date].

The identity states that by definition the number of months of marriage is identically equal to the length of time over which the woman has had pregnancies plus the most recent period over which she has not been pregnant. Thus the rate of childbearing can be characterized from the survey data by calculating the mean closed birth interval for each family. The average of these for the younger age groups is relatively short, indicating a rapid rate of procreation. This measure lengthens only slightly for women in their thirties [somewhat more for sample (2) than for sample (1) of the 35-39 age stratum] and averages three years or under for women who have completed their families. Thus, the conjecture that spacing of children may not be a serious consideration for families in the Philippines receives preliminary support.

Recent fertility activity is indicated by a shorter open birth interval. The OBIs are short for the younger age groups, but lengthen considerably for the older ages when the rate of increase of pregnancies and live births declines and fecundity should also be falling.¹ Since

¹Note that the open birth interval for the "Over 44" age group is intended to measure the approximate length of time from the last pregnancy to menopause. The calculation is simply the number of months between the last pregnancy and age 45.

the number of births and the OBI represent aspects of the "stock" and "recent flow" of children, they should both be subject to the same interrelated family decisionmaking model described in Section II. One would expect that, if spacing births is not undertaken prior to attainment of the parents' desired family size (that is, for short marriage durations), the average OBI would be reasonably short. As years of marriage increase, so too does the likelihood that parents have attained their desired family size. From this point on during the marriage, effective birth prevention and therefore maintenance of desired family size would be manifested in a longer OBI. The main empirical analysis undertaken in Section IV will deal with "total fertility" (the number of live births) but the OBI will also be investigated as an indicator of recent fertility activity.¹

BIRTH CONTROL KNOWLEDGE AND USE

Moving on to measures of birth control, it is apparent that knowledge of (including professed ability to use) at least one method of birth control is not insignificant -- over 30 percent of the women in all but the oldest age stratum claim "knowledge."² Yet less than 20 percent of any age group have actually used any method, and no more

¹For a comprehensive discussion of the open birth interval, see K. Srinivasan, "The 'Open Birth Interval' as an Index of Fertility," Journal of Family Welfare, Vol. 13, No. 2, December 1966, pp. 40-44; and his article, "A Set of Analytical Models for the Study of Open Birth Intervals," Demography, Vol. 5, No. 1, 1968, pp. 34-44.

²The proportion of ever-married women who have knowledge of any birth control method is somewhat lower in Table 1 than was reported in John E. Koehler, The Philippine Family Planning Program: Some Suggestions for Dealing with Uncertainties, The Rand Corporation, RM-6149-AID, February 1970. The differences arise out of our definitions of knowledge. The one used here is somewhat more restrictive than simply having "heard of" a method; the parents must also at least "know how to use" the method before they are included in the knowledge category.

Knowledge in this more restrictive sense is still much more widespread than use -- even among the older age groups that might be expected to be practicing birth control given the knowledge. Thus, Koehler's conclusion is still applicable and deserves emphasis (pp. 7-10): "Knowledge of such techniques is widespread. Reducing the birth rate may depend much more heavily on discovering why women who do know of methods to prevent births fail to practice these methods or practice them inefficiently." For further discussion, see Sections IV and VI.

than 3.5 percent of any age group have used the most modern and effective methods (pills or IUDs). As an indication that knowledge of birth control methods may be derived indirectly from friends or relatives as well as from direct family planning program activity, the age groups that exhibit high proportions with knowledge also usually have the larger average number of friends or relatives with "knowledge."¹ The simple correlations between these variables are positive and relatively high for samples as large as these -- about .36 for most age groups and not lower than .30 for any. The two samples for the 35-39 age group give a consistent indication of relatively extensive knowledge of methods, but slightly different implications concerning whether or not this age group uses birth control methods more than do younger groups.

EDUCATION

The more general measures of education for adults are the average years of school completed.² Years completed are slightly higher for males than females and are reasonably stable for females at about six years (except for those in the oldest age strata in which this measure drops considerably). Even for the strata below 40 years old some change in the distribution of education is indicated by standard deviations for female educational attainment. They are lower in the youngest age groups [ranging from a standard deviation of 4.26 for the 20-24 age group to 5.32 for the 35-39 age group with sample (1)]. Since the range of this measure is from 0 to 18, the distribution is apparently becoming less skewed to the right -- a larger proportion of younger women have completed or nearly completed a primary education than did previous cohorts.

¹This latter variable is not calculated from the definition as described in the preceding footnote. In fact, it is simply the number of friends or relatives (not greater than 6) whom the woman classifies as users of some form of family planning. Since the "effectiveness" of this use is not reported, it seems most appropriate to classify these people as having "knowledge" of some form of birth control.

²However, there is a gap in this count; primary school is measured from 1 to 7 but secondary school and college extend from 11 to 18.

The variable that measures schooling of children is akin to an average participation rate -- the extent to which attention of the children is diverted from household or economic activities to education during their school-aged childhoods. However, it is a rather crude first approximation of the concept. The calculation of this variable is based on the number of years in school averaged over all school-age (7 to 18) children in the family.¹ Thus, the quite young are combined with the teenagers even though their alternatives for productive economic activity in support of their families are profoundly different. Since the measure is based on schooling over past years, there is no guarantee that at present the older children are still in school rather than being of economic benefit to the family. Furthermore, on the presumption that schooling is undertaken continuously until terminated, the value of this variable for any one family increases only when each child reaches age 7, since the participation in school (leading to a participation rate of unity) is most likely in the younger ages. Although the variable is expected to decline as the children get older, it unfortunately increases on the average for families with more young children. In sum, the "educational participation of children" is very crudely measured; it is not discussed further.

LABOR FORCE PARTICIPATION AND INCOME

Labor force activity and incomes are, as usual, much higher for husbands than for wives. Economic activity for women tends to increase for the older age groups, presumably after the early years of marriage have been devoted to establishing a family. The average income for females in these later years is close to 400 pesos a year, compared

¹The same gap between primary and secondary schools was used in calculating this variable [see the previous footnote]. For this reason, or if a child entered school before the age of 7 or skipped a grade subsequently, the calculated value of this variable could exceed unity. The 1968 value of the variable reported in Table 1 is actually the school participation measure for children 10 years of age or over, since no younger children were interviewed [see also the Appendix].

with 1600 pesos a year for males. However, the "average income" is somewhat deceptive as an indicator of remuneration from economic activities by females since it is based in part on zero income for non-economically active women. But if all income generated within each age group is attributed to the labor force participants of that group, the average for males under 30 would be ₱1130 compared with about ₱1000 for females, and the comparison with the 30 or over group would be ₱1730 for males and about ₱1180 for women. Furthermore, the lower income for women is confirmed by the ranges of income in the samples. The highest income in any female age group is under ₱9000 (the lowest maximum income for any age group is about ₱5800 for women 25-29) while the maximum for males is ₱12000 for those under 30 and ₱72000 for those 30 or over.

MIGRATION

The final characteristic reported in Table 1 is migration. This measure simply indicates the proportion of husbands and wives who have moved at any time in their lives -- whether as a member of their parents' family, as individuals, or within their own family. The lack of significant increase in this cumulative proportion in the older age groups indicates that most of those who ever move from their birthplace do so by early adulthood.

Rather than belabor the possible information that can be culled from such summary measures, I now turn to the statistical analyses of the model.

IV. MARRIAGE AND FERTILITY

The discussion of the biological, demographic, and socio-economic determinants of fertility and marriage hypothesized in Section II can be briefly summarized by the following expressions:

$$F = f_1 (\text{YRS, LF, LC, EF, ... , SF, U}) \quad (1)$$

$$\text{OBI} = f_2 (\text{K, U, CM, AGEF}) \quad (2)$$

$$\text{CM} = f_3 (\text{EF, LFBM, ...}) \quad (3)$$

where

F = fertility (number of live births to date)

YRS = years of marriage

LF = labor force activity of female

LC = labor force activity of children

EF = education level of female

SF = safety factor (reciprocal of child survival rate)

K = birth control knowledge

U = birth control use

OBI = open birth interval (months from last pregnancy to date)

CM = age at marriage

AGEF = age of female

LFBM = labor force participation of female before marriage

The first two functions relate to "stock" and "recent flow" measures of fertility: expression (1) represents a description of the number of live births, and expression (2) the recency of the latest birth. The third function outlines a few of the possible influences on age at marriage. The fertility measures are both basically determined by the interaction of length of marriage and the determinants of desired family size; the stock equation alone will be used to investigate the effects of these determinants, while the "rate of birth" analysis will be directed primarily to the evaluation of reported "use" of birth control methods.

FERTILITY -- ELABORATION OF THE MODEL

Expression (1) could be described as the combined influences of length of marriage and desired family size:

$$F = f_1 (\text{YRS}, \text{DFS}, U) \quad (4)$$

and

$$\text{DFS} = \text{SF}^\alpha d(\text{LF}, \text{LC}, \text{EF}, \dots) \quad (5)$$

where DFS represents the unobservable concept "desired family size." It is convenient to separate the functional specification in this way to see that the description of total fertility [from (4)] involves the interplay of a family size objective and the ability to attain and maintain it. The objective itself can be characterized by two influences -- the family size desired by the parents if they could be sure all children would survive, and actual child mortality. Such attributes as labor force participation and education of the wife and her children, among others, govern the number of surviving children that the parents seek (the "d" function).¹ A safety factor multiplies this function to determine the number of live births the family must have -- its desired family size.² Even if the "d" function in expression (5) is linear, the entire expression, including the safety factor, is nonlinear in the parameters. The " α " exponent of the safety factor is an "elasticity," which allows for investigation of whether a family's fertility behavior reacts more or less than proportionally to changes in the safety factors. That is, if $\alpha = 1$ and the safety factor increases 10 percent, the family-size objective is set exactly 10 percent higher for a given value of the "d" expression. It is conceivable that α could be greater than unity, so that the 10 percent increase in the safety factor would lead to a greater than 10 percent increase in

¹ child-education measure is explored in the analysis reported below, since the one available is rather difficult to interpret (see Section III). Conceptually the model should include these characteristics for both present and intended children. In practice only the former can be included. For this reason the older age groups ought to reveal the most relevant information about the validity of the model.

² For a discussion of the safety factor (the reciprocal of the child survival rate), see Section II.

the goal. This might occur if families consistently hedge against the uncertainty of child mortality to a greater extent when mortality rates are high.¹ It must be emphasized that even if the elasticity of the safety factor (α) is greater than unity, the elasticity of the family-size goal with respect to child mortality [$(\frac{M}{1-M})\alpha$] is likely to be less than unity, so that a decline in this goal from a decline in child mortality is likely to be less than proportional.²

Returning to expression (4), it would be reasonable to presume that this function is also nonlinear. The " f_1 " function determines the position of the family as depicted in Fig. 3 (page 12). Throughout

¹There is some evidence that this is the case in Taiwan; see T. Paul Schultz, "Effectiveness of Family Planning in Taiwan...", p. 29.

²The "elasticity" of change in a variable (y) with respect to changes in another variable (x) is defined as:

$$E_{yx} = \frac{\partial y}{\partial x} \frac{x}{y} .$$

Therefore, the elasticity of the desired family size to the safety factor is [from equation (5)]:

$$\begin{aligned} E_{DFS, SF} &= \frac{\partial DFS}{\partial SF} \frac{SF}{DFS} \\ &= \alpha SF^{\alpha-1} d(\dots) \frac{SF}{SF^{\alpha} d(\dots)} \\ &= \alpha . \end{aligned}$$

Since the safety factor is defined as

$$SF = \frac{1}{1-M}$$

where M is a child mortality rate, the elasticity of desired family size to the child mortality rate itself is

$$\begin{aligned} E_{DFS, M} &= \frac{\partial DFS}{\partial M} \frac{M}{DFS} \\ &= \alpha \left[\frac{1}{1-M} \right]^{\alpha-1} \left[\frac{1}{(1-M)^2} \right] d(\dots) \frac{M}{\left[\frac{1}{1-M} \right]^{\alpha} d(\dots)} \\ &= \frac{M}{1-M} \alpha . \end{aligned}$$

Since the child mortality rate (M) is presumably a small fraction (presumably less than one-half; for example, .2) the expression multiplying α is less than unity (for M=.2, the expression would be .25).

the early years of marriage the length of the marriage itself will be a primary determinant of (constraint on) the number of births actually experienced by the wife. After that period, characteristics influencing the desired family size should begin to reveal themselves (as the level of "d" in Fig. 3 is achieved). The extent to which the desired family size is achieved is determined in large part by the effective use of a birth control method.

FERTILITY -- ANALYSIS OF FAMILY SIZE

The actual analysis of the fertility relationship described above will be more simplified; a purely linear structure involving years of marriage, the factors influencing desired family size, and the use of birth control methods will be explored. A primary feature of the model under investigation -- the interdependence between fertility and several of the other "decisions" faced by the family -- will be accounted for by the statistical technique used for the analysis.¹

Table 2 displays the equations estimated by two-stage least squares, a multivariate statistical technique suitable for measuring the effects of variables that are in effect "simultaneously determined."² The "t" ratio reported in parentheses below each coefficient estimate

¹For a discussion of estimation of simultaneous equation systems, see, for example, J. Johnston, Econometric Methods, New York, McGraw-Hill Book Co., 1963, Chapter 9.

²Note that the samples used to estimate the equations in this and succeeding tables are often subsamples of the complete sets of data for each stratum used in calculating most of the means in Table 1. Thus, there are differences between the means for the same variable reported in these tables and those in Table 1.

Elimination of some observations has been necessary to reduce the risk of using inaccurate data. The greatest reductions in sample size resulted from the subsampling for these fertility results. Five criteria had to be satisfied for an observation to be included in this analysis (see the Appendix for further elaboration of the variables named here):

- (a) the male head of the family had to be present [CK4=0] so that family size attainment and contraception is part of the family's current concerns;
- (b) there should be no more than one marriage [CM=CM3] so that the correct length of time married could be determined;

(the ratio of the coefficient to its standard error) provides an indication of the confidence we can have that the variable does not have simply "no influence."¹ The three equations for each age stratum result from considering infant and child mortality in different ways; I will describe these results below.

Consider first the coefficient for "years of marriage."² This slope is as high as .44 for the youngest age group, and declines to .27 among the statistically significant values for the older strata

-
- (c) the wife's age at marriage must be known [CK9<4] so that her length of marriage could be determined;
 - (d) the total number of pregnancies must be known (CK20≠1); and
 - (e) no approximation should be necessary in the calculation of the OBI [CK23=0].

The sample sizes satisfying these standards are 251 (20-24), 297 (25-29), 229 (30-34), (1) 207 and (2) 242 (35-39), 247 (40-44) and 151 (over 44). Recall from the discussion in Section III that the sample (1) for the 35-39 age group was used for all the results reported with the other age strata in the tables; comparisons with the sample (2) results will be discussed later. The major reduction in the sample for the "Over 44" group was due to the absence of a male head of household [item (a)]. Although many of these households undoubtedly did have a husband and wife during the wife's fecund years, there was no apparent means for distinguishing which ones did not. Therefore, all such observations were eliminated from the sample for the fertility analysis. This procedure probably biases the sample toward a younger selection.

¹Significance levels for the equations -- based on the distribution of the F-statistic -- are not truly asymptotic tests of the equations; they are reported here much like R^2 are usually reported for ordinary least squares to indicate approximate confidence that one may have in the equation as a whole. See P. J. Dhrymes, "Alternative Asymptotic Tests of Significance and Related Aspects of 2SLS and 3SLS Estimated Parameters," The Review of Economic Studies, Vol. 36, (2), April 1969, p. 224.

²This variable is considered endogenous since it is a linear function of "age at first marriage." The latter can be considered to be simultaneously determined with desired family size to the extent that the cultural and environmental factors influencing both of these decisions do not change very rapidly through time. The resulting estimate would be quite similar if years of marriage had been considered to be predetermined.

Table 2
ESTIMATES OF TOTAL FERTILITY EQUATIONS^a

Line	Constant	Years of Marriage ^b	Female Labor Force Participation 1968 ^b	No. of Children in Labor Force 1968 ^b	Female Education Level Attained 1968	Rural Residence	Use of Birth Control ^b	Infant Safety Factor ^c	Child Safety Factor ^c	Community Infant Safety Factor ^c	Significance of Equation: F
Part A - 20-24 Years Old											
(1)	-1.49 (-2.8)	.440 (6.9)	-1.47 (-2.2)		.048 (2.2)	-.025 (-.14)	.484 (.89)	1.27 (3.1)			9.2*
(2)	.002 (.00)	.433 (7.1)	-1.20 (-1.8)		.049 (2.3)	.001 (.01)	.745 (1.4)		-.200 (-2.2)		6.7*
(3)	-10.4 (-3.1)	.419 (6.9)	-1.24 (-2.1)		.041 (2.1)	-.027 (-.16)	.578 (1.1)	1.00 (2.6)		8.85 (2.7)	9.9*
No. of Live Births											
Means:	1.96	4.79	.201	.017	6.00	.711	.080	1.05	1.16	1.05	
Part B - 25-29 Years Old											
(1)	.015 (.02)	.395 (5.3)	1.47 (1.5)		-.006 (-.20)	-.118 (-.45)	.022 (.05)	-.063 (-.28)			6.6*
(2)	.374 (.48)	.401 (5.3)	1.67 (1.7)		-.012 (-.40)	-.216 (-.80)	.009 (.02)		-.334 (-2.3)		6.6*
(3)	.009 (.00)	.399 (5.4)	1.38 (1.4)		-.004 (-.13)	-.112 (-.44)	.053 (.13)	-.062 (-.27)		-.028 (-.01)	5.7*
No. of Live Births											
Means:	3.43	8.37	.197	.024	5.89	.744	.156	1.06	1.20	1.05	
Part C - 30-34 Years Old											
(1)	-.389 (-.43)	.433 (6.6)	.021 (.03)	-1.29 (-1.4)	.025 (.74)	.277 (1.0)	.599 (1.2)	-.191 (-.71)			12.5*
(2)	-.415 (-.46)	.439 (6.6)	-.028 (-.04)	-1.33 (-1.4)	.029 (.84)	.255 (.92)	.597 (1.2)		-.201 (-1.1)		12.5*
(3)	-4.67 (-.90)	.430 (6.6)	.015 (.02)	-1.24 (-1.3)	.025 (.74)	.244 (.87)	.577 (1.2)	-.213 (-.79)		4.16 (.86)	11.1*
No. of Live Births											
Means:	5.02	12.3	.286	.149	6.3	.714	.165	1.07	1.17	1.05	
Part D - 35-39 Years Old											
(1)	-1.63 (-.54)	.084 (.50)	.533 (.34)	1.40 (1.3)	-.092 (-1.6)	.376 (1.0)	.045 (.06)	5.76 (3.9)			3.5#
(2)	1.72 (.66)	.120 (.70)	.950 (.61)	1.48 (1.4)	-.090 (-1.5)	.481 (1.3)	.130 (.17)		1.6 (2.)		2.9#
(3)	-16.2 (-2.4)	.033 (.19)	-.065 (-.04)	1.70 (1.5)	-.089 (-1.5)	.322 (.83)	-.067 (-.08)	5.17 (3.3)		15.3 (2.4)	3.8#
No. of Live Births											
Means:	6.03	16.3	.238	.303	6.15	.722	.190	1.05	1.15	1.05	

Table 2 (continued)

Line	Constant	Years of Marriage ^b	Female Labor Force Participation 1969 ^b	No. of Children in Labor Force 1968 ^b	Female Education Level Attained 1968	Rural Residence	Use of Birth Control ^b	Infant Safety Factor ^c	Child Safety Factor ^c	Community Infant Safety Factor ^c	Significance of Equation: F
Part E - 40-44 Years Old											
(1)	-1.50 (-.52)	.273 (2.4)	2.24 (.99)	4.51 (2.3)	-.011 (-.13)	-.807 (-1.2)	-1.28 (-.81)	1.34 (.71)			3.7#
(2)	.228 (.08)	.266 (2.2)	2.58 (1.0)	4.66 (2.4)	-.023 (-.27)	-.835 (-1.1)	-1.03 (-.62)		-.164 (-.32)		2.7†
(3)	6.85 (.52)	.275 (2.4)	2.43 (1.0)	4.49 (2.4)	-.012 (-.15)	-.764 (-1.1)	-1.30 (-.82)	1.49 (.80)		-8.21 (-.64)	3.5#
No. of Live Births											
Means:	6.70	21.3	.236	.258	5.06	.675	.107	1.07	1.28	1.05	
Part F - Over 44 Years Old^d											
(1)	-5.79 (-2.0)	.255 (2.4)	-.559 (-.33)	.208 (.19)	-.025 (-.34)	.083 (.13)	.257 (.19)	6.44 (2.8)			2.7†
(2)	-.859 (-.33)	.275 (2.7)	.330 (.22)	.053 (.05)	.000 (.00)	.092 (.14)	-.046 (-.04)		.916 (1.3)		1.8
(3)	-23.2 (-2.5)	.264 (2.7)	-.440 (-.27)	.529 (.52)	-.030 (-.41)	.057 (.09)	.076 (.06)	5.41 (2.4)		17.5 (1.8)	4.4#
No. of Live Births											
Means:	6.85	23.1	.312	.246	3.63	.715	.102	1.07	1.29	1.05	

Notes:

^aThe measure of total fertility used in this analysis is the number of live births. Coefficient estimates reported in this table were obtained by two-stage least squares. Variables identified by a "b" are considered endogenous in the equation. For each equation, the first line presents the coefficient estimates while the t-ratios are in parentheses below each coefficient. The other predetermined variables from the system of equations (represented by Fig. 2), describing interrelated activities of family members, that were used in the estimation of these equations are: husband's education level (1968), education of father of household head at age 40, age of husband and wife (in 1968), labor force participation of wife before marriage, knowledge of birth control method(s), number of friends or relatives with knowledge, average level of birth control knowledge in the community in which the family resides, home ownership dummy, rent-free residence dummy, dummies for religions [Muslim and Catholic (regular church attendance)], and language dummies [Tagalog, Panay-Hiligaynon-Ilongo, and Ilocano].

The asymptotic significance test for the equations is the F test given in P. J. Dhrymes, "Alternative Asymptotic Tests of Significance and Related Aspects of 2SLS and 3SLS Estimated Parameters," *The Review of Economic Studies*, Vol. 36, No. 2, April 1969, pp. 213-226; significance levels are denoted: † (10%), # (5%), and * (1%). Significance levels for the coefficients are approximately [t greater than]: 1.6(10%), 2.0 (5%), and 2.6(1%).

^bEndogenous variable in the equation (see note a).

^cInfant, child, and community safety factors are related to the appropriate mortality rates as follows: Safety Factor = $\frac{1}{1 - \text{mortality rate}}$.

^dIn the "Over 44 Years Old" group, the calculation of years of marriage is cut off at age 45, to yield approximate lengths of time before menopause.

as hypothesized (recall Fig. 3, line ℓ_2).¹ The maximum slope for the younger age groups can be translated, holding all other influences constant, into an implication of one live birth every 27.3 months. Following Potter's calculations for birth intervals, one could obtain an approximate measure of a hypothetical biological minimum as about 14 months.² Now, the observed measure of fertility is assumed to be proportional to the maximum rate in the section of the marriage (recall from Fig. 3 that line ℓ_2 is proportional to ℓ_1 before point "A"). The implication from the estimated slope, then, is that observed fertility in the early years of marriage is at a rate of over half the "biologically obtainable" rate.

The variable "use of birth control" was entered to provide additional insight into the question of spacing births and to indicate

¹The coefficients for the 35-39 stratum are quite small and statistically insignificant. It will be possible to determine if these values are a true reflection of this age group or an anomaly of the particular random sample by checking the results from the independent random sample for this age group discussed below.

The significantly positive slope in the oldest age groups probably results from the inclusion of the broadest range of years of marriage in these groups. Whereas the coefficient in the younger age groups is probably a reasonable indication of the tangent to the nonlinear curve (ℓ_2), for the older groups it is simply an average slope over a broader range of the curve.

²See R. G. Potter, "Birth Intervals: Structure and Change," Population Studies, Vol. 17, No. 155, November 1963, pp. 155-166 (especially Table 1). The calculation of 14 months as an approximate minimum period is arrived at as follows. The period of interest can be broken down (except for the first birth interval) into three segments: the anovulatory period following the previous confinement, an ovulatory cycle for a new conception to occur, and the period of gestation. Adopting Potter's figures, 4 months (without breastfeeding), 1/2 month, and 9 months respectively produces an estimate of 13.5 months minimum to achieve a live birth. Since a large proportion of the women in the Philippines probably do breastfeed their infants, and since the probabilities of miscarriage and stillbirth are not insignificant, a "biologically obtainable" interval between live births is probably somewhat longer.

the maintenance of the family's desired size. However, the parameter estimates are positive (although not statistically significant) in almost all age groups. For the age groups under 25, women with larger families are consistently the ones claiming to "use" a birth control method. Above that age, there is no significant impact of use on achieved family size, but there is slight evidence of a negative impact from the "40-44 years" sample. In sum, reported "use" of birth control displays no significant impact on actual fertility levels. There is slight evidence that the more fecund women have a greater tendency to use such methods.¹ Before the assessment of "use of birth control" is complete, however, recent flows should also be considered -- if higher parity women use birth control methods, are they able to reduce their current birth rate? This question is addressed below by considering the open birth interval.

The remaining coefficients are for variables presumed to be related to desired family size and to replacement activity due to mortality. Labor force participation by the wife is considered endogenous to this fertility sector of the model, since employment is an alternate use of her time that is either explicitly or effectively inter-related with the parents' "decisions" concerning their family size.² Labor force activity by the children is also considered to be endogenous it should indicate the potential for future children to be of economic benefit to the family's well-being. The educational attainment of the wife is assumed to be predetermined in the system, while the rural

¹This effect has been observed in Taiwan by M. C. Chang, T. H. Liu and L. P. Chow, "Study by Matching of the Demographic Impact of an IUD Program; A Preliminary Report," The Milbank Memorial Fund Quarterly, Vol. 47, No. 2, April 1969. They concluded (p. 154) that "the IUD acceptors are strongly selected in terms of higher than average fertility. On the average, the preinsertion fertility of the acceptors was 54 percent higher than the corresponding fertility of the married women in general in the township."

²Labor force participation may be a somewhat undesirable measure since current labor force participation combined with unemployment may not be very time consuming. On the other hand, to the extent that labor force participation reveals a longer term "state of mind" concerning the relative interest of the individual woman toward employment vis-à-vis child rearing, it is an adequate measure.

(versus urban) environment and the safety factors are assumed to be exogenous influences.¹

For each age group, mortality is handled in three ways. First infant mortality rate is used to calculate an infant safety factor.² Second, the broadly defined "child mortality" rate discussed in Section III is used. And finally, under the assumption that individual families adjust not only for their own mortality experience but also according to their perception of what is typical for their community, a community average of the infant mortality rate is also used.³ Although the child mortality rate is the most comprehensive concept relevant to number of pregnancies required for the family's desired size, it may not be a very good indicator of the family's desire to replace a lost child, especially for the older age groups. In these groups, the parents may lose a teenager and not be able -- either psychologically or physiologically -- to conceive a replacement. Thus, the infant mortality rate makes for a uniform mortality measure across age strata that may be a more consistent indicator of the replacement motivation and at the same time capture a large proportion of the loss of children.

The behavior of women in the youngest age group is particularly interesting. The women, most of whom have been married only a short period, display the trade-off between labor force participation and child rearing very clearly -- those in the labor force have over one child less, on the average, than those outside the labor force when other influences (including especially length of marriage) are held

¹It might be argued that child mortality is itself endogenous to the fertility sector of the model. Along with environmental and public health factors, such mortality results from poor nutrition (which may result from low incomes) or high parity (which, among other things, may mean an unwanted child). These considerations are ignored in this analysis.

²Infant mortality is defined as the proportion of the individual family's live births that died during the first year.

³The "community" used for this calculation was the sub-area within one of the 65 provinces defined as "residence codes." They number 112 in all.

constant. Among these women, higher education leads to a desire to have their children more rapidly. This phenomenon is quite reasonable since these women may want to achieve their families as quickly as possible and then seek employment. Since the equations in Table 2 account for marriage timing, labor force participation, and education, the separate effect of a dummy variable to capture other effects of rural families is essentially zero. The replacement motivation from infant mortality is quite strong in this youngest age group [see lines (1) and (3)], when viewed either as a reaction to the family's own experience or as hedging based on mortality levels in their communities. On the other hand, the child mortality rate captures the proportion of deaths of all children in the family [see line (2)]; the negative coefficient can be explained by the fact that at the younger ages there may not be sufficient time to replace all losses.

For the remaining age groups under 35, essentially none of the determinants of desired family size are significant. The labor force participation of children in the family is only entered for women 30 or above, since the variable requires a child of at least 10 years of age. In the 30-34 age stratum this variable displays a negative coefficient but is not significantly different from zero by statistical criteria.

Turning to the age groups above 34, the variables intended to explain desired family size are somewhat more significant, but do not always indicate the expected direction of influence. The expected negative influence for female educational attainment are only marginally significant in the 35-39 age group and insignificant for the oldest groups.¹ Similarly, female labor force participation in these older age groups is only marginally significant but is positively related to fertility. These estimates suggest that rather than accurately weighing the relative merits of devoting time to children or economic pursuits,

¹The rather slight significance of a direct negative impact of education on fertility is a somewhat unusual result; however, education also has indirect effects on fertility through its influence on the timing of marriage and labor force participation (see below).

the procreation decisions by the parents take precedence and the subsequent economic pursuits of the wife arise out of financial necessity for the family. Thus, labor force participation for women is associated with having had about two more children than otherwise.¹ Rather than being an established conclusion, however, this explanation should be considered as an alternative hypothesis requiring independent substantiation.

The strongest confirmation of the determinants of desired family size is displayed by the positive coefficients for child labor force participation, indicating that where opportunities exist for children to help provide support for the family, the parents desire a larger family. Again for the older age groups, there is no independent influence of excluded variables associated with "rural life."

The safety factors due to infant and child mortality seem to be quite significant. Within the family's own experience, infant mortality is confirmed to have a larger impact on "replacement" births than is child mortality. Perception of the risk of losing a child (as represented by the community infant safety factor) also has a significantly positive effect.

The model that was discussed at the beginning of this section [see equation (5)] would have produced an estimate of the (constant) elasticity of response of desired family size to changes in a safety factor. The degree to which families engage in replacement because of mortality can be investigated by calculating the elasticities of response in fertility to the infant and child safety factors. Such elasticities are displayed in Table 3. For the individual family safety factor values, a hypothetical family with the average number of live births of the relevant age stratum is assumed; one of these births is presumed to have died before reaching one year of age. This method results in the safety factor values displayed in the third column. As can be seen from comparing these values with the corresponding

¹This conclusion is further confirmed by investigation of the effect of number of family members (or children) on the probability of the wife participating in the labor force. See Table 9 below.

Table 3

ELASTICITIES OF FERTILITY TO THE LOSS OF A CHILD

Age Group	Average No. of Live Births	Value for Safety Factor ^a	Safety Factor Elasticity ^b based on			
			Family Experience		Separate Infant Factors	
			Infant ^c	Child ^d	Family	Community ^f
20-24 Years Old	1.96	2.04	1.32	-.21	1.04	4.74
25-29 Years Old	3.43	1.41	ns	-.14	ns	ns
30-34 Years Old	5.02	1.25	ns	ns	ns	ns
35-39 Years Old	6.03	1.20	1.15	.32	1.03	2.66
40-44 Years Old	6.70	1.18	ns	ns	ns	ns
Over 44 Years Old	6.85	1.17	1.10	ns	.92	2.68

Notes:

ns -- Corresponding coefficient estimate is not statistically significant.

^aThe value of the safety factor (for a loss of one child) is derived as: $1/[1-(\text{one/average number of live births})]$.

^bThe elasticity for the loss of one child can be calculated from the linear structure as

$$E_{F,SF} = \text{coefficient}_{SF} \times \frac{SF(\text{loss of one child})}{\text{average } F}$$

^cBased on coefficients from line (1) of Table 2.

^dBased on coefficients from line (2) of Table 2.

^eBased on coefficients from line (3) of Table 2.

^fElasticity for community infant safety factor is based on the average value of the safety factor in each sample.

averages in Table 2, they differ substantially only in the lower age strata where the average number of live births is small. For the community safety factor value, the average shown in Table 2 has been used in calculating the elasticity.¹

The resulting elasticities, of course, also suggest that the "replacement" due specifically to infant mortality is greater than that due to mortality at later ages. The resulting elasticities are about unity for the infant safety factor and less than one-third for that based on child mortality. Another feature of the linear formulation, however, is that these elasticities rise for each additional child lost, since the value of the safety factor (used to calculate elasticity) increases. Thus, for the loss of a low proportion of a couple's children, this preliminary evidence indicates that the elasticities of fertility with respect to the family's infant safety factor is about unity.²

When the elasticity of the infant safety factor for the family is compared with the community's experience, however, the latter effect is much stronger. Thus, the hedging by parents against loss of children seems to be an important consideration in predicting desired family size. As infant mortality is reduced, families can be expected to have fewer replacement births and also to hedge to a lesser degree. Both of these changes will tend to offset the more rapid rate of natural increase that might otherwise result.

As a final topic of this analysis of family size, let us consider the results for the independent random sample for the 35-39 age group. The coefficient estimate for "years of marriage" in Table 4 suggests that the earlier coefficient for this age group (in Table

¹Since the values of a family's safety factors are larger than the averages for the community safety factor, the coefficient for the latter must be more than proportionately larger for the elasticity to be greater.

²Recall that no matter what the elasticity of the safety factor, the elasticity due to changes in mortality itself will be lower (if the mortality rate is less than one-half). Thus, the conclusion from these results is that this latter elasticity is less than unity.

Table 4

ANALYSIS OF FAMILY SIZE FOR INDEPENDENT SAMPLE
OF 35-39 AGE GROUP

A. Fertility -- Number of Live Births											
Line	Constant	Years of Marriage ^b	Female Labor Force Participation 1968 ^b	No. of Children in Labor Force 1968 ^b	Female Education Level 1968	Rural Residence	Use of Birth Control ^b	Infant Safety Factor ^c	Child Safety Factor ^c	Community Infant Safety Factor ^c	Significance of Equation F
(1)	-2.49 (-1.3)	.435 (4.8)	-.672 (-.65)	-1.05 (-1.2)	.072 (1.5)	.843 (2.5)	.272 (.39)	.744 (.80)			4.1#
(2)	-1.36 (-.82)	.439 (4.7)	-.616 (-.57)	-1.22 (-1.4)	.064 (1.3)	.811 (2.3)	.204 (.28)		-.232 (-1.0)		4.1#
(3)	-13.0 (-2.0)	.386 (4.1)	-.657 (-.63)	-1.11 (-1.2)	.054 (1.1)	.800 (2.3)	.323 (.45)	.091 (.09)		11.6 (1.8)	3.0#
No. of Live Births											
Means:	5.99	16.3	.265	.307	6.35	.686	.164	1.06	1.23	1.05	

B. Elasticities of Fertility to the Loss of a Child						
Average No. of Live Births	Value for Safety Factor ^a	Safety Factor Elasticity ^b based on				
		Family Experience		Separate Infant Factors ^e		
		Infant ^c	Child ^d	Family	Community ^f	
5.99	1.20	ns	ns	ns	2.01	

Notes:

See notes to Tables 2 and 3.

was merely an anomaly of the data; the coefficient of around .4 is within the range of those estimated for the 30-34 and 40-44 age groups. The reported use of birth control methods is still positively associated with births. However, several changes occur in the predicted effects of the determinants of desired family size. The rural dummy variable becomes positive and significant and the impact of child labor force participation is now negative (only marginally significant). Even less significant, but also reversed in signs, are the coefficients for female labor force participation and educational attainment. Finally, the infant safety factors are positively related to children ever born to the family, but only the community safety factor is significant. Its elasticity is confirmed to be greater than two. In sum, the timing of marriage and loss of children are confirmed to have the influences hypothesized, and the use of birth control does not; the impact of the determinants of desired family size are not very clear for this age group.

FERTILITY -- ANALYSIS OF RECENT ACTIVITY

The characteristic related to recent fertility activity is the open birth interval -- the number of months between the last pregnancy and the date of the survey. As discussed in Section III, there are a number of possible factors affecting the OBI. A rather simplified breakdown of these influences is expressed in equation (2) at the beginning of this section. The following hypotheses underlie the choice of variables in this equation: (1) currently married women should exhibit a shorter OBI on the average than those women not currently "exposed" to further pregnancy; (2) an older age at marriage may reflect an unusually rapid desired rate of procreation (and thus a negative influence on the OBI); the age of the woman, even within a 5-year age stratum, may be associated with a decline in fecundity and therefore a longer OBI on the average (this effect should appear mainly in the older age groups); (4) "knowledge" of birth control methods could lead to a desire to space births (and therefore a positive influence on OBI over all age strata) or to a desire to have children as rapidly as possible with some assurance that

unwanted births later can be averted (thus a negative influence on OBI in the younger age groups); and (5) "use" of birth control method should lengthen the OBI. Note that families that "use" a birth control method are a subset of those having "knowledge," so if the "knowledge" influence is negative, the "use" influence should be positive and larger in absolute value.

The results in Table 5 are based on somewhat broader samples than those used for the fertility analysis.¹ "Use" of birth control method is considered to be endogenous since it is clearly a decision made simultaneously with the attempt to lengthen the open birth interval (that is, to avoid pregnancy). Age at marriage is also considered to be endogenous, in keeping with the specification in Table 2. The signs and magnitudes of the coefficients for "knowledge" and "use" of birth control methods indicate that those knowing of birth control methods have their families more quickly than others, and then avoid births. But except for the youngest age group these coefficients are statistically insignificant.² There seems to be a great variation in the effectiveness with which families actually practice birth control methods. This could be due simply to the different methods used, but

¹Women who had been married more than once were included (since age at present marriage could be used for the late marriage effect) and the woman of the household was only required to be classified as "married" rather than having a male head of household present. Specifically the requirements for inclusion in the sample for the OBI analysis were:

- (a) age at present marriage non-zero [CM3≠0]; and
- (b) no approximation should be necessary in the calculation of the OBI [CK23=0].

The sample sizes satisfying these standards are: 259 (20-24), 306 (25-29), 246 (30-34), (1) 238 and (2) 274 (35-39), 285 (40-44), and 233 (over 44).

²While also statistically insignificant, the signs for the coefficients for "use" of birth control methods in several age groups are negative, indicating that on the average those who claim to use birth control methods have shorter OBIs than otherwise. While one might explain this by the conjecture that a recent birth reminds the parent that they may be exceeding their desired family size, this kind of explanation is not a very encouraging statement about the effectiveness with which family planning has been put into practice in these age groups. For the oldest age group, this negative association may be due in part to cutting off measurement of the OBI at age 45.

Table 5

ESTIMATES OF OPEN BIRTH INTERVAL EQUATION^a

Age Stratum	Constant	Knowledge of Any Birth Control Method	Use of Any Birth Control Method ^b	Married as of 1968	Age of Wife at Present Marriage ^b	Age in 1968	Significance of Equation: F
20-24 Years Old							
	2.16 (.08)	-5.87 (-1.6)	10.8 (.87)	2.82 (.14)	-3.18 (-3.3)	2.98 (4.3)	4.0#
Open Birth Interval							
Means:	14.7	.308	.079	.998	17.5	22.2	
25-29 Years Old							
	26.4 (.61)	-5.54 (-.66)	2.08 (.12)	-9.36 (-.82)	-2.86 (-2.5)	2.26 (1.6)	3.5#
Open Birth Interval							
Means:	23.2	.352	.153	.984	18.8	27.2	
30-34 Years Old							
	84.1 (1.9)	-.015 (-.001)	-19.3 (-.89)	-28.5 (-3.0)	-2.03 (-1.9)	.436 (.34)	3.3#
Open Birth Interval							
Means:	28.1	.328	.155	.960	19.5	31.8	
35-39 Years Old							
	-61.4 (-.82)	6.29 (.26)	-7.22 (-.13)	-43.5 (-4.2)	1.36 (.89)	3.11 (1.5)	1.7
Open Birth Interval							
Means:	42.5	.411	.174	.920	20.5	36.9	
40-44 Years Old							
	-96.4 (-.89)	2.70 (.21)	16.4 (.50)	-54.2 (-4.6)	-.570 (-.29)	5.33 (2.3)	3.0#
Open Birth Interval							
Means:	69.3	.345	.111	.901	20.9	41.9	
Over 44 Years Old^c							
	153. (3.6)	64.7 (1.6)	-152. (-1.7)	-43.8 (-4.5)	-1.44 (-.75)	d	3.2#
Open Birth Interval							
Means:	89.4	.189	.081	.728	22.0	55.3	

Notes:

^aFor a general explanation of the method of estimation (two-stage least squares) and a list of the predetermined variables, see the notes to Table 2. The significance level for each coefficient, based on the t-statistic enclosed in parentheses beneath the coefficient estimate, is approximately: 1.6 (10%), 2.0 (5%), 2.6 (1%).

^bEndogenous variable in the equation.

^cIn the "Over 44 Years Old" group, the calculation of months for the OBI is cut off at age 45, to yield approximate lengths of time before menopause.

^dSince the open birth interval for the oldest stratum is measured only to age 45 (see note "c"), the age variable has been excluded from the equation.

distinguishing the use of more effective methods (IUDs or pills) does not indicate a more significant influence on the OBI. Thus, neither total nor recent fertility is significantly influenced by "use" of a birth control method as measured by responses to survey questions.

The other variables are associated with the length of the OBI in the directions expected, and are usually significant. The decline of fecundity is indicated to be under 3 months per year for the younger age groups, but over 5 months per year after age 40. On the other hand, women who marry at an older age have children somewhat faster -- in the younger age groups this effect is more pronounced than at the older ages, since even those who marry "late" in the latter groups may have had reasonable time to complete their desired family size.¹

The coefficients for the 35-39 age group are confirmed by the results reported in Table 6, based on the independent random sample. The equation itself is more significant, but the only reasonably significant coefficients are the shift of shorter OBIs for currently married women and the fecundity decline based on age within the group. The insignificance of reported "use" of birth control is further confirmed.

MARRIAGE AGE ANALYSIS

As a final topic for discussion in this section, let us consider the influences on the timing of marriage. I have postulated a linear relationship between age at first marriage for a woman and some of her prior and subsequent circumstances [see equation (3)]. The woman's age at marriage should be positively related to her education level² as well as to labor force participation before marriage, which (along with employment) would make marriage less necessary from an economic

¹The influence of age at marriage on the mean closed birth interval might have been a better measure of rapidity of childbearing in the older age strata.

²The further assumption of no further formal education after marriage was necessary to use the woman's education in 1968 as a proxy for her educational attainment before marriage.

Table 6

ANALYSIS OF OPEN BIRTH INTERVAL FOR INDEPENDENT
SAMPLE OF 35-39 AGE GROUP

Constant	Knowledge of Any Birth Control Method	Use of Any Birth Control Method ^b	Married as of 1968	Age of Wife at Present Marriage ^b	Age in 1968	Significance of Equation: F
-2.47 (-.04)	1.56 (.13)	-1.98 (-.07)	-66.1 (-6.9)	.314 (.27)	2.57 (1.5)	.5#
Open Birth Interval Means:						
37.8	.367	.147	.927	20.6	36.9	

Note:

See notes to Table 5

standpoint, and in some circumstances a detriment to the woman's career. The impact on age at marriage of the extended family (membership in a "subfamily," that is, living in the same household with relatives) might be in either direction. It could contribute to a lower age of marriage viewed from the strictly economic standpoint of being less costly than setting up a completely independent household. But such residence after marriage could simply indicate a low income for the husband, making marriage not only financially difficult but less satisfactory psychologically. The tendency under such circumstances may be to delay marriage. And finally, a rural residence dummy variable was entered to capture other possible uniformities in age at marriage due to excluded characteristics associated with rural/urban differences in "life style."

The results in Table 7 are ordinary least squares estimates of the coefficients, since all influences included in the equation are assumed to be predetermined.¹ The degree of explanatory power of this equation for the younger age groups, as measured by the R^2 , is not very high but quite significant given the sample sizes; it declines for the older ages. Both educational attainment and labor force participation of the women prior to marriage lead to significantly later marriages. In the youngest age strata -- in which subfamily membership is likely to have immediately followed marriage -- this type of household arrangement is associated with marriages at significantly older ages. Holding these influences constant, rural residence shows no consistent association with age at marriage.

¹The model would suggest that this equation should also be estimated by a simultaneous equation estimation technique, since labor force participation before marriage could be considered to be simultaneously determined with marital plans. However, sufficient information on the exogenous influences on the woman before marriage was not available, so ordinary least squares was the only feasible estimation technique. Coefficient estimates obtained in this way will be biased and inconsistent. See J. J. Johnston, Econometric Methods, New York, McGraw-Hill Book Co., 1963, Chapters 9-10.

The sample sizes for these results were reduced to exclude women for whom the age at first marriage was not known (that is, an observation was included only if $CK9 < 4$). The resulting sizes are: 287 (20-24), 333 (25-29), 263 (30-34), (1) 248 and (2) 288 (35-39), 294 (40-44), and 246 (over 44).

Table 7

ESTIMATES OF AGE AT FIRST MARRIAGE EQUATION

Age Stratum	Constant	1968 Female Education Level Attained	Labor Force Participant Before Marriage	Member of Subfamily of Household in 1968	Rural Residence	Significance of Equation R ²	F
20-24 Years Old	16.7 (40.8)	.117 (3.3)	.633 (2.2)	1.04 (3.0)	-.150 (-.46)	.12	9.7*
Age at First Marriage							
Means:	17.7	6.00	.349	.204	.710		
25-29 Years Old	15.7 (23.8)	.327 (6.0)	.680 (1.5)	2.94 (4.5)	1.01 (1.9)	.20	21.0*
Age at First Marriage							
Means:	19.2	6.18	.438	.126	.733		
30-34 Years Old	18.1 (29.2)	.277 (6.2)	.922 (2.1)	.332 (.31)	-.941 (-1.8)	.23	19.4*
Age at First Marriage							
Means:	19.5	6.44	.356	.042	.716		
35-39 Years Old	18.0 (26.8)	.253 (5.0)	1.54 (3.0)	.177 (.16)	.206 (.35)	.14	9.7*
Age at First Marriage							
Means:	20.4	6.01	.457	.059	.691		
40-44 Years Old	19.6 (22.7)	.263 (3.4)	-.249 (-.35)	1.51 (.76)	.118 (.15)	.05	3.7*
Age at First Marriage							
Means:	21.0	5.17	.345	.028	.668		
Over 44 Years Old	21.0 (20.5)	.114 (1.0)	1.39 (1.5)	.831 (.52)	.335 (.34)	.02	1.1
Age at First Marriage							
Means:	22.0	3.24	.269	.068	.687		

Note:

The coefficient estimates reported in this table were obtained by ordinary least squares. The t-statistics are presented below each coefficient estimate. Significant levels for the coefficients are approximately: 1.6 (10%), 2.0 (5%), and 2.6 (1%). For the equations, significance levels are denoted: † (10%), # (5%), and * (1%).

These results are confirmed in Table 8, for the independent random sample of women aged 35-39. The estimated equation displays about the same level of significance overall. A year's education displays almost exactly the same magnitude of impact on marriage age -- about 1/4 year older age at marriage per year of education. The delay in marriage associated with resistance to status as a subfamily is more strongly revealed by this sample by a delay of over three years on the average. On the other hand, the effect of labor force participation prior to marriage, while still positive, is smaller and much less significant.

SUMMARY OF MARRIAGE AND FERTILITY RESULTS

Before further exploration of the model of family behavior described in Section II, let me recap the findings so far. A linear structure of equations representing decisions on the timing of marriage, family size, and recent fertility have now been analyzed using statistical methods appropriate to the interrelated nature of the behavioral model.

Age at marriage is significantly influenced by schooling of the woman and her participation in the labor force prior to marriage. The former contributes up to a third of a year later marriage for each year of schooling, while the latter is associated, on the average, with about one year older age at marriage. The possibility in the extended family context of living with a relative after marriage not only does not encourage earlier marriages, it is associated with a one to three year later marriage age.

Decisions concerning the timing of marriage are quite important to completed fertility of Filipino families, since the length of marriage variable has a large, significant influence on total births for families in all age groups. The closed birth interval estimates implicit in these coefficients are quite short. Moreover, reported "use" of birth control methods does not display a significant influence on births, and frequently exhibits a positive association (that is, the more fecund women have a greater preponderance to "use" these methods). Perhaps partly because of this lack of effective birth control, the

Table 8

ANALYSIS OF AGE AT FIRST MARRIAGE FOR INDEPENDENT SAMPLE
OR 35-39 AGE GROUP^a

	Constant	1968 Female Education Level Attained	Labor Force Participant Before Marriage	Member of Subfamily of House- hold in 1968	Rural Residence	Significance of Equation R ²	F
	18.0 (26.9)	.266 (4.8)	.492 (.91)	3.07 (2.8)	.752 (1.3)	.12	10.0*
Age at First Marriage							
Means:	20.5	6.21	.392	.056	.669		

Note:

The coefficient estimates reported in this table were obtained by ordinary least squares. The t-statistics are presented below each coefficient estimate. Significant levels for the coefficients are approximately: 1.6 (10%), 2.0 (5%), and 2.6 (1%). For the equations, significance levels are denoted: † (10%), # (5%), and * (1%).

postulated determinants of desired family size are often not very significant. Only in the youngest age group is the tradeoff between labor force participation and child rearing clearly revealed, while the women in this age group with higher education tend to have their families faster. Total births for the older women are usually negatively associated with education, but not as significantly as expected. The strongest link revealed in the family size analysis is between opportunities for labor force participation by children and higher fertility. By including a "safety factor" based on infant or child mortality experienced by the family, I was able to directly investigate the "replacement" motivation of families resulting from the loss of a child. An average infant mortality rate for the community in which the family lives was also used to generate a safety factor; this variable allowed for a separate measurement of births due to hedging the risk of losing a child in the future. Within the family's own experience, loss of a child within the first year leads to a larger "replacement" tendency than does loss of a child at any age. However, the elasticity of response in births from a change in the community mortality rate is even larger. In combination for example, a 5 percent decline in infant mortality rates would "automatically" reduce births by nearly 2 percent due to these aspects of observed family behavior.¹

A simplified analysis of recent fertility was undertaken to determine if the reported "use" of birth control methods was associated with longer periods without a pregnancy -- longer open birth intervals. Holding constant the age at marriage and average fecundity decline associated with advancement in age within the strata, neither "use" of any method nor of the more effective methods lead to significantly longer OBIs. On the other hand, there is some evidence that reported "knowledge" of a birth control method is associated with a more rapid rate of procreation in the younger ages.

¹This example is based on the elasticities calculated in Table 3 for the 35-39 age group and the changes in the family's and community's safety factor values resulting from a five percent reduction in infant mortality.

V. ECONOMIC ACTIVITY AND MIGRATION

Let us turn now to some of the family activities that interact with fertility behavior. I will begin by analyzing the labor force activity and income of women in the Philippines and then deal with these topics for their husbands. The final topic of the section will be a brief investigation of recent rural to urban migration patterns.

FEMALE ECONOMIC ACTIVITY

Labor force participation has been viewed as an important alternative for the wife. This may be true to a greater or lesser degree depending on the culture and mores of the particular society and the economic incentives within the family.¹ To capture the incentive structure faced by the woman, I have investigated the role of marital status, size of family, and income from all other sources. Several factors external to the family will also impinge on the wife's choice of activities -- her "opportunity wage" (representing the value of her time in employment), and the "slackness" of the labor market.

Consider first the family incentive structure. Other things held constant, currently married women should have less need to enter the labor force than those who have themselves and possibly children to

¹There is an extensive literature on this topic, dealing mainly with women in the United States. See, for example, N. B. Balloc, "Labor Force Participation and Employment Opportunities," Journal of the American Statistical Association, Vol. 45, Sept. 1950; W. G. Bowen and T. A. Finegan, "Labor Force Participation and Unemployment," in A. M. Ross (ed.), Employment Policy and the Labor Market, Berkeley, University of California Press, 1965, and The Economics of Labor Force Participation, Princeton, N. J., Princeton University Press, 1969; G. G. Cain, Married Women in the Labor Force, Chicago, University of Chicago Press, 1966, and "Unemployment and the Labor Force Participation of Secondary Workers," Industrial and Labor Relations Review, Vol. 20, No. 2, Jan. 1967; J. Mincer, "Labor Force Participation of Married Women: A Study of Labor Supply" in Aspects of Labor Economics, Princeton, N. J., Princeton University Press, 1962, and "Labor Force Participation and Unemployment: A Review of Recent Evidence," in R. A. Gordon (ed.), Prosperity and Unemployment, Berkeley, University of California Press, 1966. For a discussion and analysis of labor force participation of women in Puerto Rico, see M. Nerlove and T. P. Schultz, Love and Life Between the Censuses: A Model of Family Decision Making in Puerto Rico, 1950-1960, The RAND Corporation, RM-6322-AID, September 1970.

support without a husband. Not only may there be a shift from such current status, one might view the employment skills as subject to "decay" during marriage. Thus, the proportion of a woman's life in a married status should have a negative impact on the propensity to enter the labor force.¹ The number of small children in the home may also inhibit her ability to seek employment. This effect will be considered as endogenously determined with the propensity to participate in the labor force -- the same weighing of alternatives exists as in decisions to have more children. On the other hand, a higher income level of the family without the wife's help may relieve her of the need to seek employment; this is also an endogenous influence in the sense of being one of the range of choices for the parents.²

The "opportunity wage" is assumed to be primarily determined by the level of educational attainment. More highly educated women should be able to command higher incomes, other things equal, and thus are more likely to be labor force participants. On the other hand, a "slackness" of the labor market may influence the propensity to seek employment.³ The impact could go either way, depending on the relative strengths of influences associated with the "additional worker" and "discouragement" hypotheses. The former hypothesis suggests that as the unemployment rate⁴ increases, more family members are needed, on the average, to achieve the same level of income; in particular, the wife is more likely to seek employment. The "discouragement hypothesis" reflects

¹This variable will also reflect the age of the woman, of course.

²See J. A. Sweet, "Family Composition and the Labor Force Activity of Married Women in the United States," Ph.D. Thesis, University of Michigan, 1968.

³This effect will be measured by a broadly age-specific female provincial unemployment rate. However, such "unemployment" is not very well defined for a less-developed country such as the Philippines, especially for the rural areas. This variable must therefore be considered as no more than an approximation. See also G. Myrdal, Asian Drama; An Inquiry into the Poverty of Nations, New York, Pantheon, 1968, Vol. II, Ch. 21; or his The Challenge of World Poverty, New York, Pantheon, 1970, Ch. 1.

⁴Strictly speaking, the unemployment rate referred to here is that for the "primary breadwinner." In actual empirical work, however, main consideration is given to the female unemployment rate of the area under consideration.

the probability that as unemployment increases, the effort involved in finding a job may increase so much and the probability of finding a rewarding job may decline sufficiently that the individual may decide to drop out of the labor force. Although the "discouragement effect" is common in the United States, it is reasonable to expect the "additional worker" hypothesis in less developed countries where the "typical" family may be somewhat closer to a subsistence level of income.

Within this framework, the influences of two other variables were investigated. As another aspect of the "additional worker" hypothesis, the number of family members over 10 years old was included as a measure of the extent to which pressure on the wife to become an additional income earner is reduced. The influence is therefore hypothesized to be negative. The variable will be considered as endogenously determined since it is a result of the family's fertility decisions.¹ Finally a migration variable is included to capture the possibility of migration resulting in greater employment opportunities. Since such migration as a part of the parents' decisionmaking is probably based primarily on opportunities for the husband, this variable is considered to be exogenous to the wife's inclination toward employment.

The estimates of the female labor force participation equations are shown in Table 9.² The equations are statistically significant only for the age groups above 30 years old. Education level attained is the one variable that is significantly and positively associated with the propensity to participate at all ages except the oldest. The coefficients indicate about two percentage points greater probability of participation for each additional year of education of women under 30, and a somewhat stronger education effect for women in their thirties. Although family income from sources other than the wife is generally

¹It may also include relatives (other than members of a subfamily of the household) or live-in employees. The latter would be the result of the income level of the family, and therefore should also be considered endogenous.

²Women were excluded from the samples for the labor force participation and income analyses if they gave "no response" on amount of income earned (that is, CK11>0). This selection process reduced the sample sizes very slightly [*Indicates no reduction]: 287* (20-24), 331 (25-29), 263 (30-34), (1) 250* and (2) 288 (35-38), 296* (40-44), and 249 (over 44).

Table 9

ESTIMATES OF LABOR FORCE PARTICIPATION OF FEMALES EQUATIONS^a

Line	Constant	1968 Education Level Attained	Migration Since Birth	Unemploy- ment Rate ^b	1968 Marital Status of Female: Married	Proportion of Life Mar- ried for those Married as of 1968	No. of Surviving Children ^{c,e}	Number of Family Members 10 Years Old or Over ^e	Total Income Other than Female ^{d,e}	Significance of Equation: F
Part A - 20-24 Years Old										
(1)	.116 (1.5)	.011 (1.9)	-.106 (-2.0)	.070 (.40)		.167 (.28)	.001 (.01)		-.011 (-.25)	.82
	1968 Labor Force Participation									
Means:	.185	6.00	.262	.154	.993	.198	1.82	2.12	1.20	
Part B - 25-29 Years Old										
(1)	.210 (2.3)	.020 (2.3)	-.007 (-.11)	-.155 (-.48)		-.600 (-1.2)	.034 (.59)		-.032 (-.64)	1.73
(2)	.512 (3.4)	.022 (2.6)	.026 (.40)	.078 (.25)		-.048 (-.20)		-.165 (-2.1)	-.032 (-.65)	2.49 ^f
	1968 Labor Force Participation									
Means:	.216	6.19	.257	.053	.974	.290	3.21	2.34	1.30	
Part C - 30-34 Years Old										
(1)	.320 (1.4)	.023 (2.7)	.145 (2.0)	.601 (1.4)	-.132 (-.54)	-1.26 (-2.1)	.104 (2.1)		-.076 (-2.0)	3.92 ^g
(2)	.651 (2.7)	.023 (2.7)	.110 (1.6)	.764 (1.8)	-.447 (-1.8)	-.186 (-.33)		.008 (.11)	-.058 (-1.4)	2.79 ^g
	1968 Labor Force Participation									
Means:	.303	6.37	.263	.055	.962	.363	4.57	3.35	1.60	
Part D - 35-39 Years Old										
(1)	.336 (2.0)	.028 (3.5)	-.049 (-.74)	.109 (.30)	-.371 (-2.1)	-.210 (-.52)	.027 (.79)		.036 (.88)	5.00*
(2)	.129 (.80)	.023 (2.8)	-.077 (-1.2)	-.100 (-.28)	-.246 (-1.5)	-.756 (-1.9)		.110 (2.5)	.053 (1.3)	7.21*
	1968 Labor Force Participation									
Means:	.278	5.96	.278	.057	.916	.400	5.55	4.43	1.55	

Table 9 (continued)

Line	Constant	1968 Education Level Attained	Migration Since Birth	Unemploy- ment Rate ^b	1968 Marital Status of Female Married	Proportion of Life Mar- ried for those Married as of 1968	No. of Surviving Children ^{c,e}	Number of Family Members 10 Years Old or Over ^e	Total Income Other than Female ^{d,e}	Significan of: Equatic F
Part E - 40-44 Years Old										
(1)	.596 (4.4)	.017 (2.4)	-.092 (-1.6)	.012 (.04)	-.585 (-3.8)	.036 (.10)	.025 (.88)		-.006 (-.22)	4.40*
(2)	.410 (1.7)	.017 (2.4)	-.104 (-1.8)	.206 (.62)	-.557 (-3.6)	-.087 (-.24)		.078 (1.2)	-.024 (-.72)	4.62*
1968 Labor Force Participation										
Means:	.283	5.16	.302	.062	.897	.443	5.88	4.90	1.62	
Part F - Over 44 Years Old										
(1)	.389 (2.6)	.002 (.18)	.003 (.04)	-.133 (-.30)	.113 (.41)	-.608 (-1.1)	.022 (.67)		.007 (.20)	1.02
(2)	.477 (4.3)	.003 (.20)	.006 (.08)	-.043 (-.10)	-.029 (-.16)	-.293 (-1.0)		.001 (.03)	.005 (.13)	.96
1968 Labor Force Participation										
Means:	.362	3.22	.271	.055	.694	.395	5.62	4.10	1.57	

Notes:

^aThe coefficient estimates in this table were obtained by two-stage least squares. See the notes to Table 2 for an explanation of the form of the table and comments on the tests of significance. The other predetermined variables from the system included all those listed for Table 2 and also the infant mortality rate of the community in which the family resides.

^bUnemployment rates used in this equation are female provincial rates for the appropriate age group of the individual -- young (under 25) or old (25 or over).

^cThis measure includes the number of children surviving to the age of one year (i.e., infant mortality has been eliminated from the count of live births).

^dIncome is measured in thousands of pesos.

^eEndogenous variable in the equation (see notes to Table 2).

not a statistically significant influence, the reasonably significant coefficients for the 30-34 age group are negative, as expected. The other influence that is assumed to be endogenous to the woman's decision concerning labor force activity is her commitment to raise the family's children. The measure for this, children surviving beyond one year, displays little influence on participation in the labor force except for the 30-34 age group in which the influence is positive. This is another indication that labor force participation has a lower "priority" in the woman's range of choices than does fertility.¹ This same positive association appears for older family members in the age groups above 35. Only in the 25-29 age group is the hypothesized relief from becoming an "additional worker" (that is, a negative association of the "family member 10 years old or older") significant. The coefficient for the unemployment rate -- in the 30-34 age group where it is statistically significant -- suggests support for the "additional worker" hypothesis.²

The migration of the family appears to have no consistent influence on the wife's labor force activity; its impact is negative for women under 25 and over 35 but positive for those in their early thirties. Finally, the influence of marriage on the woman's labor force participation is as expected: other factors held constant (especially education) currently married women have a significantly reduced propensity to participate, which is further reduced as the length of time married increases.³

¹See also the discussion of labor force participation and fertility in the "Fertility -- Analysis of Family Size" part of Section IV.

²The equations for female labor force participation include female unemployment rates. While this is adequate for the "discouragement" hypothesis, the unemployment rate relevant to the husband should really be included to investigate the magnitude to the "additional worker" effect. For the independent random sample of women aged 35-39, I was able to enter both male and female unemployment rates. Although the female unemployment variable displayed a marginally significant positive association (see Table 11 below), the male unemployment rate was insignificant (although positively correlated with female labor force participation).

³For the younger age groups, the number of women no longer married (recall that a woman must have been married to be included in the sample) is so small that the "currently married" dummy is dropped from the equation.

An analysis of income of women in the various age groups is presented in Table 10. As with the labor force participation results, the equations for the age groups below 30 are less significant statistically than are the others; it is primarily the participation variable itself that is not well estimated for the younger strata. The magnitude of this coefficient for the older age groups varies between the two formulations explored, but is generally about ₱1000 per year. The two formulations differ only by the inclusion of a "no male head of household" variable, which is comparable to the "currently married" variable in Table 9. With no male head of household present, the woman would be more likely to seek higher income. While this is significantly verified for women under 30 and over 44, the association is reversed in the intermediate ages. Since the impact of labor force participation on income tends to vary between these formulations in the opposite direction from the "no male" impact, the formulation that includes only the participation variable [line (1) for each part of Table 10] is probably adequate.

Educational attainment is consistently a significant influence on income. An additional year of education is worth, on the average, no more than ₱100 per year to a woman at any age; aside from the early thirties (where its value approaches ₱100) and under 25 (where its value is statistically significant but quite small), a value of about ₱50 is consistently estimated. The proportion of life married should at least partially capture the woman's length of time away from the labor force, thereby serving as a proxy for the declining value of her employment qualifications as of the time of her marriage.¹ The effect is usually negative, although frequently statistically insignificant. Rural residence is usually associated with somewhat lower average incomes, while migration leads to no uniform implications concerning the woman's earning power, even when rural to urban migration is separately distinguished.

Finally, consider the results for the independent random sample of women aged 35-39 (see Table 11); essentially all of the implications described in the above analysis are confirmed. Labor force participation

¹It is also a proxy for the women's age, as mentioned earlier.

Table 10
ESTIMATES OF INCOME OF FEMALES EQUATIONS^a

Part	Age Group	In	Constant	1968 Labor Force Participant ^e	Migration Preceded Labor Force Participation		1968 Education Level Attained	Rural Residence	Proportion of Life in Present Marriage	Absence of Male Head of Household	Significance of Equation: F
					Any Origin	Rural to Urban					
Part A - 20-24 Years Old	(1)		83.6 (.82)	345. (1.2)	251. (.90)	395. (1.3)	17.3 (2.1)	-75.0 (-1.0)	-272. (-1.0)		4.0 ^f
	(2)		52.6 (.52)	482. (1.7)	162. (.59)	344. (1.2)	15.5 (2.0)	-88.9 (-1.2)	-195. (-.74)	445. (2.7)	5.3 ^g
	Means:		157.	.185	.029	.015	6.00	.710	.199	.031	
Part B - 25-29 Years Old	(1)		-200. (-1.6)	702. (2.2)	353. (1.3)	-236. (-1.1)	55.1 (6.2)	26.4 (.29)	-254. (-.97)		7.9 ^g
	(2)		-190. (-1.5)	153. (.42)	818. (2.7)	-244. (-1.1)	60.5 (6.5)	106. (1.1)	-366. (-1.3)	745. (3.9)	9.6 ^g
	Means:		248.	.216	.059	.037	6.19	.733	.297	.031	
Part C - 30-34 Years Old	(1)		-498. (-2.1)	855. (2.8)	-243. (-.81)	563. (1.9)	91.4 (7.7)	158. (1.2)	-144. (-.33)		21.6 ^g
	(2)		-517. (-2.2)	1134. (2.9)	-381. (-1.2)	464. (1.5)	88.9 (7.5)	126. (.93)	-111. (-.26)	-326. (-1.2)	19.0 ^g
	Means:		403.	.303	.110	.050	6.37	.713	.378	.056	
Part D - 35-39 Years Old	(1)		67.3 (.30)	863. (2.9)	546. (1.8)	-432. (-1.4)	55.1 (4.4)	35.7 (-.32)	-528 (-1.3)		25.5 ^g
	(2)		86.0 (.38)	995. (2.7)	462. (1.4)	-442. (-1.5)	51.1 (3.6)	-52.3 (-.45)	-531. (-1.3)	-118 (-.59)	21.0 ^g
	Means:		404.	.278	.084	.050	5.96	.692	.438	.097	
Part E - 40-44 Years Old	(1)		78.2 (.46)	548. (2.5)	730. (3.0)	-409. (-1.7)	49.5 (5.9)	-83.6 (-.95)	-355. (-1.3)		17.2 ^g
	(2)		139. (.87)	1088. (3.6)	443. (1.7)	-479. (-2.1)	44.4 (5.5)	-148. (-1.7)	-514. (-1.9)	-369. (-2.4)	18.1 ^g
	Means:		296.	.283	.075	.041	5.16	.669	.493	.110	
Part F - Over 44 Years Old	(1)		-142. (-.72)	1310. (4.3)	-370. (-1.5)	10.0 (.04)	61.4 (5.9)	-310. (-3.3)	148. (.57)		18.0 ^g
	(2)		-72.1 (-.35)	820. (2.2)	-82.2 (-.30)	114. (.49)	63.7 (6.0)	-256. (-2.6)	70.9 (.27)	233. (2.3)	22.6 ^g
	Means:		364.	.362	.104	.048	3.22	.690	.581	.312	

Note: ^aSee notes to Table 9.

Table 11

ANALYSIS OF ECONOMIC ACTIVITY FOR INDEPENDENT SAMPLE OF 35-39 AGE GROUP^a

A. Labor Force Participation										
Line	Constant	1968 Education Level Attained	Migration Since Birth	Unemployment Rate ^b	1968 Marital Status of Female: Married	Proportion of Life Married for those Married as of 1968	No. of Surviving Children ^{c,e}	Number of Family Members 10 Years Old or Over ^e	Tot Income Other than Female ^{d,e}	Significance of Equation: F
(1)	.713 (4.4)	.021 (2.6)	-.049 (-.74)	.419 (1.3)	-.608 (-3.0)	-.274 (-.66)	.016 (.53)		.023 (.64)	4.4*
(2)	.449 (2.2)	.025 (2.9)	-.028 (-.40)	.283 (.86)	-.557 (-2.8)	-.660 (-1.7)		.109 (2.0)	-.001 (-.03)	5.6*
Labor Force Participation										
Means:	.311	6.21	.332	.056	.927	.399	5.46	4.41	1.77	

B. Income										
Line	Constant	1968 Labor Force Participant ^e	Migration Preceded Labor Force Participation Any Origin	Rural to Urban	1968 Education Level Attained	Rural Residence	Proportion of Life in Present Marriage	Absence of Male Head of Household	Significance of Equation: F	
(1)	-112. (-.51)	806. (2.9)	-94.5 (-.35)	926. (3.3)	59.4 (5.6)	-42.6 (-.40)	-281. (-.78)		25.3*	
(2)	-114. (-.51)	828. (2.3)	-108. (-.36)	930. (3.2)	59.0 (5.3)	-43.5 (-.40)	-277. (-.76)	-22.2 (-.10)	20.3*	
Income of Females										
Means:	388.	.311	.110	.044	6.21	.666	.433	.079		

Note: See notes to Table 9

is encouraged to the extent of greater than two percentage points increase per year of additional education. The downward shift from being currently married is somewhat larger from this sample (as is the constant in the equation), and the association between larger families (as measured by members 10 years or over) and labor force activity appears. The positive impact of the unemployment rate supports the "additional worker" interpretation for female participation. The results for the income equations indicate about ₱800 per year for labor force participation (holding all other factors constant), approximately ₱60 per additional year of educational attainment, and a negative (but not very statistically significant) shift for those women who live in rural areas or have been married longer. It is interesting to note that when rural to urban migration is separated from all other migration, it has a significantly positive impact on incomes for women in this sample. This distinction between types of migration displays similar results for women in their early twenties and thirties as shown in Table 10.¹

MALE ECONOMIC ACTIVITY

Somewhat surprisingly, male labor force participation is less easily predictable on economic grounds; the equation estimates are reported in Table 12.² When considered more carefully, however, this conclusion is not really very unusual; for low-income families, the male head of the household is likely to be a labor force participant regardless of his employability. This is the conclusion for the Philippines; participation rates are above 93 percent for men in both age groups.³

¹See also the analysis of rural to urban migration of males below.

²For the male labor force participation and income analyses, the samples were slightly reduced by dropping all observations for which "no response" was given on income of the husbands (that is, CK10>0). The sample sizes used for these analyses (as well as for the means reported in Table 1) are: 531 (under 30) and 511 (30 or over).

³The rate for men between 30 and 55 years old is even higher (96 percent).

Table 12

ESTIMATES OF LABOR FORCE PARTICIPATION OF MALES EQUATIONS^a

Line	Constant	Migration to current Residence ^b	Migration for Economic Reason ^b	Additional Education 1965 to 1968 ^b	Education Level Completed 1968 (or 1965) ^c	Rural Residence	Age of Male 1968	Member of Sub-family of the Household	Unemployment Rate ^d	Significance of Equation: F
Part A - Under 30 Years of Age										
(1)	.826 (7.6)	.096 (1.2)			.0004 (.15)	.061 (1.8)	.003 (.82)	-.161 (-5.8)		9.1*
(2)	.707 (3.8)	-.256 (-1.2)	.858 (2.0)	.067 (.65)	.002 (.69)	.023 (.45)	.010 (1.3)	-.186 (-4.4)	-.05 (-.02)	9.3*
	Labor Force Participation--1968									
Means:	.938	.224	.044	.130	6.80	.715	25.7	.229	.060	
Part B - 30 Years or Older										
(1)	1.18 (18.6)	-.074 (-.76)			-.0008 (-.31)	.026 (.75)	-.005 (-5.6)	-.243 (-4.2)		7.0*
(2)	1.23 (14.0)	-.193 (-1.1)	.436 (.74)		.0001 (.05)	-.009 (-.18)	-.005 (-5.4)	-.246 (-4.1)	-.391 (-.79)	4.2#
	Labor Force Participation--1968									
Means:	.933	.278	.032		5.99	.701	46.8	.035	.023	

Notes:

^aThe coefficient estimates reported in this table were obtained by two-stage least squares. Variables identified by a "b" are considered endogenous in the equation. For each equation, the first line presents the coefficient estimates while the t-ratios are in parentheses below the coefficients. The other predetermined variables from the system of equations (represented in Fig. 2), describing the interrelated activities of family members, that were used in the estimation of these equations are: wife's education level (1968), difference between education level of husband (1968) and his father (at age 40), provincial male unemployment rate, wife's age (1968), knowledge of birth control method(s), home ownership dummy, rent-free residence dummy, dummies for religions [Muslim and Catholic (regular church attendance)], and Tagalog language dummy.

The asymptotic significance test for the equations is the F test given in P. J. Dhrymes, "Alternative Asymptotic Tests of Significance and Related Aspects of 2SLS and 3SLS Estimated Parameters," *The Review of Economic Studies*, 36 (2), April 1969, pp. 213-226. Significance levels are denoted: † (10%), # (5%), and * (1%). Significance levels for the coefficients are approximately [t greater than]: 1.6 (10%), 2.0 (5%), and 2.6 (1%).

^bEndogenous variables in the equation.

^cIn part A, line (2) [and all equations for this age group in Table 13], the education level completed is as of 1965 (the mean for this variable is 6.67). There is very little difference between educational attainment in 1965 and 1968 for the older age group (the mean for 1965 is 5.98).

^dUnemployment rates in this equation are male provincial rates for the appropriate age group of the individual -- young (under 25) or old (25 or over).

Looking first at the "under 30" group, the participation propensity is most significantly influenced by the "subfamily" status. Thus, the extended family plays the same role for the husband that marriage plays for the wife -- it reduces the need to be economically active. About 23 percent of the men in this age group are at least partially economically dependent. The inclination to participate in the labor force increases with age within this group and is positively (but statistically insignificantly) related to educational attainment.¹ Migration generally leads to higher participation, but when the economic motive for migration is separated from all other motives, it is only the economic motive that shows strong positive association while the other motives show a net negative effect on labor force participation.²

For the older age group, the same (although less intense) effects of migration are observed. Educational attainment is insignificantly related to labor force participation. The impact of increasing age reverses (as expected) to become strongly negative. Membership in a household as part of a subfamily is still an alternative means of obtaining support (or subsistence) for the family. Finally, there is only slight evidence (from the coefficient of the unemployment rate in these equations) of a net "discouragement" effect of unemployment on labor force participation.³

Turning now to the economic outcomes, analysis of income contribution to the family by the husband is displayed in Table 13. Consider

¹Education is entered in line (1) as predetermined and as endogenous in line (2) of this younger age stratum. The second equation is probably the best formulation, in which past educational attainment is predetermined, but recent educational advancement is considered simultaneously determined with the labor force participation decisions. This is the equation that is used in drawing the conclusion.

²"Other motives" includes early moves (while the person was a dependent) as well as, for example, moves necessitated by natural disasters.

³The higher average unemployment rate among the younger age group reflects the problem of young people looking for their first job. On this point, see H. A. Averch, F. H. Denton, and J. E. Koehler, A Crisis of Ambiguity: Political and Economic Development in the Philippines, The Rand Corporation, R-473-AID, January 1970, Chapter 5.

Table 13

ESTIMATES OF INCOME OF MALES EQUATIONS^a

Line	Constant	Migration to current Residence ^b	Additional Education 1965-1968 ^b	Education Level Completed 1968 (or 1965) ^c	Rural Residence	Unemployment Rate ^d	Occupation				Significant of Equation F
							Farmer Tenant	Government Employee	Adminis- trator	Profes- sional	
Part A - Under 30 Years of Age											
(1)	1009. (7.9)		-53.4 (-.34)	75.4 (8.0)	-615. (-5.8)						15.6*
(2)	528. (2.6)	1460. (3.9)	-229. (-1.2)	60.2 (5.2)	-289. (-1.9)		62.7 (.55)	762. (2.7)	348. (.60)	808. (1.1)	15.5*
(3)	482. (2.1)	1510. (3.7)	-257. (-1.0)	70.8 (6.3)	-261. (-1.5)	-101. (-.14)					18.1*
Income of Males 1968 ^e											
Means:	1065.	.224	.130	6.67(1965)	.715	.060	.245	.032	.008	.004	
Part B - 30 Years or Over											
(1)	1331. (3.9)			162. (6.1)	-993. (-3.2)						37.7* ^f
(2)	887. (1.7)	925. (.82)		105. (3.3)	-441. (-1.1)		-248. (-.76)	658. (1.3)	11119. (9.0)	3926. (2.5)	20.1*
	934. (1.3)	899. (.66)		149. (4.5)	-729. (-1.4)	1877. (.35)					9.9*
Income of Males 1968 ^e											
Means:	1608.	.278		5.99	.701	.023	.182	.072	.010	.006	

Notes:

a-d. See notes to Table 12.

^eThe income measure is annual income in Philippine pesos.

^fFor this equation, no endogenous variables are included. Therefore, the method of estimation was ordinary least squares (the R² is .15)

first the under 30 age group. Line (1) shows the minimum set of influences for this part of the model -- with provision only for the "opportunity wage" captured by education and for rural or urban opportunities.¹ The constant term represents a base income of about ₱1000 per year on the average. Educational attainment for the younger age group is separated as in Table 12. Attainment as of 1965 is considered to be predetermined but the decision to continue education to 1968 or to seek employment is considered to be endogenous. Although educational attainment contributes significantly to higher income (about ₱75 per year of schooling), recent educational activity has an insignificant but negative impact on current income.² Men in rural areas receive an average of over ₱600 per year less than do their counterparts, in terms of educational attainment, in urban areas.

In line (2), the "rents" that may arise out of particular occupations or circumstances, as well as the income associated with more mobile families, are considered.³ This form of the equation leads to a large reduction of direct influence of the education variable, down to ₱60 per year of education. Young tenant farmers are insignificantly different from other farmers. Government employees, whether through qualification or position,⁴ receive almost ₱800 per year more than

¹Since nearly all men are labor force participants, this variable has been dropped from the male income analysis. In fact, there is evidence that a few of the occurrences of nonparticipation in the older age group may in fact be coding errors -- the coefficient of the labor force variable (when included in the equation) is negative. The range of income for "nonparticipants" in the sample is from zero to almost 11,000 pesos per year.

²Those who were recently in school are usually also younger and less experienced. Thus, the ultimate economic benefit of further education is not captured by this variable, and the negative effect might be interpreted as the "opportunity cost" of the further education.

³As can be seen from the extremely low means for the "administrator" and "professional" occupations, very small proportions of the samples are involved in these parameter estimates.

⁴Since the income measures used here are divulged by each individual to the survey, it is quite unlikely that the "rent" from being a government employee is a measure of graft.

non-government employees. This amount is nearly as large as the "rent" for professionals -- doctors, dentists, and lawyers. Migration, which is most predominant in the young age group,¹ is significantly associated with higher income. This association will be further investigated below.

Line (3) again reveals the significant association between migration and educational attainment and higher income. It was intended to investigate a local slackening of demand for labor, as reflected by an increase in the provincial unemployment rate. Although on the average this lowers income, as expected, the coefficient is quite small and statistically insignificant.

The main differences for the older age group are the reduction in size and significance of the association between migration and income, and the uniform and significant increase -- approximately doubling -- in the value of educational attainment. The education effect could be due either to a relative scarcity of well-educated men in the older cohorts, or to the value of on-the-job experience which may be correlated with formal educational attainment.² The rent to "professionals" is much higher than for government employees in this age group, as one might have expected a priori. The shift in average income for rural employment is slightly higher for this older group. The unemployment affect is positive but statistically insignificant as for the younger men.

RECENT RURAL TO URBAN MIGRATION OF MALES

The association between migration and income for husbands under 30 years of age observed in Table 13 tends to confirm the presumption that migratory patterns of families in the Philippines are primarily interrelated with the husbands' other decisions. To obtain further insight into the migratory patterns of these men, the rural to urban

¹From the means for this variable, we can observe that over 22 percent of men under 30 have ever migrated, and only about 28 percent (which can be thought of as an additional 6 percent) of the older men.

²While this analysis was to include an assessment of technical or vocational training, the occurrences of such training in the NDS households were too few for adequate evaluation.

segment is considered in Table 14.¹ That is, of all migrators between 1960 and 1968, those moving from a rural to an urban area are considered. This pattern of migration is assumed to be related to the income levels of the areas involved, the education level and labor force activity of the individual, as well as his age, language, and reason for migrating. If the reason for migrating was economic, the man's income in 1968 was entered as a measure of the income level he may have anticipated.

The results of ordinary least squares estimates of this equation are presented in Table 14.² Although there are fewer migrators in the older group than in the younger,³ about half of those migrating in each age group undertake rural to urban migration. The younger age group is more adequately described by this structure, which concentrates mainly on economic incentives for the move. These young men who migrate from a rural to an urban area are significantly motivated by higher economic opportunity in the new area.⁴ Higher educational attainment significantly increases the propensity to migrate in this pattern. On the other hand, educational attainment and areal income differentials become much less significant for men in the older age group. These men still seek out urban areas to locate if their intention by migration is improvement of their economic opportunities. The only other attribute that is significantly and positively associated with this pattern of migration is

¹As of 1960, about 30 percent of the population already lived in urban areas.

²The model would suggest that this equation should be estimated by two-stage least squares, since "anticipated income" and labor force participation in the former area would be simultaneously determined with the decision to migrate. However, there was insufficient information on the exogenous economic characteristics of these areas and on the precise timing of the move, so ordinary least squares was the only feasible method. Coefficient estimates obtained in this way will be biased and inconsistent; see J. J. Johnston, Econometric Methods, New York, McGraw-Hill Book, Co., 1963, Chapters 9-10.

³The samples imply 5.4 percent of those over 30 years old migrated since 1960 while 8.5 percent under 30 years old migrated during that period.

⁴The average income differential is a crude proxy for relative economic opportunity, since it is based on current average income of families of the current province of residence compared with average income of families of the region of past residence at the approximate time of that move (1965 or 1960).

Table 14
ESTIMATES OF EQUATIONS FOR RURAL TO URBAN MIGRATION OF MALES, 1960-1968

Line	Constant	Anticipated Income: Income in 1968 of Those Who Migrated for Economic Reasons ^a	Labor Force Participation Prior to Migration	Educational Level Attained Prior to Migration	Approximate Age at Time of Migration	Area Average Income Differ- ence: Before and After Migration ^a	Tagalog Language	Significance of Equation: R ² F
Part A - Under 30 Years of Age								
(1)	.421 (1.4)	.070 (1.5)	-.011 (-.09)	.035 (2.8)	-.015 (-.87)	.074 (2.6)		.31 4.9*
(2)	.375 (1.2)	.066 (1.4)	-.024 (-.19)	.032 (2.6)	-.013 (-.74)	.072 (2.5)	.092 (.74)	.32 4.1*
	<u>Migration Rural-Urban Since 1960</u>							
Mean	.488	1.560 ^b	.593	7.73	18.8	.651	.419	
Part B - 30 Years or Older								
(1)	-.081 (-.18)	.064 (1.2)	.291 (.92)	.001 (.09)	.004 (.37)	.077 (1.2)		.18 1.3
(2)	-.027 (-.07)	.099 (2.0)	.373 (1.3)	-.008 (-.63)	-.002 (-.18)	.054 (.95)	.502 (3.0)	.37 2.9#
	<u>Migration Rural-Urban Since 1960</u>							
Mean	.481	2.698 ^b	.904	9.77	34.4	1.097	.327	

Notes:

The sample sizes involved in this table, which deals with the description of rural to urban patterns among all migrators, are 60 for Part A and 36 for Part B. The coefficient estimates reported in this table were obtained by ordinary least squares. In parentheses below each coefficient estimate is the t-statistic. Significance of the equations is indicated by: † (10%), # (5%), and * (1%). Significance levels for the coefficients are approximately [t greater than]: 1.7 (10%), 2.0 (5%), and 2.7 (1%).

^a Income measures used in these results were in thousands of pesos.

^b The "anticipated income" is the income in 1968 of those who migrated with the intention of improving their economic circumstances (these men numbered almost 41 percent of the migrators under 30 and almost 33 percent of those 30 years or older). The averages of this variable for the entire samples are: .635 (under 30) and .882 (30 or over).

use of the Tagalog language, which is spoken by a large segment of the population of Central and Southern Luzon (about a quarter of the nation's population). Comparison of the average values for the two age groups reveals that fewer of the men over 30 speak this language than do those under 30, for whom the membership in that linguistic group was of no importance at all when the other explanatory characteristics are held constant.

SUMMARY OF ECONOMIC ACTIVITY AND MIGRATION

The primary conclusion of this section concerns the importance of educational attainment to economic activity. Throughout these results, for different age groups, sexes, and for various aspects of economic activity, education has displayed a significant impact. Of all the variables investigated in the female labor force participation equation -- including not only education but also marriage, family size, and economic circumstances of the family and the area in which the family lives -- only education is significantly associated for all ages. A year of education leads to more than two percentage points greater propensity to participate in the labor force. While a year of education implies about ₱50 per year in additional income for females, each year of education is worth about ₱70 per year for her husband if he is under 30 years old, and about ₱150 per year if he is older. On the other hand, education is not nearly as important to labor force participation of the husbands in the sense that nearly all men must seek employment, regardless of qualification.

The only exception is the man whose family is living in the household of a relative. This "subfamily" status provides significant relief from the necessity to be a labor force participant, just as being "currently married" provides significant relief for the woman. The propensity to participate for men increases with age for the younger group, but declines with age thereafter. Family income from sources other than the wife also reduces her need to participate in the labor force, but is only statistically significant for the 30-34 age group. For these and older women, larger families create a greater pressure for the women to become economically active. Perhaps because of its

variability of meaning over the rural and urban areas of the Philippines unemployment rates do not greatly influence labor force participation of either women or men.

The effect of migration seems to be most predictable for younger men. Most migration occurs before the man is 30, and those who have migrated tend to have significantly higher incomes. On closer investigation, half of the recent migration for either age group was from a rural to an urban area. In the younger group this pattern was due largely to economic motivation. That is, movement is generally to areas that offer higher average incomes. The analysis showed that among the migrators under 30, higher educational attainment increases the probability of movement to an urban area.

VI. IMPLICATIONS

A model of the interrelationships between fertility and economic behavior of families has now been presented and explored empirically using information from the Republic of the Philippines. Summaries of the empirical analyses of marriage and fertility and economic activity and migration were presented in the final parts of Sections IV and V respectively. I will not undertake a thorough review of those results here.

Instead, as I comment on some of the policy implications, I will review and integrate many of the findings pertinent to the Filipino wife. To bridge this review back to the model specification, Fig. 2 has been redrawn as Fig. 4 with the findings of the empirical analysis incorporated. The new figure displays three types of links: hypothesized interactions that have been found to be significant (bold arrows with the direction of influence indicated), hypothesized links that were not confirmed (dashed arrows), and untested hypotheses (solid arrows unchanged from Fig. 2). The only other important change from Fig. 2 is the removal of the "Desired Family Size" box. Although all of the other boxes refer to potentially measurable variables, this one cannot be directly measured.¹ Instead, I have postulated some influences on births based on other attributes and decisions by the family, and have interpreted their confirmation as evidence that "Desired Family Size" is a useful concept.

The links that were not confirmed by the above analysis pertain to birth control. I observed in Section III that knowledge about birth control methods is much more widespread than their use, even among women in age groups in which desired family size has probably been achieved. Since it is tautological that one must have knowledge of a method to be able to use it, the lack of confirmation between

¹I am, of course, not claiming that an interviewer cannot simply ask: "How many children do (did) you want?" I am pointing out that there are simply too many social and psychological influences and pressures on the respondent to accept her answer as a direct "measure" of desired family size.

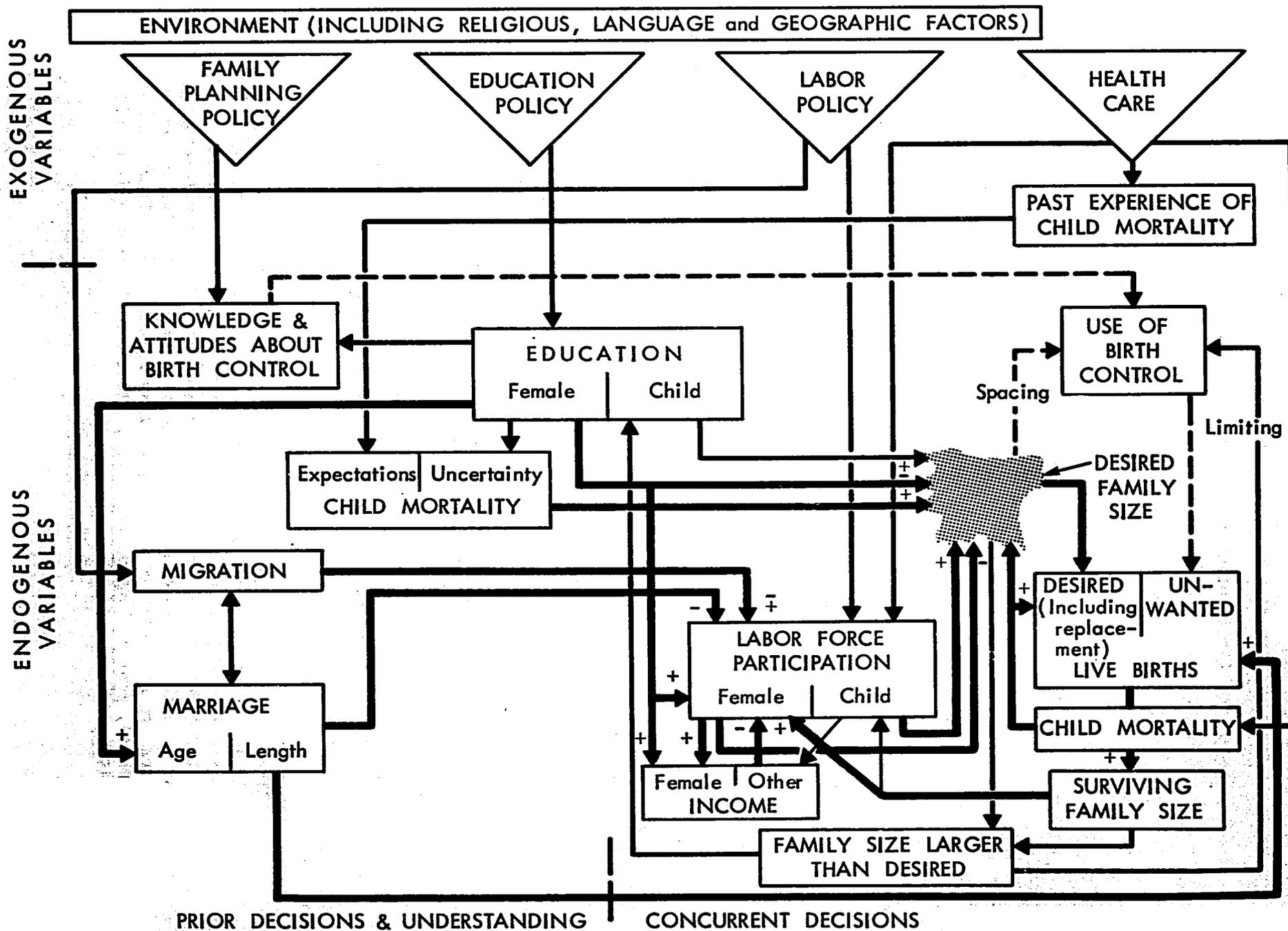


Fig. 4—Review of empirical results

"knowledge" and "use" in this context simply means that even if an understanding of family planning concepts is achieved, motivation to use these methods is also required. Furthermore, the link between "use" of birth control methods and reduction of (presumably "unwanted") births was not confirmed. Total family size is not uniformly lower, all other factors held constant, in those cases in which one or more methods of birth control have been employed. Neither has recent fertility been significantly lower in these families. From this evidence it is clear that either birth control methods are used rather inefficiently in the Philippines, or that responses to survey questions on this topic are not a very reliable means of obtaining accurate information.¹

An added complication for family planning organizations has been suggested by the empirical results. If the evidence from the analysis of the open birth interval is correct, young parents who report that they have knowledge of a birth control method will have their families at a fast rate, presumably with the intention of stopping child bearing after achieving their desired family size. If this "knowledge" then proves inadequate or the method ineffective, the short-term increase in the population growth rate may not be subsequently reversed. Thus, there may be more of a danger than a benefit, to take a simplistic example, in radio saturation of the population with the term "rhythm method" which makes "knowledge" widespread and perhaps even increases the receptivity to the concept of family planning, but provides relatively few parents with the ability to make effective use of the method.

Even if thorough knowledge of very effective birth control methods could be widely disseminated, how much would the rate of population growth decline?

¹The latter conclusion gains support from the fact that even when the influence of IUDs or pills were separately estimated, their effect was not statistically significant. On the other hand, inefficient use of "birth control" is probably also a problem. These implications contrast with the evidence of effectiveness of family planning in Taiwan before the organized family planning program began. See R. Freedman and J. Takeshita, Family Planning in Taiwan, Princeton, Princeton University Press, 1969, Chapter III.

It is that question that leads to the need for the model represented by Fig. 4. It provides a way of integrating a spectrum of influences and characteristics to obtain a measurement of a family-size goal. Once that goal can be estimated and actual fertility observed, the effect of widespread use of effective birth control methods on fertility reduction can be determined. Furthermore, if the motivation for use of birth control methods increases rapidly as the discrepancy between desired and actual fertility widens, then policies that reduce desired family size also significantly encourage slower population growth.

The other variables of the model that were investigated displayed statistically significant links with one another although not always for all age groups or of consistent direction across age groups.¹ Figure 4 indicates that one of the more pervasive influences in the entire model is female educational attainment.² It displays not only direct impact on fertility³ through its impact on desired family size, but also important influences on age at marriage, labor force participation, and income. Some of these effects feed back to fertility. Thus, more refined measurement of the role of adult education in family decisionmaking should be sought with the objective of framing a strategy of "population" policies to include this area.

As an example of the possible (admittedly long-term) impact of such a strategy, the direct effect of an additional two years of education for the wife on the family's desired size goal would be a

¹For purposes of preparation of Fig. 4, a variable need only display coefficient significant at the 10 percent level in one of the age groups for the link to be deemed "significant." When the coefficients for different age groups were significantly different from zero but indicated different directions of influence, both plus and minus signs are indicated (the upper of the two indicated the influence at younger ages).

²In fact, adult educational attainment -- female and male -- is quite important. See Section V for a further discussion.

³This influence of education on fertility, holding all other influences constant, was less significant than had been anticipated: see Section IV.

reduction on the average of about .2 of a child, other influences held constant.¹ This two-year increase in education would also have led to a half-year older age at marriage. This decrease in years of marriage, for a given present age, would imply a reduction of attained family size of about .2 of a child. Finally, this increased educational attainment would lead to a 6 percent greater likelihood of labor force participation and a \$170 (approximately 8 percent) increase in income for the family; the increase in labor force participation would imply about .05 of a child more or less.² The full impact of such a change in educational attainment would involve other direct and indirect effects, of course. These estimates of some of the main influences serve to indicate that the indirect effects may either reinforce or counteract the direct effect, and need not necessarily be smaller in magnitude.

Another important factor influencing fertility as revealed by Fig. 4 is child mortality (more specifically infant mortality). The elasticities for the safety factor based on infant mortality actually experienced by the family are about unity, while the elasticities based on community experience (represented in Fig. 4 by the influence of "expectations concerning child mortality") are even higher. Thus, policies aimed at reducing infant mortality are not only highly desirable in their own right, they also will produce adjustments in family behavior that at least partially offset the increase in population growth implied by declines in mortality. As described in the summary of Section IV, a 5 percent reduction in infant mortality will itself imply about a 2 percent decline in births.

Aside from the other "significant links," Fig. 4 reveals a shortcoming of this study. There is no explicit analysis of the ways in

As I mentioned in Section IV, the structural specification of the determinants of fertility should probably be nonlinear. Therefore, the reader should regard as preliminary any quantitative conclusions based on the linear approximations of the model reported in Table 2 and 4. The entire set of implications described here is based on the coefficients from the 35-39 age group equations (the coefficient with the largest t-statistic was used in each case).

²This last measure is based on coefficients that vary in sign, and none has a t-statistic greater than unity.

which government policies actually influence family behavior; the links from the "policy triangles" are all "untested." Neither is there any assessment of the relative costs of achieving a specified goal (for example, reduction of births by a specified amount). These issues must be specifically addressed before cost-effective policy strategies can be designed.

In sum, the results show that claimed "use" of birth control methods neither significantly influences family sizes ultimately attained nor the recent rate of bearing children among currently married women. Educational attainment has pervasive influence in the model -- on women's propensity to participate in the labor force and remuneration of both husbands and wives. More education is associated with later age at marriage, but not very significantly with fewer children when other influences are held constant. Those families with children participating in the labor force have significantly more children, and those that experience child mortality -- and especially infant mortality -- tend to exhibit "replacement" fertility. These results provide reasonable encouragement that this type of broad perspective on family decisionmaking can furnish useful insights for policymaking. They indicate that educational attainment has an important combination of effects on the family decisionmaking process.

Perhaps as important as the findings from this analysis is the microanalytic approach used here. The investigation has been based on measurements for individual families calculated from the National Demographic Survey of the Philippines. Such detailed data allow for confirmation of inferences usually based on data aggregates for areas. Well-designed retrospective surveys such as the NDS should be quite useful to continuing resolution of policy questions concerning the causes and consequences of fertility in less-developed countries.

APPENDIX

PHILIPPINE FAMILY DATA: VARIABLES AND SAMPLES

The variables used in this study were generated from retrospective histories and current information obtained by the National Demographic Survey of the Philippines, conducted in May of 1968 jointly by the Population Institute, University of the Philippines, and the Philippines Bureau of the Census and Statistics. The full survey included data on a nationwide sample of 7254 women and their families. The survey information was assembled onto two magnetic tapes. One containing the retrospective fertility histories (pregnancy rosters), household and family characteristics, family planning knowledge, attitudes and practices, as well as more general cultural, demographic, geographic, and economic information associated with each ever-married woman in the households surveyed. The other tape containing a subset of that information (essentially age, migration, education, and occupational information) for the woman's husband and every other household member 10 years of age or over.

Table 15 presents the definitions for the variables generated for each family (most of the analysis has dealt with the 1968 variables). The main difficulty in generating these variables involved coordinating the two tapes. For each observation in the sample (i.e., each family), a series of checks between the family ID on the first tape and the ID of each of several records of information (family members) on the second tape had to be performed. Of course the household number (HH) should be the same. But in the extended family context of the Philippines, households frequently had more than one family. The family classification (FAMC) was useful in distinguishing "primary" families from "subfamilies," but in the case of multiple subfamilies of the same family classification, the separation between families was not performed (in which case both subfamilies were dropped from the analysis). In many cases even these subfamilies could have been distinguished (e.g., one was a daughter and son-in-law living with her parents and the other a son and daughter-in-law living with his parents);

thus, future analyses based on these data could be more complete. Still, the elimination of observations for all reasons combined amounted to a reduction of less than 1.5 percent of the total sample.

The next problem, after separating "primary" families and "sub-families," was the identification of the male head of the subfamilies. The male head of the primary family was coded as "male head" of the household; the male head of a subfamily was selected to be the eldest male in the subfamily. Thus, as described under CK4 of the check variables in Table 15, CK4 = 1 is the normal case of no male head residing in the household, and CK4 = 2 or 3 indicates no male head found in a primary family or a subfamily respectively, even though a male head should have been present according to another survey response.

After this coordination and checking had been performed, a master variable tape could be accumulated. This tape was age stratified by a second program that identified the family as a member of a particular male or female age stratum, and subsampled from the full set of observations in that stratum. The subsampling followed the sampling scheme of the original survey, and was designed to reduce the sample size in each male or female age strata to approximately the same number of observations. The sizes of the age strata before and after subsampling¹ are:

<u>Stratum</u>	<u>Full Sample</u>		<u>Subsample Size</u>
	<u>Size</u>	<u>Proportion Requested</u>	
<u>Female</u>			
Under 20	153	Dropped from the analysis	
20-24	567	1/2	287
25-29	983	1/3	334
30-34	1054	1/4	265
35-39 (1) }	1047	1/4	{ 250
(2) }			
40-44	853	1/3	296
45 or over	2489	1/10	250
<u>Male</u>			
Under 30	1047	1/2	532
30 or over	5162	1/10	514

The independent random samples from the 35-39 female age group were obtained by independently chosen random starts in the sampling procedure. For a discussion of these samples, see Section III.

Finally, for each of the various topics investigated, some of the observations did not contain all the relevant information. The check variables were used (as described in Sections IV and V) to eliminate observations from these subsampled age strata.

Table 15

DESCRIPTION OF VARIABLES

Fertility

- F1: Estimated ten-year family size -- 120 months divided by mean closed birth interval (in months); mean closed birth interval in this case is live births.
- F2: Estimated ten-year family size -- 120 months divided by mean closed birth interval based on all pregnancies.
- F3B: Estimated ten-year family size according to average birth interval before contraceptive used.
- F3A: Estimated ten-year family size -- same as F3B except closed birth interval is measured after contraception use had begun.
- F4: Total number of pregnancies (all marriages).
- F5: Total number of pregnancies (present marriage).
- F6: Total number of live births (all marriages).

Family Planning Indicators

- OBI: Open birth interval (months from last pregnancy to survey date).
- FAPK: Knowledge of birth control methods -- as a minimum "heard of, did not use, know how to use."^b
- FAPU: Birth control use -- "heard of, used, found effective."^b
- FAPA: Birth control use in the past after birth i.^b
- FAAI: If FAPA equals one, FAAI equals i.
- CABO: Mentioned abortion as a means of child avoidance.^b
- CRHY: Used and found rhythm method effective.^b
- CCON: Used and found condom effective.^b
- CPIL: Used and found pill effective.^b
- CIUD: Used and found IUD (intrauterine device) effective.^b
- INFR: Infertility measure -- "had difficulty becoming pregnant."^b
- KBCO: Number of friends or relatives who use birth control methods.

Labor Force Activity

- LM68, 65, 60: Husband is in labor force^c in 1968, 1965, and 1960 respectively.^b
- LF68, 65, 60: Wife is in labor force^c in each of those years.^b
- LFBM: Labor force participation of female before marriage.^b

- LU68, 65, 60: Count of all family members classified as unpaid family workers in the respective years.
- LUF8: Wife was an unpaid family worker in 1968.^b
- LC68, 65, 60: Count of family members under 18 years classified as in labor force^c in the respective years.

Income

- YM: Income of husband (measured in Philippine pesos per year for 1968).
- YF: Income of wife.
- YT: Family income.
- DMMY: Migrated for an "economic" reason (husband).^b
- DMFY: Same as DMMY but for wife.^b
- DIR8: Husband is a farmer in one of the sixteen provinces in which an IR8 rice program is in effect.^b
- TNNT: Husband is a tenant farmer.^b

Marriage

- CM: Woman's age at first marriage.
- CM2: Proportion of life married.
- CM3: Age of wife at present marriage.
- CM4: Proportion of life in present marriage.
- CM68: Marital status of wife in 1968 -- wife was still married then rather than widowed, divorced, or separated.^b
- DCM: Number of times wife has been married.
- DMC1: Migration might have been with marriage in mind -- woman was single, divorced, or widowed at the time of her latest migration.^b
- DMC2: Migration for marriage -- woman gave as reason for migration "marriage".^b

Migration

- MBLM: Residence of husband is different in 1968 from birthplace.^b
- MRUM: Migration of the husband was from a rural to an urban area.^b
- MBLF: Residence of wife is different in 1968 from birthplace.^b
- MRUF: Migration for the wife was from a rural to an urban area.^b
- MVAM: Approximate age of husband at most recent move -- equals 0 if never moved; equals 5 if most recent move indicated to be birthplace different from present; equals age minus 8 if most recent move was in 1960; and equals age minus 3 if most recent move indicated to be in 1965 (survey was taken in 1968).

- MVAF: Approximate age at most recent move of wife (calculation similar to MVAM).
- RESC: NDS Residence Code of the family in 1968.
- RESM: NDS Residence Code of the husband before his most recent move.
- RESF: NDS Residence Code of the wife before her most recent move.

Health/Services

- CLDM: Child mortality -- proportion of all children no longer alive.
- INFM: Infant mortality -- proportion of children born alive who died within the first year.
- PRGW: Pregnancy wastage -- proportion of all pregnancies terminated as stillbirths, miscarriages, or abortion.
- CLMB: Child mortality -- same as CLDM but calculated for pregnancies before contraceptive used.
- CLMA: Child mortality after contraceptives used.
- DMUN: Expectations or uncertainty concerning infant mortality, based on answer to the question: "Do you think more, the same, or fewer of the babies born today die very young compared with those born 20 years ago?" Variable is 1 if no response or "don't know," 2 if response was "more."
- HLT: Flush toilet available in residence.
- HLL: Electric lighting available.
- HLW: Drinking water from "private faucet water works, private pump or artesian well."

Education/Training/Occupations

- EM68, 65, 60: Education level attained by husband, 1968, 1965, and 1960.^d
- EF68, 65, 60: Education level attained by wife in those same years.^d
- EC68, 65, 60: Measure of the school participation activity of children in the family -- the proportion of school-age life (7 years or over) of each child under 18 actually spent in school (the average for all children 7 through 18 at the time of the particular year being calculated -- 1968, 1965, 1960). [If no children are 7 or over, variables are zero.]^e
- EHF4: Education of father of head of household at age 40.
- TRNM: Equals one if husband has had an apprenticeship or training -- vocational, technical, agricultural, secretarial, commercial.^b
- TRNF: Training or apprenticeship for wife (similar calculation to TRNM).^b
- TRNC: Similar training or apprenticeship for count of all children.

GOVT: Husband is government employee in 1968.^t
ADMN: Husband is in an administrative job -- director, manager,
or working proprietor -- in 1968.^b
PROF: Husband is a professional -- lawyer, doctor, dentist, or
jurist -- in 1968.^b

Physical/Cultural/Religion

AGEM: Age of husband in 1968.
AGEF: Age of wife.
DWOW: Ownership of home or lot.^b
DWNC: Housing payment in kind -- no charge for residence.^v
LTAG: Language of wife is Tagalog.^b
LCEB: Language of wife is Cebuano.^b
LILO: Language of wife is Ilocano.^b
LPHI: Language of wife is Panay - Hiligaynon - Ilongo.^b
LSAM: Language of wife is Samar - Leyte - Waray.^b
LPAM: Language of wife is Pampango.^b
LPAN: Language of wife is Pangasinan.^b
LOPH: Language of wife is "other Filipino language."^b
RMUS: Religion of wife is Muslim.^b
RCAR: Religion of wife is Catholic; "regular" -- equals one if
attends services 4 or more times per month. [If services
held less than 4 times per month in woman's barrio and her
attendance was at that maximum, RCAR = 1/2.]
RCAO: Religion of wife is Catholic (all Catholics other than those
for whom RCAR = 1).^b
RAGL: Religion of wife is Aglipayan.^b
RINC: Religion of wife is Incesian.^b

Regional and Provincial Averages

Income

AY68: Average family income of province of
AYMB: Average family income of previous region of residence of
husband in approximate year before move (1961 or 1965); other-
wise zero (i.e., if moved prior to 1960 or never moved).^f
AYFB: Same as AYMB but for year and region of residence of wife
prior to moving.^f

Unemployment [all values are for May 1968]

- AUEM: Provincial proportion unemployed of male labor force of the appropriate age for the husband ("young" = less than 25 years; "old" = 25 or over).
- AUEF: Same as AUEM but for female labor force of appropriate age for the wife.
- AUMB: Similar to AYMB and AUEM but for age of husband at time of move and uses 1968 unemployment figures for the province of move.
- AUFB: Similar to AUMB but for wife.

Community Averages [NDS Residence Codes]

- ABCL, ABCC: Proportion of families with birth control knowledge [L -- local subarea is either the urban or rural areas of residence of the family; C -- average for the entire community].
- AIML, AIMC: Average infant mortality rates [L -- local; C -- entire community].
- ACML, ACMC: Average child mortality rates [L -- local; C -- entire community].

ID -- Family [unique to each observation]

- REGN: Region
- DICH: Dichotomy -- urban equals one, rural equals two.^g
- SEL: Selection.^g
- STR: Stratum.^g
- PROV: Province number within the region (from one to nine alphabetically).
- HH: Household number.
- MBRS: Number of members in the family who are 10 years old or over.
- FAMC: Family classification (one to four is "primary" family; five to eight is "subfamily").
- MFNO: Master file number on (generated) variable tape -- unique for each family.

Check Variables^h

Fertility and Family Planning

- CK2: No pregnancies in any marriage (392).
- CK1: No live births although there have been pregnancies (37).
- CK20: Number of times months were approximated for the calculation F1 and F2] (228).
- CK21: Number of times months were approximated for F3B (290).ⁱ

- CK22: Number of times months were approximated for F3A (239).ⁱ
CK23: Number of times months were approximated for OBI (454).^j
CK8: No past use of any birth control method by which child mortality rates CLMB and CLMA could be separated (2629).

Family Characteristics

- CK4: No male head present or found (941).^k
CK5: Male move age equals zero because of no move (3972).
CK6: Wife move age equals zero because of no move (4597).
CK9: Number of families with man's or wife's age not given (76).^l

Income

- CK10: No response on husband's income (40).
CK11: No response on wife's income (40).
CK12: No response on total family income (39).

Notes to Table 15:

^aAll variables [except pre-1968 family income for regions (AYMB and AYFB)] were calculated from the survey data obtained by the National Demographic Survey (NDS). Some of the variables actually used in the study were derived by further computation using those listed here. For example, years of marriage is simply AGEF-CM [or CM2 x AGEF] for those women married only once (i.e., DCM = 1 or CM = CM3).

^bThese are "dummy" variables -- equal to 1 if the condition described was declared to be true of the family (member), and zero otherwise.

^cA family member is classified as a "labor force participant" in this study if he responded to the question of "class of worker in 1968 (May-June)" by: 1) working for private employer for wage, salary, commission, tips, etc.; 2) working for Government or government-owned or controlled corporation; or 3) in own business, profession or trade for profit or fees with or without paid employees. A survey respondent would not be in this group if he gave no response, was not working, or if he worked without pay on a family farm or enterprise.

^dEducational attainment is measured as years of school completed. However, there is a gap in this count; primary school is measured from 1 to 7 but secondary school begins at 11. The highest value is 18 for four years of college or more.

^eAs a result of the NDS design, the only family members for whom detailed information is available are those 10 years of age or over. Thus the educational participation calculation for 1968 is based on the proportion of school-age life (7 years or over) in school of all children 10 years or over. The values of this variable for 1965 and 1960 are based on those children 7 years or over at that time, but

only include those children still in the household in 1968. The same gap between primary and secondary school was used in calculating this variable [see note d]. See also the discussion of this variable in Section III.

^fRegional average income of families for 1961 and 1965 were obtained from Table C of the feature article, "Family Income Distribution and expenditure Patterns in the Philippines: 1965," Journal of Philippine Statistics, Vol. 19, No. 2, April to June, 1968.

^gThese ID characteristics pertain to the sampling scheme used in the NDS.

^hFull sample includes 7196 observations. The numbers with non-zero values for the check variables are indicated in parentheses.

ⁱThese check variables detect several possible shortcomings of the data including no response on number of pregnancies (in which case CK20 through CK22 are set to one and F1 through F3A as well as CK2 and CK1 are set to zero) and the calculation of months for F1 and F2 or F3B or F3A are "unreasonable" values (e.g., less than zero or more than the number of months since age 12 or less than 9.5 times the number of pregnancies).

^jSix possible shortcomings of the data were checked in calculating OBI: (1) no duration of marriage given and no pregnancies (OBI set to months since age 20); (2) number of pregnancies not given (search pregnancy roster for eldest child and calculate duration of marriage minus age of eldest); (3) if both (1) and (2) problems exist (set OBI at $(\text{age} - 20 - \text{eldest}) \times 12$); (4) months between two dates calculated (last termination of pregnancy and May 1968) and found to be less than zero or greater than months of marriage less 9.5 times number of pregnancies (then set to latter); (5) check as in (4) but months of marriage unknown so approximated upper bound -- marriage at age 12; (6) check as in (5) but number of pregnancies unknown so assumed lower bound -- zero pregnancies. CK23 is equal to the number of the above problem.

^kThese possibilities of no male head of household were enumerated: (1) family classification (FAMC) indicated no male head (the normal case) (2) FAMC indicated head present, but the ("primary") family had no member identified as "male head;" (3) FAMC indicates head present for a "subfamily" but no male members are enumerated. For a "subfamily," the male head is taken to be the eldest male member.

^lThree checks for "no response" on age information were performed: (1) AGEM not given; (2) AGEF not given; (3) CM (age at first marriage) not given. Since 1 was added to CK9 for the first check, 2 for the second check, and 4 for the third check, any value of $CK9 \geq 4$ indicates that age at first marriage is not known.